A dictionary of practical surgery: comprehending all the most interesting improvements from the earliest times down to the present period : an account of the instruments and remedies employed in surgery : the etymology and signification of the principal terms : and, numerous references to ancient and modern works forming a "catalogue raisonné" of surgical literature (Volume 1).

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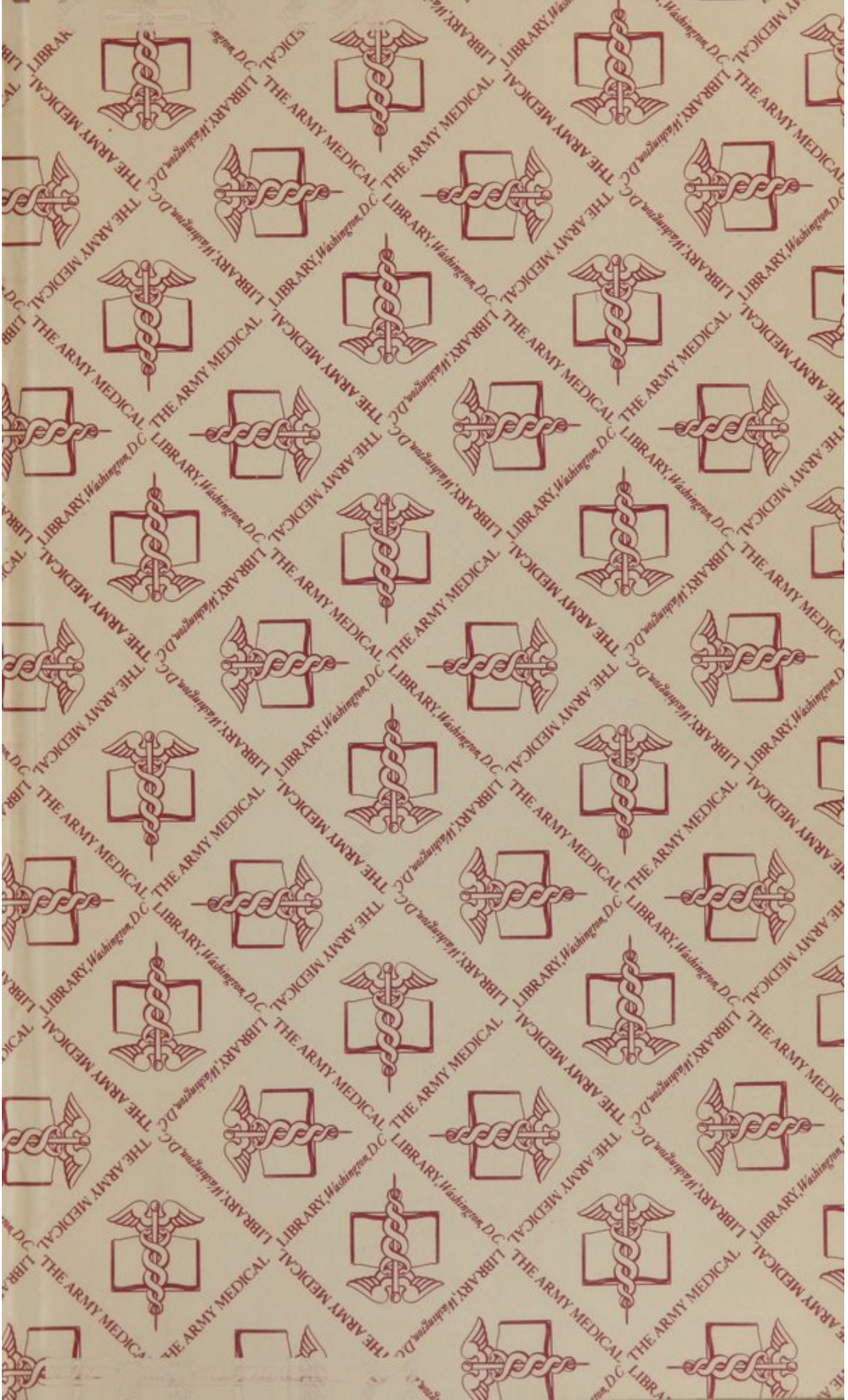
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A

DICTIONARY

OF

PRACTICAL SURGERY:

COMPREHENDING

ALL THE MOST INTERESTING IMPROVEMENTS, FROM THE EARLIEST TIMES DOWN TO THE PRESENT PERIOD; AN ACCOUNT OF THE INSTRUMENTS AND REMEDIES EMPLOYED IN SURGERY; THE ETYMOLOGY AND SIGNIFICATION OF

THE PRINCIPAL TERMS;

AND

NUMEROUS REFERENCES TO ANCIENT AND MODERN WORKS: FORMING A "CATALOGUE RAISONNÉ" OF SURGICAL LITERATURE.

BY SAMUEL COOPER,

SURGEON TO THE KING'S BENCH, THE BLOOMSBURY DISPENSARY, AND HIS MAJESTY'S PRISON OF THE FLEET; MEMBER OF THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS IN LONDON; SURGEON TO THE FORCES; HONORARY MEMBER OF THE ACADEMY OF NATURAL SCIENCES AT CALCUTTA; THE MEDICAL SOCIETY OF MARSEILLES; &c.

FROM THE SIXTH LONDON EDITION.

REVISED, CORRECTED, AND ENLARGED.

WITH NUMEROUS NOTES AND ADDITIONS,

EMBRACING ALL THE PRINCIPAL IMPROVEMENTS AND GREATER OPERATIONS INTRODUCED AND PERFORMED BY AMERICAN SURGEONS.

BY DAVID MEREDITH REESE, M.D.

LICENTIATE IN SURGERY AND MIDWIFERY; HONORARY MEMBER OF THE MEDICAL AND CHIRURGICAL FACULTY OF MARYLAND, AND OF THE MEDICAL SOCIETY OF MARYLAND; RESIDENT FELLOW OF THE MEDICAL AND PHILOSOPHICAL SOCIETY OF NEW-YORK; PRACTITIONER OF PHYSIC AND SURGERY IN THE CITY OF NEW-YORK, &c.

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PREFACE

BY THE AMERICAN EDITOR.

The exalted reputation acquired by this Dictionary having obtained for it almost exclusive preference in Great Britain, on the Continent, and throughout the United States, it will be altogether unnecessary for the publishers to introduce the work or its distinguished author to the American public by any new testimonials. Nor will it be expected of the American editor to attempt a laboured commendation of this compendium of surgical literature, with the view of attracting a larger share of attention from the profession than it has already received in its former publications in this country. It has long been esteemed a standard work, is adopted as a text-book in our universities, colleges, and schools of medicine generally, and finds a place in the library of every surgeon in the country.

The first republication in this country was edited by the late distinguished Dr. Dorsey, of Philadelphia; whose valuable improvements carried it through a second and third edition; and under the title of "Dorsey's Cooper," it rapidly gained upon public favour. The author availed himself of most of the American additions in revising his work for a fourth edition, from which it was again reprinted in America, with an appendix, by Mr. Wm. Anderson, of New-York.

Since that time, Mr. Cooper has published a fifth, and recently a sixth edition, improving and enlarging the work by availing himself of the new and valuable discoveries in surgical knowledge to which he has access; and from this last revision of 1830, the present stereotype edition is republished. And as it has passed through two revisions by the author since it was printed in America, and the last includes all that is novel and interesting among British and continental surgeons down to the present year; its republication, even without any semblance of improvement, will be acknowledged to be a desideratum by all who would keep pace with their improving profession.

As in every species of human science our highest attainments are but an approximation towards perfection, so in the science of surgery, each succeeding year demonstrates that all that is known of the principles or practice of our art, is but the prelude to still higher exhibitions of science and skill, alike honourable to the profession, and valuable to the cause of humanity. To condense and arrange all the novel and interesting facts which clinical experience is furnishing, and upon which alone the edifice of true science can be erected, is a task worthy of the immense labour which Mr. Cooper has bestowed on each succeeding reprint of his Dictionary, and one to which he has proved himself entirely adequate. The extensive and multiplied resources to which he has access, furnish him with facilities possessed by few; and in availing himself of these, he has exhibited an industry, and, for the most part, an impartiality, worthy of all praise.

Within the last few years, our profession, and especially the department of Chirurgery, has been making steady, and even rapid advances in almost every country. Many diseases formerly among the opprobria of our profession have yielded to the science and skill of modern surgeons. Besides the vast improvements made in the treatment of surgical diseases, operations have been performed with entire success for the relief of injuries, but a few years ago esteemed irremediable; and some of them of so bold and difficult a character, that to propose them would have been a hazard of reputation which but few could have then survived.

Learning is not indigenous to any country; and although national pride sometimes prompts to exclusive pretensions, yet the history of surgery, so far as this is concerned, forbids such presumptuous arrogance. The question, "Who hears of American surgeons?" is no longer tauntingly repeated; since the discoveries and operations of some of them have extorted a tribute of admiration from almost every country where this science is cultivated, and given to their names professional immortality. In this, as in the other departments of learning, we may be allowed to say, without the imputation of vanity, that our countrymen have shown to demonstration, that when the tree of science is transplanted across the Atlantic, it is capable of taking as firm a root as in its native soil.

The improvements which surgery has received in the United States, and especially within a few years, although highly important to the interests of the profession and to the cause of suffering humanity, are far from being generally known even in our own country, and still less to the profession abroad. Our periodicals containing them have but a limited circulation, and local views have multiplied their number, until many of the States, and most of our medical institutions, have a vehicle of their own; thus still farther contracting the sphere of their usefulness. And although several of them are most ably conducted, and are adapted to general circulation, we are yet without the advantages which would result from a periodical, strictly national, in which the whole profession might combine their energies for the promotion of science, and to which all might have free and equal access.

From these periodicals our European brethren obtain their information relative to the state and progress of medical and surgical science among us, and some of them never find their way either into Great Britain, France, or Germany. Hence foreign authors are so often charged with criminal remissness in their notices of American surgery. But when we advert to the small proportion of the surgical improvements of this country which have ever been published at all, and recollect that of these but a few are ever seen by our British or continental brethren, we may find an apology for much of the neglect of which we have complained.

That there has been a disposition on the part of some European writers to pass over in silence every thing American, has long been a subject of remonstrance; and in relation to some of these, there is doubtless just ground of complaint. How far Mr. Cooper will be found in the same condemnation will be estimated by those who peruse the present edition, and who will, of course, award him due praise for so much as he has said of American surgery. It is difficult to believe that he has introduced all he knew on this subject, and it is certain that he might have known much more equally worthy of his notice.

In preparing the present edition for the press, the publishers have desired that it might include all that is novel and interesting among American surgeons; and

have committed to the present editor the task of collecting and arranging the materials furnished by our periodicals and original publications, and of condensing these with such original matter as he might be able to obtain, sufficiently important to merit introduction into this Dictionary.

To perform this duty in a manner which should be acceptable to the profession and useful to the community, no pains or labour has been spared. How far he has succeeded in this humble task of compiling from the productions of his fellow-countrymen an epitome of American surgery, remains to be adjudged by those for whose benefit he has been thus employed. He claims no merit for himself, other than that of having rendered, as far as possible, equal and exact justice to the claims of gentlemen in every part of our common country, whether living or dead; and for this purpose, he has availed himself of every accessible means.

He has corresponded with distinguished surgeons in various and remote parts of the land, from many of whom he has received communications of great merit and practical importance. To the periodicals of the last few years he has had frequent recourse, and from most of them he has extracted improvements and inventions which cannot fail to interest and instruct. He must also acknowledge his obligations to Dr. Gross's edition of Tavernier's Operative Surgery; Dr. Sterling's translation of Valpeau's Surgical Anatomy; and to the late Philadelphia edition of Cooper's First Lines, with notes by Professor Stevens, of New-York, and the "Philadelphia Editor."

To a number of his professional friends in New-York, as well as in distant parts of the United States, the editor is greatly indebted, not only for the assistance rendered, but for the encouragement they have given him in the performance of this duty. And although he has not heard from some who had promised communications, yet he has availed himself of their published works, and introduced all the operations they claim, so far as his limits would permit.

The limits assigned him by the publishers for enlarging the work, have rendered it necessary to abbreviate and condense many new and important surgical improvements more than was agreeable to his own wishes; and this must be his apology for so frequent reference to the works and periodicals in which they are recorded at length. The same reason will account for the brevity of many of the notes, which consist of mere hints, upon which some amplification would have been more congenial to his own views, and perhaps more acceptable to the profession. It is but an act of justice, however, on the part of the editor towards the publishers to state, that they have suffered him to transcend their limits very considerably, and allowed him a brief appendix for the purpose of introducing some articles unavoidably omitted under their appropriate heads.

It will be perceived by those who have the opportunity of comparing this with the late London edition, as revised and enlarged by the author, that it contains the whole of the matter of that edition, although the size of the type has somewhat diminished the number of pages. Although many of the terms, doctrines, and operations are now obsolete, and might very plausibly be omitted, yet as Mr. Cooper has seen fit to retain them, it has been thought best to make no alteration whatever in the work, and hence also the long catalogue of references at the end of each article is preserved, although many of the works cannot be obtained in this country.

The original matter introduced by the American editor will be found im-

bodied in the text, in immediate connexion with the subject to which it refers, except where an occasional foot note for obvious reasons has been preferred. To distinguish it from the rest, it is included within brackets, and at the close of each of these additions will be found the surname of the editor.

This method of making interpolations in the body of the work may appear less imposing than an array of additions in an appendix at the end of the book, or a display of notes at the foot of the pages, distinguished by asterisks, obelisks, &c.; but they will certainly be found more convenient to the student, and more in conformity to the character of a dictionary. It is from this conviction that this course has been pursued; which, it is hoped, will be satisfactory to the profession.

As the work is stereotyped, it will be necessary in future editions to enlarge the appendix, which can be done to any desirable extent, and the Dictionary may thus keep pace with the steady advancement of surgical knowledge in this and other countries. For the purpose of supplying any omissions which may have been inadvertently made, it is intended at first to publish but a small edition, sufficient to supply the present demand, and any communications from American surgeons will receive respectful notice in a future edition, by being included in the appendix at the close of the second volume. Such communications are respectfully solicited, and may be forwarded to the editor without delay.

To rescue American surgery from unmerited neglect, and to present to our transatlantic brethren a brief epitome of what is doing in the United States for the promotion and improvement of surgical science, is the object at which the editor has directed this effort. That his task has been imperfectly performed he is fully conscious, nor will he affect to conceal his own misgivings in thus attempting to improve upon the work of one of the master-spirits of the other hemisphere. How far the haste with which the work has been hurried through the press, to supply the great demand which is every where felt and expressed, may have contributed to his imperfections, he will not attempt to determine; perhaps his inexperience in such a vocation may be more plausibly urged. His design, however, is now completed; and he submits the result to his brethren in the profession, and to students of this noble science, with no other wish than that it may contribute to elevate our national character, and excite to the still farther cultivation and improvement of surgical literature.

DAVID MEREDITH REESE, M.D.

New-York, August 22d, 1830.

PREFACE

TO THE

SIXTH LONDON EDITION.

The utility of this Dictionary to students and all classes of medical practitioners, has obtained for it in this country a larger share of patronage than was perhaps ever conferred upon any other book of surgery; while its translation into the French, German, Italian, and Russian languages, and several republications of it in America, may be taken as proofs of its being deemed worthy of considerable notice in various other parts of the world. At Milan, one translation of it was produced a few years ago; and I learn from a letter, with which I have lately been honoured by Dr. Crescimbini, president of the Medico-Chirurgical Society of Bologna, that he is preparing another Italian translation, into which he proposes to introduce additional subjects, and such remarks as are founded upon his own researches and experience. The diligent and enlightened Germans were not only the first to undertake and complete a translation; they have bestowed still greater attention upon my humble endeavours to promote the cultivation and diffusion of surgical science; for they have followed up their translation by a series of well-executed engravings, expressly designed to illustrate the nature of the diseases, accidental injuries, and curative methods, treated of in this Dictionary.—(See *Chirurgische Kupfertafeln*, 4*to*. *Weimar*, 1820—1829.) Of these valuable plates, the publication of which I regard as an honourable compliment to my surgical labours, nearly fifty numbers have already been brought out at an extremely moderate price; and it is with real pleasure that I recommend them to the notice of every surgeon who is a German scholar, as being the most useful collection of surgical and pathological plates ever offered to the profession.

In preparing this edition, which is enriched with an account of all the latest improvements in surgery, I have conscientiously endeavoured to deal fairly and impartially with every individual whose name I have had occasion to mention, or whose suggestions form subjects of consideration in the ensuing pages. My aim has been truth, wherever I could find her; and in every situation where any glimpse of her beautiful figure presented itself, I have ardently courted her, regardless of the name, school, or country on which she might deign to shed her glory. By steadily adhering to this principle; by zealously marking what the book of nature and the field of experience unfolded; by renouncing all obsequious submission to every other kind of authority; and by taking the liberty of sometimes thinking and judging for myself; I trust that the most likely plan has been adopted of maintaining the character of this book, and raising my own humble reputation.

According to my usual plan, I subjoin the notice of a few things, which were either inadvertently omitted in the articles to which they relate, or communicated to me after such articles had been printed.

[The several additions which follow in Mr. Cooper's preface, for the greater convenience of the student have been inserted in the body of the Dictionary, under the respective articles to which they refer. They will be found designated by the abbreviation *Pref.* affixed to the termination of each.]

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SURGICAL DICTIONARY.

ABAPTISTON. (From ἀ, priv. and βαπτίζω, *immergo*, to sink under.) Galen, Fabricius ab Aquapendente, and especially Scultetus, in his *Armamentariam Chirurgicum*, so denominate the crown of the trepan, because it formerly had a conical shape, which kept it from penetrating the cranium too rapidly, and plunging its teeth in the dura mater and brain. While, however, it is admitted by modern surgeons that mischief may be done by letting the saw penetrate too deeply, they do not find it necessary to obviate the possibility of such an accident, by using a conical trepan, with which it would be difficult to make any perforation at all; but they guard against the danger, by observing particular rules and cautions laid down in another part of this book.—(See *Trephine.*)

ABDOMEN. The Belly. When a surgeon speaks of the cavity of the abdomen, he confines his meaning to the space included within the bag of the peritoneum. Hence, neither the kidneys nor the pelvis viscera are, strictly speaking, parts of the abdomen.

Anatomists have divided the abdomen into different regions, the terms allotted to which are so frequent in the language of surgical books, that some account of them in this Dictionary seems indispensable.

The middle of the upper part of the abdomen, from the ensiform cartilage as low down as a line drawn directly across the greatest convexity of the cartilages of the ribs, is called the *epigastric region.*

The spaces at the sides of the epigastric region are termed the *right* and *left hypochondria* or *hypochondriac regions.*

The *umbilical region* extends from the navel upwards to the line forming the lower boundary of the epigastric region, and downwards to a line drawn across from one anterior superior spinous process to the ileum of the other.

The middle space, below the last line, down to the os pubis, is named the *hypogastric region.*

The parts of the abdomen situated on the outside of the umbilical region to the right and left, or externally with respect to two perpendicular lines drawn from the greatest convexities of the cartilages of the seventh true ribs, are named the *ilia* or *flanks.* On each side of the hypogastric region is situated the *inguinal region* or *groin.* The whole of the back part of the abdomen has only one technical appellation, viz. the *lumbar region* or *loins.*

As the abdomen is the frequent situation of several important surgical diseases; is much exposed to wounds; and various operations on different parts of it are often indispensable; it claims the particular notice of every practical surgeon. One of the most common afflictions to which mankind are subject, is that in which some of the bowels protrude. This disease is called *hernia*, and ought to be well understood by every practitioner, who, however, can never acquire the necessary knowledge without being minutely acquainted with the anatomy of the abdomen. In dropsical cases it is frequently proper to tap the abdomen; and this operation, named *paracentesis*, simple as it may seem, requires more consideration and attention to the anatomy of the parts than many surgeons bestow.—(See *Hernia*, *Paracentesis*, and *Wounds.*)

Abdomen, Abscesses of the, may take place either within the cavity of the belly, or at some point of its circumference, may be either of an acute or chronic nature. Women are generally considered more liable than men to abscesses in and about the abdomen; the abscesses named *lumbar*, being elsewhere treated of, are here excluded from consideration. Collections of purulent matter, resembling turbid whey, and containing whitish or yellowish flakes, are not unfrequently formed in the cavity of the peritoneum, as one of the effects of inflammation accompanying puerperal fever.—(*Stoll, Rat. Med. t.* 4, *p.* 103; *Lassus, Pathologie Chir. t.* 1, *p.* 137, *nouvelle édit.* 8*vo. Paris*, 1809.)

In lying-in women, abscesses frequently form between the abdominal muscles and the peritoneum, especially just above the groin. They are cases which have been very correctly described by Conradi. Before the integuments project, the diagnosis is often attended with difficulty, and sometimes an obscurity prevails several weeks; for the patients seem as if affected with slight colic pains, which yield to common treatment, particularly external applications, but soon return. Thus, unless the vicinity of Poupart's ligament be carefully examined, where some painful point, hardness, or elevation can be detected, the abscess may remain concealed until a large prominence, or the extension of the matter down the thigh, lameness, &c., makes the nature of the case completely manifest. As the peritoneum adjoining the abscess is always thickened by the preceding inflammation, Conradi assures us that there is no danger of the collection of matter bursting inwards. Some abscesses, indeed, have been so enormous, that the matter actually pushed the viscera out of their places, yet all this happened without any inward bursting of the disease. The whole danger depends upon the duration of the complaint and the extent to which the matter spreads. A timely detection of the nature of the case, the use of emollient applications, and the making of an early opening, generally bring the disease to a speedy and favourable termination.—(See *Arnemann's Magazin für die Wundarzneiwissenschaft, b.* 1, *p.* 175, 8*vo. Gött.* 1797.)

Chronic tumours of the mesentery, which in scrofulous children sometimes terminate slowly in suppuration, and diseases of the ovary and other abdominal viscera, bringing on the formation of matter, are often the cause of purulent extravasation, great emaciation, hectic symptoms, and death. However, sometimes salutary adhesions are produced between the viscera, by which means an outlet is obtained for the matter through the bladder, anus, or vagina. Thus (says Lassus) in the case of a woman who had had for a long while pains in the right lumbar region, supposed to proceed from suppuration of the kidney, because pus was voided with the urine; the right kidney was found after death in the natural state; but there was an abscess in the right ovary, which was adherent to the bladder, into which the pus had passed through an ulcerated communication. In another patient, who had voided pus by the anus, the right kidney was suppurated and adherent to the colon, with which it communicated by a preternatural aperture. For many years a woman had a hard tumour of considerable size in the abdomen: at length the pain of it became intolerable; and just at the moment when her death was apprehended, an immense quantity of pus was suddenly discharged from the vagina. The pain abated; the swelling of the belly subsided; merely the remains of the induration were now perceptible; and the woman's health was perfectly re-established.—(*Lassus, Pathologie Chir. t.* 1, *p.* 138.)

The abscesses which sometimes form between the peritoneum and abdominal muscles, or between the layers of these muscles, or under the integuments of the abdomen, are attended with considerable variety, according as they happen to be chronic or acute, circumscribed or diffused, small or extensive. Those of the acute or phlegmonous kind, sometimes following stabs and contusions, are particularly noticed in the article *Wounds.* They are cases which demand especial care, because if not checked they may prove

fatal, many examples of which are upon record.—(See *Commerc. Literar. Noric.* 1741, *p.* 100; *Eller, Medic. and Chir. Anmerkungen, p.* 108, *&c.*) As for chronic external abscesses of the abdomen, they should be opened early, and treated on the principles explained in the article *Lumbar abscess.*

Hard, indigestible substances, after being swallowed, are not unfrequently discharged from abscesses in some of the abdominal regions.—(See *De La Grange, in Museum der Heilkunde, b.* 4, *p.* 154 : *a fish-bone, which had been swallowed, found in the abscess; Petit, Traité de Mal. Chir. t.* 2, *p.* 226 : *an awl, without a handle, extracted from an abscess of the abdomen; and many other analogous cases.*)

Encysted tumours are sometimes formed between the peritoneum and abdominal muscles, and attain an immense size before they burst; a remarkable specimen of which is detailed by Gooch.—(*Chir. Works, vol.* 2, *p.* 144, *&c.* 8*vo. Lond.* 1792.) In this case the spontaneous opening in the navel was enlarged with caustic, and the cyst extracted; but before a cure could be effected it became necessary to make a depending opening, and introduce a seton. Swellings of this nature, however, are only noticed here on account of their resemblance to circumscribed chronic abscesses of the parietes of the abdomen.

Abdomen, pulsations in the. From the article *Aneurism* the reader will understand that, though it be the common nature of this disease to be attended with throbbing, it is not every pulsating tumour that is an aneurism. The cases usually called *abdominal* or *epigastric pulsations* often furnish a proof of the correctness of the preceding remark. The authors who have treated of the latter affection with the greatest discrimination, are Dr. Albers, of Bremen, and Mr. Allan Burns, of Glasgow, two gentlemen whose high reputation and useful labours will long survive the recent termination of their meritorious lives. Some of the pulsations here referred to are the consequence of organic disease, and capable of demonstration by dissection; while the rest are not attended with any such appearance, and have therefore been regarded as nervous. The pulsation is not always produced by the impulse communicated to some solid tumour or substance between the hand and the artery, but was conceived by Mr. Burns to be sometimes dependent on a nervous affection of the vessel itself.—(*On the Diseases of the Heart, p.* 263.) Hippocrates, in his book "De Morbis Popularibus," makes mention of three patients affected with extraordinary pulsations in the abdomen. As one of these cases seemed to depend upon obstructed menses, it was probably not the result of any organic disease.—(*Hippocratis Opera Omnia, ex edit. Fæsii. Francof.* 1621, *lib.* 5, *sect.* 7, *p.* 1144.) In order to remove a difficulty in believing how an artery, not affected with aneurismal enlargement, can communicate to the superincumbent parts such movements as are frequently remarked in cases of abdominal pulsations, a fact pointed out by Mr. Hunter should be remembered: in speaking of the actual dilatation of an artery, he says, that when the vessel is "covered by the integuments, the apparent effect is much greater than it really is in the artery itself; for in laying such an artery bare, the nearer we come to it, the less visible is its pulsation; and when laid bare, its motion is hardly to be either felt or seen."—(*Treatise on the Blood, &c. p.* 175, 4*to. Lond.* 1794.) And this observation will apply to all tumours and indurations situated over a large artery. In the epigastric region of a certain patient Taberranus felt not only a pulsation, but a tumour as large as the fist, with all the other usual symptoms of an aneurism. On opening the body after death, he was therefore surprised to find, instead of this disease, a considerable scirrhous tumour in the middle of the mesentery, so closely connected to the large vessels as to compress the aorta, by the pulsations of which it had been lifted up.—(*Obs. Anat. ed.* 2, *No.* 9.)

Dr. Albers quotes an extraordinary case from Tulpius: the patient, a laborious man, but subject to bilious attacks, was sometimes affected with violent throbbings of the spleen. These were not only very painful, but could be heard at a distance, and their number distinctly counted when the hand was applied to the part. What seems almost incredible, it is alleged that Tulpius could hear them at the distance of thirty feet! Their violence increased or diminished according as the patient was more or less bilious, and sometimes they entirely ceased, when his health improved; but always recurred as soon as the chylopoietic organs became disordered again. After the patient's death, permission could not be obtained to open his body.—(*Tulpii Obs. Medicæ, Amst.* 1652, *lib.* 2, *cap.* 28.)

According to Bonetus, pulsations in the left hypochondrium are not unfrequent, and it was his belief that they were produced by the cœliac artery. He cites several cases of this disorder from other writers, the tenour of which is to prove that the cœliac artery and mesenteric vessels must have been affected, as they were found after death dilated and filled with black blood.—(*Sepulchretum Anatomicum, lib.* 1, *sect.* 9. *Obs.* 9, 25, 27, 30, 38, 42, 44, 45, and 46.) The conjecture of Bonetus and others, however, respecting the frequency of abdominal pulsations from dilatation of the cœliac and mesenteric arteries, by no means coincides with the results of modern observations. Mr. Wilson, whose dissections were numerous, met with only one instance of true aneurism affecting any of the branches of the aorta, distributed to the abdominal viscera. This case was an aneurism of the left branch of the hepatic artery.—(*Lectures on the Blood, and on the Anatomy, Physiology, and Surgical Pathology of the Vascular System, &c. p.* 379, 8*vo. Lond.* 1819.) Bontius was present at the opening of an inhabitant of Batavia, who had been afflicted three years with a disease, the exact nature of which could never be made out during life. When the hand was applied above or below the navel, a pulsation was felt like that of the heart or an artery, and as forcible as the motion of a child in the womb. It was synchronous to the pulsation of the heart and arteries. Hence Bontius concluded, that the case was owing to some affection of the heart. The vena cava, instead of containing blood, was filled with a medullary substance, which, pressing against the aorta, is supposed to have excited the extraordinary pulsations in that vessel. The heart was unusually dilated and flabby. The two ventricles were very large, and filled with dark-coloured blood. The liver was of nearly twice its natural size. The gall-bladder resembled that of a bullock, and was filled with viscid bile nearly as thick as an extract.—(*Jacobi Bontii de Medicina Indorum, libri* 4, *Lugd.* 1718, *Obs.* 8, *p.* 101.)

Lewenhoek met with an instance of a similar pulsation, which he imputed to irregular action of the diaphragm, the pulse at the wrist not being affected. The disorder lasted three days, during which the functions of the alimentary canal were so much disordered that the patient was expected to die.—(*Philosoph. Trans. from* 1719 *to* 1733, *abr. by J. Eames, &c. Lond.* 1734, *vol.* 7, *p.* 683.)

Dr. Albers has described the particulars of a case recorded by Burggraf, and entitled "Diuturna, magna, et valde molesta pulsatio in epigastrio."—(*Vid. Acta Natur. Cur. Norimb.* 1740, *vol.* 6, *Obs.* 131.) Burggraf gives his reasons for believing that in this instance, the pulsation arose neither from the aorta nor from the cœliac artery; and suspects that it was caused by a dilatation of that considerable branch of the inferior mesenteric artery, which inosculates with the branch of the superior mesenteric. This idea, however, which was merely surmise, could not be correct, as the patient was cured by taking, every morning and evening, half a drachm of a mass composed of equal parts of gum ammoniac, extr. centaur. minor, and Venice soap.

In an example recorded by Störk, the symptoms were found to have arisen from disease of the pancreas, which weighed thirteen pounds, and contained a large cyst filled with lamellated blood.—(*Annus Medicus, Vindob.* 1760, *p.* 245.)

The subsequent case somewhat analogous to the former, is from a different author.

A man, aged 60, complained of pain in the left side of the abdomen, midway between the umbilicus and crista of the ileum. Emaciation, weakness, distress of countenance, anorexia, constipation succeeded. At length a large pulsating tumour was discovered in the epigastric region. The case was now pronounced aneurism of the abdominal aorta. There was *no nausea nor vomiting*, except that some days before death a quantity of fetid blackish fluid was twice or thrice voided. *No fever.* The swelling caused a sense of constriction rather than pain, and the throbbings became more perceptible. The pulse was feeble, but *slow and regular.* After death, the stomach was found

adhering to the liver, pancreas, and abdomen; and a *cancerous tumour* occupying its internal surface from the duodenum to the insertion of the œsophagus, the coats of the stomach being an inch thick. The surface of the pancreas was also diseased, and the pylorus, situated in the midst of the cancerous mass, was contracted by the thickening of the parietes of the stomach, and obstructed by numerous fungi. The liver was large, but apparently sound; the spleen small. *The aorta, the cœliac trunk, and its branches, were quite natural.*—(See *Journ. de Méd. par Leroux, Oct.* 1815, *and Medico-Chir. Journ. vol.* 1, *p.* 289.)

Morgagni describes the case of a woman 44 years of age, who, after a suppression of the menses for some months, was attacked with palpitations in the epigastrium. Morgagni, on applying his hand to the part, felt a large hard body moving forcibly. At first, it was regarded as an aneurism in the abdomen; but, as there were no similar throbbings in the chest, and there was nothing extraordinary in the pulse at the wrists, Morgagni concluded that the movements in question could not depend upon the heart. Neither did he take the disease for an aneurism, because the throbbings did not correspond to the pulse. As for the large indurated mass, it appeared to him more easy to say what it was not, than what it was: it could not be merely a *globus hystericus*, which never beats like an aneurism. Morgagni considered the case as an hysterical spasmodic complaint, ordered the patient to be bled, and the following day the pulsations ceased.—(*Morgagni, de Sedibus et Causis Morborum, t.* 2, *Epist.* 39. 18.)

Senac has spoken of these abdominal pulsations as occurring in hypochondriacal and chlorotic patients; and, as they frequently subside without leaving any vestige behind, he sets them down as nervous affections.—(*Traité des Mal. du Cœur.*) De Haen had under his care a hypochondriacal patient, affected with pulsations in the abdomen; which, with other complaints, were dispelled by means of brisk opening medicines.—(*Heilungs Methode, übersetzt von Plattner, Leipz.* 1782, *b.* 2, *s.* 29.)

Thilenius observed a flatulence of the stomach, which he represents as having been epidemic, and attended, in some patients, with pulsations at the scrobiculus cordis.—(*Med. Chir. Bemerk. Frankf.* 1789, *s.* 211—217.) My friend Mr. Hodgson, also, in speaking of pulsations in the epigastrium, which are not the consequence of organic disease, and occur in irritable hypochondriac subjects, states his opinion, that, in some instances, these pulsations were a consequence of distention of the stomach with air, which was thrown against the abdominal muscles by the pulsation of the great blood-vessels; and in such cases, the throbbing was diminished by the eructations.—(*On the Diseases of Arteries and Veins, p.* 96.)

Abdominal pulsations are also described by Zuliani, as a symptom of hypochondriasis and hysteria.—(*De Apoplexia, Lips.* 1790, *p.* 79.) They also happen in certain ferbrile diseases.—(*Versuch über den Pemphygus und das Blasenfieber, von C. G. C. Braune, Leipz.* 1795, *s.* 23; and *Dr. R. Jackson on the Fevers of Jamaica, 8vo. Lond.* 1791.)

In a dissertation on cramp in the stomach, Haü remarks, "Quin immo, ubi diutius vexavit gastrodynia, continuos ægrotans persentit spasmos, ut et haud raro pulsationem quandam plane singularem, in cardia et ventriculo, pulsui autem cordis minime synchrone."—(*Diss. de Gastrodynia, Upsal,* 1797.) In the same essay, there is an account of a man, who had violent palpitations in the epigastric region, apparently first excited by the larvæ of the musca pendula, many of which were vomited up.

Pinel is another writer who describes these abdominal pulsations as an occasional symptom of hypochondriasis. "Palpitations du cœur, et quelquefois une sorte de pulsation irréguliere, dans quelque partie de l'abdomen."—(*Nosographie Philosophique, t.* 2, *p.* 25, *Paris, an.* 6.)

Dr. Albers details some cases which fell under his own notice. A young woman, whose menses were upon her, and who had been for some days constipated, was seized with frequent fainting fits and febrile symptoms, occasionally voiding from the bowels a quantity of dark matter, each evacuation of which was followed by a swoon. One morning at five o'clock Dr. Albers was sent for, as it was feared the patient was about to die. She was extremely exhausted, and the fainting fits followed each other with hardly any intervals. She could just say "I feel a throbbing in the belly;" and, when Dr. Albers applied his hand to the part, he felt a violent pulsation extending from the ensiform cartilage down to about the bifurcation of the aorta. The action of the heart was weaker than natural; the pulse at the wrist very small, but not quicker than it had been on the preceding day, and not synchronous to the throbbing in the abdomen. Dr. Albers confesses, that, at first, he took the case for an aneurism. Dr. Meyerhoff was of the same opinion. Another physician, however, Dr. Weinholt, entertained doubts of the complaint being aneurismal, saying, that he recollected having read similar cases in Morgagni. These gentlemen decided to persevere in the employment of opening medicines and clysters, combining opium with the former. Under this plan, the pulsations in the abdomen and tightness of the chest diminished in a few days. The stools were at first of the colour of chocolate, but afterward resumed their natural appearance. The throbbings, in a weakened form, however, were perceptible for six weeks longer. The patient at length got quite well, and was remaining so four years afterward.

A man about 40, severely afflicted with hypochondriasis, great oppression of the chest, constipation, and tension of the abdomen, tendency to fainting, &c., complained to Dr. Albers that he felt as if his heart had fallen down into his belly, where he was annoyed with an incessant throbbing. Indeed, when Dr. Albers examined the abdominal parietes he could feel a very strong pulsation, and, what is curious, could trace it not only along the track of the aorta, but in the course of the left iliac artery. The pulse at the wrist, which was small, frequent, and hard, did not correspond with the abdominal pulsations. For several days the evacuations from the bowels had been as black as pitch. After the employment of gentle purgatives, all the complaints quickly abated, though the throbbings were feebly perceptible for nine months afterward.

The next case which Dr. Albers met with is very interesting. A robust sailor, whose bowels were so constipated, that hardly the strongest purgative could affect them, was seized with constant pain in the left hypochondrium. With this complaint was soon joined great pain in the back, and a sensation as if something alive moved about in the belly from one side to the other, and thence extended up to the neck, followed by the vomiting of a greenish matter. At the same time, he felt in the left side a pulsation which he took for that of the heart, and which continued the whole of his illness. The pulse at the wrist was natural, and synchronous with that in the abdomen. In the beginning of the disorder, the patient was obliged to sit with his body very much inclined forwards, as no other posture could be endured. For the first week opening medicines afforded so much relief, that he was sometimes quite free from pain for six or eight hours. After a time, a round swelling formed in the left hypochondrium, reached to the navel, and attained with incredible quickness the size of a child's head. Indeed, it could now be traced beyond the umbilicus to the right side. The motions were quite of a dark colour, or else red blood and a puriform matter were discharged. Sometimes the blood voided was of a bright red colour, sometimes it was dark, coagulated, and mixed with bile. The patient was at length worn out with febrile symptoms, and died. On opening the body, Dr. Albers found a swelling in the middle of the mesentery, the texture of which cannot be easily described, and the circumference of which was 16 French inches. The stomach was filled with coagulated blood. The spleen, pancreas, and liver were sound; but the gall-bladder was of prodigious size, and contained thick viscid bile. The arteria cœliaca, arteria coronaria ventriculi, and the arteria mesenterica were preternaturally dilated, and full of dark-coloured blood. He speaks of them, however, only as being in an enlarged, not an aneurismal state. Dr. Albers thinks it highly probable, that it was one of these vessels by which the pulsations had been occasioned.

Dr. Albers has also seen these abdominal pulsations in a paralytic female; and in a lunatic, who was afterward seized with apoplexy. He likewise met with a married woman, the mother of several children, in whom these throbbings took place invariably at the commencement of pregnancy, and were a surer sign

of this state, than other common effects, as stoppage of the menses, &c. After the third month, however, they used to cease altogether.

Many valuable practical observations on cases attended with hemorrhages from the intestinal canal, my limits here oblige me to pass over. According to Dr. Albers, hemorrhoidal patients, especially when put to inconvenience by compression of the tumours, often complain of throbbings about the spleen, which are plain even to the hand.—(*J. F. Albers, über Pulsationen im Unterleibe*, 8vo. *Bremen*, 1803.)

Dr. Parry makes a few interesting remarks on such abdominal pulsations as excite suspicion of aneurism. In any persons not very fat, and lying upon their backs, he says, the pulse of the aorta can easily be felt, if strong pressure be made a little to the left of the median line, about half way between the navel and scrobiculus cordis. In certain instances, the pulsation is painfully felt by the patient himself. In many cases of this kind, particularly in nervous individuals, the sense of pulsation is merely the effect of preternatural action of the heart. While, in other examples, it is the effect of the pressure of some hard substance upon the descending aorta, determining a disproportionate quantity of blood to the head, "and giving to the hand placed on the abdomen, and sometimes even to the eye, the appearance of a beating so near the surface, as to lead inexperienced observers to conclude, that the aorta is morbidly dilated." According to Dr. Parry, the most common causes are collections of feces in the colon, requiring repeated and active purgatives, which must bring away almost incredible discharges of stercoraceous matter before the aortal pulsation subsides.—(See *Parry's Elements of Pathology*, &c. and the *Medico-Chir. Journ. and Review*, *vol.* 1, *p.* 157.)

Another cause of a temporary appearance of pulsation or movement in the abdomen, not mentioned by any of the preceding authors, is the power which some persons have of putting portions of the recti muscles separately into strong convulsive action. I have seen a large abcess of the loins attended with distinct and forcible pulsations, corresponding to those of the aorta.

According to Mr. Allan Burns, a beating is generally felt about the pit of the stomach, in the advanced stage of chronic inflammation of the heart: in this case, when the pericardium is closely adherent to the latter organ, it is corrugated at every contraction of the ventricles, and the diaphragm and liver are elevated. The ventricle, however, having completely emptied itself, is again distended, and, in proportion to the degree of dilatation, the liver and diaphragm descend, whereby an impulse is communicated in the epigastric region.—(*On Diseases of the Heart*, *p.* 263.) This valuable writer cites the remark of Morgagni (*Epist.* 17, *art.* 28), that sometimes, in dilatation of the heart, this organ descends so far as to push the diaphragm into the hypochondrium, and pulsate in that situation, so that the disease is mistaken for an aneurism of the cœliac artery. In Mr. Burns's work, a memorable case of this description is related. An erroneous judgment is the more likely to be formed in such examples, because the pulsations of the heart and tumour are not exactly simultaneous; for it is not the heart which is felt directly beating, but the liver, which, by the action of the heart, is thrown forwards. Hence the palpable interval between the stroke of the heart and the movement of the liver.

The following fact shows how circumspect a practitioner should be in the prognosis. An anonymous writer informs us, that he attended a gentleman, in consultation with an eminent surgeon and lecturer on anatomy, where the most distressing palpitations of the heart, and loud pulsations below the epigastrium, were awful symptoms. The pulsations could be both seen and heard at a distance on entering the room in which the patient sat. Several physicians were inclined to suspect some organic lesion of the arterial system; but their opinion was given with becoming diffidence:—not so the surgeon's; his impression was, that there existed *an aneurism of the descending aorta*; and such was the firm persuasion he had acquired of the reality of his impression, that he could grasp the aneurismal sac through the abdominal coverings, though nobody else could, and trace its magnitude and position. After death, the heart was found enlarged, and its left ventricle of enormous size. The inner surface of the stomach also exhibited traces of long existing disease; but the aorta was quite sound.—(See *Med. Intelligencer*, 1821, *p.* 71.)

Preternatural pulsation about the epigastrium is also stated by Mr. A. Burns to be sometimes occasioned by encysted tumours, attached either to the lower surface of the diaphragm, or formed between the layers of the pericardium towards the diaphragm, as happened in an instance recorded by Lancisi.

Another cause specified by Mr. A. Burns, is enlargement of the vena cava, or of the right auricle of the heart. Senac describes a case in which the vena cava was as large as the arm, and there had been a violent pulsation in the epigastrium.

The next cause enumerated by the same gentleman is increased solidity of the lungs, more especially of their lower acute margins, where they overlap the pericardium. In this case the pulsation is about the scrobiculus cordis.

Mr. A. Burns likewise notices several other causes of epigastric or abdominal pulsations, already illustrated in the foregoing part of this article, indurations of the pancreas, scirrhus of the pylorus, tumours in the mesentery, or any solid increase of substance about the abdominal aorta, or its principal branches; and, lastly, a peculiar affection of the vascular system itself.

The following observations on the criteria between various abdominal pulsations and those of aneurism, appear interesting.

According to Dr. Albers, an internal aneurism originates gradually, and the pulsations increase in strength by degrees. Other abdominal pulsations, on the contrary, begin suddenly, and are most violent in the beginning, abating after they have lasted some time

In an aneurism, the pulsation is synchronous with the stroke of the artery at the wrist; but this is not regularly the case with other pulsations.

Should the patient be affected with melancholia, hypochondriasis, hysteria, or other nervous complaints, void blood from the stomach, or a black matter from the bowels; should there be any hardness or swelling of any of the abdominal viscera discoverable by the touch, the probability is, that the pulsations are not owing to an internal aneurism.

With the exception of cases in which these pulsations are owing to mechanical impediments to the circulation, Dr. Albers believes, that they are mostly a symptom of some nervous affection. He also thinks, that the surprise excited by these throbbings arises only from their strength and situation, other analogous strong pulsations, as, for instance, those of the heart, or of the carotids being common enough in hypochondriacal and hysterical persons. The same gentleman adverts to the increased action, which, in inflammation and fevers, is often more conspicuous in some parts of the sanguiferous system, than in others.—(*Uber Pulsationen im Unterleibe*, *p.* 36, &c. *Bremen*, 8vo. 1803.) Much important additional information on this subject may be found in *Observations on some of the most frequent and important Diseases of the Heart; on Aneurism of the Thoracic Aorta; on Preternatural Pulsation in the Epigastric Region*, &c. *By Allan Burns*, *p.* 262, &c. 8vo. *Edinb.* 1809.

ABSCESS. A tumour containing pus, or a collection of purulent matter.

Abscesses are divided into two principal kinds, viz. *acute* and *chronic*. For information relative to the former, see *Suppuration*; and for that concerning the latter, refer to *Lumbar Abscess*. See also *Abdomen*, *Antrum*, *Anus Abscesses of*, *Bubo*, *Empyema*, *Hypopium*, *Mammary Abscess*, *Whitlow*, &c.

ABSORPTION. That nature has fully provided for the due execution of this important function, is a truth of which no doubt is entertained: it must be immediately manifest to every person who reflects upon the mutation which is continually taking place in the particles of every texture of the animal body; upon the gradual and harmonious removal of the old matter in proportion as the new is deposited by the secerning arteries; or upon the impossibility of accounting for the changes produced by growth in the size and figure of different organs, and, indeed, of the whole body, without constantly bringing into the explanation this interesting process, of which numerous and even the most essential particulars, it is true, yet remain obscure. But, besides these considerations in proof of absorption, many others must strike the con-

templative physiologist. By the action of the secreting and exhalent arteries, the whole mass of blood would soon be so lessened that life would unavoidable cease, if the sanguiferous system were not duly replenished in some way or another. The undiminished quantity of blood in the circulation, notwithstanding the constant deductions from it by secretion and exhalation; the regular fulness of the blood-vessels, notwithstanding the incessant drain from them; and the constant supply of materials for the numerous secretions; all imply the existence of a certain function, one principal design of which is to counteract the effect which, without it, would be rapidly and fatally produced upon the quantity of blood in the system. As M. Magendie observes, whenever any substance in the form of a liquid, gas, or vapour, is put, for a certain time, in immediate contact with an external or internal surface of the body, it is *absorbed*; that is to say, it passes into the blood-vessels, mixes with the blood, circulates with it, and thus occasions either salutary or noxious effects upon the system. This is particularly exemplified in the action of certain poisons; a drop of pure hydrocyanic acid, put on a dog's tongue, causes the animal's death in a few seconds, in consequence of being transmitted with the blood to the brain. Food, drink, medicines, and even air itself, only become useful to us, after having been absorbed. Many diseases, some of a very dangerous nature, are contracted by absorption. In fact our existence is so inseparably connected with this function, that the suspension of it for an instant would produce almost immediate death.—(See *Journ. de Physiol. Expérim. t.* 1, *p.* 1.)

The office of the absorbents, as a modern writer has remarked, is literally expressed by their name; it consists in receiving or taking up certain substances, and in transporting them from one part of the body to another. The substances which are thus taken up, are of two kinds, the chyle and the lymph; the former being received by the lacteals, and the latter by the lymphatics. The immediate object of the action of the two sets of vessels, he observes, is also essentially different; that of the first being to convey a fluid from the part where it is formed into the blood, in order that it may directly serve for the nutrition of the body; the latter serving, n the first instance, to remove what is useless or noxious, and to dispose of it in such a manner, that it may either be applied to some secondary purpose of utility, or be finally discharged from the system.—(*Bostock, in Elem. Syst. of Physiology, vol.* 2, *p.* 551.)

The uses of the absorbent system are far more numerous than would at first be supposed by a person only superficially acquainted with physiology and the phenomena of disease. If we wish to have a just comprehension of all the various purposes which this system fulfils in the animal economy, we must take the same enlarged view of the subject as Mr. Hunter did. We must contemplate all the modifications of absorption, and its effects both in health and disease, in the nutrition and growth of the body, as well as in its emaciation, or atrophy, and the diminution, or even total removal, of parts of it, become diseased or useless.

First, According to Mr. Hunter's explanation, the absorbents take up extraneous matter, in which is included nourishment.—(*On the Blood, &c. p.* 439.) By extraneous matter we are here to understand matter not originally contained within any texture of the body, not constituting any part of its natural structure, but introduced from without. Thus the absorption of mercury, arsenical paint, cantharides, and other substances applied to the skin, furnishes examples of the absorption of extraneous matter, which are also illustrated by the effects of the venereal, variolous, vaccine, and several other poisons. Sometimes the passage of the poison into the system and its pernicious operation, happen so rapidly, that suspicions are entertained that it must have a shorter track into the circulation than through the lymphatic vessels, their glands, and trunks. This has been suspected to be the case when animals are killed with hydrocyanic acid, the nux vomica, the poison of certain snakes, the upas tiente, &c. How far this opinion is true will be hereafter considered. Such is the rapidity with which the poisons of upas tiente, nux vomica, and St. Ignatius's bean are absorbed and carried into the sanguiferous system, that in twenty seconds after being put into the cavity of the peritoneum, their action reaches the spinal marrow.—(See *Magendie's Journ. de Physioli Expérim. t.* 1, *p.* 18.)

Secondly, As Mr. Hunter has noticed, the absorbents take up superfluous and extravasated matter, whether natural or diseased. Thus, the removal of the old particles of the body, after they have become unfit to continue longer in their respective situations and textures, —an action that is reciprocal with the deposition of new matter by the secerning arteries; and the incessant regulation of the quantity of serous fluid in the cavities of the abdomen, chest, pericardium, and tunica vaginalis, so that, though the arteries unremittingly secrete this fluid, the absorbents prevent its redundant accumulation, and combine with the blood-vessels in maintaining a continual renovation of it; are examples of the absorption of natural but superfluous matter. On the contrary, the dispersion of extravasated blood, of the fluid of ascites and anasarca, of coagulating lymph, or air, effused in the cellular tissue; and of an infinite number and variety of swellings and thickenings of parts; are instances of what Mr. Hunter has termed the absorption of superfluous diseased matter, or, as I should say, of superfluous matter from disease.

Thirdly, Mr. Hunter enumerates the absorption of the fat. No doubt can exist respecting the continual change which is taking place in the quantity of adipose matter in the body, according to the state of the health, the degree of exercise, fatigue, or labour to which the body is exposed, a disturbed or undisturbed condition of the mind, and the effects of different kinds of regimen and diet on the whole system. Perhaps it may be inquired why Mr. Hunter should distinguish this absorption from that of other superfluous matter in the body. The reason does not appear in his writings; unless we receive as such the observation, that he did not consider the fat and earth of bones as true animal substances, as they have no action within themselves and no principle of life. However, this would not be very consistent, because other superfluous matter, comprised in the second classification, especially the fluid secreted by serous membranes, and the fluid of anasarca, are likewise quite destitute of the living principle. At the same time, I admit that the absorption of the fat may be entitled to distinct consideration on other grounds; for sometimes its absorption seems to be retarded in a much greater degree than that of other substances in the body; or at all events its absorption does not keep pace with that of its secretion, so that, although the muscles and other organs remain of their usual bulk, the fat may acquire the thickness of several inches. On the other hand, the absorbents sometimes act upon it with a quickness that does not always extend at the same time to other parts of the body. Thus in fever nearly all the fat may be absorbed in the course of a few days; yet the size of the muscles may have undergone but little reduction.

Fourthly, Mr. Hunter enumerates the species of absorption by which a waste of parts is produced, and in consequence of which the muscles become smaller, the bones lighter, &c. These cases we find exemplified in the ordinary course of nature; for in old age such changes happen in the bones and muscles, and also in other organs like the absorbent glands, which become so diminished, that some writers erroneously assert that they entirely disappear. Whenever the action of a muscle is long prevented by disease of a joint, a fractured bone, or other causes, it always dwindles away in a greater or less degree, and the limb compared with the sound one will be found to be considerably reduced. The absorption of the fat, by which the bulk of parts is also lessened under various circumstances of disease, I believe is not generally restricted to a particular limb or part, like the absorption which affects the muscles in similar cases. Thus, when a patient becomes hectic from disease of the hip-joint, the muscles of the thigh and leg on the same side as the disease undergo a remarkable diminution of their bulk, while those of the sound limb are little or not at all altered; but the fat of the whole body is rapidly absorbed, and the greatest universal emaciation prevails.

Before the period of Mr. Hunter's inquiries, the knowledge of all the different purposes of absorption, by whatever organs it was supposed to be performed, whether by lymphatics or veins, was certainly very limited in comparison with the more extensive in-

formation which now prevails, and which is in a great measure the fruit of his industrious researches. Speaking of the absorbent vessels, which he considered, with the generality of modern physiologists, as the true instruments of absorption, he says: "From a farther knowledge of these vessels we shall find that they are of much more consequence in the body than has been imagined, and that they are often taking down what the arteries have built up; removing whole organs, becoming modellers of the form of the body in its growth; and removing many diseased and dead parts, which are beyond the power of cure."

As these vessels are productive of a great variety of changes in the animal economy, which are very dissimilar in their intention and effect, Mr. Hunter considered them in two general points of view: first, as they absorb matter, which is not any part of the body itself; secondly, as they absorb the body itself. The first of these uses, the absorption of matter which is no part of the machine, he observes, is well known, and of two kinds; first, that of exterior matter, comprising every thing applied to the skin, and also the chyle; the other interior, comprehending that of many of the secretions, the fat, the earth of bone, &c. These kinds of absorption take place principally for the nourishment of the body; but they also answer other purposes, and are very extensive; for, besides their salutary effects, they are frequently the cause of disease in a thousand forms.

In the second of the above-mentioned views, Mr. Hunter considers the absorbents as removing parts of the body itself, and here he again views them in two lights. The first is where only a wasting is produced in the whole body or some particular part of it; to which mode of absorption he applies the epithet *interstitial*, because it consists in the removal of particles of the body out of the insterstices of parts which yet remain, and still form a perfect whole. This kind of absorption, Mr. Hunter says, has always been admitted or supposed, whether performed by the veins or lymphatics. It is often carried farther than the mere wasting of the part; for it may proceed till not a vestige of such part is left, as is sometimes exemplified in the total decay of a testicle. *Interstitial absorption*, therefore, may be understood in two senses.

The second view taken by Mr. Hunter embraces that kind of absorption by which whole parts of the body are removed, and which is sometimes a natural, sometimes a diseased, process. It is a view of which he particularly claims the discovery. In the natural process, he says, the absorbents are to be considered as the modellers of the original construction of the body. No alteration can take place in the original formation of many of the parts, either in the natural growth or the formation arising from disease, without the action of the absorbents, which always have a considerable share in the production of the changes. This he terms *modelling absorption*, the principle of which is as extensive as any in the animal economy. Bones and numerous other parts cannot be formed without it. A part which is of use in one stage of life, but becomes quite useless in another, is thus removed, as is exemplified in the thymus gland, the ductus arteriosus, and the membrana pupillaris. In some cases the absorption of whole parts in consequence of disease leads to dissimilar effects; one is a sore or ulcer; and Mr. Hunter therefore calls the process by which it is produced, *ulcerative absorption*. In other cases no ulcer is caused, although whole parts are removed. Both these forms of absorption, he thinks, might be named *progressive*.

The removal of a whole solid part of the body, or as Mr. Hunter expresses it, "that power which the animal economy has of taking a part of itself into the circulation, by means of the absorbent vessels, whenever it is necessary," is unquestionably one of the most curious facts which can present themselves to the notice of the physiological inquirer. In Mr. Hunter's time the doctrine was a new one; but he informs us, that he had long been able to demonstrate its truth, and that he received the first hints of it from the waste of the sockets of the teeth and of their fangs at the period of their being shed.

"It may be difficult at first to conceive how a part of the body can be removed by itself; but it is just as difficult to conceive how the body can form itself;" yet they are both equally facts. Without dwelling on the exact mode in which such changes happen, he gives it as his belief, that "whenever any solid part of our bodies undergoes a diminution, or is broken in upon, in consequence of any disease, it is the absorbing system which does it.

"When it becomes necessary, that some whole living part should be removed, it is evident that nature, in order to effect this, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into such a state as to yield to this operation."—(See *Hunter on the Blood, &c. p.* 439—442.) For an account of *ulcerative absorption*, vide *Ulceration.*

With regard to the difficulty which there may be in conceiving how such small tubes as the lymphatics can take up solid substances, Bichat points out that the distinction between the solids and the fluids can only be said to prevail when they form a mass; but that when reference is made to their separate particles, they do not differ from each other. This, he says, is so perfectly true, that the very same particle will alternately enter into the composition of a solid and a fluid, just as the elements of water are the same, whether it be in the liquid or frozen state. Now as the absorption of solid substances takes place by the removal of these separate particles or atoms, no greater difficulty can present itself in understanding how this may be effected than in conceiving how fluids may be absorbed. —(See *Anat. Gén. t.* 2, *p.* 92.)

I come now to a very difficult question, and one that has hitherto received no satisfactory answer; not because the subject has not been earnestly, deeply, and ably considered, but because its difficulties and obscurity seem to defy all successful investigation: the question here referred to, is, On what principle and by what power are the lymphatics, *supposing them to be absorbent vessels*, enabled not only to take up the old particles of various organs and different fluids secreted in different textures and cavities, but to convey them frequently with considerable velocity and through a long tract, intercepted also by those complicated organs, the absorbent glands, into the venous system near the heart? In other words, what is their mode of action? As Mr. Hunter has observed, the principle of capillary tubes was at first the most general idea, because it was familiar one; but this is too confined a principle; nor will it account for every kind of absorption. Capillary tubes can only attract fluids; but as solids were often absorbed, such as firm tumours, coagulated blood, the earth of bones, &c., the advocates for this hypothesis were compelled to suppose the existence of a solvent. "This may or may not be true; it is one of those hypotheses that can never be proved or disproved, and may for ever rest upon opinion." But Mr. Hunter's conception of this matter was, that nature leaves as little as possible to chance, and that the whole operation of absorption is performed by an action in the mouths of the absorbents; but even under the idea of capillary tubes, physiologists were still obliged to have recourse to the action of those vessels to carry the lymph along after it had been absorbed; and they might as well therefore have extended this action to the mouths of the vessels.—(*On the Blood, &c. p.* 443.)

The question still continues without satisfactory answer, whether Hunter's language be adopted, and we say that absorption is effected by an action of the lymphatics and their orifices; or whether we employ the language of Bichat, and ascribe the performance of the functions of these vessels, and the circulation of the fluid in them, to what he ingeniously (but not much to the edification of his readers) calls *organic sensibility* and *insensible organic contractility*. This imagined kind of sensibility confers upon every absorbent vessel a power of feeling quite unconnected with the brain, by which it is presumed to be sensible of the presence of matter fit for removal, which is then imbibed and conveyed along the tube by the insensible organic contractility, by which is signified a power of contraction, not admitting of demonstration, not excitable by stimulation or irritation, but inferred to take place in some inexplicable manner, chiefly because the fluid in the absorbents is known to be constantly in motion, and always flowing towards the thoracic duct. In fact, Bichat's explanation is merely a reference to two principles, which are themselves hypothetical, and more calculated to amuse a playful fancy than to satisfy a sound judgment. Organic sensibility, and insensible organic contractility, he observes, are the

more remarkable in the absorbent system, as they survive for a certain time death itself. A fluid, injected while the animal retains some degree of heat, is absorbed both on serous and mucous surfaces, and also in the cellular tissue, though with less freedom. This power of absorption after death, he says, may even be lengthened by keeping up artificial heat by means of a bath, though the plan is less efficacious than he at first supposed, vital heat seeming to be essential.—(*Anat. Gén. t.* 2, *p.* 117.) All these observations, however, merely amount to a recital of the facts, that absorption may proceed for a short time after death (never later than two hours from this event, *p.* 118), and that it is promoted by artificial heat; but how, or by what exact mechanism it is accomplished, is not revealed to us.

The lymphatics are not regarded by Bichat as endued either with what he terms *animal sensibility*, or with *animal contractility*. His proof of the first of these statements is, that when a lacteal vessel, full of chyle, a lymphatic filled with serosity on the surface of the liver, or even the thoracic duct, is punctured, the animal betrays no mark of pain. But the little faith which he himself put in the doctrine, may be conceived from the question to which it leads him, namely, what inference can be drawn from a circumstance where, in consequence of the belly being laid open, the many agonies produced would comparatively annihilate any slight sensation, even were it to exist! He also adverts to the acute sensibility of the absorbent vessels in their inflamed state.—(*P.* 115, *t.* 2.)

Hunter admitted a vital contractile property in the lymphatics, or, as Bichat would express it, sensible organic contractility. The former adopted this belief, because those vessels readily empty themselves of the chyle that is pervading them, and contract when sulphuric acid is applied to them. On the other hand, Bichat argues, that sulphuric acid, like every other concentrated acid, and also heat, produce the same effect upon all animal substances, even after death, namely, a shrinking of them. When the absorbents, and particularly the thoracic duct, are touched with the point of a knife, they do not contract. If they are capable of contraction, Bichat maintains that it is when they cease to be distended, and not when they are irritated; consequently, it appears to him to be by virtue of their contractility of tissue. The opinion at which he finally arrives is, that sensible organic contractility in them is at all events doubtful, and that, if it exist, it is very obscure, and at most not greater than that of the dartos.—(*T.* 2, *p.* 117.)

This last inference, and, indeed, the whole of Bichat's doctrine respecting the non-existence of sensible organic contractility in the absorbent vessels, are very difficult to reconcile with certain observations made by himself, in other parts of his work. Thus, he informs his readers (*t.* 2, *p.* 95), that he had frequently noticed in living animals, especially in dogs, manifest expansions in the course of a lymphatic, and containing a limpid fluid. These appearances were mostly met with on the concave surface of the liver, and on the gall-bladder. When the dilated portions of the vessel were pricked with a lancet, the fluid ran out, and they immediately disappeared. "*On another occasion, I saw two or three of these small dilatations on the gall-bladder, and having then let the liver descend while I examined the bowels, I was much astonished the next instant at not being able to find them again; no doubt* (says he) *the contraction of the vessel had made them disappear.*" He adds, that the liver is the organ on which these vessels can be best seen in living animals; but *its concave surface must be looked at the instant the belly is opened, for the contact of air, by making them contract, soon hinders them from being distinguished.*—(*See Anat. Gén. t.* 2, *p.* 95, 96.) And in another place he says, "in dropsies where the absorbents are full, if the skin be lifted up, they may easily be distinguished by their transparency; but very soon, notwithstanding their valves, they empty themselves, and can no longer be discerned with the eye."—(*P.* 108.)

The fact of the absorbents expelling more or less of their contents, when they have been punctured, might be very well ascribed to what Bichat calls *contractility of tissue*, or even to *elasticity*; but, the propulsion of the fluid from a dilated portion of an unwounded lymphatic into another portion of the same vessel, certainly does not admit of the same explanation. The valves may determine the direction which such fluid must follow, if it move at all; the anastomoses may facilitate the passage of it; and contractility of tissue, or elasticity, may have an auxiliary effect; but its first motion can only be accounted for by supposing either that there is an impelling power in the vessels themselves, or in some organ or organs with which they are connected; or else that their contents are set in motion by external pressure, the swell of muscles in action, or the pulsation of neighbouring arteries. Now, in some of the cases mentioned by Bichat, no doubt can be entertained that the impelling power was in the lymphatics themselves, because he distinctly adverts to the contraction so speedily excited in them by exposure to the air, that the concave surface of the liver must be looked at immediately on the animal's belly being opened, or else they will not be distinguished.

Dr. Bostock conceives, that "an attraction exists between the mouths of the lacteals and the chyle, which seems to be analogous to, or identical with, the elective attraction, which unites different chemical substances;" and "that the lacteals, as well at their extremities as through their whole extent, are possessed of contractility, by which the fluids, when they have once entered, are propelled along them; an effect which is probably promoted by the pressure of the neighbouring parts, while the numerous valves with which they are furnished prevent the retrograde motion of their contents."—(*Elem. Syst. of Physiol. vol.* 2, *p.* 580.) The principle on which the lacteals imbibe the chyle can scarcely be referred to any thing so fixed and determinate as chemical attraction, or so independent of life. On the contrary, the absorption of chyle from the bowels may be looked upon as a process liable to be accelerated, or retarded, by various states of the constitution, habits of life, and different affections of the mind. If it were a chemical operation, and the abundance of chyle happened to exist on the villous coat of the small intestines, at the period of any sudden death, the process would be expected to go on as long as that fluid and the villi remained in contact; yet we have no proof of this being the case: indeed I cannot comprehend any similarity between elective attraction and the absorption of chyle; the former being an operation in which the action of vessels or their orifices, and the influence of life, are considerations totally separated from the subject; whereas, in the latter, they form in reality the main topics of inquiry. Elective attraction, however, may only be intended as a comparison applicable to the disposition which the lacteals have to take up certain substances, but to reject others: though, even in this sense, the comparison would be very imperfect.

Dr. Bostock's opinion is probably true, that an elucidation of the action of the lymphatics must be attended with even greater difficulty, than what presents itself to the inquiry into the principle on which the chyle is taken up and conveyed into the system. The increased difficulty chiefly proceeds from our having no positive information respecting the extremities of the lymphatic vessels, or the mode in which their contents are first received; "for there is reason to suppose that the transmission of the fluids themselves is conducted upon the same plan with that of the lacteals." As the same author remarks, we do not know where the mouths of the lymphatics are situated; with what parts they are connected; how they are brought into contact with the substances which they receive; nor by what power they are enabled to take them up.—(*Vol.* 1, *p.* 582.)

The source of the lymph is also less certain than that of the chyle; for, even at the present day, M. Magendie, influenced by the possibility of injecting the lymphatics from the arteries, and by the uniform nature of the lymph, and its analogy to the blood, professes a belief, which was common many years ago, that it is not formed by the decomposition of the old particles of the body, nor by fluids absorbed from various surfaces; but that it is composed of the thinner parts of the blood, which, instead of returning by the veins to the heart, pass into the lymphatics, and are conveyed to that organ through the thoracic duct. The lacteals certainly have little disposition to take up any thing but chyle; but, as Dr. Bostock has explained, "the lymphatics are capable of absorbing a great variety of substances, differing from each other most

widely in their nature, so that it would almost appear as if, by a certain mode of application, any substance might be forced into them. Nor (says Dr. Bostock) is this conclusion affected by the hypothesis of M. Magendie; for, although we might agree with him in supposing that in the ordinary operations of the system, the veins are the principal, or even the sole instruments in removing the materials of which the body is composed, yet we have unequivocal evidence, that when certain poisonous or medicinal agents are applied to their extremities, they may be received or forced into them, and conveyed into the circulation. The case of metallic or other medicinal substances that are taken up by the lymphatics, may appear to be less difficult to explain, because the absorption is generally produced by friction, or some mechanical process, which may be supposed to force the substance into the mouths of the vessels, or to produce an erosion of the epidermis, which may enable the substances to come into more immediate contact with the mouths of the vessels. We may also imagine that when the component parts of the body are brought into close approximation with their capillary extremities, they are then taken up in the same way that the chyle is absorbed from the intestines."—(*Elem. Syst. of Physiol. vol.* 2, *p.* 583.) For my own part, I believe, that if the modern doctrine of absorption can be effectually defended and retained, the general presence of the orifices of the lymphatics at every point of the variously organized textures of the body must be received as one of its leading principles. Many physiologists have little difficulty in conceiving how fluids can be taken up by the lymphatics, but rather stagger at the notion of this being also the case with the hardest solids. Others, however, accommodate their creed to both hypotheses, reconciling themselves to them by the argument that, if the minute capillary arteries can secrete this dense, hard matter, the small lymphatics can remove it. One example is not more difficult to comprehend than the other. Yet, such reasoning throws little light on the questions, how are the solids prepared for absorption, and in what manner are they taken up? These in fact remain completely unanswered.

"What (inquires a judicious physiologist) are we to conceive of the intimate nature of this operation? If solution of the substance be necessary, we are at a loss to find a proper solvent; many of the substances are insoluble in water, or in the serous fluid which is found in the vessels; while, on the other hand, it is perhaps not easy to conceive how the substances can be absorbed without being previously dissolved, and still more so, how the solids can have their texture broken down, and enter the vessels, particle by particle, as it were, and be suspended in the lymph in a state of extreme communition?" As I have already mentioned, these difficulties some physiologists, including Bichat, endeavour to diminish by arguing that the lymphatics must be supposed to act only upon the elements of every texture, and that, on this principle, the absorption of solids is as readily intelligible as that of fluids, the same elements frequently contributing to the composition of both. However, it must be acknowledged, that all this kind of reasoning is entirely visionary.

It is conjectured, that while parts retain the vital principle, they are capable of resisting the action of the absorbents. According to Dr. Bostock, dead matter is more easily acted upon by the absorbents than living; and, in fact, "no part can be absorbed until its texture is destroyed, and, consequently, until it is deprived of life. No substance can possibly enter the absorbents, while it retains its aggregation, so that it necessarily follows, that the preliminary step to the absorption of the body is its decomposition."—(*Elem. Syst. of Physiol. vol.* 2, *p.* 585.) He afterward explains, that by the death of a part preceding its absorption, is here signified only, "that it is no longer under the influence of arterial action. It therefore ceases to receive the supply of matter which is essential to the support of all vital (living!) parts, and the process of decomposition necessarily commences." To me a better account of the subject appears to be that which, dismissing all metaphysical and chemical reflections upon the supposed death and decomposition of parts, previously to their absorption, represents the absorbents as acting directly upon the individual atoms, particles, or elements of the various textures. We know nothing about the vitality of these atoms, or elements, in their separate capacity; supposing them to possess it, we know nothing of the moment when they part with it previously to their entrance into the absorbent system, just as we are completely ignorant both of the manner in which such elementary materials acquire the vital principle, and of the exact moment when they become thus endued.

With regard to the lymphatic glands, their use is not precisely known, though various conjectures have been offered concerning it. As Dr. Bostock observes, we may presume that they serve an important purpose, from the circumstance of every absorbent vessel, in some part of its course, passing through one or more of these glands, as was first remarked by Nuck.

Mr. Hewson in one subject injected the lymphatic vessels from the groin to the neck, without filling any lymphatic gland, so as to prove a fact which, he says, is contradictory to the received opinion, that such vessels always pass through glands in their way to the blood-vessels. He found, with regard to the abdomen, the observation not strictly true, as, besides the lymphatic vessels which enter glands, there are others which escape them. He declares, that some of the lacteals in the mesentery do not pass into glands.—(*Exp. Inq. vol.* 2, *p.* 44, *vol.* 3, *p.* 54.) On the other hand, Mascagni, in his numerous injections, never met with the circumstance (*Vas. Lymph. Hist. pt.* 1, *sect.* 4, *p.* 25); and Dr. Bostock refers us to Gordon's Anat. p. 74, in confirmation of the rarity of such an arrangement.—(*Elem. Syst. of Physiol. vol.* 2, *p.* 548.)

The fact of every lymphatic vessel commonly entering a gland in some part of its course, seems to Dr. Bostock to warrant the inference, that some important change is effected in the chyle and lymph by means of the lymphatic glands. "But (says he) the same mode of reasoning might lead us to conclude, that although the absorbent glands are necessary to the existence of the higher orders of animals, they are not so for the purposes of nutrition and growth generally, as it appears that there are large classes of animals, which resemble the mammalia in many of their nutritive functions, and in the vascular part of the absorbents, which are without any lymphatic glands, or are very sparingly furnished with them. It is not easy to point out any circumstances that belong exclusively to the mammalia, which can assist us in explaining the necessity for these appendages to their lymphatic system."—(*Vol.* 1, *p.* 554.)

Malpighi fancied that the lymphatic glands had a muscular covering, which enabled them to act as organs for propelling the lymph from their cells into the vasa efferentia, and thence towards the thoracic duct, so that they were, according to his notions, like so many little hearts distributed through the system. This hypothesis, which is contradicted by anatomy, receives no confirmation from observation in the living animal. If it were true, we should expect to find the cells larger, and not so minute as to render even their existence in the human absorbent glands a questionable point; some pulsating movement, gentle or strong, would be perceptible in the situation of every superficial gland; or, if the contraction were of a slower kind, the gland would sometimes be enlarged, and sometimes considerably reduced. Yet none of these circumstances prevail. It is likewise to be remembered, that no jet of fluid takes place from the vasa efferentia when they are cut, as they frequently are in surgical operations.

It is also to be taken into consideration that fishes are destitute of lymphatic glands (*see Blumenbach's Comparative Anat. by Lawrence, p.* 256); yet the fluid in their lymphatic vessels must be presumed to have its due degree of motion. In the mesentery of a turtle, no glands are observable; still, "in this animal, nature does her business as well, though the apparatus is differently constructed."—(*Hewson's Exp. Inq. vol.* 3, *p.* 60.)

Malpighi's hypothesis is, therefore, decidedly untenable; and whatever difficulty we may feel in agreeing with Bichat, that the absorbent vessels are destitute of animal contractility, we can have no hesitation in adopting this conclusion with respect to the absorbent glands, considered as entire organs, without any reference to the nature of the congeries of lymphatics within them.

The existence of a white thick fluid in the lymphatic

glands was noticed by Haller in the following terms: "Succum glandulis conglobatis inesse, album, serosum, lacte tenuiorem, in juniori potissimum animali conspicuum, id quidem certum est. Eum cremori similem dixit Thomas Wharton, cinerum Malpighius, diaphanum Nuckius, album Morgagnius, recte et ad naturam, ut puto omnes.—(*Elem. Physiol. t.* 1, *p.* 184.)

According to Hewson, the fluid formed in the lymphatic glands, if diluted with a solution of Glauber's salts in water, or with the serum of the blood, and viewed with a lens of one twenty-third of an inch focus, presents numberless small white solid particles, resembling in size and shape the central particles found in the vesicles of the blood.—(*Exper. Inq. vol.* 3, *p.* 67.)

The supposition of Ruysch and Nuck (adopted also by Haller) that one use of the lymphatic glands is to produce a fluid for the dilution of the lymph, is destitute of proof, inasmuch as the lymph is not known to be thinner after its egress from, than previously to its entrance into, a gland; and one notion sometimes promulgated is, that it is thicker. The investigations of Dr. Prout certainly show, that it contains a larger quantity of albumen and fibrine in proportion to its vicinity to the subclavian vein.—(See *Thomson's Annals of Philosophy*, 1819.) According to Mr. Wilson, the absorbent glands contain numerous arteries; and, in a horse, this vascularity gives to the inner lining of the cells the usual appearance of a secreting membrane; but whether it does actually secrete, or what it secretes, we have no means of thoroughly knowing.—(*On the Blood and Vascular System*, *p.* 209.) The appearance of the lining of the cells of the lymphatic glands of the whale, is in favour of the opinion, that some secretion takes place from it, as an addition to the lymph.—(See *Abernethy's Obs. in Philos. Trans.* 1796, *pt.* 1.) Other speculators imagined, that the absorbent glands were like so many filters, through which the lymph, or chyle, was strained. Another idea was, that they drew some crude liquid from the nerves and returned it to the blood.—(*Glisson, de Hepate*, *p.* 439.) As to the conglobate glands, they were also sometimes contrasted with the conglomerate, and represented as organs for making good the loss produced in the sanguiferous system by the secretions from the latter. Another suggestion was, that their office was to form the central particles of the globules of the blood. But, as Mr. Wilson justly observed, all these opinions are merely suppositions, without a shadow of proof.

Dr. Bostock considers it most probable either that these glands are proper secreting organs, and intended to prepare a peculiar substance, which is mixed with the chyle and lymph, or that they offer a mechanical obstruction to the progress of these fluids, by which means their elements are allowed to act upon each other, and thus some necessary change in the nature of the chyle and lymph may be produced.—(See *Elem. System of Physiol. vol.* 2, *p.* 554.) Richerand's opinion embraces both these views; for he says it was necessary that the lymph should be retarded in the glands, that it might undergo all the changes which these organs had to communicate to it. Although he confesses his ignorance of what these changes precisely are, he represents the intention of them to be the production of a more intimate mixture, a more perfect combination of the elements of the lymph, and to give it a certain degree of animalization, as, he says, is proved by the greater tendency of the lymph to concrete, taken from the vasa efferentia, or discharged from the glands. He also supposes that another use of the glands is to deprive the lymph of its heterogeneous parts, or, at least, to alter them so that they may do no harm by passing into the circulation. The yellow colour of the glands, in which the lymphatics from the liver ramify; the black colour of the bronchial glands; the redness of the mesenteric glands in animals fed with madder or beet-root; their whiteness at the period when the chyle is pervading them; are circumstances regarded by Richerand as proving that the glands tend to separate the colouring matter from the lymph, though their action in this respect may not always be completely efficient. He adds that, from numerous arteries in the texture of conglobate glands, a serous secretion occurs, which dilutes the lymph, increases its quantity, and at the same time animalizes it.—(*Nouveaux Elém. t.* 1, *p.* 276, *ed.* 5.) These observations, however, are only conjectures, which absurdly enough endeavour to blend together the doctrine of the glands rendering the lymph thinner, yet more disposed to concrete.

Mr. Wilson, and some other anatomists prior to him, affirmed, that they had succeeded in tracing filaments of nerves into the substance of the absorbent glands; the possibility of which, however, is not generally admitted. These contradictory statements are to be reconciled by the consideration, that one anatomist would set down as a minute nervous filament, apparently derived from a large unequivocal nerve, what another would doubt, or deny, to be a real continuation of such nerve; for anatomy, like most other pursuits, cannot be prosecuted to extreme minuteness without leading to conjectures, difference of opinion, doubts, and obscurity. According to Bichat, when the lymphatic glands are irritated in various ways, which is easily done, they do not appear to be endued with animal sensibility; but it may be developed in them, as well as in the absorbent vessels, by inflammation, which raises their organic sensibility to a great height.—(*See Anat. Gén. t.* 2, *p.* 116.)

The changes in the structure and size of the lymphatic glands, brought on by the progress of age, justify the presumption, that the action of the lymphatic system undergoes modifications at different periods of life; but, on this point, as M. Magendie has remarked, no precise information exists.—(*See Précis Elém. de Physiol. t.* 2, *p.* 202.) Haller believed that the absorbent glands were of greater consequence to young than adult animals; and Mascagni, Bichat, and all the best modern anatomists, coincide respecting their greater size and turgidity in children than in grown-up persons. Whatever use may be ascribed to them, it is natural to suppose, as Dr. Bostock remarks, that, during the growth of the body, a larger quantity of nutritive matter will be conveyed into the blood, and must pass through these organs.—(*Elem. Syst. vol.* 2, *p.* 554.)

In the foregoing observations on the functions of the lymphatic system, its vessels have been presumed to be the true instruments of absorption; by which is meant, not merely that they contain lymph, and transmit it into the venous system, a fact of which no doubt is entertained by any class of physiologists; but, that such lymph is really produced by the operation of these vessels upon the various kinds of matter presumed to be taken up by them, and to consist of all the old particles of every texture of the body, the fat, the earth of the bones, and the superfluous quantity of many different secretions, naturally undergoing continual renovation, besides the chyle which is taken up by the lacteals, and conveyed to the thoracic duct, or common trunk of both descriptions of vessels. To this view of the subject, some physiologists of eminent talents do not accede, and even if it should hereafter be decidedly proved that the lymphatics possess the power of absorption, the tendency of numerous experiments performed by M. Magendie, Fodera, and others, is to show that, at all events, they are not the only absorbents, and that the veins are very actively concerned in the function.

As the doctrine of absorption is one that is inseparably interwoven with the theory of disease in general, and always has a powerful influence on practice, and the choice of remedies, I have considered the subject highly deserving of notice in this work; but my thanks are due to Professor M'Kenzie, of Glasgow, for his kindness in having suggested the want of such an article in the book.

ACETIC ACID. *Vinegar. Distilled Vinegar.* Vinegar is of considerable use in surgery; mixed with farinaceous substances it is frequently applied to sprained joints, and, in conjunction with alcohol and water, it makes an eligible lotion for many cases, in which it is desirable to keep up an evaporation from the surface of inflamed parts. Vinegar was once considered useful in quickening exfoliations, which effect was ascribed to its property of dissolving phosphate of lime. Its application to this purpose, however, seems hardly admissible, for reasons which will be well understood from a perusal of what is said on the subject of *Necrosis*. The good effects of vinegar, as an application to burns and scalds, were taken particular notice of by Mr. Cleghorn, a brewer in Edinburgh, whose sentiments were deemed by Mr. Hunter worthy of publication.—(See *Med. Facts and Obs. vol* 2, *and the art. Burns.*)

Diluted vinegar is sometimes applied to the eye.—(See *Collyrium Acidi Acetici.*) In the form of ac ollyrium it is alleged to be the best lotion for clearing the eye of any small particles of lime which happen to have fallen into and become adherent to it on the inside of the eyelids.—(See *A. T. Thomson's Dispensatory, p. 8, ed. 2.*)

Concentrated vinegar is sometimes employed for stopping violent hemorrhage from the nose. With this view it may be used either as an injection or a lotion, in which lint is to be dipped and introduced up the nostril.

Vinegar is sometimes employed for obviating the smell of sick rooms. The strongest acetic acid which can be made is found also to be one of the most certain and convenient applications for the destruction of warts and corns, care being taken not to injure the surrounding skin with it.

Acetic acid has occasionally been recommended as an antidote to the narcotic poisons; but the proofs of this are quite unsatisfactory, and the chemical history of opium and other narcotics by no means sanctions the practice.—(*Brande's Manual of Pharmacy, p. 9, 8vo. Lond.* 1825.)

The pyroligneous acid, which is merely strong acetic acid impregnated with empyreumatic oil and bitumen, is much used by Mr. Buchanan, of Hull, as an ingredient in applications to the ear in certain cases of deafness.—(See *Illustrations of Acoustic Surgery, 8vo. Lond.* 1825.)

ACHILLES, *Tendon of.* See *Tendons.*

ACID. See *Acetic Acid; Muriatic Acid;* and *Nitrous* and *Nitric Acids.*

ACTUAL CAUTERY. A heated iron, formerly much used in surgery for the extirpation and cure of diseases. Its shape was adapted to different cases, and the instrument was of tenapplied through a cannula, in order that no injury might be done to the surrounding parts. *Actual* cauteries were so called in opposition to other applications, which, though they were not really hot, produced the same effect as fire, and consequently were named *virtual* or *potential cauteries.* The actual cautery is still in use upon the continent; and by foreign surgeons we are not unfrequently criticised for our general aversion to what they distinguish by the appellation of an *heroic* remedy. Pouteau, Percy, Dupuytren, Larrey, Roux, Delpech, and Maunoir are all advocates for the practice; and the latter gentleman, when he was in England, took the opportunity of reminding British surgeons of their error, in totally abandoning, as they now do, the employment of heated irons in the business of their profession.—(See *Obs. on the Use of the Actual Cautery, Med. Chir. Trans. vol.* 13, *p.* 364, &c.)

ACUPUNCTURE. (From *acus*, a needle, and *pungo*, to prick.) The operation of making small punctures in certain parts of the body with a needle, for the purpose of relieving diseases, as is practised in Siam, Japan, and other oriental countries, for the cure of headaches, lethargies, convulsions, colics, &c.—(See *Phil. Trans. No.* 148; and *Wilh. Ten. Rhyne, de Arthritide Mantissa Schematica, &c. 8vo. Lond.* 1683.) Dr. Elliotson has tried acupuncture very extensively, and his experience coincides with that of Mr. Churchill, confirming the fact, that as a remedy for chronic rheumatism it answers best where the disorder is seated in fleshy parts. He also finds that one needle, allowed to remain an hour or two in the part, is more efficient than several, used but for a few minutes.—(See *Med. Chir. Trans. vol.* 13, *p.* 467.) Neuralgia is a disease in which the practice may deserve trial. Local paralysis is another. In a modern French work it has been highly commended; but the author sets so rash an example, and is so wild in his expectations of what may be done by the thrust of a needle, that the tenour of his observations will not meet with many approvers. For instance, in one case, he ventured to pierce the epigastric region so deeply, that *the coats of the stomach were supposed to have been perforated: this was done for the cure of an obstinate cough, and is alleged to have effected a cure!* But if this be not enough to excite wonder, I am sure the author's suggestion *to run a long needle into the right ventricle of the heart,* in cases of asphyxia, must create that sensation.—(See *Berlioz, Mém. sur les Maladies Chroniques, et sur l'Acupuncture, p.* 305—309, *8vo. Paris,* 1816. *Churchill on Acupuncture,* 1824; *Dantu, Traité de l'Acupuncture,* 1826.)

ADHESIVE INFLAMMATION. That kind of inflammation which makes parts of the body adhere or grow together. The process by which recent incised wounds are united without any suppuration, and frequently synonymous with union by the first intention.—(See *Union by the First Intention.*)

ÆGYLOPS. (From *αἴξ*, a goat, and *ὤψ*, an eye.) A disease so named from the supposition that goats were very subject to it. The term means a sore just under the inner angle of the eye.

The best modern surgeons seem to consider the ægylops only as a stage of the fistula lachrymalis. Mr. Pott remarks, when the skin covering the lachrymal sac has been for some time inflamed, or subject to frequently returning inflammations, it most commonly happens that the puncta lachrymalia are affected by it, and the fluid, not having an opportunity of passing off by them, distends the inflamed skin, so that at last it becomes sloughy, and bursts externally. This is the state of the disease which is called perfect aigylops or ægylops.

Ægylops was a common term among the old surgical writers, who certainly did not suspect that obstruction in the lachrymal parts of the eye is so frequently the cause of the sore as it really is. The skin over the lachrymal sac must undoubtedly be, like that in every other situation, subject to inflammation and abscesses; but we do not find that sores unconnected with disease of the lachrymal sac are here so frequent as to merit a distinct appellation.

AGARIC. A species of fungus growing on the oak, and formerly much celebrated for its efficacy in stopping bleeding.—(See Hemorrhage.)

ALBUGO. (From albus, white.) A white opacity of the cornea, not of a superficial kind, but affecting the very substance of this membrane. The disease is similar to the leucoma, with which it will be considered.—(See Leucoma.)

ALPHONSIN. The name of an instrument for extracting balls. It is so called from the name of its inventor, Alphonso Ferrier, a Neapolitan physician. It consists of three branches, which separate from each other by their elasticity, but are capable of being closed by means of a tube in which they are included.

ALUM. (An Arabic word.) Alum either in its simple state, or deprived of its water of crystallization by being burnt, has long been used in surgery. The ingenious author of the Pharmacopœia Chirurgica remarks that, except for external use as a dry powder, the virtues of alum are not improved by exposure to fire. Ten grains of alum made into a bolus with conserves of roses are given thrice a day at Guy's Hospital in internal hemorrhages, gleets, and other cases demanding powerful astringent remedies. In a relaxed state of the urinary passages, or want of power of the sphincter vesicæ, small doses of alum have been found of service. Alum is employed as an ingredient in several astringent lotions, gargles, injections, and collyria. Dr. Groshuis, a Dutch physician, first recommended its use in colica pictonum, and Dr. Perceval subsequently joined in the advice. The principle on which it acts is that of decomposing the common preparations of lead, and converting them into sulphates, which are comparatively innoxious. Burnt alum, which is a mild caustic, is a principal ingredient in many styptic powders.

ALVINE CONCRETIONS. Comprehending under this head both gall-stones and intestinal concretions, an interesting subject presents itself, certain parts of which have been chiefly elucidated in modern times, as will be hereafter explained. When the concretions voided are very numerous they are generally gall-stones. Thus Dr. Coe relates an instance in which seventy were discharged in one day. In the same short time Petermann knew of seventy-two being voided from one individual; Birch, one hundred; Barbette, Sloane, and Vögel, two hundred; and Russell, four hundred. A patient under the care of Van Swieten had voided two hundred, and was still continuing to expel others. Riverius speaks of another patient who had voided calculi from the bowels for several years whenever he went to stool.—(Observ. Commun.) Fernelius likewise adverts to cases in which the concretions evacuated were innumerable.—(Pathol. lib. 6, cap. 9.) If we take a view of alvine concretions generally, and include all their different kinds, we shall find that they are of various sizes. Most of them are

not larger than a pea or nut; but others are as large as an orange, and weigh four pounds.—(See Monro's Morbid Anat. of the Human Gullet, &c. and Medico-Chir. Journ. vol. 4, p. 188.) Morgagni saw one which equalled in size a moderate finger, and Gooch, Guettard, Heuermann, Maréschal (Mém. de l'Acad. Royale de Chir. t. 3, p. 55), and others, have seen concretions of this nature which were too bulky to pass out of the rectum without surgical aid. In certain examples, recorded by Heuermann and Maréschal, the passage of the concretion outwards lacerated the sphincter ani. Horstius speaks of one concretion which was as large as an apple (Epist. l. 2, sect. 2, Opp. 2, p. 237), and Marcellus Donatus, Schwind (Schmucker's Verm. Schriften, b. 2, p. 129). Hooke, Venette, and Hecquet give the particulars of other examples in which the concretions discharged were as large as a hen's egg. Mr. C. White extracted two from the rectum, which were nearly as big as the fist (Cases in Surgery, p. 18); and in a boy who had died in an emaciated state, after continued pain in the abdomen, attended with frequent attacks of ileus, Mr. Hey found in the transverse arch of the colon so large a concretion that it could not pass any farther along the bowel, and appeared to have been the sole cause of the boy's death.—(Practical Obs. in Surgery, p. 509, ed. 2.) An analogous case is also reported by White (p. 28). It is stated in the Mém. de l'Acad. de Chir. that Duhamel saw a concretion that had been discharged, which was two inches and a half in length, one inch and a half in diameter, three inches and a half in circumference, and the weight of which was three drachms and a half. But, judging by their weight, how much larger those must have been which were seen by Scroekius and Lettsom, and weighed ten drachms; that reported by Dolæus, which weighed two ounces; that recorded by Orteschi, which, besides weighing two ounces two drachms and a half, is said to have been eight inches in circumference, and to have been taken out by force; that recorded by Schaarschmidt, which weighed four ounces; and lastly, the specimen cited by Plouquet (Literatura Med. Dig. vol. 1, p. 171), the weight of which is alleged to have been half a pound.—(Samml. Med. Wahr. nehm. b. 9, p. 231.) It is observed by Rubini, that although examples of alvine concretions being discharged by vomiting are not so frequent as the foregoing cases, yet they are tolerably numerous. Many of them have been collected by Schenck, and others are collected by Breyn (Phil. Trans. No. 479); by Orteschi in his Journal; by Moreali, (Dell' Uscita di una Pietra, per la Via del Esophago, Modena, 1781); by Borsieri; and by a long list of other writers, whose names and publications are specified by Plouquet.—(Lit. Med. Dig. art. Calculus, Vomitus, &c.)—With this class of substances, says Rubini, may also be arranged those concretions which are found upon dissection either in the intestines or stomach, whence probably in time they might have been expelled. Facts of this description are recorded by Portal, Vicq d'Azyr, Jacquinelle, Chandron, &c. The cases recited by White and Hey, in which the colon was completely obstructed, I have already mentioned; and to these may be added the instance quoted by Rubini, in which Meckel found the jejunum entirely blocked up by a similar substance.—(See Pensieri sulla varia origine e natura de corpi calcolosi, che vengono talvolta espulsi dal tubo gastrico, Memoria, p. 5 and 6, 4to. Verona, 1808.)

Rubini observes that, with respect to the origin of alvine concretions, whether discharged from the alimentary canal upwards or downwards, some of them appear to be formed in that canal itself, while others pass into it from other situations; and they all admit of being distinguished according to the place of their origin and formation into three kinds: 1. hepatic, or biliary; 2. gastric, or intestinal; and 3. (what this author terms) mixed, or hepatico-gastric. Hepatic alvine concretions, as the name implies, are derived from some point of the hepatic system; the gastric, or intestinal, are formed within the alimentary canal; and the mixed commence in the hepatic organs, but afterward get into the bowels, where they acquire an increased size.

On the subject of hepatic concretions, or biliary calculi, or gall-stones (as they are usually named), there is no point of the system where they do not occasionally form. Riedlin found them in the surface of the liver. Sorbait met with a biliary calculus as large as a goose's egg, adhering to the peritoneal covering of the liver, and a similar case is recorded by Benivenio. Tallon, Pomme, Saurau, and Heberden have seen calculi within the substance of the liver; while Blasius, Fallopius, Columbus, Ruysch, Henricus ab Heers, and Morgagni record examples, in which the concretions were in the parenchyma of that organ. Plater, Reverhorst, Glisson, Morgagni, and Walter have seen them in the biliary ducts, as probably were those which Columbus and Camenicus say they found in the vena portæ. Walther and Dietrick found calculi in the ductus hepaticus; Ruysch and Soemmering in the ductus cysticus; and Dietrick, Galeazzi, and Richter, in the ductus choledocus. Greisel, Benivenio, Eller, Morgagni, Dargeat, and D'Hervillay have seen calculi included in morbid cysts, attached either to the liver or the gall-bladder. The place, however, where calculi are found in the greatest number, and with most frequency, is the cavity of the gall-bladder itself. Here they are sometimes single, their size varying up to a magnitude completely filling that cavity, as Saye (Journ. des Savans, Sept. 1697), Halle, and Isenflamm have noticed: while sometimes their number amounts to a hundred, or even a thousand, of different sizes. Rubini possesses a gall-bladder, which contains above a hundred small calculi, and formerly I had a similar number, which I found in the body of a female. Van Swieten met with a hundred; Haller, a hundred and forty; Stieber, two hundred; F. Plater, three hundred; Walther, five hundred; Mentski, seven hundred; Baillie, a thousand; Hunter, eleven hundred; Paré, sixteen hundred; Stork, two thousand; and Meckel, several thousands.—(Handb. der Pathol. Anat. b. 2, p. 460.)

All hepatic concretions, however, are not calculated to pass from the place of their origin into the intestines, but only such as are situated in the ductus hepaticus, or its main branches, in the gall-bladder, the ductus cysticus, or the ductus choledocus. When their size is not disproportionate to the diameter of the ducts, they pass with facility; but, when their dimensions are larger than those ducts can naturally admit, the latter becomes stretched and dilated, whence arise the sharp pains and colic which attend the disorder, analogous to the sufferings produced by the descent of large calculi from the kidneys to the bladder. The reality of these dilatations of the hepatic ducts is proved by dissection. Heister found the orifice of the ductus choledocus, which is usually very small, so much enlarged that it could receive a finger; and Vicq d'Azyr saw this duct enlarged through its whole extent in a similar degree.—(Hist. de la Société Royale de Médecine, an. 1779, p. 220.) Galeazzi, in dissecting a body, found the ductus choledocus so dilated, that it resembled a kind of bag, in which several calculi were included. Mr. Thomas has likewise seen two cases, in which the point of the fore-finger readily passed from the duodenum into the gall-bladder.—(See Med. Chir. Trans. vol. 6, p. 105.) Morgagni saw this duct in one instance large enough to hold a couple of fingers, and he quotes many similar instances from Bezold, Trew, Verney, and others. We may conceive how dilated this tube must have been in a case recorded by Richter, where, though it was not completely obstructed, a calculus weighing three ounces and a half was lodged within it.—(Rubini, op. cit. p. 7—10.)

With regard to those concretions which are distinguished by the epithet gastric, or intestinal, some are formed in the cavity of the stomach; the rest in one or other of the intestines. They remain for a greater or less period in the place of their formation, according as they happen to be lighter or heavier, smoother or rougher, more or less adherent, or as local or general circumstances are more or less favourable to their retention or expulsion. Sometimes, they continue undischarged until they have attained a very considerable size. In particular instances, instead of remaining constantly in one place, they successively pass through the whole intestinal tube, lodging at different points for a greater or less time. In the works of Haller and Conradi may be seen representations of the points of the intestinal canal, where these concretions have been found. The alvine concretion, of which Maréschal has given an account, was some years in traversing all the convolutions of the bowels. These gastric or alvine concretions, which are very common in animals, are less frequent in the human subject, as is proved by the observations of Fourcroy

and Vauquelin, inserted in their valuable essay on this subject in the Annales du Museum Nationale d'Histoire Naturelle de Paris. In the horse they are sometimes of an enormous size, as we may learn from an instance on record, in which the concretion weighed thirteen pounds.—(Voigt, Magazin für das Neueste der Naturkunde, b. 3, p. 578.)

As for the third species, which Rubini names mixed, or hepatico-gastric, they have their beginning in the hepatic organs, and augment in the intestinal tube. Here, if the extraneous body be detained, and the contents of the bowels have a disposition to become thickened and condensed round it, as a nucleus, it may be rendered larger by additional strata of matter, and would increase sine fine, if a stop were not put to the augmentation by the narrowness of the canal, or an effort made for the expulsion of the concretion. Morgagni cites two instances of this sort of concretion; one from Gemma, the other from Bezold; and he gives his opinion that another alvine calculus, spoken of by Vater, must have been of the same nature. Dr. Coe describes another interesting specimen; and others are referred to by Vandermonde, Moreali, Portal, &c. Perhaps, says Rubini, the instances of this kind would have been more numerous if all the concretions discharged from the bowels had been noted with greater attention, and the hepatico-gastric substances not confounded with the hepatic. The lodgement of these concretions in the intestinal canal is of uncertain duration, and depends upon a variety of circumstances. Vandermonde gives the history of a calculus, which, as far as could be judged of by the pain in the right hypochondrium, and the change of symptoms, must have passed into the duodenum in the month of January, and then continued in the bowels until August, when it was discharged from the rectum.

The crystallized appearance of alvine concretions is generally so conspicuous, that it has not escaped the attention of several of the old writers, as we may convince ourselves by referring to the works of Corn, Gemma, Greisel, Baglivi, Scultetus, &c. It was noticed by Haller in his Elementa Physiologiæ, vol. 6, and by Morgagni in his Epist. 37, de Sedibus et Causis, &c. If, says Rubini, these crystallizations are not always plainly visible, distinct, and regular, this depends either upon their imperfection, the heterogeneous nature of the accumulated matter, or particular unfavourable circumstances, which would equally affect the process of crystallization out of the body.

Now, as all crystallizations depend upon the fluids in which they form, and from which they receive their crystallizing elements, it must be evident that, inasmuch as the fluids of the hepatic organs differ in their constituent principles from the fluids contained in the intestinal canal, the concretions produced in the first system must differ from those originating in the second; while the hepatico-gastric calculi will combine the nature and properties of both together.

The fluid from which hepatic concretions are formed is unquestionably the bile, either some or all its ingredients entering into their composition. Indeed, previously to the new chemical doctrines, hepatic calculi were generally considered as being simply condensed indurated bile.

From investigations made in more modern times, however, when the art of analysis has attained a precision of which the old chemistry was not susceptible, it appears, that although human biliary calculi yield the same products as the bile, there is contained in them more or less of a peculiar substance, which was named by the celebrated Fourcroy, adipocere.—(Mém. de l'Acad. des Sciences, 1789, p. 323.) The presence of this substance in the concretion is of such importance, that, when it is abundant and in large proportion, the calculus is regular and the crystallization well finished; and, when it is in small quantity, the crystallization is confused and disordered, the calculus only exhibiting an irregular misshapen concretion, more like a clot than true crystals. The kind of adipocere constituting the base of all human biliary calculi, has some resemblance to spermaceti. Both Fourcroy and Dr. Bostock, who analyzed it, found it composed entirely of carbon, hydrogen, and oxygen. It melts, but requires a heat superior to that of boiling water: in fusion it has a smell like wax, and on cooling, forms a substance, which breaks into crystalline laminæ. It is not soluble in alcohol in the cold; but when the alcohol is boiled on it, it is dissolved in a proportion, according to Fourcroy, of one part in nineteen—according to Dr. Bostock, one in thirty.—(Nicholson's Journal, 8vo. vol. 4, p. 137.) The solution, when it cools, deposites light brilliant scales. It is soluble in ether in the cold, and more abundantly if the ether be heated. Oil of turpentine generally dissolves biliary calculi; and, according to Gren, it dissolves those which consist almost entirely of this peculiar matter; yet Dr. Bostock has remarked, that oil of turpentine acts on it with difficulty, and even when digested with it, at a boiling heat, dissolves it only in a small degree. Pure soda and potassa dissolve it completely, and reduce it to a saponaceous state. Ammonia, as Dr. Bostock has remarked, exerts little action on it, except when boiling. Nitric acid dissolves it, and, according to Fourcroy, converts it into a species of liquid similar to the oil of camphor. This becomes concrete, but without any crystalline structure, and is more soluble in ether and the alkalis than the original matter.

"This substance (Fourcroy has observed) is contained in greater or less quantity in nearly all human biliary calculi, more or less intermixed with other matter, but still so far predominant as to form their basis. Hence, they partake of its properties; are fusible, inflammable, and more or less soluble in the agents which dissolve it."—(See Murray's Syst. of Chemist. vol. 4, p. 594, ed. 2.) Fourcroy, on exposing the above peculiar substance to the action of oxygenated muriatic acid, saw it whitened, and afterward resume its former silvery hue. However, Rubini repeated this experiment, and found that the whiteness which was contracted remained permanent.

While the hepatic system contains a fluid which is always nearly of the same quality, viz. the bile, the alimentary canal, as Rubini observes, contains a hundred different fluids, and is continually occupied by substances of various natures, kinds, and properties, consisting of food, drink, and several secretions. All the principles which are to serve for the formation and renewal of the different species of living solids, and of the many kinds of fluids, at first remain more or less time in the alimentary canal, and there undergo peculiar changes. All the principles which, under different circumstances, may contribute to the production of morbid concretions, either in the gall-bladder, the urinary bladder, the kidneys, or in any other part of the body, where they ever occur, pass at first into the intestinal canal, where they continue for some time. Such a multiplicity of principles, disposed to crystallize, and be converted into calculi, would very often, almost daily, produce these concretions in the bowels, were there not many circumstances which counteract this tendency, as, for instance, exercise, the incessant motion of the matter itself along the intestinal tube, the variety of these elements, whereby their requisite tendency to unite is disturbed, and the decomposing and recomposing influence of the gastric secretions, whereby parts are united, disposed of, dissolved, and analogous matter kept divided, &c. But whenever these circumstances are not actively operating, as may be the case in a noose, or fold of the bowels, or in some preternatural cyst belonging to them; whenever the intestinal fluids undergo such an alteration that the production of these concretions cannot be prevented; or, lastly, whenever some favourable circumstance, such as an extraneous nucleus, forms a centre of reunion for particular elements; then the saline matter, which is most disposed to crystallize, and the earthy and mucilaginous substances, &c., are attracted together, and produce more or less perfect crystallizations. A chemical analysis of some intestinal calculi, first made by Konig, and afterward by Slare (Philosophical Transactions), proves, that when they are exposed to a strong heat in distillation, they yield water, ammonia, and a lixivious salt, a caput mortuum remaining behind. Cadet, in analyzing a similar concretion, found, in addition to the above products, phosphorus. The muriate of ammonia was afterward discovered; and Gioberti, Fourcroy, and Vauquelin, in their histories of the intestinal concretions met with in animals, describe them as composed of the acidulous phospate of lime, phosphate of magnesia, and of the ammoniacal-magnesian phosphate.

Some specimens contained in the Edinburgh museum were very carefully examined by Dr. T. Thomson: they at first swam in water, but afterward sunk;

the specific gravity varying from 1.376 to 1.540. Cold water acquired from them a brownish tinge, and took up albumen, which separated in white flakes by boiling. There was also a peculiar brown substance, at first dissolving in water, but rendered nearly insoluble by slow evaporation; soluble in alcohol; and most nearly resembling vegetable extract. The specimens likewise contained muriate of soda, crystallizing on spontaneous evaporation of the water; phosphate of lime, precipitated by ammonia; sulphate of soda in minute proportion; and, perhaps, sulphate of lime. Alcohol dissolved the peculiar brown matter and some of the salts; caustic potash, the albumen, brown matter, and perhaps some of the salts; and muriatic acid a proportion of phosphate of lime. After all, there remained a peculiar substance, having the colour and texture of the calculus; in very short threads, light, resembling cork, or rather agaric; tasteless, insoluble in water, alcohol, ether, potash-ley, and muriatic acid; being blackened, and partly reduced to charcoal by sulphuric acid; slowly dissolving by heat, without effervescence, in nitric acid; and leaving on evaporation a whitish residue, of bitter taste, and imperfectly soluble in water; burning with a bright flame; but differing from all other animal and vegetable substances hitherto examined, and distinguishable from wood, by its insolubility in potash-ley. The calculi consisted of alternate layers, or intimate mixtures of this substance and phosphate of lime, to which the albumen and brown matter served as a cement, the other substances being in small proportions. Phosphate of lime mixed with a brown animal matter, formed the external crust of some of the specimens. On the surface of a few were noticed crystals of phosphate of ammonia and magnesia. The presence of neither potash, ammonia, carbonate of lime, uric acid, nor urea could be detected.

Varieties have also been found by Dr. Henry and Mr. Brande, exclusively composed of magnesia, of which the patients had been in the habit of taking vast quantities.—(See Thomson's Obs. in Monro's Morbid Anatomy of the Human Gullet, &c. p. 36, or in Medico-Chir. Journ. vol. 4, p. 188, 189.)

From observations made by Dr. Wollaston, it appears probable, that the above fibrous, light, thready substance is derived from oats, which are so commonly taken as food in Scotland.

"If the oat-seed be divested of its husk, minute needles or beards, forming a small brush, are seen planted at one of its ends. Dr. Wollaston, on examining these needles and comparing them with similar ones detached from the calculi, and forming the velvet substance in question, satisfied himself, beyond all doubt, of their perfect identity."—(Marcet on Calculous Disorders, p. 130, 8vo. London, 1817.)

The specimen analyzed by Dr. Ure, he inferred to be a modification of ambergris.—(Dict. of Chemistry, art. Intestinal Concretions.)

As for the mixed or hepatico-gastric calculi, they have for their nucleus a biliary concretion, round which other substances contained in the bowels adhere; hence, it is evident, that as they are formed at two distinct periods in two different situations, and among various fluids, two distinct compositions must be the result. Although, says Rubini, there has hitherto been no scientific analysis of this species of calculus, excepting the very imperfect one by Moreali, reason shows clearly enough, that, if two separate analyses were made, one of the nucleus, the other of the surrounding matter, there would be obtained from the nucleus the same elements as those of an hepatic calculus, and from the rest those of an intestinal concretion.—(See Pensieri sulla Varia Origine, &c. de' Corpi calcolosi che vengono espulsi dal tubo gastrico, p. 15—17.)

As the same author remarks, the foregoing principles will enable us to determine with greater precision than formerly, the characters which appertain to the several classes of calculi liable to be voided from the intestinal canal; characters, by means of which there can be no difficulty in deciding, from the appearance of one of these concretions, the place of its origin, and its peculiar nature. The hepatic calculus being composed of bile, and also of adipocere, its characters will be such as indicate the predominance of a uniform, oleaginous, and (what Rubini terms) a well-animalized principle. The gastric or intestinal calculus, arising from the union of various salts, earths, and other principles, which happen to be in the alimentary canal, will have very different characters, generally indicating its earthy saline composition. Lastly, the hepatico-gastric calculus will present a union of the different characters; viz. in the centre, the characters of the hepatic calculus; more externally, those of the gastric.

The criteria for distinguishing the several kinds of calculi from each other may be divided into such as may be termed external, being derived from accidental circumstances attending the foreign body; and others, which may be called internal, being deduced from the inherent characters belonging to the composition and nature of these concretions.

The first of these external criteria is the age of the patient. C. Stephanus, Hoffmann, Durande, and Morgagni all agree, that biliary calculi seldom occur, except in subjects of advanced age, and never in youth. And Haller writes, "Juniores et pueros, quantum novi, numquam adfligit morbus." Morgagni met with sixty-one old persons who had alvine concretions, but with only eight young persons, not one of whom was a child, the youngest being twelve years of age, and the eldest twenty-nine. To these I may add the instance reported by Saye, in which a stone as large as a hen's egg was found in the gall-bladder of a young female aged only twelve.—(See Journ. des Savans, Sept. 1697.) The cause of this difference is attempted to be explained by Morgagni; but, probably, a more rational explanation than that suggested by him, will be found in the analysis of the bile of old and young subjects, as made by Fourcroy and other modern chemists. From these and other observations, collected by Rubini, it is rational to conclude, that when an alvine concretion is discharged from a young subject, the chances are, that it is not a biliary one; though if the patient be of advanced age, it is not to be inferred, that the foreign substance expelled must certainly be hepatic, because gastric or intestinal concretions are common to individuals of every age.—(Rubini, op. cit. p. 18.) Indeed, with the latter kind of calculi, men of advanced age and women are said to be most frequently afflicted; children and young persons rarely suffering, unless the formation of such bodies has been produced by the presence of fruit-stones, or other indigestible substances, which serve as nuclei.—(Richerand, Nosographie Chir. t. 3, p. 433, ed. 4.) These concretions are also sometimes formed in patients who have been confined by disease a long while in a recumbent posture.

The second criterion is drawn from the symptoms, which precede or accompany the expulsion of the calculus. Sense of heaviness, irritation, and pain in the region of the liver, pain about the ensiform cartilage and navel, bilious vomiting, jaundice, and either looseness of the bowels or constipation, are the symptoms which (especially when they frequently occur) indicate the hepatic origin of the calculus, and proceed from its passing through the narrow ducts of the liver or gall-bladder towards the intestines. The most careful observations have proved, however, that these symptoms are only to be depended upon when taken collectively, and that no single one gives any certain information. Also, if their presence be sufficient to prove the hepatic origin of the calculus, their absence can by no means be regarded as a proof of the concretion being of the intestinal kind.—(Rubini, p. 19.)

Third criterion. A calculus voided may be set down as undoubtedly hepatic, if accompanied by others unequivocally of this nature. In a case recorded by Brunner, and in another by Vater, the absence of certain symptoms in the first, and the magnitude of the calculus in the second, created doubts whether the concretions were not more likely to be of the intestinal kind, than of the hepatic. At length, the bodies having been opened, the presence of other similar calculi in the gall-bladders afforded an adequate criterion.

Morgagni lays down a fourth criterion, deduced from the number of the calculi voided; which, if very numerous, are to be considered as biliary. Rubini points out, however, the fallacy of this test; both hepatic and gastric concretions being sometimes single, sometimes in various numbers even up to a thousand; and he refers to a case where a very large number of concretions of the gastric description were voided, as reported by Konig. The test here suggested, however, may be considered as generally valid; for, the number of in-

testinal concretions is rarely more than two, though sometimes very considerable.—(T. Thomson. See Med. Chir. Journ. vol. 4, p. 189.)

I shall now follow Rubini, and notice those characters of alvine concretions, which he calls internal, and are deduced from their quality and composition, beginning with the criterion furnished by the size of the extraneous substance voided. As the biliary ducts are narrow, it is obvious, that if the calculus be above a certain size, it cannot have passed in this state suddenly through those narrow tubes, and consequently must be either of the gastric description or mixed, having quitted the hepatic system while small, and afterward increased within the alimentary canal. Unquestionably, as Rubini admits, this criterion has considerable weight, especially when the discharge of the calculus has not been preceded by pain, or other symptoms indicating such violent distention, as the above ducts must have suffered from the passage of the foreign body. These are certainly capable of being dilated in a remarkable degree, as some facts, already noticed in this article, sufficiently prove; but such dilatation can never happen without pain, irritation, and a serious train of sympathetic effects. Rubini remarks, this criterion will only apply to large, and not to diminutive concretions. A biliary calculus, of prodigious size, was found by Mr. Brayne, of Banbury, to have passed by ulceration directly from the cavity of the gall-bladder into that of the duodenum, whence it made its way through the rest of the bowels, and was voided from the anus.—(See Med. Chir. Trans. vol. 12.)

A second criterion is the colour of the calculus; a test admitted by Moreau, who asserts, that biliary calculi are yellow or green, and intestinal ones grayish brown or black. But, says Rubini, one need only look at various specimens of alvine concretions, and read the statements of authors who have seen a great many of them, particularly Morgagni and Soemmering, to comprehend, that any criterion deduced from their colour is most fallacious, every species of them presenting great variety in this particular. And it is to be remembered, that the bile and the intestinal fluids, whence these concretions are formed, differ in colour in different individuals, according to a variety of circumstances, in health and disease. One species of hepatic calculus has a white colour, but is sometimes yellow or greenish. Another is of a round or polygonal shape, and often of a gray colour externally, and brown within. A third is of a deep brown or green colour.—(See Ure's Dict. of Chemistry, art. Gallstones.) The smaller intestinal concretions examined by Dr. T. Thomson, destitute of coating, resembled bad yellow ochre; the larger were encrusted with an earthy matter, of a coffee colour, and purple or sometimes white.—(See Monro on the Human Gullet, &c., and Med. Chir. Journ. vol. 4, p. 188.)

Third criterion. The presence or absence of a nucleus will enable one to judge whether a calculus be gastric or hepatic. A biliary concretion has no nucleus, properly so called; that is to say, it has no foreign body in its centre. When a transverse section is made of such a calculus, one finds either a cavity in its middle, or else nothing by which this part of its substance can be distinguished from the rest; or if a nucleus different from the other part of the concretion be apparent there, it consists merely of bile, either grumous, differently coloured, or more or less fluid than the rest of the calculus, but which is nevertheless invariably bile. On the contrary, every gastric concretion has, as it were, an extraneous nucleus, as Fourcroy and Vauquelin have explained in their essay upon the intestinal calculi met with in animals. Ruysch in the Phil. Trans. gives an account of some alvine concretions which were formed round grains of seed. Birch records an example of a crystallized calculus formed round a leaden bullet. Haller met with a calculus in the centre of which was an iron nail. Concretions formed upon fruit-stones are recorded by Clarke, White, and Hey, and also in the Edinb. Med. Essays. Instances in which the nucleus was a small portion of bone are related in the latter work, and also by Hooke and Coe. Homberg and others describe alvine concretions formed round indurated excrementitious matter; and many similar cases are specified by Vallisnieri, Van Swieten, and others. In the hepatico-gastric calculus the biliary concretions serve as a nucleus for the gastric. According to Dr. T. Thomson, the nucleus is commonly a cherry-stone, a small piece of bone, or a biliary calculus.—(See Med. Chir. Journ. vol. 4, p. 188.)

A fourth criterion is deduced from a certain unctuosity which belongs to biliary calculi, but not to those of the gastric class. This character is more palpable when the calculus has been recently voided, or when it is handled with warm fingers. The unctuosity is still more evident when the concretion is cut or sawn, as then the knife, saw, or fingers become smeared with saponaceous particles, which adhere to them. In order to denote an hepatic calculus, however, the unctuosity must pervade its whole substance, and not merely appear towards its outside; for a gastric, earthy, saline concretion may by accident become coated, as it passes through the bowels, with a stratum of bile or saponaceous matter. When the unctuosity is deficient externally, or in the outer laminæ of a calculus, but is found in its interior, it is a clear indication of the hepatico-gastric formation of the concretion.

Fifth criterion. The specific gravity of a calculus, the property which it has of floating or sinking in water, has been long considered as a test of its species. The hepatic calculus is generally specifically lighter than water, as most oily substances are: on the contrary, gastric calculi are specifically heavier than water, like all earthy saline matter, and of course sink in that fluid. This criterion was often employed by Reverhorst, Fernelius, and others, for distinguishing various concretions. But it is by no means regular, as many biliary calculi swim only a little while and then sink. The specific gravity of that analyzed by Dr. Ure, of Glasgow, was 1.0135.—(See Med. Chir. Journ. vol. 4, p. 179.) As Rubini observes, this test will not answer for hepatico-gastric calculi, which are subject to great anomalies.—(Pensieri, &c. p. 22.) Nevertheless, the most correct modern examinations prove, that gastric concretions have a specific gravity varying from 1.376 to 1.540 (Dr. T. Thomson in Monro's Morb. Anat. &c.), and consequently their general character is to be heavier than biliary calculi.

A sixth criterion is that proposed by Vicq d'Azyr in the Mém. de l'Acad. Royale de Méd., and deduced from the figure of the crystallization. According to this writer, intestinal concretions crystallize in concentric laminæ, shaped like a cock's comb, while the crystallizations of biliary calculi are radiated and needle-shaped. Although this criterion is ingeniously founded upon the known laws by which every crystallized substance assumes a peculiar and determinate shape, yet it may be generally observed with respect to the mark of distinction here proposed, that the concretions of which we are now speaking are usually too compound, and too much disturbed in their crystallization to exhibit a regularity, for which simplicity and quietude are indispensable. Hence many of these concretions do not present the slightest vestige of crystallization, while others scarcely show a trace of it, in the midst of a large misshapen mass. The white-coloured hepatic calculus when broken is said to present crystalline plates or striæ, brilliant and white like mica. The round or polygonal one which is often of a gray colour externally, and brown within, is described as consisting of concentric layers of inspissated bile, usually with a nucleus of the white crystalline matter in the centre. Lastly, the hepatic calculi, of a deep brown or green colour, when broken, are said to exhibit a number of crystals of the substance resembling spermaceti, mixed with inspissated bile.—(See Ure's Dict. art. Gall-stones.) With respect to the special shape assigned by Vicq d'Azyr to the two classes of alvine concretions, it may be observed that his specimens were taken from animals, and that consequently the inferences made from them are not applicable to substances of an analogous nature discharged from the human body; because, as the bile varies in different animals, so must the formative principles of the calculous crystallizations. It is farther remarked by Rubini that the substance termed adipocire, which is the basis of biliary concretions, was not found by Poulletier in hepatic calculi taken from horned cattle.

A seventh criterion is founded upon the inflammability of an alvine calculus. A biliary concretion being commonly made up altogether of unctuous matter, liquefies when subjected to heat, smokes, emits a flame, and burns. When this experiment is made in close vessels, the products are hydrogen, carbonic acid gas, oil, and ammonia: some carbon and earth remaining

behind. An intestinal concretion, on the other hand, decrepitates or turns black, but generally does not burn. One specimen examined by Dr. Ure, when heated to the temperature of 400° F., fused into a black mass, and exhaled a copious white smoke, in the odour of which was recognised that of ambergris, mixed with the smell of burning fat. Exposed in a platina capsule to a dull red heat, it burned with much flame and smoke, leaving no appreciable residuum.—(See Ure's Dict. of Chemistry, art. Intestinal Concretions.)

The eighth criterion depends upon the solubility of calculi in an oily menstruum. Haller dissolved biliary calculi in oil of turpentine; Dietrick found them soluble in oil of sweet almonds; and Gren in oils in general. But intestinal calculi are not so readily dissolved by any of these menstrua.

The ninth criterion is founded upon the solubility of the calculus in alcohol. In biliary calculi this solubility is not always the same; but as this point has been already spoken of, it is unnecessary to dwell upon it; and I shall merely add, that while hepatic concretions are almost always more or less dissolved by alcohol, those of the gastric kind resist this menstruum.

Though the above criteria are interesting, as tending to establish distinctions between the different species of alvine concretions, it merits attention that not one of them taken separately is at all certain and pathognomonic. It may happen, says Rubini, that some peculiarity in the biliary secretion, and an irregularity in the crystallization and accumulation of the matter, may cause salts and earths to predominate in hepatic concretions, in which circumstance their usual oily quality will be defective. On the other hand, in the formation of an intestinal concretion, oily adipose matter may accidentally adhere to it, so as to disguise its wonted character. If uniformity of characters and physical properties depend upon uniformity of elementary constituent principles, it can hardly happen even in the natural healthy state of the secretions, because age, sex, and other particular circumstances of the individual will always make a difference in the proportions of those principles. How then can identity of results be expected in a diseased state of the process of secretion?—Such reflections may explain how Morgagni among others met with many biliary calculi which were not inflammable; with others which did not give a yellow tinge to water; and with some which floated or sunk in water, according as they had been recently or long discharged; while Gren found some of these calculi insoluble in alcohol, &c.—(Rubini, p. 24, 25.)

Moreali put a piece of the outer part of an alvine concretion into nitrous acid, when a considerable effervescence took place, and the substance afterward completely dissolved. Now as this calculus had a nucleus, it must have been of the hepatico-gastric kind, and the experiment was therefore made only with the intestinal part of it. Should the experiment be often repeated with the same result, says Rubini, it would furnish another criterion for distinguishing the two species of calculi; those being intestinal which effervesce, and others being hepatic which do not effervesce, but yield globules of wax-like, oily matter.—(P. 28.)

For additional chemical observations on biliary and other alvine concretions, the reader is particularly referred to Rubini's interesting memoir, Vicq d'Azyr's essay in the Hist. de la Société Royale de Médecine, an 1779; the writings of Fourcroy, Vauquelin, and Thenard; Thomson's account of the subject in Monro's Morbid Anatomy of the Human Gullet, &c.; Marcet on Calculous Disorders; and some interesting experiments by Dr. Ure, related in a paper by Mr. Kennedy, in Medico-Chir. Journ. vol. 4, p. 177, &c. Also Ure's valuable Dict. of Chemistry.

With respect to the treatment of cases of biliary calculi, the subject not being generally one for which any surgical proceeding is advisable, I may be very brief. The medicine which is alleged by Durande, a physician at Dijon, to be the best solvent for them, consists of three parts of sulphuric ether and two parts of oil of turpentine. It is to be given in the dose of ℈ij. every morning; purgatives being previously exhibited for a few days. The efficacy of this medicine is also corroborated by Soemmering and Richter. To these statements, however, some doubts must be attached; because what symptoms and circumstances will ever unequivocally prove, that there were biliary calculi in the bowels, and that they have been dissolved by this medicine? And how can the product of such solution be got at and examined? But admitting the authenticity of the cases, doubts must exist of the solvent action of the remedy; since at a temperature below that of the human body, the ether separates from the turpentine and is volatilized.—(See Dict. des Sciences Méd. t. 3, p. 464, 465.)

A calculus in the gall-bladder or one of the biliary ducts sometimes produces so much irritation, that inflammation and suppuration take place, and if the abscess point outwardly, the stone may escape externally, and a termination be put to the patient's sufferings. Heberden records a case of this description; and another is given by Mr. Blagden.—(See Med. Trans. of the College of Physicians, vol. 5, and Thomas in Med. Chir. Trans. vol. 6, p. 106. And for other instances, the following works referred to by Ploucquet: Acrel, Diss. de Cholelithis, Upsal, 1788, p. 204; Act. Natur. Cur. vol. 6, Obs. 69; Bartholinus, Act. Hafn. 4, Obs. 46; Block, Med. Bemerk, p. 27; Gooch's Works, vol. 2, 157—161; Johnston in Phil. Trans. vol. 50, p. 2, 548; Petit, Mém. de l'Acad. de Chir. 1, p. 182—185; Sandifort, Tab. Anat. Fasc. 3; Schlichting in Bald. N. Magas, b. 9, p. 210; Vogler in Museum der Heilkunde, b. 4, p. 91; Haller, Collect. Diss. Pract. 3, No. 107.)

It was J. L. Petit who first suggested the bold practice of making, under certain circumstances, an incision into the gall-bladder, in order to extract biliary calculi. This proceeding, however, is liable to serious objections, arising not only from the usual difficulty of knowing positively whether there is a calculus in the gall-bladder, but also from the difficulty of ascertaining whether this viscus is adherent to the peritoneum, without which state of things, the operation would cause an extravasation of bile, enteritis, and death. Petit himself, indeed, mentions three cases in which distention of the gall-bladder was mistaken for an abscess, and punctured. In two of these examples the consequences were fatal, there having been no adhesion between that organ and the peritoneum to prevent the bile from getting among the bowels: the other patient was saved by this fortunate circumstance.—(See Traité des Mal. Chir. t. 1, p. 262, &c.) However, if a case were to present itself in which an abscess had formed and broken, leaving an aperture in which the calculus could be plainly felt, the surgeon would be justified in attempting to make a sufficient opening for its extraction.

The symptoms induced by the lodgement of large concretions in the bowels are of a formidable description: severe pains in the stomach and bowels, diarrhœa, violent vomitings of blood and mucus, a discharge of thin fetid matter from the rectum, a difficulty of voiding the excrement, an afflicting tenesmus, extreme emaciation, and debility.

That the foregoing account is not exaggerated, may be seen by a perusal of the cases, and remarks published by Mr. C. White, and the late Mr. Hey.

In cases like that reported by Mr. Hey (Pract. Obs. p. 509, ed. 2), where the colon was completely obstructed, surgeons have been advised to cut into that bowel, and extract the foreign body. Let the inexperienced admirer of curious feats with the scalpel, however, pause a little, before he ventures to make up his mind upon this matter; and at all events let him know, that some serious mistakes have nearly been made: "upon the very bold operation of cutting out these concretions when lodged in the colon, proposed by Dr. Monro, senior (See Monro's Morbid Anatomy of the Human Gullet, &c. p. 63), we think it our duty to state that the diagnosis is so difficult, that in one case where the operation was strongly advised, it turned out upon dissection that the disease was a scirrhous pylorus."—(See Edinb. Med. and Surg. Journ. No. 33, p. 112.)

Sometimes patients ultimately get well by voiding the concretions either by vomiting or stool. Mr. C. White gives us an account of some instances of this kind: in one, fourteen concretions on plumb-stones were discharged from the anus; in another, twenty-one similar bodies were ejected from the stomach.

When such concretions are not particularly large and indurated, they sometimes admit of expulsion by doses of castor oil, oleaginous clysters, &c. But in other instances their extraction must be attempted if their situation in the rectum will permit. It may be done with a pair of lithotomy forceps or with the sort of scoop used for taking fragments of stone out of the bladder. In this manner Mr. C. White succeeded in

removing two alvine concretions from the rectum nearly as big as his fist. When the spincter ani will not allow the concretion to be taken out, the muscle should be divided at its posterior angle. According to Richerand, such a division does not permanently weaken its fibres in a perceptible degree, and its paralysis never originates from this cause.—(Nosogr. Chir. t. 3, p. 434. edit. 4.) Maréschal, after a proper dilatation with a scalpel, extracted from the rectum an alvine concretion which weighed two ounces and a half, and was of an oval form, its greatest diameter being two inches eight lines, and its smaller one inch seven lines.—(See Mém. de l'Acad. de Chir.)

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AMAUROSIS. (From ἀμαυρόω, to darken or obscure.) Gutta serena. Suffusio nigra. Fr. L'Amaurose; Germ. Schwarzer Staar. According to Beer, the term amaurosis properly means that diminution or total loss of sight which immediately depends upon a morbid state of the retina and optic nerve, whether this morbid state exist as the only defect, or be complicated with other mischief; whether it be a primary affection, or a secondary one induced by previous disease of other parts of the eye. Or we may say, with a critical writer, that the term amaurosis designates all affections of the nerves of vision, which produce either complete or partial loss of sight, whether this arise from obvious or inferred organic disease, or from a diminution or loss of sensibility in the eye, which cannot be traced to change of structure or any other evident cause.—(See Journ. of Foreign Med. and Surgery, vol. 4, p. 166.)

The definition given by Mr. Lawrence in his Lectures appears to be correct and comprehensive. Amaurosis and gutta serena, he remarks, are names applied indifferently to those forms of blindness which result from an affection of the nervous structure of the eye, whether it be seated in the retina, optic nerve, or sensorium; or whether this affection be produced immediately by vascular congestion, inflammation, or organic change; or indirectly by sympathy with other organs.

From these definitions, which comprehend every form of amaurosis, it is evident that this affection does not uniformly take place as a single independent disorder; but not unfrequently presents itself as a symptomatic effect of some other disease of the eye; a fact exemplified in cases of hydrophthalmia, cirsophthalmia, glaucoma, &c. And, as Mr. Wardrop observes, amaurosis in its usual acceptation signifies a symptom of disease as well as a distinct affection.—(Essays on the Morbid Anatomy of the Human Eye, vol. 2, p. 165, 8vo. Lond. 1818.) With respect to the mere name of the kind of disease here implied by amaurosis, its correctness will remain the same, whether the iris be moveable or immoveable; whether the pupil be preternaturally enlarged or contracted; and whether it be perfectly clear and transparent, or more or less turbid; for the name only refers to the morbid state of the retina and optic nerve, and not to the condition of the sight in general. When the long-established name of amaurosis is received with this precise meaning, there will not be the slightest danger of confounding the disease with other affections of the eye. However, when it is wished to make out the very different forms and kinds of amaurosis, the foregoing appearances of the iris and pupil are considerations of great importance.—(See Beer's Lehre von den Augenkrankheiten, b. 2, p. 420, &c. Wien. 1817.)

I think it also of importance that surgeons should well understand what Mr. Travers has particularly mentioned, that the term "amaurosis" comprehends all those imperfections of vision which depend upon a morbid condition, whether affecting structure or function of the sentient apparatus proper to the organ.—(See his Synopsis of the Diseases of the Eye, p. 293.)

Beer reckons four species of amaurosis.

The first is a genuine uncomplicated amaurosis, the characteristic symptom of which consists peculiarly and entirely in an impairment or loss of vision, without any morbid change in the organic matter of the eye. To this case the epithet "proper functional," used by Mr. Travers, would be applicable.

Secondly, there is an amaurosis, which, besides being attended with a diminution or total loss of vision, is also accompanied with appearances of disease in the organic matter of the eye.

Thirdly, there is another amaurosis, in which, together with the above principal symptom, viz. weakness or loss of sight, there are also morbid phenomena exhibited in the form of the eye in general, or its particular textures, and especially in the action of its irritable parts.

Lastly, Beer says, he can often point out an amaurosis in which all the characteristic symptoms of the three preceding cases are more or less combined.—(See Lehre von den Augenkr. b. 2, p. 478.)

The genuine uncomplicated amaurosis, consisting of a mere diminution or loss of sight, without the appearance of any other defect, is one of the most uncommon forms of complaint, not only because singly operating causes are few, but because they can rarely operate directly upon the optic nerves.

In the true uncomplicated amaurosis, merely the vital qualities of the optic nerve and retina are affected, and after death nothing preternatural can be traced in those parts either within or on the outside of the eyeball. It is, in short, the case in which the functions of the retina have become imperfect or destroyed, the eye appearing in other respects sound.

According to Beer, this simple unmixed form of amaurosis is subdivisible into that amaurotic weakness of sight or blindness, which depends upon the vitality or rather sensibility of the optic nerve and retina being too highly raised, and into another case, the proximate cause of which is peculiarly and entirely referable to depression of such vitality or sensibility. The first example is much less common than the second.

Amaurosis does not constantly attack both eyes at the same time; frequently one is attacked some time after the other, and it is not unusual even for one eye to remain sound during life, while the other is completely blind. This depends, in part, upon the disposi-

tion to the disease in one eye being quite local, and in part upon the causes giving rise to the complaint extending their operation only to the eye affected. Where also the origin of amaurosis seems to depend altogether upon constitutional causes, one eye is not unfrequently attacked much sooner than the other; though in these examples, it is more rare to find the eye which does not suffer at first continue perfectly unaffected.—(Beer, b. 2, p. 422.) As a general observation, Mr. Wardrop thinks it may be remarked, that when only one eye becomes at first amaurotic from a sympathetic affection, there is little danger of the other eye becoming blind; but that when amaurosis is produced by any organic change in one eye, the other is very liable to be sympathetically affected.—(Essays on the Morbid Anatomy of the Human Eye, vol. 2, p. 190.) Amaurosis may not completely hinder vision, a diminished power of seeing often remaining during life. Hence the division of cases into perfect and imperfect; which latter, however, sometimes attain a degree in which the patient is only just able to distinguish light, the direction of its rays, and its degree.

Imperfect amaurosis, besides being characterized by a considerable weakness of sight, approaching to real blindness (Amblyopia Amaurotica), is mostly complicated with a greater or less number of other morbid appearances, which merit serious attention.

Among the most important of these symptomatic appearances of imperfect amaurosis is a defective interrupted vision (visus interruptus). For instance, when the patient is reading, single syllables, words, or lines cannot be seen, unless the eye be first directed to them by a movement of the whole head, and greater or less portions of other objects are, in the same manner, indistinguishable. Sometimes, amaurotic patients can see only the upper or lower, or the left or the right half of objects (Visus dimidiatus; Amaurosis dimidiata; Hemiopia; Hemiopsia.)

Sometimes, when the patient shuts one eye, he can only distinguish the halves of objects; but if he open both eyes, he sees every thing in its natural form. In this case, according to Schmucker, one eye is sound, and only some fibres of the nerve of sight are injured in the other.—(Vermischte Chir. Schrift. b. 2, p. 12.)

There are likewise some not very uncommon cases of imperfect amaurosis, in which the patient cannot see an object, unless it be held in a particular direction before the eye; but when the eye or head is moved in the least, he loses all view of the thing, and cannot easily get sight of it again.—(Beer, Lehre von den Augenkrankheiten, b. 2, p. 424.) On this part of the subject, it is remarked by Richter, that patients who may be said to be entirely blind, sometimes have a small part of the retina which is still susceptible of the impression of light, and is usually situated towards one side of the eye. This obliquity of sight was long ago pointed out by the late Mr. Hey, as common in the present disease.—(See Med. Obs. and Inquiries, vol. 5.) Richter mentions, that in one man, who was, in other respects, entirely bereft of vision, this sensible point of the retina was situated obliquely over the nose, and so small, that it was always a considerable time before its situation could be discovered; he adds, that it was so sensible, as not only to discern the light, but even the spire of a distant steeple. According to this author, it is the centre of the eye that seems to be the first and most seriously affected. Hence, the generality of patients, who have a beginning imperfect amaurosis, see objects, which are latterally situated, better than such as are immediately before them.—(Anfangsgr. der Wundarzn. b. 3, kap. 14.)

One of the most common symptoms of a beginning amaurosis, is an appearance in the patient's fancy, as if gnats or flies were flying about before his eyes (Visus Muscarum, Myodesopsia). Sometimes, transparent, dark-streaked, circular, or serpentine diminutive bodies appear as if flying in greater or less numbers before the eyes, often suddenly ascending, and as quickly falling down again, and chiefly annoying the patient and confusing his sight when he looks at strongly illuminated or white objects. The substances thus appearing to fly about before the patient's eyes, are termed Muscæ volitantes; Mouches volantes.—(Beer, Lehre, &c. b. 2, p. 424.) If what obstructs the sight be a single black speck, it receives the name of scotoma.

This illusive perception of various substances being in rapid motion before the eye, gradually increases; the substances themselves become less and less transparent, and, at length, are so connected together, that they form a kind of net-work or gauze, by which all objects are more or less obscured. This is another symptom of amaurosis, technically called visus reticulatus. The net-work commonly has the peculiarity of being black in very light situations, or when white substances are before the eye; while, in dark places, it is quite shining, and, as it were, of a bluish white hue, like silver, though sometimes of a red-yellow golden colour.

A not uncommon symptom of imperfect amaurosis is the patient's seeing every object indistinctly in a rainbow-like, sometimes tremulous, and generally very dazzling light; while, in the dark especially, blue or yellow flashes, or fiery balls seem suddenly to pass before his eyes when the eyelids are shut, and excite considerable alarm (Visus lucidus; Marmoryge Hippocratis; Photopsia.)

In imperfect amaurosis, the sensibility of the retina may be so augmented, that the patient shuns all very light places, particularly those in which the light is strongly reflected into the eye, and, in order yet to discern in some measure large objects, he feels himself obliged always to seek shady, darkish situations, or to screen his eyes, out of doors, with a green shade, or green glasses. This state is termed by Beer, Lichtscheue (Photophobia). Under these circumstances, it sometimes happens, that the patient for a very short time, for example a few moments, or (what is very uncommon) for a more considerable period, is able of himself to discern the smallest objects in a weak light, more plainly and accurately than the best eye can hardly do in a good light. Yet, excepting at such period, the patient with the above degree of light is not capable of seeing even larger objects. This infirmity of sight receives the name of oxyopia.

Sometimes, in the early stage of amaurosis, all objects seem covered with a dense mist; while, in other instances, this mist first presents itself as a simple, continually-increasing scotoma, and rarely in the form of a net-work or gauze; but to the patient, when his blindness commences with the visus nebulosus, the mist usually appears for a day or two of a light gray colour, and then for another day or two very black, every thing appearing as if looked at through a dense sooty smoke.—(Beer, Lehre von den Augenkrankheiten, b. 2, p. 422—426.)

To an eye affected with imperfect amaurosis, all objects frequently appear indistinct, but double (Visus duplicatus; Diplopia). It is remarked by Schmucker, that in the gutta serena, which comes on gradually, the patient sometimes sees double, with both eyes. He once cured a major of hussars, who saw the three lines of his squadron double; and he attended another gentleman similarly afflicted. Such cases, he conceives, are brought on by a violent distention of the vessels of the choroides, where, he thinks, varices may easily arise, in consequence of the weak resistance of that membrane. In this manner, the filaments of the retina suffer pressure, and the rays of light are broken. Under these circumstances, if prompt assistance be not afforded, total and frequently incurable blindness may be the consequence. Schmucker met with an irremediable amaurosis of this kind, in a young man, twenty-six years of age. When the patient made application for advice he had been blind a year. Before he lost his sight, he remarked, that after any violent emotion, his sight at first grew weak, and that objects afterward appeared double. When his circulation was at all hurried, he saw black spots before his eyes, and at length was quite blind. The vessels of the choroides were as large as if they had been injected with wax, and every kind of surgical assistance proved ineffectual.—(Vermischte Chir. Schriften, b. 2, p. 12, &c. 8vo. Berlin, 1786.) In some cases, according to Beer, double vision only occurs when the patient looks at objects with both eyes, and it ceases as soon as he shuts either the diseased or the sound eye. In the last of these circumstances, double vision only originates from the deviation of the unsound eye from the axis of sight; but, in the first instance, it arises from the morbid state of the retina itself of the diseased eye. For the purpose of distinguishing both these examples of diplopia from every other species of symptomatic double vision, Beer applies to them the name of diplopia nervosa. A degree of squinting (strabismus), there-

fore, is a very common symptom of incipient amaurosis, particularly when only one eye is affected; for this always deviates more or less from the axis of vision. It is owing to this loss of correspondence, that persons affected with an imperfect amaurosis of one eye often mistake the relative distance of objects, and frequently see them reflected.—(Traver's Synopsis, p. 170.) It is less usual for imperfect amaurosis to be accompanied with what Beer terms obliquity of the eye (Luscitas); either a paralysis, or a ceaseless, irregular action of one or more of the muscles of the organ, being evidently a condition of this symptomatic appearance.—(See Beer's Lehre von den Augenkrankheiten, b. 2, p. 427.)

Beer has often met with patients labouring under imperfect amaurosis, who could plainly distinguish all objects which were not very small; but saw them of a different colour from their real one; for instance, yellow, green, purple, &c. (Visus coloratus; crupsia.) He had under his care an amaurotic woman, who at midday could discern even the smallest objects in a strong light; but they all appeared yellow, though no marks of jaundice were perceptible.

Sometimes, in the early stage of amaurosis, all objects appear quite distorted, bent, shortened, and, in rarer instances, inverted (Visus defiguratis; Metamorphosia). Thus the flame of a candle appears very long, but all awry. This is said by Beer to be constantly an unfavourable omen, as the cause of it lies in the brain itself.

Imperfect amaurosis is sometimes attended with considerable short-sightedness (Myopia); and sometimes with the opposite affection (Presbyopia); an infallible proof that essential changes have happened either in the transparent media or in the muscles of the eye.

Many patients, when first attacked with amaurosis, every where testify a partiality to a great quantity of light, employing several candles at night, and sitting in the daytime with their backs against a sunshiny window, in order to let whatever they are reading have a very strong light upon it. This symptomatic appearance of incipient amaurosis is termed by Beer, Lichthunger.

Amaurosis may either take place in an instant, even so as to be attended with entire blindness; or it may come on quickly, that is, it may be complete in a few days or weeks; or lastly, what is most frequently the case, it may be produced gradually, and several years elapse before it attains its utmost degree; circumstances of great moment in the diagnosis and treatment.

The type which the disease assumes in its course and developement, is also subject to great variety, and claims the utmost attention; for amaurosis may either be permanent or temporary. It is sometimes an intermittent disorder, making its appearance at regular or irregular intervals. In certain examples it prevails at particular times, commonly all day, till a certain hour; or from one day till the next; or at a stated time every month. The attacks sometimes take place at indeterminate periods. In particular cases, another morbid affection is associated with the impairment of sight. Richter mentions a man who became blind at twelve o'clock in the day, when the upper eyelid used to hang down paralytic. The attack always lasted twenty-four hours. On the following day at twelve o'clock, the sight used to return, and the patient then suddenly regained the power of raising the upper eyelid. He would continue thus able to see for the next twenty-four hours. Whenever he took bark, the disease was regularly doubled; that is to say, the man then alternately remained blind forty-eight hours, and recovered the power of seeing for only twenty-four. In another patient, cited by the same writer, the aqueous humour, during the blindness, always became discoloured, whitish, and turbid; but its transparency regularly returned on the cessation of the attack. According to Richter, the periodical amaurosis commonly depends upon irritation affecting the digestive organs, the stimulus of worms, or irregularity in the menstrual discharge. Sometimes it is plainly a symptom of a confirmed ague, the patient being attacked with an ordinary intermittent, and blind during each paroxysm, but always regaining his sight as soon as each fit is over.—(Anfangsgr. der Wundarzn. b. 3, kap. 14.) Beer believes that periodical amaurosis is chiefly observed in chlorotic, hemorrhoidal, hysterical, and hypochondriacal subjects. Day-blindness (Cæcitas Diurna; Nyctalopia) and night-blindness (Cæcitas Crepuscularis; Hemeralopia) are nothing more than cases of periodical amaurosis. But sometimes the frequently recurring form of the disease confines itself to no determinate type; and, on account of its irregularity, it is then termed by Beer "amaurosis vaga," which, he says, is often of spasmodic origin, and therefore principally met with in persons liable to hysteria, hypochondriasis, convulsions, or epilepsy. Periodical amaurosis, after remaining uncured a certain time, often becomes permanent.—(Beer, Lehre, &c. b. 2, p. 429.)

In amaurosis in general, but particularly when no material knowledge can be acquired of causes, and the treatment must of necessity be conducted on empirical principles, it is of the highest importance to recollect what Richter has pointed out; namely, that amaurosis sometimes commences with several symptoms, betraying an increase of sensibility in the eye, or some irritation affecting this organ. In moderately light places, the patient can discern things very well; but in a great light, he is not able to see at all. The eye is sometimes so sensible, that a strong light will make it weep and become painful. Patients of this description ought always to wear a shade, however bad their sight may be.

This form of amaurosis is described by Beer as having two stages; in the first, the patient never becomes blind; the eyesight not being lost till the end of the second stage. The disease always forms with great quickness, so that the limits between the two stages are frequently very indistinct.

The first stage commences with a peculiar sensation of fulness in the eyeball, joined with continually increasing, violent, and annoying, luminous appearances, and a remarkable weakness of sight. These symptoms are soon followed by a stupifying, constantly increasing headache, during which the power of vision manifestly diminishes, without the slightest defect being perceptible either in the eye itself, or its surrounding parts. The patient, however, is always marked by an athletic constitution, or, at all events, by such symptoms of general and local plethora, and of a phlogistic diathesis, as cannot be mistaken.

Upon the advance of the disorder into its second stage the headache becomes irregular, being less violent at some periods than others; the patient feels as if there were before his eyes a thick net or gauze, which, in a bright light, appears quite black, but in the shade, fiery and shining. This net or gauze, when there is any temporary determination of blood to the head and eyes, as in straining at stool, is immediately rendered considerably more dense; and when such determination of blood is often repeated, or long maintained, the density at length remains much greater than before, and, consequently, the patient suddenly grows more blind, and is very quickly entirely bereft of vision. This complete loss of sight, in the second stage, if efficient assistance be not given, is ultimately produced by the progress of the disease, even without any accidental determination of blood, though never quite suddenly. At last, all power of discerning the light is abolished under incessant stupifying headaches, which are sometimes weaker, sometimes stronger, and attended with a sensation, as if the dimensions of the eye were increased, and, indeed, it really feels harder than in the healthy state.

Sometimes amaurosis originates with symptoms of weakness and diminished irritability. The sight is cloudy, and the patient finds that he can see better in a light than a dark situation. He feels as if some dirt or dust were upon his eyes, and is in the habit of frequently wiping them. His power of vision is greater after meals than at the time of fasting. His sight is always plainer, for a short time, after the external use of tonic remedies, such as hartshorn, cold water, &c. Richter informs us of a person, who was nearly quite blind, but was constantly able to see very well for the space of an hour, after drinking champaign wine. He also mentions a woman entirely bereft of sight, who was in the habit of having it restored again, for half an hour, whenever she walked a quick pace up and down her garden. He likewise acquaints us with the case of a lady, who had been blind for years, but experienced a short recovery of her sight, on having a tooth extracted.—(Anfangsgr. &c. b. 3, kap. 14.)

Whether the benefit arose from the stimulus of the operation, as Richter seems to imply, or from the

removal of an irritating cause, doubts may rationally be entertained. A similar fact is recorded by Mr. Travers, who says, that he has seen an incipient functional amaurosis distinctly arrested by the extraction of a diseased tooth, when the delay of a similar operation had occasioned gutta serena on the opposite side two years before.—(Synopsis, p. 299.)

When the disorder is accompanied with diminished sensibility in the eye in general, Beer joins Richter, with respect to the temporary improvement of the sight after a nourishing meal, or drinking spirituous liquors; or when the patient's mind is elated with joy, or anger, though such melioration of sight, it is true, is but of very short duration.—(See also Vetch's Treatise on the Diseases of the Eye, p. 137.)

On the other hand, it may be remarked, that every thing which tends to depress the passions and spirits, augments the imperfection of sight. Where marks of increased sensibility prevail, the above-mentioned circumstances exercise a transient disadvantageous operation; the patient carefully retires from every strong light, and frequently shelters his eye with his hand, &c.—(Lehre von den Augenkr. b. 2, p. 430.)

Mr. Travers also knows patients, whose vision is benefited in a high degree, and others, in whom it is much deteriorated, by the quickened circulation of a full meal, and a few glasses of wine. The former, he says, are persons of spare and meagre habits; the latter plethoric.—(Synopsis of the Diseases of the Eye, p. 157.)

According to Beer, this amaurosis differs from the preceding, by its formation being usually very slow, and its not exhibiting any traces of those two very different stages which are peculiar to the other case. It also invariably commences with the visus reticulatus, or nebulosus, without any alternation with a blinding glare of light; and the eyesight is sometimes considerably better, and sometimes weaker, which always depends upon the accidental operation of the above internal or external circumstances. The melioration of the eyesight never continues long, while the diminution of it not only remains, but gets worse and worse. It is not at all uncommon for this species of amaurosis to make its appearance as a night-blindness, because common artificial light is much too feeble to make due impression upon the diminished sensibility of the optic nerve, and consequently these patients always show a partiality to a very strong light. To such weak-sighted individuals, the flame of a candle, or the moon, appears as if covered by a dense veil, with an expanded halo round it of various colours. There is no complaint made of pain in the head or eyes; and no sensation of fulness or weight is experienced in the eyeball; much less are there any signs of the disease in the structure and form of the eye, or in the action of its irritable textures; but when it has been long complete, it is usually conjoined with a debilitated habit.

Amaurosis either presents itself as a genuine uncomplicated affection, or, at least, with the appearance of such a form of disease of the eye, depending solely upon a morbid state of the optic nerve, and cognizable by a diminution, or complete abolition, of the power of vision; or the disease is co-existent with other diseased appearances, either in the eye, its vicinity, or some other organs at a distance from the eye, or in the general constitution. These appearances merit the most earnest consideration, because they are for the most part connected with the cause of amaurosis. According to this statement then, there is a genuine local amaurosis, and a complicated amaurosis, which last may be either local, or general, or of both descriptions together, and therefore named by Beer, "perfectly complicated."—(Vol. cit. p. 431.)

The general symptoms of the simple uncomplicated species of amaurosis, putting out of consideration the morbid increase, or diminution of the sensibility of the optic nerve, are thus described by Beer. In the first place, all morbid appearances are absent, which might be produced in the amaurotic eye by any one preternatural change in the texture, form, or state of that organ. Hence we are obliged to trust almost exclusively to the patient's assertion that his sight is bad, or quite gone; and not unfrequently it is necessary, especially in judicial cases, to employ political artifices in order to determine whether such assertion be true, particularly when the patient affirms that the blindness is restricted to one eye. Secondly, when the amaurosis is indeed nearly or quite formed in one eye, a slight degree of strabismus is at most perceptible, arising from the circumstance of the patient's not fixing the eye affected upon any object. This degree of strabismus is noticed by Ackerman and Fischer as the surest sign of amaurosis.—(See Klinische Annalen von Jena, st. 1, p. 144.) And it is particularly pointed out by Richter as an invariable attendant upon amaurosis. The patient, says he, not only does not turn either eye towards any object, in such a manner, that the object looked at is in the axis of vision, but he does not turn both his eyes towards the same thing. This was regarded by Richter as the only symptom which we can trust, where implicit confidence should not be put in the mere assurance of the patient that he cannot see, while all the coats and humours of the eyes present their natural appearance.—(See Anfangsgr. der Wundarzn. b. 3, kap. 14.) Provided this observation be correct, it must be highly interesting to the military surgeon, amaurosis being a common affliction of soldiers, many of whom, however, endeavour to avoid service by pretending to labour under a disqualification which they well know does not necessarily produce any very considerable alteration in the natural appearance of the part affected. Thirdly, while the disorder is only in the stage of amblyopia, the patient always complains of continually multiplying muscæ volitantes, or of the visus reticulatus, or nebulosus. Fourthly, luminous forms appear before the eyes, especially in the dark, even when the patient is entirely blind. Fifthly, the decrease of vision goes on to complete blindness, without any material interruption, or retrogression. Sixthly, when only one eye is quite blind, and the eyesight on the other side is perfectly undisturbed, there is one infallible symptom of this amaurosis; namely, if the sound eye be very carefully covered, the pupil of the blind one immediately expands, and the iris becomes quite motionless, notwithstanding the diseased eye be exposed to the strongest light possible. However, this criterion is mostly wanting, because the amaurosis, unattended with any perceptible effect, except loss of vision, is seldom confined to one eye, but usually affects both.—(See Lehre von den Augenkr. b. 2, p. 481, 482.)

Mr. Travers divides amaurotic affections into two classes, the organic and the functional. The first comprehends alterations, however induced, in the texture or position of the retina, optic nerve, or thalamus. The second includes suspension, or loss of function of the retina and optic organ, depending upon a change, either in the action of the vessels, or in the tone of the sentient apparatus.

As causes of organic amaurosis, Mr. Travers enumerates; 1. Lesion, extravasation of blood, inflammatory deposition upon either of its surfaces, and loss of transparency of the retina. 2. Morbid growths within the eyeball, dropsy, atrophy, and all such disorganizations as directly oppress or derange the texture of the retina. 3. Apoplexy, hydrocephalus, tumours or abscesses in the brain, or in or upon the optic nerve or its sheath, and thickening, extenuation, absorption, or ossification of the latter. As causes of functional amaurosis, Mr. Travers specifies; 1. Temporary determination; vascular congestion, or vacuity, as from visceral or cerebral irritation; suppressed or deranged or excessive secretions, as of the liver, kidneys, uterus, mammæ, and testes; various forms of injury and disease; and hidden translations of remote morbid actions. 2. Paralysis idiopathica, suspension or exhaustion of sensorial power from various constitutional and local causes; from undue excitement or exertion of the visual faculty; and from the deleterious action of poisons on the nervous system, as lead, mercury, &c.

From this description, says Mr. Travers, it will be understood that organic, and many forms of functional amaurosis are incurable; and the functional, by continuance, lapses into the organic disease.

Functional amaurosis is subdivided by Mr. Travers into, 1st, the Symptomatic, or that which is only a symptom of some general disease, or disorder of the system; as, for example, general plethora, general debility: 2dly, the Metastatic, or that produced by the sudden translation of the morbid action from another organ of the body; as, for example, from the skin, the testicle, &c.: 3dly, the Proper, or that which depends upon a peculiar condition of the retina; as, for example, the visus nebulosus, muscæ volitantes.—(Synopsis, p. 139—155.)

On the whole, genuine local amaurosis, that is to say, a diminution or total loss of the eyesight, unattended with any other apparent local or constitutional defect, may be said to be a very rare case, the disorder being usually more or less complicated.

To the local complications, says Beer, belong the cataract; glaucoma; a general varicose state of the eyeball (cirsophthalmia); exophthalmia; atrophy of the eye; spasms in the organ and surrounding parts; paralysis of one or more muscles of the eye (ophthalmoplegia); paralysis of the eyelids; ophthalmia in general, and internal ophthalmia in particular; a scorbutic blood-shot appearance of the eye (hypoema scorbuticum); and finally, wounds or contusions of the eye or adjacent parts. With these cases should also be mentioned that important case, fungus hæmatodes of the eye. From this simple enumeration of local complications one may see how frequently amaurosis is only a symptomatic effect of another disorder of the eye, with which it is conjoined, and how often it is connected with the same common causes which pertain to another or several other diseases of the eye.

Among the general complications Beer enumerates those which are purely nervous: impairment of the health in various forms by infection, contagion, or miasmata; a bad habit of body; typhoid fevers, the amaurotic effects of which upon the eye the author of this work has frequently noticed; asthma; internal and external hydrocephalus; organic defects of the abdominal viscera; worms; chlorosis; consumption; old ulcers of the legs; organic disease of the brain and skull; complaints arising from pregnancy; hemorrhage, &c. In these general complications Beer remarks that the casual connexion between amaurosis and some remote disease of another organ, or of the whole constitution, cannot be mistaken; and in these cases we often see the disease of some other distant part from the eye suddenly or gradually diminish, and immediately appear again as a sympathetic action in the form of amaurosis, of which the most remarkable instance is seen after the sudden healing of old ulcers of the legs.—(Beer, Lehre von den Augenkr. b. 2, p. 433.)

From the above general remarks upon amaurosis it is quite manifest that the symptoms of the disease vary considerably according to the violence of its causes, and of the local and general complications, though the seat of the disease and what is particularly the proximate cause of the loss of vision be in the optic nerve; and it depends especially on the nature of the causes, whether this or that morbid appearance take place in the eye.

One may consider as the only really inseparable symptom of amaurosis that weakness of sight (amblyopia), or that complete blindness, in which neither with the unassisted or assisted eye the least defect can be perceived in the structure and shape of the affected organ. Hence Beer names such impairment of vision, or blindness, amaurotic. But how rarely this essential symptom is met with alone, and how frequently it is obscured by some other defect in the structure and form of the eye, is proved by daily experience.

The incidental symptoms of amaurosis have hitherto been set down as merely consisting of a considerable dilatation of the pupil, and immobility of the iris, because these appearances are indeed the most frequent; but, as Beer observes, this is another proof what ignorance has prevailed respecting the true nature of that disease of the eye and its modifications, which are usually termed amaurosis.

The incidental symptoms of amaurosis may consist in the faulty size and shape of the pupil. In many cases the pupil is very much dilated, immoveable, and possesses its natural black colour and usual transparency. It cannot be denied that this is the state of numerous cases, but it is equally true that there are many exceptions. Sometimes, according to Richter, in the most complete and incurable cases the pupil is of its proper size, and even capable of free motion (Turbès, Recueil Périodique, &c. t. 2, p. 319); and occasionally, it is actually smaller and more contracted than natural. This aperture often continues extraordinarily large in the strongest light; but in some instances it is unusually small in every kind of light.—(Arrachard, Recueil Period. &c. t. 1, p. 273. Richter, Anfangsgr. &c. b. 3, p. 424. Beer, Lehre, &c. b. 2, p. 435.) According to the latter writer, the pupillary edge of the iris rarely has its primitive shape, being generally more or less angular; either at some indeterminate point, or above and below, so as to resemble in some measure the pupil of the cat race; or towards the nose or temple, so as to have some similitude in its form to the pupil of ruminating animals. These appearances are highly important, having great influence over the diagnosis.

Frequently not only the size and shape of the pupil are faulty, but the position of that opening is quite unnatural, being inclined either upwards or downwards, or outwards or inwards; but most commonly in a diagonal line between inwards and upwards, and in these cases the pupillary margin of the iris never describes a regular circle, but is always more or less angular.—(Beer, vol. cit. p. 436.)

The pupil of an eye affected with amaurosis frequently does not exhibit the clear shining blackness which is seen in a healthy eye. In general it is of a dull, glassy, horn-like blackness, which symptom alone is frequently enough to apprize a well-informed practitioner of the nature of the disease. It is, in the words of Mr. Travers, "little more than the healthy appearance of the humours in the eye of a horse."—(Synopsis, p. 146.) Sometimes the colour of the pupil has an inclination to green; while in other examples this aperture seems to be dense, white, and cloudy, so that the complaint might easily be mistaken for the beginning of a cataract. This error, into which inexperienced surgeons are liable to fall, may generally be avoided by attention to the following circumstances:—The misty appearance is not situated close behind the pupil in the place of the crystalline lens, but more deeply in the eye. Nor is it in proportion to the impairment of sight, the patient being quite blind, while the misty appearance is so trivial, that if it arose from the opacity of the crystalline lens, it could at most only occasion a slight weakness and obscurity of vision; at the same time Richter acknowledges that it must be more difficult to avoid mistake when a beginning amaurosis is accompanied with this cloudiness of the eye, and consequently when the degree of blindness seems to bear some proportion to the degree of mistiness in the pupil. However, in this case he maintains that the true nature of the disease may generally be known by comparing the ordinary symptoms of the two diseases.—(Anfangsgr. b. 3, p. 14.) And, according to Beer, when the pupil is of a true dark-gray, or greenish-gray colour, a lateral inspection of the eye will show plainly enough, that the cloudiness is in the vitreous humour or behind it. Sometimes the pupil appears reddish, quite red, or of a yellowish-white colour (Lehre von den Augenkr. b. 2, p. 436); while in other cases the interior of the eye a good way behind the pupil seems quite white, and a concave light-coloured surface may be observed, upon which the ramifications of blood-vessels can be plainly seen. In particular instances this white surface extends over the whole back part of the eye, while in other cases it only occupies a half or a small portion of it. This peculiar appearance has been ascribed to a loss of transparency in the retina itself, and a consequent reflection of the rays of light.—(Haller, Element. Physiol. tom. 5, p. 409.) Mr. Travers inclines to the opinion, that it arises from a deficient secretion of the choroid pigment, a preternatural adhesion between the choroid coat and the retina, and a discoloration or resplendent appearance of the latter from this cause.—(Synopsis, p. 148.)

One of the strongest characteristics of amaurosis and an incipient cataract, and one most to be depended upon in practice, is reported by Mr. Stevenson to be the difference which the flame of a candle exhibits in the two affections. In incipient cataract it appears as if it were involved in a generally diffused, thin mist or white cloud, which increases with the distance of the light; but in amaurosis a halo or iris appears to encircle or emanate from the mist, the flame seeming to be split, when at a distance.—(On the Nature, &c. of Amaurosis, Lond. 1821.)

There can now be no doubt that the whiteness behind the pupil must sometimes have originated from the diseased mass which, in cases of fungus hæmatodes of the eye, grows from the deeper part of this organ, and gradually makes its way forwards to the iris, being always attended with total loss of sight. Putting out of present consideration the change of colour within the eye, produced by fungus hæmatodes, the other palish changes behind the pupil are not confined, as Kieser supposes, to very old cases of amaurosis, because the alteration is described by Schmucker as taking

place especially in examples the formation of which was quite sudden (Vermischte Chir. Schrift. b. 2); and Langenbeck has recorded cases in which the same appearance happened in the early stage of the disease.—(Neue Bibl. b. 1, p. 64, &c.)

Besides the above appearances in the pupil itself, and in the pupillary margin of the iris, Beer adverts to several important phenomena with respect to the motion of the iris. Sometimes the iris moves but very inertly, and frequently not at all, though the light be strong, and the upper eyelid be rubbed over the eyeball. While in other examples a very moderate light will bring on such a rapid contraction of the iris and closure of the pupil, as are never witnessed in a healthy eye.

We have also the authority of Richter for asserting, that in particular instances the iris not only possesses the power of motion, but is capable of moving with uncommon activity, so that in a very moderate light, it will contract in an unusual degree, and nearly close the pupil.—(Anfangsgr. der Wundarzn. b. 3, p. 424, edit. 1795.)

Two or three remarkable instances of the active state of the iris, in cases of amaurosis, were some years ago shown to me by Dr. Albert, then staff-surgeon at the York Hospital, Chelsea, and I have seen other similar cases in St. Bartholomew's Hospital. Most of the patients in question had not the least power of distinguishing the difference between total darkness and the vivid light of the sun, or a candle placed just before their eyes. Janin sometimes found the pupil capable of motion in this disease, and Schmucker twice noticed the same fact.

Such cases, Mr. Travers thinks, can only be explained by concluding the organ to be sound, and the cause of the amaurosis remote or external to it. Thus, says he, in a case of circumscribed tumour, compressing the left optic nerve, immediately behind the ganglion opticum, although the blindness was complete, the iris was active. In two young ladies, in whom the eyes, as in the former case, were perfect, and the blindness complete, the iris was even vivacious; and there was the strongest presumptive evidence from the symptoms that the amaurosis was in the cerebral portion of the nerve.—(Synopsis, p. 188.)

In some anomalous cases, when the strength of the light is suddenly increased, the pupil expands with more or less celerity.

I have already adverted to the occasional moveableness of the iris, notwithstanding the insensible state of the retina. Let me next take notice of a case which sometimes presents itself, and is quite the reverse of this last. The nerves of the iris may be paralytic, while those of sight continue unimpaired. Schmucker was acquainted with a woman whose pupil was uncommonly distended, and totally incapable of motion. Her sight was very weak, and spectacles were of no use to her. She could scarcely discern any thing by day or in a strong light, but she could see rather better at night and in dark places. This infirmity of sight depended upon the dilated, paralytic state of the pupil, by which too many rays of light were admitted into the eye; and the reason why the patient could see better at night was because the pupil, in its natural state, always becomes widened in a dark situation.—(See Vermischte Chirurgische Schriften, von J. L. Schmucker, band 2, p. 13, 14.)

On this curious part of the subject it is remarked by Mr. Travers, that if the retina be opaque, compressed, or unsupported, the iris mechanically disordered, or the ciliary nerves palsied, the pupil is inactive, independently of the state of vision. In the first of these cases it is evident vision will be lost; but we continually see useful vision combined with the second and third, as after operations in which the iris has been half destroyed or has become preternaturally adherent, or in malformations where it is half wanting; and in paralysis of the ciliary nerves accompanying ptosis.—(Synopsis, p. 188.)

Frequently in amaurosis, when the sight of only one eye is lost, and the other retains its full power of vision, not the slightest defect can be discovered as long as the patient keeps both of them open; but the instant the sound eye is completely covered, the iris becomes perfectly motionless, its pupillary margin assumes an angular shape, and the pupil expands, being sometimes evidently drawn towards the edge of the cornea.—(Beer, Lehre von den Augenkrank. b. 2, p. 438.) This demonstrates the difference between the independent and the associated action of the iris.

Besides the above appearances of the pupil and iris, amaurosis is attended with other characteristic phenomena, which occur under certain circumstances, in the form, texture, and state of other parts of the eye and adjoining organs. Thus the patient often complains of a peculiar troublesome dryness of the eye, or of a sensation as if the eyeball were about to be pressed out of its socket; and indeed, says Beer, one may sometimes hear a grating noise, and distinguish a fluctuation in the orbit behind the eyeball, when this organ is pressed upon by the finger, or moved in various directions, though neither its circumference be enlarged, nor any tendency to exophthalmia be really present. Nor is it very uncommon to find the affected eye preternaturally hard, soft, or even quite flaccid; but it is less common to find the dimensions of the globe of the eye increased, or the organ affected with atrophy.—(Beer, vol. cit. p. 428.)

However, in organic amaurosis, as Mr. Travers notices, a peculiar bluish-gray tint of the sclerotic coat is frequently remarkable; and sometimes even a degree of bulging on one or more sides of the eye, or simply a loss of sphericity, its sides appearing flattened.

A turgescence of the superficial vessels, especially of the long fasciculi of conjunctival veins, is likewise another symptom, frequently observed in cases of organic amaurosis.—(See Travers's Synopsis, p. 146.)

The same gentleman also gives the particulars of a dissection, in which a case of amaurosis was attended with a collapse of the retina from absorption of the vitreous humour.—(Op. cit. p. 150.)

Some of the principal morbid effects of amaurosis have been already described in speaking of the several defects of vision, which accompany an amaurotic weakness of sight. Besides these, however, there are others which merit attention. For instance, the patient feels in the eye and surrounding parts an irksome sensation without any actual pain, and complains of a remarkable sense of fulness or weight in the organ. Amaurotic patients are also frequently attacked with sudden violent giddiness, usually ending in a considerable diminution of the eyesight, and sometimes in severe general headache. Occasionally they fancy that small atoms of dust are lodged under the eyelids, and are fearful of moving these parts of the eye. It is also well known, that many persons become amaurotic while labouring under severe hemicrania, extending from or to the diseased eye; while, on other occasions, the most violent pains are confined particularly to the region of the eyebrow, and have the appearance of being strictly periodical. In certain other cases the pain is wandering, and shoots in every direction about the eyebrow. These painful feelings often precede the amaurotic blindness a considerable time, and often first take place when one or both eyes are already blind; but the pains and loss of sight are not unfrequently produced together. Lastly, some patients are met with, in whom the worst pains only last until the amaurosis is perfectly formed, when they gradually and permanently cease. In all these painful cases of amaurosis, the pain and the blindness chiefly depend upon the same cause, and one is seldom the occasion of the other. Sometimes amaurotic patients experience such violent pain, that they lose their senses and grow delirious; but in these cases, if we can credit the assertion of Beer, important morbid changes in the bones of the skull, or the brain itself, are invariably noticed after death.—(See Lehre von den Augenkr. b. 2, p. 439.) In some amaurotic patients lethargic symptoms may be remarked; in others, restlessness; and more rarely delirium in all its degrees, either as a transient or permanent affection.

According to the observations of Mr. Travers, pain affecting the forehead and temples is a percursory symptom of amaurosis, diminishing in proportion as the dimness increases. When the amaurosis is perfect, it usually ceases altogether, if the disease has its seat in the eyeball. But when the pain is severe, remits imperfectly, and is quickly rendered worse by exercise, it is usually connected with organic disease of the brain. In this case derangement and torpor of the primæ viæ, loss of strength and flesh, disposition to stupor, occasional confusion of intellect, inaptitude to exertion, and paralysis of one or more muscles will be concomitant symptoms.—(Synopsis, &c. p. 167.)

Paralytic appearances may precede amaurosis, either in the vicinity of the eye, or in the muscles of the face, or in a distant situation, as the extremities. Sometimes they accompany the disease, and sometimes closely follow the weakness of sight, being not unfrequently the forerunners of a fatal attack of apoplexy.

In the same way convulsive symptoms may be conjoined with amaurosis, and when they first occur in the complete stage of the latter disease, Beer pronounces them a very unfavourable omen for the patient's life.

But according to the same experienced oculist, when in a cause of perfect amaurosis several of the other external senses are affected; and lastly, when the internal senses begin to suffer, when, for instance, the hearing, and then the smell and taste are lost, and afterward the memory and other intellectual powers fail, the patient's speedy dissolution may be expected.—(See Lehre von den Augenkrankh. b. 2, p. 441, Wien, 1817.)

As Professor Beer correctly observes, age cannot be considered a predisposing cause of amaurosis, as it is of cataract; for there are many more blind persons who have been deprived of their sight by amaurosis in their best days than old persons thus attacked. Amaurosis spares no age—not even the new-born infant. Mr. Lawrence, in his Lectures, concurs in this statement, adding his opinion, however, that amaurosis is very frequent during the active middle period of life, and very common about the cessation of menstruation in females, and the corresponding age in the male.

Four forms of congenital organic amaurosis are noticed by Mr. Travers. One in which the eye is preternaturally small, soft, and even flaccid; the iris tremulous, and not influenced by belladonna; and the globe affected with tremor, and not subject to the control of the will. A second, depending on a deficiency of the pigmentum nigrum; the organ is tremulous, strong light produces uneasiness, and vision is dazzled and confused. The vessels of the choroid give the interior of the eye a deep-red tinge. A third case is that in which the sclerotica so encroaches upon the cornea, that the latter is scarcely wider than the pupil. In the fourth kind of congenital amaurosis, described by Mr. Travers, the eyes move in concert, as if attracted by a faint perception of light: but the infant is blind; no marks of organic derangement can be seen; but Mr. Travers apprehends that the disease must be connected with a morbid state of the thalami or optic nerve.—(Synopsis, p. 153, 154.)

Neither does sex nor race appear to have any influence over the origin of the complaint; but it would seem that dark eyes, especially those which are called black, are more disposed to amaurotic blindness than such as are light-coloured. According to Beer's experience, for every gray or blue eye affected with amaurosis, there are five-and-twent yor thirty brown or black ones thus, diseased. In the peculiar constitution of the eye, then, as well as in a sanguineous and choleric temperament, there exists a tendency to the disorder.

More frequently than cataract, amaurosis is found to be a true hereditary disease:—this is so much the case, that most of the members of a family for more than one generation may lose their sight from amaurosis at a certain period of life. Beer says that he is acquainted with more than one family in which this has happened, and what merits attention, the women of one of these families, down to the third generation, became completely and permanently blind from amaurosis on the cessation of the menses, while all the others who had had children were unaffected. But the males of this unfortunate family, who as well as the females have very dark-brown eyes, all seem to be weak-sighted, though none of them are yet blind.—(Lehre von den Augenkrankheiten, b. 2, p. 443.)

In women, especially those with black eyes, the time when the menses stop is a dangerous period for the commencement of amaurosis.

According to the same writer, patients whose piles used to bleed periodically for a long time, but are now suddenly stopped, and whose eyes are dark, are very liable to amaurosis.

One of the less common causes of amaurosis is an idiosyncrasy, in relation to this or that sort of nutriment or medicine, or this or that particular state of the body. Here is to be reckoned the amaurotic weakness of sight, or the perfect amaurosis, which comes on at the very commencement of pregnancy, and subsides after delivery, but always attended with dyspepsia and insuperable vomiting. This species of amaurosis, however, should be carefully distinguished from that which sometimes first originates in the final months of pregnancy, and chiefly from strong and long-continued determination of blood to the head and eyes, particularly when the bowels are at the same time loaded, and the patient constipated. This latter case usually continues till after delivery; or if the labour be tedious, difficult, and attended with considerable efforts, the blindness may first attain its complete form at the time of delivery, and not afterward subside.

Beer saw a young Jewess, who, at the very beginning of her first three pregnancies, which followed each other quickly, regularly lost her sight, becoming completely amaurotic between the third and fourth months, and on the first two occasions she continued blind till after delivery; but in the third instance the power of vision never returned at all. Beer twice had under his care another woman, who was attacked with amaurosis whenever she drank chocolate; but upon leaving off that drink, she never afterward had any complaint in her eyes.

If we are to believe the generality of writers on this subject, the abuse of bitter substances, as of chicory in coffee, bitter malt liquors, and bitter medicines, especially quassia, is unquestionably a predisposing cause of amaurosis.

The abuse of narcotic poisonous substances may induce amaurosis; immoderate doses of opium; hyoscyamus; belladonna, &c. Lead will do the same thing. Respecting the operation of some of these causes, however, Mr. Lawrence entertains a doubt. The narcotic vegetables used to dilate the pupil, he observes, are supposed to give a tendency to amaurosis. He has never seen such an effect produced by the belladonna; and he adverts to one case in which it was used a great length of time. The effect of bitters seems to him equally problematic.

One not unfrequent and very important cause of amaurosis is hysteria and hypochondriasis, with which must be mentioned infarction, and disease of one or more of the abdominal viscera, especially the liver.—(Beer, Lehre, &c. b. 2, p. 444—446.)

According to Richter, the remote causes of amaurosis may be properly divided into three principal classes, the differences of which indicate three general methods of treatment.

The first class of causes depends upon an extraordinary plethora and turgidity of the blood-vessels of the brain, or of those of the optic nerves and retinæ, upon which last parts a degree of pressure is thereby supposed to be occasioned. A considerable plethora, especially when the patient heats himself, or lets his head hang down, will frequently excite the appearance of black specks before the eyes, and sometimes complete blindness. A plethoric person (says Richter) who held his breath, and looked at a white wall, was conscious of discerning a kind of net-work which alternately appeared and disappeared with the diastole and systole of the arteries.

Richter thinks it likely that the disease is thus produced, when it proceeds from the suppression of some habitual discharge of blood, not being bled according to custom, the stoppage of the menses, and the cessation of hemorrhage from piles. In the same manner the complaint may be brought on by great bodily exertions, which must determine a more rapid current of blood to the head. Richter informs us of a man who became blind all on a sudden, while carrying a heavy burden up stairs. He tells us of another man, who laboured excessively hard for three days in succession, and became blind at the end of the third day. Pregnant women in like manner are sometimes bereft of their sight during the time of labour. Schmucker has recorded a remarkable instance of this in a strong young woman, thirty years old, and of a full habit. Whenever she was pregnant, she was troubled with violent sickness till the time of delivery, so that nothing would stop in her stomach. She was bled three or four times without effect. Towards the ninth month her sight grew weak, and for eight or ten days before parturition, she was quite blind. The pupil of the eye was greatly enlarged, but retained its shining black appearance. She recovered her sight immediately after delivery, and did not suffer any particular complaints. Schmucker assures us that he has been three times a

witness of this extraordinary circumstance.—(Vermischte Chir. Schriften, band 2, p. 6, edit. 1786.) Richter speaks of a person who lost his sight during a violent fit of vomiting. Schmucker acquaints us that it is not uncommon for soldiers, who are performing forced marches in hot weather, to become blind all on a sudden.

Beer also coincides with Schmucker, Richter, and others, in regarding as a frequent cause of amaurosis repeated and long-continued determinations of blood to the head and eyes, produced by various circumstances, viz. by pregnancy; a tedious and difficult labour; lifting and carrying heavy burdens, especially with the arms raised up; all kinds of work, in which the eyesight and intellectual faculties are intensely exerted, with the head bent forwards, and the abdomen compressed, as is the case with shoemakers, tailors, &c.; every sudden stoppage of natural or preternatural long-established discharges of blood, as that of the menses, lochia, or hemorrhoids; the omission of habitual venesection at some particular season of the year; severe and obstinate vomiting; forced marches in hot dry weather; scrofulous and other swellings of considerable size in the neck, pressing upon the jugular veins, and obstructing the return of blood from the head; the use of a pediluvium, or warm bath, the water of which is of high temperature; hard drinking; violent gusts of passion; frequent and obstinate constipation; and hard straining at stool. These causes are more likely to occasion amaurosis in proportion as the individual is young and plethoric. The causes of that amaurosis which is characterized in its first stage by increased sensibility of the eye, and intolerance of light, are referred by Professor Beer to circumstances which produce a long and repeated determination of blood to the head and eyes.—(Beer, Lehre von den Augenkr. b. 2, p. 446 and 483, &c.)

Mr. Lawrence, in his Lectures, regards amaurosis, in its most frequent and important form, that which is seated in the eye itself, as generally the result of inflammation of the nervous structure; including under that phrase, all degrees of increased vascular action, whether designated as fulness, turgescence, determination, congestion, or as inflammation in its more limited sense; and the usual consequence of inflammatory disturbance, that is, organic change permanently destroying the function of the part. When, says Mr. Lawrence, we advert to the structure of the retina, we must suppose that it would be liable to such affections; we find it composed of minute ramifications of the arteria centralis retinæ, and on this net-work of vessels the nervous pulp is expanded. The state of the retina, when examined after death, in amaurotic eyes, accords with these views; it exhibits those changes which long-continued inflammatory disturbance would produce; it has been found thickened, opaque, spotted, buff-coloured, tough, and in some cases even ossified. The preceding doctrine is, however, judiciously qualified by its restriction to the disease as seated in the eye itself. The retina and optic nerve, Mr. Lawrence admits, with other surgeons, may be disordered sympathetically, as the stomach may be disordered without any change visible on dissection.

The second class of causes are supposed to operate by weakening either the whole body or the eye alone, and they indicate the general or topical use of tonic remedies. In the first case, the blindness appears as a symptom of considerable universal debility of the whole system; in the second case it is altogether local. Every great general weakness of body, let it proceed from any cause whatsoever, may be followed by a loss of sight. Amaurosis, if we can give credit to the statement of Richter, is sometimes the consequence of a tedious diarrhœa, a violent cholera morbus, profuse hemorrhage, and immoderate salivations.—(Also Travers's Synopsis, p. 144.) Richter informs us of a dropsical woman, who became blind on the water being let out of her abdomen. According to the same author, no general weakening causes operate upon the eyes, and occasion total blindness, so powerfully and often as premature and excessive indulgence in venereal pleasures. Mr. Lawrence, in his Lectures, does not coincide in some of the foregoing views. "Those," says he, "who have considered amaurosis to arise from debilitating causes, have considered that debility and atony of the nerve may be produced by all those circumstances which debilitate the system generally, such as loss of blood from profuse hemorrhage, diarrhœa, copious salivation, &c. I have never seen amaurosis produced by such causes. That great anxiety and grief may favour the occurrence of amaurosis, I am inclined to allow; for it is not improbable that severe impressions of that kind may produce inflammatory excitement in the brain or eyes; but I think we cannot without more direct proofs, admit the influence of debilitating causes generally in the production of amaurosis. The most clear instance of any directly debilitating cause producing amaurosis, is that of protracted suckling."

The causes which operate locally in weakening the eyes are various. Nothing has a greater tendency to debilitate these organs, than keeping them long and attentively fixed upon minute objects. But however long and assiduously objects are viewed, if they are diversified, the eye suffers much less, than when they are all of the same kind. A frequent change in the objects which are looked at has a material effect in strengthening and refreshing the eye. The sight is particularly injured by looking at objects with only one eye at a time, as is done with telescopes and magnifying glasses; for when one eye remains shut, the pupil of that which is open always becomes dilated beyond its natural diameter, and lets an extraordinary quantity of light into the organ. The eye is generally very much hurt, by being employed in the close inspection of brilliant, light-coloured, shining objects. Among the occupations enumerated by Mr. Travers as particularly exposing persons to amaurosis, are those of needle-workers, writers, draughtsmen, inspectors of linen and scarlet cloths, and of new banknotes; money counters; smiths, stokers in iron-furnaces and glass-houses; tavern-cooks; watchmakers, engravers, philosophical instrument makers, sea officers, &c.—(Synopsis, p. 144.) They are greatly mistaken, says Richter, who think that they save their eyes, when they illuminate the object which they wish to see in the evening with more lights, or with a lamp that intercepts and collects all the rays of light, and reflects them upon the body which is to be looked at. Richter mentions a man, who, in the middle of winter, went a journey on horseback, through a snowy country, while the sun was shining quite bright, and who was attacked with amaurosis. He speaks of another person, who lost his sight in consequence of the chamber in which he lay being suddenly illuminated by a vivid flash of lightning. A man was one night seized with blindness, while his eyes were fixed on the moon in a fit of contemplation. Richter also expresses his belief, that a concussion of the head from external violence, may sometimes operate directly on the nerves, so as to weaken and render them completely paralytic.

Beer corroborates the foregoing statement; for, he says, among the most frequent causes is to be considered every abuse of the eyesight, especially in dark-eyed persons, as a long and close inspection of one object particularly with a microscope, when the thing examined is very brilliant, or reflects back much light into the eye. Hence the view of jewels at night, and long journeys through snowy countries &c., are conducive to the disease. In this respect, every kind of employment which strains the eyes much, and requires a strong reflected light, must be considered injurious.—(See also Travers's Synopsis, p. 144.) Thus, reverberating lamps, like Argand's; the view of a white wall illuminated with the sun's rays; and looking a long while at the moon, or more especially the sun, with the unassisted eye, are circumstances likely to bring on the disease. That a flash of lightning, especially when it suddenly wakes a person in the night-time out of a sound sleep, may produce an amaurotic amblyopia in an irritable eye or even perfect blindness, is a well-known fact, and it is on the same principle that going suddenly out of a dark bedroom, immediately after waking in the morning, into an apartment that commands an open extensive prospect, must be hurtful to an irritable eye, though the bad effects may only be very slow. Here is also to be included every kind of over-irritation of the eye by light, as happens to typhoid patients, when they lie with their eyes open all the day in a large sunny chamber.

Very often the cause of amaurosis consists in local or constitutional debility, proceeding from impairment of the nerves in general, or of the nerves of the head, especially those of the forehead and eyebrow; either

from a concussion of the spinal marrow, falls from a considerable height with the weight of the whole body upon the heels; concussions of the eyeball, sometimes caused by violent sneezing, but more generally by contusions of the eye with blunt weapons, &c. Some of the cases of amaurosis from blows on the temple or the eye, observed by Mr. Travers, were attended with signs of disorganization; some were superficially inflamed; and others presented no external appearance of injury. We learn also from the same authority, that it is not always the eye on the struck side of the head that is affected.—(Synopsis, &c. p. 152.) If we are to believe Beer, and other foreign practitioners, considerable direct weakness may arise from cholera, long-continued diarrhœa, salivation, and the incessant spitting of tobacco smokers; bleedings; injudicious tapping of the abdomen; excessive indulgence in venery, and the misemployment of issues. A general debility, which has the worst effect on the eyes, may also arise from long trouble, especially when the diet is poor and bad; also from a deficiency of proper food; long watching; violent and sudden fright; imprudently washing the eyes with very cold water, especially when they are already weakish and irritable; and keeping them long in a dark place, particularly when they are also exerted a good deal in some particular kinds of labour, a case which, Beer says, is very frequent in Vienna. The amaurosis following typhus, without any unusual irritation of the eye by light, Beer also refers to general debility.—(Lehre von den Augenkr, b. 2, p. 449.)

Like nervous deafness (says Mr. Travers), amaurosis sometimes follows typhus and scarlet fever, and the various forms of acute constitutional disease. He has several times met with it as a consequence of infantile fevers. He observes that it is also sometimes a consequence of chronic wasting diseases, in which organic changes interrupt the nutrition of the system. He has seen a rapid and severe salivation instituted for a remote affection, and where no disease had previously affected the eyes, terminate in gutta serena of both.—(Synopsis, p. 155.)

With regard to the doctrine that certain forms of amaurosis are diseases of debility, Mr. Lawrence expresses his disbelief in its correctness, and asserts, that the only scientific and successful treatment of amaurotic affections is found to be antiphlogistic. Whether the amaurosis resulting from typhoid fevers, of which I have seen several instances, proceed from debility, or from too great a determination of blood to the head, may admit of dispute; but I conceive, that in many of such cases, tonic treatment is clearly indicated, if not for the eye itself, certainly for the generally enfeebled state of the health, with which the amaurosis is connected. Yet Mr. Lawrence's doctrine, that fulness and congestion of the vessels originally lead to the amaurotic affection, may be more correct than the theory which refers the blindness simply to weakness. However, as the amaurosis generally does not show itself till an advanced stage of fever, or that of great debility, and as it only recedes as the patient regains strength, it can hardly be considered as a case in which any other treatment than tonic can be availing. It is right to state that Mr. Lawrence himself, notwithstanding his belief in amaurosis being a kind of inflammation of the retina, modifies the antiphlogistic treatment according to the state of the constitution.

The third class of causes consists of irritations, most of which are asserted to lie in the abdominal viscera, whence they sympathetically operate upon the eyes. The observations of Richter, Scarpa, and Schmucker, all tend to support this doctrine. Many amaurotic patients are found to have suffered much trouble and long grief, or been agitated by repeated vexations, anger, and other passions, which have great effect in disordering the bilious secretion and the digestive functions in general. Richter tells us of a man who lost his sight, a few hours after being in a violent passion, and recovered it again the next day, upon taking an emetic, by which a considerable quantity of bile was evacuated. A woman is also cited, who became blind whenever she was troubled with what are termed acidities in the stomach.—(See Anfangs. der Wundarzn. b. 3, kap. 14.) However, according to Beer, imperfect amaurosis seldom depends upon disorder of the gastric organs, excepting the case from worms. (Lehre von den Augenkr. b. 2, p. 456): a very important difference from the sentiments entertained by Schmucker, Richter, and Scarpa. The close sympathy between the stomach and the eyes is well illustrated by a case recorded in one of the journals, and referred to by Mr. Lawrence in his Lectures. It was an amaurosis, with fixed pain over the eyebrow, in a child. It was not relieved by purging and other depletive measures: an emetic was at last given; and under its action, a bead was rejected from the stomach, and the amaurosis immediately disappeared.

Amaurosis sometimes proceeds from mechanical irritation. A small shot pierced the upper eyelid, and lodged at the upper part of the right orbit, between the eyelid and eyeball, so that it could be felt externally. The patient shortly afterward became blind in the left eye; but recovered his sight after the excision of the shot.—(Anfangsgr. der Wundarzn. band 3, p. 439.)

According to Beer, several constitutional disorders, but more especially gout, are frequently concerned in the production of amaurosis. Whoever reads Beer's history of what he terms gouty amaurosis, will naturally doubt the correctness of the name; and Mr. Lawrence distinctly affirms, in his Lectures, that he has never seen gout or rheumatism occasion any tendency to affections of the nervous structure of the eye. It is not because amaurosis sometimes occurs in gouty or rheumatic constitutions, that the affection of the sight is necessarily of a gouty or rheumatic origin; for the fact merely proves, that such constitutions are not exempt from the risk of being attacked by disorders of the eye. Mr. Lawrence has also never seen any case, in which the origin of amaurosis could be referred to syphilis.

Respecting the causes of amaurosis, the following remarks by Beer claim attention. Various swellings in the orbit, as, for instance, encysted tumours, tophi, hydatids in the sheath of the optic nerve, may and must gradually produce complete amaurosis by their pressure upon the optic nerves and retina. Some of these cases are usually characterized by a protrusion of the eye from its socket.—(See Exophthalmia.) In Mr. Langstaff's museum is a specimen of two amaurotic eyes, in which the optic nerves are shrunk to about one-third of their natural size. Similar instances are recorded by Dr. Monteith.—(See Weller's Manual.) According to Mr. Lawrence, Mr. Langstaff has also some interesting specimens of enlargement in front of the third ventricle, the parietes of which bulge so as to press upon the optic nerves, and thus to account for the amaurosis under which the patients laboured.

In the same manner different morbid changes in the brain itself, and in the bones of the cranium in particular, may be the direct cause of amaurosis: for example, hydrocephalus internus, caries, and exostoses at the basis of the skull.

Just as amaurosis is frequently a pure symptomatic effect of various disordered states of the constitution, so may different morbid changes, occasioned in the eye by those states of the health, become the proximate cause of amaurosis, as hydrophthalmia, cirsophthalmia, fungus hæmatodes, dissolution of the vitreous humour, glaucoma, &c.

From a contagious atmosphere, which is generally injurious to the eyes, an amaurotic blindness may originate, though but very rarely, and, as it would seem, only through the powerful influence of such state of the air over the whole sanguiferous and nervous system. Debilitated, nervous, weak-sighted persons, by remaining long in the atmosphere of a privy (Chomel, Mém. de Paris, 1711, Obs. Anat. 5, and Ramazzini, De Morbis Artificum, c. 13), that of a deep cellar, or exposed to other effluvia, may be suddenly attacked with amaurosis; and Beer assures us, that his experience confirms the truth of these reports.—(Lehre, &c. b. 2, p. 452.) A sympathetic affection of the nerves of the eye, with a carious grinder in the upper jaw-bone, is one of the most uncommon causes of amaurotic blindness.

A case, not yet duly considered, and very like the amblyopia senilis, consists of an incessantly diminishing secretion of the pigmentum nigrum upon the tunica Ruyschiana, choroidea, and uvea, which secretion indeed, in some individuals earlier, and more considerably, in others later and in a slighter degree, recedes with other secretions of a different nature.—(See Beer's Lehre von den Augenkr. b. 2, p. 151, &c.)

As Mr. Travers has correctly explained, the history and concomitant appearances of amaurosis, usually

denote whether the case is organic or functional. "For example, diseased changes in the situation or texture of the eyeball or in the brain, or hemiplegia, or partial paralysis, with other signs of apoplectic or hydrocephalic pressure, whether resulting from an injury of the head or otherwise, or an acute deep-seated inflammation, whether accompanied by a visible opacity or not, point out the organic nature of the affection. I have seen (continues Mr. Travers) such an amaurosis produced by abscess in the cerebral substance, and by the medullary fungus of the cerebrum. On the other hand, I have known the following distinct sources of irritation operating to produce functional amaurosis, viz. a wound of the scalp, caries of the skull, abscess and caries of the antrum maxillare, with excessive œdema of the integuments of the lids and cheek, a large abscess under the masseter and muscles of the cheek, and an abscess at the extremity of a molar tooth, while the crown of the tooth was sound. In all these cases, it is to be understood, that the eye was sound, and the orbit was untouched by the disease of the parts in the vicinity, to which the amaurosis was clearly attributable. In like manner, an excessive use, or rather abuse, of the visual faculty, the disordered functions of the stomach, liver, uterus, &c. sudden and alarming depletion, excessive or obstinately suppressed secretions, difficult dentition, the presence of worms in the intestinal canal, and the deleterious effects of noxious agents upon the organ or the system, are sufficiently obvious causes of the functional amaurosis."—(Synopsis, &c. p. 142.) For a variety of additional facts and observations respecting the causes of amaurosis, I would advise the reader to consult Wardrop's Essays on the Morbid Anatomy of the Human Eye, vol. 2, chap. 45; and Travers's Synopsis: works replete with valuable information.

It is remarked by Beer, that amaurosis, when completely formed, has hitherto been but rarely cured. This (says he) may depend in the first place upon our far too imperfect knowledge of the nerves, and of their genuine and complicated disorders. Secondly, it may equally depend upon the present very defective etiology of amaurosis. Thirdly, the frequent incurability of amaurosis also very materially proceeds from the causes of the disease being, in most instances, not only obscure, but exceedingly complicated.

In amaurosis the difficulty of cure is naturally in proportion to the variety and number of causes of the complaint; and the more readily the surgeon makes himself acquainted with them, and the more certainly he obviates them, the more surely and quickly does the cure follow.

It may be considered as generally true, that every amaurotic weakness of sight, and every completely formed amaurosis, are attended with the greatest probability of cure, where they began suddenly and were quickly developed; for experience proves, that in these cases, the whole of the causes of the disease are much more frequently and earlier comprehended, than when the complaint has been several years in forming.—(Beer, Lehre von den Augenkr. b. 2, p. 454—456.) This observation perfectly coincides with the account given by Schmucker, who says that many of these suddenly formed cases fell under his notice, and were more easy of cure than when the disorder had come on in a more gradual way.—(See Vermischte Chir. Schriften, b. 2.)

It also agrees with what Mr. Travers has stated; namely, that slow and steadily progressive cases of amaurosis are more to be apprehended in the result, that is, are less tractable, than either the sudden or the rapidly advancing disease, supposing all to be alike free from unequivocal signs of organic change.—(Synopsis, p. 298.)

Respecting suddenly produced cases, Mr. Lawrence, in his Lectures, holds out less encouragement than the preceding authorities. The prognosis, he says, is doubtful, and rather unfavourable than otherwise, as to the complete recovery of vision, if the affection, even in its most recent state, should have produced complete insensibility of the retina. He thinks we should speak doubtfully of the result in the case of complete insensibility to strong light, even if it had only lasted twenty-four hours. He considers it difficult to say in what number of days or weeks we should give up all hopes of recovery. In the supposed case of total insensibility, or even of a near approximation to it, there would be more ground for apprehension than hope at the end of a week, though sight is sometimes restored under these circumstances; but the lapse of a few weeks, without improvement, makes the case hopeless.

A case may happen, nay, it happens not unfrequently, says Beer (which, considering the imperfect etiology of amaurosis, cannot be wondered at), that the surgeon, after the most careful investigation, can absolutely detect no particular cause of the existing amaurotic blindness; in which event, the prognosis must in every respect be very uncertain and unfavourable, since only empirical treatment can be tried, which rarely answers; and even when a cure in this manner does follow, it is frequently quite accidental.

As will be seen in the account of each particular species of amaurosis, the affected eye is sometimes so conditioned, that the complete incurability, sooner or later, may be prognosticated with entire certainty, and this even though a degree of vision may now be enjoyed.

There are amaurotic patients to whom every treatment does harm, the disease making uninterrupted advances to perpetual blindness. This observation especially refers to local remedies, of the danger of which, under certain circumstances, the patient should be carefully warned.

In general the more complete the amaurosis is, and the longer the patient has been deprived, not only of vision, but of all sensibility to light, the less hope is there of sight being ever re-established.

If the affection be partial, and the case seen early, Mr. Lawrence says, a complete cure may be expected. He thinks favourably of the event, when amaurosis takes place in conjunction with chronic internal inflammation, or when it is evidently caused by active congestion in the head or eye; for that cause can be removed by suitable treatment.

When one eye has been completely bereft of sight by amaurosis, and the surgeon can find out little or no cause for the infirmity, there is strong reason for apprehending that the other eye will sooner or later become blind. This is a fact amply proved by experience, and the exceptions are very rare.

According to Beer, the idea entertained by some writers is not built upon experience, that amaurotic patients in whom the iris is still moveable, and the pupil not very much dilated, are more easily and frequently cured than others in whom the iris is perfectly motionless, and the pupil exceedingly dilated. For sometimes during the treatment, or even spontaneously, the iris, after being quite immoveable, recovers it power of motion, yet the patient may not, at the same time, regain the slightest degree of vision; and, on the other hand, many cases of perfect amaurosis are cured, without the iris recovering any of its mobility, and the pupil remains dilated during the remainder of the patient's life.—(Lehre, von den Augenkr. b. 2, p. 458.) Richter also thinks, that the moveable or immoveable state of the pupil can neither be considered as a favourable nor unfavourable circumstance. Sometimes, says he, an amaurosis may be cured, which is attended with a pupil extraordinarily dilated, and entirely motionless; and sometimes the disorder proves incurable, notwithstanding the pupil be of its proper size, and capable of motion. There are likewise examples, in which the pupil recovers its moveableness, in the course of the treatment, although nothing will succeed in restoring the eyesight.—(Anfangsgr. der Wundarzn. b. 3, p. 424, 8vo. Gött. 1795.)

In some very rare instances, says Beer, amaurotic blindness has been cured by some apparently accidental or indeed morbid effect, without any assistance from art; by hemorrhage from the nose, an intermittent fever, a blow on the head, &c. The same experienced writer operated successfully upon both eyes of a patient with cataracts, which had been previously depressed too far against the retina, so that their pressure gave rise to amaurosis, which, after continuing eight years, had been suddenly removed by the patient's accidentally falling out of bed, and pitching upon the top of his head.—(Lehre von den Augenkr. b. 2, p. 458.)

The following observations made by Beer, respecting the prognosis, cannot fail to prove interesting. There is a species of amaurosis, which gradually diminishes of itself; for instance, that which arises from hard drinking, or the effect of narcotic poisons, belladonna, opium, hyoscyamus, &c.

Sometimes imperfect amaurosis goes away without

any assistance from art, in consequence of the accession of some other disease, as an eruption, a discharge of matter from the ear, bleeding from piles, the menses, &c.

Also, in most cases, when the surgeon is so fortunate as to cure amaurosis, either by scientific or empirical methods, there still continues for life a considerable degree of amblyopia, more especially if the amaurosis has been complete.

Sometimes, by successful treatment, vision is in a great measure, or even entirely restored in one eye, yet the other remains completely blind; or one eye sees again much sooner than its fellow, although they were both affected together with an equal degree of blindness.

It often happens, that though a material degree of vision returns in the course of the treatment, the faculty is restricted to a circumscribed point of the retina, so that the patient is enabled to see objects plainly only when they are held in a particular direction before him; while in other directions, they are either quite invisible, or very indistinct.—(Beer, Lehre von den Augenkr. b. 2, p. 459, 460.)

Amaurosis following an injury of the supra-orbitary nerve, frequently resists every endeavour made to relieve it, and this, whether it come on directly after the blow or some weeks subsequently to the healing of the wound of the eyebrow; but it is not always absolutely incurable. Scarpa only knows of one such cure, viz. the example recorded by Valsalva.—(Dissert. 2, § 11.) But additional instances are reported by Hey (Med. Obs. and Inq. vol. 5), by Larrey (Mém. de Chir. Militaire, t. 4, p. 181), and Dr. Hennen (Principles of Military Surgery, p. 346, ed. 2). According to Mr. Wardrop, it is only when this nerve is wounded or injured, and not divided, that amaurosis takes place; for the blindness may sometimes be cured by making a complete division of the trunk nearest its origin.—(Essays on the Morbid Anatomy of the Human Eye, vol. 2, p. 180.)

Perfect inveterate amaurosis, attended with organic injury of the substance constituting the immediate organ of sight, says Scarpa, is a disease absolutely incurable. Imperfect recent amaurosis, particularly that which is periodical, is usually curable; for it is mostly dependent upon causes which, though they affect the immediate organ of sight, are capable of being dispersed, without leaving any vestige of impaired organization in the optic nerve or retina.

When amaurosis has prevailed several years, in persons of advanced age, whose eyesight has been weak from their youth; when it has come on slowly, at first with a morbid irritability of the retina, and then with a gradual diminution of sense in this part, till total blindness was the consequence; when the pupil is motionless, not circular, and not much dilated; when it is widened in such a degree that the iris seems as if it were wanting, and the margin of this opening is irregular and jagged; and when the bottom of the eye, independently of any opacity of the crystalline lens, presents an unusual paleness like that of horn, sometimes partaking of green, and reflected from the thickened retina, the disease may be generally set down as incurable. Kieser joins Scarpa in representing this alteration as an unfavourable omen, adding, that it only takes place in examples of long standing, and that when it is considerable, the disease is incurable. Langenbeck differs, however, from both these authors, and particularly from Kieser; assuring us, not only that he has often seen this discoloration of the bottom of the eye in the early stage of amaurosis, but seen patients in this state soon cured. The cases which he has published in proof of this statement, I have read with care, and find them completely satisfactory. Langenbeck agrees with other writers in imputing the appearance to a morbid change of the retina; and the treatment which he prescribes consists in the internal exhibition of the oxymuriate of mercury in small doses, and friction with mercurial ointment on the eyebrow and temple.—(See Langenbeck's Neue Bibl. für de Chirurgie, b. 1, p. 64—69, &c. Göttingen, 1815.)

Cases, says Scarpa, attended with pain all over the head, and a continual sensation of tightness in the eyeball; or preceded by a violent, protracted excitement of the nervous system, and then by general debility, and languor of the constitution, as after masturbation, premature venery, and hard drinking; or connected with epileptic fits, or frequent spasmodic hemicrania; or which are the consequence of violent, long-continued, internal ophthalmia, may be set down as incurable. Nor can any cure be expected when amaurosis proceeds from a direct blow on the eye; foreign bodies in the eyeball; lues venerea, or exostoses about the orbit; or when it is conjoined with a manifest change in the figure and dimensions of the eyeball.

Recent, sudden cases, in which the pupil is not excessively dilated, and its circle remains regular, while the bottom of the eye is of a deep black colour; cases unaccompanied with any acute, continual pain in the head and eyebrow, or any sense of constriction in the globe of the eye itself; cases which originate from violent anger, deep sorrow, fright, gastric disorder, general plethora, or the same partial affection of the head, suppression of the menses, habitual bleedings from the nose, piles, &c., great loss of blood, nervous debility, not too inveterate, and in young subjects, are all, generally speaking, curable. Amaurosis is also mostly remediable, when produced by convulsions or the efforts of difficult parturition; when it arises during the course, or towards the termination of acute or intermittent fevers; and when it is periodical.—(Scarpa, Osservazioni sulle Mallatie degli Occhi, cap. 20, Venez. 1802.)

According to Mr. Travers, it is rather the degree than the nature and origin of the symptomatic functional amaurosis, that should in most cases influence our prognosis; yet the latter circumstances, it is equally clear, afford more or less encouragement, in proportion as the pre-existing states of disease ordinarily admit of relief or not. Thus, says he, the amaurosis from gastric diseases, from plethora, from irritation, are all of them relievable, and if treated at an early period, remediable. Whereas paralysis, the sequel of fever, or of epilepsy, or severe constitutional diseases, whether acute or chronic, or depending upon habitual cerebral congestions combined with organic visceral disease, or induced by the operation of noxious agents on the system, is a hopeless form of the malady.—(Synopsis, p. 296.) I may remark, however, that various examples of recovery from amaurosis induced by fevers have fallen under my own notice.

In general, when the treatment proves successful, the return of the power of vision is accompanied with a regression of the same characteristic effects, which were disclosed in the gradual advance of the disorder, viz. appearances as if there were before the eyes flashes of light, a cobweb, net-work, mist, or flaky substances. —(Beer, Lehre von den Augenkr. b. 2, p. 460. Wien, 1817.)

Upon the commencement of the cure, there is also a return of the obliquity of sight; one of the most constant symptoms of imperfect amaurosis. This is a circumstance which Hey took particular notice of; he says, that it was most remarkable in those persons who had totally lost the sight in either eye; for in them the most oblique rays of light seemed to make the first perceptible impression upon the retina; and, in proportion as that nervous coat regained its sensibility, the sight became more direct and natural.—(See Med. Obs. and Inq. vol. 5.)

TREATMENT OF AMAUROSIS.

When amaurosis is to be fundamentally cured, not upon empirical, but scientific principles, all the causes of the disorder must be ascertained, and, if possible, removed, as in the treatment of every other complaint. How often, however, it is impossible to accomplish either the one or the other of these objects, must be clear enough from the preceding observations, particularly those concerning the etiology of the disease; and hence it is not surprising, that amaurosis should so frequently resist every endeavour to cure it.

The plan of treatment is to be regulated, first by the number and kinds of circumstances, which determine the form of the disorder; secondly, by its presence, degree, and duration. When only the chief causes can be ascertained, a scientific mode of treatment may always be instituted; though here it is very necessary to pay the utmost attention to those morbid effects in the constitution, and in the eye in particular, which appear to have no connexion with the causes of amaurosis, and merely exist as accidental contemporary defects.

If no particular circumstances can be assigned as the cause of amaurosis, the surgeon has no alternative

but the adoption of some empirical method of treatment; but, exclaims Beer, wo to the patient whose surgeon, under these circumstances, draws from a heap of what are considered remedies for amaurosis, as from a lottery, the first as the best!

In order to avoid this erroneous method, and not render a half-blind person completely blind, instead of improving, or at least preserving, whatever remnant of vision there may be, the surgeon should act with great caution, and constantly bear in his mind, first, the constitution, sex, and age of the patient; secondly, his ordinary employments, and general mode of living; and thirdly, the principal morbid appearances under which the amaurosis originated and was developed.—(Beer, Lehre von den Augenkr. b. 2, p. 462.) But what will be the greatest assistance is a correct acquaintance with the remedies for amaurosis in general, and the circumstances under which the use of this or that particular means is likely to be useful or detrimental. I know of no writer who has been so minute on this part of the subject as Beer, whose sentiments (be it also remarked) are here in many respects different from those of Richter and Scarpa; for, like the surgeons of this metropolis, he rarely employs the emetic plan of treatment, which, according to his principles, is not only ineffectual, but hurtful, whenever the blindness is attended with determination of blood to the head and eyes, plethora, an accelerated circulation, or (what is understood by) a phlogistic diathesis. Beer's opinions, respecting the employment of emetics and other means for the cure of amaurosis, may be partly collected from the sequel of this article, but more especially from the fuller statement which will be made at a future opportunity.—(See Gutta Serena.) In the mean time, I shall endeavour to offer a general account of the practice recommended by Schmucker, Richter, Scarpa, Travers, and Lawrence, according to the arrangement of causes adopted by the second of these valuable writers; for I need not repeat, that whenever the method of cure can be directed against the causes of the disease, it is the most proper and scientific. The present article will, then, close with some practical observations, chiefly taken from Professor Beer.

In that species of amaurosis, which arises from the first class of causes, or those which induce the disease, by means of a preternatural fulness and dilatation of the blood-vessels of the brain or eye, the indication is to lessen the quantity of blood, and the determination of it to the head. For this purpose, the patient may be bled in the arm, temporal artery, or, as is often preferred by foreign surgeons, in the foot. This evacuation is to be repeated as often as seems necessary, and it will be better to begin with taking away from twelve to sixteen ounces. The efficacy of bleeding, in the cure of particular cases of gutta serena, is strikingly exemplified by numerous well-authenticated observations. Richter informs us of a woman, who, on leaving off having children, lost her sight; but recovered it again by being only once bled in the foot. A spontaneous hemorrhage from the nose also cured a young woman, who had been blind for several weeks.—(Anfangsgr. der Wundarzn. b. 3, p. 442.)

That bleeding is sometimes hurtfully and wrongly practised in amaurotic cases, is a fact which admits of no doubt. Mr. Travers particularly refers to one description of cases where the lancet does harm: these are cases of undue determination of blood to the organ, which are especially common after deep-seated chronic inflammation or distress from over-excitement, by which its vessels have lost their tone; an effect decidedly increased by depletion. In one interesting case of this kind, a gradual but perfect recovery followed a regulated diet, and a course of the blue pill, with saline aperients.—(Synopsis, p. 159.) All cases of direct debility and proper paralysis of the retina (says Mr. Travers) are aggravated by loss of blood, and the great prevailing mistake in the treatment of amaurosis, is the indiscriminate detraction of blood.—(Synopsis, p. 303.)

When, in addition to general bleeding, topical is also necessary, leeches may be applied to the temples, or cupping-glasses to the back of the neck, or temples. Besides bleeding, purgatives, blisters, bathing the feet in warm water, low diet, repose of the organs, &c. are frequently proper.

In some cases, the foregoing means fail in producing the desired benefit, even when followed up as far as the pulse and strength will allow. Here the continuance of the disease may depend either upon the stoppage of some wonted evacuation of blood, or else upon some other cause of the first class. In the first of these cases (says Richter) experience proves, that the disease will sometimes not give way before the accustomed discharge is re-established. A woman, who (as this author acquaints us) had lost her sight in consequence of a sudden suppression of the menses, did not recover it again till three months after the return of the menstrual discharge, notwithstanding the trial of every sort of evacuation. He also tells us of another woman, who had been blind half a year, and did not menstruate, and to whose external parts of generation leeches were several times applied. As often as the leeches were put on (says Richter) the menses in part recommenced; and as long as they made their appearance, which was seldom above two hours, the woman always enjoyed a degree of vision.—(Anfangsgr. der Wundarzn. b. 3, p. 443.)

For the amaurosis arising from suppression of the menses, Scarpa recommends leeches to the pudenda, bathing the feet in warm water, and afterward exhibiting an emetic, and laxative pills, made of rhubarb and tartrate of antimony, combined with gummy and saponaceous substances. If these means fail in establishing the menstrual discharge, he says, great confidence may be placed in a stream of electricity, conducted from the loins across the pelvis, in every direction, and thence repeatedly to the thighs and feet. He enjoins us not to despair at want of success at first, as the plan frequently succeeds after a trial of several weeks.

For the amaurosis proceeding from the stoppage of an habitual copious bleeding from piles, Scarpa recommends leeches and fomentations to the hemorrhoidal veins, then an emetic, and afterward the same opening pills.—(Osservazioni sulle principali Malattie degli Occhi, cap. 19.)

When the disease does not originate from the stoppage of any natural or habitual discharge of blood, and does not yield to the evacuating plan, Richter thinks the surgeon justified in concluding, that the preternaturally dilated vessels have not regained their proper tone and diameter, and that topical corroborant remedies, particularly cold water, ought to be employed. In this kind of case, he is an advocate for washing and bathing the whole head with cold water, especially the part about the eyes; a method, he says, which may often be practised after evacuations, with singular and remarkable efficacy.

When the return of sight cannot be brought about in this manner, Richter advises us to try such means as seem calculated to stimulate the nerves, and remove the torpid affection of the optic nerves in particular. Of these last remedies, says he, emetics are the principal and most effectual.

The principle on which Mr. Lawrence directs the treatment, is that of putting a stop to vascular excitement, with the view of preventing the permanent injury of altered structure, and impaired function of the retina. Hence he is a zealous advocate for the antiphlogistic treatment, in the early stage of amaurosis. "But," says he, "if this treatment be not found to remove the change which has been produced in the retina, we must have recourse to mercury, which appears to be as decidedly beneficial in these cases as in iritis, or general internal inflammation. The remark which I made respecting the use of mercury in those affections, applies also to the present case; namely, that its good effect mainly depends upon the promptitude with which it is employed. The alterative form is insufficient; we give it with the view of arresting inflammation in the structure, which is the very seat of vision; that structure is easily changed by the inflammatory process; our only remedy is to push the mercury in a decided manner, and if we do so, we shall put a stop to the affection." When the antiphlogistic treatment and a fair trial of mercury have failed, Mr. Lawrence contents himself with recommending such management as is most conducive to general health; as a residence and frequent exercise in a pure air; plain nutritious diet; mild aperients, with the occasional use of an active purgative; and repose of the affected organ. He mentions also a trial of a seton, or repeated blisters behind the ears, or at the side or back

of the neck. As already stated, however, Mr. Lawrence does not wish it to be supposed, that all amaurotic patients require to be bled and salivated. Amaurosis, he says, often comes on in a slow and very insidious manner in persons of enfeebled constitution: the organ suffers from habitual excessive exertion at the same time that the general powers are depressed by residence in confined dwellings, bad air, sedentary occupations, unwholesome diet, costiveness, and the other injurious influences of such causes. If you should see a thin, pallid, and feeble woman, who had destroyed her health by close confinement to needle-work, and whose eyes were beginning to fail, the same active measures would by no means be admissible. You would empty the alimentary canal, perhaps take a little blood by cupping, or by leeches to the temples, and then use mercury in the alterative form, together with mild aperients. A few grains of Plummer's pill may be given every night, or every second night, and the bowels may be kept open with electuary, castor oil, or rhubarb and magnesia, taken occasionally. The blue pill may be taken in combination with aloes or colocynth. It may be necessary, says Mr. Lawrence, to persevere with the mercury, slowly increasing the dose until a slight influence is visible in the mouth. A nutritious diet without stimuli, good air, and exercise, and repose of the affected organ, are important auxiliaries, and a succession of moderate-sized blisters may be advantageously combined with these means. Thus, observes Mr. Lawrence, you see, that the same principles regulate our treatment, but that it is modified in degree according to the violence of the symptoms, and the patient's strength. In the latter description of cases, after mild antiphlogistic means, and clearing the alimentary canal, he admits that it may be expedient to combine tonics with aperients, or rhubarb with bark, columba, or cascarilla: and to allow a little porter and wine.

We come now to the consideration of that species of the gutta serena, which is regarded as the effect of some unnatural irritation. Here, according to the precepts delivered by Richter, we should endeavour to discover what the particular irritation is, and then endeavour to effect its removal. When it cannot be exactly detected, we are recommended generally to employ such remedies as will lessen the sensibility of the nerves, and render them less apt to be affected by any kind of irritation.

Sometimes the irritation is both discoverable and removeable, and still the effect, that is to say, the blindness, continues. In this circumstance, Richter thinks that the surgeon should endeavour to obviate the impression which the irritation has left upon the nerves, by the use of anodynes; or else try to remove the torpor of the nerves by stimulants.

But, according to Schmucker, Richter, and Scarpa, the curable imperfect amaurosis commonly depends on some disease or irritation, existing in the gastric system, occasionally complicated with general nervous debility, in which the eyes participate. Hence, in the majority of cases, we are assured that the chief indications are, to free the alimentary canal from all irritating matter, improve the state of the chylopoietic viscera, and invigorate the nervous system in general, and the nerves of the eye in particular.

For an adult, dissolve three grains of antimonium tartarizatum in four ounces of water, and give a spoonful of this solution every half hour, until nausea and copious vomiting are produced. The next day some opening powders are to be exhibited, consisting of an ounce of the supertartrate of potash, and one grain of antimonium tartarizatum, divided into six equal parts. The patient must take one of these in the morning, another four hours afterward, and a third in the evening, for eight or ten days in succession. They will create a little nausea, rather more evacuations from the bowels than usual, and perhaps, in the course of a few days, vomiting. If the patient, during their use, should make vain efforts to vomit, complain of bitterness in his mouth, loss of appetite, and no renovation of sight, the emetic, as at first directed, is to be prescribed again. This is to be repeated a third and fourth time, should the morbid state of the gastric system, the bitter taste in the mouth, the tension of the hypochondria, the acid eructations, and the inclination to vomit, make it necessary. The first emetic often produces only an evacuation of an aqueous fluid, blended with a little mucus, but, if it be repeated, a few days after the resolvent powders have been administered, it then occasions a discharge of a considerable quantity of a yellow, greenish matter, to the infinite relief of the stomach, head, and eyes.

The stomach having been thus emptied, the following aperient pills are to be ordered:

℞. Gum. sagapen. } an. 3 j.
Galban. }
Sap. venet. }
Rhei optim. 3 iss.
Tart. emet. gr. xvi.
Suc. liquerit. 3 j. fiant pilulæ gran. quinque.

Three are to be taken every morning and evening, for a month or six weeks.

When the state of the stomach has been improved, and the restoration of sight partly effected, such remedies must be employed, as strengthen the digestive organs, and excite the vigour of the nervous system in general, and of the nerves of the eye in particular. With this intention Scarpa prescribes bark and valerian in powder, and recommends a diet of tender succulent meat, and wholesome broths, with a moderate quantity of wine, and proper exercise in a salubrious air. For exciting the action of the nerves of the eye, the vapour of liquor ammoniæ, properly directed against the eye, he says, is of the greatest service. This remedy is applied by holding a small vessel containing it sufficiently near the eye to make this organ feel a smarting, occasioned by the very penetrating vapours with which it is enveloped, and which cause a copious secretion of tears, and a redness, in less than half an hour after the beginning of the application. It is now proper to stop, and repeat the application three or four hours afterward. The plan must be thus followed up till the incomplete amaurosis is quite cured.

The operation of these vapours may be promoted by other external stimulants, applied to such other parts of the body as have a great deal of sympathy with the eyes. Of this kind are blisters to the nape of the neck; friction on the eyebrow with the anodyne liquor; the irritation of the nerves of the nostrils by sternutative powders, like that composed of two grains of turbeth mineral, and a scruple of powdered betony leaves; and, lastly, a stream of electricity.—(See Gutta Serena.)

Bark, which is efficacious in intermittent fevers, and other periodical diseases, far from curing periodical amaurosis, seems to aggravate it, rendering its return more frequent, and of longer duration. On the other hand, this disease is most commonly cured, in a very short time, by exhibiting, first, emetics, then the above laxative pills, and lastly, corroborants, and even bark, which was before useless and hurtful.

Such is Scarpa's statement, which agrees with that of Richter, respecting the effect of bark in periodical amaurosis. As if, however, practitioners were doomed always to differ, and learners to be puzzled, Beer tells us, that he has seen only two cases of periodical intermittent amaurosis, both of which were soon perfectly cured by large doses of bark. Other periodical amaurotic affections he has seen, however, attendant on intermittent fever, but they spontaneously subsided with the febrile paroxysms, without any particular treatment being applied to the eyes. Sometimes, when the paroxysms recurred frequently, a considerable weakness of sight remained after them; but this always went off of itself, except in a single instance, in which the functions of the eyes were perfectly re-established by the exhibition of arnica joined with bitters.—(Lehre, von den Augenkr. b. 2, p. 585.)

In the two cases, which were unaccompanied with fever, the vitreous humour had the appearance of being turbid during the attacks, but regained its natural clearness on each return of vision, the loss of which used to be complete. Here we see another instance, in which a cloudiness behind the pupil in amaurosis did not impede the cure, and went away in the most ready manner. Possibly, the opacity, which, in speaking of the prognosis, I said that Langenbeck had not found to prevent the cure of certain cases, might also have had its seat in the vitreous humour, and not depended upon disease of the retina.

Cases, in the formation of which many other causes operate, demand the employment of particular curative means, in addition to those which have been already described. Such is, for example, the imperfect amau-

rosis, which occurs suddenly in consequence of the body being excessively heated, or exposure to the sun, or violent anger in plethoric subjects. This case requires, in particular, general and topical evacuations of blood, and the application of cold washes to the eyes and whole head. An emetic should next be given, and afterward a purge of potassæ tartras, or small repeated doses of antimonium tartarizatum. By means of bleeding and an emetic, Schmucker often restored the eyesight of soldiers who had lost it in making forced marches, with very heavy burdens. In amaurosis, suddenly occasioned by violent anger, an emetic is the more strongly indicated after bleeding, as the blindness, thus arising, is always attended with a bitter taste in the mouth, tension of the hypochondria, and continual nausea. Richter mentions a clergyman, who became completely blind after being in a violent passion, and whose eyesight was restored the very next day, by means of an emetic, given with the view of relieving some obvious marks of bilious disorder in the stomach.

Scarpa's treatment of the imperfect amaurosis brought on by fevers, deep sorrow, great loss of blood, intense study, and forced exertions of the eyes on very minute or brilliant objects, consists also in removing all irritation from the stomach, and afterward strengthening the nervous system in general, and the nerves of the eye in particular. In the case originating from fevers, the emetic and opening pills are to be given; then bark, steel medicines, and bitters; while the vapour of the liquor ammoniæ is to be applied to the eye itself.

When the disorder has been brought on by grief, or fright, the stomach and intestines are to be emptied by means of antimonium tartarizatum and the opening pills; and the cure is to be completed by giving bark and valerian; applying the vapour of liquor ammoniæ to the eyes; ordering nourishing, easily digestible food; diverting the patient's mind, and fixing it on agreeable objects, and recommending moderate exercise. The amaurosis from fright is said to require a longer perseverance in such treatment, than the case from sorrow.—(Scarpa's Osservaz. cap. 19.)

In this country, the emetic practice, which has proved so decidedly efficacious on the continent, has not been attended with much success; Mr. Travers even states, that he does not recollect an instance of decided benefit from it, though he has often tried it fairly. He agrees, however, in the indication, as he remarks, that the removal of an irritating or oppressing cause, will often effect a sudden and marked relief, as by clearing the intestinal canal of vitiated secretions, restoring the digestive functions, or taking away blood where the necessity is indicated. In gastric cases for which emetics have been particularly recommended, he prefers a long-continued course of the blue pill, with gentle saline purgatives and tonic bitters.—(Synopsis, p. 299—304.)

Beer is also a high authority against the use of emetics, even in the amaurosis from disorder of the gastric organs. When, says he, the saburræ have a tendency to be discharged upwards, as indicated by continual nausea and disposition to vomit, emetics, which never operate without some violence, are to be most carefully avoided in plethoric individuals, or those who have a manifest determination of blood to their heads and eyes, or any acceleration of the circulation. The caution here given must be observed, even though emetics may on other accounts seem advisable; and, according to Beer, the determination of blood and the state of the system here mentioned, are commonly attendant upon this species of amaurosis. Indeed (notwithstanding the testimony of Schmucker, Richter, and Scarpa, in favour of emetics in this case), Beer positively affirms, that the violent operation of an emetic frequently converts this sympathetic amaurotic weakness of sight all on a sudden into blindness. Although I apprehend that Beer may here be somewhat prejudiced against emetics, candour obliges me to add, that in this country, their efficacy in the present disease is by no means equal to the representations of Richter and Scarpa. When there is less tendency to vomiting, but the case is attended with an oppressive sense of weight about the stomach, frequent eructations, as if arising from rotten eggs, an inflated belly, and tense hypochondria, a gentle aperient clyster may be ordered, especially when the bowels have been for some days confined, in which circumstances Beer has found, that tolerably brisk purgatives are always of the greatest service, both in regard to the general complaints, and the amaurotic weakness of sight; the removal of the offensive matter from the alimentary canal being immediately followed by a cessation of the determination of blood already mentioned. Lastly, when this amaurosis originates altogether from the presence of worms in the bowels, common anthelmintics are to be prescribed. In all these cases, says Beer, mere local treatment is quite inapplicable, and may do mischief.—(Beer, Lehre von den Augenkr. b. 2, p. 517—521.)

The third species of gutta serena, or that which arises from debilitating causes, is of two kinds; in one, the disease is the consequence of a general weakness of the body; in the other, it is the effect of debility, which is confined to the eye itself, and does not extend to the whole constitution.

According to Scarpa, the incomplete amaurosis from general nervous debility, copious hemorrhage, convulsions ab inanitione, and long-continued intense study, especially by candle-light, is less a case of real amaurosis, than a weakness of sight from a fatigued state of the nerves, especially of those constituting the immediate organ of sight. When this complaint is recent, in a young subject, it may be cured or diminished, by emptying the alimentary canal with small repeated doses of rhubarb, and then giving tonic cordial remedies. At the same time, the patient must abstain from every thing that has a tendency to weaken the nervous system, and, consequently, the eyesight. After emptying the stomach and bowels, it is proper to prescribe the decoction of bark with valerian, or the infusion of quassia with the addition of a few drops of sulphuric ether to each dose, with nourishing easily-digestible food. The aromatic spirituous vapours (mentioned in the article Ophthalmy) may then be topically applied; or, if these prove ineffectual, the vapour of liquor ammoniæ. The patient must take exercise on foot, horseback, or in a carriage, in a wholesome dry air, in warm weather, and avail himself of sea-bathing. He must avoid all thoughts of care, and refrain from fixing his eyes on minute shining objects. The impression of vivid light on the retina is always to be moderated by means of flat green glasses.—(Saggio di Osservaz. cap. 19.)

One case of temporary palsy of the retina from over-excitement, mentioned by Mr. Travers, yielded to blistering the forehead, and a gentle salivation excited by calomel joined with opium.—(Synopsis, p. 164.) Another case, brought on by the use of telescopes and sextants, gave way to a copious bleeding, brisk purging with jalap and calomel, blisters to the temples, and a course of mercury.—(Op. cit. p. 166.)

Mr. Travers remarks, that the amaurosis from depletion is sometimes mistaken for the opposite case, viz. that from plethoric congestion: this is owing to the coincidence of a dilated and immoveable pupil, muscæ, and a deep-seated pain in the head, with occasional vertigo; and its frequent occurrence in a corpulent habit. By a cautious use of tonics (says Mr. Travers) it is relieved; by whatever lowers or stimulates, whether diet or medicine, it is decidedly aggravated. In this form of amaurosis, vision is farther enfeebled by the loss of as much blood as flows from two or three leech-bites.—(Synopsis, &c. p. 160.)

When the weakness is confined to the eye, Richter thinks corroborant applications alone necessary. Bathing the eye with cold water, says he, is one of the most powerful means of strengthening the eye. The patient should dip in cold water a compress, doubled into eight folds, and sufficiently large to cover the whole face and forehead, and this he should keep applied, as long as it continues cold. Or else he should frequently apply cold water to his eyes and face with his hand, on a piece of rag.

The eye may also be strengthened by repeatedly applying blisters of a semilunar shape above the eyebrows, just long enough to excite redness. Richter likewise speaks favourably of rubbing the upper eyelid, several times a day, with a mixture of the tinctura lyttæ and spiritus serpilli.—(Anfangsgr. der Wundarzn. b. 3, p. 452.)

When no probable cause whatsoever can be assigned for the disease, the surgeon is justified in employing such remedies, as have been proved by experience to be sometimes capable of relieving the affection, although upon what principle is utterly unknown.—(See Gutta Serena.) To this article I would refer the reader,

before he makes up his mind about any empirical method of treatment, because he will there find many cautions and instructions given by Beer, respecting the remedies for amaurosis in general. To his remarks, I have also annexed such others, on the same topic, as appeared to me interesting.

Cat-eye amaurosis.

This species of the disorder, of which Beer met with but one form, rarely increases to complete blindness; it occurs chiefly in very old persons, and it is perhaps this affection to which some oculists have given the unmeaning name of "amblyopia senilis." Sometimes, however, this kind of amaurosis takes place in young persons and children: and one circumstance that demands particular notice in its nosology is, that it always takes place either in thin, dwindled, old, gray-headed subjects, nearly in the state of marasmus senilis, in whom consequently the exchange of organic matter is carried on but tardily, or else in young subjects, who are unhealthy, and disposed to consumption, hectical adults, emaciated children, and as a consequence of severe injuries of the eye. While this amaurosis is not perfectly formed, the iris retains its mobility, and the pupil is neither preternaturally dilated nor contracted; but when once the patient is quite bereft of vision, the motions of the iris are slow, and the pupil larger than in a healthy eye in an equal degree of light. At the bottom of the eye, very far behind the pupil, a concave pale-gray, bright-yellowish, or variegated reddish opacity is developed. By this the eyesight is not merely weakened, but rendered quite confused, since all objects, but especially smallish ones, appear to be confounded together, particularly when the patient tries to inspect closely any determinate body. The farther the disease advances, the brighter and more visible is the bottom of the eye, the paler is the colour of the iris (a thing very conspicuous in dark-eyed persons); and when once the amaurosis is complete, so that no susceptibility of the impression of light is left, then, upon an attentive examination of the eye, one can mostly perceive, at the troubled deeper part of the eye, a very slender vascular plexus, which merely consists of the ordinary ramifications of the central artery and vein, which are now visible at the pale-coloured bottom of the eye. In a half-darkened place, such an eye presents a shining yellowish or reddish appearance, but only in certain positions of the eyeball; and, in this respect, it is somewhat similar to the eye of a cat, whence Beer chooses to term the complaint cat-eye amaurosis. The disorder is also not accompanied with any other essential morbid appearances, except the decline of vision or complete blindness.—(Lehre von den Augenkr. b. 2, p. 496.) Beer, in fig. 1, tab. 4 of his second vol., has given from nature an admirable representation of this very remarkable species of amaurosis. The differences in the appearances at the bottom of the eye, in this case, from those presented in the early stage of fungus hæmatodes of that organ, will be best understood by referring to the article Fungus Hæmatodes. On this point, however, I may here briefly state, that in the cat-eye amaurosis, there is no projection, but, on the contrary, a concave depression in the axis of vision. Cat-eye amaurosis may be known from incipient cataract, by the opacity being more deeply situated, and having a shining, pearly lustre.—(See Journ. of Foreign Med. vol. 4, p. 168.)

Beer observes that the causes of this species of amaurosis are so obscure, that whatever is offered upon the subject can be received only as conjecture. After what has been said in the foregoing paragraph is considered, about the particular individuals who are liable to be affected, and the change of the iris to a pale colour, as a constant symptom of this case, a suspicion may be entertained that a deficiency of the pigmentum nigrum and of the tapetum of the uvea, in consequence of the stoppage of this secretion, may be the cause of the disease. Beer justly remarks that much might be learned on this point from the dissection of eyes thus affected; but he has never met with the opportunity.

The prognosis cannot but be very unfavourable; for, as the surgeon is ignorant of causes, he cannot know what means ought to be adopted for their removal. It is fortunate, however, that this amaurosis rarely attains its highest degree, but almost constantly remains in the form of a more or less considerable amblyopia.

Just as little is yet known respecting any well-regulated mode of treatment; but the disease may sometimes be kept from getting worse by the careful employment of such general remedies, regimen, and diet, as are calculated to improve the health. However, in the most fortunately managed cases, Beer never knew a step made towards the removal of the disease.—(Lehre von den Augenkr. b. 2, p. 497, 498.)

Amaurosis produced by bitters, certain articles of food in particular constitutions, or the poison of lead.

The reality of the first alleged cause is sometimes doubted in this country. The following treatment is recommended by Beer. In the first stage he advises gentle antiphlogistic means. When plethora exists, a few ounces of blood may be taken away by venesection, or leeches applied behind the ears, when after bleeding a determination of blood to the head and eyes still continues in full habits, or there is any tendency to inflammation. The same topical bleeding without venesection, but with lukewarm pediluvia, containing salt or mustard, is proper when no general plethora exists; and merely a determination of blood to the head and eyes and some acceleration of the circulation prevail. Internally, lemon-juice or the liquor ammoniæ acet. has excellent effects; and externally, poultices composed of bread-crumb and vinegar, or fomentations containing oxycrat, are the means which Beer has found most successful in the first stage of this form of amaurosis.

As in the first stage, a moderate antiphlogistic general or local treatment is the only one which can be adopted, and which in urgent cases may yet save the patient from blindness, so in the second stage the internal and external employment of fluid stimulants is of great service; for example, naphtha combined with camphor inwardly, liniments to the eyebrow, and the vapours of ether to the eye. The amaurosis produced altogether by the poison of lead, and complicated with lead-colic and ileus, will require, in addition to the foregoing means, such remedies as are known to be of service in these latter disorders.—(Beer, Lehre von den Augenkr. b. 2, p. 499—503.)

Symptomatic amaurosis in individuals affected with hysteria, hypochondriasis, epilepsy, and convulsions.

This amaurosis is rarely permanent, and usually subsides as soon as the spasmodic, epileptic, or convulsive attack is over. However, the complaint may begin at two periods, viz. either during such an attack, or (what is more uncommon) afterward, and it never loses its symptomatic character. The pupil always remains perfectly clear, and of a shining blackness, even when the disease has induced entire blindness; but a slight dull pain in the forehead, especially about the eyebrow, constantly preceding and accompanying the blindness, generally lasts a good while after the amaurosis has completely subsided.

Besides the foregoing general symptoms, the following characteristic appearances present themselves in hysterical and hypochondriacal patients, who suffer frequent attacks of violent spasm. The pupil is much dilated, and the iris, which is immoveable, seems evidently to project in a convexity forwards, when the eye is inspected sidewise; consequently, the anterior chamber is lessened. The eye itself does not move freely in its socket, the patient experiencing an annoying and sometimes a truly painful sensation, as if the eyeball were forcibly compressed (Ophthalmodynia). Every attempt which the patient himself makes to move the eye, or the surgeon to push it out of the position which it has assumed, is unavailing and excessively painful. The eyelids are either painfully shut, or incapable of being shut at all; the eyesight is very weak, but seldom quite impeded; and at the termination of each attack vision returns, though every paroxysm leaves it more and more debilitated, until at length the spasmodic attacks of blindness frequently occurring, and lasting a long while, it is entirely lost. But when the disorder has acquired its utmost degree, the eye always still retains the power of discerning the light, and it seldom happens that vision is abolished by the first or second attack. It is different with respect to the characteristic phenomena of this amaurosis, in hysterical or hypochondriacal patients, especially when often affected with spasms, before, during, or after which the impairment of sight originates; for though the pupil may continue quite clear, it cannot escape the notice of an attentive observer, that, together with a

pupil of diminished diameter, there exists a peculiar motion of the iris, a constant fluttering of it between expansion and contraction, technically called hippus pupillæ. This convulsive state of the iris is mostly accompanied with a similar affection of the eyelids, namely, with an involuntary blinking (nictitatio), and not unfrequently with an involuntary pendulum-like rolling of the eyeball (nistagmus). In these patients the amaurotic injury of sight hardly ever proceeds directly to complete blindness, but more commonly remains as a weakness of vision, characterized during the rest of life by ceaseless oscillations of the eyeball, aversion to light, and frequent sensations as if there were shining fiery objects before the eyes.

This case of symptomatic amaurosis is distinguished by an untroubled, but very expanded pupil; considerable diminution of the motion of the iris; a dilated state of the pupil, even under the stimulus of the strongest light, and tremulous motions of the eyeball, which continue during life, after the epilepsy and amaurosis are cured; and the case is farther characterized by amblyopia, which rarely increases to complete blindness.

According to Beer, the amaurosis connected with convulsions is most frequent in children. The first and most prominent symptom of this incomplete or complete amaurosis consists in an extremely violent convulsive rotation of the eyeball, especially upwards, not unfrequently attended with the most violent convulsive motions of the eyelids. The pupil is excessively dilated, and scarcely the least movement of the iris is distinguishable on exposing the eye to the strongest light. When the general twitchings are over, and only an amaurotic weakness of sight is left, strabismus occurs in both eyes in various directions, though the eyes very seldom deviate from the axis of vision in the direction towards the inner canthus. When the general convulsions happen frequently, and are violent and of long duration, the amaurotic weakness of sight usually changes into perfect blindness, in which the pupil, though it be regularly clear, and of a shining blackness, is greatly expanded, and the eyes constantly retain their faulty position and pendulum-like motion.

With respect to the prognosis, it is observed by Beer, that even when merely an amaurotic weakness remains, the prognosis is always serious; but it is naturally still more unfavourable, when the blindness is complete, and when the loss of sight has suddenly recurred after violent spasmodic, epileptic, or convulsive attacks, without such attacks themselves ever returning. Under these circumstances, Beer has not hitherto seen more than two instances of such blindness partially cured. Generally some hope of recovery may be entertained, when the amblyopia, or even complete amaurosis, begins with these attacks, but always terminates with them, without leaving any serious impairment of vision. On the contrary, it is a very bad sign, not only in regard to the removal of this symptomatic amaurosis, but likewise to the cure of the original disease, when the amaurosis invariably precedes these attacks, and lasts a considerable time after their cessation. As yet, Beer says, he has not known any such patients cured, either of their spasms, epilepsy, or convulsions, much less of their blindness: on the contrary, after three or four attacks, perfect amaurosis remains, and some of the patients die in one of these paroxysms.

As this amaurosis is merely a symptomatic effect of the above general disorders, its removal must entirely depend upon the success with which their treatment is conducted. Were the blindness to continue, however, after the cure of the original disease, the surgeon could do nothing more than try an empirical mode of treatment, and ascertain what good could be effected with antispasmodic and tonic medicines.—(Beer, Lehre von den Augenkr. b. 2, p. 506—510.)

Rheumatic amaurosis.

According to Beer, rheumatic amaurosis is not very uncommon, and is so plainly denoted by certain symptoms, that it cannot well be mistaken; namely, a perfectly clear pupil wavers in the mid state between contraction and dilatation, the iris seeming to be nearly motionless; the eyes weep from the slightest causes, and constantly betray more or less aversion to light; the case is invariably attended with wandering, irritating pains, sometimes affecting the eyeball itself, sometimes the vicinity of the eye, and in other instances, the teeth or neck. Also when both eyes are affected together, which is not regularly the case, a cast of the eye, which cannot be called actual squinting, may be remarked, and frequently the motion of the eyeball is chiefly obstructed only in one direction, though sometimes a true obliquity of the organ exists (luscitas). In nearly every instance there is considerable weakness of the levator muscle of the upper eyelid, and not unfrequently a complete blepharoplegia; but total blindness is seldom produced.

According to Beer, this amaurosis, which is to be considered as chronic rheumatism, often arises from keeping the head long exposed to the air, and is chiefly met with in individuals who, while sweating profusely from the scalp and brow in warm weather, have taken off their hats, and remained with their heads a long while uncovered. As, however, in warm weather, the generality of persons expose themselves in this manner, and few are attacked by amaurosis, I infer that something more is requisite for the production of the disease.

Under certain circumstances the prognosis is by no means unfavourable, and Beer mostly succeeded in effecting a perfect cure, when the amaurosis was not completely formed, and not of very long standing, the patient had no tendency to gout, and when during the treatment every thing likely to bring on an attack of that disease was avoided.

The treatment consists not simply of local means, which indeed are always needful, but likewise of general remedies. With regard to the latter, Beer assures us that manifold experience has convinced him of the preference which ought to be given to the extract of guaiacum joined with camphor, and given alternately with the compound powder of ipecacuanha; which remedies, as soon as the wandering pains about the eye and eyebrow begin to be milder, and more fixed to one part, are to be succeeded by the extract of aconitum, antimonial preparations, and flowers of sulphur. Externally, the most powerful operating means are not to be omitted, especially blisters applied successively behind the ears, to the temples, and eyebrows; and as soon as the pain has completely subsided in these last parts, and is perhaps more concentrated in the eye, frictions are to be made on the eyebrow with liniments, containing at first a moderate quantity of opium, and afterward of the extractum conii. At length, when the pain in and about the eye is nearly subdued, but some degree of amaurotic weakness of sight is left, frictions with naphtha and a small proportion of tinctura lyttæ and tinctura opii will be found exceedingly beneficial. Afterward, when a considerable time has transpired without the recurrence of the slightest rheumatic pain in the eye, its vicinity, or the head, but the eyesight is not perfectly re-established by perseverance in the above general and local treatment, and especially when the paralytic affection of the levator of one or other of the upper eyelids continues (as often happens), galvanism may be tried, with the cautions elsewhere premised.—(See Gutta Serena.) And in the most desperate cases, Beer approves of making an issue in the depression between the angle of the jaw and the mastoid process, and keeping it open for a fortnight after the recovery seems complete.—(Lehre von den Augenkr. b. 2, p. 526—529.)

Traumatic amaurosis.

Beer applies the epithet "traumatic" to such cases of amaurosis as are the consequence of a considerable wound of the eye itself, its surrounding parts, or the skull. Here, consequently, is first arranged the amaurosis produced by the laceration and stretching of the branches of the frontal nerve from irregular scars about the eyebrow. Secondly, Beer reckons the amaurosis arising from external violence directed in such a degree against the upper or lower side of the orbit, that the retina is torn, and many of the internal softer textures of the eye forced out of their natural situations. Thirdly, Beer includes every weakness of sight or perfect amaurosis, which is the result of such injuries of the eyeball itself as extend to the retina, so as either violently to bruise or lacerate it, or cut or pierce it. For the prognosis and treatment of all these cases, he refers to his observations upon ophthalmy. Nor does he choose here to treat of the perfectly complicated amaurosis, which is a direct consequence of a coup-de-soleil, because it never happens unpreceded by a violent general inflammation of the eyeball, and therefore is to be regarded as an effect both of the injury and the inflam-

mation together; but which, like the symptomatic amaurosis, following common and genuine internal ophthalmy, may be easily known by the total insensibility to light, and the evident changes in the texture and shape of the eye; and is quite as incurable as the other example to which we have alluded.—(Lehre von den Augenkr. b. 2, p. 542.)

Gouty amaurosis.

According to Mr. Travers, gout attacks the eye through the medium of the stomach. Vomiting occurs with pain in that organ, on the subsidence of an inflammation in the extremities, and is succeeded by violent pain in the head. The loss of sight, he adds, is sudden and permanent.—(Synopsis, &c. p. 163.) The gouty amaurosis described by Beer, is perhaps badly named; at all events, there are some circumstances in its history which must create doubts on the subject. Gouty amaurosis, he says, has two forms: the first is characterized by a very considerable dilatation and angular displacement of the pupillary edge of the iris towards the canthi; a continually increasing slowness in the movements of the iris, and final immobility of this organ; an actual change of colour at both its circles; a dull, glassy blackness of the pupil, and even a tarnish in the lustre of the cornea; an alternate appearance of the gray and black cloudy substances described in the account of the general symptoms of amaurosis, which effect lasts while the patient is not totally blind. The disorder is farther indicated by a fleeting, wandering, irritating, yet not very severe pain, all about the vicinity of the eye; a manifest tendency to a varicose enlargement of the blood-vessels of the conjunctiva and sclerotica; a transient melioration of sight after meals, or any accidental excitement or stimulus; a considerable temporary decrease of it after the operation of any causes which depress the spirits; the excessively slow formation of the disease, for which several years are usually required; and lastly, by the nature of the patient's constitution. For, in general, this amaurosis (if we are to believe Beer) always attacks both eyes at once, and is confined to dark-eyed and very irritable, slender, weak, maiden females, who either have suffered from scrofula in their childhood, or from severe acute or chronic diseases at a later period of their lives; who are not yet far advanced in years; and whose menses have never been very irregular though profuse.

It is remarked by Beer, that although the second form of gouty amaurosis makes its attack upon males as well as females, the latter, on the whole, are most frequently affected, particularly about the period when the menses cease. This amaurosis, which is seldom formed quickly, that is to say, in a few weeks or months, but mostly requires years for its production, begins with cloudy, indistinct vision; an appearance of different colours before the eyes; and a peculiar sensation, as if insects were crawling over the skin around the eye. The pupil becomes manifestly dilated, and presents a dull greenish-gray colour, which, however, is easily distinguished from the colour seen behind the pupil in the amaurotic cat-eye, and plainly depends upon some defect in the vitreous humour (glaucoma). Also the iris, the pupillary edge of which is drawn towards both angles of the eye, as in the first form of the disorder, undergoes an obvious change of colour, first at its less circle, which becomes of an uncommonly dark hue, and then at its greater circle. The alteration of colour here spoken of certainly proceeds from a general varicose state of the blood-vessels of the eye, which affection daily augments, and is attended with vehement pain in the organ and surrounding parts, or even in the whole head, or one side of it, whether the blindness attack one or both eyes together. This violent pain, however, which is such as often to distract the patient, is unsteady and irregular, being immediately aggravated by every violent mental emotion, whether of the exalting or depressing kind, every sudden and considerable change of temperature, every quick accession of wet cold weather, or when the patient stays only for a short time near a very heated fireplace, lies on feather pillows with the affected eye resting upon them, or covered with flannel, or he has been eating any indigestible food. These attacks of pain subside without any medical assistance, in the dry, warm season of the year, and in a mild, not too hot, climate are often kept off for several years. Upon every such attack the glaucoma becomes more evident, the pupil larger and more angular, and the eyesight perceptibly weaker. At length, during one of these painful exacerbations, vision is completely abolished, not the least sensibility to light remaining; and the pupillary edge of the iris, together with the less circle of the same organ, then entirely disappears, being inverted towards the lens. The cirsophthalmia also gets so much worse, that the sclerotica acquires a smutty, grayish-blue colour; and at length the bluish windings of vessels may be noticed at various points, particularly about the place where the tendons of the muscles are affixed. Afterward the green, or what may be more properly called the glaucomatous cataract, is manifestly developed, and the eye then generally wastes under the most violent attacks of pain. The light which the patient always thinks he sees, but which, according to Beer, is produced of a reddish or bluish colour in the interior of the eye, like galvanism, keeps up the hope of recovery; but all consciousness of this luminous appearance ceases as soon as the eye begins to waste. The first degree of gouty amaurosis readily changes to the second, especially in persons who are getting into years, or are near the period of life when menstruation terminates.

According to Beer, the apothecary's magazines contain no remedies which are adequate to the cure of the first form of this amaurosis. A total change of the whole constitution would be requisite, ere success could be expected, and such change it is not in the power of physic to accomplish. In one single example Beer succeeded in checking the disease, by persuading the patient to observe a strict regimen, not a grain of medicine being given; but the patient still remains weak-sighted, though various medicines have latterly been tried.

With respect to the treatment of the second form of gouty amaurosis, Beer observes that it should be like that of gouty iritis. In particular, attention must be paid to the attacks of pain, and palliative means adopted. The patient should not lie upon feather beds, nor especially feather pillows, but only employ articles of this kind which are stuffed with horse-hair. Neither must he expose himself to an atmosphere which is at the same time both cold and damp; and if he cannot altogether take care of himself in this respect, at all events let him keep his head and feet warm and dry; shun every thing which tends to impede the functions of the skin; and avoid pork-meat, every thing cooked with hogs' lard, and all acid and salt dishes, like herrings. With what are usually considered as gout medicines, the practitioners should act very circumspectly; and, as in gouty iritis, he should pay close attention to the state of the constitution, rather seeking to afford relief by means of a well-regulated diet, than by the employment of much physic.

Of the amaurosis occasioned by the sudden cure of cutaneous diseases, and of old ulcers of the leg.

When this amaurosis assumes its ordinary form, Beer has not yet been able to remark in it any peculiar characteristic symptoms by which it can be effectually distinguished from the second form of gouty amaurosis, excepting, first, that it originates and increases very suddenly, while the true arthritic amaurosis is a long time, and for the most part several years, in forming. Secondly, that at its commencement it is never attended with violent pain in the eyes or head. Hence, the diagnosis will depend very materially upon a correct recollection of circumstances. But, according to Beer, there are some cases in which, besides the complete blindness, unattended with the slightest power of perceiving light, there is no characteristic symptom, but extraordinary enlargement of the pupil, total immobility of the iris, and an inanimate projection of the eye.

Respecting the causes of this amaurosis, Beer says that he has nothing important to offer. He owns that, after the sudden cure of certain cutaneous diseases, and of old ulcers of the legs, an amaurotic blindness does not always ensue; and he believes that the reason why the bad effects take place in other organs, sometimes the brain, the lungs, or the bowels, &c., may probably depend upon this or that organ happening to be most predisposed to disease. Here the discerning reader will not require me to point out to him that such a mode of accounting for things is entirely hypothetical,

and destitute of proof: it is indeed so convenient a sort of explanation that it admits of being extended to all diseases without exception. If we are to believe Beer, the prognosis is very uncertain, and in many cases highly unfavourable; first, because an organic part, namely, the optic nerve, is directly affected, which, by the operation of external and internal causes, is soon rendered unfit for the performance of its functions. Secondly, because in the majority of examples important changes immediately take place in the organization of the whole eye, which are particularly difficult of removal when the nervous textures are affected. Thirdly, because it is impossible to know whether morbid changes may not already exist in the retina or course of the optic nerve.

In the treatment, Beer, who places implicit reliance upon the above statement of causes, is an advocate for reproducing as quickly as possible the original disease; and if that cannot be done, he thinks some artificial disease should be formed in lieu of it. For these purposes, he often employs blisters and friction with antimonial ointment. His treatment, where amaurosis happens to follow the cure of itch, seems very objectionable, as it consists in inoculating the poor patient again with psoric infection, as if it were not more tolerable to remain blind than live perpetually scourged with the other disorder; for the professor's theory leaves us uninformed of the circumstances under which the patient whose sight is restored by this expedient could ever venture to have a sound skin again without the risk of a fresh attack upon his eyes. But it seems, even from Beer's account, that the patient's subjecting himself to the itch will not always cure his eyes; for, says he, when this method fails, friction with antimonial ointment should be tried.

When amaurosis follows the healing of old sores, Beer recommends the formation of them again, by applying to the cicatrix strong mustard cataplasms, and the muriate of soda; and if the new ulcers cannot be made to discharge properly, he praises the application of issues to the calves of the legs, and, in urgent cases, to the thighs. These plans are to be aided by such medicines as act specifically upon the skin, like antimonials, especially the sulphur auratum antimonii. Beer also speaks favourably of sulphur baths; and in cases complicated with debility, administers tonics, particularly the calamus aromaticus and bark.—(See Lehre von den Augenkr. b. 2, p. 556—563.)

Of the sympathetic amaurosis in lying-in women, from suppression of the secretion of milk.

This case is set down by Beer as one of the most uncommon varieties of amaurosis. It comes on rapidly, after sudden stoppage of the secretion and excretion of the milk, with violent headache, concentrated about the forehead and eyebrows; troublesome luminous appearances; an inconsiderable dilatation of the pupil; and scarcely any perceptible irregularity in the pupillary edge of the iris, which is quite motionless, somewhat altered in colour, and swollen. The disease is also accompanied with great aversion to light; a palpable turgescence of all the blood-vessels of the conjunctiva; a slight turbidness of the transparent media of the eye; and, at first, with a mere weakness of sight, which, in the end, suddenly changes into complete amaurotic blindness. The breasts, which before the attack were full of milk, are now empty, and hang down like bags, but are quite free from pain.

From the few cases which Beer had seen, he inferred, that the prognosis is always unfavourable when the blindness is complete, and particularly when there is a manifest diseased change in the transparent parts of the eye; for, in the latter case, he has known patients remain perfectly blind, though the secretion of milk had been most successfully and expeditiously re-established. In one instance, the remedies applied to the breast, instead of reproducing the secretion of milk, excited in the part a painful inflammation and abscess, during which the weakness of sight subsided, though it was very considerable.

In considering other analogous cases of amaurosis, enough has already been said concerning the first and most important indication, namely, the re-establishment of the action which is obstructed; and here the only question is, about the manner in which that object can be most expeditiously and safely effected. For, says Beer, it should be distinctly understood, that the prevention of a complete amaurotic blindness essentially depends, not only upon the renewal of the secretion from the breasts, but upon this change being made without delay. The remedies which Beer has found most effectual for this purpose are warm poultices applied to the breasts, and at first composed of simple emollients, and afterward of more stimulating ingredients, such as hemlock, chamomile flowers, &c. When the breasts have more of a leucophlegmatic appearance, than that indicative of a fulness of the mammary gland, and disposition to a renewal of the milk secretion, Beer strengthens these poultices with aromatic herbs, and applies them alternately with well-warmed bags, full of dry aromatic plants, and sprinkled with camphor. These last means are very useful at night, or when the patient is asleep, and fresh warm poultices cannot be put on sufficiently often. In the daytime, the breasts should be frequently and gently rubbed with warm flannels, medicated with olibanum and mastic. This plan is to be followed up until the secretion and excretion of milk are renewed, and the amaurotic amblyopia has subsided. When the secretion either cannot be restored by the foregoing means, or the eyesight does not return with the re-established secretion, internal remedies must be tried, especially arnica, joined with calomel and camphor. Issues or setons should also be formed, and kept open for a considerable time.—(Lehre von den Augenkr. b. 2, p. 572—575.)

Of the symptomatic amaurosis from morbid changes, either in the optic nerves and their sheaths, or in the bones of the cranium, or the brain itself.

Beer says, a very considerable number of cases of this form of amaurosis, which have fallen under his notice, have enabled him, as it were, not only to know it at once, but to describe its exact symptoms.—1st. Its formation is constantly very slow, and in all cases the patient is not only completely deprived of vision, but, for more or less time previously to his death, rendered quite incapable of distinguishing light. 2dly. A second peculiar symptom of this amaurosis consists in morbid changes in the structure of the eye, which are at first scarcely perceptible, and increase very slowly. 3dly. The amaurosis either originates during an attack of violent headache, which continues almost uninterruptedly until death, or the headache does not come on until complete blindness has taken place; or the patient may have no pain whatever either in his eyes or head. 4thly. In the progress of this amaurosis, objects invariably seem to the patient to be perverted, disfigured, &c.

Symptoms when the disorder proceeds from disease of the optic nerves or their sheaths.

This case comes on slowly, and rarely attacks both eyes together. It always commences with a black cloud, which grows more and more dense, and with a troublesome, alarming perversion and disfigurement of every object, without the least painful sensation in the eye or head. The patient merely complains of a slight sensation of dull pressure at the bottom of the orbit, as if the eyeball were about to be forced from its socket, of which displacement, however, there is not yet the smallest appearance. In the very beginning of the disease, the pupil is already considerably dilated, and the pupillary edge of the motionless iris presents angles at several points, the pupil sometimes representing an irregular pentagon or hexagon. By degrees, though very slowly, a glaucomatous change of the vitreous humour ensues, and afterward of the lens itself; the only species of glaucoma which Beer has ever noticed quite unattended with a varicose affection of the blood-vessels of the eye. At last, the globe of the eye becomes perceptibly smaller than natural; but a complete atrophy does not ensue.

Symptoms when the case proceeds from disease of the skull or brain.

In this form of amaurosis, which usually attacks both eyes together, or at least one very soon after the other, the blindness also commences very slowly, with appearances as if every object looked at were perverted or disfigured. However, there is no black cloud, but rather an obscurity or confusion of every object. The disease in this stage is also accompanied with frequent giddiness, ugly luminous spectra, and, for the most part,

with aversion to light, uncommonly lively motions of the iris, a contracted pupil, angles in the upper and lower portions of the pupillary margin of the iris; an evident turgescence of the blood-vessels of the eye, gradually augmenting with most violent headache into actual cirsophthalmia; frequent convulsive motions of the eyes and eyelids, and strabismus of one or both eyes, ending in a true deviation of one or both of these organs from their natural positions. Under these symptoms, vision is afterward entirely abolished; and the headache, though subject to remissions, grows so much worse, extending back to the spine, that the patient is often nearly frantic, and, indeed, after a time, a destruction of the external senses happens, followed by that of the intellectual faculties. The first of the external senses which is lost is always the hearing, which infirmity is next followed by loss of the smell, or taste, or both these senses together; and then the memory and other intellectual powers decline. In this stage of the disorder, the eyeball not unfrequently protrudes from the orbit, a pathognomonic symptom, to which Beer attaches great importance, because it is an infallible criterion of a diseased state of the bones of the orbit, of the parts which invest this cavity, and of the optic nerve and dura mater, in the sella turcica. In such cases, complete mania now usually follows, and this sometimes in its most violent form, unless the patient happen to be first carried off by paralytic symptoms; life, under these circumstances, never lasting any considerable time.

As far as our external senses can discover, the cause of both these forms of amaurosis, as the title of this section specifies, lies in certain morbid changes in the structure of the optic nerve and its investments, or in diseased alterations of the bones of the cranium, the dura mater, and the brain. But how these changes arise, is not so easy of explanation. The morbid changes in the structures above mentioned, which Beer had himself ascertained by dissection, consist in a real induration of the optic nerves, and an adhesion of them to their sheaths, while within the skull these ash-coloured, gray, very much diminished nerves presented no vestige of medullary structure even as far as their origin from the brain. On the contrary, the optic thalamus presented externally its natural appearance. The retina seemed to have lost its pulpy matter, was tough, not easily torn, and appeared to consist but of a vascular membrane. In one example, although both eyes had been completely deprived of sight together, Beer found only the retina and optic nerve of the left side in this state of atrophy as far forwards as the point of union in the sella turcica. On the other hand, the optic nerve of the right eye was hard, without being in the least dwindled, and was closely adherent to its external coverings. Anteriorly to their decussation, nothing at all preternatural in either nerve could be discerned. But the left corpus striatum was so indurated, that a very sharp, strong scalpel was required for its division, though in colour and shape it was perfectly natural. On this side, also, the plexus choroides was entirely wanting. In three amaurotic patients of this kind, Beer found hydatids between the coverings of the optic nerve, and where such hydatids lay, the medullary matter seemed to have been displaced by their pressure. With the utmost care, he could not trace the ophthalmic ganglion.

Paw also found in the optic nerve a large hydatid, which had produced amaurosis.—(Obs. Anat. Rarior. Obs. 2.) In Mr. Heaviside's museum, there is a preparation of the optic nerve of an amaurotic eye, where a tumour of considerable bulk has grown from the neurilema.—(See Wardrop's Essays on the Morbid Anatomy of the Human Eye, vol. 2, p. 157.) In this work are specified examples of various other morbid changes of the optic nerve, especially calculous concretions within it, the presence of a viscid, muddy, gray fluid in the thickened neurilema, instead of pulp, a dwindling of the nerve, &c.

To the present description of cases, Beer refers the instance recorded by Haller (Opusc. Pathol. Obs. 65, p. 172), in which a calcareous mass was found between the membrane of Ruysch and the vitreous humour. According to Beer, there is preserved in the pathological and anatomical museum of the general hospital at Vienna, an eye, distended with a similar osseous mass, without the capsule of the lens being at all affected. Examples, in which the amaurotic blindness arose from abscesses in the brain, are reported by Ballonius (Paradigmata Hist. 7), by Pelargus (Med. Jahrg. 3, p. 198), Peyronie (Mém. de l'Acad. Royale de Chir. 1, p. 212), Schaarschmid (Berlin Nachrichte, 1740. No. 26), Langenbeck (Neue Bibl. 1, p. 61), and Mr. Travers (Synopsis, p. 143). The latter author has recorded an instance in which a firm lardaceous tumour, of the size of a garden bean, situated on the same side as the blindness, compressed the optic ganglion and nerve at its origin from it.—(Synopsis, p. 151.) I have seen a case of amaurosis, in which a tumour as large as a middling-sized apple was found in the anterior lobe of the brain, attended with protrusion of the eye, and vast destruction of the bones. Mr. Travers has seen amaurosis produced by a medullary fungus of the brain. A case, occasioned by disease of the thalamus, is related by Villeneuve (Journ. de Méd. continué, 1811, Févr. p. 98); another, of a tumour of the thalamus on the same side as the blindness, is recorded by Ford (Med. Commun. vol. 1, No. 4); and other swellings in various parts of the brain are described in Ephem. Nat. Cur. Dec. 3, Ann. 9, and 10, Obs. 253; De Haen's Ratio Medendi, P. 6, p. 271; Journ. des Savans, 1697; Muzell's Wahrnehm. 2, No. 13; Plater, Obs. lib. 1, p. 108; Thomann, Annalen für 1800, p. 400, &c. On this part of the subject, I beg leave to refer also particularly to my friend Mr. Wardrop's valuable Essays on the Morbid Anatomy of the Human Eye, vol. 2, p. 174, &c.

The morbid alterations of the bones of the cavity of the skull mostly happen at its basis, and not only may caries take place, but still more frequently exostoses of various forms, which are sometimes so small that they are first detected by the bone giving the feel of a rough grater. At the same time they are so sharp, that if the finger be passed rudely over them, it will be painfully hurt. In these cases the bones of the cavity of the skull are always found extremely thin; the diploe is almost entirely wanting, and the parietes of the orbit are preternaturally diaphanous, and in some places imperfect. Beer speaks of a lady's skull who had been completely blind, and for some weeks previously to her death insensible, in which instance scarcely any part of the cavity of the skull could be carelessly touched without risk of scratching the fingers with spiculæ. Once in an amaurotic boy, who for a short time before his death was so insane that he used to devour his own excrement, Beer found at the side of the sella turcica a long considerable spicula, which passed directly through the optic nerves at the place of their decussation. A case of amaurosis produced by a spicula of bone injuring the opposite side of the brain is related by Anderson.—(See Trans. of the Society of Edinb. vol. 2.) Sometimes the ethmoid bone has been found carious (Ballonius, Paradigmata, No. 7); sometimes other parts of the cranium.—(Mursinna, Beobacht. 1, No. 6; Schmucker, Vermischte Schrift. 2, p. 12.) Nor is it unfrequent to find the medullary substance of the brain itself as soft as pap, while the cortical substance is full of blood-vessels, and unusually firm, the convolutions being hardly distinguishable.

Many of the causes of amaurosis are of such a nature as to render the disease totally incurable. Of this description is fungus hæmatodes, in which the structure of the retina and optic nerve is changed in a remarkable manner, the whole cavity of the eyeball becoming filled with a substance resembling medullary matter, and the optic nerve changed in its form, colour, and structure.—(See Wardrop's Essays on the Morbid Anatomy of the Human Eye, vol. 2, p. 156, 8vo. Lond. 1818.)

On the authority of Ecker, one case is upon record, where the cause of amaurosis depended upon an aneurism of the central artery of the retina.—(Pinel, Nosographie Philos. vol. 2, p. 122.)

In another instance the macula lutea, which is naturally a yellow spot near the centre of the retina, was found black.—(Mém. de la Société Méd. d'Emulation, an 1798.)

Bonetus, in his Sepulchretum Anatomicum, lib. 1, sect. 18, describes various cases which were quite incurable: after death the blindness in one instance was found to be occasioned by an encysted tumour, weighing fourteen drachms, situated in the substance of the cerebrum, and pressing on the optic nerves near their origin. In the second, the blindness was produced by a cyst containing water and lodged on the optic nerves

where they unite. In the third, it arose from a caries of the os frontis, and a consequent alteration in the figure of the optic foramina. In a fourth, the cause of the disease was a malformation of the optic nerves themselves. In some of the instances in which no apparent alteration can be discovered in the optic nerve, the late Mr. Ware conjectured that a dilatation of the anterior portion of the circulus arteriosus may be the cause of the affection. The circulus arteriosus is an arterial circle, surrounding the sella turcica, formed by the carotid arteries on each side, branches passing from them to meet each other before, and other branches passing backwards to meet branches from the basilary artery behind. The anterior part of the circulus arteriosus lies directly over, crosses, and is in contact with the optic nerves, and just in the same way as the anterior branches lie over the optic nerves, the posterior ones lie over the nervi motores oculorum. Hence Mr. Ware attempted to refer the amaurosis itself, and the paralytic affection of the eyelids and muscles of the eye, sometimes attendant on the complaint, to a dilatation of the anterior and posterior branches of the circulus arteriosus. The frequently diseased state of the trunk or small branches of the carotid arteries at the side of the sella turcica is noticed by Dr. Baillie in his useful work on Morbid Anatomy, and, he says, the same sort of diseased structure is also found in the basilary artery and its branches.—(See Ware's Chir. Obs. on the Eye.)

In 1826, M. Magendie related to the French Academy of Sciences various facts exemplifying the remarkable influence of the fifth nerves over all the senses; and with respect to the sense of sight, he finds that the action of the eyeball and optic nerve cease immediately they are completely deprived of the influence of those nerves. Thus a state of the eye is produced that has the greatest analogy to amaurosis. Indeed, when the fifth nerves are divided in an animal, it is instantly bereft of sight on the side on which the nerve has been cut, notwithstanding the eye retains at the moment all the physical conditions necessary for vision. It is not to be supposed, however, that the fifth nerves perform the function usually referred to the optic ones. To perceive the light, and to see, as Magendie remarks, are, experimentally speaking, two different things. An animal whose fifth nerves have been divided does not see, neither is it conscious of the daylight or of the strongest artificial light; yet it decidedly perceives the impression of the rays of the sun when they fall directly on the eye. Hence a healthy, sound condition of the optic nerve on the one part, and of the fifth nerve on the other, is essential to perfect vision; and M. Magendie therefore deems it highly probable that there are two kinds of amaurosis, one depending on a particular affection of the optic nerve and retina; the other on disease of the fifth nerve, and the defect of its influence on the organ of vision. These reflections led him to make trial of a combination of acupuncture and galvanism for the cure of certain cases of amaurosis. Thus in one case, having introduced one needle into the frontal nerve, and another into the upper maxillary, he brought the needles into repeated contact with the two poles of a Voltaic pile. In a fortnight the patient had received considerable benefit from the plan. Other facts are also recorded in favour of this treatment.—(See Journ. Expér. de Physiol. t. 6, p. 156 et seq.)

L. Heister, Apologia et uberior Illustratio Systematis sui de Cataractâ, Glaucomate, et Amaurosi, 12mo. *Altorf.* 1717. *J. B. G. Œhme, de Amaurosi*, 4to. *Lips.* 1748, *in Halleri Disp. Chir.* 2, 265. *Jos. Warner, Description of Human Eye, and Diseases*, 8vo. *Lond.* 1754. *Trnka de Krzowitz, Historia Amauroseos*, 8vo. *Vindob.* 1781. *Gius. Flajani, Collezione d'Osservaz. &c. t.* 4, *p.* 173, 187, 8vo. *Roma*, 1803. *D. G. Kieser, Ueber die Natur, Ursachen, Kennzeichen und Heilung des schwarze Staars*, 8vo. *Gött*, 1811. *Langenbeck, Neue Bibl. für die Chirurgie, b.* 1, *Hanover*, 1815. *J. Beer, Lehre von den Augenkrankheiten, b.* 2, 8vo. *Wien*, 1817. *James Wardrop, Essays on the Morbid Anatomy of the Human Eye, vol.* 2, 8vo. *Lond.* 1818. *The two latter books are works of the highest merit; and as we have no translation of the first, I have thrown a good deal of the information which it contains on amaurosis, into the present edition. B. A. Winkler, De Amaurosi*, 12mo. *Berol.* 1818. *Vermischte Chirurgische Schriften von J. L. Schmucker, b.* 2, *Berlin, ed.* 2, 1786. *Remarks on Ophthalmy, &c. by James Ware. Inquiry into the causes preventing success in the extraction of the Cataract, &c. by the same. Osservazioni sulle Malattie degli Occhi di A. Scarpa, Venez.* 1802. *This book has gone through many editions in Italy. The last, which is much improved, has been well translated by Mr. Briggs. W. Hey, in Practical Observations in Surgery, and Med. Obs. and Inquiries, vol.* 5. *Schmucker's Wahrnehmungen, b.* 1, *p.* 273. *Richter's Anfangsgründe der Wundarzneykunst, b.* 3. *Frick on the Diseases of the Eye, by Welbank*, 8vo. *Lond. ed.* 2, 1826. *Some scattered remarks in the posthumous work on the Diseases of the Eye, of the late J. C. Saunders, &c. De Wenzel, Manuel de l' Oculiste, ou Dictionaire Ophthalmologique*, 8vo. *Paris*, 1808. *J. Stevenson, On the Nature, &c. of the different Species of Amaurosis*, 8vo. 1821. *B. Travers's Synopsis of the Diseases of the Eye, &c.* 8vo. *Lond.* 1820. *Also Lawrence's Lectures on Diseases of the Eye, the republication of which in a separate form, with references to the best works and authorities, would make one of the most useful books on the subject.*

Many additional observations, connected with the subject of amaurosis, will be found in the articles Cataract, Diplopia, Fungus Hæmatodes, Gutta Serena, Hemeralopia, Hemiopia, Nyctalopia, Sight, Defects of, &c.

AMBE. (From ἄμβη, the projecting edge of a rock.) An old chirurgical machine for reducing dislocations of the shoulder, and so called because its extremity projects like the prominence of a rock. Its invention is referred to Hippocrates. The ambe is the most ancient mechanical contrivance for the above purpose; but it is not at present employed. Indeed, it is scarcely to be met with in the richest cabinets of surgical apparatus. It is composed of a piece of wood, rising vertically from a pedestal. With the vertical piece is articulated, after the manner of a hinge, a horizontal piece, with a gutter formed in it, in which the luxated limb is laid and secured with straps. The patient places himself on one side of the machine; his arm is extended in the gutter and secured; the angle formed by the union of the ascending piece and by the horizontal branch is lodged in the armpit, and then the horizontal branch is depressed. In this way extension is made, while the vertical part makes counter-extension, and its superior part tends to force the head of the humerus into the articular cavity. But there is nothing to fix the scapula, and the compression made by the superior portion of the vertical piece of the machine tends to force the head of the humerus into the glenoid cavity, before it is well disengaged by the extension.—(See Boyer on Diseases of the Bones, vol. 2.)

AMBLYOPIA. (From ἀμβλὺς, dull, and ὤψ, the eye.) Hippocrates means by this word, in his Aph. 31, Sect. 3, the dimness of sight to which old people are subject. Modern writers generally understand by amblyopia incomplete amaurosis, or the weakness of sight attending certain stages and forms of this disorder.

AMMONIÆ MURIAS. AMMONIA MURIATA. Sal ammoniac. Its chief use in surgery is as an external discutient application.—(See Lotio Ammon. Muriatæ cum Aceto.)

Mr. Justamond recommends the following application to milk abscesses: ℞. Ammoniæ muriatæ ʒj. Spiritus roris marini ℔j. Misce. Linen rags are to be wet with the remedy, and kept continually applied to the part affected.

There can be little doubt of the utility of this lotion in dispersing the induration left after mammary abscesses; but while these cases are accompanied with much pain, tension, and inflammation, emollient fomentations and poultices are to be preferred.

If muriate of ammonia be mixed with its weight of powdered nitre, and dissolved in six or eight parts of water, it produces a very cold lotion, which may be used as a substitute for ice in cases of strangulated hernia.

AMPUTATION. The operation of cutting off a limb, or other part of the body, as the breast, penis, &c.

Such an operation frequently becomes indispensably proper, on the principle of sacrificing a branch, as it were, for the sake of taking the only rational chance of saving the trunk itself. Indeed the suggestion of this measure, in cases of mortification, where there is no chance of the parts recovering, may be said to be derived from nature herself, who, by a process to which I shall advert in speaking of mortification, detaches

the dead from the living parts; this separation is followed by cicatrization, and the patient recovers.

The necessity for amputation has always existed, and ever will continue, as long as the destructive effects of injuries and diseases of the limbs cannot be obviated in any other manner. As Graefe observes, there was once a period (I should say, about forty years ago) when the operation was more frequently practised than at present, and this fact is to be imputed less to the caprice of surgeons than to the imperfection of the means which used to be employed for the relief of local diseases. For then aneurisms of the limbs, and some other cases, at present treated with success, were always deemed incurable without amputation. Boucher, Gervaise, Faure, and Bilguer inveighed against the frequent performance of amputation on the field of battle; yet their arguments must prove of little value; unless a path were at the same time traced which would conduct us to the method of remedying the circumstances which form the necessity for the operation. When this condition is fulfill d, and more effectual modes of treatment are devised, as for instance with respect to the gun-shot wounds specified by Bilguer, then the necessity for amputation in such cases would cease of itself.—(Normen für die Ablösung grösserer Gliedmassen, p. 13, 4to. Berlin, 1812.)

As the author of another valuable modern work has said, it is an excellent observation, founded on the purest humanity, and justified by the soundest professional principles, that to save one limb is infinitely more honourable to the surgeon, than to have performed numerous amputations, however successful; but it is a remark, notwithstanding its quaintness, fully as true, that it is much better for a man "to live with three limbs, than to die with four."—(Hennen on Military Surgery, p. 251, ed. 2.)

To this saying should be added the reflection, that some unfortunate beings, influenced by a relish for life, have been known to submit to the loss of all their legs and arms, and yet recover. In the Hôtel des Invalides at Paris, mutilated objects are in recollection, who had lost all their thighs and arms, so that, unless assisted, they could not stir, and it was necessary to feed and wait upon them like new-born infants.—(Morand, Opusc. de Chir. p. 183, and Graefe, op. cit. p. 23.)

The amputation of the large limbs was anciently practised under many disadvantages. The best way of making the incisions was unknown; the ignorance of the old surgeons about the right method of stopping hemorrhage was the death of a large proportion of the patients who had courage to submit to the operation; the mode of healing the wound by the first intention was not understood, or not duly appreciated; and the instruments were as awkward and clumsy, as the dressings were irritating and improper.

Modern practitioners have materially simplified all the chief operations in surgery; an object which has been accomplished not merely by letting anatomical science be the main guide of their proceedings; not simply by devising more judicious and less painful methods; not only by diminishing the number, and improving the construction, of instruments; but also, in a very essential degree, by abandoning the use of a multitude of external applications, most of which were useless or hurtful.

The Greek, Roman, and Arabian practitioners amputated limbs with feelings of alarm, and, in general, with the most melancholy results; while modern surgeons proceed to the operation completely fearless, well knowing that it mostly proves successful: hence, as Graefe justly remarks, nothing can be more evident, than that the patient's safety must depend very much upon the kind of practice.—(See Normen für die Ablösung grösserer Gliedmassen, p. 1.) By practice is here implied the mode in which the operation is performed, the way in which the wound is dressed, and the whole of the after-treatment.

But, much improved as amputation has been, it cannot be dissembled, that it is an operation at once terrible to bear, dreadful to behold, and sometimes severe and fatal in the consequences which it itself produces, while the patient, if saved, is left for ever afterward in a crippled, mutilated state. Hence it is the surgeon's duty never to have recourse to so serious a proceeding without a perfect and well-grounded conviction of its necessity. Amputation should be generally regarded as the last expedient to which a surgeon ought to resort; an expedient justifiable, as a late writer says, only when the part is either already gangrenous, or the seat of so much injury or disease, that the attempt to preserve it any longer, would expose the patient's life to the greatest danger.—(Dict. des Sciences Méd. t. 1, p. 472.)

Although, says a distinguished modern surgeon, this amounts to a confession, that the cure of some local disorders is not within the limits of our art, yet, on the other hand, it furnishes a proof, that surgery may be the means of saving life under circumstances which, without its assistance, would infallibly have a fatal termination. The operation is adopted as the safest measure: the cause is removed for the prevention of consequences.—(Graefe, op. cit. p. 14.)

Nothing can be more absurd or more misapplied, than the censures sometimes passed upon amputation, because the body is mutilated by it, &c. Although, as a modern writer remarks, the objection proves the limitation of human knowledge and ability, it must be very unfair on this account to throw blame on surgery, or the practitioner who thus saves the patient's life. For, without dwelling upon the fact, that a humane surgeon would never amputate through a mere love of operating, and without urgent cause, one may simply ask, are all diseases in their nature curable? Does not the surgeon cure such as are curable without mutilation? And are not cases, which were in the beginning remediable, often first brought to the surgeon when, from neglect, they have become totally incurable? Is it not his duty then to employ the only means left for saving the patient? And is not the preservation of a long and healthy life a compensation for the sacrifice? Would it not be just as reasonable to blame an architect, when the irresistible force of lightning or a bomb destroys his building? Indeed, is it not rather a greater honour to surgery, that even when death has already taken possession as it were, of a part, and is threatening inevitable destruction to the whole, a means is yet furnished, not only of saving the patient's life, but of bringing him into a state in which he may recover his former good health?—(Brünninghausen, Erfahrungen und Bemerkungen über die Amputation, p. 11, 12mo. Bamberg, 1818.)

Though amputation is in every respect much better than in former times, and its right performance is by no means difficult, I would not wish to be thought to say, that it is always, or even usually done secundum artem, because long opportunities of observation have convinced me of the contrary; and the reason of the knife being yet so badly handled in this part of surgery, may generally be imputed to carelessness, slovenly habits, or, what is as bad, a want of ordinary dexterity. There are several egregious faults in the method of amputating, which even many hospital surgeons in this metropolis are guilty of; but these we shall find, when we criticise them, are for the most part easily avoidable, without any particular share of skill being required. A greater difficulty is to ascertain with precision the cases which demand the operation, those in which it may be dispensed with, and the exact periods at which it should be practised. These are considerations requiring profound attention, and the brightest talents. The most expert operator (as Mr. O'Halloran observes) may not always be the best surgeon. To do justice to the sick and ourselves, we must, in many cases, rather avoid than perform capital operations; and with respect to amputation, if we consider the many cases in which it has been unnecessarily undertaken, or done at unseasonable periods, it may be suspected, that this operation, upon the whole, may have done more mischief than good. At all events, it is not enough for a surgeon to know how to operate; he must also know when to do it.—(See O'Halloran on Gangrene and Sphacelus: preface.)

For such reasons I shall first take a view of the circumstances under which the best surgeons deem amputation necessary; though it may be proper to observe, that in each of the articles relative to the particular diseases and injuries which ever call for the operation, additional information will be offered.

1. *Compound fractures.*

In a compound fracture the necessity for amputation is not altogether proportioned to the seriousness of the accident, but also frequently depends in part upon other circumstances. For example, in the field, and

on board of a crowded ship, it is not constantly in the surgeon's power to pay such attention as the cases demand, nor to procure for the patient the proper degree of rest and good accommodation. In the field, there is often a necessity for transporting the wounded from one place to another. Under these circumstances it is proper to have immediate recourse to amputation, in numerous cases of bad compound fractures, some of which, perhaps, might not absolutely demand the operation, were the patients so situated, as to be capable of receiving all the advantages of the best and most scientific treatment in a well-ventilated quiet house or hospital, furnished with every desirable convenience. At the same time, daily experience proves, that there are many other cases, in which it would be improper to have recourse to the knife, even under the most unfavourable circumstances of the above description. So, when a compound fracture occurs, in which the soft parts have not been considerably injured; in which the bones have been broken in such a direction that they can be easily set and kept in their proper position, or in which there is only one bone broken, amputation would be unnecessary and cruel. But when the soft parts have been more extensively hurt, and the bones have been so badly broken, that perfect quietude and incessant care are required to afford any chance of recovery, it is a good general rule to amputate whenever these advantages cannot be obtained.

The bad air in crowded hospitals and large cities, a circumstance so detrimental to wounds in general, is another consideration which may seriously lessen the chances of saving a badly broken limb, and should be remembered in weighing the reasons for and against amputation.

On this part of the subject, I find the sentiments of Graefe interesting: besides an absolute, says he, there is a relative, necessity for amputation: it is the most mournful, and proceeds altogether from unfavourable external circumstances, though, alas! in many cases nearly unavoidable, when life is to be preserved. In war, every bloody action furnishes proof of what has been stated. The number of the wounded is immense; the number of surgeons for the duty too limited. The supplies most needed are at a distance. In these emergencies, though the military surgeon may, from routine and genius, be able to suggest the quickest method of obtaining what is wanted, know how to avail himself of every advantage which circumstances permit, and contrive tolerable substitutes for such things as are deficient, yet this will not always do. Were we (says Graefe) here to complain of the government not providing due assistance for the defenders of our native soil, to many the remonstrance would only appear reasonable. Yet they who manage the medical affairs of the Prussian army may not constantly have it in their power to avert the inconvenience. The general cannot foretel the number and nature of the wounds which may happen, so as to enable the medical department to take with them exactly the apparatus required, without encumbering the army with a redundance of useless articles. The enemy, perhaps, captures the medical stores, or the rapid movements of particular corps cut us off from the principal depôts. Detachments often skirmish at remote points. The hospitals may lie several miles in the rear of the line; and, for want of means, the transport of the imperfectly-dressed wounded may continue night and day. Hardly are the sufferers brought into the nearest hospital, in the most pitiful state from pain, anxiety, and cold, when an order is given to break up, and they must be conveyed still farther towards their grave; and a thousand other circumstances, as Graefe observes, which deprive the wounded of the requisite attendance, and essential number of surgeons, together with the most necessary stores, make it desirable to simplify every wound as much as possible; which, indeed, is the only means of shunning the reproach, that, while we are endeavouring to save one man's limb, we let another die.

Who doubts, says Graefe, that a soldier with a gun-shot wound, complicated with a smashed state of the bones, may sometimes be saved, without loss of his limb, by employing all the means which the resources of surgery offer? But these very resources are often wanting in a campaign; and the business of dressing the patient would occupy the surgeon several hours daily, during which his useful assistance could not be extended to other sufferers. Notwithstanding the utmost care, the removal of patients from one place to another frequently makes their wounds extremely dangerous, or fatal; and we now lose many a man, who, had he undergone amputation, would have been able to bear the journey.—(See Normen für die Ablösung grösserer Gliedmassen, p. 15, 16.)

From what I have seen of the ill effects of moving patients with bad compound fractures of the lower extremity, produced by gun-shot violence, I am convinced that, as a general rule, it is better to perform amputation; but if this be not done, and an attempt is to be made to save the member, it will be more humane, when the army is retreating, and the enemy are not savages, to leave such wounded behind, than subject them to all the fatal mischief of hastily and roughly transporting them in such a condition. It gives me particular pleasure to find the preceding sentiment confirmed by Dr. Hennen, whose knowledge and experience in military surgery entitle all his opinions to the greatest attention: in noticing what ought to be done with the wounded, when the army is compelled to retreat, he says, "it then becomes the duty of a certain proportion of the hospital staff to devote themselves for their wounded, and become prisoners of war along with them; and it may be an encouragement to the inexperienced, while it is grateful to me, to observe, that I have never witnessed, nor traced, on inquiry, an act of unnecessary severity practised either by the French or English armies on their wounded prisoners."

Compound fractures of the thigh, produced by gun-shot violence, too often have an unfavourable termination, especially when the accident has been caused by grape-shot or even a musket-ball, fired from a moderate distance, and the patient is moved from one place to another after the receipt of the injury. In the military hospital at Oudenbosch, in the spring of 1814, I had charge of about eight bad compound fractures of the thigh, of which cases only one escaped a fatal termination. This was an instance in which the femur was broken a little way above the knee. Another patient was extricated by amputation from the perils immediately arising from the splintered displaced state of the bone, the serious injury of the muscles, and enormous abscesses, but was unfortunately lost by secondary hemorrhage. All these patients had not merely been struck by grape-shot, or else by balls fired from a short distance, but they had been moved from Bergen-op-Zoom into my hospital five or six days after the receipt of the injury, the very worst period possible on account of the inflammation being then most violent. From the ill success of these cases, many a surgeon who saw them might be inclined to think that immediate amputation ought generally to be performed for all compound fractures of the thigh as soon after the receipt of the injury as possible. And such is my own sentiment, whenever the accident has been caused in the violent manner above specified, or whenever the patient must be moved any distance in a wagon after the occurrence of the injury. It may be right to state, however, that I have known more than one compound fracture of the thigh cured, where the accident had not been occasioned by gun-shot violence, and I have been informed of one or two successful cases where the bone was broken by a pistol-ball. In St. Bartholomew's hospital, two compound fractures of the thigh were pointed out to me some time ago, as cases likely to end favourably. However, these may only have been lucky escapes, deviations from what is common, and not entitled to any stress, with the view of affecting the general excellent rule of amputating where the thigh-bone is broken by gun-shot violence.

As Mr. Guthrie has accurately observed, one circumstance which increases the danger of fractures of the femur from gun-shot violence is, that the bone is very often broken obliquely, the fracture extending far above and below the point immediately struck by the ball.—(On Gun-shot Wounds, p. 189, 190.) This disposition of the thigh-bone to be splintered for several inches when hit by a ball, and the increased danger arising from the occurrence, are also very particularly commented upon by the experienced Schmucker, who was surgeon-general to the Prussian armies in the campaigns of Frederick the Great.—(See his Vermischte Chirurgische Schriften, b. 1, p. 39, 8vo. Berlin, 1785.) In several of the cases under the care of Dr. Cole and myself in Holland, the bone was split longitudinally to the extent of seven or eight inches.

According to Schmucker, all fractures of the middle or upper part of the femur are attended with great danger. "But (says he) if the fracture be situated at the lowest part of the bone, the risk is considerably less, the muscles here not being so powerful; in such a case, therefore, amputation should not be performed before every other means has been fairly tried; and very frequently I have treated fractures of this kind with success, though the limb sometimes continued stiff. But (says Schmucker) if the bone be completely fractured or splintered by a ball at its middle, or above that point, I never wait for the bad symptoms to commence, but amputate ere they originate; and when the operation has been done early enough, most of my patients have been saved. However, when some days had transpired, and inflammation, swelling, and fever had come on, I must candidly confess that the issue was not always fortunate. Yet the operation should not on this account be dispensed with; for if only a few can thus be saved out of many, some benefit is obtained, as, without this step, such few would also perish."—(Vermischte Chir. Schriften, b. 1, p. 42.) What I saw of compound fractures of the thigh, after the assault on Bergen-op-Zoom, we may remark, coincides with the results of Schmucker's ample experience; for the only two patients who survived the bad symptoms proceeding directly from the fracture were, one whose femur was broken near the knee, and another whose limb I took off on account of a fracture of the middle of the bone, accompanied with abscesses of surprising extent. The latter was a case, however, in which the limb ought to have been removed earlier. The following remarks, by Mr. Guthrie, I consider judicious and correct.

"The danger and difficulty of cure attendant on fractures of the femur from gun-shot wounds, depend much on the part of the bone injured; and in the consideration of these circumstances it will be useful to divide it into five parts. Of these, the head and neck included in the capsular ligament, may be considered the first; the body of the bone, which may be divided into three parts, and the spongy portion of the lower end of the bone exterior to the capsular ligament, forming the fifth part. Of these, the fractures of the first kind are, I believe, always ultimately fatal, although life may be prolonged for some time. The upper third of the body of the bone, if badly fractured, generally causes death at the end of six or eight weeks of acute suffering. I have seen few escape, and then not with a useful limb that had been badly fractured in the middle part. Fractures of the lower or fifth division are in the next degree dangerous, as they generally affect the joint; and the least dangerous are fractures of the lower third of the body of the bone. Of these even I do not mean to conceal, that when there is much shattered bone the danger is great, so that a fractured thigh by gun-shot, even without particular injury of the soft parts, is one of the most dangerous kinds of wounds that can occur."—(See Guthrie on Gun-shot Wounds, p. 190.)

In compound fractures, as Mr. Pott has correctly pointed out, there are three points of time when amputation may be proper. The first of these is immediately or as soon as possible after the receipt of the injury. The second is, when the bones continue for a great length of time without any disposition to unite, and the discharge from the wound has been so long and is so large that the patient's strength fails, and general symptoms foreboding dissolution come on. The third is, when a mortification has taken such complete possession of the soft parts of the inferior portion of the limb quite down to the bone, that upon the separation of such parts the bone or bones shall be left bare in the interspace,

The first and second of these are matters of very serious consideration. The third hardly requires any.

When a compound fracture is caused by the passage of a very heavy body over a limb, such, for instance, as the broad wheel of a wagon or loaded cart, or by the fall of a very ponderous body on it, or by a cannon-shot, or by any other means so violent as to break the bones into many fragments, and so to tear, bruise, and wound the soft parts, that there shall be good reason to fear that there will not be vessels sufficient to carry on the circulation with the parts below the fracture, it becomes, as Mr. Pott observes, a matter of the most serious consideration, whether an attempt to save such a limb will not occasion loss of life. This consideration must be before any degree of inflammation has seized the part, and therefore must be immediately after the accident. When inflammation, tension, and a disposition to gangrene in the limb have arisen, the period is highly disadvantageous for operating, and the patient's chances of being saved by amputation under these circumstances are much smaller than before the changes here spoken of had taken place. At the same time, there are certain examples of mortification from external causes, where, as far as one can judge from the results of later experience than that of Mr. Pott, the surgeon should not defer amputation, even though the disorder be yet in a spreading state, attended with considerable swelling and tension reaching far up the limb. This is a subject, however, which will require more explanation hereafter.—(See what is presently said on Mortification.) Nor are the cases to which reference is made meant to affect the general truth of the observation delivered by the most experienced surgeons of every age, that when a limb is extensively swelled and inflamed, with a part of it either in a state of spreading mortification or ready to become gangrenous, the period is so unfavourable for amputation that very few patients so circumstanced ever recover after the operation. Nor is it meant to be insinuated, that in the very cases which form exceptions to the general rule of not amputating before the tendency to gangrene has ceased, the patient might not have had an infinitely better chance of his life, had the operation been done immediately after the first receipt of the injury, before any disposition to gangrene had had time to be produced.

The necessity of immediate or very early decision in this case makes it a very delicate part of practice; for however pressing the case may seem to the surgeon, it will not, in general, appear in the same light to the patient, to the relations, or to bystanders. They will be inclined to regard the proposition as arising from ignorance, or an inclination to save trouble, or a desire to operate; and it will often require more firmness on the part of the practitioner, and more resignation and confidence on the part of the patient, than is generally met with, to submit to such a severe operation in such a seeming hurry, and upon so little apparent deliberation; and yet it often happens, that the suffering this point of time to pass decides the patient's fate.

This necessity of early decision arises from the quick tendency to mortification which ensues in the injured limb, and too often ends in the patient's death. That this is no exaggeration, says Pott, melancholy and frequent experience evinces, even in those whose constitutions previous to the accident were in good order; but much more in those who have been heated by violent exercise, or labour, or liquor, or who have led very debauched and intemperate lives, or who have habits naturally inflammable and irritable. This is often the case when the fracture happens to the middle part of the bones, but is much more likely to happen when any of the large joints are concerned. In many of these cases a determination for or against amputation is really a determination for or against the patient's existence.

That it would have been impossible to have saved some limbs which have been cut off, no man will pretend to say; but this does not render the practice injudicious. Do not the majority of those who get into the above hazardous condition, and on whom amputation is not performed, perish in consequence of their wounds? Have not many lives been preserved by amputation which, from the same circumstances, would otherwise most probably have been lost?

Pressing and urgent as the state of a compound fracture may be at this first point of time, still it will be a matter of choice whether the limb shall be removed or not; but at the second period the operation must be submitted to, or the patient must die.

The most unpromising appearances at first do not necessarily or constantly end unfortunately. Sometimes, after the most threatening first symptoms, after considerable length of time, great discharges of matter and large exfoliations of bone, success shall ultimately be obtained, and the patient shall recover his health and the use of his limb.

But sometimes, after the most judicious treatment through every stage of the disease; after the united efforts of physic and surgery; the sore, instead of granulating kindly, and contracting daily to a smaller

size, shall remain as large as at first, with a tawny, spongy surface, discharging a large quantity of thin sanies, instead of a small one of good matter; the fractured ends of the bones, instead of tending to exfoliate or to unite, will remain as perfectly loose and disunited as at first, while the patient shall loose his sleep, his appetite, and his strength; a hectic fever, with a quick, small, hard pulse, profuse sweats, and colliquative purging, contributing at the same time to bring him to the brink of the grave, notwithstanding every kind of assistance: in these circumstances, if amputation be not performed, Mr. Pott asks, what else can rescue the patient from destruction?

The third and last period is a matter which does not require much consideration. Too often the inflammation consequent upon the injury, instead of producing abscess and suppuration, tends to gangrene and mortification, the progress of which is often so rapid, as to destroy the patient in a very short space of time, constituting that very sort of case in which amputation should have been immediately performed. But sometimes even this dreadful malady is, by the help of art, put a stop to, but not until it has totally destroyed all the surrounding muscles, tendons, and membranes quite down to the bone, which, upon the separation of the mortified parts, is left quite bare, and all circulation between the parts above and those below is by this totally cut off. In this instance, whether the surgeon saw through the bare bone, or leave the separation to be effected by nature, the patient must lose his limb. —(See Pott's Remarks on the Necessity, &c. of Amputation in certain Cases, &c. Chir. Works, vol. 3.)

For the consideration of a variety of complicated cases which affect the question of amputation in compound fractures, I must refer to the article Gun-shot Wounds.

2. *Extensive contused and lacerated wounds.*

These form the second class of general cases requiring amputation. Wounds without fracture are not often so bad as to require this operation. When a limb, however, is extensively contused and lacerated, and its principal blood-vessels are injured, so that there is no hope of a continuance of the circulation, the immediate removal of the member should be recommended, whether the bones be injured or not. Also, since no effort on the part of the surgeon can preserve a limb so injured, and such wounds are more likely to mortify than any others, the sooner the operation is undertaken the better.

In these cases, as in those of compound fractures, though amputation may not always be necessary at first, it may become so afterward. The foregoing observations, relative to the second period of compound fractures, are equally applicable to badly lacerated wounds, unattended with injury of the bones. Sometimes a rapid mortification comes on; or a profuse suppuration, which the system can no longer endure.—(Encyclopédie Méthodique; partie Chir. t. 1, p. 80.)

3. *Cases in which part of a limb has been carried away by a cannon-ball.*

When part of a limb has been torn off by a cannon-ball, or any other cause capable of producing a similar effect, the formation of a good and serviceable stump, the greater facility of healing the clean, regular wound of amputation, and the benefit of a far more expeditious, as well as of a sounder cure, are the principal reasons which here make the operation advisable.

This was an instance, in which some former surgeons disputed the necessity of amputation. They urged as a reason for their opinion, that the limb being already removed, it is better to endeavour to cure the wound as speedily as possible, than increase the patient's sufferings and danger, by making him submit to amputation. It must be remembered, however, that the bones are generally shattered, and reduced into numerous fragments; the muscles and tendons are unequally divided, and their ends torn and contused. Now, none of the old surgeons questioned the absolute necessity of extracting the splinters of bone, and cutting away the irregular extremities of the tendons and muscles, which operations would require a longer time than amputation itself. Besides, we should recollect that, by making the incision above the injured part, so as to be enabled to cover the bone with flesh and integuments perfectly free from injury, the extent of the wound is so diminished, that the healing can be accomplished in one-third of the time which would otherwise be requisite, and a much firmer cicatrix is also obtained. Such reflections must convince us, that amputation here holds forth very great advantages. It cannot increase the patient's danger, and as for the momentary augmentation of pain which he suffers, he is amply compensated by all the benefits resulting from the operation.—(See Gun-shot Wounds.)

4. *Mortification.*

Mortification is another cause, which, when advanced to a certain degree, renders amputation indispensably proper. We have noticed, that bad compound fractures and wounds often terminate in the death of the injured limb. Such surgeons as have been determined, at all events, to oppose the performance of amputation, have pretended, that the operation is here totally useless. They assert, that when the mortification is only in a slight degree, it may be cured, and that when it has spread to a considerable extent, the patient will perish, whether amputation be performed or not. But this way of viewing things is so contrary to facts, and the experience of every impartial practitioner, that I shall make no attempt to refute the assertion. While it is allowed that it would be very bad practice, to amputate on every slight appearance of gangrene, it is equally a fact, that when the disorder affects the substance of a member, the operation is generally the safest and most advantageous measure. Nay, there are, as we shall presently see, certain forms of mortification, in which the early performance of amputation is the only chance of saving the patient.

Practitioners have entertained very opposite opinions, concerning the period when one should operate in cases of mortification. Some pretend, that whenever the disorder presents itself, and especially when it is the effect of external violence, we should amputate immediately the mortification has decidedly begun to form, and while the mischief is in a spreading state. Others believe, that the operation should never be undertaken before the progress of the disorder has stopped, even not till the dead parts have begun to separate from the living ones.

The advocates for the speedy performance of amputation declare, that the farther progress of the mortification may be stopped, and the life of the patient preserved, by cutting above the parts affected. However, according to the reports of the greater number of eminent surgical writers, this practice is highly dangerous, and undeserving of confidence. Whatever pains may be taken, in the operation, only to divide sound parts, there is no certainty of succeeding in this object, and the most skilful practitioner may be deceived. The skin may appear to be perfectly sound and free from inflammation, while the muscles which it covers, and the parts immediately surrounding the bone, may actually be in a gangrenous state. But even when the soft parts are found free from apparent distemper, on making the incision, still, if the operator should not have waited till the mortification has ceased to spread, the stump will almost always be attacked by gangrene. Surgeons who have had opportunities of frequently seeing wounds which have a tendency to mortify, entertain the latter opinion. Such was the sentiment of Pott, who says that he has often seen the experiment made, of amputating a limb in which gangrene had begun to show itself, but never saw it succeed, and it invariably hastened the patient's death.

The operation may be postponed, however, too long. Mr. S. Sharp, in particular, recommended too much delay, advising the operation never to be done, till the natural separation of the mortified parts had considerably advanced. Mr. Sharp was a surgeon of immense experience, and his authority carries with it the greatest weight. But, perhaps, he was too zealous in his opposition to a practice, the peril of which he had so often beheld. When the mortification has ceased to spread, there is no occasion for farther delay. We now obtain, just as certainly, all the benefits of the operation, and get rid of a mass of putridity, the exhalations from which poison the atmosphere which the patient breathes, and are highly detrimental to his health. Nay, according to the reports of writers, patients in these circumstances may actually fall victims to the absorption of the putrid matter which is suffered to remain too long. However, this danger would not be

so considerable as that which would arise from too precipitate an operation; and it is better to defer amputation a little more than is absolutely requisite, than run any risk of doing the operation before it is certain that the parts have lost their tendency to gangrene.

In the article Mortification, we have noticed particular cases of gangrene, where, according to Larrey's experience, the surgeon is not to wait for the line of separation being formed, but have recourse to the immediate performance of amputation. The experience of Mr. Lawrence tends also to confirm the propriety of such practice.—(See Medico-Chir. Trans. vol. 6, p. 156, &c.)

In an example, where a large part of the arm was deeply affected with gangrene from external violence, and the disorder was yet making rapid progress, I once recommended the performance of amputation at the shoulder-joint. On the whole this instance was favourable to the practice; for, though the patient died at the end of a fortnight, probably he would not have lived twenty-four hours, had the operation not been done; nor was the stump attacked with mortification, a circumstance worthy of attention, because it is a danger particularly insisted upon by the opponents of amputation, under the preceding circumstances; and, had it not been for a large abscess, which formed in the back, as was supposed, from a violent blow received in the fall which produced the original injury, there were well-grounded hopes of recovery. The patient, here spoken of, was attended by Dr. Blicke, of Walthamstow.

There is likewise a species of gangrene, which is pointed out by Mr. Guthrie as requiring early amputation. "A soldier (says he) shall receive a flesh-wound from a musket-ball in the middle of the thigh, which passed through the limb apparently, on a superficial inspection, without injuring the main artery; or it shall pass close behind the femur, where the artery turns to the back part of the bone; or it may go through the middle of the bone, from behind forwards, between the condyles of the femur, into the knee-joint, and the patient shall walk to the surgeon with little assistance, be superficially dressed, and, in many cases be considered slightly wounded; yet the femoral artery and vein of the whole of these cases, and, indeed, in many others, shall be wounded, or cut across, and the local inflammation be so slight as to obtain little attention. On the third or fourth day, the patient shows his toes discoloured, and complains of pain and coldness in the limb below the wound, the constitution begins to sympathize with the injury, and the surgeon probably thinks the case extraordinary. Perhaps he suspects the real state of the injury; but is surprised that a wound of the femoral or popliteal artery, with so little attendant injury, could cause mortification, &c. He is anxious to do something; but mortification, or at least gangrene, having commenced, he must, according to general rule, await the formation of the line of separation. The temperature of the leg, a little above the gangrene, is good, perhaps higher than natural; he hopes it will not extend farther, and it probably does remain stationary for a little time. At last, the parts originally affected, the toes, become sphacelated, and gangrene quickly spreads up the leg as far as the wounded artery, by which time the patient dies."

For the purpose of preventing such a disaster, where the artery, or artery and vein, have been divided, Mr. Guthrie recommends the performance of amputation as soon as the gangrene is perceived to extend beyond the toes; and the swelling and slight attendant inflammation, which is marked more by the tumefaction, than the redness of the part, has passed higher up than the ankle.—(See Guthrie on Gun-shot Wounds, p. 60, 61.)

5. *White swellings.*

Scrofulous joints, with diseased bones, and distempered ligaments and cartilages, is another case, in which amputation may become absolutely necessary. As Mr. Pott remarks, there is one circumstance attending this complaint, often rendering it particularly unpleasant, which is, that the subjects are most frequently young children, so as to be incapable of determining for themselves, which inflicts a very distressing task on their nearest relations. All the efforts of physic and surgery often prove absolutely ineffectual, not only to cure, but even to retard, the disease in question. Notwithstanding many cases admit of cure, there are numerous others which do not so. The disease often begins in the very inmost recesses of the cellular texture of the heads of the bones forming the large articulations, such as the hip, knee, ankle, and elbow; the bones become diseased, in a manner which we shall explain in the article Joints, sometimes with great pain and symptomatic fever; sometimes with very little of either, at least in the beginning. The cartilages covering the ends of these bones, and designed for the mobility of the joints, are totally destroyed; the epiphyses in young subjects are either partially or totally separated from the said bones; the ligaments of the joints are so thickened and spoiled by the distemper, as to lose all natural appearance, and become quite unfit for all the purposes for which they were intended: the parts appointed for the secretion of the synovia become distempered in like manner; all these together furnish a large quantity of stinking sanious matter, which is discharged either through artificial openings, made for the purpose, or through small ulcerated ones. These openings commonly lead to bones which are diseased through their whole texture. When the disease has got into this state, the constant pain, irritation, and discharge bring on hectic symptoms of the most destructive kind, such as total loss of appetite, rest, and strength, profuse night-sweats, and as profuse purgings, which foil all the efforts of medicine, and bring the patient to the brink of destruction.

It is an incontestable truth, that unless amputation be performed, a patient thus situated must perish; and it is equally true, that numbers, in the same circumstances, by submitting to the operation, have recovered vigorous health.—(See Pott on Amputation.)

It is a fact, highly important to be known, that in these cases amputation is attended with more success, when performed late, than when undertaken at an early period, before the disease has made great advances. This is particularly fortunate, as it affords time for giving a fair trial to such remedies as are best calculated to check the progress of the disorder, and obviate all necessity for the operation.—(Encyclopédie Méthodique, tom. 1, p. 83. See Joints, White Swelling.)

6. *Exostoses.*

Here it will be sufficient merely to mention, that this disease may render amputation necessary, when the tumour becomes hurtful to the health, or insupportable, on account of its weight or other circumstances, and cannot be removed by any of the plans specified in the article Exostoses.

7. *Necrosis.*

Another distemper, sometimes producing a necessity for amputation, is necrosis, or the death of the whole, or of a very considerable part, of the bones of the extremities, accompanied with such extensive abscesses, such disease of the soft parts, such disorder of the constitution and prostration of strength, that every hope of a cure being effected by a natural process must be renounced. By necrosis, is here meant, not merely some disease which destroys the surface of a bone, but one which extends its depredations to the whole of the internal substance, and that from end to end. Portions of the bones die from a variety of causes, such as struma, lues venerea, deep-seated abscesses, pressure, &c.; and bones in this state, when properly treated, often exfoliate and cast off their dead parts. But when the whole substance of a bone becomes diseased from end to end, frequently no means will avail. In the words of Mr. Pott, the use of the scalpel, the raspatory, and the rugine, for the removal of the diseased surface of bones; of the trephine, for perforating into the internal texture of the diseased bone, and of exfoliating applications (if there be any such which merit the name), will prove in many instances unavailing, and, unless the whole bone be removed by amputation, the patient will die. Mr. Pott's refutation of Bilguer, who asserts that amputation is not requisite in these instances, is a masterly and most convincing production; but I would not exactly do as the former of these writers has done, and positively affirm, that every extensive necrosis, affecting a bone nearly its whole length, must inevitably require amputation. The power of nature in restoring the bones is sometimes wonderful, as will be hereafter explained.—(See Necrosis.)

The very late period at which an extensive necro-

sis may follow the injury of a bone, and make amputation necessary, is sometimes almost incredible. Schmucker details the case of a captain who received a musket-ball through the left arm, four or five inches above the elbow. The bone was violently struck, but not broken; several exfoliations followed, and after more than a year's treatment, the patient appeared perfectly cured. For nine years this officer remained well; but at the end of this time, being on a journey, he was attacked with pain and inflammation in the wounded part, and febrile symptoms. He hastened to Berlin, and put himself under the care of Theden and Schmucker, who found an abscess in the situation of the former wound, and as an opening had been already made, the bone could be felt stripped of its periosteum. At length a piece of bone exfoliated, and became loose, precisely under the brachial artery, which interfered with its removal. Notwithstanding the discharge, the elbow-joint continued swelled, and there were red points observable, not only above that joint, but also over the heads of the ulna and radius, indicating disease of those bones. Amputation was therefore performed by Theden, and the patient got quite well. On examining the os brachii, a splinter was found, three inches in length, and one in breadth, its edges being thin and sharp, while its centre was more than three lines thick. The bone, every where about the place where it had been struck by the ball, seemed to consist of callus without any medullary cavity, and the whole of it down to the elbow had no periosteum. The cartilage appeared also disposed to separate, and the periosteum was detached from the radius and ulna, which were likewise affected with necrosis.—(See Schmucker's Vermischte Chir. Schriften, b. 1, p. 23, ed. 2.)

8. *Cancerous and other inveterate diseases, such as fungus hæmatodes.*

Cancerous, inveterate diseases, and malignant incurable ulcers on the limbs, sometimes render amputation a matter of necessity. In treating of cancer, we shall remark that little or no confidence can be placed either in internal or any kind of topical remedies, and that there is nothing, except the total separation of the part affected, upon which any rational hopes of cure can be built. Cancer is not frequently seen on the extremities. Every man of experience, however, must occasionally have seen, in this situation, if not actually cancer, diseases quite as intractable, and which cannot be cured except by removing the affected part. This may often be accomplished without cutting off the whole limb. But when the disease has spread beyond certain bounds, amputation above the part affected is the only thing to which recourse can be had with any hope of success. Sometimes, when the operation has been delayed too long, even amputation itself will not effect a cure. In a few cases of fungus hæmatodes, the operation has succeeded, however, after the disease had reappeared, and a cure had been seemingly achieved by the excision of the diseased parts. Yet, from what I have seen of fungus hæmatodes, I should much doubt whether the benefit obtained by amputation would be lasting; as when this disease shows itself only externally, internal organs are mostly at the same time similarly affected.—(See Fungus Hæmatodes.)

Besides cancerous, there are other ulcers, which may render amputation indispensable. Thus, when an extensive ulcer, of any sort whatsoever, is evidently impairing the health; when, instead of yielding to remedies, it becomes larger and more inveterate; when, in short, it puts life in imminent danger; amputation should be advised.

9. *Various tumours.*

That there are numerous swellings, which destroy the texture of the limbs, rendering them useless; causing dreadful sufferings, and bringing the patients into the most debilitated state, no man of observation can fail to have seen. When such tumours can neither be dispersed nor cut out with safety, amputation of the limb is the only resource.

Mr. Pott has particularly described a tumour affecting the leg, for which the operation is sometimes requisite. It has its seat in the middle of the calf of the leg, or rather more towards its upper part, under the gastrocnemius and soleus muscles. It begins by a small, hard, deep-seated swelling, sometimes very painful, sometimes but little so, and only hindering the patient's exercises. It does not alter the natural colour of the skin, at least until it has attained a considerable size. It enlarges gradually, does not soften as it enlarges, but continues through the greatest part of it incompressibly hard, and when it is got to a large size, it seems to contain a fluid, which may be felt towards the bottom, or resting, as it were, on the back part of the bones. If an opening be made for the discharge of this fluid, it must be made very deep, and through a strangely distempered mass. This fluid is generally small in quantity, and consists of a sanies mixed with grumous blood; the discharge of it produces very little diminution of the tumour, and very high symptoms of irritation and inflammation come on, and, advancing with great rapidity, and most exquisite pain, very soon destroy the patient, either by the fever, which is high and unremitting, or by a mortification of the whole leg. If amputation has not been performed, and the patient dies after the tumour has been freely opened, the mortified and putrid state of the parts prevents all satisfactory examination; but if the limb was removed, without any previous operation (and which Mr. Pott, in his experience, found to be the only way of preserving the patient's life), the posterior tibial artery will be found to be enlarged, distempered, and burst; the muscles of the calf to have been converted into a strangely morbid mass; and the posterior part of both the tibia and fibula more or less carious.—(Pott on Amputation.)

It seems only necessary to adduce another species of tumour to illustrate the necessity of amputation. The following case is related by Mr. Abernethy. A woman was admitted into St. Bartholomew's Hospital with a hard tumour in the ham. It was about four inches in length, and three in breadth. She had also a tumour in front of the thigh, a little above the patella, of less size and hardness. The tumour in the ham, by its pressure on the nerves and vessels, had greatly lessened the sensibility, and obstructed the circulation of the leg, so that the limb was very œdematous. As it appeared impossible to remove this tumour, and its origin and connexions were unknown, amputation was performed. On examining the amputated limb, the tumour in the ham could only be divided with a saw. Several slices were taken out of it by this means, and appeared to consist of a coagulable and vascular substance, in the interstices of which a great deal of bony matter was deposited. The remainder of the tumour was macerated and dried, and it appeared to be formed of an irregular and compact deposition of the earth of bone. The tumour on the front of the thigh was of the same nature as that of the ham, but contained so little lime, that it could be cut with a knife. The thigh-bone was not at all diseased, which is mentioned, because, when bony matter is deposited in a limb, it generally arises from the disease of a bone.—(Surgical Observations, 1804.)

Before the late facts and improvements relative to the treatment of aneurisms, these cases, on the extremities, were generally set down as requiring amputation. Even Mr. Pott, and J. L. Petit, wrote in recommendation of such practice, and their observations on this subject are among the few parts of their writings which the enlargement of surgical knowledge, since their time, has rendered objectionable. The surgeon to whom the honour of first correcting this erroneous doctrine belongs is A. N. Guenault, who opposed the advice delivered on this subject by Petit.—(Haller, Disp. Chir. vol. 5, p. 155.)

I shall conclude these remarks on the cases requiring amputation, with advising surgeons never to undertake this serious operation, without consulting the opinions of other professional men, whenever their advice can be obtained. The best operators are often deficient in that invaluable kind of judgment by which the cases absolutely demanding amputation are discriminated from others, in which the operation may be wisely postponed, and a chance taken of preserving the limb.

Historical remarks on Amputation.

The history of amputation evinces that the steps of surgery to perfection are slow, and that they even sometimes deviate from the straight path, though upon all essential points no retrogration has ever taken place. Here nature has acted as the guide, and the surgeon's chief merit has consisted in obeying the

hints which she herself has thrown out. As already mentioned, the following natural occurrence, no doubt, was one of the circumstances which first led to the bold practice of amputation: in consequence of disease and grievous local injuries, whole limbs were sometimes seized with mortification. In the majority of cases, this was attended with so much constitutional disturbance that the patients died; but in other less numerous instances, the mortification was confined to the part; suppuration was established between the dead and living parts; the whole of the mortified limb fell off; the suppurating surfaces healed up; and thus, by the powers of nature, the patients were restored to health. Here was clearly proved the possibility of recovery, notwithstanding the loss of a limb. The surgeon, as Brünninghausen remarks, viewed with surprise this course of nature, and hardly ventured to promote it by the feeble means formerly employed, which, however, were not really needed. But as the mortified parts, previously to their detachment, caused great annoyance by their fetor, a surgical attempt was at length made to get rid of them; in doing which the knife was always kept from touching the living flesh, on account of a well-grounded fear of bleeding, for the suppression of which no effectual methods were known. Such was the practice that prevailed from Hippocrates down to Celsus.—(Erfahr. &c. über die Amp. p. 14.) "Partes autem corporis, quæ infra terminos denigrationis fuerint, ubi jam prorsus emortuæ fuerint et dolorem non senserint, ad articulos auferendæ ea cautione ut ne vulnus inferatur," &c.—(De Articulis, sect. 6.) Here we find that the earliest mode of amputation was that done at the joints.

A. C. Celsus, who lived in the reign of Tiberius, and whose book, De Re Medicâ, should be read by every surgeon, has left us a short description of the mode of amputating gangrenous limbs.—(Lib. 7, c. 33.) It has been often remarked, that Celsus has left no instructions for securing the divided blood-vessels; but it has not been commonly noticed, that in his chapter on wounds he directs us to stop hemorrhage by taking hold of the vessels, then tying them in two places and dividing the intermediate portion. If this measure cannot be adopted, he advises the use of a cauterizing iron. Several hints are to be met with in the writings of Celsus, from which it may be inferred that the ligature of bleeding vessels was sometimes practised at the early age in which he lived; and this supposition is strengthened by a fragment of Archigenes preserved by Cocchius, on the subject of amputation, where he speaks of tying or sewing the blood-vessels. We are not, however, in possession of all the writings of medical authors prior to the time of Galen, and must therefore remain in doubt upon this point.—(Rees's Cyclopædia, art. Amputation.)

This anonymous writer argues, therefore, with some appearance of reason, that if amputation often proved fatal in the days of Celsus, "sæpe in ipso opere," as the expression is, it was owing to the want of some efficacious method of compressing the blood-vessels during the operation itself; for whether the use of the ligature were known to the ancients or not, no doubt exists about their ignorance of the tourniquet.

But admitting that the ancients were not altogether uninformed of the plan of tying arteries, it cannot be credited that they adopted the practice to any extent; for if they had, they would not have continued so partial to the cautery, boiling oils, and a farrago of astringent applications. They would also never have had recourse to the barbarous method of cutting the flesh with a red-hot knife, with the view of stopping the hemorrhage by converting the whole surface of the stump into an eschar. Painful in its execution and horrid in its consequence as this burning operation was, it seldom proved a lasting antidote to the bleeding, which generally came on in a fatal manner, as soon as the sloughs were loose. On this part of the subject my own ideas fully agree with those of a distinguished foreign surgeon, who says, that although the document left us may prove that the ligature was known to the ancients, and employed in cases of aneurisms and wounded blood-vessels, nay, that the arteries were secured with a needle and ligature; yet the practice could not have been extended to the operation of amputation, since, with the custom of making the incisions in the dead parts, the method scarcely admitted of being put in execution.—(Brünninghausen, Erfahr. über die Amput. p. 29.) Ambrose Paré, therefore, seems to me to deserve as much praise for the introduction of the ligature into common use, as if no allusion to this method whatsoever had existed in the writings of Celsus and other ancients.

The different parts of the operation meriting particular attention are, the choice of the part of the limb where the incisions are to begin; the measures for guarding against bleeding during the operation; the division of the integuments, muscles, and bones, which is to be accomplished in such a manner that the whole surface of the stump will afterward be covered with skin; tying the arteries, which should be done without including the nerves or any other adjacent part; placing the integuments in a proper position after the operation; and, finally, the subsequent treatment of the wound.

At the period of making the incision, the ancients contented themselves with having the skin forcibly drawn upwards by an assistant; they next divided, with one sweep of the knife, the integuments and flesh down to the bone, and afterward sawed the bone on a level with the soft parts, which were drawn upwards. Celsus considered it better to let the incision encroach upon the living flesh than leave any of the diseased parts behind. "Et potius ex sanâ parte aliquid excidatur, quam ex ægrâ relinquatur."—(De Medicinâ, lib. 7, c. 33.)

It appears, however, that his views extended farther than those of most of his contemporaries, and even his followers, almost downto modern times. After cutting the muscles down to the bone, he says that the flesh should be reflected and detached underneath with a scalpel, in order to denude a portion of the bone, which is then to be sawn as near as possible to the healthy flesh which remains adherent. He states, that when this plan is pursued, the skin around the wound will be so loose that it can almost be made to cover the extremity of the bone. It is to be lamented that this advice, inculcated by Celsus, should not have been comprehended, or that it should have been so neglected as to stand in need, as it were, of a new discoverer, and that a suggestion of such importance should have remained so long useless. But the fact is, hemorrhage formerly rendered amputation so dangerous, that the ancient surgeons could not devote much attention to any thing else in the operation, and practitioners amputated so seldom, that we read in Albucasis that he positively refused to cut off a person's hand, lest a fatal hemorrhage should ensue, and the patient did it himself and recovered. Over that part of the stump which the small quantity of preserved skin would not cover, Celsus recommended compresses, and a sponge dipped in vinegar to be laid.—(De Re Medicâ, lib. 7, c. 33.)

Archigenes, who was born at Apamia, in Syria, was the disciple of Agathinus, and physician to Philip, king of that country. He repaired to Rome, where he practised physic and surgery in the reign of the emperor Trajan, about 108 years after the birth of Christ.—(Portal, Hist. de l'Anatomie et de la Chirurgie, vol. 1, p. 61.) In the history of amputation the name of Archigenes is conspicuous, not only because he is supposed to have been acquainted with the use of the needle and ligature for the stoppage of bleeding, but because his description of the operation is in some respects more minute than that of Celsus. For the hindrance of loss of blood in the operation, says Sprengel (Geschichte der Chir. b. 1, p. 404, Halle, 1805), he first of all tied up the vessels, and often the whole limb, over which he also sprinkled cold water. The integuments were then drawn upwards from the wound, and confined there with a band; and after the limb was off, he cauterized the stump, and applied folded compresses. The band was now loosened and a mixture of leeks and salt laid on the stump, to which were also applied oil and cerate.—(Nicet, Coll. Chir. p. 155.) Such was likewise the practice of Heliodorus, who thus early made objections to the plan of cutting off a limb by a single stroke, a proposal that was renewed in far later days. The same author has also spoken of amputating at the joints; a method of which he disapproves.—(Nicet, Coll. Chir. p. 155.) However, Galen entertained a favourable opinion of it, on account of its safety and expedition.—(Comm. 4, in lib. de artic. p. 650.) Galen's precepts concerning amputation are, upon the whole, very like those given by Hippocrates; for he directs only dead parts to be cut, and the stump to be caute-

rized.—(De Arte Curativâ ad Glauconem, lib. 2.) By all the old writers, amputation was entirely restricted to cases of mortification; farther they were afraid to go; and this precept, and all the other doctrines of Galen, may be said to have been the guide of the whole surgical profession for full fourteen centuries.

The timid Arabians were not partial to amputation, and even in cases of mortification generally preferred a farrago of useless applications, like Armenian bole, &c. Paulus Ægineta, like Galen, deviated from Celsus's good rule of making the incisions in the healthy parts, and only approved of making the requisite division near them.—Lib. 4, c. 19, p. 140.) Avicenna, however, repeated the directions left by the Greek writers (Can. lib. 4. Fen. 3, tr. 1, p. 454), and Abu'l Kasem proposed doing the operation with a red-hot knife.—(Chirurg. lib. 1, sect. 52, p. 99.) In the middle ages, little was done for the improvement of amputation. In the 14th century gunpowder was invented, and soon applied to the purposes of war, so that an abundance of cases must have presented themselves in which the wise maxim of not deferring amputation until mortification had come on, but of preventing the mischief by the operation, ought to have struck an intelligent surgeon. One might also expect that practitioners would now have been led to make the incisions in the sound flesh. Unfortunately, the invention of gunpowder and its immediate consequences in surgery, happened at a period when practitioners were ill qualified to profit by the new lessons of experience set before them. The writings of their predecessors furnished them with no directions how they ought to act, and they were themselves too much confounded at the sight of the mischief for which they were consulted, to be able to form any correct opinion about causes and effects. Their first idea was, that the terrible symptoms proceeded from the parts being actually burned, and they afterward inclined to the belief that gun-shot wounds were poisoned. Hence the most absurd modes of treatment were instituted, and, as Brünninghausen expresses himself, human nature groaned under a new evil, for which there were for some time no true plans of relief.—(Erfahr. &c. über die Amp. c. 19.) This deplorable state was the natural result of the depression of science in general, and of the healing art in particular, in the days to which I now refer. In these middle ages, as they are called, the population of all Europe was plunged in the deepest ignorance; and whatever little knowledge remained, either of the arts or languages, was monopolized by the priesthood, the physicians of those times, who, instead of studying the volume of nature, wasted most of their time in discussing the doctrines of Galen. Surgery itself sunk to the lowest ebb, as may be well conceived from the decrees issued at Rheims by Pope Boniface the Eighth, forbidding any of the clergy to do any thing themselves which drew blood; and of course all the operative part of surgery, that which required the most skill and science, was transferred to a set of illiterate, low-bred mechanics, far inferior to the worst country farriers of modern times. Yet the clergy, who were here scrupulously averse to soiling their own hands with blood, or hurting their own tender feelings by viewing the agony of their fellow-creatures submitted to operations, had no hesitation in taking the chief emoluments and honours of the profession, or in turning over these poor sufferers to men more qualified to torture and murder than to give relief; and, what nearly staggers all credulity, the same professors of Christianity, who shuddered to spill a drop of blood themselves on a proper occasion, as Haller observes, eagerly had a hand, and acted an important part, in every sanguinary war, where it was possible for them to interfere. In these dismal days of surgery, the advice delivered by Celsus was renewed by Theodoricus, who used to administer opium and hemlock previously to the operation, for the purpose of rendering the patient less sensible to pain, and afterward vinegar and fennel were given, with the view of dispersing the intoxicating effects of the preceding medicines.—(Chirurg. lib. 3, c. 10.)

The renowned Guido di Cauliaco was the inventor of the plan of taking off limbs without any bloodshed. It is better, says he, for the limb to drop off than be cut off; as in the latter circumstance the conduct of the surgeon is viewed with spite, because it is supposed that the part might have been saved. Guido's practice consisted in covering the whole membrane with pitch-plaster, and applying round one of the joints so tight a band, that the parts below the constriction ultimately dropped off.—(Chirurg. tr. 6, Doctr. 1, cap. 8.) As Sprengel next observes, the method of amputating suggested by Celsus was again revived by Gersdorf, who after the operation not only drew down over the stump the skin which had been retracted, but applied a hog's or bullock's bladder over the stump, so as to render all burning and stitching of the parts needless.—(Feldbuch der Wundarzn. fol. 63.) Bartholomew Maggi also endeavoured to preserve a considerable flap of integuments for covering the stump.—(De Vulner. bombard. et sclopet. 4to. Bonon. 1552; see Sprengel's Geschichte der Chirurgie, p. 404. 406, 8vo. Halle, 1805.)

At length, in the 15th century, the revival of learning occurred first in Italy. Men now began to think for themselves again, and physicians turned from compilations and scholastic nonsense to the consideration of nature. Anatomy was cultivated with great ardour, and made brilliant progress under the eminent characters of the time: De la Torre, Berengarius Carpi, Vesalius, Fallopius, Eustachius, and others, who were also for the most part very distinguished surgeons. "In Italia scientiarum matre medici se nunquam chirurgia abdicarunt. Seculo 15 et 16, professores medici academiæ Bononiensis, Patavinæ, et aliarum in Italia illustrium scholarum et manu curaverunt, et consilio, et inter istos viros summi chirurgi exstiterunt.'—(Haller, Bibl. Chir. b. 1, p. 161.) Practitioners now ventured to amputate limbs in the sound part for other incurable diseases besides mortifications; but the art of stopping hemorrhage after the operation continued imperfect. Though the method of applying the ligature in cases of wounded arteries and aneurisms was understood, yet from some unaccountable causes the practice was never thought of in amputations. Even Fallopius knew of no other means for stopping the bleeding but the cautery.—(De Tum. prætern. p. 665.) On the whole, the stoppage of bleeding was not attended with a degree of success proportionate to the advances of the healing art in general. Straps, bands, and compresses were indeed put round the member; but as the circulation of the blood was not yet correctly known, they were not applied in the proper places, being arranged either close to the wound, or several of them put at random round the limb. The effects of such immoderately tight, long-continued constriction could be nothing less than gangrene; and hence the actual cautery was still chiefly employed. The other means for suppressing hemorrhage scarcely merit the name. Terrified at the insecurity and ill consequences of such expedients, J. de Vigo (Practica in Chirurgia Copiosa, 491, Romæ, 1514), and Fabricius ab Aquapendente (Op. Chir. Venet. 1619), disapproved of amputating in the sound flesh, and returned to the principle inculcated by the ancients, of making the incision in the mortified parts. Others endeavoured to lessen the peril of the bleeding by the rapidity with which the limb was removed, and the instantaneous application of the cautery. For this purpose L. Botalli invented a sort of guillotine, by means of which a member was severed from the body in an instant (De Curandis vulneribus sclopetorum, Lugd. 1560), while others laid a sharp axe upon the limb, and effected the dismemberment by the blow of a wooden mallet. An example of this barbarous practice is recorded by Fabricius Hildanus, called by his countrymen the patriarch and ornament of the German surgery. In consequence of this fear of bleeding, before he knew of the use of the ligature, he was himself accustomed to amputate with a red-hot knife, the representation of which is given in his work.—(De Gangræna et Sphacelo, Op.) Hildanus became a better surgeon, however, as he grew older, and in the end partly contributed to the improvement of amputation, inasmuch as he made the incisions completely in the sound parts, and adopted the method of tying the arteries, as then recently proposed by Paré; but, unfortunately, in weak persons he still preferred the actual cautery to the ligature.—(Op. p. 814.) One of his inventions was a linen bag or cap for the stump; and a sort of retractor for holding back the muscles. According to Sprengel (Geschichte der Chir. b. 1, p. 407), his observations on the pain following the operation are interesting.—(Op. p. 807. 814.)

Ambrose Paré, a French surgeon, who flourished in the 16th century (Opera, Parisiis, 1582), and to whom I have already alluded, made some beneficial innova-

tions with regard to the operation of amputation. It is to his industry, good sense, and skill that we are chiefly indebted for the abolition of cauterizing instruments, and the general use of a needle and ligature for the suppression of the bleeding.—(Lib. 6, c. 28, p. 224.)

An anonymous writer has given the following account of the practice and opinions of this distinguished surgeon in relation to amputation. "Paré recommended to cut off the whole of the gangrenous part if the limb be mortified, but to encroach as little as possible upon the living flesh. At the same time, he laid it down as a rule not to leave a very long stump to an amputated leg; because the patient could more conveniently make use of a wooden leg, with the stump only five finger-breadths long below the knee, than if much more of the flesh were to be preserved. In the arm, however, he left the whole of the living and healthy portion of the member, only separating the diseased part from the sound.

In preparing for amputation, he directs the skin and muscles to be drawn upwards, and bound tight with a broad bandage a little above the part where the incision is to be made. This fillet was intended to answer a threefold purpose:—1st, to afford a quantity of flesh for covering the bone, and facilitating the cure; 2dly, to close the extremities of the divided blood-vessels; 3dly, to dull the patient's feelings by pressure on the subjacent nerves. When this firm ligature has been applied, Paré directs an incision to be made down to the bone, either with a common large scalpel or a curved knife. Then with a smaller curved knife we are carefully to divide the muscle or ligament remaining between the bones of the forearm or leg; after which we may proceed to saw off the bone as high as possible, and to remove the asperities occasioned by the saw.

With the assistance of a curved pair of forceps he drew out the extremities of the bleeding arteries, either by themselves alone, or with some portion of the surrounding flesh, to be firmly tied with a strong double thread. He now loosened his bandage, brought together the lips of the wound over the face of the stump, and kept them as close as he could without actual stretching, by means of four stitches or sutures. If the larger tied vessels should accidently become loose, he desires the ligature or bandage to be again passed round the limb; or else, what is better, to let an assistant grasp the limb firm with both hands, and press with his fingers over the course of the bleeding vessel, so as to stop the hemorrhage; then with a square edged needle, about four inches long, and a thread four times doubled, the surgeon must secure the artery in the following manner. Thrust the armed needle into the outside of the flesh, half a finger's breath from the vessel which bleeds, and bring it out at the same distance from the bleeding orifice; then surround the vessel with the ligature, pass it back again to within one finger's breadth of the place where it first entered, and tie a fast knot upon a folded slip of linen rag to prevent its hurting the flesh. By this means, says Paré, the orifice of the artery will be agglutinated to the adjoining flesh so firmly, as not to yield one drop of blood; but if the hemorrhage were not considerable, he contented himself with the application of astringent powders, &c.

Thus did this famous surgeon endeavour, by his single example and precepts, to exclude the barbarous use of hot irons in amputation. He says, he knew not of any such practice among the old surgeons; except that Galen recommended us to tie bleeding vessels towards their origin in accidental wounds: and he thought proper to do the same in cases of amputation. But in an apology at the end of his book, Paré has quoted in his own defence a dozen authors who employed or recommended the ligature before him; and he might have cited many more.

From the statement we have here given, it may be seen how far the best writers of almost every country have erred in ascribing the original invention of tying arteries to Ambrose Paré. Great merit, indeed, was due to him for the part he took in extending, and even reviving, this incomparable practice: nay, it is not certain whether any one before him had ever applied the needle and ligature in similar cases, that is, after amputation; but how very wide of the truth Mr. John Bell's recent account of this matter is, will appear to every person who will inquire into the facts themselves; for not only were ligatures and needles in use among the ancients, but likewise the tenaculum or hook to lay hold of the bleeding vessels, when they had buried themselves in the muscles. We refer our inquisitive readers to Avicenna, Ætius Albucacis, Brunus, Theodoric, Guido di Cauliaco, John de Vigo, L. Bertapaelia, Tagaultius, Petrus Argillata, Andreas a Cruce, &c. &c., where they will find enough to satisfy them on this head."—(Rees's Cyclopædia, art. Amputation.)

I shall not here expatiate upon the ill-treatment which Paré experienced from the base and ignorant Gourmelin; nor upon the slowness and reluctance with which the generality of surgeons renounced the cautery for the ligature. These circumstances may be conceived, from what has been already stated. Suffice it to add, upon the authority of Dionis, that almost 100 years after Paré, a button of vitriol was ordinarily employed in the Hôtel-Dieu at Paris for the stoppage of hemorrhage after amputations. And Dionis was the first Frenchman who openly taught and recommended Paré's method. This happened towards the close of the 17th century, while Paré lived towards the end of the 16th.—(Dionis, Cours d'Opérat. Paris, 1707.)

As Paré, like the rest of the old surgeons, used to cut directly down to the bone, many of the stumps which he made must have been badly covered with flesh, and ill-fitted for bearing pressure. But all that I have read on the subject of amputation impresses me with a strong conviction, that in former times the projection of the end of the bone, the sugar-loaf form of the stump, the frequent exfoliations, and the difficulty in healing the part and keeping it healed, were as much owing to the mischief done with the cautery, the rude way of dressing the stump, and ignorance of the right method of promoting union by the first intention, as to the mode of operating or any other circumstance.

By many surgeons, however, the tying of arteries continued to be deemed too troublesome, and hence they persisted in the barbarous use of the actual cautery: of this number were Pigrai (Epitome des Preceptes de Med. et de Chir. 8vo. Rouen, 1642), F. Plazzoni (De Vuln. Sclopet. 4to. Venet. 1618), and P. M. Rossi (Consult. et Observ. 8vo. Francof. 1616). Nay, so difficult was it to eradicate the blind attachment to the ancients, that Theodorus Baronius, a professor at Cremona, publicly declared, in 1609, that he would rather err with Galen than follow the advice of any other person; and Van Hoorne seems even to have countenanced the detestable machine of Botalli.—(Μικροτέχνη, p. 75.)

What, asks Brünninghausen, was the reason why the ligature of the arteries, which is now regarded by the surgeons of all civilized nations as the best, easiest, and safest method of stopping hemorrhage after amputation, should so long have remained unadopted? Besides the prejudice for the opinions of the ancients, already mentioned, another cause was undoubtedly the imperfect knowledge of the circulation of the blood, a correct description of which was first delivered by the immortal Harvey early in the 17th century.—(Exercitatio Anat. de Motu Cordis et Sanguinis in Animalibus. Francof. 1628.) For some time this grand discovery met with violent opposition; but after it had been acknowledged as an eternal truth, a happy application of it was made to surgery by a French surgeon, named Morell, who, at the siege of Besançon, in 1674, invented the field tourniquet, by means of which more certain pressure was made on the trunk of the artery. By this simple invention, founded, however, on a knowledge of the circulation, the surgeon could at option let the blood of the stump spirt out, or stop its jet entirely; and now both during and after the operation, he was first enabled to command the hemorrhage, and coolly and judiciously employ whatever measures were indicated; for the most powerful bandages and pressure previously in use either stopped the circulation in the whole limb, or could not be made to have the right effect with sufficient quickness.—(Brünninghausen, Erfahr. &c. über die Amp. p. 36.) Morell's tourniquet, however, was very imperfect, and it was not till the year 1718, that J. L. Petit, whose name shines so brightly in the history of surgery, invented the kind of tourniquet now employed.

Richard Wiseman, who is justly considered as the father of good English surgery, saw the necessity of making the incision in the sound parts, because gangrene does not always spread evenly, but frequently extends much higher up one side of the limb than the other. He deemed the actual cautery objectionable, as

the sloughs were so long in being thrown off. He applied a ligature round the limb, two inches above the limits of the mortification, and, drawing up the muscles, made the incision with a large curved knife, with the back of which he scraped off the periosteum. The bag, or sort of retractor, employed by Fabricius Hildanus, Wiseman thought unnecessary, as the muscles spontaneously drew themselves up as soon as divided. He tied the blood-vessels after the manner of Paré, and deprecated all burning of the stump. After the operation, he drew the flaps over the bone, and either fastened them in this position with stiches or a tight bandage, though he generally preferred the former, as the surest means of keeping the end of the bone from protruding. Across the stump he laid a pledget of wax-cerate, and over this a thick layer of Armenian bole and other styptics, and the whole was covered with a bullock's bladder and a roller, applied spirally from the upper part of the remaining portion of the limb down to the extremity of the stump. On the third day, the dressings were taken off, and a digestive ointment applied. —(Chirurg. Treatises, vol. 2, p. 220, 8vo. Lond. 1690.)

From this time, amputation may be considered as being an infinitely safer proceeding than what it used to be; for, as we have explained, the ligature of the arteries was now practised and commended in Germany by F. Hildanus, in England by Wiseman, and in France by Dionis. Much, however, remained to be done. The wound was large, and suppurated long and profusely; the healing was slow; the ends of the bones perished, and, projecting far beyond the soft parts, retarded the cure so long, that the patient was not unfrequently worn out. Hence the best surgeons began seriously to consider what farther could be done, with a view of lessening the exposed surface of the wound, and making a better covering of flesh for the ends of the bones.

According to Sprengel, most of the old surgeons preserved a flap of flesh, and he is therefore by no means disposed to regard our countryman, Lowdham, as the inventor of this method, though it is acknowledged that the latter surgeon's practice was novel, inasmuch as the flap was formed by making an oblique incision through the integuments from below upwards. —(See James Yonge's Currus Triumphalis e Terebintho, 8vo. Lond. 1679; and Sprengel's Geschichte der Chirurgie, b. 1, p. 408.) Here, if Sprengel means that many of the old surgeons endeavoured to preserve a partial covering of flesh for the bone, there can be no doubt of his correctness; because we find, that they drew back the flesh before they divided it, and Celsus and some others even did more, for, after cutting down to the bone, they detached the flesh farther from it upwards, previously to taking the saw: but, on the contrary, if Sprengel wishes us to believe, that there were practitioners who, previously to Lowdham, in the operation of amputation formed what in England is usually understood by a flap, that is, a portion of flesh, generally of a semilunar shape, and saved particularly from one side of the member for covering the bone, I cannot see any reason for coinciding with Sprengel's observation. Upon the merit of Lowdham's suggestions, and the practice and principles inculcated by J. Yonge, some reflections lately sent me by Mr. Carwardine I insert with great pleasure, as perhaps he is right in thinking that the third edition of this work did not do justice to the memory of the latter writer.

"At the time Yonge wrote (1679)," says Mr. Carwardine, "it was supposed impossible to heal a stump before the bone had exfoliated, and therefore no surgeon would venture upon an attempt at uniting the surface by the first intention. Now this union by the first intention was the chief object of Mr. Yonge in proposing the flap-operation, and it is to him, and not to Mr. Alanson, who wrote precisely 100 years after him, that we must attribute the honour of this improvement. It is related in a letter addressed to his friend Thomas Hobs, chirurgeon, in London, dated Plymouth, August 3, 1678, and published, 1679, at the end of his Currus Triumphalis e Terebintho. It begins thus:

'Sir, I find by yours that you are surprised with the intimation I gave you, of a way of amputating large members, so as to be able to cure them per symphysin in three weeks; and without fouling or scaling the bone. It is a paradox which I will now evince to you to be a truth, after I have first taken notice of what you affirm, that there is a necessity of scaling the ends of those bones left bare after the usual manner of dismembering, before the stump can be soundly cured; that you never yet found it otherwise, but that where it hath been attempted, the stumps have apostumated, and the caries come off thereby.'

Yonge then acknowledges, that it was from an ingenious brother, Mr. C. Lowdham of Exeter, that he had the first hint thereof. He then describes the operation—the laying down the flap over the face of the stump, and sewing it by four or five stitches, &c. After this, Yonge proceeds with a methodical enumeration of the advantages of this mode of operating over all others then in use, viz. that it is more speedy—the cure not occupying a fourth of the usual time—no suppuration—no exfoliation—less danger of hemorrhage—not liable to break open again from slight injury—and lastly, much better adapted to the pressure from an artificial leg, &c.

The foregoing abstract will show (says Mr. Carwardine) how far Mr. O'Halloran's method, presently to be described, in which he dresses the flap and the stump as distinct surfaces, can be regarded as a revival of Lowdham's operation, or whether it has been superseded or improved upon by the mechanical ingenuity of the Dutch and French surgeons:—the apparatus of M. de la Faye and Verduin appear to have been merely clumsy and unscientific contrivances for the suppression of hemorrhage. Garengeot's operation had also for its object to supersede the use of the ligature, which, however, after twelve years' practice, he was obliged to give up, and tie the vessel before he laid down the flap (the particulars of all these methods the reader will presently meet with). Opinions, therefore, founded upon the practice of these gentlemen, I conceive, cannot fairly be admitted as evidence against the flap-operation of Lowdham, which nevertheless appears sinking in the estimation of the best modern surgeons; perhaps no material advantage is gained by it over the common mode of operating in the lower extremities, as now practised—but even here cases may occur where we are glad to resort to it: a few years since, I attended a patient in consultation with a friend at Dunmow, in Essex, where we thought it necessary to remove a man's leg for a caries of the tibia. An ulceration in front extended so high, that no integument could be saved, and the limb would have been removed above the knee, if I had not suggested the propriety of making a flap from the calf of the leg. The tibia was obliged to be sawed as high as possible, but the flap was left sufficiently long to cover the surface, and that most important object, the bend of the knee, was preserved, to bear the pressure of a wooden leg. In the removal of the arm at the shoulder-joint, doubtless the advantages of making a flap from the deltoid, &c. are sufficiently established; but in the mode of dressing, I presume that no English surgeon will admit, that the practice of M. Larrey (perhaps the most eminent surgeon that has been formed by the wars of Buonaparte, and whose practice will be hereafter noticed) can supersede the method of Yonge (or Lowdham), who wrote 140 years before him! Larrey introduces charpie beneath the flap to prevent union by the first intention! Lowdham's object is simply to lay the flap over the wound to prevent exfoliation, and to heal the surface 'per symphysin' in three weeks."—To the correctness of these sentiments of Mr. Carwardine, I believe that every impartial surgeon will bear witness; and it merely remains for me to thank him for his obliging communication, and say, that I have recently looked over the copy of the Currus Triumphalis e Terebintho, preserved in the valuable library of the Medical and Chirurgical Society, and find, that what he had stated is fully confirmed by the contents of that ancient work. At the same time, I retain the belief, that the example set by Mr. Alanson, with respect to the proper method of dressing stumps and obtaining a speedy union of the wound, is entitled to the praise of posterity; because his advice was so well enforced that it soon produced a revolution in practice, while the correct suggestions of Lowdham and Yonge, like the hint in Celsus, of the double incision, had sunk into oblivion, or were only known to a few admirers of surgical antiquities.

As Sprengel remarks, Purmann, Dionis (Cours d'Opér. de Chir. p. 611), De la Vauguyon (Traité Compel. des Opér. de Chir. p. 531), and most other surgeons of the seventeenth century, continued the method of first drawing up the integuments, and then

applying a band round the member. Dionis also took particular pains to recommend the ligature of the vessels, and expresses a strong aversion to the actual cautery. Neither did he approve of amputation at the knee-joint, because he thought that the patella, which must be left behind, would impede the healing of the stump, and he was apprehensive of the articular surface of the femur becoming diseased. De la Vauguyon relied upon the styptic properties of vitriol, and he praised drawing back the muscles by means of the kind of bag invented by Fabricius Hildanus.

Taking off the limbs at the joints was first commended again in modern times by J. Munnicks, who was more partial to styptics than the ligature; and for dressing the wound employed compresses and sticking-plaster.—(Chirurgia, p. 101.)

Mauquest de la Mothe adopted the plan of operating recommended by Dionis; he was also one of the first who made common use of the tourniquet in amputations, afterward drawing out the vessels with the forceps and tying them.—(Traité Compl. de Chir. vol. 3, p. 171.) Lowdham's original suggestion of amputating with a flap has been briefly noticed. About eighteen years after Yonge's publication, Peter Verduin, an eminent surgeon at Amsterdam, submitted to the judgment of the profession a new kind of flap-amputation, which he had put in practice.—(See Dis. Epistolica de Novâ Artuum decurtandorum ratione, 8vo. Amst. 1696.) The following are the chief particulars of Verduin's flap-operation.

Two compresses were applied, one under the ham, and the other on the course of the large vessels. The thigh was wrapped in a fine linen cloth, which was sustained by some turns of a roller. This apparatus was covered with a piece of leather, six inches broad, furnished with three straps with buckles, to secure it round the part. The tourniquet was placed in the usual manner. The part above the place intended to be amputated was surrounded with a leather strap. The point of a crooked knife, which was made to pass as near to the back part of the bones as possible, was thrust in on one side of the leg, and made to come out on the other. The knife was then carried down nearly to the tendo achillis, and thus it separated almost the whole calf of the leg. The flap being formed, the operation was finished in the ordinary manner. The wound was then washed with a wet sponge, in order to clear it from the fragments of sawed bone. The leather strap, which served to secure the flesh, was next loosened, and the flap laid over the stump. The wound was dressed with lycoperdon, lint, and tow, over which was put a bladder, sustained by strips of sticking-plaster. Upon this bladder was placed an instrument called a retinaculum, consisting of a compress, and a concave plate, which were made to press upon the stump, by means of two straps, which crossed each other and were attached to the broad leather strap surrounding the thigh.

In 1702, Sabourin, an able surgeon at Geneva, gave an account of Verduin's practice to the Royal Academy of Sciences, which, however, declined to pronounce any judgment about it, without farther experience.

Though this method of amputation was objected to by Cönerding, in a tract published at Amsterdam in 1705, it was afterward highly extolled by P. Massuet, on account of the quickness with which the stump healed, the safety with which the flap served for the stoppage of the hemorrhage, and the avoidance of exfoliation by the non-exposure of the bone. He also dwelt upon the excellency of the stump for the application of an artificial foot.—(De l'Amputation à lambeau, 8vo. Paris, 1756.) Heister disapproved of the flap-amputation, because it appeared to him, that the irritation of the flesh by the projecting bones was apt to cause pain and inflammation: he operated himself after the manner of Dionis, and was strongly in favour of the use of ligatures.

Some excellent precepts were delivered by J. L. Petit concerning amputation. He improved the tourniquet; and, instead of the large crooked amputating knife formerly employed, first brought into use the straight more moderate-sized knives with sharp backs, now seen in the hands of the best surgeons, because much better calculated than crooked knives for dividing the flesh by a sawing movement, which is the only right and surgical way of attempting to cut any part of the human body. He proved that making the division in the mortified parts was frequently followed by hemorrhage; and for the suppression of bleeding he thought it the best principle to promote the formation of a coagulum.—(Mém. de l'Acad. des Sciences, an 1732, p. 285. See Hemorrhage.) For compressing the vessels, he employed an instrument which covered the stump, like Verduin's retinaculum, and made pressure by means of a screw. His only objection to Verduin's method was, that the extension of gangrene up the limb frequently hindered the formation of so large a flap. He laid down the valuable general maxim of always removing as much bone, and as little flesh, as possible; for which purpose he invented what is termed the double incision, or dividing the business of cutting through the soft parts into two stages. About an inch higher than the place where he meant to saw through the bones, he first made the circular cut through the integuments down to the muscles; the skin was then pulled up so as to leave the flesh uncovered to the extent of an inch, and the muscles were now divided at the highest point of their exposure. Lastly, the flesh was held out of the way with a retractor, and the bone was sawed through high enough up to allow of its extremity being well covered with flesh and integuments. The greatest defect in the doctrine of Petit, relative to amputation, was the confidence he put in pressure, instead of the ligature.—(Traité des Malad. Chir. vol. 3, p. 126.) The first performance of amputation at the shoulder-joint, by Le Dran, and the improvements and alterations of that operation suggested by Garengeot, De la Faye, Desault, &c. I shall notice in a future section.

In chronological order, the next event claiming notice in the history of amputation, was the promulgation of an opinion by T. R. Gagnier, that Verduin's flap-amputation might be traced back to times of great antiquity, the method described by Celsus being very similar.—(Haller, Diss. Chir. vol. 6, p. 161.) On this point, with reference to Lowdham, the true inventor of the flap-operation, I have already delivered my own sentiments.

The flap-amputation of the leg, after Verduin's manner, was tried by De la Faye, who found that the pressure of the flap was not enough to check bleeding from all the vessels, as it only operated on the anterior tibial artery, and by pressing the flesh more firmly against the end of the bones, he thought the risk of mortification would be occasioned.

Verduin and Sabourin, as we have seen, made only one flap. Two French surgeons, Ravaton and Vermale, afterward thought that it would be better to save a flap from each side of the limb. They were also advocates for tying the vessels, and bringing the two flaps into contact, so as to procure their speedy union, and hinder exfoliations and profuse suppuration.

However, there is some difference in their methods of forming the flaps. Ravaton, who submitted his plan to the French Academy in 1739, made three deep incisions down to the bone; first, a circular one, with a crooked knife, within four finger-breadths of the bone intended to be sawed; and then with a somewhat larger knife, the two others perpendicularly to the first, one at the fore part, and the other at the back of the limb; and, taking care not to touch the principal vessels, he detached the two flaps from the bone.

Vermale formed the separate flaps by two incisions. After applying the tourniquet, he surrounded the part with two red threads, at the distance of four finger-breadths from each other; one at the place where the bone was to be sawed, the other at the place where the incision of the flaps was to terminate. He afterward thrust a long bistoury down to the bone, at the fore part of the limb; turned it round the circumference, so that it might come out at the opposite part; then, directing the edge of the knife along the bone, he cut down to the inferior thread, where he separated the first flap, which, as the author says, was of a round or conical figure at its extremity. The second flap was made in a similar way on the interior side of the member.—(Traité des Playes d'Armes à feu, par Ravaton, 8vo. Paris, 1750. De la Faye, in Mém. de l'Acad. de Chir. t. 5, ed. 12mo. Vermale, Obs. de Chir. 8vo. Manheim, 1767.)

In presence of M. Quesnay, Garengeot performed the flap-amputation according to the method of Verduin and Sabourin. We know that they made no ligature on the vessels, and that their intention was, that the

flap, when applied to the stump, and sustained by a particular apparatus, should reunite, and stop all bleeding.

Garengeot's patient died on the third day after the operation; hemorrhage having had a considerable share in producing death.

The multiplicity of machines described by Verduin, La Faye, &c. had no other end but that of keeping the flap near the orifices of the vessels, so as to compress and close them. In consequence of the difficulty of making this compression precisely as required, the most considerable vessels being situated between the two bones, and when cut, generally becoming retracted, Garengeot determined in future to employ ligatures.

With these views, twelve years after the foregoing case, Garengeot performed a flap-amputation of the arm, preserving two flaps, according to the method communicated to the Academy by Ravaton. The brachial artery was tied, and the patient was cured, without any exfoliations.

Garengeot made a third trial of this operation on a soldier dangerously wounded in the right foot by the bursting of a bomb, which fractured the interior part of the two bones of the leg, and several of the foot: the patient recovered in twenty-seven days.

In this operation one single flap was made. Garengeot was fearful, however, that the quick union might create some difficulty in withdrawing the ligatures, and he therefore took a means of hindering adhesion where they were situated; but of this objectionable plan I shall not speak. He rightly preferred dressing and bandaging the stump to the use of the compressing machines invented by Verduin and La Faye; and his choice of a straight knife, instead of a crooked one, was equally judicious.

The preceding case dictated a truth, which will last as long as surgery itself, viz. that it is advantageous to apply the ligatures in such manner as to embrace no more than the vessel, so that they may fall off the sooner, and the parts more quickly unite.—(M. de Garengeot, in Mémoires de l'Acad. de Chir. t. 5, 12mo.)

At one time, an objection frequently urged against the foregoing methods was, that when the fresh cut flap was immediately laid over the stump, inflammation and abscesses were apt to ensue. Hence, in 1765, Sylvester O'Halloran, a surgeon at Limerick, was led to make the experiment of deferring laying down the flap till the end of the first eight or twelve days after the operation, when it was conjectured that the risk of inflammation and abscesses would be diminished. The tenor of O'Halloran's book is apparently corroborated by the facts brought forward. Here we see one of the grand points, insisted upon by our worthy countryman James Yonge, viz. the chance of an immediate union of the wound from laying down the flap without delay, suddenly given up, and because the wound could not always be healed without suppuration, it was determined that it never should do so. However, it is consolatory to find, that O'Halloran's suggestion now exists only in the history, and not in the practice, of surgery.

Alexander Monro, senior, was a great opposer of certain methods which originated among the French surgeons, and, in particular, he disapproved of the tourniquet: he secured the vessels with needles and ligatures; and was the inventor of a bandage, which has been extensively approved of under the name of Monro's roller.—(Medical Essays of Edinb. vol. 4, p. 257.)

Bromfield, like Le Dran, restricted amputation to a few cases; and he did not acknowledge its necessity, as a matter of course, in every case of gangrene, much less in every instance of white swelling or caries. From a passage which I have cited from Dr. Rees's Cyclopædia, it would seem that the tenaculum was known to the ancients; yet, according to general opinion (and I cannot affirm that it is incorrect from any passage in my recollection), Bromfield is allowed to be the first modern surgeon who employed this very useful instrument.—(Chir. Cases and Obs. vol. 1, p. 41, 8vo. Lond. 1773.)

About the year 1742, the removal of thighs without bloodshed was a subject a good deal broached. A single case recorded by Schaarschmid, where a mortified thigh separated without hemorrhage, was the foundation of the scheme. The arteries were completely blocked up, and the parts insensible.—(Haller, Diss. Chir. vol. 5, p. 155.) A similar occurrence was related by Acrel (Chir. händels. p. 557); and Lalouette professed himself a believer in the security from hemorrhage, on account of the vessels being filled with coagula, and therefore he also approved of letting dead parts be removed, or rather fall off, without bloodshed.—(Haller, Diss. Chir. vol. 5, p. 273.)

In cases where the projecting bone of the stump was affected with necrosis, Bagieu, an experienced military surgeon, ventured to amputate a second time, and urged a variety of arguments in defence of the practice.—(Mém. de l'Acad. de Chir. t. 2, p. 274.) He coincided with Le Dran and Bromfield, however, about the propriety of restricting amputation to few cases, and has related numerous examples of limbs being saved, which, according to the doctrines then in vogue, ought to have been cut off.—(Deux Lettres d'un Chir. de l'Armée, 12mo. Paris, 1750.)

M. Louis, a French surgeon of extraordinary talents, introduced the plan of dividing the loose muscles first, and lastly those which are closely connected with the bone. He noticed that the muscles of the thigh, after being divided, were retracted in an unequal degree. He observed that the superficial ones extending along the limb, more or less obliquely, without being attached to the bone, were drawn up with greater force, and in a greater degree than others, which are deeply situated, in some measure, parallel to the axis of the femur, and fixed to this bone throughout their whole length. The retraction begins the very instant when the muscles are cut, and is not completed till a short time has elapsed. Hence, the effect should be promoted, and be as perfect as possible, before the bone is sawed. In the amputation of the thigh, Mr. Louis was always desirous of letting the muscles contract as far as they could, and for this reason he was rather averse to using the tourniquet, as the circular pressure of this instrument in some measure counteracted what he wished to take place; and hence, at one time he preferred letting an assistant make pressure on the artery, though he subsequently expressed his approbation of the tourniquet proposed by M. Pipelet for compressing the femoral artery.—(Mem. de l'Acad. de Chir. vol. 4, p. 60, 4to.)

Actuated by such principles, Louis practised a kind of double incision different from that of Cheselden and Petit, and different also from Alanson's method, which I shall hereafter notice. By the first stroke he cut, at the same time, both the integuments and the loose superficial muscles; by the second, he divided those muscles which are deep and closely adherent to the femur. On the first deep circular cut being completed, Louis used to remove a band which was placed round the limb, above the track of the knife. This was taken off in order to allow the divided muscles to become retracted without any impediment. He next cut the deep adherent muscles on a level with the surfaces of those loose ones which had been divided in the first incision, and which had now attained their utmost state of retraction. In this way he could evidently saw the bone very high up, and the painful dissection of the skin from the muscles was avoided. Louis was conscious that there was more necessity for saving muscle than skin; and he knew that when an incision was made at once down to the bone, the retraction of the divided muscles always left the edge of the skin projecting a considerable way beyond them. Hence he deemed the plan of first saving a portion of skin by dissecting it from the muscles and turning it up, quite unnecessary. As the bone should always be sawed rather higher than the division of the soft parts, Louis, like J. L. Petit, and most other judicious surgeons, highly approved of the employment of a retractor. He was likewise the author of some valuable instructions for preventing the protrusion of the bone after the operation.—(See Mém. de l'Acad. de Chir. t. 2, p. 268—410, &c. 4to.) The impartial reader, who takes the trouble to read the remarks on amputation published by this greatest of all the French surgeons of the last century, with the exception perhaps of J. L. Petit and Desault, will be impressed at once with the force and perspicuity of his matter, and with the evident propriety of a good deal of the practice inculcated.

In England, Cheselden, and not J. L. Petit, is regarded as the surgeon who revived Celsus's method, by proposing to divide the soft parts by a double incision, that is, by cutting the skin and cellular substance first, and then, by dividing the muscles down to the bone, on a level with the edge of the skin, so that the bone might be sawed higher up, and its end be more com-

pletely covered with skin. Whether Cheselden had the priority in this improvement, I cannot presume to say; but he gave an account of it in Gataker's translation of Le Dran's treatise on the operations, as early as 1749, which was long prior to the appearance of Petit's posthumous writings; and Mr. Cheselden farther mentions, that during his apprenticeship to Mr. Fern he had communicated to that gentleman his sentiments about the double incision.

In order to hinder the stump from assuming a pyramidal or sugar-loaf shape, which sometimes happened notwithstanding every improvement hitherto mentioned, a circular bandage was employed, which acted by supporting the skin and muscles, and preventing their retraction. This bandage, when properly applied, from the upper part of the limb downward, fulfilled in a certain measure the end proposed, though many stumps yet turned out very badly. Mr. Sharp was induced, therefore, to revive the ancient plan of bringing the edges of the skin together with sutures; but the pain and other inconveniences of this method were such that it was never extensively adopted, and Mr. Sharp himself ultimately abandoned it. The cross-bandage, however, which he used to put over the end of the stump, remains in fashion even at the present day.—(Treatise on the Oper. p. 216; Critical Inquiry, p. 268.) It is to be regretted that an excellent modern surgeon, the late Mr. Hey, should have commended so much as he has done the use of sutures, in bringing together the edges of the wound after amputation.—(Practical Observations in Surgery, p. 534, edit. 2.)

In opposition to Louis, the inefficiency of his method for hindering the protrusion of the bone was asserted by Valentin, who thought the object might be better attained by dividing the parts while they were in a state of tension; for which purpose he recommended changing the posture of the limb, according to the parts which he was about to cut.—(Recherches Critiques sur la Chirurgie Moderne, 8vo. Amst. 1772.) Valentin's proposal seems never to have made much impression on the profession; whether on account of its inconvenience or inefficacy, I know not; certain it is, many cases present themselves, in which the posture of a limb absolutely cannot be changed during the operation, owing to the nature of the disease, or cannot be altered without extreme agony.

At this period arose the celebrated controversy about the propriety of amputation in general. As Sprengel remarks, several French surgeons now began to be convinced, with Le Dran and Bagieu, that the operation was undertaken on too slight grounds, and in particular that many bad complicated fractures might be cured without amputation. Such was the doctrine of Boucher (Mem. de l'Acad. de Chir. t. 2, p. 304), Gervaise (Anfangsgr. der Wundarzn. 8vo. Strasb. 1755), and Faure (Mem. qui ont concourn pour le Prix de l'Ac. de Chir. vol. 1, p. 100). The latter especially urged the prudence of delay in gun-shot wounds, and comminuted injuries of the bones. But the writer who at this time made the most noise in the world by his general condemnation of amputation, was Bilguer (Diss. de Membrorum Amputatione, 8vo. Hal. 1761), whose sentiments received a complete refutation from his own contemporaries, Pott (Chir. Works, vol. 2), Morand (Opusc. de Chir. t. 1, p. 232), and de La Martinière (Mem. de l'Acad. de Chir. vol. 4, p. 1), and also from later writers, to whom reference will be made in speaking of Gun-shot Wounds. Even Bilguer himself was compelled to admit the necessity of amputation in cases of gangrene.—(Anweis. für die Feldwundärzie, s. 170.)

Bilguer's colleague, the celebrated Schmucker, inclined to the same doctrines, and has detailed several cases, where limbs were not only shattered, but actually carried away by balls, yet where a cure followed without amputation. One of his maxims was, that it was better for the member to be taken off by gun-shot than by the surgeon's knife, as the ball operated on a healthy subject, and the knife on a person debilitated by an hospital.—(Chir. Wahrn. th. 2, s. 493.) In a later valuable essay on this subject, he restricts amputation to shattered limbs affected with gangrene. His mode of operating was that of M. Louis. He sanctioned joint-operations on the hip and shoulder; but condemned those of the knee and elbow as never answering.—(Verm. Schrift. th. 1, s. 3.)

Soon after the middle of the last century, the practice of amputating at the joints began to excite increased attention; but as this is a topic to which I must presently return, it is unnecessary now to dwell upon it. The writings of Puthod, Wohler, Brasdor, Barbet, Sabatier, Park, Moreau, and Vermandois, in relation to this subject, deserve particular notice.

I now come to Mr. Alanson, whose name is as conspicuous in the history of amputation as that of any surgeon yet mentioned. His chief objects were to hinder a protrusion of the bone, and to promote union by the first intention. He rejected the band which was formerly put round the limb for the guidance of the knife, as altogether useless, and an impediment to the quick performance of the circular incision through the skin. When the tourniquet had been applied, an assistant grasped the integuments with both hands, and drew them and the muscles firmly upwards. The operator then fixed his eye upon the proper part where he was to begin the incision, which was made with considerable facility and despatch, the knife passing with greater quickness in consequence of the tense state of the integuments.

After the incision through the skin had been made, the assistant still continued a steady support of the parts, while Mr. Alanson separated the cellular and ligamentous attachments with the point of his knife till as much skin had been drawn up as would, with the muscles divided in the particular way hereafter recommended, fully cover the whole surface of the wound. Then, instead of applying the knife close to the edge of the integuments, and dividing the muscles in a circular perpendicular manner down to the bone, Mr. Alanson proceeded as follows: when operating upon the thigh, and standing on the outside of the limb, he applied the edge of his knife under the edge of the supported integuments, upon the inner margin of the vastus internus muscle, and cut obliquely through that and the adjacent muscles upwards as to the limb, and down to the bone, so as to lay it bare about three or four finger-breadths higher than is usually done by the common perpendicular circular incision. He now drew the knife towards himself; then keeping its point upon the bone, and the edge in the same oblique line already pointed out for the former incision, he divided the rest of the muscles in that direction all round the limb; the point of the knife being in contact with and revolving round the bone through the whole of the division.

According to Mr. Alanson, the speedy execution of the above-directed incision will be much expedited by one assistant continuing a firm and steady elevation of the parts, and another taking care to keep the skin from being wounded as the knife goes through the muscles, at the under part of the limb. Mr. Alanson censures the old method of depriving the bone of its periosteum to a considerable extent above and below the part where the saw was to pass, not only as creating unnecessary delay, but, since the periosteum serves to support the vessels in their passage to the bone, as apt to produce exfoliations above the part where the bone is to be divided with the saw. Instead of this practice he recommends first the application of the retractor, as advised by Gooch and Bromfield; and then denuding the bone at the part where the saw is to pass, whereby the bone may be sawed off higher than is usually practised; a material object for hindering a projection of the bone and forming a small cicatrix.

If the flesh of a stump formed in the thigh agreeably to the foregoing plan, be gently brought forwards after the operation, and the surface of the wound be then viewed, it may be said to resemble in some degree a conical cavity, the apex of which is the extremity of the bone; and the parts thus divided Mr. Alanson thought the best calculated to prevent a sugar-loaf stump.

The part where the bone is to be laid bare, whether two, three, or four finger-breadths higher than the edge of the retracted integuments; or, in other words, the quantity of muscular substance to be taken out in making the double incision, must be regulated by considering the length of the limb, and the quantity of skin that has been previously saved by dividing the membranous attachments. The quantity of skin saved, and muscular substance taken out, must be in such exact proportion to each other, that the whole surface of the wound will afterward be easily covered, and the limb not more shortened than is necessary to obtain this end.

After the removal of the limb, Mr. Alanson drew each

bleeding artery gently out with the tenaculum, and tied it as nakedly as possible with a common slender ligature. When the large vessels had been tied, the tourniquet was immediately slackened, and the wound well cleaned, in order to detect any vessel that might otherwise have remained concealed with its orifice blocked up with coagulated blood; and before the wound was dressed, its whole surface was examined with the greatest accuracy; by which means Mr. Alanson frequently observed a pulsation where no hemorrhage previously appeared, and turned out a small clot of blood from within the orifice of a considerable artery. He is very particular in recommending every vessel to be secured that is likely to bleed on the attack of the symptomatic fever; for, besides the fatigue and pain to which such an accident immediately exposes the patient, it seriously interrupts the desired union of the wound. He used always to clean the whole surface of the wound well with a sponge and warm water, as he thought that the lodgement of any coagulated blood would be a considerable obstruction to the quick union of the parts.

The skin and muscles were now gently brought forwards; a flannel roller was put around the body, and carried two or three times rather tightly round the upper part of the thigh, as at this point it was intended to form what Mr. Alanson called a sufficient basis, which materially added to the support of the skin and muscles. The roller was then carried down in a circular direction to the extremity of the stump, not so tight as to press rudely or forcibly, but so as to give an easy support to the parts.

The skin and muscles were now placed over the bone in such a direction that the wound appeared only as a line across the face of the stump, with the angles at each side, from which points the ligatures were left out, as their vicinity to either angle might direct. The skin was easily secured in this posture by long slips of linen or lint of the breadth of about two fingers, spread with cerate or any cooling ointment. If the skin did not easily meet, strips of sticking-plaster were preferred. These were applied from below upwards, across the face of the stump, and over them a soft tow-pledget and compress of linen; the whole being retained with the many-tailed bandage, and two tails placed perpendicularly, in order to retain the dressings upon the face of the stump.

Mr. Alanson censured the plan of raising the end of the stump far from the surface of the bed with pillows, as the posterior muscles were retracted by it; and he considered it best to raise the stump only about half a hand's breadth from the surface of the bed, by which means the muscles were put in an easy relaxed position. The many-tailed bandage Mr. Alanson found much more convenient than the woollen cap, frequently used in former times to support the dressings; and he observes, that though this seems well calculated to answer that purpose, yet if it be not put on with particular care, the skin is liable to be drawn backwards from the face of the stump; nor can the wound be dressed without first lifting up the stump to remove the cap.—(See Alanson's Pract. Obs. on Amputation, 8vo. Lond. 1779.)

The chief peculiarity of Alanson's method of operating, namely, the mode in which he recommended the oblique division of the muscles to be performed, did not, however, meet with universal approbation, and his extensive dissection of the skin from the muscles was complained of as excessively painful. The formation of a conical wound by following Alanson's directions, was regarded by several as impracticable.—(See Marten's Paradoxieen, b. 1, s. 88; Loeffler, Beytrage 1, No. 7; Wardenburg, Briefe eines Arztes, b. 2, p. 20; Richter, Anfangsgr. vol. 7; Graefe, Normen, &c. p. 8; Hey, Pract. Obs.) In my opinion there can be no doubt of the truth of some of the criticisms made by these and some other writers on the impossibility of making a wound with a regular conical cavity, by observing the directions given by Alanson; for if the knife be carried round the member with its edge turned obliquely upwards towards the bone, it will pass spirally, and of course the end of the incision will be considerably higher than the beginning. But though Alanson probably never did himself exactly what he has stated, I am sure that his proposition of making an oblique division of the muscles all round the member has been the source of great improvement in amputations in general, and is what is usually aimed at by all the best modern surgeons. It is true they do not actually perform the oblique incision all round the limb by one stroke or revolution of the knife round the bone, as Alanson says that he did; but they accomplish their purpose by repeated, distinct, and suitable applications of the edge of the instrument turned obliquely upwards towards the bone or bones.

Among others, Mynors found fault with some of Alanson's instructions, and thought every desideratum might be more certainly attained by saving skin enough, and then cutting through the muscles. The first incision, however, he directed obliquely upwards through the integuments, while they were drawn up by an assistant, and he then cut down to the bone.—(Pract. Thoughts on Amputation, 8vo. Birming. 1783.) Sprengel considers Mynors's plan merely as a revival of Celsus's method, as it had in view only the preservation of skin, and not the formation of a fleshy cushion.—(Geschichte der Chir. b. 1, p. 426.)

Kirkland endeavoured to improve Mynors's plan by cutting off a piece of skin at each angle of the stump, so as to keep the integuments from being thrown into folds; and in opposition to Pott, he defended the sentiments of Bilguer concerning the successful management of desperate cases without amputation.—(On the present State of Surgery, p. 273, and Thoughts on Amputation, 8vo. Lond. 1780.)

B. Bell used to operate very much in the same way as Mynors; and when it seemed advantageous to make a flap, he did not disapprove of the plans suggested by Ravaton, Verduin, and Alanson.—(Syst. of Surgery.)

An interesting paper on amputation was some years ago published by Loder; its chief purport was to defend Alanson's method with some slight modifications.—(Chir. und Medic. Beobacht. b. 1, p. 20, 8vo. 1794.) However, the alterations suggested by Loder do not seem to Graefe at all adequate to the removal of the difficulties with which the mode of cutting the flesh exactly after Alanson's directions is complicated.—(Normen für die Abl. grösserer Gliedmassen, p. 8, 4to. Berlin, 1812.)

The removal of limbs, without bloodshed, proposed by Guido di Cauliaco in the 14th century, has met with modern defenders in J. Wrabetz and W. G. Plouquet. J. Wrabetz, with a ligature, which was daily made tighter, took off an arm above the elbow. In the fissure he sprinkled a styptic powder. On the fourth day, the flesh was severed down to the bone, which was sawed through.—(Geschichte eines ohne Messer abgesetzten Oberarms, 8vo. Freyb. 1782.) Plouquet thought the plan suited to emaciated timid subjects, but not well adapted to the leg or forearm.—(Von der Unblutigen Abnehmung der Glieder, 8vo. Tub. 1786.)

Some other modes of doing flap-amputations, and in particular the suggestions and improvements made by Hey, Chopart, Dupuytren, Larrey, Lisfranc, and other modern practitioners, will be noticed in the description of the amputation of particular members. In the mean time, I shall conclude this section with mentioning the laudable attempts made at different periods to render the patient less sensible of the agony produced by the removal of a limb. Theodoricus, as we have said, administered for this purpose opium and hemlock, and though he was imitated by many of the ancient surgeons, few moderns have deemed the practice worthy of being continued. Guido made the experiment of benumbing the parts with a tight ligature; but a machine devised a few years ago in England expressly for the object of stupifying the nerves of a limb previously to amputation, is perhaps not undeserving of farther consideration.—(See J. Moore's Method of preventing or diminishing Pain in several Operations of Surgery, 8vo. Lond. 1784.) The great reason of the latter plan being given up is, that some patients have made more complaint of the sufferings occasioned by the process of dulling the sensibility of the nerves than of the agony of amputation itself without any such expedient. Yet daily experience proves that the pressure caused on the sciatic nerve by sitting with the pelvis in a certain position, will completely benumb the foot and leg, and this with such an absence of pain, that the person so affected is actually unaware of his foot being asleep, as it is termed, until he tries to walk. On the little good done by warming and oiling the cutting instruments, a method once much commended (Faust und Hunold über die Anwendung des Oehls und der Warme, p. 3—23, Leipsic, 1806), I am sure it is unnecessary for me to comment.

AMPUTATION OF THE THIGH.

The thigh ought always to be amputated as low as the disease will allow, so that as little of the limb may be cut off as possible, the pain may not be greater than necessary, and the surface of the wound have less extent than would otherwise happen.—(Sabatier, Med. Obs. p. 350, t. 3, ed. 2.) The patient is to be placed on a firm table, with his back properly supported by pillows and assistants, who are also to hold his hands, and keep him from moving too much during the operation. The ankle of the sound limb is to be fastened by means of a strong band or garter to the nearest leg of the table.

Here, however, through an imprudent solicitude to obtain the above advantages, let not the surgeon ever be unmindful of the great axiom in surgical operations, that all the diseased parts should be removed; but let him be assured of the truth of what Graefe inculcates, that it is more pardonable to cut away too much than too little.—(Normen für die Ablösung grösserer Gliedm. p. 60.) At the same time, I do not agree with some modern writers, who deem it necessary to amputate beyond the limits of every abscess and sinus, which may extend very far above a diseased joint or compound fracture. Many of these suppurations are only like ordinary abscesses, and finally get well after the main disease or injury is removed, as I have often seen. Were it an invariable rule to cut off a limb above every collection of matter, sometimes five or six inches more of the thigh would be sacrificed than circumstances absolutely demanded, and the greater danger of a high than a low amputation would be encountered. However, in all cases where the bone is suspected to be unsound, or the muscles are affected with the morbid changes peculiar to fungus hæmatodes or other incurable diseases, the operation should be practised sufficiently high to take away all the distempered parts. In secondary amputations, where there has been much suppuration in the limb, and a sinus runs up, Mr. Guthrie says, that if the sinus extend only a short way between the muscles, the membrane lining it may be dissected out; but if the matter has lain upon the bone, this will have become diseased, and amputation should be done high enough to remove the affected part of it.—(On Gun-shot Wounds, p. 87.)

Many writers disapprove of amputating too close to the knee (Graefe, Op. cit. p. 60); and Langenbeck urges one objection to it not specified by any other author, viz. that if the operation be done lower down than two hand-breadths above the knee, the femoral artery shrinks into the aponeurotic sheath, which it here receives from the vastus internus and triceps, and cannot be drawn out with the forceps, so as to be separately tied, without first slitting up that sheath. Hence, he recommends cutting through the muscles at the distance above the knee already mentioned.—(Bibl. für die Chir. b. 1, p. 571, 12mo. Gött. 1806.) But when I come to look at the breadth of two adult hands, and see how much of the limb would be sacrificed at all events, only to save a little trouble, I cannot bring my mind to concur with Langenbeck—the remedy being worse than the alleged evil.

The next thing is the application of the tourniquet.—(See Tourniquet.) The pad should be placed exactly over the femoral artery in as high a situation as can be conveniently done. When the thigh is to be amputated high up, it is better to let an assistant compress the femoral artery in the groin with any commodious instrument, furnished with a round blunt end, calculated for making direct pressure on the vessel without injuring the integuments. Some authors indeed give a general preference to this method, whether the thigh be amputated high up or low down.—(Paroisse, Opuscules de Chir. p. 188. Brünninghausen, Erfahr. über die Amp. p. 273. Langenbeck, Bibl. Chir. p. 564. See also Liston's Obs. in Ed. Med. and Surg. Journ. vol. 20, p. 43.) Were the patient, however, in a debilitated state, and unable to bear loss of blood, as there might, in this way, be some considerable bleeding, by reason of the anastomoses with the branches of the internal iliac artery, I should feel disposed to employ the tourniquet whenever circumstances would admit of its application. In amputations of the thigh, the great objection to the use of this instrument is, that it impedes the free and immediate retraction of the loose muscles after they have been cut; the consequence of which is, that the surgeon cannot divide so high as he otherwise could do, the deeper muscles which are more fixed and attached to the bone. Yet in order to have the bone well covered with flesh, and no danger of a sugar-loaf stump, the latter object is one of vast importance. Perhaps the best general rule is to abandon the application of the tourniquet in amputations done as high as the middle of the thigh, except where the patient is remarkably weak, so that he cannot bear the smallest loss of blood, and no steady intelligent assistant is at hand, to whom the compression of the artery in the groin can be prudently confided. When, however, the operation is to be done much higher up, of course the employment of a tourniquet is wholly inadmissible.

Whether the right or left thigh is to be removed, it is customary for the operator to stand on the patient's right side. The great advantage of this situation seems to be, that the surgeon's left hand can be thus more conveniently and quickly brought into use than if he were always to stand on the same side as the limb he is about to amputate. This seems to be the only assignable reason for this habit; for when the left thigh is to be amputated, it is certainly some inconvenience to have the right limb between the operator and the one that is to be removed. But this is found less inconvenient than not having the left hand next the wound.

Mr. Guthrie, in speaking of amputations on the two lower thirds of the thigh, observes, that "in these cases the tourniquet should be used;" but in operations high up the thigh, he joins all other surgeons in recommending the inguinal artery to be compressed against the os pubis.—(On Gun-shot Wounds, p. 202.) The utility of slackening the tourniquet completely, however, as soon as the principal vessels are secured, a piece of advice delivered by this excellent surgeon, I presume, cannot be right on the ground which he specifies, viz. the impediment made by the strap of the instrument to the retraction of the muscles, and the consequent difficulty in high operations of sawing the bone, because in common practice the bone is always sawed before any of the vessels are secured; and loosening the tourniquet entirely, while any arterial branches still require the ligature, must generally be objectionable, if loss of blood be a disadvantage. In flap-amputations high up the limb, indeed, where the arteries are sometimes tied, before the division of the bone, the employment of a tourniquet at all is quite out of the question.

We know that it was an opinion of the late Mr. J. Bell, that the flow of blood through a large artery could not be completely stopped by pressure; and the late Mr. Hey adopted a similar notion, in consequence of seeing a case in which the application of two tourniquets to the thigh did not restrain the hemorrhage from a fungus hæmatodes of the limb. He says, the pressure of the tourniquet does not completely obstruct the passage of blood in the arteries; it only diminishes so much of the force of the current as to enable the vessels, in a sound state, to exert their natural contractile power so effectually as to prevent hemorrhage. (See Hey's Pract. Obs. p. 257, 258, ed. 2.) Of the inaccuracy of this doctrine no man can doubt, who sees the femoral artery with its open mouth on the face of a stump not bleeding, while the tourniquet is tight, or skilful pressure is kept up, but throwing out its blood to a great distance the instant the pressure is discontinued. Nor, I apprehend, can any surgeon, who has amputated at the shoulder, and seen how completely pressure commands the flow of blood through the open-mouthed axillary artery, join in the sentiment of John Bell and Hey upon this particular point. Here I can speak with confidence, because I have myself amputated at the shoulder, and assisted at this operation several times, and found the statements of the preceding writers perfectly and clearly contradicted. Were any farther testimony required, I might cite that of Dr Hennen, who mentions, among other facts, that in a shoulder-joint case, operated upon by Mr. Dease, the amount of blood lost from the principal artery was no more than the quantity contained between the point of pressure and the point of incision through the vessels.—(Principles of Military Surgery, p. 257, ed. 2.) The same fact presented itself in the example, where I recently assisted Dr. Blicke in private practice.

Mr. Liston, of Edinburgh, confirms the preceding statement, observing that pressure complete enough not only to stop the pulsation of an artery in a limb,

but also to arrest completely the flow of blood, can be easily applied by means of the fingers only. And, in order to prove the correctness of this remark, he has repeatedly, when no proper assistant was at hand, compressed both the femoral and humeral arteries with the fingers of one hand, while with the other hand he removed the limb, and this, as he affirms, with the loss of much less blood than if he had followed the ordinary mode. His common practice, however, is to let the pressure be made by an assistant, and to employ no tourniquet.—(See Ed. Med. and Surg. Journ. vol. 20, p. 44.)

If, then, the flow of blood through an artery can easily be commanded by pressure, how are we to explain the occasional continuance of bleeding, notwithstanding the pressure of one, or even two, tourniquets? Without doubt, by the fact that the pads of these instruments, when not duly arranged, do more harm than good, by raising the band off the vessel, and perhaps also, in Mr. Hey's example, by the additional consideration, that tumours of the fungus hæmatodes kind include a large quantity of blood, and will bleed profusely, and for a considerable time, after the main supply of blood to them is cut off. The same thing happens in the disease called aneurism by anastomosis, as I have had several opportunities of witnessing, but in no instance more strikingly than in one, where, some time after Mr. Hodgson had tied the radial and ulnar arteries, Mr. Lawrence divided every part of the finger, excepting the tendons and bone, and yet a considerable bleeding went on from the farther side of the wound.—(See Med. Chir. Trans. vol. 9, p. 216.)

The application of the tourniquet is generally left too much to assistants; but, as far as my judgment extends, no operator is justified in commencing his incisions before he has examined, and fully satisfied himself that the instrument is correctly applied. Mr. Guthrie candidly tells us, that he once lost an officer, in consequence of hemorrhage during the operation, although the tourniquet was in the charge of a surgeon of ability; and the advice with which he follows this statement is worth recollecting: "In a case of this kind, where it (the tourniquet) is found of little benefit, the surgeon should not continue twisting and turning it, while his patient is bleeding, but quit it altogether, and compress the artery against the pubes." This maxim, I think, cannot be too highly commended.

The shape and size of the pad of the tourniquet are matters of importance. At St. Bartholomew's, the pads employed are very firm, being composed of wood, or cork covered with leather, and rather thicker than the thumb, the upper surface being flat, and the lower, which is put against the thigh, being convex. They are about an inch and a half in length. Such pads answer extremely well, as I can affirm from the observation of some hundreds of amputations in that hospital. A common fault formerly was the employment of pads which were too large and soft, and not judiciously shaped. As Mr. C. Hutchison remarks, the principal objection to a large pad is, that the band of the tourniquet is so much raised by it, that a considerable space is left on each side of it, where no compression is made on the limb, however closely the instrument may be screwed, and thus there will be a risk of hemorrhage from such vessels as happen to be in these situations. The same gentleman uses a pad which is not thicker than a finger, and places it obliquely over the artery, so as to preclude the possibility of displacement.—(Pract. Obs. in Surgery, p. 21—23.) Mr. Guthrie says, "the pad should be firm and rather narrow, and carefully held directly over the artery, while the ends of the bandage in which it is contained, are pinned on the thigh. The strap of the tourniquet is then to be put round the limb, the instrument itself being directly over the pad, with the screw entirely free. The strap is then to be drawn tight, and buckled on the outside, so as to prevent its slipping, and not interfere with the screw, which is to be turned until the pressure is sufficiently forcible to stop the circulation. If the screw require to be turned for more than half its number of turns to effect this, the strap is not sufficiently tight, or the pad has not been well applied, and they must be replaced."—(On Gun-shot Wounds, p. 204.)

In two amputations at St. Bartholomew's Hospital, I saw the tourniquet break after the soft parts had been divided, and as in one of these cases a good deal of blood was lost, because another tourniquet happened not to be in the room, and pressure on the artery in the groin was not immediately adopted, I coincide with such writers as recommend the rule of always having two tourniquets ready. Graefe even goes so far as to advise putting both of them round the limb before the operation commences (Normen für die Ablösung grösserer Gliedmassen, p. 48); but the frequency of a tourniquet breaking is not so great, I believe, as to demand such precaution, and the plan would be very objectionable in thigh-amputations, where it is a material advantage to have plenty of room between the place of the incision and the band which goes round the limb.

An assistant, firmly grasping the thigh with both hands, is to draw up the skin and muscles, while the surgeon, beginning with that part of the edge of the knife which is towards the handle, makes a circular incision as quickly as possible, through the integuments down to the fascia, or, as Mr. Guthrie and Dr. Hennen recommend, even completely through it. According to Mr. Guthrie, the skin cannot be sufficiently retracted, unless the fascia be divided, which he appears to think ought rather to be drawn up with the integuments than dissected from them.—(On Gun-shot Wounds, p. 205. Also, Hennen's Military Surgery, p. 263.) On the contrary, Professor Langenbeck is very particular in enjoining surgeons to avoid cutting through the fascia by the first sweep of the knife, because he finds that the muscles are better held together, and can be more regularly divided, by cutting them and the fascia at the same time.—(Bibl. für die Chir. b. 1, p. 564.) Nor does M. Roux divide the fascia by the first incision.—(Mem. sur la Réunion immédiate de la Plaie après l'Amputation circulaire, p. 9, 8vo. Paris, 1814.) At St. Bartholomew's, the surgeons rarely or never cut through the fascia with the integuments, but aim at carrying the knife perfectly down to it all round the limb. This at least ought to be done without fear of doing rather more; for, as Graefe observes, if the outer layers of the muscles be here and there a little touched, this occasions less pain than the additional strokes of the knife for dividing any portion of the skin and cellular substance not completely cut through in the first instance. Graefe also dissents from Mynors and others, who are advocates for cutting the skin obliquely instead of perpendicularly, because he finds the thin edge of the integuments thus separated from the subjacent cellular membrane, very apt to slough.—(Normen für die Abl. grösserer Gliedmassen, p. 102.) In a thigh of ordinary dimensions, the first incision should be made four inches below where it is intended to saw the bone. When the thigh is bulky, the large amputation knife will be found the best. Before beginning this first cut, the arm is to be carried under the limb, till the knife reaches almost round to the side on which the operator stands. With one sweep penetrating at least to the fascia, the knife is then to be brought round to the point where it first touched the skin. Thus, the wound is more likely to be regularly made, than by cutting first on one side, and then on the other, while the patient is saved some degree of pain, in consequence of the uninterrupted quickness with which the incision is made. At the same time, I ought to confess, that the late Sir C. Blicke, and some other surgeons, whom I have seen operate, used to complete the circle by two strokes of the knife, so well and expeditiously, that their capricious attachment to this plan could hardly be found fault with.

The next object is the preservation of as much skin as will afterward, conjointly with the muscles, cut in an oblique direction, cover the end of the stump with the utmost facility. It is rather difficult to lay down any other general principles for the guidance of the surgeon in saving integuments. I am disposed to agree with several modern writers, that the painful dissection of the skin from the muscles has been recommended and practised to a very unnecessary extent, that is to say, unnecessary if the division of the muscles be performed in the most advantageous manner. Graefe, one of the best surgeons at Berlin, does not dissect the skin from the muscles at all in amputating the thigh, but takes care, after making the cutaneous incision, to have the integuments and subjacent flesh very firmly drawn up before commencing the oblique division of the muscles. This retraction he also strongly advises to be done uniformly and smoothly all round

the member, lest in dividing the muscles any irregular projection of the skin interfere with the requisite movements of the knife.—(Normen für die Abl. grösserer Gliedmassen, p. 103.) Instead of dissecting back the skin, Dupuytren cuts all the soft parts at once to the bone, which he next removes, after retracting the muscles.—(Syme, in Edinb. Med. and Surg. Journal, vol. 14, p. 32.) However, Langenbeck, another of the most skilful operators on the continent, prefers detaching the integuments from the fascia for about two finger-breadths (Bibl. für die Chir. b. 1, p. 567), as is perhaps the most common practice in the London hospitals. Some late writers, particularly Mr. Syme, in expressing their preference to muscle as a covering for the end of the bone, seem to forget one fact which I have often noticed, viz. that the muscular cushion, though at first thick and good, soon shrinks to a comparatively small mass. This is consonant to a general law in the animal economy, prevailing whenever the natural action of a muscle is lost or prevented. Sir Astley Cooper states, that the covering for the end of the bone must be integuments and not muscles; for if muscular fibres are preserved with the integuments they will contract, and retraction of the skin covering the stump will be the result.—(Lancet, vol. 1, p. 148.) Brünninghausen also thinks skin a better and more durable covering for the end of the bone than muscular fibres, which after a time dwindle away; and hence he computes the quantity of integuments which ought to be saved, by the measure of the circumference and diameter of the member. Thus, when the limb is nine inches in its circumference, the diameter is about three; therefore, one inch and a half of skin on each side is to be saved.—(Erfahr. &c. über die Amp. p. 75.) But this author cuts the muscles perpendicularly, so that he is obliged to separate much more skin from the flesh than is necessary when the incision through the muscles is carried obliquely upwards. Mr. Hey's method of calculation, which I shall presently notice, appears more adapted to ordinary practice; and he says, "the division of the posterior muscles may be begun at half an inch, and that of the anterior at three quarters, above the place where the integuments were divided."—(Pract. Obs. in Surgery, p. 528, ed. 2.) With the view of preventing the necessity of dissecting the skin from the fascia, Mr. Guthrie, as already noticed, commends the plan of cutting through the fascia, together with the integuments, by the first stroke of the knife, and retracting these parts at the same time, instead of detaching them from each other. If this method be found perfectly efficient, and it be not objectionable, as exposing the muscles to be cut unnecessarily, I think the reason specified against it by Langenbeck, and explained in a preceding page, not weighty enough to form a just ground for rejecting a practice which comes with the alleged advantage of superseding the necessity for all painful dissection of the skin from the muscles. However, in secondary amputations of the thigh, if the integuments be unsound and will not retract, Mr. Guthrie approves of their being dissected back to an equal distance all round.—(On Gun-shot Wounds, p. 205—208.) Dr. Hennen, by giving an oblique direction to all the incisions through the muscles, obviates the necessity for much dissection of the integuments, and he says that in a small limb he has repeatedly performed the operation with one sweep of the knife, cutting obliquely inwards and upwards at once to the bone.—(Principles of Military Surgery, p. 265, ed. 2.) This author, like Mr. Guthrie, also recommends carrying the knife through the fascia in the first circular incision; and so does Mr. C. Hutchison, who makes no mention of dissecting back the skin, but simply states, that the "integuments and fascia being divided by a circular incision, and retracted upwards as high as is judged necessary, the superficial muscles should next be divided," &c.—(Pract. Obs. in Surgery, p. 23, 8vo. Lond. 1816.) We are therefore to conclude, that he joins Graefe and others in thinking the separation of the skin from the fascia unnecessary. My own observations in practice lead me to believe, that the dissection of the integuments from the subjacent parts used formerly to be carried to an extent beyond all moderation and necessity, and that, as it is a most painful proceeding, and hurtful by forming a large loose pouch for the lodgement of matter, it ought to be abandoned by every surgeon who follows the method of sawing the bone considerably higher than the first cut through the superficial muscles. I am not, however, prepared to assert, that no dissection at all is generally requisite, but am rather disposed to believe the moderate adoption of it, as recommended by Mr. Hey, the most prudent. This gentleman, like Desault (Œuvres Chir. t. 21, p. 515), is an advocate for amputating with a triple incision, and for preserving such a quantity of muscular flesh and integuments as are proportionate to the diameter of the limb. By a triple incision, he means first an incision through the integuments alone; secondly, an incision through all the muscles, made somewhat higher than that through the integuments; and thirdly, another incision through that part of the muscular flesh which adheres to the bone, made round that point of the bone where the saw is to be applied. The proper distance of these incisions from each other, he says, must be determined by the thickness of the limb upon which the operation is to be performed, making allowance for the retraction of the integuments, and of those muscles which are not adherent to the bone. Supposing the circumference of the limb to be twelve inches where the bone is to be divided, the diameter is about four inches, and if no retraction of the integuments were to take place, a sufficient covering of the stump would be afforded by making the first incision at the distance of two inches from the place where the bone is to be sawed, that is, at the distance of the semi-diameter of the limb on each side. But as the integuments, when in a sound state, always recede after they are divided, it is useful to make some allowance for this recession; and to make the first incision in this case at least two inches and a half or three inches below the place where the bone is to be sawed. As the posterior muscles of the thigh retract a great deal in the process of healing, Mr. Hey advises their division to be begun half an inch above the place where the integuments were cut, and the anterior muscles three quarters of an inch. The integuments, says he, will retract a little both above and below the place where they were divided; but the distance from that place must be computed from the mark left upon the surface of the muscles in dividing the integuments. Thus, in fact, in a common thigh-amputation, Mr. Hey deemed it necessary to detach the skin from the muscles merely to the extent of half an inch at the back part of the limb, and of three quarters in front; a very different practice from the old custom of making quite a bag of integuments, and turning them back as the upper piece of a glove is turned down, or rather as the sleeves of a coat are turned up.

In common amputations of the thigh, Roux strongly disapproves of separating the skin far from the muscles, as a circumstance highly unfavourable to the healing of the wound by adhesion; he divides only a few of the cellular bands between the integuments and fascia; and occasionally he has imitated M. Louis in cutting through the skin and superficial muscles together.—(Mém. sur la Réunion de la Plaie après l'Amputation, &c. p. 9.)

I believe the generality of the best modern operators are now convinced of the impropriety of dividing the muscles exactly in the manner directed by Mr. Alanson, viz. by letting the knife revolve uninterruptedly all round the bone, with its edge turned obliquely upwards towards the point where it is intended to apply the saw. It is a topic, indeed, to which I have already called the reader's attention in the foregoing columns. Langenbeck says, that he is perfectly convinced of the impossibility of forming a conical wound with one stroke of a large amputating knife, and joins Mr. Hey in approving of the triple incision.—(Bibl. für die Chir. b. 1, p. 564.) The objections first urged by Wardenburgh against Alanson's method are mathematically correct, inasmuch as the course of the edge of the knife, in this gentleman's method, must be spiral, and the end of the incision be considerably higher than the beginning of it. Such must be the result of performing the division of the muscles all round the limb by one continued stroke of the knife, with its edge directed obliquely upwards; for the idea of making the knife revolve in this manner while its point is confined to an imaginary, regular, determinate circle on the bone, I believe, is now abandoned as not really practicable. Yet with the exception of Desault, who confined himself to the triple incision conducted on the principles of M Louis (Œuvres Chir. t. 2, p. 547), few experienced surgeons refuse to acknowledge, that in this operation im-

mense advantage does proceed from the oblique division of the muscles, the honour of bringing which method into practice Mr. Alanson still unquestionably merits, however he may have erred in recommending the conical wound to be made with one sweep of the knife. Nor are there many living surgeons who entertain a doubt of the excellence of the principle inculcated by M. Louis respecting the utility of dividing the loose superficial muscles first, and then such as are deeper and adherent to the bone. In fact, a combination of this last method with the oblique division of the muscles, not exactly by one but several strokes of the knife, constitutes the mode of amputating at present most extensively adopted, and sometimes termed, as already mentioned, amputation by a triple incision. Thus, after the skin is cut, and as much of it retracted and saved as is deemed necessary, the operater cuts through the loose muscles of the thigh at the edge of the retracted skin, first those on the fore part of the limb, and then such as are situated behind. For this purpose he makes two or more sweeps of the knife, as may be found necessary, carefully directing them obliquely upwards towards the point where he means to saw the bone. The oblique division of the muscles does not merely enable the operator to saw the bone higher up than he could otherwise do, and leaves at the same time more muscle for covering its extremity, but it is a preservation of sound, undetached integuments, which assuredly form the most efficient and durable covering to the stump. I say this without precisely coinciding with Brünninghausen, who, trusting entirely to skin for covering his stumps, makes an extensive detachment of it from the muscles, and then cuts straight down to the bone. The loose muscles actually cut through now retract considerably, leaving those which are deeper and attached to the bone in a condition to be cut higher up than could have been previously done. Lastly, these are also to be divided with the edge of the knife directed obliquely upwards towards the place where the saw is to be applied. Some operators do more than this; for, after cutting down to the bone, they follow the plan of Celsus, and detach the flesh from its whole circumference upwards with a scalpel, to the extent of about another inch, in order to be enabled to saw the bone still higher up. "Inter sanam vitiatamque partem incidenda scalpello, caro usque ad os, reducenda ab eo sana caro, et circa os subsecanda est, ut eâ quoque parte aliquid ossis nudetur." This method, I think, deserves commendation, because it may have considerable effect in hindering a protrusion of the bone, if it does not, in conjunction with the foregoing method of operating and judicious dressings, render this disagreeable event quite impossible. As long as I live, however, I shall never forget a poor soldier, whose thigh had been amputated in Bergen-op-Zoom, and who was brought about ten days after the operation into the military hospital at Oudenbosch, under my care. Not the slightest union of any part of the wound had taken place; abscesses had formed under the fascia on every side of the stump; the loose skin was literally a large bag of purulent matter; the muscles were wasted to almost nothing, and their remains retracted and shrinking still farther away from the extremity of the bone, which protruded at least three inches beyond the soft parts. This unfortunate man had been attacked with chronic tetanus soon after the operation, and probably it was to the disturbance of the stump by the effects of that disease, and to the strong and continual tendency of the muscles to retract themselves, induced by this state of the system, the deplorable state of the stump was to be attributed. He lingered nearly a fortnight in the hospital before he died; previously to which event large abscesses, communicating with the hollow of the stump, surrounded the greater part of the pelvis. As I had every reason to believe that the operation had been skilfully done, perhaps when I say that the above mode of amputating will make a protrusion of the bone impossible, it is not exactly correct, as the occurrence may sometimes originate from causes which are quite independent of the particular way in which the operation has been executed.

The practice of detaching the bone from the circumjacent flesh to the extent of about an inch, after the other principal incisions are completed, as advised by Celsus and Louis, I have sometimes seen done at St. Bartholomew's Hospital, and have practised myself on other occasions, with the decided advantage of letting the bone be sawed higher up than could otherwise have been effected. Mr. Guthrie, after the incisions down to the bone, even recommends dissecting back the muscles from it "for the space of two or three inches, as the size of the limb or other circumstances may require;" but I should be reluctant myself to imitate the practice to this extent, though inclined to think most favourably of it within more moderate limits. If we reckon that three inches of the member lie between the first circular cut in the skin and the place where the knife arrives at the bone, and then take away two or three inches more of the femur, it is clear that in many examples we should be getting very high up the limb, and if a detachment of the muscles from the bone to the extent of two or three inches were thus made, it would at all events be of no service unless the bone would admit of being sawed at this great distance from the termination of the oblique division of the muscles. However, if this were truly practicable (a point which I leave for others to discuss), it would certainly be consonant to the excellent general maxim laid down by J. L. Petit, that in amputation as much of the bone and as little of the flesh should be taken away as possible.—(See Traité des Mal. Chir. t. 3, p. 150.) When this final detachment of the deep muscles from the bone is adopted, particular care, as Roux observes, should be taken always to divide the thick aponeurosis connecting the triceps to the linea aspera.—(Mem. sur la Réunion de la Plaie aprés l'Amputation, p. 10.)

With respect to Desault's method of amputating the thigh by a circular incision, already mentioned, he considered turning the knife obliquely upwards quite unnecessary: his plan was, to cut through the muscles, layer after layer, with the precaution of retracting the first stratum before he divided the second; the latter was then cut through on a level with the flesh that had been previously divided and retracted, and so on down to the bone. This, says he, is the right way of forming a true hollow cone, of which the integuments, which were drawn up before the muscles were cut, form the base, from which are gradually continued the various layers of muscles, and the highest point of which is the bone itself. Desault owns, that this method is somewhat tedious and painful, but in his opinion, these disadvantages are more than counterbalanced by the benefits procured for the patient.—(Œuvres Chir. de Desault par Bichat, t. 2, p. 547.)

All the muscular fibres, on every side, having been cut down to the bone, a piece of linen, somewhat broader than the diameter of the wound, should be torn at one end, along its middle part, to the extent of about eight or ten inches. This is called a retractor, and is applied by placing the exposed part of the bone in the slit, and drawing the ends of the linen upwards on each side of the stump. In this manner, the retractor will obviously keep every part of the surface of the wound out of the way of the saw. Graefe thinks, that in amputations of parts, where there is only one bone, the unslit portion of the linen should always be applied over the anterior muscles, as these ought constantly to be most evenly kept back, so that no projection of them may interfere with the action of the saw.—(Normen für die Ablösung grösserer Gliedm. p. 105.) This is a preference, however, which may not be of great importance, though I confess that there appears some reason in what Graefe has stated. That meritorious surgeon, J. L. Petit, whose name I always mention with pleasure, strongly commends the use of the retractor, the ends of which he drew over the anterior muscles: he says that he has employed this simple and natural means, but that it did not suit the taste of every body, especially of those who consider all the merit of an operation to consist in the quickness of its performance, or who think it satisfactory reasoning to say, this is not their way.—(Traité des Mal. Chir. t. 3, p. 152.) I have seen the saw do so much mischief, in consequence of the operator neglecting to use the retractor, that my conscience obliges me to censure such surgeons as neglect to defend the soft parts by this simple contrivance. There are some who have rejected the use of the retractor, because they have seen it get under the teeth of the saw, and obstruct the action of the instrument; but this very circumstance adduced against the retractor is, when considered, the strongest one that could possibly be brought forward in its favour, as the surface of the wound itself, and particularly the edges

of the skin, would, in all probability, suffer the same fate as the linen, by getting under the teeth of the saw, if no retractor were employed, in attempting to saw the bone high up, as closely as possible to the soft parts. I think no one can urge any but the most frivolous objections to the use of the retractor, and I know that many who have been with myself eye-witnesses of the mischief frequently done by the saw in amputations, are deeply impressed with an aversion to the neglect of this bandage. I have often seen the soft parts skilfully divided, and I have, in these same instances, seen the operators directly afterward lose all the praise which every one was ready to bestow, by their actually sawing through one-half of the ends of the muscles together with the bone. Men who have had fortitude not to utter a sigh, nor to let a groan be heard, in their previous sufferings, have now had their involuntary cries extorted from them by unnecessary, unjustifiable torture. But besides defending the surface of the stump from the teeth of the saw, the retractor will undoubtedly enable the operator to saw the bone higher up than he could otherwise do.

Mr. Liston, of Edinburgh, endeavours to show, that the saw is the only necessary thing in the case of amputating instruments; and he adds (alluding, as I suppose, to operations at the joints), that it was seldomer required than might be supposed; and he particularly declares all kinds of retractors superfluous. Here it should be remembered, that this gentleman's practice is that of flap-amputation, to which he gives the universal preference; a method in which unquestionably the retractor may be dispensed with, as, while the saw is acting, one or both of the flaps can be effectually held out of the way by an assistant. The same preference also explains, in some measure, this surgeon's rejection of the tourniquet, the application of which is inconvenient in certain flap-amputations.—(See Edinburgh Med. and Surg. Journ. vol. 20, p. 43—45.) Here, however, I am treating of amputation by the circular incision, in which practice I consider both the tourniquet and the retractor too useful to be commonly relinquished.

Another proceeding, which seems fit for reprobation, and which, indeed, Mr. Alanson very properly condemned, is the practice of scraping up the periosteum with the knife, as far as the muscles will allow. Nothing seems more probable, than that this may be the cause of the exfoliations which occasionally happen after amputations. At all events, it is a superfluous, useless measure, as a sharp saw, such as ought to be employed, will never be impeded by so slender a membrane as the periosteum. All that the operator ought to do is, to take care to cut completely down to the bone all round its circumference. Thus a circular division of the periosteum will be made, and upon this precise situation the saw should be placed. This is the method which was approved of by J. L. Petit.—(Traité des Mal. Chir. t. 3, p. 159.) It is what I have always done and recommended; yet it must be confessed, that differences of opinion prevail about the necessity and modes of dividing the periosteum. Graefe, in common with several others, entertains considerable apprehension of the effects of the periosteum being torn and lacerated by the saw, exfoliations of the bone and abscesses up to the joint being possible consequences of the rude separation and inflammation of this membrane. Hence he is an advocate for making a circular cut through at the place where the saw is to be applied, and then scraping away all below this point in the direction downwards.—(Normen für die Abl. grösserer Gliedm. p. 105 and 165.) Perhaps no very great objection may lie against this mode, which is not uncommonly followed, though I have some doubts of its real utility, as it scarcely seems practicable in the midst of the oozing of blood to hit with the saw the precise line at which the remains of the periosteum terminate; and in confirmation of the safety of Petit's practice, Mr. Guthrie's experience may be adduced, who says, "I have often sawed through the bone, without previously touching the periosteum, and the stumps have been as soon healed, and with as little inconvenience as any others."—(On Gun-shot Wounds, p. 88.) A very modern author, impressed, like many others, with the fear of tearing the periosteum with the saw, differs from them, in thinking it best to scrape the periosteum upwards; by which means, he says, that at least half an inch of this membrane, and a proportionate quantity of muscular fibres, may be preserved for covering the end of the bone, inasmuch as the muscular fibres adherent to the periosteum will remain connected with it; an advantage which this author deems very important while the edges of the bone are sharp. In amputation below the knee, he considers the method highly useful, as the sharp edge of the tibia may be not merely covered with skin, but periosteum and the cellular membrane connected with it. Since his adoption of this practice, he assures us that he has not for a very long time seen any exfoliation of the tibia, and never any protrusion of the bone of a stump.—(Brünninghausen Erfahr. &c., über die Amp. p. 65, 66, 8vo. Bamb. 1818.) Such are the sentiments of a gentleman who has published a valuable tract on amputation, as well as some other works of deserved reputation. His opinion is unquestionably the reverse of what is most prevalent in England; and I think his practice liable to the objection, that the disadvantages of scraping the bone at all, and denuding it, may exceed the benefit supposed to proceed from afterward bringing down the detached membrane over its sharp margin, even admitting this to be always practicable.

But in no part of the operation of amputation do operators in general display more awkwardness, than in sawing the bone; though, if we except directing the saw against the flesh, the faults are here less pernicious in their consequences than the errors already noticed. At the time of sawing the bone, much depends upon the assistant who holds the limb. If he elevate the lower portion of the thigh bone too much, the saw becomes so pinched that it cannot work. On the other hand, if he allow the weight of the leg to operate too much, the thigh bone breaks before it is nearly sawn through, and its extremity is splintered. It is one of the most common remarks of such persons as are in the habit of frequently seeing amputations, that the part of these operations, which a plain carpenter would do well, foils the skill of a consummate surgeon, and few operators acquit themselves well in the management of the saw. Many of them begin the action of this instrument by moving it in a direction contrary to the inclination of its teeth. Many, seemingly through confusion, endeavour to shorten this part of the operation, by making short, very rapid, and almost convulsive strokes with the saw. Almost all operators fall into the error of bearing too heavily on the instrument. That operator will saw best, who makes the first stroke of the saw by applying its heel to the bone, and drawing the instrument across the part towards himself, so as to make a slight groove in the bone, which serves very materially to steady the future operations of the instrument; and who makes long regular sweeps with the saw, rather slowly than quickly, rather lightly than heavily. But there is often a fault in the construction of the saw itself, which impedes its action, quite independently of any fault on the part of the surgeon. I allude to the edge of the instrument not being a little broader than its blade. When the saw is well made, the teeth always make plenty of space for the movement of the rest of the instrument. The instrument, as Mr. Guthrie recommends, should cut with both edges, backwards and forwards, which expedites the operation, and (what is of more consequence) helps to prevent splintering when the bone is nearly divided, because the division can be finished by the backward motions, which are the most gentle.—(On Gun-shot Wounds, p. 89.)

Graefe commends the plan of oiling the saw, for the purpose of facilitating its action (Normen für die Abl. grösserer Gliedmassen, p. 65); and though the method is innocent enough, the best operators in this metropolis do not consider it sufficiently important for adoption.

If the bone should happen to break before the sawing is finished, the sharp-pointed, projecting spiculæ, thus occasioned, must be removed by means of a strong, cutting sort of forceps, termed bone-nippers. The perpendicular division of the bone, leaves a sharp edge at the extremity of its circumference. It is not the common practice to take any measures for the removal of such sharpness; yet Graefe recommends filing it away (Op. cit. p. 66), and Mr. C. Hutchison makes it an invariable rule, whether there be any occasion to use the bone-nippers or not, "to take off the asperities, and scrape or endeavour somewhat to round the sharp cut edge of the bone with a strong blunt scalpel, in order to prevent the soft parts from being injured,

when brought over the end of the bone in forming the stump."—(Pract. Obs. in Surgery, p. 24.) Though I have not followed this practice, or rather the part of it which relates to cutting off the edge of the bone, nor seen it adopted in London in amputation of the thigh, I know of no objection to it, unless it be on the score of its inutility, and the delay which it occasions. All projecting points of bone, it is the ordinary custom to remove.

After the removal of the limb, the femoral artery is to be immediately taken hold of with a pair of forceps, and tied with a firm round small ligature, the best being that kind which is recommended and used by my friend Mr. Lawrence.—(See Ligature.) Care is to be taken to leave the accompanying branches of the anterior crural nerve out of the noose. None of the surrounding flesh ought to be tied, though the ligature should undoubtedly be placed round the artery, just where it emerges from its lateral connexions. The late Mr. Hey was accustomed to tie the femoral artery twice, leaving a small space between the ligatures. Some reasons against this plan will be found in the article Hemorrhage. The other arteries are usually taken up with a tenaculum. After tying as many vessels as require it, one-half of each ligature is to be cut off near the knot on the surface of the stump. One portion is quite sufficient for withdrawing the ligature when this becomes loose, and the other being only an extraneous body, and productive of irritation and suppuration, should never be allowed to remain.

My friend, the late Dr. Hennen, in his excellent publication, ascribes the improvement of removing one half of the ligature to Mr. James Veitch, a naval surgeon, who, in April, 1806, published some valuable precepts relative to the mode of tying the arteries in amputation.—(See Edinb. Med. and Surgical Journal, vol. 2, p. 176.) But highly as I approve of the tenor of the anonymous paper here referred to, it is impossible for me to suppose Mr. Veitch could be the first, or nearly the first, who suggested such improvement. When I went as an apprentice to St. Bartholomew's Hospital, in 1797, no surgeon of that hospital ever followed any other mode, and the practice was then so far from being new there, that gentlemen who were at the hospital seven years before myself, had seen one-half of each ligature regularly cut off the first time they went into the operating theatre of that munificent institution. The use of very broad ligatures, and the inclusion of a considerable quantity of flesh in the noose, together with the vessel, were also practices quite exploded at St. Bartholomew's at the very beginning of my apprenticeship. Mr. Veitch, however, seems to merit the honour of having been perhaps the first to set the example of tying every vessel, the femoral, as well as the smaller arteries, with a single silk thread, taking care to include, as far as was possible, nothing but the artery; and when this had been done, he took off one-half of each ligature, as near as possible to the knot, "so that the foreign matter introduced was a mere trifle, compared with what I had been accustomed to see."—(Edinb. Med. and Surg. Journ. vol. 2, p. 178.) The use of a single silk thread, therefore, was the part of these improvements, probably originating with Mr. Veitch, though the principles which led to this innovation were unquestionably first established by Dr. Jones.

Mr. Alanson directs the ends of the ligatures to be left hanging out at the two extremities of the wound, according as their nearness may point out as best. But when a ligature is situated in the centre of the wound, it is best to bring it out between the strips of adhesive plaster, at the nearest part of the surface; otherwise its running across one-half the wound to get at either angle, would create a great deal of unnecessary irritation and suppuration. The advantages of this method of placing the ends of the ligatures were well explained by Mr. Veitch; but his practice, like the innovation of cutting off the half of each ligature, has been common in the London hospitals, and at St. Bartholomew's in particular, many years earlier, I presume, than the case referred to by this gentleman; since it has been familiarly adopted in those institutions ever since 1797, as I can testify from my own personal observation. These remarks are offered without the slightest intention of detracting from the merits of the abovementioned paper, which is replete with valuable advice; nor am I influenced by any design of throwing honour on the memory or character of any other individual at the expense of Mr. Veitch, being at this time unacquainted with the exact periods when either this improvement, or that of removing the half of each ligature, commenced. M. Roux is one of the few remaining modern surgeons who declare their preference to the method of bringing out all the ligatures at the lower angle of the wound; the benefit of having them brought out thus low, so as to keep up a drain for any pus that may form, being in his opinion greater than that of arranging them at the points of the wound nearest to them.—(Mém. sur la Réunion de la Plaie après l'Amp. p. 12.)

As Dr. Hennen observes, the reducing the immoderate size of ligatures, the separating the threads of which they were composed, and placing them at convenient points along the face of the stump or wound, and the actual removal of one-half of each ligature, were amendments very slowly made; "but," says he, "an improvement which appears to me of great consequence, was the last of introduction, and is now the slowest of adoption, although the artery once secured, and the value of adhesion duly acknowledged, it is the most obvious of all. I allude to the plan of removing the ends of the ligature altogether, and thus leaving to an extensive wound the greatest possible chance of immediate union." The first printed mention of this practice, as far as Dr. Hennen's investigations have discovered, was in a letter written by Mr. Haire, dated Southminster, Essex, Nov. 1786. "The ligatures," says this gentleman, "sometimes became troublesome and retarded the cure. An intimate friend of mine, a surgeon of great abilities, proposed to cut the ends of them off close to the knot, and thus leave them to themselves. By following this plan we have seen stumps healed in the course of ten days. The short ligature thus left in commonly made its way out by a small opening in a short time without any trouble, or the patient being sensible of pain."—(See Lond. Med. Journ. vol. 7.) Certainly, considering the thickness of the ligatures in use at the above period, this testimony of the success of the method, as Dr. Hennen remarks, is very satisfactory.—(Principles of Military Surgery, p. 181, ed. 2.) In a letter received by me from Mr. Dunn, surgeon at Scarborough, and dated June 3, 1819, he tells me, "My predecessor, Mr. J. Wilson, the late partner of Mr. Travis, amputated a limb in 1792 or 1793, and cut off the ligatures close to the arteries, and no trouble ensued. He did this at the recommendation of Dr. Balcombe, of York, who had seen the method practised on the continent." In September, 1813, Dr. Hennen, who was serving with the army in Spain, began the adoption of this plan, which, he expected, would not only prove useful in promoting immediate union, but in obviating any accidental violence to the ligatures, and the wrong interference of the younger dressers in trying to pull them away. Between September and January, thirty-four cases were treated in this way without any inconvenience following, or the small particles of silk left behind giving rise to any apparent irritation. Dr. Hennen also presented to Sir J. M'Grigor some of the small circles of silk, a part of which had come away with the dressings, while others had floated out on opening the little pustules, which formed over the face of the stump at the points where the arteries had been tied. Some few of the ligatures never made their appearance, and the patients complained of no uneasiness whatever. Convinced of the utility of the method, Dr. Hennen afterward published an account of it.—(See Lond. Med. Repository, vol. 3, p. 177, and vol. 5, p. 221.) This gentleman subsequently found that Dr. Maxwell of Dumfries had adopted the plan as far back as 1798; and Dr. Ferguson, who was at Stockholm during the peace of Amiens, saw it also then followed by some of the surgeons of that city, without any ill effects.—(Hennen's Military Surgery, p. 175—178, ed. 2.) In July, 1814, Mr. Lawrence communicated to the Medical and Chirurgical Society of London, some cases and observations highly in favour of the practice, and the particularity which he lays much stress upon is, using for the purpose minute firm ligatures, composed of what is called dentist's silk.—(See Med. Chir. Trans. vol. 6, p. 156.) And in a paper of later date, he says, his farther experience had confirmed the usefulness of the method, "that this plan, by diminishing irritation and inflammation, and simplifying the process of dressing, very mate-

rially promotes the comfort of the patient, and the convenience of the surgeon, while it has not produced ill consequences or any unpleasant effect, in the cases which have come under his own observation." According to Mr. Lawrence, the small knots of silk generally separate early, and come away with the discharge; that where the integuments have united by the first intention, the ligatures often come out rather later, with very trifling suppuration, and that, in some instances, they remain quietly in the part.—(Op. cit. vol. 8, p. 490.)

After the battle of Waterloo, it was tried in many cases by Mr. Collier and by myself, though our ligatures were certainly not so minute and eligible as those employed by my friend Mr. Lawrence, whose plan essentially requires the use of minute ligatures made of dentist's silk. As I joined the army in the field after nine days, and was therefore obliged to leave my patients at Brussels to the care of others, I lost the opportunity of witnessing the effects of this method. But from Mr. Collier I afterward learned, that the new plan and the common one appeared in his judgment to answer about equally well; which report, considering hat we did not use the smallest ligatures, must be regarded as favourable. When the plan is tried, single strong threads and silks, or rather the kind of ligature which will be described in another place (see Ligature), should be employed; for otherwise, the knots would be large, and likely to create suppuration and future trouble. The practice has likewise been tried by Delpech at Montpellier; but it is not explained whether he used single threads or silks, or whether any inconveniences resulted from the method.—(See Relation d'un Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Anglaise avec la Chirurgie Francaise par P. J. Roux, 8vo. 1815.) Yet candour requires me to state, that the method is not generally adopted, and that one well-informed writer, as I shall hereafter notice (see Hemorrhage), has recited a case and some experiments, which are unfavourable to the practice.—(Cross, in Lond. Med. Repository, vol. 7, p. 355.) By Sir Astley Cooper, the practice has been found to occasion suppuration, and he has therefore given it up.—(Lancet, vol. 1, p. 149.) Mr. Guthrie, in two or three instances, has also seen some ill-looking abscesses arise from the presence of the bits of ligature, though he approves of the plan where the wound will not unite by the first intention, which, however, can rarely be known beforehand.—(On Gun-shot Wounds, p. 941.) On this subject, it merits particular attention, that no cases can be regarded as fair trials of Mr. Lawrence's method, unless precisely such ligatures as he himself employs be used.

[Dr. Koch, Professor of Chemical Surgery at the Hospital of Munich, Bavaria, after performing the flap-operation on the thigh, contents himself with approximating the flaps without securing any vessel; thus dispensing with ligatures altogether, as he finds that keeping the cut surfaces in perfect co-aptation is sufficient to prevent hemorrhage; and his success has been truly surprising. Dr. Wagner has long since proved in this country, that ligatures may be dispensed with in cases of surgical wounds, in which they are not only applied by most surgeons, but thought indispensable. See the report of his operation for removing the lower jaw, in which he used no ligatures. Many surgeons in this country are satisfied with securing the larger arteries only, and incur the risk of unimportant hemorrhages from the smaller vessels rather than multiply their ligatures. Professor Davidge, of Maryland, fell into the opposite extreme; from having encountered terrible secondary hemorrhages in the early part of his practice, he would never leave a single artery without a ligature, if he could distinguish it, and would often wait half an hour after amputation before closing the stump. He operated with singular success; but if he had used animal ligatures, his cases would not have been retarded for the sloughing of their pendent extremities. He used to say in his lectures, that arteries were like felons and murderers; there is no safety for us without we rope them.—*Reese.*]

Sometimes the sawed surface of the bone itself bleeds rather profusely. When this happens, it is an excellent plan, which I have often seen my late master Mr. Ramsden and others adopt with the greatest success, to hold a compress of lint over the end of the bone during the time requisite for securing the rest of the vessels. At the end of this period, the compress may generally be taken away, the bleeding from the bone having entirely ceased. As Monro remarks, the surgeon ought not to content himself with tying only such vessels as he observes throwing out blood, while the patient is faint with pain; he should endeavour to rouse him from that faintish state by a cordial, and then wiping off the coagulated blood with a sponge wet in warm water, he should examine narrowly all the surface of the stump, for otherwise he may expect to be obliged by a fresh hemorrhage to undo all the dressings.—(On Amputation of the larger Extremities, p. 475, Monro's Works.)

When there is merely an oozing from small vessels, Bromfield's advice to loosen the tourniquet completely is highly proper, as this measure, and washing the stump with a little cold water, will put an entire stop to such bleeding, without any occasion for more ligatures. A good deal of blood is sometimes lost from the mouths of the larger veins, and where they bleed much in debilitated subjects, I think Dr. Hennen is right in recommending them to be tied.—(On Military Surgery, p. 264.) There is no necessity for doing so, however, in ordinary cases, nor should I be disposed to imitate Mr. Hey, who, in consequence of having seen a few instances of bleeding from the femoral vein, generally enclosed that vessel in the ligature along with the artery.—(Practical Obs. in Surgery, p. 530, ed. 2.) This method was sanctioned by the eminent Desault, who says, that if the vein be left open, and the bandage at the upper part of the limb be too tight, the flood regurgitates downwards, and hemorrhage takes place, as this surgeon assures us he has often seen. When the vein and artery lie close together, as often happens, one branch of the forceps is to be introduced into the artery, and the other into the vein, which being done, the two vessels are to be drawn out together, and included in one ligature, but if they are not so near together, they must be tied separately.—(Euvres Chir. de Desault par Bichat, t. 2, p. 550, 8vo. Paris, 1801.) At St. Bartholomew's, it is not the usual practice to tie the femoral vein; and except in particular cases, I consider the custom wrong, because a ligature on a large vein sometimes excites a dangerous and fatal inflammation within the vessel, while the intervention of the vein between the one side of the circle of the ligature and the artery, must rather tend to hinder the thread from operating in the most desirable manner upon the latter vessel.

The wound is now to be evenly closed with strips of sticking plaster, so that the edges of the skin may form a straight line across the face of the stump. This was the mode commended by Alanson, and is what is preferred by the generality of surgeons in this country. It is also advised by Graefe.—(Normen für die Abt. grösserer Gliedm. p. 106. Guthrie on Gun-shot Wounds, p. 208.) Over these plasters and the ends of the ligatures it is best to place some pieces of lint, spread with the unguentum cetaceum, in order to keep such lint from sticking, which becomes an exceedingly troublesome circumstance when the dressings are to be removed. I am decidedly averse to the general plan of loading the stump with a large mass of plasters, pledgets, compresses, flannels, &c.; and I see no reason why the strips of adhesive plaster and a pledget of simple ointment should not suffice, when supported by two cross bandages and a common linen roller, applied spirally round the limb from above downwards. The first turn of the roller, indeed, should be fixed round the pelvis, while the lower circles secure the cross bandages, often called the Malta cross, over the end of the stump. It is also an excellent method to leave some little interspaces between the plasters, and in summer to keep the linen bandages constantly wet with cold water. In this way any discharge will readily escape, and the parts, being kept cool, will be less disposed to hemorrhage and inflammation.

Sir Astley Cooper states, that he has seldom succeeded with his stumps above the elbow or knee when a roller was not employed, which, he says, prevents retraction of the muscles and extensive suppuration. After applying the roller, and bringing the integuments together, he merely puts three strips of adhesive plaster over the wound, and one round the stump to keep the ends of the plaster in their place: in hot weather he applies a lotion of spirit of wine and water.—(Lancet, vol. 1, p. 150.)

I am completely of opinion with Mr. Alanson, that the elastic woollen cap, sometimes placed over all the bandages and dressings, if not put on with a great deal of care, has a tendency to push the skin backwards from the extremity of the stump; and as it must also heat the part, its employment should be discontinued.

If possible, the dressings should never be removed before the fourth day, not reckoning the one on which the amputation is performed; and Sir Astley Cooper even prefers the sixth or eighth day, merely removing on the fourth one strip of plaster in order to let out any confined matter.—(See Lancet, vol. 1, p. 150.) Monro also set down the fifth, sixth, or seventh day as generally soon enough for the change of the dressings. He allows, however, that if the smell of the wound should become offensive, the outer dressings may be removed sooner. Even when the dressings are to be taken away, it will frequently be found useful not to remove one strip of plaster; but the stump must be made clean, and any discharge washed away. These and other valuable precepts, derived from the eminent Dr. A. Monro senior, are worthy their great source, and the correctness of them promises to be acknowledged for ever.

The manner of renewing the dressings of stumps is indeed a very important business, which should never be intrusted to mere novices; for in taking off the straps of sticking plaster, if great care be not taken, the slight and newly-formed adhesions may be torn asunder. Thus, as Mr. A. C. Hutchison has remarked, if the strap be pulled off by holding one end of it at nearly a right angle with the adhering part, the flap will be raised up with it, and thus a separation of the newly-united parts will be produced. "My plan," says he, "is to reflect the raised end of the strap close down upon the adhering part, and to bring it gently forwards with one hand, while the removing part of the strap is followed by two fingers of the other placed upon the skin, &c.; and when one end is detached from its adhesion, as far as the line of incision on the face of the stump, in like manner the other end is brought down and wholly removed."—(Pract. Obs. p. 46.)

In order to facilitate the removal of the plasters, and save the patient a great deal of pain, I have always followed the plan of letting warmish water drop over them from a sponge for a few minutes previously to the attempt to remove them. In the early part of the treatment, it is also a valuable rule never to let every strap of plaster be off at once, so as to leave the flesh quite unsupported. Some skill and care are also invariably necessary, to avoid pulling away the ligatures with the dressings.

At the end of five or six days the surgeon may begin to try, in a very gentle manner, whether any of the ligatures are loose; observing rather to twist than suddenly pull them directly outwards. However, he should not use the smallest force, nor persist, if the trial create pain. One would hardly try whether the ligature on the main artery were loose before the eighth or ninth day. If minute ligatures made of dentist's silk be employed, and both their ends cut off close to the knot, of course this delicate business of trying to get rid of the irritation of these foreign bodies is entirely superseded.

Though in the above account I have directed the edges of the wound, after the amputation of the thigh, to be brought together in such a way that the wound shall appear as a line across the face of the stump, yet there are instances in which the bone seems most easily and conveniently covered, by making the line of the wound in a perpendicular direction.

Mr. B. Bell, indeed, generally approved of it, as affording a ready outlet for matter; it is likewise directed by Mr. C. Bell (Op. Surgery, vol. 1), by Roux (Mém. sur la Réunion immédiate de la Plaie, après l'Amp. p. 11), and by Dr. Hennen (On Military Surgery, p. 265, ed. 2).

On the other hand, Mr. C. Hutchison objects to it, because it seems to him, that when a stump thus put up is laid on a pillow, the pressure tends to separate and open the lower part of the wound.—(Pract. Obs. on Surgery, p. 37.)

It is curious to remark, however, that the thing which leads this gentleman to disapprove of the plan, is one which would be urged in its favour by Roux and some other surgeons, who actually take the precaution of never closing the lower angle of the wound, in order that whatever discharge occurs may find a ready outlet.—(Mém. cit. p. 14.)

Mr. Alanson objected to this method, asserting that the cicatrix afterward became situated immediately over the end of the bone, the pressure of which was very likely to make the part ulcerate. However, in St. Bartholomew's Hospital, I have seen the edges of the wound occasionally brought together in the perpendicular direction, and capital stumps made in this manner. In a case in which I assisted Mr. Ramsden at Christ's Hospital, when an attempt was made to put up the wound in a common manner, the bone seemed to make considerable pressure against the skin, which did not happen when the line of the wound was made in the other direction, which of course was immediately adopted. Mr. Hey has noticed this subject as follows: the integuments and muscles may be brought into contact by pressing either the anterior and posterior parts or the sides of the thigh together. The former method, by the gradual retraction of the posterior muscles, causes the integuments of the anterior part of the stump to cover more completely the extremity of the bone. The latter method causes the integuments and muscles to meet each other the more readily, and therefore is to be preferred when the quantity of soft parts preserved is somewhat deficient.—(Pract. Obs. on Surgery, p. 533, edit. 2.)

The plan of bringing the edges of the wound together after amputation, so that they may unite by the first intention, has received, for many years past, the universal approbation of British surgeons. It is their general practice in the treatment of all incised wounds. It may be said to be the pride of English surgery; for in nothing does she display more convincingly her superiority. Baron Larrey, however, in cases of amputation, disapproves of the attempt to unite the wound by the first intention, and merely brings forward its edges somewhat towards each other with a piece of linen, that covers the whole of the wound, and has small holes cut in it for the passage of the discharge.—(Mém. de Chir. Mil. t. 3, p. 379.) This piece of linen is supported with a moderately tight roller.

M. Roux, on his arrival in this country, wondered to see British surgeons so prejudiced in favour of union by the first intention, as to adopt it after all amputations. "C'est pareillement abuser de la réunion immédiate que de l'appliquer en toute circonstance à la plaie qui résulte de l'amputation des membres. J'entends parler de l'amputation dans la continuité des membres, et plus particuliérement encore de l'amputation circulaire."—(P. 128. Parallèle de la Chirurgie Anglaise avec la Chirurgie Française, 8vo. Paris, 1815.) But M. Roux has curiously omitted to explain in his book what are the advantages of not bringing the edges of the wound together, and why he calls prejudice the partiality to a method, the superior efficacy of which is continually demonstrated in every hospital of London. He does not indeed presume to condemn the practice altogether; on the contrary, he allows it to be proper in certain cases; yet he contends that it ought to be confined within particular limits.—(P. 130. See also Mém. et Obs. sur la Réunion immédiate de la Plaie après l'Amputation, &c. 8vo. Paris, 1814.)

In this tract, which is well drawn up, Roux proves most convincingly the benefits of union by the first intention after amputation of the thigh by the circular incision; but, strangely enough, his prejudices hinder him from advising the practice to be extended to other amputations. He does not positively condemn it in the arm, though he thinks the method less necessary, because amputation there is less dangerous than in the thigh, &c.—(P. 45.) To such futile reasoning is this author reduced by the unsoundness of his doctrine. He also deems the attempt at union by the first intention counterindicated where limbs are amputated for injuries which violently contuse and crush the parts (P. 48), and where the limb is much wasted.—(P. 50.) In the latter condition, however, he thinks Desault's flap-amputation may be done, and an effort made to heal the wound by adhesion. In one case he did this with success.—(P. 51.)

Richerand informs us that Dubois at Paris follows the plan with a success equal to that of the London surgeons. For some years past, he has himself also constantly endeavoured to accomplish union by the first intention, after all the amputations which he has had occasion to practise, and he succeeds at least in

three out of four. "The method is preferable," says he, "to the old one, in whatever point of view it is considered. This union is more expeditious; a few days being sufficient for its completion. A woman, whose thigh I took off in 1810, was very well in a week, &c. Besides the advantage of a quick cure, and such quickness is especially of great importance where the patient has been much reduced, so that he would hardly be able to bear a long suppuration, union by the first intention has the recommendation of saving the patient from a great deal of pain, the flap of integuments, with which the bleeding surface of the stump is covered, being much less irritating to the flesh than the softest charpie would be, &c. Three years have elapsed since the publication of the third edition of this book. During this interval I have performed more than a hundred and fifty amputations, and the utility of immediate union has been more and more proved to me."—(Nosographie Chirurg. p. 475. 477, edit. 4.)

But notwithstanding these and other encomiums on the practice, Richerand, like other French surgeons, is not an advocate for it in certain cases; as, for instance, limbs shattered by gun-shot wounds, or affected with hospital gangrene. Here, he maintains, that it hardly ever succeeds.—(P. 478.) But though it be true that amputations after gun-shot wounds do not generally heal so well as many other cases, it cannot be denied that they do sometimes unite more or less by the first intention; and why should not the chance be taken? It is productive of no danger; there is nothing better to be tried; and if it fail, what is the harm? Why, the wound will then heal by suppuration and the granulating process, just as soon as if the hollow of the stump had been filled with charpie or left open; it will in fact heal in a way which is less advantageous than union by the first intention, but which is the best which can now happen.

From what has been said, it appears that the practice of healing the wound by the first intention after amputation is less general in France than it is in England; a circumstance which may perhaps be explained by the fact of its being much newer to the French than to us. Every improvement must encounter for a time the opposition of prejudice; but one so important as that which we are considering, must at length prevail and meet with universal adoption. Our extraordinary partiality to union by the first intention arises from a conviction of its superior efficacy, and is a decisive proof of the goodness of English surgery in respect to wounds. The observations of Roux and Richerand tend to prove, that they are not altogether unaware of its advantages, and they therefore recommend it for certain cases; but their backwardness to extend it to all amputations without exception, is little in favour of the comparison which they are so fond of making of French with English surgery. Even the justly eminent Dupuytren still fills the hollow of the stump with charpie.—(Syme, in Edinb. Med. and Surgical Journ. No. 78, p. 32.)

However, that stumps may fall into a state in which the pressure of all plasters and bandages whatever should be most carefully avoided and emollient poultices used, is a truth of which every surgeon of experience must be fully convinced. This happens whenever the parts are affected with considerable tension, inflammation, and swelling, or painful acute abscesses. There is also no utility in keeping the edges of the wound very closely compressed together when all chance of adhesion is past, and the parts must heal by the granulating process. My friend Mr. Guthrie, after amputations performed from necessity in parts not in a healthy state, as in most secondary amputations after compound fractures of the thigh, does not insist upon the edges of the wound being brought into close contact by sticking plaster, compress, and bandage. In these cases, he also recommends the bone to be sawed an inch shorter than usual, or than would be necessray under other circumstances, in order to prevent its protrusion, and the ligatures to be cut off close to the knots, so as to lessen irritation. The integuments and muscles are to be brought forwards and retained so by a moderately tight roller, but not laid down against the bone. Some fine lint, smeared with cerate or oil, is to be put between the edges of the wound; and a piece of linen and a Malta cross over it, supported by a few light turns of the roller. "In some cases," says Mr. Guthrie, "I have put one and even two straps of plaster over the stump to keep the edges approximated without being in contact; and where the parts are but little diseased, this may be attempted; but if the stump becomes uneasy they should be cut, and a poultice applied. When only a part of the stump has appeared to slough, I have found the spiritus camphoræ, alone or diluted with a watery solution of opium, applied with the lint, very useful."—(On Gun-shot Wounds, p. 104.)

The reasons which led Mr. Guthrie to incline to the plan of not bringing together the edges of the wound in cases of this description, must be learned by reference to his own valuable work. His cases and arguments are entitled to serious consideration; and though they, as well as the observations of Roux (Mém. sur la Réunion immédiate de la Plaie après l'Amputation, 8vo. Paris, 1814), leave me unconvinced of the usefulness of not bringing the edges of the wound together immediately after the amputation of bad compound fractures, there are some of his observations respecting the injurious effects of too much pressure in certain conditions of the stump, perfectly agreeing with my own sentiments. At present, I have never seen any case of amputation in which I should not have thought the surgeon wrong, had he not brought the sides of the wound together directly after the operation, so as to afford the chance of union by the first intention

[A mode of amputating the thigh with two flaps was proposed a few years since by Professor J. B. Davidge, of the University of Maryland, which combines several important advantages.

The first incision is made with the large knife on the outside and inside of the thigh through the integument, so as to surround the limb, with the exception of an inch or more in the centre above and below. The surgeon having calculated the size of the flaps required, which are to be as long as the semi-diameter of the limb, makes with a scalpel a second and third incision through the skin, in form of the letter V, commencing above the centre of the space left vacant on the superior and inferior surface, and continued until its diverging extremities reach the ends of the semicircular cuts first mentioned. The flaps of integument are then dissected back until they equal in length a little more than the semi-diameter of the limb, to allow for the retraction that may occur. A circular incision is then made through the muscles down to the bone with the large knife. The bone is then denuded for an inch or two, the retractor employed, and the bone sawed off at the edge of the divided flesh. The arteries are then secured, the muscles drawn down, the ligatures so arranged as to come out of the superior and inferior angles of the wound, and the flaps are brought together and kept in place by adhesive straps, supported by a cross bandage, roller, &c. By this amputation the bone is cut off an inch or more within the actual face of the stump, and the flaps of integument having the angle cut out above and below do not present that unnecessary and inconvenient lump or puckering, formed at the angles after the common circular amputation. I have seen this operation performed by Dr. Davidge and others with singular success. The stump heals by the first intention, without any of the delays which are often encountered with the common flap-operation, and I prefer it for the arm as well as the thigh, unless the limb be much emaciated.—*Reese.*]

HEMORRHAGE AFTER AMPUTATION.

Bleeding after the operation is of two kinds in regard to the time when it occurs. The first takes place within twenty-four hours after the operation. Hence an assistant should always be left with the patient, with directions carefully and repeatedly to look at the stump; and if any bleeding should arise, to apply the tourniquet until farther aid be obtained. In case no assistant can be spared for this purpose, as must frequently happen in country practice, the tourniquet should be left slackly round the limb, and the nurse or patient himself directed to turn the screw of the instrument, in order to tighten it in case of need. A slack tourniquet left round the limb after amputation cannot do harm, and its not having been ready in this way has cost many patients their lives, as I have known instances of.

This kind of hemorrhage has often been known to arise from the pressure of a tight bandage round the stump. As Monro observes, the circular turns of the bandage, when tight, must stop the return of blood in the cutaneous veins, and thus by making a greater re-

sistance to the blood in the arteries which anastomose with them, occasion the contracting power of the heart and arteries to dilate, and force more blood into their other branches, but these being cut in the amputation will pour out their blood, and so hemorrhage is brought on. Making much pressure round the stump is highly deserving of reprobation; and whenever there is an universal oozing of blood I would recommend the operator to be sure that the circulation in the superficial veins is not impeded by the tightness of any bandage or tourniquet.

If the bleeding should not be from an artery of consequence, the application of linen dipped in cold water will sometimes check it, and the disagreeable necessity for removing the dressings and opening the wound may thus be avoided.

But it often happens that the wound must be opened, and the bleeding vessel tied. This is a very painful proceeding, and when the dressings have been applied some hours, so that the stump has had time to inflame, nothing can exceed the suffering to which the patient is now subjected. Here we see the prudence of being particularly careful at first to tie every suspicious vessel.

The second sort of hemorrhage after amputation arises from ulceration of the large arteries, and may occur a month after the operation, when the ligatures are all away, and the patient seems nearly well.

Two such cases are related by Mr. Bromfield.—(Vol. i, p. 307.) Now that the plan of covering the stump with sound skin is adopted, this kind of bleeding is less common than formerly. When the bleeding vessel is large there is no chance of putting the patient out of danger, except by cutting down to the vessel and tying it. The trunk of the vessel, however, may sometimes be more conveniently tied than the bleeding branch itself.

Mr. Hey makes mention of a particular sort of hemorrhage after the operation: "I have seen," says he, "a few instances of the integuments becoming so contracted after the operation as to compress the veins just above the extremity of the stump, and bring on after some hours a copious hemorrhage. When it has appeared clear to me that the hemorrhage was venous, I have made a division of the integuments on one side of the thigh, sufficient to remove the stricture, and this method has immediately suppressed the hemorrhage." —(P. 530, edit. 2.)

I have never yet met with a case in which a hemorrhage was unequivocally produced by a contraction of the integuments. Dr. Hennen says that he has seen only one example, and it was successfully treated by loosening the bandage and moistening the dressings with cold water.—(On Military Surgery, p. 264, ed. 2.) Doubts may therefore be entertained, whether the cause was the pressure of the integuments or of the roller on the veins.

In Mr. Guthrie's truly practical work there are some excellent remarks on the hemorrhages which, in an irritable and sloughing state of a stump, frequently take place from the small branches, or from the main trunks of the arteries, in consequence of ulceration. It is (says he) not always easy to discover the bleeding vessel, or, when discovered, to secure it on the face of the stump; for, as the ulcerative process has not ceased, and the end of the artery, which is to be secured, is not sound, no healthy action takes place. The ligature very soon cuts its way through, or is thrown off, and the hemorrhage returns; or some other branch is opened, and another ligature is required which is equally uncertain; and under this succession of ligatures and hemorrhages the patient dies. Here cutting down to the principal artery in preference to another amputation has often succeeded; but under certain circumstances it fails, and amputation becomes ultimately necessary. At the same time it is allowed that this operation may also fail. On the whole, Mr. Guthrie professes himself to be an advocate in most cases for tying the artery in the first instance; and if this proceeding should not answer, he would then amputate. However, the practice of taking up the artery, he thinks, should not be adopted indiscriminately, the doctrines of aneurism not being here applicable, because there is a wounded vessel with an external opening. "In the thigh the operation is less certain than in the arm, and especially if it is not the main artery that bleeds; for the branch from which the hemorrhage proceeds may come from the profunda, and tying the artery in the groin on such opinion would be doing a serious operation, and one which probably would not succeed; for the anastomosing branches would restore the circulation in the stump in a short time, and again establish the bleeding. If it is the femoral artery that bleeds, and the ligature is applied high, it is very liable to a return of hemorrhage. To obviate these difficulties, the part from which the bleeding comes should be well studied, and the shortest distance from the stump carefully noted, at which compression on the artery commands the bleeding; and at this spot the ligature should be applied, provided it is not within the sphere of the inflammation of the stump."—(On Gun-shot Wounds, p. 105, 106.) Thus far the advice seems to me correct and valuable; but where the hemorrhage could be restrained by taking up the artery in the groin, though not lower down, I doubt the propriety of preferring amputation to this other less severe operation, provided the efficiency of a ligature above the profunda be proved in the manner judiciously recommended by Mr. Guthrie, viz. by means of pressure.

The following is the counsel offered by Mr. Hey: "When we are under the necessity of amputating a limb that has suffered great contusion, though the operation is performed upon a part apparently sound, the wound sometimes becomes sloughy and ill-conditioned No good granulations arise to cover the extremities of the arteries; but the ligatures cut through these vessels, or becoming loose, cease to make a sufficient pressure upon them, and hence repeated hemorrhages ensue. This is a dangerous state for a patient; for if the vessels are taken up afresh with the needle, the hemorrhage will now and then return in the course of two or three days. In such cases, the application of dry sponge cut transversely, as directed by Mr. White (Cases in Surgery), has been found singularly useful, and has saved the life of the patient. But a constant pressure must be kept upon the pieces of sponge by the fingers of a succession of assistants, till granulations begin to arise upon the stump, and the prospect of future hemorrhage disappears. This method is of the greatest importance after amputation on the thigh or leg, where the great vessels are deeply seated. In the arm, above the elbow, where the vessels are more superficial, the great artery may be taken up with a portion of muscular flesh above the surface of the stump, by making first an incision through the integuments. My colleague, Mr. Logan, has done this twice within the last year with complete success, when repeated ligatures, applied in the usual way, had failed.

"In the morbid sloughy state of the stump above-mentioned, the application of lint, soaked in a liquid composed of equal quantities of lemon-juice and rectified spirit of wine, has been found very advantageous, and has caused it to put on soon a healthy aspect."—(P. 536, 537, edit. 2.)

[When this operation is necessary in crowded hospitals, where hospital gangrene is prevailing, Delpech recommends the practice of cutting off the ligatures close to the knots on the vessels, so that the lips of the wound may be more completely and accurately brought together.

By this means, as his experience has taught him, the risk of the wound being affected is materially lessened. The small particles of the ligatures enclosed in the stump, he says, are discharged at a period when the patient has regained strength enough to be moved into a healthy atmosphere, little openings being produced for their escape, and healing up again within twenty-four hours. He assures us that he has never seen the practice give rise to an abscess. Delpech is led by the view he takes of the consequences of suppuration, and the contraction of cicatrices, to prefer bringing the sides of the wound together after amputation of the thigh, so that the line of the cicatrix may be transverse and not perpendicular. His reason is, that most of the ligatures which unavoidably produce suppuration are placed on branches of the profunda in the posterior part of the limb, consequently here the greatest contraction follows cicatrization, and the anterior flap is thereby drawn over the extremity of the bone in the most advantageous manner.—(Chirurg. Clinique, t. 2, p. 395.) The same author gives an instance of the failure of a seton to unite a broken thigh-bone, where no union had followed a long trial of common means; and he was in the end compelled to

amputate the limb at the hip joint; the second example of his performing this severe operation.—(P. 466.) Under certain circumstances he is an advocate for the excision of diseased joints in preference to amputation; and refers the union of the bones in this case, not to the same process by which fractures are united, but to the production of a fibrous substance analogous to that of a cicatrix. Several successful examples of the practice are recorded.—(P. 472.) With respect to uncured fractures, I have now one under my care in the King's Bench. The accident happened two years and a half ago, and I have recommended the trial of a seton.—Pref.]

ON PROTRUSION OF THE BONE.

It is clearly proved by the observations of M. Louis, that this disagreeable consequence may be generally prevented by taking care to divide the loose muscles first, and (after their complete retraction, which will be favoured by no band or tourniquet being applied round the limb,) by observing to divide with a bistoury the muscles which adhere to the bone; for instance, the crural muscle, and the adhesion of the vasti and triceps to the spine of the femur. By this method, the bone may be sawn three finger-breadths higher than it could be if no attention were paid to beginning with the division of the loose muscles, and concluding with that of others attached to the bone.

The protrusion of the bones will never take place so long as they are immediately encompassed with the fleshy substance of the muscles: this proposition is incontestable. The state of the skin, whether longer or shorter, conduces nothing to this protrusion; nor will the inconvenience be prevented by drawing the skin upwards and preserving as much of it as possible. —(See Mém. sur la Saille de l'Os après l'amputation, in Mém. de l'Acad. de Chirurgie, tom. 5, p. 273, édit. in 12mo.)

As Mr. Guthrie has observed, a protrusion of the bone, after sloughing of the stump, or other accidental circumstances, will sometimes happen without any fault on the part of the operator; but he thinks it may almost always be prevented by attention to the following rules:—1. To leave the integuments attached to the muscles, instead of turning them back. 2. When the muscles are cut through in a slanting direction, upwards and inwards, or even directly downwards, to separate them from the bone, so that it may appear at the bottom of the cone as a depressed point. 3. To cut the bone short, and to keep the thigh constantly bandaged from the trunk during the cure, so as to prevent the retraction of the muscles. If, says Mr. Guthrie, a surgeon find, directly after the operation, that the bone cannot be well covered, he should immediately saw off as much more of it as will reduce it to its proper length. The error may be remedied at this moment with very little inconvenience in comparison with what must afterward be encountered if the opportunity be neglected.—(On Gun-shot Wounds, p. 109.) For some very useful directions how to bandage and support the soft parts with adhesive plasters, with the view of counteracting the tendency of the bone to protrude, I refer to some observations by Mr. Wright.—(See Bromfield's Chir. Cases, &c. vol. 1, p. 177.)

Having explained, that the surest way of preventing the evil is to save a sufficiency of muscle, especially of that muscular substance which is naturally most near and adherent to the bone, we shall next speak of the mode of relief.

When the end of the thigh-bone protrudes, it of course hinders cicatrization and becomes itself affected with necrosis. By the process of exfoliation, the dead portion of bone is sometimes thrown off, and a cure follows. But, in general, this desirable change is extremely tedious, and the result uncertain, because it frequently happens that, after the piece of bone has separated, the rest yet projects too much, and the stump still continues too conical to heal firmly enough to be capable of bearing the pressure of a wooden leg. When, however, the end of the bone forms only a slight projection, and the stump is not too conical, it is always best to leave nature to throw off the redundant exfoliating portion. In the opposite circumstances, the removal of all such part of it as cannot be covered by the integuments is the best practice, and, if well executed, will effect a cure.

This second operation is exceedingly unpleasant to the surgeon, because patients are apt to suspect, and not without reason, that the first was not properly managed. Let me therefore repeat, that the surest way of avoiding the evil is to cut the deep muscles rather higher than the superficial ones, as inculcated by M. Louis, by which means the bone will certainly lie within the level of the surface of the divided flesh. The advice delivered by my friend, Mr. Guthrie, I also consider valuable.

The second performance of amputation is a still more severe and unpleasant operation; yet, as Dr. Hennen has explained, it sometimes becomes necessary for osteosarcoma, extensive necrosis, abscesses of the medulla, unsuspected fissure, phagedena, or great protrusion of bone, with an extensively diseased periosteum, where the powers of nature are inadequate to the cure. "If the general health is not impaired, and the flesh does not peel off from the bone, as if it were boiled, the efforts of nature may be trusted to, aided by proper bandaging, and, in some cases, by the employment of the saw; but when restless nights, intense pain, flushings, and irregular bowels, with great tumefaction and hardness of the stump take place, indicating approaching hectic, and there is evidence of an irregular action of the parts, osseous matter becoming deposited, and forming a distinct tumour around the stump, our best plan will be to operate again near the trunk."—(Principles of Military Surgery, p. 266, ed. 2.) Sometimes amputation has been considered necessary a second time, in consequence of a morbid protuberance of the nerves of the stump, a change noticed by Molinelli, Morgagni, Lower, Arnemann, and Prochaska, and always attended with excruciating pain and great irritability of the part, and sometimes with retraction of the skin, and protrusion of the bone. Sir Astley Cooper, in his Lectures, relates one instance of such a stump high up the arm, where, upon examination of the part near the axilla, a tumour was felt, which, when touched, made the patient jump as if he had been electrified. In this case, as the bone protruded, amputation at the shoulder was performed. In another example, where a leg-stump was in a painful irritable state from a similar cause, Sir Astley Cooper effectually relieved the patient by removing the diseased end of the posterior tibial nerve. In a third instance, amputation was repeated at the patient's desire, and the nerves were found enlarged, forming a ganglion which partly rested upon the extremity of the bone. Such a degree of irritation had been produced by it, that no part of the stump could be touched without exciting a kind of electric shock. In a case that occurred in the Middlesex Hospital, amputation of the thigh was performed a second time, in consequence of the first stump being thus diseased. A complete ganglion, or plexus of nerves, was found closely adhering to the removed portion of bone, having almost the appearance of cartilage. The os femoris was of an unusually small size, but the linea aspera larger than natural. —(See Lancet, vol. 1, p. 115; vol. 2, p. 192.)

The following works may be consulted for information on diseases of the bones of stumps: Bonn, Thesaurus Ossium Morborum, Amst. 1788; Weidmann de Necrosi Ossium, Francof. 1798; Macdonald, de Necrosi ac Callo, Edinb. 1799; the above-mentioned Essays of M. Louis; Lévéillé sur les Mal. des Os après l'Amputation, Mém. de la Société d'Emulation, t. 1, p. 148; Von Hoorn De iis, quæ in partibus membri, præsertim osseis amputatione vulneratis, notanda sunt; Lugd. 1803. Roux, de la resection des Os Malades, Paris, 1812; Mém. de Physiologie, &c. par Scarpa, et Lévéillé, Paris, 1804.)

SPASMS OF THE STUMP.

Spasmodic contractions of the muscles of the stump is another very afflicting occurrence. Such spasms put the patient to the greatest agony, tend to cause a protrusion of the bone or sugar-loaf stump, and in some cases increase, affect the whole body, and ultimately prove fatal. But this unfortunate affection, which was rather frequent after amputations performed in the ancient manner, is infinitely less so after the modern improved plans of operating, tying the vessels, and dressing the wound. When, however, it does occur, the stump must be kept from starting, by fastening it to the pillow and bedding on which it lies, the flesh is to be properly supported with a bandage applied from the pelvis downwards, and

opium and the camphor mixture should be liberally exhibited.—(Encyclopédie Méthodique, Partie Chir. t. 1, p. 93. Latta's Surgery, vol. 3, &c.)

FLAP-AMPUTATION OF THE THIGH.

Although I concur with the majority of surgeons in regarding the operation by a circular incision the most eligible under ordinary circumstances, no doubt can exist about the preference which should be given to amputating with a flap in particular examples. The choice, as Dr. Bushe has well remarked, ought to depend on the state of the limb and nature of the malady requiring amputation. "One surgeon is so devoted to the double circular incision, that he performs no other (method), though his coadjutor in the same hospital is bigoted to the double flap-operation, and never amputates but after this manner. But the unprejudiced practitioner will look to the nature of the case, and adjust means accordingly."—(Lancet, No. 246, p. 204.) Notwithstanding this good doctrine, however, Dr. Bushe is in reality very partial to flap-amputations, affirming, that there is only one part, viz. the upper third of the leg, where he would recommend the double circular incision to be preferred.—(Op. cit. p. 207.) At the same time, he confesses, that when the arm is much emaciated and flaccid, Dupuytren's mode, with a single circular incision, is that to which he has himself given the preference. He admits, also, the frequency of tedious suppuration and sinuses after flap-amputations, which evils, however, he ascribes to the fault of making the flaps too long.—(P. 206.) Flap-amputation of the thigh, I believe, has the important advantage of being least exposed to the danger of a protrusion of the bone, and, hence, I think it may be advisable, whenever any reasons exist in the state of the parts, or the constitution, for apprehending that disagreeable occurrence. An experienced military surgeon informs us, that, in the first years of his practice, he performed several amputations by the double incision, strictly according to the precepts of Sabatier, Desault, Pelletan, and Pott, but had the mortification to have three cases in which the bone protruded, though the greatest circumspection was used in the operation and after-treatment. Hence he was induced to make trial of the flap-amputation, and although he imitates O'Halloran in not attempting to bring the flaps close together for the first six or eight days, he reports that the stump is generally healed in twenty or thirty days, and exfoliations rarely happen, on account of the bone being so well covered. In short, he says, that this method is to be preferred to all others.—(J. B. Paroisse, Opusc. de Chir. p. 185—203. Paris, 1806.)

Mr. Syme also informs us, that though the flap-amputations seen by him have been very numerous, he has never met with an instance of the bone protruding or exfoliating after them.—(Ed. Journ. vol. 14, p. 38.)

A description of Desault's or rather Vermale's mode of operating, being given in the First Lines of the Practice of Surgery, I need not here repeat it, nor say by how many respectable names the practice is sanctioned. In Guy's Hospital, flap-amputation of the thigh seems now to be mostly preferred. The operation is also sometimes adopted by my friend Mr. Vincent in St. Bartholomew's Hospital, who showed me, some time ago, a capital stump which he had made in this manner, and which healed with great expedition.

By Mr. Guthrie the flap-operation is considered preferable to the circular incision at the upper part of the thigh, "as it permits the head of the bone to be removed if found necessary, allows it to be examined and cut shorter with greater ease, and makes a much better covering afterward.—(On Gun-shot Wounds, p. 200.)

In military surgery, flap-amputation of the thigh is often advantageous, because all the flesh on one side of the limb is frequently torn away, or left in so terribly a mangled state as to be unfit for making a covering for the end of the bone. Here a flap, sufficient to cover the whole face of the stump, should be saved from the sound flesh on the other side of the limb. When the surgeon chooses the flap-amputation, not from necessity, as under these last circumstances, and the flesh is sound all round the member, the best way is to save a flap on each side of the limb, by making two semicircular cuts, the convexities of which extend in a parallel manner forwards, and the terminations of which meet at the upper and lower surfaces of the limb. The skin is not to be at all dissected from the muscles, which are to be obliquely divided as high as the base of the flap on each side. However, though this is the best plan, particular cases may require a flap to be made from the anterior, or even the posterior side of the thigh. The latter method should never be followed but from necessity.—(See Hey's Pract. Obs. in Surgery, p. 531. ed. 2.)

According to Mr. Guthrie, the difference between the flap-operation at the upper part of the thigh and that at the hip consists in its being done lower down, and in the flaps being saved more immediately from the external and internal sides of the thigh, the inner flap being the largest, in order to prevent the inconvenience which might arise from the external one being tightly stretched over the end of the bone. For the same reason Mr. Guthrie also recommends the bone to be sawed off close tothe lesser trochanter, even when the nature of the injury would allow of its being left an inch longer.—(On Gun-shot Wounds, p. 200.)

Flap-amputation of the thigh, after the manner of Vermale, is now preferred by Klein, one of the best operating surgeons in Germany, and by Messrs. Liston and Syme, two surgeons of great merit in Edinburgh. —(See Edinb. Med. and Surg. Journ. vol. 14, p. 36—46, &c.) It is also sometimes practised in several of the metropolitan hospitals. Of seven cases in which Klein adopted this method, the greater number were healed in ten days, and the rest in three weeks; and this success determined him in future always to practise it. After this mode he finds there is no danger of the muscles retracting themselves, and leaving the end of the bone protruding, even though the patient be transported from one place to another. With respect to the occasional difficulty of taking up the obliquely cut vessels, Klein admits this objection, but thinks that it equally applies to Alanson's method. He lays great stress on the utility of giving due support to the flaps with compresses and a roller.—(See Practische Ansichten der bedeutendsten chirurgischen Operationen, p. 35—38, 4to. Stuttgart, 1816.)

In one instance, where a ball had broken the upper part of the femur, and mortification had spread so far towards the great trochanter and buttock, that it was impossible to operate except by the flap-operation, or by taking the head of the bone out of the joint, Klein made a broad flap six inches long at the inner and upper part of the thigh, and then he cut the soft parts straight across just below the great trochanter, so as to make this wound meet the termination of the incision by which the inner flap was formed. This patient got perfectly well in three weeks (Op. cit. p. 39); and so did another very similar case, operated upon by the same gentleman.—(P. 43.) Where the bleeding is considerable, the femoral artery and profunda should be tied previously to sawing the bone; but if the vessels are well commanded by the pressure the sawing ought to be first completed.

At the middle of the thigh, Lisfranc also prefers amputating with two lateral flaps; pressure is made on the femoral artery as it passes over the brim of the pelvis; and the vessel is tied immediately the inner flap is formed. Lisfranc makes the flaps with a very long narrow two-edged knife, which he introduces through the limb on each side, and then cuts obliquely outwards, and downwards with it; but I think Mr. Syme is right in recommending the knife used by Mr. Liston, and the back of which is thin and blunt except for an inch from the point.—(Ed. Med. Surg. Journ. vol. 14, p. 37.) Mr. Hey also preferred a knife with a blunt back, lest the vessels should be cut with it in a way that would render the securing of them troublesome.

AMPUTATION BELOW THE KNEE.

In treating of amputation of the thigh I have remarked that as much of the limb as possible should be preserved. The longer it is after the operation, the stronger and more useful will it be found. But when the leg is to be amputated writers commonly advise the operation to be performed a little way below the knee, even though the disease for which the limb is removed may be situated in the foot or ankle, and would allow the operation to be done much farther down. The common practice is to make the incision through the integuments, just low enough to enable the operator to saw the bones, about four inches below the lowest part of the patella.

About six inches below this point is generally an eligible place for the first circular cut through the skin. This degree of lowness is usually deemed necessary, in order not to deprive the stump of that power of motion which arises from the flexor tendons of the leg continuing undivided. It is alleged also as a reason for this mode of proceeding, that it is quite sufficient to preserve a few inches of the leg in order to afford the body a proper surface of support in walking with a wooden leg; whereas, if a larger portion was saved, the superfluous part would be a great inconvenience both in walking and sitting down, without being of the smallest utility in any respect whatever. However, as I shall presently notice, experience proves that where, according to these maxims, an injury or disease would dictate the performance of amputation above the knee, the practice of amputating below this joint, but much higher than is generally sanctioned, may be followed with advantage.

The tourniquet should be applied to the femoral artery about two-thirds of the way down the thigh, just before the vessel perforates the tendon of the triceps muscle. This place is much more convenient than the ham, where it is very difficult to compress the vessel against the bone. The patient is to be placed upon a firm table, as in the amputation of the thigh, and the leg being properly held by one assistant, while the integuments are drawn upwards by another, the surgeon with one quick stroke of the knife is to make a circular incision through the integuments all round the limb. Some recommend the operator to stand on the inside of the leg, in order that he may be able to saw both bones at once. No reflections could ever make me perceive that any real advantage ought strictly to be imputed to this plan. Many suppose that it diminishes the chance of the fibula being splintered, this bone being completely divided rather sooner than the tibia. But splintering the bones generally arises from the assistant depressing the limb too much, or else not supporting it enough. If the assistant were to be guilty of this mismanagement, it would be difficult to explain why the tibia should not be splintered instead of the fibula, when a certain thickness of it had been sawed through. At the same time it must be admitted, that if the surgeon prefer standing on the inside of the limb, there is no objection to it at the time of using the saw; but before this period, in amputating the right leg, there is great convenience in having the left hand next to the wound, as is the case when the surgeon stands on the outside of the right limb. Hence I have seen many hospital surgeons, in amputating the right leg, cut the soft parts while they stood on the outside of the limb, and having done this part of the operation they proceeded to the other side of the member for the purpose of applying the saw. I have only to repeat, that I do not think any particular reason exists against sawing the two bones together, yet in such manner as to let the fibula be divided entirely through the first; and the advantage of fixing this bone against the tibia by the pressure of the hands of the assistants, while the surgeon is sawing it, is another circumstance which influences a great many writers to commend the latter plan. Graefe, who, as already mentioned, prefers the true flap-operation, does not think it advisable for the surgeon to stand on the inside of the limb in his method of operating, because, when the knife is introduced through the muscles of the calf, its point would be apt to go between the two bones.—(Normen für die Abl. grösserer Gliedm. p. 130.)

A circular cut having been made through the integuments, about two inches below the place where it is intended to saw the bones, the next object is to preserve skin enough to cover the front of the tibia and the part of the stump corresponding to the situation of the tibialis anticus, extensor longus pollicis pedis, and other muscles, between the tibia and fibula, and those covering the latter bone. Throughout this extent there are no bulky muscles which can be made very serviceable in covering the end of the stump, and consequently the operator must take care to preserve sufficient skin in this situation by dissecting it from the parts beneath and turning it up.

On the back part of the leg, on the contrary, the skin should never be uselessly detached to a great extent from the large gastrocnemius muscle, which, with the soleus, will here form a sufficient mass for covering the stump. However, the experience which I had in the army taught me the truth of a remark made by Graefe, that in forming the posterior flap of muscle it is a matter of the highest importance to let the integuments be somewhat longer than it; for otherwise, when it is turned forwards, as it must be for the purpose of covering the ends of the bones, its front edge will be left uncovered by integuments which, being the outermost, describe a greater circumference than the deeper muscular flap.—(Normen für die Abl. grösserer Glied. p. 131.) I was fully convinced of the truth of this observation by two amputations which were done by myself one in the neighbourhood of Antwerp, in 1814, and the other at Brussels the day after the battle of Waterloo. Yet Graefe, who performs the flap-amputation, strictly so called (that is to say, the operation in which a flap of skin corresponding in shape to the flap of muscle is preserved), does not himself detach the skin from the muscles of the calf at all, but at the time of making the incision in that situation directs one assistant to pull up the integuments, while another bends the foot as much as possible, which manœuvres have the effect of letting the muscles be cut rather shorter than the skin. Unfortunately, however, in many cases, the very nature of the disease or injury for which the operation is performed, would not admit of these proceedings. Nor, in a very muscular limb, would they be likely to suffice, as Graefe himself confesses, since in such cases he recommends the use of a knife bent laterally for the purpose of excavating, as it were, as the incision is made, the thick muscular flap.—(Op. cit. p. 134.) In the common method with the circular incision, I am disposed to think it best, therefore, to let a small quantity of skin be detached and saved at the back part of the leg, so that there may be a certainty of having enough to cover well the extremity of the divided muscles of the calf. As soon as the skin has been separated in front and on the outside of the leg, the surgeon is to detach the skin from the calf for about an inch, and having reflected or drawn this preserved portion out of the way, he is to place the edge of the knife close to the edge of the retracted or reflected skin at the back of the limb, and cut obliquely upwards through the muscles of the calf, from the inner edge of the tibia quite across the fibula, supposing the operator to be on the outside of the right leg, and that it is this member which is undergoing removal. In performing this last incision, as M. Louis well observes, it is essential to incline the edge of the knife obliquely upwards. In this manner the skin will be longer than the muscles, and the cure considerably accelerated.—(Mém. de l'Acad. de Chir. t. 5, édit. in 12mo.)

In the leg, the necessity of dissecting the skin from the subjacent parts is acknowledged to be greater than in the thigh: thus Mr. Guthrie says, "as the attachment of the skin to the bone will not readily allow of its retraction, it must be dissected back all round, and separated from the fascia, the division of which in the first incision would avail nothing, from its strong attachment to the parts beneath."—(On Gun-shot Wounds, p. 220.) In dissecting the skin, however, a much greater detachment of it should be made at the front and outer part of the limb, than at the opposite points, as already explained.

The flap formed of the integuments and muscles of the calf is then to be held back by one of the assistants, while the surgeon completes the division of the rest of the muscles, together with that of the interosseous ligament, by means of the catling, a kind of long, narrow, double-edged knife.

In amputating below the knee, very particular care must be taken to cut every fasciculus of muscular fibres before the saw is used. Every part except the bones being divided, the soft parts are next to be protected from the teeth of the saw by a linen retractor, made with two slits to receive the two bones, care being taken to let the unslit part be applied to the muscles of the calf, as particularly advised by Graefe.—(Op. cit p. 136.)

In the leg there are only three principal arteries requiring ligatures, viz. the anterior and posterior tibial, and the peroneal or fibular arteries. In addition to these, however, the surgeon is sometimes obliged to tie large muscular branches. The anterior tibial artery will be found in front of the interosseous membrane, and between the extremities of the bones; the fibular artery behind the fibula; and the posterior tibial situated more inwardly than the last, among the fibres of

the soleus, near the tibia.—(C. Bell, Oper. Surgery, vol. 1, p. 385.)

When the soft parts have been cut in the preceding way, the bones sawed, and the arteries tied, the wound is to be closed by bringing the flap of skin over the front and external parts of the stump, so as to meet the flap composed of the gastrocnemius, soleus, and integuments on the opposite side. This should be done without letting any tight strap of plaster press the skin against the sharp edge of the tibia; a serious and hurtful practice, which has often occasioned ulceration and sloughing of the integuments, and protrusion and necrosis of the bone. It is this danger which leads Mr. Guthrie to prefer closing the wound vertically, or nearly so, and applying the adhesive straps from side to side.—(On Gun-shot Wounds, p. 221.) I think, however, the above mode of operating almost necessarily requires the wound to be closed, so as to form a line, extending in a direction from the tibia to the fibula. But where a great deal of skin is saved all round the limb, and the muscles of the calf are not chiefly calculated upon for covering the bones, the perpendicular line of the wound will answer very well.

Many surgeons, however, operate differently. They first make the circular incision through the skin, two inches below where they mean to saw the bones. They next detach the skin from the muscles and bones equally all round the limb to the extent of about a couple of inches. The integuments are then turned up, and a division of the muscles made all round down to the bones, on a level with the line where the detachment of the skin has terminated. The parts between the bones are afterward cut through, &c. The hemorrhage having been stopped, the integuments are drawn down over the stump, and the line of the wound made perpendicular.

In the army, the practice has sometimes been adopted of sawing off the sharp upper ridge of the tibia; but I can offer no exact judgment on the merits of the innovation, which has made but slow progress. It has been done a few times at St. Bartholomew's, and I should have no objection to giving it a fair trial, especially as it has the sanction of Mr. Guthrie, who says, that in thin persons, where the spine of the tibia is very sharp, this part should be removed with the saw. —(P. 222.)

Occasionally surgeons have also removed the small remnant of the fibula, and such was sometimes the practice of Larrey, when he amputated nearer the knee than common.—(Mem. de Chir. Mil. t. 3, p. 389.)

Whether the above plan of amputating the leg so high up, when the foot or ankle is the part diseased or injured, be on the whole most advantageous, I cannot presume to determine. By some clever men the practice has been condemned; and though we see it pursued by the best surgeons in this metropolis, and my own sentiments incline me to believe they are right, I will not say that the matter is so settled as not to require farther consideration.

Mr. White of Manchester, in a paper dated 1769 (Med. Obs. and Inq. vol. 4), informs us that he took the hint to amputate a little above the ankle, from seeing a case in which this had been done by a simple incision, with such success that the patient could walk extremely well, though with a machine that was very badly constructed. After this, Mr. White began to operate above the ankle with the double incision; and he invented a machine much better calculated for the patient to walk upon.

In 1773, Mr. Bromfield published his Chirurgical Cases and Observations, wherein he mentions his having begun about the year 1740 to amputate above the ankle, in a case of gangrene of this part of the leg. The patient walked so well, with the aid of a very simple machine, both along a level surface, and in going up and down stairs, that it was difficult to perceive he had lost his foot. Mr. Bromfield was persuaded, however, to give up this practice, until he learned that in 1754, a Mr. Wright had thrice amputated in this way with success, when he again had recourse to it without the least unpleasant consequences.—(See Chir. Cases and Obs. vol. 1, p. 189, &c.)

The advantage of amputating a little below the knee is, that the pressure in walking with a wooden leg is entirely confined to the front of the limb, the cicatrix itself not being subjected to irritation. After amputating at the ankle, the pressure in walking operates directly on the cicatrix. According to Sabatier, this st plan has been extensively tried in France, but not found to answer, the stump being incapable of bearing pressure, and not continuing healed.—(Médecine Opératoire, t. 3, p. 377, edit. 2.) Baron Larrey also speaks of it as an objectionable operation, not merely because some patients, as for instance soldiers, have not the means of providing themselves with artificial legs of the above description, but because it is almost always followed by bad symptoms, owing to the small quantity of cellular substance and flesh, and the thickness of the bone at this part of the leg, whereby cicatrization is impeded. A nervous irritation is more apt to be produced by this than the common mode of operating, and the suppuration, which is always sanious, takes place with difficulty. "I have (says Larrey) seen many amputations done at this part, but nearly all the patients died of nervous fever or tetanus."—(Mém. de Chir. Mil. t. 3, p. 394.)

In the foregoing columns I have given some account of the flap-amputation of the leg, as done by Lowdham, Verduin, Garengeot, Vermale, and others, and, in particular, the practice of O'Halloran has been touched upon, whose chief peculiarity, viz. that of not laying down the flap until ten or twelve days had elapsed, was unquestionably his greatest error, though the idea may have been admired and followed by a few speculators in modern times.—(See Paroisse, Opusc. de Chir. p. 196, &c. Paris, 1806.) This last author, who is a general approver of flap-amputations, leaves the stump unclosed for some days after the removal of the limb; but it surprised me to hear, that in one of the finest hospitals in this metropolis, three or four trials were made a few years ago, of a modification of this absurd practice, after amputation by the circular incision. Instead of bringing the sides of the wound together, the stumps were only partially closed, and kept for a day or two covered with wet linen. The last patient whom I heard of as having been treated in this manner, died a few days after the operation; and it gives me pleasure to hear, that all farther intention of subjecting more patients to the experiment, in the hospital alluded to, is given up.

In flap-amputations below the knee, Alanson and Lucas conjectured that the cure might be rendered more safe, easy, and expeditious by applying the flap, with the view of uniting it by the first intention.

The following case explains Mr. Alanson's flap-operation. The disease was in the left leg, the patient, therefore, lay on his right side, upon a table of convenient height, so as to turn the part to be first cut fully into view. The intended line, where the knife was to pass in forming the flap, had been previously marked out with ink. A longitudinal incision was made with a common scalpel, about the middle of the side of the leg; first on the outside, then on the inside, and across the tendo Achillis: hence, the intended flap was formed, first by incisions through the skin and adipose membrane, and then completed by pushing a catling through the muscular parts in the upper incised point, and afterward carrying it out below, in the direction of the line already mentioned. The flap was thick, containing the whole substance of the tendo Achillis. The usual double incision was made; the retractor applied to defend the soft parts; and the bone divided as high as possible with the saw.

The flap was placed in contact with the naked stump, and retained there at first by three superficial stitches, between which adhesive plasters were used. Notwithstanding the patient caught an infectious fever a few days afterward, the stump healed in three weeks, except half an inch at the inner angle, where the principal vent had been. In another week, the wound was reduced to a spongy substance, about the size of a split pea. This being touched with caustic healed in a few days. The man was soon able to use an artificial leg, with which he walked remarkably well. He went several voyages to sea, and did his business with great activity. He bore the pressure of the machine totally upon the end of the stump, and was not troubled with the least excoriation or soreness.

In the next instance, in which Mr. Alanson operated, he formed the flap by pushing a double-edged knife through the leg, and passing it downwards and then outwards, in a line first marked out for the direction of the knife. In this way, the flap was more quickly made.

The leg should be completely extended during the operation; and kept in that posture till the wound is perfectly healed.

We shall next notice Mr. Hey's method. He was satisfied, that very near the ankle is not the most proper place for this kind of amputation.

Some cases occurring in which, from a scrofulous habit, the wound at the stump would not heal completely, nor remain healed, Mr. Hey determined to try whether amputation in a more muscular part would not secure a complete healing, and give the patient an opportunity of resting his knee on the common wooden leg, or using a socket, as he might find most convenient. Mr. Hey latterly preferred this method, which he reduced to certain measures.

It had been customary at the Leeds Infirmary, to make the length of the flap equal to one-third of the circumference of the leg. This was determined by the eye of the operator, who usually pushed the catling through the leg near the posterior part of the fibula. Mr. Hey, finding the flap was not always of the proper breadth, began to determine this by measure, and then operated as follows: to ascertain the place where the bones are to be sawed, together with the length and breadth of the flap, he draws upon the limb five lines, three circular and two longitudinal ones. He first measures the length of the leg from the highest part of the tibia to the middle of the inferior protuberance of the fibula. At the mid-point between the knee and ankle, he makes the first or highest circular mark upon the leg. Here the bones are to be sawed. Here Mr. Hey also measures the circumference of the leg, and thence determines the length and breadth of the flap, each of which is to be equal to one-third of the circumference. In measuring the circumference of the limb, Mr. Hey employs a piece of marked tape or riband, and places one end of it on the front edge of the tibia. Supposing the circumference to be twelve inches, he makes a dot in the circular mark on each side of the leg, four inches from the anterior edge of the tibia. These dots must, of course, be four inches apart behind. From each of these dots Mr. Hey draws a straight line downwards, four inches in length, and parallel to the front edge of the tibia. These lines show the direction which the catling is to take in making the flap. At the termination of these lines, Mr. Hey makes a second mark round the limb, to show the place where the flap is to end. Lastly, a third circular mark is to be made an inch below the upper one, first made for the purpose of directing the circular cut through the integuments, in front of the limb. The catling for making the flap should be longer than those commonly employed in amputations. Mr. Hey uses one which is seven inches long in the blade, and blunt at the back, to avoid making any longitudinal wound of the arteries, which is very difficult to close with a ligature; and, for the same reason, he pushes the catling through the leg a little below the place where such muscles are to be divided as are not included in the flap. The limb being nearly horizontal, and the fibula upwards, he pushes the catling through the leg where the dot was made, and carries it downwards along the longitudinal mark, till it approaches the lowest circular mark, a little below which the instrument is brought out. The flap being held back, Mr. Hey divides the integuments on the front of the limb along the course of the second circular mark. The muscles not included in the flap are then divided a little below the place where the bones are to be sawed. No great quantity of these muscles can be saved, nor is it necessary, as the flap contains a sufficient portion of the gastrocnemius and soleus muscles to make a cushion for the ends of the bones. After sawing the bones, Mr. Hey advises a little of the end of the tendon of the gastrocnemius to be cut off, as it is apt to project beyond the skin when the flap is put down; and he recommends the large crural nerve, when found on the inner surface of the flap, to be dissected out, lest it should suffer compression.

As strips of adhesive plaster cause great pressure on the end of the stump, Mr. Hey prefers sutures for keeping the flap applied; small strips of court plaster being put between the ligatures. The sutures may be cut out on the eighth or ninth day, and the flap supported by plasters.

Mr. C. Bell describes another sort of flap-amputation. The operation is not to be done so low, as there will not be a sufficiency of muscle to cover the end of the bones. An oblique cut is to be made with the large amputating knife upwards, through the skin of the back part of the leg. The assistant is to draw up the skin, and the knife is to be again applied to the upper margin of the wound, and carried obliquely upwards till it reaches the bones. The knife, without being withdrawn, is next to be carried in a circular direction over the tibia and fascia, covering the tibialis anticus until it meets the angle of the first incision on the outside of the limb. The surgeon is then to pierce the interosseous membrane, &c. The sawing being completed, and the arteries secured, the flap is to be laid down, and the integuments of the two sides of the wound will be found to meet.—(Operative Surgery, vol. 1.) Langenbeck disapproves of the plan of pushing the knife through the calf of the leg, as practised by Alanson, Hey, Graefe, Liston, Lisfranc, Syme, &c., because an inexperienced surgeon may run the point between the two bones, and in this way the wound is never made evenly. His manner of forming the flap is very similar to Mr. C. Bell's, except that he first makes three cuts in the integuments, two longitudinal and one transverse, by which the shape of the flap of skin is determined.—(Bibl. für die Chir. b. 1, p. 571.)

The regular flap-amputation of the leg, I mean that operation in which the circular incision is abandoned, and a semicircular flap both of skin and muscle preserved, is often considered more painful than the common method. Yet when we come to see what respectable names are recorded in its favour, how soon the stump generally heals, how well the ends of the bones are covered, and how all dissection of the integuments from the fascia is avoided in this mode of operating, at least as far as the flap extends, the method must be allowed to possess weighty recommendations. Indeed, in its present improved state, and with the peculiar fitness of such a stump for adhesion, this operation, I think, is again rather rising in the estimation of the profession. In 1816, Klein had performed flap-amputation of the leg about twenty times. If the flap should happen to be made too large, he particularly dwells on the propriety of removing part of it at once; and when it is too short, he enjoins carrying the incision a little farther upwards without delay. He confesses that the plan is attended with some little trouble in securing the interosseous arteries, which are apt to retract considerably; but such has been the success of his practice, that out of twenty cases seventeen got well, and most of them very soon, without the least exfoliation; and the other three died of typhus.—(Practische Ansichten der bedeutendsten Chir. Op. Iste Heft, p. 47.) In the same work, this experienced surgeon, convinced how much more quickly and certainly the wound heals after amputations with two flaps than those with one, has suggested a plan of amputating below the knee, so as to form two lateral flaps. Mr. Syme, of Edinburgh, recommends an anterior and a posterior flap. On the other hand, as already mentioned, it is only in amputating below the knee that Dr. Bushe conceives the circular incision decidedly preferable to the flap-operation. He distinctly declares, that he "never saw a case where a flap was formed from the calf of the leg, in which considerable retraction of the remaining muscles did not ensue, attended with great induration of the flap, separation of its edge from the skin on the front of the tibia, sometimes exfoliation of the bone, and generally tedious suppuration. Nor (says he) can I speak much in favour of the method recommended by Mr. Syme, viz. that of forming an anterior and posterior flap; for before I saw his paper, I once performed this operation, and regret to say that my success was so indifferent, that I have not since repeated it."—(Lancet, No. 246, p. 208.) I have also tried the same method, and coincide with Dr. Bushe respecting it.

The principal reasons have already been specified which have established the common custom of amputating the leg about four inches below the patella, and if the disease or injury will not admit of the operation being done thus low, of removing the limb above the knee-joint. In the Egyptian campaign, however, Baron Larrey performed two amputations very near the knee-joint, almost on a level with the head of the fibula, which he judged proper to extirpate. The successful result of these operations dispelled the fear which this experienced surgeon previously entertained about am-

putating in the thick part of the upper head of the tibia; for no caries of this spongy portion of the bone, no bad effects on the knee-joint, and no anchylosis of the stump ensued: and, with the difference of a few days, the wound healed as readily as that made in the common place of election, viz. three or four finger-breadths below the tuberosity of the tibia. Since the above-mentioned campaign, Larrey has adopted this practice in many cases where it was impossible to have operated at the usual place, and he assures us, the success fully equalled what attends operations done at the ordinary distance from the knee. In 1806, another French military surgeon, who had tried this method himself, published a dissertation, in which he commended operating, where circumstance required it, much higher than the point allowed by generally-received rules. Larrey differs, however, from Garrigues, in forbidding amputation higher than the level of the tuberosity of the tibia, the thick portion of which may be sawed, but not above the insertion of the tendon of the patella. A transverse line, drawn from this point, usually passes below the articulation of the fibula, and over the lower portion of the uppermost part of the condyles of the tibia; but as the relative positions of the heads of the two bones to each other differ somewhat in different individuals, Larrey makes the tuberosity of the tibia the point above which the bone should never be sawed. By cutting higher, the ligament of the patella is separated from its insertion; the bursa mucosa, situated underneath it, is wounded, and the ligaments at the sides of the joint are injured; whence arise retraction of the patella, effusion of the synovia, and such disease of the knee-joint as may render another amputation indispensable. By making the division on a level with the tuberosity of the tibia, the attachment of the ligament of the patella is preserved as well as that of the flexor tendons of the leg, which are requisite for the motion of the stump. The bursa mucosa is left untouched; and the head of the bone is sawed low enough to avoid creating a risk of caries. But, says Larrey, if this mode of amputating below the knee be compared with amputation of the thigh, as recommended by authors for the cases in which the new method is proposed, the advantages of the latter are considerable. In the first place, life is less endangered, because a smaller portion of the body is removed. The operation is as easy in one situation as the other. The stumps heal with equal facility. Larrey has never seen the spongy part of the tibia become carious, nor perceptibly exfoliate. When the remaining portion of the fibula is very short, as usually happens, it ought to be taken away, as it is a useless body, inconvenient for the employment of a wooden leg. Larrey directs as much skin as possible to be preserved, and making a perpendicular incision through that part of it which covers the tibia, in order to hinder the bone from making its way through it by ulceration.

With a stump thus formed, comprising the knee and one or two finger-breadths of the leg, the patient has a firm point of support, on which he can securely walk without a stick. The stump admits also of an artificial leg of the natural shape being worn, the knee being always bent, provided the length of the stump do not exceed the diameter of the calf of the artificial limb.—(Mém. de Chir. Militaire, t. 3, p. 386—394.) From a passage quoted by Mr. Guthrie, it would seem that Mr. Bromfield (Chir. Obs. and Cases, vol. 1, p. 185) advised amputating as near to the knee as could be done, without risk of cutting the ligament of the patella, so that the stump might not extend beyond the wooden leg. On the whole, Mr. Guthrie's own observations are very favourable to this practice; but he candidly acknowledges his belief, that "it would not succeed when indiscriminately done in the hospitals of large cities," though it may frequently be practised in the army with advantage, provided the surgeon saw through the tibia below its tuberosity.—(On Gun-shot Wounds, p. 223 and 227.) Upon looking over the details of the cases recorded by Larrey in confirmation of the above statement, I was struck with one important fact, which does not justify a part of his commendations; viz. most of the stumps were above four months in healing; and that which healed most quickly was not well before the sixty-eighth day.—(See Mém. de Chir. Mil. t. 3, p. 57. 397, 398, &c.) Hence, unless it be supposed that the wounds produced by amputation below the knee in the ordinary manner are generally thus long in healing, as treated by the French surgeons, the inference is rather unfavourable to the method so highly commended by Larrey, though I am far from wishing to assert that, even if the stumps cannot usually be healed in less time, more than a full compensation for this disadvantage is not obtained by some of the benefits above enumerated. However, in order to be able to pronounce any positive judgment on the merits of this mode of operating, it would be requisite not only to see two or three successful cases just after their cure, but to examine the state of a tolerable number of stumps some time after they had been subjected to the pressure of an artificial leg.

AMPUTATION OF THE ARM.

The structure of the arm is very analogous to that of the thigh: like the latter, it contains only one bone, round which the muscles are arranged. The interior muscles are attached to the os brachii, while the more superficial ones extend along the limb, without being at all adherent. The first consist of the brachialis internus and the two short heads of the triceps; the second of the biceps and long head of the triceps. Hence amputation is here to be done in the same way as in the thigh, unless when we are necessitated to amputate very high up above the insertion of the deltoid muscle. In the arm, says Graefe, the incisions through the muscles should even be made more obliquely upwards than in the thigh, where the muscles are more bulky, by which means two inches of muscle may be saved, besides the retracted integuments; an abundance for covering the stump, were the arm full ten inches in cicumference.—(Normen für die Abl. grösserer Gliedm. p. 109.)

The patient being properly seated, the arm is to be raised from the side, and, if the disease will allow it, into a horizontal position. As I have seen some inconveniences produced by the patient's fainting in the midst of the operation, I join Graefe and some other practitioners in thinking that the patient, if circumstances will allow, should be placed upon a table in the recumbent position.—(Normen für die Ablosung grösserer Gliedm. p. 108.) The surgeon is to stand on the outside of the limb, apply the tourniquet as high as possible, and let the skin and muscles, which he is about to divide, be made tense by the hands of an assistant. The soft parts are next to be divided, as much of the limb being preserved as possible. The retractor is to be applied, the bone sawed with the usual precautions, and the bleeding stopped in the ordinary way, care being taken to leave the radial nerve out of the ligature, which is put round the brachial artery. The wound is then to be closed so as to form a transverse line, the dressings are to be applied, and the patient put to bed with the wound a little elevated from the surface of the bleeding.

In taking off the arm, I entirely coincide with Mr. Guthrie with regard to the uselessness of dissecting back the integuments, a plan long ago renounced by the celebrated Dupuytren, their effectual retraction by an assistant after their complete division being quite enough (On Gun-shot Wounds, p. 354); but, as I have invariably imitated Graefe and others, in making the incisions through the muscles with the edge of the knife turned very obliquely upwards, it has not appeared to me necessary, after cutting down to the bone in this manner, to clear away the muscles from it to the extent of an inch and a half or two inches higher. Instead also of attempting to perform the circular oblique incision through the muscles with one stroke of the knife, the objections to which have been noticed in the description of amputation of the thigh, I have made it a rule to divide the loose biceps muscle as soon as the integuments have been cut and retracted, and of letting it fully recede before the division of the rest of the soft parts is begun.

If the disease should require the arm to be taken off at its upper part, there would be no room for the application of the tourniquet. Here, instead of putting a compress in the axilla, and having it held firmly upon the artery by a bystander, as advised by Sabatier, it is more eligible to make pressure on the artery as it passes over the first rib, of which method I shall speak in treating of amputation at the shoulder-joint. With a straight bistoury the surgeon is now to make a transverse incision down to the bone, a little above the lower extremity of the deltoid muscle. Two other longitudinal incisions,

made along the front and back edge of this muscle, now form a flap, which must be detached, and reflected. Lastly, the rest of the soft parts of the limb are to be divided by a circular cut, made on a level with the base of the flap, and the operation finished like a common amputation.—(Sabatier, Medecine Opératoire, t. 3, p. 375, &c. ed. 2.)

As a matter of choice, and not at all of necessity, the arm may be amputated with two flaps; one anterior, the other posterior. The first should be formed of the skin and biceps, and be three or four inches in length; the other is to be of the same size, and composed of the triceps and integuments. The muscular flesh close to the bone is now to be divided all round, and the saw used. Klein preferred this to the common method, and adopted it in nine cases. So well is the end of the bone always covered, that a protrusion of it is impossible.—(Practische Ansichten der Chirurgischen Operationen, p. 44.)

When the arm is injured very high up, Baron Larrey prefers amputation at the shoulder-joint to preserving a short stump, containing the upper end of the humerus; for, says he, if this bone cannot be divided at least on a level with the tendinous insertion of the deltoid, the stump is retracted towards the armpit by the pectoralis major and latissimus dorsi; the ligatures on the vessels irritate the brachial plexus of nerves; great pain and nervous twitchings, often ending in tetanus, are produced; the stump continues swelled; and, in the end, the humerus is fixed by anchylosis to the shoulder, so that this portion of the arm remains altogether useless, and renders the patient liable to accidents. "I have seen (says Larrey) many officers and soldiers, who, on these accounts, were sorry that they had not undergone amputation at the shoulder."—(Mem. de Chir. Mil. t. 3, p. 53. 400.)

Mr. Guthrie also states, that when amputation by the circular incision is attempted at the insertion of the pectoralis major, the bone will generally protrude after a few dressings. However, he entirely dissents from Larrey respecting the necessity of taking off the limb at the shoulder, and prefers doing it from half an inch to an inch and a half below the tuberosities of the humerus, as the state of the injury may require. Two incisions are to commence one or two finger-breadths below the acromion; and the inner one is to be extended directly across the under side of the limb, till it meets the lower point of the outer wound. Thus the under part of the arm is cut by a circular incision; the upper in the same manner as it sometimes is in removing the limb at the shoulder-joint. Without detaching the skin from the muscles these are cut through; the soft parts are held out of the way of the saw; the bone is sawed; the vessels secured; and the flaps brought together, so as to form a line from the acromion downwards.—(Gun-shot Wounds, p. 337, &c.) I am decidedly of opinion, that, in the description of cases referred to, either this method or Sabatier's operation should be preferred to the removal of the whole limb at the shoulder-joint.

Dupuytren sometimes amputates at the elbow-joint; but as the stump is not more useful than when the operation is done a little higher up, and the wound is frequently long in healing, the method appears hardly to merit a description.

AMPUTATION OF THE FOREARM.

The wisest maxim, with respect to the place for making the incision, is to cut off as little of the limb as possible. This fact is perfectly established, though it is true that Larrey, in consequence of his mode of dressing the stump, has not experienced success in his amputations done in the tendinous part of the forearm. The forearm is to be held by two assistants, one of whom is to take hold of the elbow, the other of the wrist. The tourniquet is to be applied to the lower part of the arm, and the assistant holding the elbow should draw up the integuments, so as to make them tense. The circular incision is then to be made down to the fascia; from this as much skin is to be detached, reflected, and saved, as is necessary for covering the ends of the bones, and the muscles are to be cut on a level with the reflected skin, the knife being at the same time directed obliquely upwards. As many of the muscles are deeply situated between the two bones of the forearm, too much attention cannot be paid to dividing all of them, with a double-edged knife introduced between the radius and ulna.

The soft parts are to be protected from the saw by a linen retractor. It is generally recommended to saw the two bones together, for which purpose the forearm should be placed in the utmost state of pronation. As the radius at the lower part of the forearm is larger than the ulna, it should perhaps be sawed through first, the latter bone, in consequence of its connexion with the humerus, being better adapted to bear the weight of the saw.—(Averill's Op. Surgery, p. 124.)

The ulnar, radial, and two interosseous arteries are those which usually require a ligature.

Graefe removes the forearm by making a flap from the flesh in front of the limb, and then extending the wound quite round the member.—(Normen für die Ablösung grösserer Gliedm. p. 138, &c. 4to. Berlin, 1812.) Mr. Guthrie makes two flaps, one in front, the other on the back of the forearm; but, above the middle of this part of the limb, he prefers the circular incision.—(On Gun-shot Wounds, p. 373, 374.) Dr. Hennen also expresses his approbation of amputating the forearm, so as to make two semilunar flaps (Principles of Military Surgery, p. 265, edit. 2); which is the method recommended and practised by Klein.—(Practische Ansichten bedeutendsten Operationen, Heft 1, p. 45.) Lisfranc also operates in this way at the lower third of the forearm. These flap-operations of the forearm are rather proceedings of choice than of necessity; for I have seen this part of the limb removed in numberless instances by the circular incision, and can hardly remember a case in which the stump turned out badly. In making the inner flap, the radial and ulnar arteries must obviously be in danger of being wounded higher up than the point where they are quite cut through, as Mr. Guthrie candidly acknowledges; an accident which I think might give rise to a great deal of trouble.

With respect to Larrey's preference to amputating in the fleshy part of the forearm, though the case would admit of the operation being done much lower, I need only say, he would find no reason for this choice were he to practise union by the first intention at every opportunity, as is the custom in England.

The hand may be amputated at the joint of the wrist whenever the disease does not extend too high, and a flap can be made of the integuments of the back of the hand. Richerand thinks such an operation sometimes preferable to amputation above the joint.—(Nosogr. Chirurg. t. 4, p. 506, edit. 4.) Lisfranc saves the flap from the palm. The circumstances of the case should of course frequently determine the choice. The amputation may also be done by the circular incision.

AMPUTATION AT THE HIP-JOINT.

The very idea of this formidable operation for a long while checked the hand even of the most ready advocate for the use of the amputating knife, and every mind shuddered at so extensive a mutilation. Still, it could not be denied, that the chance of saving life occasionally depended upon a submission to the greatest temporary suffering, and that, without the most cruel of sacrifices, the preservation of the patient was totally impossible. Dreadful as amputation at the hip appeared, both in respect to the magnitude of the part of the body to be removed, and the extent of the wound caused by such removal, the desperate nature of some cases at length began to incline surgeons to view more dispassionately a scheme, at which the mind at first naturally revolted. Morand is the earliest practitioner who made this severe operation the subject of considerable attention (Opuscules de Chir. t. 1, p. 176, 8vo. 1768); and in the year 1739, two essays on the same topic were communicated to the Royal Academy of Surgery at Paris, by two of his pupils, Volner and Puthod. In 1743, Ravaton wished to have performed amputation at the hip-joint in a case of gun-shot fracture of the trochanter major, and neck of the thigh-bone, but was prevented by the opposition of other surgeons.—(Chir. d'Arm. p. 323, &c.) In 1748, the propriety of attempting the operation was urged by l'Alouette.—(Disp. Chir. Halleri, t. 5, p. 265.) At length, the Royal Academy of Surgery at Paris thought the subject highly deserving of farther investigation, as it appeared to several of its members, that there were circumstances under which its performance might be advisable. In the year 1756, they therefore proposed the following

question, as the grand prize subject: In the case in which amputation of the hip-joint should appear to be the only resource for saving the patient's life, to determine whether this operation ought to be practised, and what would be the best way of performing it? No satisfactory memoirs having been presented, the same subject was proposed in 1759. The approbation of the Academy was now conferred on a paper written by Barbet, in which the propriety of amputating at the hip-joint was defended, and some of the cases demanding the operation specified. If, for instance, a cannon-ball, or any other violently contusing cause, had carried off or crushed the thigh, so as to leave only a few parts to be cut to make the separation complete, he thought a surgeon ought not to hesitate about doing it. The same author conceived that a sphacelus, extending to the circumference of the joint, and destroying the greatest part of the surrounding flesh, might also render the operation equally necessary and easy.—(See Sabatier, Méd. Opératoire, t. 3, p. 271, &c.) Cases were also adduced, where the surgeon completed the separation of the dead parts with a knife. However, this cannot be considered as amputation at the hip-joint. Dividing a few dead fibres was a thing of no importance, in regard to the likelihood of its creating any bad symptoms. The proceeding, in fact, seems to me to have no analogy at all to the bloody operation of taking the thigh-bone out of the socket. It is quite a different thing, when the operator has to cut through parts which bleed profusely, and are endowed with life and sensibility.

In addition to the memoir by Barbet, thirty-three other essays were offered to the academy, the majority of which were filled with arguments in favour of the operation; and, besides these productions, two other memoirs were published at Paris, one by Goursaud in 1758, explaining a new method of operating, and another by Moublet (see Journ. de Médec. an 1759), in which, says Professor Thomson, the operation is very ably considered in all its different relations.—(Obs. made in the Mil. Hospitals in Belgium, p. 260—263.)

Some of the best surgeons of the last and present century condemn the proceeding. The following are Mr. Pott's sentiments: "M. Bilguer and M. Tissot are the only people whom I have met with or heard of in the profession, who speak of an amputation in the joint of the hip as an advisable thing, or as being preferable to the same operation in the thigh." After a quotation or two, he continues; "that amputation in the joint of the hip is not an impracticable operation (although it be a dreadful one) I very well know. I cannot say that I have ever done it, but I have seen it done, and am now very sure I shall never do it, unless it be on a dead body. The parallel which is drawn between this operation and that in the shoulder will not hold. In the latter it sometimes happens, that the caries is confined to the head of the os humeri, and that the scapula is perfectly sound and unaffected. In the case of a carious hip-joint, this never is the fact; the acetabulum ischii, and parts about, are always more or less in the same state, or at least in a distempered one, and so indeed most frequently are the parts within the pelvis, &c.—(Pott on Amputation.) Here it may be remarked, that Pott was right, inasmuch as the operation is totally unjustifiable in disease of the hip-joint, but wrong in not perceiving, that, though unfit for such a case, it might be proper for others. Callisen had difficulty in supposing any circumstances in which the operation could be undertaken with hopes of success.—(Syst. Chir. Hod. p. 418, t. 2, edit. 1800.) And Richerand thinks, that unless the limb be nearly separated by the disease or accident, a prudent surgeon should decline making the attempt.—(Nosogr. Chir. t. 4, p. 519, edit. 4.)

It is a remarkable fact in the history of surgery, that an operation which had been invented in France, and concerning which so much had been written in that country, should have been first actually put in practice in England. "I have been informed (says Professor Thomson), that the operation was performed in London by the late Mr. H. Thomson, surgeon to the London Hospital, and imagine that it must have been his operation to which Mr. Pott alludes."—(Obs. made in the Mil. Hospitals in Belgium, p. 264.) At all events, whether this was the identical case which Mr. Pott saw or not, the example referred to by this distinguished surgeon is the earliest instance of the operation being actually performed. It was even repeated in this country before it was ever practised on the continent, as far as can be made out from the records of the profession; for it was performed by Mr. Kerr, of Northampton, on a girl between eleven and twelve years of age, in a case of diseased hip; a case in which I am now completely satisfied that it ought never to be attempted, for the reason laid down by Mr. Pott. In fact, Mr. Kerr, after removing the limb, found the acetabulum, and all the adjacent parts of the ossa innominata, carious. But the experiment was here rendered still more hopeless by the patient being consumptive. Yet with all these disadvantages, the girl lived till the eighteenth day from the operation, and after death her lungs were found to be a complete mass of disease, one of them being totally reduced to matter.—(See Duncan's Med. Commentaries, vol. 6, p. 337, 8vo. Lond. 1779.) Larrey performed this operation twice in Egypt; and once while he was serving with the French army on the Rhine. He was encouraged to make these attempts to save his patients by the consideration that he had already preserved some lives by amputating either both thighs, both legs, or both arms, or removing the humerus at the shoulder-joint. Larrey has also the true merit of having first done the operation in the only description of cases in which perhaps (with the exception of bad examples of necrosis of the higher part of the femur) it ought ever to be performed; viz. gun-shot injuries of the head, neck, and upper part of the femur, with or without injury of the femoral artery, or where the limb had been carried away by a shell or cannon-ball, too high up to admit of amputation in the ordinary manner. However, he also regards as fit occasions for amputation at the hip-joint circumstances in which, from gun-shot violence, the limb is seized or threatened with gangrene nearly up to the hip.—(Mém. de Chir. Mil. t. 2, p. 185.)

Severe as the operation is, Larrey contends that it is an act of humanity, if it ever is the means of saving lives which are in danger, and he argues that it is justifiable by the old maxim of Hippocrates, "Ad extremos morbos extrema remedia." To the chief objections which have been made to it, he replies, 1st, That the wound is more alarming than dangerous. The Cæsarean operation (says he) has been successfully performed on the living female, and is still recommended by many practitioners. L'Aumonier, principal surgeon of the Rouen Hospital, has successfully removed a scirrhous ovary of considerable size. Examples are recorded of the arm and scapula being torn away, and the patients soon recovering. Besides, the surgeon has it in his power to lessen the wound produced by the operation. 2dly, The dangers of hemorrhage may be obviated by the assistants temporarily placing their fingers on the mouths of the cut vessels, until ligatures can be applied.

In confirmation of his sentiments concerning the propriety of the operation, Larrey adverts to a fact reported by Morand, where a soldier had both his legs amputated very high up, and also both his arms so near the shoulders that he could hold nothing in his armpits. Yet, mutilated as he was, he enjoyed good health.—(Opuscules de Chir. p. 183.) And Larrey, in his own work has recorded several instances in which the whole of a limb was removed, or more than the halves of both the upper or lower extremities of the same subject, without any fatal constitutional disturbance.—(Mém. de Chir. Mil. t. 2, p. 182—184.) One of his patients above alluded to survived the operation a week, at the end of which he was carried off by the plague; and the others died, after being conveyed, in a very uneasy manner, during the precipitate march of the army.—(See Relation de l'Expédition de l'Armée d'Orient en Egypte, &c. p. 319, 8vo. Paris, 1803.) At the battle of Wagram, Larrey operated at the hip-joint on two soldiers of the imperial guard, under very unfavourable circumstances; and the events were fatal in a few hours.—(Mem. de Chir. Mil. t. 3, p. 349.)

Larrey used to operate as follows: he began with making an incision in the track of the inguinal artery in the bend of the groin, and after carefully excluding the nerve, which is more externally situated, he tied this vessel, with the aid of a semicircular curved needle, as closely as possible to Poupart's ligament, in order that the ligature, which was placed above the origin of the circumflex arteries and the profunda, might obviate all inconvenience from the bleeding

which might otherwise happen from their numerous branches. This being done, a straight knife was perpendicularly plunged between the tendons of the muscles attached to the trochanter minor and the base of the neck of the femur, so as to bring out its point at the back part of the limb, or in a diametrically opposite situation to its first entrance; and now, by directing the knife obliquely inwards and downwards, a flap, which was not to be too large, was made of the soft parts at the inner and upper portion of the limb. This flap was now drawn towards the scrotum by an assistant, and the articulation was brought into view. The obturator artery, and some branches of the pudendal, wounded by making the flap, were immediately tied. The thigh was now put into the state of abduction; the inner part of the orbicular ligament made tense by this position, was divided, and the joint opened. The ligamentum teres was then cut, and the bone dislocated. The knife was next brought to the outside of the great trochanter, and an external flap formed of the soft parts, calculated to meet that which had been made at the inside of the limb. In proceeding through the operation, Larrey secured, as soon as they were divided, the obturator arteries, and several branches of the pudendal, gluteal, and ischiatic arteries. The two flaps were brought together and kept in this position with strips of adhesive plaster, and a woollen spica bandage.—(See Mem. de Chir. Mil. t. 2, p. 186—188.)

In the Russian campaign, Larrey had two more opportunities of amputating at the hip-joint. In the first instance he operated upon a Russian at Witepsk, whose thigh-bone was broken to pieces up to the trochanter, and the soft parts of two-thirds of the thickness of the limb destroyed. This man went on as favourably as possible until the 25th day from the operation, the parts being healed except at two points where the ligatures had been brought out; but, unfortunately, a scarcity of provisions now occurred from some neglect or another; and the patient on the 29th or 30th day fell a victim. The second operation was done on a French dragoon, at the battle of Mozaïsk, who was afterward seen perfectly cured by the surgeon-major at Orcha, who received him there, and made a report of the fact to Larrey by letter.—(See Mém. de Chir. Mil. t. 4, p. 26—50, 51, 8vo. Paris, 1817.)

In 1812, M. Baffos, surgeon to the Hôpital des Enfans Malades at Paris, amputated at the hip nearly in the manner of Larrey, except that he only compressed the artery in the groin, and did not begin with tying it, a method to which Larrey himself now gives the preference.—(See Mém de Chir. Mil. t. 4, p. 434.) The patient was a child seven years old, and the case a diseased hip. The patient got well of the wound, but died of scrofula three months afterward. The cotyloid cavity was found full of fungous flesh, and the os innominatum carious. As the latter state always exists in the diseased hip-joint, the whole of the disease does not admit of removal by amputation, and consequently the attempt ought never to be made.—(See Joints, Diseases of.)

The plan of operating adopted by Baffos is considered, I believe, by all surgeons of the present day, better than that formerly advised by Larrey, inasmuch as the objectionable and unnecessary preliminary measure of taking up the artery in the groin, instead of simply compressing it against the os pubis, was rejected. Cutting down to the artery as a precaution against hemorrhage, is doing a double operation and putting the patient to needless suffering: it was the earliest method, having been proposed by Volther and Puthod. Who was the first proposer to press the artery against the os pubis, instead of cutting down to the vessel, I am not at present aware; but I know that it has been publicly recommended by Mr. Abernethy, in his anatomical lectures, for the last thirty years; it is thirty-two years since I began to attend his courses, and in the exhibition of this operation, by the circular incision upon the dead subject, compression of the artery in the groin was then advised, and, as I have stated, not for the first time. Lisfranc is said to complete amputation at the hip-joint upon the dead subject in ten seconds: the following is his method, as described by a modern writer:—The nates of the patient resting on the edge of the table, and the limb being supported by an assistant, the operator draws a line an inch in length, from the anterior and superior spinous process of the ileum, straight down the thigh. From this point he marks another inwards towards the pubes, of half an inch, so as to form a right angle. On the inner extremity of the last he places the point of a long-bladed catling, and pushes it perpendicularly downwards till it strikes against the head of the femur. Then passing it on the outer side of the bone, he thrusts it onwards till it protrudes at about an inch from the margin of the anus. He now cuts outwards, for near an inch, in order to clear the great trochanter, and forms the external flap, four or five inches in length, by cutting down the limb between the muscles and bone. The femoral artery, which may now be seen, is to be compressed between the fingers and thumb of an assistant, while the operator thrusts the knife in and out at the same points as before; but carrying it on the inner side of the head of the bone, he forms a smaller flap on that side of the extremity. He then, with the point of his knife, cuts through the capsular ligament, dislocates the bone, and removes the limb by dividing the round ligament, &c.—(See Averill's Operative Surgery, Lond. 1823, p. 158, &c.; also Maingault, Méd. Opératoire, fol. Paris, 1822.) It is obvious (says Mr. Syme), that as long as the surgeon merely cuts downwards, and keeps close by the bone, he will not injure the femoral artery, which cannot be divided till the knife is carried outwards. This is one great excellence referred by Lisfranc to his operation; for before the surgeon cuts the artery, the assistant can introduce his fingers into the wound and compress the vessel.

The disarticulation is accomplished as follows: the surgeon, seizing the limb with his left hand, while the assistant holds aside the flaps, makes a cut half round margin of the acetabulum at its fore part. The limb is then put in the posture of abduction, the bone starts from its socket, the knife is carried round its head, and the triangular and what remains of the capsular ligament are divided.—(See Ed. Med. Surg. Journ. No. 78, p. 41.)

A very similar method of operating was followed by Professor Von Walther.—(See Graefe and Walther's Journ. Also Anderson's Quarterly Journ. vol. 1, p. 630.)

This method was preferred by Mr. Syme in the very interesting case in which he lately amputated at the hip-joint for an extensive necrosis of the femur, where the neck of the bone was itself diseased. Unfortunately, when the wound was nearly healed, the patient became dropsical, and died at the beginning of the eighth week from the period when his limb was taken off.—(Op. cit. p. 25.)

Langenbeck begins the first incision on the outside of the femoral artery, and forms the external flap by extending the wound towards the tuberosity of the ischium. The knee is then inclined inwards, and the head of the femur dislocated, after which the knife is carried to the inside of the thigh, and the inner flap made.—(Bibl. für die Chir. b. 4, s. 512.)

When serving with the army in Holland in 1814, I assisted the late Dr. Cole in the performance of this operation. The plan adopted by him is the same as that which has been taught by Mr. Abernethy, in his lectures, for more than thirty years. The flow of blood through the femoral artery was stopped by compressing the vessel in the groin with the handle of a key covered with lint. The thigh was then amputated as high as possible, close below the trochanters. The femoral artery was immediately secured, and afterward every other vessel requiring ligature. An incision was now made directly on the acetabulum, and the head of the bone removed with the utmost facility and expedition. The patient lost even less blood than in an ordinary amputation, and the wound admitted of being brought together with adhesive plaster in the best manner possible, so as to represent a transverse line. I am sorry to add, that the patient lived only till the following day. In one dreadful case of fracture of the upper part of the femur by a grape-shot, where the operation had been delayed too long, the whole limb being inundated with matter, and the upper end of the lower portion of the bone projecting through the flesh backwards, I ventured to perform the same operation at Oudenbosch in Holland, a few days after the assault on Bergen-op-Zoom; and here happened what must often occur; immediately the soft parts had been divided, as the bone was broken to pieces, the limb came off, leaving the head of the bone, the trochanters, and

a small piece below them projecting. Had not the man appeared in a very bad way by the time the vessels had been secured, I should now have removed the head of the bone; but the shock of the operation was such, that he survived it but a few minutes, though scarcely any blood was lost. The mode of operating by the circular incision is preferred by Graefe, who unknowingly considers it as a new method.—(Normen für die Abl. grösserer Gliedm. p. 118.) It has also been proposed by Mr. Veitch, with the modification of leaving an inch or two of the bone projecting, which is done without giving any additional pain, by dissecting off the soft parts below the first incisions down to the bone. This projecting piece is intended to serve as a lever, with which the head of the bone is to be got out of the acetabulum.—(Edinb. Med. and Surg. Journ. vol. 3, p. 129.) Ingenious as this suggestion may be, I do not regard it as an important practical improvement; 1st, because in almost all cases, where the operation is necessary, the bone is so fractured that its division is already made by the injury; 2dly, because the scheme is unnecessary; for, in Dr. Cole's case, where I assisted, the head of the femur was removed from the acetabulum with the utmost facility by merely making an incision over that cavity, cutting the ligaments, and availing ourselves of the small piece of bone accidentally projecting. In fact, in all gun-shot injuries, requiring this operation, excepting a few instances of spreading gangrene from wounds, the bone is usually broken too high for Mr. Veitch's method to be practicable. With the same view of facilitating the exit of the head of the bone from the acetabulum, Graefe (p. 123) recommends dividing the transverse ligament which completes the brim of the anterior and inferior side of the socket. From my having once seen one of the first anatomists in London, with a powerful young assistant, and the whole length of the unbroken femur for a lever, baffled for nearly half an hour before he could dislocate the head of the bone, I suppose Graefe's maxim worth recollecting.

Sir Astley Cooper commenced his operation by making an incision just below Poupart's ligament, a little on the outside of the femoral artery. The wound was then carried obliquely downwards and outwards to the back of the thigh, about one-third of the way down it, from which point the knife was carried in the opposite direction, obliquely upwards and inwards to meet the first incision, so as to form an elliptical curve. The femoral artery, being now divided, was immediately tied. The muscles were next cut through, another artery secured, and the bone taken out of its socket. Only about twelve ounces of blood were lost.—(See Lancet, vol. 2, p. 95, &c.)

The following method is recommended by Mr. Scoutteten. The patient is to lie on the opposite side of the body to that on which the operation is to be done. The inguinal artery is to be compressed. The surgeon, standing behind the limb, is to put the thumb or forefinger of his left hand on the great trochanter. With the right he introduces the point of the knife perpendicularly over this process, and then depressing the handle, extends the incision forwards and inwards four finger-breadths below the groin. He then carries the knife round the limb, cutting as deeply as possible, and bringing the knife at length up to the point from which the wound commenced. All the muscular fibres are rarely divided by this first incision, and hence the knife must generally be applied again, ere this first stage of the operation can be completed.

For the purpose of getting at the capsule, the sides of the wound must be kept apart, and any muscular fibres not yet cut, be divided. As soon as it is perceived, it is to be cut through perpendicularly on the head of the femur. The limb is now to be somewhat depressed, and foot turned outwards, whereby the head of the bone is forced nearly out of its socket, and quits it completely as soon as the round ligament is cut, which is the only part by which it is confined. The operator then raises the thigh-bone, so as to make its head project, after which he cuts the rest of the capsule and muscular fibres, and completes the separation of the limb. When the operation is on the left side, the surgeon stands in front of the limb.—(See Scoutteten, Méthode Ovalaire, ou Nouvelle Méthode pour amputer dans les Articulations, Paris, 1827, 4to.)

The variety in the mode of operating is now very considerable. Were I to offer a particular description of every method, my limits would be greatly exceeded. It may suffice, therefore, to refer to Graefe's Journal for an account of the plan which he adopted on the living subject; and though the case had not a fortunate result, the operation itself was very skilfully performed.

Several cases are now recorded, in which amputation at the hip-joint proved successful. The first was that under the care of Mr. Brownrigg, surgeon to the forces, on the twelfth of December, 1812. The upper part of the thigh-bone had been broken by a gun-shot near Merida, in Spain, the 29th of December, 1811. Some time ago, the man was living at Spalding, in Lincolnshire, in perfect health.

The second successful operation was that performed by Larrey, at Witepsk.

The third was done by Mr. Guthrie in the Netherlands on a French prisoner of war, who completely recovered. The fourth is the example in which Sir Astley Cooper amputated at the hip on account of a disease of the higher part of the femur. As the patient had formerly suffered amputation of the thigh, it was certainly not the sudden removal of nearly a quarter of him; but I cannot presume to say, what difference in the chances of success, and whether any, would be connected with the circumstance.

In June, 1824, amputation at the hip was done by Professor Delpech, of Montpellier, on account of a necrosis of the femur, and the patient was completely well in the following September.—(See Revue Medicale.) The operation was also performed by Dr. Mott, of New-York, on the 7th of October, 1824, and the whole of the wound had healed by the 20th of November. This case was a bad fracture of the upper part of the femur, followed by abscesses and disease of the bone.—(See Philadelphia Journal, No. 9, vol. 5, New Series.) The patient's age was favourable, as he was a boy of only ten years of age. At this period of life, the chances of success will always be greater than in adults, not only in consequence of the remedial power of nature being then particularly great, but on account of the smaller dimensions of the wound necessary for the purposes of the operation.

[The following details of this case may prove serviceable to the profession, by showing that the operation may be advantageously attempted in a patient who would otherwise have speedily sunk under his disease. It is moreover interesting from the circumstance of its being the fifth instance in which it was ever successfully performed, and the first amputation at the hip-joint in this country.

"George Byles, a healthy boy, ten years old, broke his thigh about two-thirds of its length from the hip-joint; two days after, splints and bandages were firmly (and injudiciously) applied, which produced great distress, and were removed at the instigation of the boy. Physick's modification of Desault's splint was prepared by the physician then called in, who pointed out to the father, previous to its application, a projecting point on the outside of the thigh, which was the extremity of the superior fragment, which by the improper pressure was nearly forced through the integuments. The bone being properly coaptated, the long splint was then applied.

About three weeks subsequent to this period another physician was called in, who recommended the employment of the inclined plane, which was adopted, the boards forming it having pegs at the side. The boy stated that during his confinement to this inclined plane for several weeks, he had in tossing restlessly about, injured the thigh on the inside just above the condyle, which produced a sinuous opening leading to the fractured bone. It is most probable, however, that the sinus was formed and pointing when it was struck against the peg and opened.

He was brought into the city of New-York on the 7th of September, 1824, at which time we first saw him. His countenance was expressive of much anguish, with a white tongue and feeble pulse; his right limb was much enlarged on the outside, resembling a case of spina ventosa. To the touch it was hard and irregular, was exceedingly tender, and when pressed gave excruciating pain. The swelling extended to the great trochanter, gradually diminishing towards the top of the thigh. Opposite to the greatest enlargement was a sinus, discharging a thin sanious fluid, leading to the middle of the thigh bone, which was perfectly carious.

During two weeks succeeding his arrival in the city, medicines were administered with a view of allaying irritation, and imparting tone to the system, but hectic and night sweats, notwithstanding, supervened. As ulcerations began to occur by the side of the tibia, and all the symptoms became worse, it was resolved to amputate at the hip-joint as the only chance of saving the life of the patient.

On the 7th of October, 1824, the patient, after having passed a comfortable night, was placed upon the table in order to be operated on. An incision was made over the femoral artery as it emerges from under the femoral arch, and the vessel secured by ligature. While feeling on the outside of the artery for the lesser trochanter, the pulsation of a vessel apparently but little smaller than the femoral artery immediately below the ligature, convinced us that in this case the profunda femoris was given off above the femoral arch, as we occasionally find it. This vessel was taken up.

Lisfranc's knife was then introduced between the artery and bone, and carried through close by the neck of the femur towards the tuber ischii, thus forming the inner flap. The external flap was formed by cutting from without inwards. The hemorrhage from the veins and small arteries was considerable when the incisions were made, and numerous vessels were taken up: but comparatively little blood was lost during the operation, and the patient was put to bed shortly after it was completed. After the inner flap was cut, some of the surgical attendants, examining the lesser trochanter, pronounced that the head of the bone was not diseased. In order to satisfy the doubts expressed, the bone was sawed through the lesser trochanter, when it was found to be of the consistence of cheese, being denuded of periosteum on the outer side up towards the joint, and requiring to be removed, which was afterward done, as originally contemplated.

It is scarcely necessary for us to enter into the detail of symptoms and treatment subsequent to the operation, as nothing occurred worthy of note, except various degrees of irritation of the stomach and whole system, previous to the coming away of the ligatures. The treatment consisted in regulating the diet, and administering anodyne and tonic medicines according to circumstances.

On the 15th of October, eight days from the operation, two-thirds of the stump was healed by the first intention. Between the 17th and 31st of October, all the ligatures, seventeen in number, were removed; and by the 20th of November the whole stump was effectually healed, and the boy had become fat and lusty. There can be no doubt but that this limb might have been saved without difficulty, had the proper treatment been instituted when the accident occurred. When it came under our charge, nothing short of the operation above related could have saved this boy's life."—*Reese.*]

Another successful amputation at the hip was performed by Mr. Orten: the disease commenced in the knee; but terminated in extensive disease of the thigh-bone, large abscesses, and dislocation of the knee, the leg being fixed in the bent position, and drawn under the thigh.—(See Med. Chir. Trans. vol. 13, p. 605.)

On the other hand, the failures of this operation are numerous, though undertaken by surgeons of reputation and ability. Mr. Guthrie, Dr. Emery, Mr. Brownrigg, Baron Larrey, Walther, Graefe, Mr. Brodie, Mr. Carmichael (Trans. of the Assoc. Physicians, vol. 3), Drs. Blick and Cole, and many other military practitioners, have had opportunities of amputating at the hip without success.

A calculation has been made, that out of twenty examples of hip-joint amputation, six have had a favourable termination.—(Chelius, Handb. der Chir. b. 2, p. 763.) According to my computations, this account is rather too favourable.

No one can expect, however, this operation not to fail in a large proportion of the cases in which it is attempted; this must always happen, let it be done in the most skilful manner possible. Yet, as there are unquestionably some descriptions of injury, where life must be inevitably lost, if this proceeding be rejected, and experience proves that it sometimes answers, an important consideration is, what cases are most proper for it? Here I am decidedly of opinion with Professor Thomson, that the examples, in which it is particularly called for, and where no delay should be suffered, are those in which the head or neck of the thigh-bone has been fractured by a musket-ball, grape-shot, or small piece of shell. Eight or ten such cases, where amputation ought to have been done in the first instance, were brought in wagons several days after the assault on Bergen-op-Zoom, into the hospital superintended by myself at Oudenbosch, and not one of these patients lived ten days after their removal. In the whole course of my professional life, I have never elsewhere witnessed so much suffering, or suppuration in such profusion. From each limb, I should guess, that at least three or four pints of matter were discharged daily. Had amputation at the hip been performed at first, some of these patients might possibly have been saved; at all events, I am certain that it was their only chance.

Larrey, as I have stated, thinks the operation proper, where the thigh has been shot off high up, or where the femur and soft parts near the hip have been broken, and extensively lacerated by a cannon-ball or pieces of shell. Here the operation (though perhaps the only chance) must almost always fail, because, as Professor Thomson observes, these injuries occasion a shock to the constitution, of which the patient mostly sinks either immediately, or in a few hours.—(Obs. made in the Mil. Hosp. in Belgium, p. 274.) The truth of this observation I saw exemplified at Merxham, near Antwerp, at the bombardment of the French fleet in that port; a shell burst between the thighs of one of the guards; tore and lacerated two-thirds of the thickness of the upper part of the right thigh; broke the ascending ramus of the ischium; lacerated the perinæum and scrotum; and fractured the higher part of the femur. There was no hemorrhage of consequence; but the exposed lacerated surface of the soft parts was immense, and the unfortunate soldier, who lay with his hairs standing erect, and bereft of his intellectual faculties, sunk in the course of a quarter of an hour into a state of insensibility, and was quite dead in twenty minutes. However, there are numerous cases in which the patients, after dreadful injuries of the upper part of the thigh, are less depressed and overcome, and live several weeks; facts clearly proving that the operation ought to be attempted. Many instances of this kind are related by Mr. Guthrie.—(On Gun-shot Wounds, p. 134, &c.) Bad and incurable disease of the upper part of the femur (not the scrofulous hip, nor any other example in which the pelvis is affected) may also require the performance of amputation at the hip-joint, as was recently illustrated in the practice of Mr. Syme, of Edinburgh, and in that of Sir Astley Cooper. The case in which Mr. Carmichael amputated at the hip, was what is termed an osteosarcoma; the patient, a girl 19 years of age, died on the fifth day.—(See Trans. of the King's and Queen's College of Physicians, Ireland, vol. 2, p. 357, &c., and vol. 3, p. 158.) Dr. Mott's case, already referred to, was one of fracture of the upper part of the femur, ending in disease of the bone and extensive abscesses. The disease, for which Delpech operated, was necrosis of the thigh-bone. The propriety of the operation in desperate cases is now perfectly established.

AMPUTATION AT THE SHOULDER-JOINT.

H. F. Le Dran performed the first operation of this kind, of which the particulars are recorded. It was in a case of caries and exostosis, reaching from the middle to the neck of the humerus. Le Dran began with rendering himself master of the bleeding, for which purpose he introduced a straight needle and a strong ligature under the artery. This was passed from the front to the back part of the arm as closely to the axilla and bone as possible. The ligature then, including the vessels, the flesh surrounding them, and the skin covering them, was tightened over a compress. Le Dran, with a straight narrow knife, then made a transverse incision through the skin and deltoid muscle down to the joint, and through the ligament surrounding the head of the humerus. An assistant now raised the arm and dislocated the head of the bone from the cavity of the scapula. This allowed the knife to be passed with ease between the bone and the flesh. Le Dran then carried the knife downwards, keeping its edge always somewhat inclined towards the bone. In this manner he gradually cut through all the parts, as far as a little below the ligature. As there was a large flap, Le Dran made a second ligature with a curved

needle, which ligature included a great deal of flesh, the redundant portion of which was cut off together with the first ligature, which had become useless. The cure was completed in about ten weeks.—(Obs. de Chir. t. 1, p. 315, Paris, 1731; and Traité de Opér. p. 365.) Le Dran (the son), who published this memorable case, does not state that the operation was a new one, and it appears from the Recherches Critiques sur l'Origine, &c. de la Chirurgie en France, and from La Faye's notes on Dionis, that it had been previously practised by Morand, the father.

Garengeot thought that the ligature might be applied by means of a curved needle, with sharp edges; and in order to lessen the wound, he directs the incision to begin two or three finger-breaths below the acromion, across the deltoid muscle, so as to form one flap; then a lower one was made in the axilla; and after the second ligature had been applied, the two flaps were brought into contact.—(Traité des Opér. de Chir. t. 3, p. 350; Mém. de Acad. de Chir. t. 2, p. 261.)

La Faye extended the improvements farther. After placing the patient in a chair, and bringing the arm in a horizontal position, he made, with a common bistoury, a transverse incision into the deltoid muscle down to the bone, four finger-breadths below the acromion. Two other incisions, one in front, the other behind, descended perpendicularly to this first, and made a large flap of the figure of a trapezium, which was detached and turned up towards the top of the shoulder. The two heads of the biceps, the tendons of the supra-spinatus, infra-spinatus, teres minor and subscapularis, and the capsular ligament, were next divided. Now when the assistant who held the lower part of the limb made the bone describe the motion of a lever upwards, the head of the bone was easily dislocated. La Faye next carried his incision downwards, along the inner part of the arm, until he was able to feel the vessels, which he tied as near the axilla as possible. The separation of the limb was then completed a finger's-breadth below the ligature. The flap was then brought down over the glenoid cavity, and the wound dressed. —(See Nouvelle Methode pour faire l'Opération de l'Amputation dans l'Articulation du Bras avec l'Omoplate, par M. La Faye, in Mém de l'Acad. de Chirurgie, tom. 5, p. 195, edit. in 12mo.) With respect to La Faye, it is curious to remark a coincidence between him and Larrey: the latter, though generally averse to the attempt of uniting stumps by the first intention, is an advocate for this practice after hip-joint amputations; so La Faye, who was fearful of laying down the flap after amputation of the leg, had no such apprehension at the shoulder.

La Faye's method is yet regarded as one of the most approved where the state of the soft parts will admit of it. But it is absurd to think of applying any one plan to all the various states in which the injured or diseased limb may present itself. It is advised by Larrey himself, when a wound extends through the upper part of the arm, breaking the bone, and injuring the soft parts. Here, says he, it would be impossible to form an anterior and a posterior flap, for the soft parts in these situations have been destroyed. On the contrary, when the deltoid is shot away, La Faye's plan is inadmissible.—(Mém. de Chir. Mil. t. 2, p. 167.)

The advantages of La Faye's plan are obvious. As only one ligature was applied, the patient was saved a great deal of pain; the flap connected with the acromion was capable of covering the whole surface of the wound, and was more easily applied and kept on the stump than the lowermost of the two flaps which Garengeot recommended; and the discharge found a ready outlet downwards.

Mr. S. Sharp recommended the following plan: "The patient's arm being held horizontally, make an incision through the membrana adiposa, from the upper part of the shoulder across the pectoral muscle down to the armpit; then turning the knife with its edge upwards, divide that muscle and part of the deltoid; all which may be done without danger of wounding the great vessels, which will become exposed by these openings. If they be not, cut still more of the deltoid muscle, and carry the arm backwards. Then, with a strong ligature, having tied the artery and vein, pursue the circular incision through the joint, and carefully divide the vessels at a considerable distance below the ligature; the other small vessels are to be stopped, as in other cases.

"In doing this operation, regard should be had to the saving as much skin as possible, and to the situation of the processus acromion, which, projecting considerably beyond the joint, an unwary operator would be apt to cut upon."—(Operations of Surgery.)

Bromfield used to press the artery against the first rib. His incision began on the inside of the arm, by the edge of the deltoid muscle, as high up as where the pectoralis goes over the axilla to its insertion into the humerus. Cutting through the integuments and muscles, he continued his incision obliquely downwards and outwards, as far as a little below the termination of the deltoid muscle. Then carrying on the incision transversely for a small space in a semicircular direction, the wound was next extended to the external part of the arm, as high up as the fold of the integuments in the axilla. The flap thus shaped, when raised from the humerus, was intended to fill up the axilla, after the removal of the limb. Bromfield's next incision began at the acromion, and being carried through the skin and deltoid down to the bone, terminated in the semicircular incision above described, and it was so guided that it left the outer portion of the divided flap larger than the inner one. Bromfield then passed his knife under the lower edge of the internal half flap, and dissected it up as high as possible. The tendon of the pectoral muscle was thus exposed, under which he now passed his left fore-finger, which served as a conductor to a probe-pointed curved bistoury. With this he now divided the attachment of that muscle to the humerus. If the vessels were not now sufficiently brought into view, he cut through the outer head of the biceps, and tied them (artery and vein) each with two strong ligatures about half an inch apart. The vessels were then cut through in the interspace, and the nerve was divided much higher than the artery. The external flap was now raised sufficiently to expose the joint; and the muscles and capsular ligament having been cut through in the superior and lateral parts, the humerus slipped out of the glenoid cavity immediately the arm was carried a little backwards. Lastly, the ligatures and vessels being held out of the way, the soft parts towards the axilla were divided in a semicircular direction.—(Chir. Obs. and Cases, vol. 1, p. 249—252, 8vo. London, 1773.) The unnecessary tediousness and, I may add, severity of Bromfield's method have long withdrawn from it the approbation of modern operators. The division of the flap into two portions, its extraordinary length, and the painful dissection practised to get at the artery, were serious faults in the operation.

In 1774, Alanson amputated at the shoulder-joint as follows: the subclavian artery was compressed by the fingers of an assistant. An incision was made about a hand's breadth below the acromion, and carried through the integuments all round the limb. The deltoid and posterior muscles were then obliquely divided up to the capsular ligament. The tendon of the biceps and the capsular ligament upon the anterior and posterior part of the joint were now cut through. One of the circumflex arteries, which bled a good deal, was next tied. The great pectoral muscle, the rest of the capsule, and all the other parts except the vessels and nerves were then divided, but previously to cutting the vessels a temporary ligature was put around them. Thus the separation of the limb was completed. The mouths of the vessels were drawn out and tied, and the temporary ligature taken away. Lastly, the sides of the wound were brought together so as to make a transverse line. Graefe, seeming not to recollect that amputation by the circular incision directed obliquely upwards had been practised by Alanson, mentions it as a new proposition. In one case, after operating in this manner, his patient was quite well in three weeks; and with the particular sort of knife which he uses, and which is broadest towards its point, he pretends to be able to make the oblique incision through the muscles all around the limb with one sweep. Of course he is very careful to make pressure on the artery, both with Mohrenheim's compressor applied under the clavicle, and the fingers of an assistant above it.—(See Normen für die Abl. grösserer Gliedm. p. 110, &c.) In proof of the possibility of making the oblique incision quite evenly with one stroke of his particular knife, he injected a female subject, did the operation, and caused the stump to be drawn from nature.—(See Plate ii. of his Work.)

In 1760, P. H. Dahl published at Göttingen a dissertation on amputation at the shoulder. In this tract a

tourniquet was proposed, the pad of which was calculated to press upon the subclavian artery under the clavicle, and enabled the operator to dispense with tying the vessels in the first instance. Camper had observed, that if the scapula were pushed backwards, and the axillary artery pressed with the finger between the clavicle, coracoid process, and great pectoral muscle, the pulse at the wrist might be instantly stopped.

Dahl's tourniquet was obviously constructed in consequence of what Camper had observed. It is made of a curved, elastic plate of steel, to the shortest end of which a pad is attached, capable of projecting farther by means of a screw. The instrument embraces the shoulder from behind forwards, while the pad presses on the hollow under the clavicle, between the margins of the deltoid and pectoral muscles. The long extremity of the steel plate, which descends behind the shoulder, is fixed to the body by a sort of belt. The pad is depressed until the pulsation of the axillary artery is stopped.

Farther experiments have proved, however, that this tourniquet may be dispensed with, and the flow of blood in the axillary artery commanded, by properly compressing this vessel with a pad, or even the fingers alone, as some operators prefer, at the place where it emerges from between the scaleni muscles above the middle part of the clavicle. Thus the artery is pressed between the pad or fingers and the first rib, across which it runs. In certain plans of operation, hereafter to be described, all compression of the artery either above or below the clavicle is dispensed with.

Some practitioners, forgetful of the horizontal posture in which the patient is usually placed after the operation, have feared that in La Faye's method the lower flap may sometimes confine the discharge. In order to avoid this inconvenience, Desault recommended the formation of two flaps, one of which was anterior, the other posterior. The axillary artery was compressed from above the clavicle, at its coming out from between the scaleni muscles, while the integuments and flesh of the upper and internal part of the arm were pushed away from the humerus. A knife was plunged between these and the other soft parts behind, to make the anterior flap. The arm being inclined backwards and outwards, the humeral artery was tied, the articulation opened, and the head of the bone dislocated. The knife was then carried downwards and backwards so as to form the posterior flap, the incisions meeting in the axilla.—(See Sabatier's Médecine Opératoire, t. 3, p. 393—399, ed. 2.)

Larrey, who had frequent opportunities of amputating at the shoulder-joint, aimed at the same object which Desault did; but in his earlier operations, he was in the habit of beginning with the formation of the external or posterior flap, for the following reason: by proceeding in this way, the surgeon can tie the humeral artery more safely, because the ligature is applied after the operation is entirely finished, and consequently at a time when there is nothing to be attended to but the hemorrhage. Thus, the patient being placed on a stool, and well supported, the arm is to be raised from the side, and the axillary artery compressed from above the clavicle. The integuments and other soft parts of the upper and outer parts of the arm are then to be pushed away from the humerus, and the external flap formed. It is now very easy to cut the tendons of the infra-spinatus and teres minor, and open the outside of the joint. The limb is to be carried inwards and luxated backwards. The tendons of the supra-spinatus and biceps are to be divided, and as soon as the head of the bone is out of the glenoid cavity, the knife is to be carried along the internal part of the head and neck of the humerus, with its edge close to the bone. An internal flap, equal to the external one, is to be formed, consisting of a portion of the deltoid, great pectoral, biceps, and coraco-brachialis muscles, and including the brachial vessels and nerves. The artery is to be taken hold of with a pair of forceps, and tied. Any other vessels which require a ligature are also now to be secured. Larrey puts some charpie between the flaps, and brings them towards each other by the usual means.—(See Mém. de Chir. Militaire, t. 2, p. 170.) Of this method of putting charpie to prevent union by the first intention, I entertain the most unfavourable opinion.

When Larrey published his campaign in Egypt, he had operated in this way on nineteen patients, thirteen of whom recovered. But, at a subsequent period, he and his colleagues had amputated at the shoulder, in the above manner, in upwards of a hundred cases, more than ninety of which recovered.—(Mém. de Chir. Mil. t. 4, p. 432, 8vo. Paris, 1817.)

In his latter operations he adopted the innovation of first making a longitudinal incision from the acromion to about an inch below the neck of the humerus down to the bone, so as to divide the fleshy part of the deltoid into two even parts. This cut, he says, facilitates and renders more exact the rest of the operation. From this wound the incisions for the flaps are continued. Having made the foregoing incision, "I direct an assistant to draw up the skin of the arm towards the shoulder, and I form the anterior and posterior flaps by two oblique strokes of the knife made from within outwards and downwards, so as to cut through the tendons of the pectoralis major and latissimus dorsi. There is no risk of injuring the axillary vessels, as they are out of the reach of the point of the knife. The cellular connexions of these two flaps are to be divided, and the flaps themselves raised by an assistant, who, at the same time, is to compress the two divided circumflex arteries. The whole joint is now exposed. By a third sweep of the knife, carried circularly over the head of the humerus, the capsule and tendons running near the articulation are cut; and the head of the bone being inclined a little outwards, the knife is to be carried along its posterior part in order to finish the section of the tendinous and ligamentous attachments in that direction. The assistant now applies his fore-fingers over the brachial plexus, for the purpose of compressing the artery, and commanding the current of blood through it. Lastly, the edge of the knife is turned backwards, and the whole fasciculus of axillary vessels is cut through, on a level with the lower angles of the two flaps, and in front of the assistant's fingers. The patient does not lose a drop of blood; and ere the compression is remitted, the extremity of the axillary artery is readily seen, taken up with a pair of forceps, and tied. The circumflex arteries are next secured, which completes the operation."—(Mém. de Chir. Mil. t. 4, p. 428, Paris, 1817.) In addition to these important deviations from his earlier method, he subsequently preferred bringing the flaps together with two or three straps of adhesive plaster, and interposes no charpie.—(P. 429.) It should be observed also, that he lays no stress on first making the outer flap, though, from the description, it does not exactly appear which flap he now begins with. He has changed likewise, on another point of importance, viz. instead of preferring La Faye's plan in certain examples already specified, he affirms that the above-described way of operating is applicable to almost every case met with in military practice. First, because all gun-shot wounds, generally, which mutilate the arm so as to create the necessity for the operation, partly or entirely destroy the centre of the deltoid, while there is always enough flesh left at the sides for making the two flaps. Secondly, because, in the very rare instances where the lateral parts of the shoulder are destroyed, and the middle untouched, no advantage would be gained by operating in La Faye's manner, as Larrey conceives that the detached flap would slough, or become, as he terms it, disorganized. He now prefers dividing the middle piece of flesh, and giving the flaps the same shape as if they were uninjured. He even asserts, that the operation, done without any flaps at all, answers better than any method in which the surgeon preserves flaps not naturally intended for the part. Thus, when all the flesh of the shoulder has been shot away, he has seen surgeons cover the glenoid cavity with a flap saved from the soft parts of the axilla; but such flaps invariably sloughed, hemorrhages ensued, and the patients died.—(P. 430—431.) Some of these latter observations are, clearly enough, the result of great partiality to a particular method of operating; because who can doubt, when the lateral parts of the shoulder are injured, as they frequently are (and not very rarely, as Larrey asserts), by the passage of a musket-ball through the shoulder, from before backwards, that the right method is that of La Faye; or the same operation, with the slight difference of making the flap of a semicircular shape? It was for cases of this description that Mr. Collier and I operated after La Faye's plan, with perfect success, after the battle of Waterloo; and a poor fellow of the

rifle brigade, who was brought in too late for operation, and died of sloughing, had his shoulder injured in the same way, the middle of the deltoid being untouched, and shot-holes existing behind, and in front of, the articulation. But if it required any farther arguments to prove, that Larrey is wrong in wishing to extend his, or rather Desault's method, to all cases, I might criticise his assertions about the sloughing of the flap, when it is not cut into two portions, and its preservation by the singular expedient of making a division of it, and, of course, injuring it still more than it may have been injured underneath by the bullet. The cases, however, which have fallen under my own personal observation, and numerous others on record, furnish an adequate proof, that excellent as Larrey's method is for many cases, La Faye's answers very well in others. Thus, in an example where a Prussian hussar had had his arm amputated, and a projection of the bone took place, to the extent of three inches, with hospital gangrene commencing in the stump, Klein felt obliged to remove the limb at the shoulder. He operated in La Faye's manner; the separation was finished in one minute; and on the eighteenth day the stump was perfectly healed.—(See Practische Ansichte Chir. op. h. 1, p. 1—10, 4to. Stuttgart, 1816.) The same practitioner had five other secondary amputations of the same kind; but one patient was afterward carried off by hemorrhage, and another by hospital gangrene. Klein, however, in common with the majority of army surgeons, considers the idea of applying any one plan of operating to different cases, totally absurd.—(P. 12.) After the storming of St. Sebastian's, nine shoulder-joint amputations were done with success; seven of them by raising the deltoid as a flap.—(See Guthrie on Gun-shot Wounds, p. 108.)

After the battle of Waterloo, I adopted La Faye's plan; but with this difference, that I did not cut the brachial artery till I made the last stroke of the knife, which separated the limb; and consequently I did not tie that vessel till the time when I had nothing but the hemorrhage to occupy my attention. The circumflex arteries, however, I tied as soon as the external flap was made. The modification of thrusting a knife under the deltoid, quite across the shoulder, and making the flap by cutting downwards, until the instrument comes out again through the skin, is practised by some surgeons of eminence.—(Klein, Lisfranc, &c.) An excellent lithographic plate illustrative of this last method is given by Maingault, pl. 4, fig. 17.—(See Méd. Opérat. p. 24, fol. Paris, 1812.)

When the state of the integuments will permit the choice, Mr. Guthrie thinks their preservation best effected by Larrey's first method; but he particularly insists upon the advantage of raising the shattered arm or stump to nearly a right angle with the body before the operation begins, and even before the assistant makes pressure on the subclavian artery, as some change in the mode of accomplishing the latter object might be rendered necessary by elevating the limb during the operation itself. Mr. Guthrie commences the first incision immediately below the acromion, and, with a gentle curve, extends it downwards and inwards, through the integuments only, a little below the anterior fold of the armpit. The second incision outwards is made after the same manner, but is carried rather farther down, so as to expose the long head of the triceps at the under edge of the deltoid. The third incision, commencing at the same spot as the first, but following the margin of the retracted skin, divides the deltoid on that side down to the bone, and exposes the insertion of the pectoralis major, which must be cut through. This flap is now to be raised, so as to expose the head of the bone. The fourth incision outwards divides the deltoid muscle down to the bone, when the posterior flap is to be well turned back, so as to bring into view the teres minor and infra-spinatus passing from the scapula to the great tuberosity of the humerus. The outer and inner flap being now raised, the head of the bone may be rolled a little outwards, the teres minor and infra-spinatus cut, and an opening made into the joint. The capsular ligament, supra-spinatus, and long head of the biceps are then divided. The inner side of the capsule is now cut through, together with the subscapularis muscle, as it approaches its insertion into the lesser tuberosity of the humerus. The long head of the triceps is next divided, and lastly, with one sweep of the knife, the rest of the soft parts are cut, together with the axillary artery, veins, and nerve.—(On Gun-shot Wounds, p. 274—276.) Larrey, in his latest method, takes no measures in the first stage of the operation for commanding the flow of blood, as the assistant merely presses the axillary artery between his fingers just before it is divided.

Some of the modern French surgeons were earlier than Larrey in dispensing with the compression of the axillary artery, and following a method which renders it unnecessary. Richerand, for instance, describes nearly the same plan as that advised by La Faye; but after making the deltoid flap, cutting the tendons, and dislocating the bone, he dissects down close to the inside of the humerus, so as to enable an intelligent assistant to put his thumb on the cut surface behind the artery, which, with the aid of the fingers applied to the skin of the axilla, can then be grasped and compressed so as to command the flow of blood through the vessel. The operator now, fearless of hemorrhage, completes the internal or inferior flap.—(Richerand, Nosographie Chir. t. 4, p. 509—511, edit. 4.)

Baron Dupuytren amputates at the shoulder, in a manner which seems principally commendable on account of its celerity. The arm being raised and held at a right angle with the trunk, Dupuytren stands at the inside of the limb, with one hand grasps and elevates the mass of the deltoid muscle, and plunges under it a two-edged knife, from before backwards, on a level with the end of the acromion. Cutting in this way close to the head of the humerus, he continues the incision downwards between this bone and the deltoid, and at length, bringing out the knife, completes the external or superior flap. The rest of the operation does not essentially differ from Richerand's, except that Dupuytren takes hold of the lower flap itself, before dividing it, and compresses the artery until he has cut through it and tied it.

Dupuytren's plan would be difficult on the left side, unless the surgeon were an ambidexter; but, in other respects, it cannot be found much fault with. This surgeon has also proposed making one flap in front, and the other behind, in order to prevent the lodgement of matter. Richerand justly observes, however, that frequently a good deal of the wound unites by the first intention, and that as the patient after the operation lies in the recumbent posture on an oblique plane, he cannot see what advantage one way of making the flaps has over another, in regard to affording a ready issue to the discharge.—(Op. cit. p. 515.)

For the sake of celerity, of which the French are rightly admirers in all capital operations, another plan of amputating at the shoulder has been proposed by Lisfranc. Supposing the left extremity is to be removed, the patient is placed on an elevated seat, one assistant pressing the artery against the first rib, while another draws the arm forwards: the operator, standing behind the patient with a long-bladed catling, pierces the integuments on the inner edge of the latissimus dorsi muscle, opposite the middle of the axilla, and pushes it obliquely upwards and forwards, till its point strikes against the under surface of the acromion; then, by raising the handle of the knife, its point is lowered, and protruded just in front of the clavicle at its junction with the acromion. By cutting downwards and outwards, he then forms a flap from the superior and posterior part of the arm, including the whole breadth of the deltoid muscle, and a part of the latissimus dorsi. This being held back by the assistant, the joint is cut through from behind forwards, and a corresponding flap is formed by cutting downwards and outwards, between the muscles and bone, on the inner side of the arm. When the operation is on the right side, the patient should be seated on a low chair, and the catling thrust from above downwards, from the part just in front of the point where the clavicle is connected with the acromion, the surgeon raising his hand as the instrument proceeds downwards and backwards, until its point has come out at the inner edge of the latissimus dorsi, when the flap is to be made, and the operation finished as above directed.—(See Averill's Operative Surgery, p. 135. Also Lisfranc de St. Martin, et Champesme, Nouveau Procedé Opératoire pour l'amputation du bras dans son articulation scapulo-humerale. Paris, 1815.)

Speaking of this mode of operating, Richerand remarks; "en l'employant, on parvient à desarticuler

l'humérus, et à séparer le bras en aussi peu de temps qu'en met un habile découpeur à détacher l'aile d'un perdrix."—(P. 514.)

The last method which I shall describe is that of M. Scoutteten. It is done on the left arm, as follows:—The surgeon first takes hold of the middle of the arm with his left hand, and raises it four or five inches from the side. With his right hand he then applies the point of the scalpel immediately below the acromion, and passes it into the flesh until it touches the head of the humerus. He then depresses the handle, and forms the first incision, which extends downwards four inches from the point of the acromion, and divides the posterior third of the deltoid, and the greater part of the fibres of the long portion of the triceps down to the bone. The second incision is next commenced with the point of the knife directed downwards upon the inner side of the limb, and in front of the biceps, on a level with the place where the first incision ended. The wound is then extended inwards and upwards to the acromion, where it terminates by joining the first. These two wounds form a triangle, which partly consists of relinquished integuments, and has its base downwards.

In order to find the joint with greater ease, the surgeon may now detach a little of the deltoid from the bone. An assistant can also keep the edges of the incision asunder, so that the operator may be enabled to see and divide the capsular ligament, and the tendons of the supra-spinatus, infra-spinatus, and teres minor, which are inserted into the greater tubercle of the humerus, and the tendon of the subscapularis, which is inserted into the lesser tubercle. The operator, who constantly keeps hold of the arm, now communicates to it some rotatory movements, in order to bring the above tendons, one after another, under the knife, and divide them with the capsule. Immediately the capsule and tendons have been cut through, the head of the bone readily quits its socket. The surgeon luxates the bone by pushing it a little upwards, and, at the same moment, inclining the condyles towards the side. The next proceeding is to divide the flesh on the inner side of the limb as closely as possible down to the bone; but when the knife approaches the artery, this vessel is to be taken hold of and compressed by an assistant, before the incision is completed. In this way, no hemorrhage need be apprehended.

When it is the right limb, the only difference is, that the first incision is made at the inner side of the arm, and extended up to the acromion. Scoutteten considers a single assistant sufficient, and compression of the subclavian artery unnecessary.—(H. Scoutteten, La Méthode Ovalaire, ou Nouvelle Methode pour amputer dans les Articulations, Paris, 1827, 4to.)

When the scapula is shattered, of course the loose fragments should be taken away, and if the acromion be broken, and the remnant of it pointed and irregular, this sharp rough portion should be sawed off, as was practised long ago by M. Faure.—(See Mém. de l'Acad. de Chir. t. 6, p. 114.) In one case, indeed, Larrey found it necessary to take away more than two-thirds of the scapula, and the humeral end of the clavicle.—(Mém. de Chir. Mil. t. 4, p. 432.) Sawing off part of the acromion and coracoid process, as a general rule, seems to me quite unnecessary (see Fraser on the Shoulder-joint Operation, 8vo. Lond. 1813) and improper, not only as producing delay, but wounding other parts which should not be at all disturbed.—(See Guthrie on Gun-shot Wounds, p. 285, 286, &c.) The practice of scraping away the cartilage of the glenoid cavity, except when it is diseased, is not of greater value.

Amputation at the shoulder has been partly superseded by a preferable operation, even in cases in which it would formerly have been deemed quite indispensable; such as considerable gun-shot fractures of the head of the humerus, a caries of the substance of this part, &c. Boucher, in 1753, proved that considerable wounds extending into the shoulder-joint might be successfully treated by extracting the fragments and splinters of bone.—(Mem. de l'Acad. de Chir. t. 2, p. 287 et 461.) Instances are also recorded, in which, when the head and neck of the humerus in children had been totally disunited from the body of that bone, a cure was accomplished by making such incisions as allowed the portions of bone, now become extraneous bodies, to be taken away. The earliest case of this kind on record is that in which M. Thomas, a surgeon at Pezenas in Languedoc, removed the separated head of the humerus in 1740, which in a child four years of age presented itself loose in an incision which had been previously made for the extraction of some sequestra. The particulars may be read in Guthrie's valuable work.—(On Gun-shot Wounds, p. 215, &c.) Mr. White of Manchester proceeded farther, for he made a deep incision at the upper part of the arm, dislocated the head of the humerus, which he knew was carious, and pushing it through the wound took it off with a saw. He began an incision at the orifice of a sinus situated just below the processus acromion, and extended the wound down to the middle of the humerus, by which all the subjacent bone was brought into view. He then took hold of the patient's elbow, and easily forcing the upper end of the humerus out of its socket, he brought it so entirely out of the wound that he readily grasped it in his left hand, and held it there till he had sawed it off with a common amputation saw, having first applied a pasteboard card between the bone and the skin. The patient did not lose more than two ounces of blood, only a small artery which partly surrounded the joint being wounded, which was easily secured.

In about five or six weeks, the part from which the bone had been taken had acquired a considerable degree of firmness, and the boy was able to lift a pretty heavy weight. At the end of two months, a large piece of the whole substance of the humerus was ready to separate from the sound bone, and with a pair of forceps it was easily removed. After this exfoliation the wound healed very fast, and in four months after the operation, the boy was discharged perfectly cured. On comparing this arm with the other, it was not quite an inch shorter; the boy had the perfect use of it, and could not only elevate his arm to any height, but perform the rotary motion as well as ever. The figure of the arm was not at all altered. Mr. White did not make use of any splints, machine, or bandage, during the cure, in order to confine the limb strictly in one certain situation, nor was the patient's arm ever dressed in bed, but while he was sitting in a chair, and as soon as he could bear it standing up. To this method, Mr. White attributed the preservation of the motion of the joint.

"As this is the first operation of the kind that has been performed, or at least made public (says Mr. White), I thought the relation of it might possibly conduce to the improvement of the art. That ingenious surgeon Mr. Gooch, has indeed related three instances of the heads of bones being sawed off in compound luxations. In one of these cases the lower heads of the tibia and fibula were sawed off; in another, that of the radius; and in the third, that of the second bone of the thumb; but these were in many respects different from the present case. I believe it will seldom happen, that this operation will not be greatly preferable to amputation of the arm at the scapula, as this last is generally performed for a caries of the upper head of the os humeri, and as the preservation of a limb is always of the utmost consequence, and what every surgeon of the least humanity would at all times wish for, but particularly where, as in this case, the whole limb and its actions are preserved entire, the cure no ways protracted, and the danger of the operation most undoubtedly less. For though amputation is often indispensably necessary, and frequently attended with little danger or inconvenience when only part of a limb is removed, yet when the whole is lost, the danger is greatly increased, and the loss irreparable." Mr. White concludes with suggesting an analogous operation for removing the head of the femur, in lieu of amputation at the hip. Something of this kind is indeed reported to have been actually done on a girl with success.—(See Joannis Mulder Oratio de Meritis P. Camperi, &c. p. 81. Cases in Surgery, by C. White, p. 57; or Phil. Trans. vol. 59, for 1769.)

Here, however, the acetabulum and ossa innominata being always, or generally, more diseased than the head of the femur, neither of these operations, I think, ought to be attempted. Long after the publication of White's case, viz. in 1767, an example, in which Vigaroux adopted the same practice, in 1788, was communicated to the profession: the result, however, was unfortunate, the patient, a lad seventeen years of age, having died soon after the experiment.—(See Œuvres de Chir. Prat. par I. M. I. Vigaroux (fils), Montp. 1812.)

Mr. Bent, of Newcastle, inserted a similar case to Mr. White's in the 64th vol. of the Philosophical Transactions. White made only one incision, from the vicinity of the acromion down to the middle of the arm. Bent, not being able to get at the head of the bone through the wound which he had made, from the clavicle to the attachment of the pectoral muscle, detached a portion of the deltoid where it is connected with the clavicle, and another part where it is adherent to the humerus. A third successful case is also reported in the 69th vol. of the same work, p. 6. Afterward, Bromfield published some directions for the guidance of the surgeon in such operations.—(Chir. Obs. and Cases.) Sabatier proposed making two cuts at the upper part of the arm, which meet below like the letter V, extirpating the flap, dividing the inner head of the biceps and capsular ligament; dislocating the head of the bone, and sawing it off.—(Médecine Opératoire, t. 3.)

I think the cases recorded by White and Bent are truly important, inasmuch as they are the earliest models of a practice which may sometimes supersede all occasion for one of the most formidable and mutilating operations of surgery. To military and naval surgeons, these cases cannot fail to be highly interesting, as they must have frequent opportunities of availing themselves of the instruction which they afford. Larrey, who was surgeon-general to the French army in Egypt, employed the practice with the greatest success, in cases of gun-shot wounds. He thereby saved limbs, which, according to ordinary precepts and opinions, would have been a just ground for amputating at the shoulder; and when it is considered, not only that a most dangerous operation is avoided, but that an upper extremity is saved, for which no substitute can be applied, we must allow that the plan, first suggested and practised by Mr. White, cannot be too highly appreciated. When the arm was fractured near its upper extremity by a musket-ball, most surgeons formerly deemed it necessary to amputate the limb. Here, says Larrey, it would be useless to dilate the entrance and exit of the ball, because a sufficient opening could not be prudently made in this way for the extraction of the head of the bone. Yet this body is now an extraneous substance, having lost its connexion with the shaft of the humerus, and its presence exciting irritation and inflammation of the joint, abscesses, necrosis, &c. Here Larrey seems to imply, that the detached head of the bone cannot unite again; an assertion which, I have no doubt, is quite incorrect, as I have attended several cases in which the humerus was broken very high up, yet united without difficulty. The bad symptoms, which he so emphatically attributes to the detachment of the head from the body of the bone, are in reality the effects of the gun-shot violence itself. If, therefore, the head of the bone were merely broken off, and it and the neighbouring part of the bone not splintered, nor the flesh not more extensively injured than would arise from the passage of a musket-ball, and the joint itself not involved, I should question the propriety of having recourse, at once, either to the extraction of the head of the bone, or amputation at the shoulder. When the bone is shattered the case is often very different, and Larrey's practice is then commendable. In confirmation of these sentiments, I may mention Mr. Guthrie's opinion, who, in reference to the extraction of the head of the bone, says, he does not consider a perfect fracture of the humerus an inch below its head (although there be evident separation) as demanding even this operation, as he has known such cases do well when treated as other compound fractures, except that the motion of the joint was nearly lost.—(On Gun-shot Wounds, p. 329.) However, it is fair to mention that Mr. Guthrie inclines to amputation at the shoulder when the body of the bone is splintered or has long fissures in it, in which sentiment he is probably right. The other operation seems principally calculated for cases in which the damage is restricted to the head and uppermost portion of the bone.

According to Mr. Guthrie, when the ball passes out with little injury to the bone, and the openings already made are not sufficient to admit of a moderate examination with the point of the finger, the wound should be enlarged. However, others might argue, that such dilatation should be made only when the bone is felt to be seriously broken, and the fragments will probably require immediate removal. But whatever course be adopted, the most rigorous antiphlogistic treatment will be proper; and if abscesses form, depending openings should be made for the discharge.

Larrey says, "I have had the good fortune on ten different occasions to supersede the necessity for amputation at the shoulder, by the complete and immediate extraction of the head of the humerus or its splinters without delay. I perform the operation in the following manner: I make an incision in the centre of the deltoid muscle, and parallel to its fibres, carrying the incision as low down as possible. I get the edges of the wound drawn asunder, in order to lay bare the articulation, of which the capsule is generally opened by the first incision, and by means of a probe-pointed bistoury I detach with the greatest ease from their insertions the tendons of the supra and infra-spinati, of the teres minor, of the subscapularis, and of the long head of the biceps; then I disengage the head of the humerus, and remove it through the wound in the deltoid by means of my fingers or of an elevator. I bring the humerus up to the shoulder, and fix it in a proper position with the aid of a sling and a bandage. Such is the operation which I performed on ten patients in extirpating the head of the humerus; one of these died of the hospital fever, two of the scurvy at Alexandria, and the fourth, after he was cured, died of the plague on our return to Syria. The rest returned to France in good health. In some the arm became anchylosed to the shoulder, and in others an artificial joint, allowing of motion, was formed."—(See Mem. de Chir. Militaire, t. 2, p. 175.) Another successful case of the same kind was published by Mr. Morel.—(See Medico-Chirurg. Trans. vol. 7, p. 161.)

Mr. Guthrie thinks it not sufficient to make a simple incision through the deltoid muscle into the capsular ligament, and take away the fragments of bone, but urges the removal at the same time of a considerable part of the capsular ligament, lest disease still go on in the joint. Also, as it is impossible to know beforehand in what state the bone may be below the fracture (that is, with respect to fissures running more or less down it), he advises the incision designed for the extraction of the splintered head of the bone, to be made in a situation where, if amputation at the joint be found indispensable, it will be of advantage. Mr. Guthrie likewise describes the manner of turning out the head of the bone in these cases, and sawing it off; the necessity of which, however, I do not clearly comprehend, unless the taking away of any sharp spicula of the upper end of the body of the bone be implied, which may be right.—(On Gun-shot Wounds, p. 333—335.) My ideas, however, chiefly extend to the removal of loose fragments and splinters; and with respect to sawing off the head of the bone, this is a proceeding, I suppose, necessarily limited to the kind of cases reported by Mr. White and Mr. Syme.—(Edinb. Med. and Surgical Journ. No. 88, p. 49.)

In Mr. Syme's example the head of the humerus was diseased. A perpendicular cut was made from the acromion through the middle of the deltoid, extending nearly to its insertion. A similar incision was then made upwards and backwards from the lower end of the first wound, and a large flap formed from the back portion of the deltoid, "which being held up, exposed the joint so far, that (says Mr. Syme) I was able to insulate the head of the bone by means of my finger, and then to detach the scapular muscles from their connexions with the tuberosities, when, the arm being brought forwards, I easily protruded the head of the humerus, embraced it in my left hand, and sawed it off without any injury to the other parts."—(Op. cit. p. 51.) A portion of the acromion, being diseased, was removed with the cutting plyers. From what has been stated, it may be inferred, that when the object is merely to extract splinters, a single perpendicular incision will suffice; but that when the joint is diseased, and the head of the bone requires to be sawed off, the operation will be much facilitated by following the plan adopted by Mr. Syme. In this gentleman's case the patient recovered, and the shoulder had motion in every direction.

Walther first demonstrated on the dead body the practicableness of amputating the scapula; and in one case, where this bone was inseparably connected with a tumour, the greater part of it was successfully removed by Haymann.—(See Walther in Journ. für Chir. b. 5, p. 274; and Haymann, vol. cit. p. 509.) The par-

neulars are also detailed by Chelius.—(Handb. der Chir. b. 2, p. 759.)

AMPUTATION OF THE HEADS OF BONES.

In a letter to Mr. Pott, dated 1782, Mr. Park, surgeon to the Liverpool Hospital, made the proposal of totally extirpating many diseased joints, by which the limbs might be preserved, with a share of motion that would still allow them to be very useful.

Mr. Park's scheme, in short, was to remove entirely the extremities of all the bones, which form the diseased joint, with the whole or as much as possible of the capsular ligament; and to obtain a cure by means of callus, or by uniting the femur to the tibia, when the operation was done on the knee; and the humerus to the radius and ulna, when it was done on the elbow; so as to have no moveable articulation in those situations.

In order to learn whether the popliteal vessels could be avoided without much difficulty in the excision of the knee, Mr. Park made an experiment on the dead subject. An incision was made, beginning about two inches above the upper end of the patella, and extending about as far below its lower part. Another one was made across this at right angles, immediately above the patella, down to the bone, and nearly half round the limb, the leg being in an extended state. The lower angles formed by these incisions were raised so as to lay bare the capsular ligament; the patella was then taken out; the upper angles were raised, so as fairly to denude the head of the femur, and to allow a small catling to be passed across the posterior flat part of the bone, immediately above the condyles, care being taken to keep one of the flat sides of the point of the instrument quite close to the bone all the way. The catling being withdrawn, an elastic spatula was introduced in its place, to guard the soft parts while the femur was sawed. The head of the bone, thus separated, was carefully dissected out; the head of the tibia was then with ease turned out and sawed off, and as much as possible of the capsular ligament dissected away, leaving only the posterior part covering the vessels, which on examination had been in very little danger of being wounded.

The next attempt was on the elbow: a simple longitudinal incision was made from about two inches above to the same distance below the point of the olecranon. The integuments having been raised, an attempt was made to divide the lateral ligaments, and dislocate the joint; but this being found difficult, the olecranon was sawed off, after which the joint could be easily dislocated without any transverse incision, the lower extremity of the os humeri sawed off, and afterward the heads of the radius and ulna. This appeared an easy work; but Mr. Park conceives the case will be difficult in a diseased state of the parts, and that a crucial incision would be requisite, as well as dividing the humerus above the condyles, in the way done with respect to the thigh-bone.

Mr. Park first operated, July 2, 1781, on a strong, robust sailor, aged 33, who had a diseased knee, of ten years' standing. The man's sufferings were daily increasing, and his health declining. Mr. Park wished to avoid making the transverse incision, thinking that, after removing the patella, he could effect his object by the longitudinal one; but it was found that the difference between a healthy and diseased state of parts deceived him in this expectation. Hence the idea was relinquished, and the transverse incision made. The operation was finished exactly as the one on the dead subject related above. The quantity of bone removed was very little more than two inches of the femur, and rather more than one inch of the tibia. The only artery divided was one on the front of the knee, and it ceased to bleed before the operation was concluded, but the ends of the bones bled very freely. In order to keep the redundant integuments from falling inwards, and the edges of the wounds in tolerable contact, a few sutures were used. The dressings were light and superficial, and the limb was put into a tin case, sufficiently long to receive the whole of it, from the ankle to the insertion of the glutæus muscle.

I shall not follow Mr. Park throughout the treatment. Suffice it to remark, that the case gave him a great deal of trouble, and that it was attended with many embarrassing circumstances, arising chiefly from the difficulty of keeping the limb in a fixed position, the great depth of the wound, and the abscesses and sinuses which formed. On the other hand, however, the first symptoms were not at all dangerous. But the patient was obliged to keep his bed nine or ten weeks, and it was many months more before the cure was complete. The man afterward went to sea, and did his duty very well.

Subsequently to the publication of the letter to Mr. Pott, another excision of the knee was done by Mr. Park, on the 22d of June, but the event was unsuccessful, as the patient lingered till the 13th of October, and then died.

In 1782, P. F. Moreau presented to the French Academy of Surgery a memoir proposing the excision of carious joints. It only seems necessary to notice here the difference in Moreau's plan of operating from that adopted by our countryman. Moreau, the son, who has published the account, observes, that the multiplicity of flaps is unnecessary, as two answer every purpose; and he deems Mr. Park's direction to remove the olecranon, if this be free from caries, at least useless. Moreau junior operated on the elbow as follows: with a dissecting scalpel he cut down to the sharp edge or spine of the inner condyle of the os humeri, about two inches above its tuberosity; and, directed by the spine, he carried the incision down to the joint. He did the same on the other side, and then connected the two wounds by a transverse incision, which divided the skin and the tendon of the triceps immediately above the olecranon. The flap was dissected from the bone, and held out of the way by an assistant.

The flesh which adhered to the front of the bone above the condyles was now separated, care being taken to guide the point of the instrument with the forefinger of the left hand, and when the handle of the scalpel could be passed through between the flesh and the bone, M. Moreau allowed it to remain there, and sawed the bone through upon it. The removal of the piece of bone was next finished, by detaching it from all its adhesions. The removal of the heads of the radius and ulna remaining to be done, was more difficult, and the first flap being insufficient, it became necessary to make another. The lateral incision, at the outer side of the arm, was extended downwards, along the external border of the upper part of the radius. The head of the radius was separated from the surrounding parts; its connexion with the ulna destroyed, and a strap of linen was introduced between the bones, in order to keep the flesh out of the way of the saw. The radius was sawed through, near the insertion of the biceps, which was fortunately preserved. Some remaining medullary cells, filled with pus, were removed with a gouge. The ulna was now exposed, by extending the lateral incision on the inner side of the arm. Thus another flap was made, and detached from the back part of the forearm, and that portion of the bone which it was wished to remove. The bone being separated from every thing that adhered to it, and a strap of linen put round it to protect the flesh, about an inch and a half of it was sawed off, measuring from the tip of the olecranon downwards. A few diseased medullary cells were taken away with the gouge. Two or three vessels were tied, and the flaps were brought together with sutures. In a fortnight this man became so well, that he was allowed to go wherever he pleased, with his arm supported in a case. The arm was at first powerless, but it slowly regained its strength, and the man could ultimately thrash corn and hold the plough with it, &c.

Seven months after another operation, performed in the same way as the preceding one, by Moreau the father, the patient was completely cured, and two years after this period the flexion of the forearm on the arm was very distinct. In another case only one longitudinal incision and a transverse one were made, the flap being of course triangular. The patient got well in six weeks, and in three months more joined his regiment.

In all Moreau's cases, the flexion and extension of the forearm were preserved, which circumstance no doubt depended very much on the insertion of the biceps not being destroyed. After the excision of the knee, however, the bones grew together.

Moreau junior's method of operating differed from his father's, inasmuch as the patient was in a recumbent instead of a sitting posture, and the os humeri sawed before it was dislocated.

In a knee-case, Moreau the father operated as follows:—He made a longitudinal incision on each

side of the thigh, between the vasti and the flexors of the leg, down to the bone. These incisions began about two inches above the condyles of the femur, and were carried down along the sides of the joint till they reached the tibia. They were united by a transverse cut, which passed below the patella, down to the bone.

The flap was raised; but the patella attached to it, being diseased, was dissected out. The limb was then bent, so as to bring the condyles of the femur into view. As it was desired to cut them from the body of the bone before dislocating them, every thing adhering to them behind, where they joined the body of the bone, was separated, and at that place the fore-finger of the left hand was passed through, in order to press back the flesh from the bone while the saw was used. The knee having been bent, Moreau drew the cut piece towards him, and easily detached it from the flesh and ligaments.

The head of the tibia was laid bare by an incision nearly eighteen lines long, made on the spine of that bone. The first lateral incision on the outer side of the knee was extended nearly as far down on the head of the fibula. Thus were obtained one flap which adhered to the flesh filling up the interosseous space, and another triangular flap formed of the skin covering the inner surface of the tibia, which bone was of necessity exposed before the saw could be applied.

Upon raising the outer flap, the head of the fibula came into view, and after being separated from its attachments was cut off with a small saw. The inner flap was then raised, and the head of the tibia having been separated from the muscles behind, was sawed off.—(See Moreau (le fils), Obs. pratiques relatives à la resection des articulations affectées de carie. Paris, an xi.) Some cases and remarks, in favour of the excision of diseased joints, have been published by Mr. Crampton.—(Dublin Hospital Reports, vol. 4, p. 185, &c.) He has removed with success one knee and one elbow. Another knee-operation may be set down as a failure, no union having taken place, and a sinus and discharge having continued in the ham until the patient's death, three years and two months after the operation. Respecting the plan of operating on the knee he concludes thus: "I am satisfied, from repeated trials on the dead subject, that the operation can be most safely and rapidly executed by separating the condyles from all their attachments previously to sawing the bone. As soon, therefore, as the flap containing the patella is turned upwards, the edge of the knife should be carried round the condyles close to the bone, so as to divide all the ligaments which connect the femur with the tibia. The tibia can then with great ease be pushed backwards, and as much of the projecting condyles can be removed as the operator may think necessary."—(Vol. cit. p. 213.)

It does not appear necessary to insert in this work the account of cutting out the ankle-joint, an operation which will never be extensively adopted; nor shall I add any thing more concerning the mode of removing, in a similar way, the shoulder-joint. In treating of amputation in this situation I have already said enough, and whoever wishes for farther information respecting this practice, must refer to Dr. Jeffray's work, entitled "Cases of Excision of Carious Joints." (Glasgow, 1806.) This publication contains all that was then known on the subject. Dr. Jeffray has recommended a particular, and indeed a very ingenious, saw, for facilitating the above operation. The saw alluded to is constructed with joints, like the chain of a watch, so as to allow itself to be drawn through behind a bone, by means of a crooked needle, like a thread, and to cut the bone from behind forwards without injuring the soft parts. An instrument of this kind was executed in London by Mr. Richards, who was assisted in making it by his nephew, the present Mr. Richards, of Brick-lane. In placing the saw under a bone, its cutting edge is to be turned away from the flesh. Handles are afterward hooked on the instrument.

According to my notions of the treatment of diseased joints, as long as the patient's strength is not subdued by the irritation of the local disease, humanity dictates the propriety of persevering in an attempt to save the affected limb, &c. Will a patient, greatly reduced by hectic symptoms, be able to recover from so bold and bloody an operation as the dissection of the whole of the knee-joint out of the limb? If some few should escape with life and limb preserved, would the bulk of persons treated in this manner have the same good fortune? I cannot admit that the extirpation of the whole of so large an articulation as the knee can be compared with the operation of amputation, in point of simplicity and safety. However, it is not on the difficulty of practising the former, that I would found my objections; for I believe that any man possessing a tolerable knowledge of the anatomy of the leg, might contrive to achieve the business. The grounds on which I withhold my approbation from the attempt to cut out large joints are the following:—1. The great length of time which the healing of the wound requires. Whoever peruses the case of Hector M'Caghan, will find that the operation was performed on the 2d of July, 1781, and that it was February 28th of the following year before all the subsequent abscesses and sores were perfectly healed. This space of time is very nearly eight months! Mr. Park describes the patient as a strong, robust sailor, and gives no farther particulars concerning the state of his constitution than that his health was declining. I entertain little doubt, that if the excision of the knee had been performed in that state of the health in which amputation becomes truly indispensable, this man would not have survived the illness arising from the operation. The only other case in which Mr. Park extirpated the knee ended fatally. In the instance related by Moreau there seemed, indeed, to be considerable debility. This patient escaped the first dangers consequent to so severe an operation; and after three months' confinement, the patient was in such a state that Moreau expected he would be able to walk upon crutches in another month or six weeks! The young man, in the mean time, was attacked by an epidemic dysentery and died. On the 21st of October, 1809, Mölder extirpated the knee-joint of a pregnant woman in the hospital at Groningen; but she died of tetanus on the 8th of the following February. He conceives that the operation is much facilitated by removing the ends of the femur and tibia in their connected state.—(See Diss. de Articulis extirpandis auctore G. H. Wachter, 1810.) 2. Even supposing the excision of the knee to be followed by all possible success, is the advantage of having a mutilated, shortened, stiff limb, in lieu of a wooden leg, sufficiently great to induce any man to submit to an operation, beyond a doubt infinitely more dangerous than amputation? I think not. The practice is at present nearly exploded in this country; but I hear every now and then of its being adopted at Paris, and Mr. Crampton has thought it worthy of revival. The difficulties of his operations, however, and tediousness of the after-treatment, and in particular the general course and termination of one of his two knee-cases, as represented by himself, are sufficiently discouraging. No doubt, more limbs might be saved by this practice than by that of amputation, but more lives would be lost. On this principle I see no reason for preferring excision to amputation. Many interesting observations on the extirpation of various diseased joints may be found in the above-mentioned dissertation by Wachter, and in the analysis of it by Langenbeck.—(Bibl. für die Chir. b. 3, Göttingen, 1811.)

In quitting this part of the subject, I may just notice the interesting case recorded by Mr. Dunn of Scarborough, who cut out several of the tarsal bones, including the diseased surface of the astragalus, and also some of the metatarsal bones from a boy's foot, with complete final success. The hemorrhage, however, was profuse, and great difficulty experienced in stopping it. Whether this bold experiment merits imitation, I am not prepared to say; but, be this as it may, the fact merits attention.—(See Med. Chir. Trans. vol. 11, p. 337.) Consult also White's Cases in Surgery; Sabatier, Séances publiques de l'Acad. de Chir. Paris, 1779, p. 73; et Mém. de l'Institut National, vol. 5, 1805; Roux, de la Resection, &c. de portions d'os malades, &c. Paris, 1812; Ph. Crampton, in Dublin Hospital Reports, vol. 4, 1827.

AMPUTATION OF THE FINGERS AND TOES, AND PART OF THE FOOT.

The best surgeons all agree with Mr. Sharp, that the amputation of the fingers and toes is most conveniently performed in their articulations. With a common scalpel, the skin is to be cut through circularly, not exactly upon the joint, but a little towards the extremity of the finger, in order that a sufficient flap may

be preserved for covering the end of the bone. On taking away a finger from a metacarpal bone, Mr. Sharp recommends making two small longitudinal incisions on each side of the joint, as a means of facilitating the separation.

In amputating the fingers and toes, the operation is greatly facilitated by cutting into the joint when it is bent. Having made an opening in the back part of the capsule, one of the lateral ligaments may easily be cut, after which nothing keeps the head of the bone from being turned out, and the surgeon has only to cut through the rest of the exposed ligamentous and tendinous parts.

Some recommend making a small semicircular flap of skin to cover the bone; but this is quite unnecessary if care be taken to draw the skin a little up, and to cut where Mr. Sharp directs. However, as making a small flap gives little pain, I have generally followed this method, though it appears to me nearly a matter of indifference which plan is adopted. In operating at the joints between the phalanges and metacarpal bones, a flap should always be made, either on the upper or under part of the fingers to be removed.

Although it is generally best to remove the fingers at the joints, it is sometimes thought right, where the injury just includes the joint and no more, to saw through the bone, instead of operating at the next articulation.—(See Guthrie on Gun-shot Wounds, p. 384.) The division can also be readily made with cutting plyers.

It may happen, that the bones of the toes and only part of the metatarsal bones are carious, in which case the leg need not be cut off, but only so much of the foot as is disordered. A small spring saw is here the most convenient. When this operation is performed, the heel and the remainder of the foot will be of great service, and the wound heal up safely, of which Mr. S. Sharp says, he had in his time seen one example.—(Op. of Surgery, chap. 37, ed. 3.) Mr. Hey confirms this statement of Sharp's concerning the impropriety of removing the whole foot, when the metatarsal bones are carious, and every other part of the leg is sound, as the remainder of the foot is of immense service in walking, the use of the ankle not being destroyed.

Mr. Hey describes a new mode of removing the metatarsal bones, which on repeated trial has fully answered his expectations. By the term new, I here mean a particular method, which had not been previously described, though it may have been performed by others sooner than by Mr. Hey himself; for the merit of having first done it is imputed to the late Mr. Turner, of North Yarmouth, who did it with success about the year 1787.—(See Hutchison's Pract. Obs. p. 70.) Mr. Hey makes a mark across the upper part of the foot, to denote where the metatarsal bones are joined to those of the tarsus. About half an inch from this mark, nearer the toes, he makes a transverse incision through the integuments and muscles covering the metatarsal bones. From each extremity of this cut, he makes an incision along the inner and outer side of the foot to the toes; he removes all the toes from the metatarsal bones, and then separates the integuments and muscles, forming the sole of the foot, from the inferior part of the metatarsal bones, keeping the edge of the knife as near the bones as possible, in order to expedite the operation, and preserve as much muscular flesh in the flap as can be saved. He then separates the four smaller metatarsal bones at their junction with the tarsus, and divides, with a saw, the projecting part of the first cuneiform bone, which supports the great toe. The arteries being tied, Mr. Hey applies the flap, which had formed the sole of the foot, to the integuments which remain at the upper part, and keeps them in contact with sutures. The cicatrix being situated at the top of the foot, is in no danger of being hurt, while the place where the toes were situated is covered with such strong skin, viz. what previously formed the sole of the foot, that it cannot be injured by any moderate violence.—(See Practical Observations in Surgery, p. 535, &c.)

When the metatarsal bone of the great toe is alone diseased, Mr. Hey recommends dissecting it out from the cuneiform bone, instead of sawing it. The latter plan cannot be easily accomplished, without removing part of the integuments and muscles, and making a transverse as well as a longitudinal incision. These disagreeable things may be avoided by following the method of Mr. Hey, or that of Mr. C. Bell. For removing the metatarsal bone, either of the little or great toe, the latter gentleman directs us to carry a scalpel round the root of the toe, and then along the side of the foot. The flaps are then to be dissected back, the metatarsal bone is to be separated from the next, and its square head is to be detached from the tarsus.—(Operative Surgery, vol. 1, p. 390.)

The removal of the central metatarsal and metacarpal bones is an operation of much difficulty, and the sawing of them is hardly practicable, without injuring the soft parts. Hence, I am decidedly of opinion with Mr. C. Bell, that instead of a formal amputation, it is better to extract the diseased bones from the foot or hand, as, indeed, Mr. Hey was in the habit of doing.

That skilful surgeon, Langenbeck, however, has devised a ready mode of taking away the middle finger with its metacarpal bone from the os magnum, or the ring-finger, with its metacarpal bone, from the articulation of the latter with the os magnum and os cuneiforme. In order to find out these articulations, he draws a line from the upper head of the metacarpal bone of the thumb straight across to the metacarpal bone of the finger to be extirpated, and at this place he begins his first incision, which runs towards each side of the finger like an inverted V. The bone is then separated all round from the soft parts, and dislocated from the carpus, when nothing remains to be done but to cut the parts towards the palm, where the wound is also made to resemble an inverted V, but does not extend any farther than is necessary, to complete the separation.—(See Langenbeck's Bibl. b. 1, p. 575, and plate 3, f. 1.) This is unquestionably a simple and excellent method of operating, which Langenbeck also recommends as the best way of removing such bones of the metatarsus, as are not situated at the sides of the foot; care being taken to save a flap from the sole. It is often difficult, however, to know with certainty whether the disease is confined to the metacarpal or metatarsal bones; and if it be not, and the carpus or tarsus be affected, the operation will not answer, and amputation be indispensable. This happened in one of Langenbeck's cases, in which he had removed one of the metacarpal bones.

Modern surgeons never amputate the whole of the foot or hand, when there is a reasonable chance of preserving any useful portion of it, though the rest may be most severely shattered. Thus, when a soldier had been struck by a grape-shot, which shattered the metacarpal bones of the little and ring-fingers, grazed the middle finger, and tore up the integuments on the palm and back of the hand, Mr. Guthrie succeeded in saving the two fingers and thumb, although, in the removal of the other parts, no regular flaps could be made for covering the wound.—(On Gun-shot Wounds, p. 382.) In winter campaigns, the toes, and more or less of the foot, are often attacked with mortification from cold. In this circumstance, when the disorder does not extend beyond the middle of the foot or the toes, it is only necessary to cut away the gangrenous part. On the first entrance of the French army into Holland, after the revolution, Paroisse met with many of these cases, in which it was necessary merely to take away the metatarsal bones, or sometimes those of the tarsus. All the patients operated upon in this manner for the effects of cold were cured; walking afterward with more or less difficulty, according as the portion of the foot taken away had been greater or smaller.—(Opuscules de Chir. p. 218.)

M. Roux, in his late publication, finds fault with our ignorance of Chopart's method of removing a part of the foot. He says, "I am certain, the principal surgeons in England have never practised, and are even totally unacquainted with, the amputation of the foot at the junction of the two halves of the tarsus, or Chopart's operation."—(Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Françoise, p. 338.) As it is an operation of considerable merit, I think it will be useful to introduce a description of it in the present work. It is performed in the nearly parallel articulations of the os calcis with the os cuboides, and of the astragalus with the os naviculare. Thus the heel is preserved, on which the patient can afterward walk. The performance of it is simple. The tourniquet having been applied, the

surgeon is to make a transverse incision through the skin which covers the instep, two inches from the ankle-joint. He is to divide the skin, and the extensor tendons and muscles in that situation, so as to expose the convexity of the tarsus. He is next to make on each side a small longitudinal incision, which is to begin below and a little in front of the malleolus, and is to end at one of the extremities of the first incision. After having formed in this way a flap of integuments, he is to let it be drawn upwards by the assistant who holds the leg. There is no occasion to dissect and reflect the flap; for the cellular substance connecting the skin with the subjacent aponeurosis is so loose, that it can easily be drawn up above the place where the joint of the calcaneum with the cuboides, and that between the astragalus and scaphoides, ought to be opened. The surgeon will penetrate the last the most easily, particularly by taking for his guidance the eminence which indicates the attachment of the tibialis anticus muscle to the inside of the os naviculare. The joint of the os cuboides and os calcis lies pretty nearly in the same transverse line, but rather obliquely forwards. The ligaments having been cut, the foot falls back. The bistoury is then to be put down, and the straight knife used, with which a flap of the soft parts is to be formed under the tarsus and metatarsus, long enough to admit of being applied to the naked bones so as entirely to cover them. It is to be maintained in this position with three or four strips of adhesive plaster, which are to extend from the heel, over the flap, to the inferior and anterior part of the leg.

Chopart used to tie every artery as soon as it was divided. On the instep, the continuation of the anterior tibial artery will require a ligature; and in the sole, the internal and external plantar arteries, in the thickness of the flap of soft parts, must generally be taken up. One-half of each ligature is to be cut away, and the other one is to be left hanging out between the plasters, at the nearest and most convenient point.

Walther and Graefe have given some very precise directions for the performance of this operation. A cut is first made, beginning half an inch below the outer ankle, and extending forwards along the side of the foot two inches. Another similar incision is then made from one inch below the inner ankle. The foot is now to be bent upwards, and the first two cuts united by a transverse incision, two finger-breadths from the front of the tibia. A flap is then dissected up, as far back as the commencement of the lateral incisions, or a line corresponding to the articulation of the astragalus with the os naviculare, and of the os calcis with the os cuboides. An assistant now checks the bleeding by applying the points of his fingers on the mouths of such vessels as bleed profusely, and holds up the flap. The extremity of the foot is now to be firmly inclined downwards, so as to stretch the ligaments connecting the tarsal bones together. The ligaments between the astragalus and os naviculare are to be first cut, when the foot may be twisted somewhat outwards, and the ligaments between the os calcis and os cuboides divided. The division is lastly completed by cutting through the soft parts regularly from above downwards, with the precaution of directing the amputating knife so as to leave a flap composed of part of the sole of the foot.—(See Abhandl. aus dem Gebiete der Prakt. Med. &c. Landshut, 1810, b. 1, p. 152; aan Graefe, Normen für die Abl. grössr. Gliedm. p. 142.)

Sometimes, in consequence of the soft parts of the instep being all gangrenous or otherwise destroyed, it is necessary to make the flap entirely from the sole of the foot, as Klein was obliged to do in one of his cases.—(Practische Ansichten bedeutendsten Chir. Operationen, h. 1, p. 28.) Indeed, Richerand thinks this mode generally advantageous, as the line of the cicatrix is not placed at the lower end of the stump, where it would be most exposed to injury.—(Nosogr. Chir. t. 2, p. 502, &c. ed. 4.) Langenbeck and Klein also condemn the painful and unnecessary measure of dissecting up a flap from the instep, as advised by Walther and Graefe. Chopart himself, as we have seen, merely drew back the integuments of the instep, without making any detachment of them from the subjacent parts. When the ends of the flexor tendons of the toes project too much from the inner surface of the lower flap, they are to be cut shorter, as Klein particularly directs; and I consider his advice, not to use sutures for keeping the flap applied, but merely strips of sticking-plaster, perfectly judicious.—(Op. cit. p. 33—34.)

[For amputation of the lower jaw see note on "Jaw-Bone." For amputation or excision of the upper jaw as first performed in this country by Dr. David L. Rogers, of this city, see note on "Osteosarcoma;" or for the details of the case, reference may be had to the N. Y. Med. and Phys. Journal for 1824, vol. 3, p. 301. For amputation or exsection of the clavicle, an operation performed for the first time by Dr. Mott, in 1829, see also note on "Osteosarcoma."—*Reese.*]

The following sources of instruction, on the subject of amputation, are particularly entitled to notice: *Celsus de Re Medicâ. Œuvres de Paré, livre* 12, *chap.* 30 *et* 33. *James Yonge, Currus Triumphalis è Terebintho*, 8*vo. Lond.* 1679. *R. Wiseman, Chir. Treatises*, 4*to. Lond.* 1692. *Sharp's Operations of Surgery, chap.* 37, *and Critical Inquiry into the present state of Surgery, chap.* 8. *Ravaton, Traité des Plaies d'Armes à Feu, Paris*, 1768. *Bertrandi, Traité des Opérations de Chirurgie, chap.* 23. *Le Dran's Obs. de Chir. Paris*, 1731, *and his Traité des Operations de Chirurgie, Paris*, 1742, *and the English Translation with the additions of Cheselden; by Gataker, Lond.* 1749; *Heister's Instit, Chirurg. pars* 2, *sect.* 1. *Nouvelle Méthode pour faire l'Operation de l'Amputation dans l'Articulation du Bras avec l'Omoplate, par M. de La Faye. P. H. Dahl, Dis. de Humeri Amputatione ex Articulo. Gott.* 1760. *Histoire de l'Amputation, suivant la Méthode de Verduin et Sabourin, avec la Description d'un nouvel instrument pour cette Opération, par M. De la Faye. P. H. F. Verduin, Dis. Epistolaris de Nova Artuum decurtandorum Ratione*, 12*mo. Amst.* 1696. *Moyens de rendre plus simple et plus sûre l'Amputation à Lambeau, par M. de Garengeot. Observation sur la Resection de l'Os, après l'Amputation de la Cuisse, par M. Veyret. Mémoire sur la Saillie de l'Os après l'Amputation des Membres; où l'on examine les causes de cet inconvénient, les moyens d'y remédier, et ceux de la prevenir, par M. Louis. Seconde Mémoire sur l'Amputation des Grandes Extrémités, par M. Louis. The foregoing Essays are in Mém. de l'Acad. de Chirurgie*, t. 5, *edit.* 12*mo. R. de Vermale, Obs. et Rémarques de Chirurgie pratique, Manheim*, 1767. *Essai sur les Amputations dans les Articles, par M. Brasdor, in t.* 15 *Mém. de l'Acad. de Chir. J. U. Bilguer de Membrorum Amputatione rarissime administranda aut quasi abroganda*, 4*to. Halæ Magd.* 1761. *White's Cases in Surgery*, 1770. *Bromfield's Chirurgical Observations and Cases, vol.* 1, *chap.* 2, 8*vo.* 1773. *O'Halloran's complete Treatise on Gangrene, &c., with a new Method of Amputation*, 8*vo. Dublin*, 1765. *Alanson's Practical Observations on Amputation, ed.* 2, 1782. *J. L. Petit, Traité des Maladies Chir. t.* 3, *Paris*, 1774, *or the later ed.* 1790. *R. Mynor's Practical Thoughts on Amputation, Birmingh.* 1783. *T. Kirkland, Thoughts on Amputation, &c.* 8*vo. Lond.* 1780. *Loder, Comment. de Nova Alansoni, Amputationis Methodo, Progr.* 1, 7, *Jen.* 1784, *or Chir. Med. Beobachtungen*, 8*vo. Weimar*, 1794. *J. F. Tschepius, Casus de Amputatione Femoris non Cruenta, Halæ*, 1742. (*Haller, Disp. Chir.* 5, 239.) *Mursinna, Neue Med. Chir. Beobacht. Berlin*, 1796; *P. F. Walther, Abhandl. aus dem Gebiete der Prakt. Medicin, besonders der Chirurgie und Augenheilkunde, b.* 1, *Landshut*, 1810; *Kern. Ueber die Handlungsweise bey der Absetzung der Glieder. Wien*, 1814; *G. Kloss, De Amputatione Humeri ex Articulo*, 4*to. Francof.* 1811; *W. Fraser, An Essay on the Shoulder-joint Operation*, 8*vo. Lond.* 1813. *H. Robbi, De Via ac Ratione, qua olim membrorum Amputatio instituta est*, 4*to. Lips.* 1815. *J. P. Roux, Mémoire et Obs. sur la Réunion Immediate de la Plaie après l'Amputation*, 8*vo. Paris*, 1814. *J. G. Hause, Amputationis Ossium præcipua quædam momenta, Lips.* 1801. *J. F. D. Evans, Practical Observations on Cataract and closed Pupil, and on the Amputation of the Arm at the Shoulder, &c.* 8*vo. Lond.* 1815. *H. J. Brunninghausen, Erfahrungen und Bemerkungen über die Amputationen*, 8*vo. Bamb.* 1818. *Langenbeck, Bibl. für die Chirurgie, b.* 1, *p.* 502, *&c.* 8*vo. Gott.* 1816. *P. G. Van Hoorn, De iis, quæ in partibus Membri, præsertim osseis, amputatione vulneratis notanda sunt.* 4*to. Lugd.* 1803. *Graefe, Normen für die Ablösung grösserer Gliedm.* 4*to. Berlin*, 1813. *Klein, Practische Ansichten bedeutendsten Chir. Op. h.* 1, 4*to.*

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AMYLUM. Starch. Powdered starch is sometimes used as an external application to erysipelas; but chiefly in clysters when the neck of the bladder is affected with spasm. The following is the formula used at St. Bartholomew's Hospital. ℞. Mucilaginis amyli, aquæ distillatæ: sing. ʒij. Tinct. opii guttas quadraginta: Misce.

ANASTOMOSIS. (From ανα, through, and στομα, a mouth.) Anatomists and surgeons imply by this term the communications of the blood-vessels with each other, or their running and opening into each other, by which the continuance of a free circulation of the blood is greatly ensured, and the danger of mortification lessened. The immense importance of this part of our structure in all cases in which the main artery or veins of a limb are obliterated, is particularly conspicuous in the disease called aneurism.—(See Aneurism.)

Nay, such has been the providence of nature in this respect, that even where the thoracic aorta has been completely obstructed, the channels for the conveyance of the blood to the lower extremities have yet been found adequate to that purpose. This was proved in an example where the obstruction had been gradually produced by disease, and the anastomosing vessels of course had had time for enlargement; for this is a very different case from that in which a ligature is suddenly applied to the aorta; though, as far as can be deduced from the particulars of some experiments made on dogs by Sir Astley Cooper, and of one operation in which he tied the human abdominal aorta (Surgical Essays, part 1, p. 101), blood will still pass to the lower extremities in sufficient quantity for their nutrition. At least this inference is safely deducible from the very memorable operation to which I have referred, subject to one important condition, viz. that there be no additional cause of impediment to the passage of blood to the lower extremities besides the ligature above the bifurcation of the aorta. When Sir A. Cooper tied the human aorta in the abdomen, the experiment was made as the only possible means of hindering a man from bleeding to death, who had a large aneurism of the external iliac artery actually beginning to bleed, and extending too high to admit of any thing else being done. Now, although the unfortunate patient was not saved, and it must be acknowledged that the chances of any other result were very small, the case furnished the important proof, that if the abdominal aorta be suddenly and completely obstructed, the blood may yet pass in adequate quantity to the lower extremities, provided there exist no other cause of impediment to the passage of the blood into those members; for on the side occupied by the aneurism the circulation in the limb was stopped, while in the opposite limb the circulation and natural warmth were preserved. To this subject I shall hereafter return.—(See Aorta.)

The changes which take place in the arterial system of the limb, when the main artery is rendered impervious by the application of a ligature, are well described by Mr. Hodgson: "The blood, meeting with an obstacle to its progress through the accustomed channel, is thrown in greater quantity and with greater force into those branches which arise above the seat of the obstruction. The ramifications of these branches, in consequence of the unusual influx of blood, undergo a remarkable dilatation; the more minute vessels also, by which they anastomose with corresponding ramifications, arising from branches given off below the obstruction, are from the same cause sufficiently enlarged to allow a free passage of the blood into the inferior trunks of the limb. At first, the circulation is in this manner carried on through a congeries of minute anastomosing arteries; in a short time a few of these channels become more enlarged than the rest: as these increase in size, the smaller vessels gradually collapse, and ultimately a few large communications constitute permanent channels through which the blood is transmitted to the parts that it is destined to supply. This is one mode by which a collateral circulation is established.

"But in some situations more direct and ostensible inosculations are provided; so that when one channel is obstructed, the blood passes at once through the other in a sufficient stream for the nourishment of the part which it is destined to supply. Under these circumstances no dilatation of the collateral branches is necessary: the circulation, in such instances, may be said to be constantly carried on through inosculating trunks. These great communications principally exist in the extremities of the body where the dilating impulse which the blood receives from the heart is of course diminished. Thus the radical artery inosculates freely with the ulnar; the anterior with the posterior tibial; and the internal carotid with the vertebral arteries. Two modes therefore exist by which arteries communicate with each other—the anastomoses of minute ramifications and the direct inosculations of trunks."—(See Hodgson on the Diseases of Arteries and Veins, p. 234.) Refer also to Inosculation. The best general account of the inosculations in relation to aneurism is contained in Scarpa's Treatise on Aneurism; more especially the Italian edition, which is embellished with beautiful engravings.

ANCHYLOPS. (From αγχι, near, and ωψ, the eye.) Same as Ægylops.

ANCHYLOSIS. (From αγκυλος, crooked.) This denotes an intimate union of two bones which were naturally connected by a moveable kind of joint. All joints originally designed for motion may become anchylosed, that is, the heads of the bones forming them may become so consolidated together that no degree of motion whatever can take place. Bernard Conner (De stupendo ossium coalitu) describes an instance of a general anchylosis of all the bones of the human body. A still more curious fact is mentioned in the Hist. of the Acad. of Sciences, 1716, of a child 23 months old affected with universal anchylosis. In the advanced periods of life anchylosis more readily occurs than in the earlier parts of it. The author of the article Anchylosis in the Encyclopédie Méthodique, mentions a preparation in which the femur is so anchylosed with the tibia and patella, that both the compact and spongy substances of these bones appear to be common to them all without the least perceptible line of separation between them. In old subjects the same kind of union is common between the vertebræ and between these and the heads of the ribs.

Anchylosis is divided into the true and false. In the true, the bones grow together so completely that not the smallest degree of motion can take place, and the case

is positively incurable. The position in which the joint becomes thus unalterably fixed makes a material difference in the inconvenience resulting from the occurrence. In false anchylosis the bones have not completely grown together, and their motion is only diminished, not destroyed. True anchylosis is sometimes termed complete; false, incomplete.

In young subjects in particular, anchylosis is seldom an original affection, but generally the consequence of some other disease. It very often occurs after fractures in the vicinity of joints; after sprains and dislocations attended with a great deal of contusion; and after white swellings and abscesses in joints. Aneurisms, and swellings, and abscesses on the outside of a joint may also induce anchylosis. In short, every thing that keeps a joint for a long timem otionless may give rise to the affection, which is generally the more complete the longer the cause has operated.

When a bone is fractured near a joint, the limb is kept motionless by the apparatus during the whole time requisite for uniting the bones. The subsequent inflammation also extends to the articulation, and attacks the ligaments and surrounding parts. Sometimes these only become more thickened and rigid: on other occasions, the inflammation produces a mutual adhesion of the articular surfaces. Hence fractures so situated are more serious than when they occur at the middle part of a bone. After the cure of fractures, a certain degree of stiffness generally remains in the adjacent joints, but this is different from true anchylosis; it merely arises from the inactivity in which the muscles have been kept, and their consequent loss of tone.

The position of an anchylosed limb is a thing of great importance. When abscesses form near the joints of the fingers, and the tendons mortify, the fingers should be bent, that they may anchylose in that position, which renders the hand much more useful than if the fingers were permanently extended. On the contrary, when there is danger of anchylosis, the knee should always be kept as straight as possible. The same plan is to be pursued, when the head of the thigh-bone is dislocated in consequence of a diseased hip. When the elbow cannot be prevented from becoming anchylosed, the joint should always be kept bent. No attempt should ever be made to cure, though every possible exertion should often be made to prevent a true anchylosis. The attempt to prevent, however, is not always proper, for many diseases of joints may be said to terminate when anchylosis occurs.

When the false or incomplete anchylosis is apprehended, measures should be taken to avert it. The limb is to be moved as much as the state of the soft parts will allow. Boyer remarks, that this precaution is much more necessary in affections of the ginglymoid than of the orbicular joints, on account of the tendency of the former to become anchylosed, by reason of the great extent of their surfaces, the number of their ligaments, and the naturally limited degree of their motion.

The exercise of the joint promotes the secretion of the synovia, and the grating first perceived in consequence of the deficiency of this fluid soon ceases. A certain caution is necessary in moving the limb: too violent motion might create pain, swelling, and inflammation, and even caries of the heads of the bones. It is by proportioning it to the state of the limb, and increasing its extent daily, as the soft parts yield and grow supple, that good effects may be derived from it.—(See Boyer, Mal. des Os, t. 2.) The use of embrocations and pumping cold water on the joint every morning have great power in removing the stiffness of a limb remaining after the cure of fractures, dislocations, &c.

Unreduced dislocations are not always followed by anchylosis. Nature often forms a new joint, especially in persons of the lower order, who are obliged to move their limbs a great deal, in order to obtain a livelihood. The surrounding cellular substance becomes condensed, so as to form around the head of the luxated bone a membrane serving the purpose of a capsular ligament. The muscles, at first impeded in their action, become so habituated to their new state, that they resume their functions. This is particularly the case with bones which move in every direction, and have round heads; but in ginglymoid joints, the heads of the bones are only imperfectly dislocated, and the motion is greatly restrained by the extent of surface; while some of the numerous ligaments are only sprained, not ruptured. These causes promote the occurrence of anchylosis.

Anchylosis may follow sprains and contusions of the joints, and such shocks as the articular surfaces experience in leaping or falling on the feet from great heights. This is more likely to happen when the inflammatory symptoms, resulting from such violence, have not been properly counteracted by bleeding and other general remedies, while the plan of beginning to move the joint gently every day, as soon as the case will allow, has been entirely neglected.

When certain diseases of joints end in complete anchylosis, it is sometimes a desirable event. In fact, it is as much a means of cure, as the formation of callus is for the union of broken bones. The disease of the vertebræ, described by Pott, is cured as soon as the bones anchylose, nor can the patient be considered well before this event has taken place.—*W. H. Müller, de Anchylosi, Lugd.* 1707. *L'Encyclodédie Méthodique, partie Chir. t.* 1, *art. Anchylose. J. L. Petit, Traité des Mal. d' Os, t.* 2. *J. T. van de Wynpersse, de Anchyloseos Pathologia et Curatione; singularibus et fig. illustr. 4to. Lugd.* 1783. *Gentleman's Magazine,* 1787, *universal anchylosis, ligaments ossified. Wurz, Wundarzn. p.* 224, *following the removal of the patella. Sandifort, Exercit. Acad. p.* 1, *&c., anchylosis of the occiput with the atlas, and of the atlas with the dentatus; Sandifort, Obs. Pathol. anchylosis of the jaw. Dumas, Recueil Périodique de la Société de Méd. t.* 10, *p.* 30, *and t.* 13, *p.* 352. *Hennen's Principles of Military Surgery, p.* 161, *&c. ed.* 2. *The examples of general anchylosis are numerous: Plouequet refers to Columbus de Re Anatomicâ; Connor de stupendo Ossium coalitu, Oxon.* 1695; *Deslandes in Mem. de l'Acad. des Sciences,* 1716; *Frank, Reise nach Paris, London, &c., p.* 127, *anchylosis of all the joints except those of the lower jaw; Olivier, in Journ. de Méd. t.* 12, *p.* 273; *Voigt Mag. für den Neuesten Zustand der Naturkunde, b.* 4, *p.* 412; *Portal, Cours d'Anat. Méd. t.* 1, *p.* 14; *Phil. Trans. No.* 461; *J. C. Smith, Nat. Hist. Hiberniæ Comit.* 1744. *Job a Meckren's Obs. c.* 64, *p.* 297. *Callisen's Systema Chir. Hodiernæ, t.* 2, *p.* 699, *edit.* 1800. *Boyer, Mal. des Os, t.* 2, *et Traité des Maladies Chir. t.* 4, *p.* 553. *Verduc, Traité des Bandages, chap.* 35, *p.* 172. *Richerand, Nosogr. Chir. t.* 3, *p.* 223, *edit.* 4. *Murray, Diss. de Anchylosi, Upsal.* 1797.

[A highly interesting operation has been performed by Professor Mott for the cure of permanent anchylosis, or rather "immobility of the lower jaw," which had existed for ten years. A report of this case is published in the American Journal for Nov. 1829; but as the disease and operation are of so novel and interesting a character, Dr. Mott, at my request, has politely furnished me with the following description of the case, which cannot be unacceptable to the profession, and I therefore insert it here.

"A young man, twenty-one years of age, from North Carolina, called, with the lower jaw almost immoveably fixed to the upper. No motion in a downward direction could be discovered, nor was the most powerful effort with the hand upon the chin able in the slightest degree to alter its situation. He had been in this deplorable state for ten years. Unable to chew a mouthful of food, or even open the jaws for its reception, his food had to be introduced through a small opening, occasioned by an irregularity of the bicuspides teeth on the right side. On the left side, just within the angle of the mouth, a very firm band, of more than ligamentous hardness was to be seen and felt, reaching from this point along the alveolar ridge to the coronoid process.

Along the whole course of this adhesion to the gum of the lower jaw, there was not a vestige of a tooth, and he stated that from this part the jaw had been formerly separated, with the teeth attached to it. This morbid adhesion had been several times freely divided; it was cut from within the mouth in different directions, but never permitted the least motion of the jaw.

From the circumstance that he could give a little lateral motion to the jaw, I thought that his mouth might yet be opened, and the deformity removed. I then made an incision from the angle of the mouth on the left side through the check, nearly to the coronoid process, dividing the firm cicatrix within completely. The jaws being relieved by dividing all the adhesions between them, a piece of very broad tape was placed between the teeth by a probe and spatula, and tied some distance below the chin. To the loop thus formed I applied all the strength I could command, but not the least yielding of the jaw could be discovered.

I then applied the principle of the screw and lever, by an instrument prepared for the purpose, composed of two steel plates about three inches in length. When applied to each other, they were of a wedge-shape. To the large end was attached a screw, which, when turned, caused the thin extremity of the plates to expand. This instrument enabled me to open the mouth completely.

With considerable difficulty this vice was insinuated between the range of teeth on the left side, resting along their whole course. It was then expanded, by turning the screw, and such was the report that attended the yielding of the lower jaw, that several present thought it was broken, but the noise was like that attending the laceration of ligaments rather than such as attends the fracture of a bone. The mouth was immediately opened to a sufficient extent.

The wound was closed with the interrupted suture and adhesive plaster; to prevent the adhesion of the cheek to the jaws internally, pieces of sponge were interposed. The patient was enabled to chew his food, and to converse and articulate distinctly as the result of the operation, and he entirely recovered."

Dr. Mott has since repeated the operation with the same success on a gentleman from Louisiana.

In the North Amer. Med. and Surg. Journal for April, 1828, Dr. J. Rhea Barton has published a most successful operation performed on a case of anchylosis at the hip-joint, attended with very great deformity, after it had existed for more than eighteen months. The object of the operation was to substitute an artificial joint for the loss of the natural articulation at the hip, and it is most honourable to Dr. Barton, and alike gratifying to the profession and to humanity, to record, that it has been most completely successful. An abridged account of this novel and most interesting exhibition of consummate surgical skill is given in the Appendix to the late Philadelphia edition of Cooper's "First Lines," of 1828. It was performed on a sailor at the Pennsylvania Hospital in Nov. 1826.

In Dr. Francis's edition of Denman's Midwifery is described a peculiar affection of the hip-joint, in some respects novel and important. It is in effect an anchylosis, and is denominated "a displacement of bone without fracture or dislocation," inducing a morbid change in the form and cavity of the pelvis, such as might wholly defeat the process of natural labour. The patient, an adult subject, fell on the right hip; the injury done to the external parts was comparatively slight; but an inflammatory action took place in the bottom of the acetabulum, which caused total absorption of the bone, and the protrusion of the head of the thigh-bone itself into the cavity of the pelvis. Nor was the diseased action limited to these changes; large deposites of osseous matter were made within the pelvis surrounding the absorbed acetabulum; and the head of the thigh-bone was by the same material augmented to more than double its original size. The neck of the bone and also both trochanters were considerably increased in bulk. The capacity of the pelvis was diminished about two inches in its superior and lateral portion.—*Reese.*]

ANEURISM, or ANEURYSM. (From *ανευρυνω*, to dilate.) The tumours which are formed by a preternatural dilatation of a part of an artery, as well as those swellings which are occasioned by a collection of arterial blood, effused in the cellular membrane, in consequence of a rupture or wound of the coats of the artery, receive the name of aneurisms. According to these opinions, aneurisms are of two kinds; the first being termed true; the second spurious or false. Some modern writers have ventured to reckon another form of aneurism, which is said to happen when the external coats of an artery being weakened by mechanical injury or disease, the internal coat protrudes through the breach in the outer coat, so as to form a tumour distended with blood. This case has been denominated the internal mixed aneurism, or aneurisma herniam arteriæ sistens. The reality of this form of disease was believed by Dr. W. Hunter; and some delicate experiments, instituted by Haller on the mesenteric arteries of frogs, appear to have been the first ground of the opinion. Such an aneurism, however, has not been universally admitted, not that any body doubted the correctness of what Haller advanced, but because there might not always be a perfect analogy between the results of an experiment on animals, and those afforded by the observation of the diseases of the human body.

When Haller asserted, that by separating the muscular from the inner coat of the arteries he could, when he pleased, produce an aneurism in these animals; and when Hunter declared that such an experiment made the artery firmer than ever, in consequence of the adhesive inflammation taking place; the character and veracity of these eminent men naturally lead to the question, whether the experiments were conducted exactly in the same manner. Now, says Mr. Wilson, when we know that Haller did not suffer the surrounding parts to unite, and that John Hunter did, we can no longer be at a loss to account for the different conclusions.—(See Wilson's Anatomy, Pathology, &c. of the Vascular System, p. 378.)

However this may be with respect to the experiments made on certain animals, I am disposed to consider it fully proved by Mr. J. Hunter, Sir E. Home, and Professor Scarpa, that in the human subject an aneurism will not arise from the kind of weakness which is caused by cutting or even stripping off the external coat of a sound artery, whether the wound be closed or not.

This fact would at least appear to be well established, with respect to the generality of the arteries; but how far it is so in relation to the aorta, is another question, the inner membrane of which vessel is alleged to be more elastic than that of common arteries. Dubois and Dupuytren in fact are stated to have presented to the Faculty of Medicine at Paris preparations which exhibit the lining of the aorta protruding through the middle coat, in the form of a sac filled with blood.—(See Dict. des Sciences Med. art. Aneurisme, and Breschet in Transl. of Mr. Hodgson's work, p. 130.)

By the term mixed aneurism, Dr. A. Monro senior implied the state of a true aneurism, when its cyst had burst, and the blood was diffused in the adjacent cellular substance; an event which is frequent. Besides these varieties of aneurism, the aneurismal varix or venous aneurism, and the aneurism by anastomosis, constitute diseases which are usually regarded as cases pertaining to the present subject, though incapable of being comprised under the ordinary definition of an aneurism.

Nothing can be more manifest than the fact, that previously to the discovery of the circulation of the blood, no correct nor valuable opinions could have prevailed, respecting the diseases which now go under the name of aneurisms. Indeed, it was not until after the days of Aristotle that any distinction was made between the swellings of veins and those of arteries, such vessels not having been at that early period distinguished from each other. Their differences were first pointed out by Rufus of Ephesus.

Down to Galen, however, nothing like consistency was established in the notions respecting aneurism. His opinion was, that all tumours of this nature were produced either by anastomosis or by rupture; and though he has described their symptoms, he has not informed us of the characters by which each of these cases was distinguishable one from the other. Paulus Ægineta divides aneurisms into two sorts, both of which, he says, are attended with extravasation, and of course with rupture.

Vesalius, who first applied anatomy to the investigation of disease, has described an aneurism arising from the rupture of a dilated aorta; the first specimen, I believe, on record of this form of disease.—(Bonetus Sepulch. Anat. lib. 4, sect. 2.)

The combination of rupture with dilatation of the artery was afterward more particularly noticed by Nuck.—(Oper. Chir., &c. Lugd. 1692.)

It was Fernelius who first promulgated the doctrine that aneurisms were always dilated arteries.—(Universa Medicina, De Extern. Corp. Affect. lib. 7, cap. 3, Venet. 1564.)

This opinion was espoused by Forrestus, Diemerbroek, and others; but at length the inaccuracy of attempting to refer every aneurism solely to dilatation of the coats of the vessel, was established by the observations of Lancisi, Freind, Guattani, and Morgagni. In short, as Mr. Hodgson has stated, these authors proved that aneurism may be produced either by the rupture or the dilatation of the coats of an artery, or by a combination of both circumstances, the dilatation having preceded the rupture.—(On the Diseases of Arteries, &c. 8vo. Lond. 1815.)

This admission of aneurism by dilatation, and of

aneurism by rupture of the coats of an artery, together with the frequent combination of both circumstances, was indeed the prevailing undisturbed doctrine of every surgical school, until Professor Scarpa, inclining to the tenets of Sylvaticus (De Aneurysmate. Tract. Venetiis, 1600, 4to.), ventured to question the correctness of the common opinion about the dilatation of all the arterial coats. However, after the very clear and satisfactory elucidation of this disputed point by my friend Mr. Hodgson, the accurate views of the subject, first taken by Morgagni, and the other eminent writers specified above, may be regarded as established beyond the possibility of dispute. At the same time, it is not to be supposed that Scarpa means to say, that the arteries are not subject to a morbid dilatation; on the contrary, he gives a particular description of this affection, which he carefully discriminates from aneurism.

Previously to offering a more particular account of the doctrine taught by Scarpa respecting the formation of aneurism, as well as of the chief facts which may be adduced against a part of such doctrine, it seems proper to make the reader acquainted with the various species of the disease, their ordinary symptoms, and a few other circumstances.

When any part of an artery is dilated (attended with particular circumstances marking its difference from another form of dilatation which, as I shall explain, perhaps ought not to be set down as aneurismal), the swelling is commonly named a true or genuine aneurism. In such cases the artery is either enlarged at only a small part of its track, and the tumour has a determinate border, or the vessel is dilated for a considerable length, in which circumstance the swelling is oblong, and loses itself so gradually in the surrounding parts, that its margin cannot be exactly ascertained. The first case, which is the most common, is termed the circumscribed true aneurism; the last the diffused true aneurism; a case, however, which would be looked upon by Scarpa only as a specimen of dilatation different in several particulars from aneurism, as will be hereafter noticed. When blood escapes from a wound or rupture of an artery into the adjoining cellular substance, the swelling is denominated a spurious or false aneurism. In this instance the blood either collects in one mass, distends the cellular substance, and condenses it into a cyst, so as to form a distinctly circumscribed tumour; or it is injected into all the cavities of the surrounding cellular substance, and extends along the course of the great vessels, from one end of the limb to the other, thus producing an irregular oblong swelling. The first case is named a circumscribed false aneurism; the second a diffused false aneurism. —(Richter's Anfangsgr. b. 4.)

These appellations are, in my opinion, preferable to to the term cylindrical, applied by Sauvages to true aneurisms, or sacciform, proposed by Morgagni for false aneurisms.—(Advers. Anat. 2, Aortæ Animadv. 38, et Epist. Anat. 17, No. 27.) Because, as we shall see in the course of this article, though true aneurisms (including dilatations of all the arterial coats of every kind) do mostly affect the whole circumference of the vessel, and must therefore partake of a cylindrical shape, there are exceptions, in which a distinct circumscribed sac, composed of all the coats of the vessel, projects from one side of an artery, the diameter of which may not be at all increased. Here the disease might rather be named sacciform, the very appellation suggested by Morgagni for false aneurisms, in which the disease generally originates in this shape, from whatever particular side of the vessel the inner coats have given way. We see also that the subject actually demands more numerous distinctions, since aneurisms undergo in their progress various changes, which sometimes make an immense, and even a very sudden difference in their shape, cases which were at first circumscribed afterward becoming diffused.

The symptoms of a circumscribed true aneurism take place as follows: the first thing which the patient perceives is an extraordinary throbbing in some particular situation, and on paying a little more attention he discovers there a small pulsating tumour which entirely disappears when compressed, but returns again as soon as the pressure is removed. It is commonly unattended with pain or change in the colour of the skin. When once the tumour has originated, it continually grows larger, and at length attains a very considerable size. In proportion as it becomes larger, its pulsations become weaker, and indeed they are almost quite lost when the disease has acquired much magnitude. The diminution of the pulsation has been ascribed to the coats of the artery losing their dilatable and elastic quality in proportion as they are distended and indurated, and, consequently, the aneurismal sac being no longer capable of an alternate diastole and systole from the action of the heart. The fact is also imputed to the lamellated coagulated blood deposited on the inner surface of the sac, particularly in large aneurisms, in which the motion of some of the blood is always interrupted. Immediately such coagulated blood lodges in the sac, pressure can only produce a partial disappearance of the swelling. This deposition of lamellated coagulum in the aneurismal sac is a circumstance of considerable importance; for it has been well explained by Mr. Hodgson, that it is the mode by which the spontaneous cure of the disease is in most instances effected. "One of the circumstances which, in the most early stage, generally attend the formation of aneurism (says this author), is the establishment of that process which is the basis of its future cure. The blood, which enters the sac soon after its formation, generally leaves upon its internal surface a stratum of coagulum, and successive depositions of the fibrous part of the blood gradually diminish the cavity of the tumour. At length the sac becomes entirely filled with this substance, and the deposition of it generally continues in the artery which supplies the disease, forming a firm plug of coagulum, which extends on both sides of the sac to the next important ramifications that are given off from the artery. The circulation through the vessel is thus prevented, the blood is conveyed by collateral channels, and another process is instituted, whereby the bulk of the tumour is removed," &c.—(On the Diseases of Arteries &c. p. 114.) Whether there is any truth in Kreysig's conjecture, that some of the lymph may exude from the inside of the sac itself, I cannot pretend to say: he owns, however, that the inner concentric layers presenting the appearance of being deposited last, is a circumstance rather against his surmise, though he adverts to some other circumstances which incline him to look upon the opinion as possibly correct.—(German Transl. of Mr. Hodgson's Work, p. 124.)

In a preceding paragraph I have spoken of the diastole and systole of the aneurismal sac; for it is the general belief that the pulsation of the tumour is produced by the jet of blood into it at each stroke of the heart. This opinion, however, is disputed by an eminent writer, who asks, is it true that the pulsation of aneurisms proceeds from the entrance of a more considerable stream of blood into the sac, and the distention of the swelling thereby produced? In aneurisms, which have only a narrow communication with the arterial tube, or which are filled with laminated coagula, the idea, says he, is quite inadmissible: the aneurism is rather shaken, as it were, like other different swellings in the vicinity of an artery, by the stroke of the heart occasioning a stretching of the whole arterial system, and at the same time communicating an impulse to the column of blood.—(Kreysig, Germ. Tr. of Mr. Hodgson's Work, p. 143.) Here, however, I am by no means disposed to coincide with this distinguished physician, whose sentiments appear to me to be refuted by the fact, that whenever any change happens, calculated to lessen or entirely stop the influx of blood into the sac, the pulsation either diminishes or ceases in proportion. Thus, when Kreysig adverted to the pulsation of aneurisms, in which much coagulated blood was deposited, he might at the same time have mentioned the effect which such deposition has in weakening the pulsation, the layers of coagulated blood within the tumour being in the natural mode of cure, as Mr. Hodgson has correctly explained, "the means by which the force of the circulation is removed from the sac, and the fatal termination of the disease by rupture is prevented."—(On Diseases of Art. and Veins, p. 126.) In proportion as the aneurismal sac grows larger, the communication of blood into the artery beyond the tumour is lessened. Hence, in this state, the pulse below the swelling becomes weak and small, and the limb frequently cold and œdematous. On dissection, the lower continuation of the artery is found preternaturally small and contracted. The pressure of the tumour on the adjacent parts may also produce a variety of symptoms, ulceration, absorption of bone,

&c. Sometimes (says Richter) an accidental contusion or concussion may detach a piece of coagulum from the inner surface of the cyst, and the circulation through the sac be obstructed by it: nay, he asserts that the coagulum may possibly be impelled quite into the artery below, so as to induce important changes. The danger of an aneurism arrives when it is on the point of bursting, by which occurrence the patient usually bleeds to death, and this sometimes in a few seconds. The fatal event may generally be foreseen, as the part about to give way becomes particularly tense, elevated, thin, soft, and of a dark purple colour.—(Richter's Anfangsgr. band 1.)

A large axillary aneurism, which burst in St. Bartholomew's Hospital some years ago, did not burst by ulceration, but by the detachment of a small slough from a conical, discoloured part of the tumour; and soon after this case fell under my observation, I had an opportunity of seeing the process by which an inguinal aneurism burst: at a certain point the tumour became more conical, thin, and inflamed, and here a slough about an inch in width was formed. On the dead part becoming loose, a profuse bleeding began, which was stopped for a short time by pressure, but soon returned with increasing violence, and put an end to the patient's misery. We are then to conclude that external aneurisms do not burst by ulceration, but by the formation and detachment of a slough. I believe this is a fact which was first particularly pointed out in the early editions of my work, and it gives me pleasure to find that it is a statement which entirely coincides with that subsequently made by several writers of eminence, especially Mr. A. Burns (On Diseases of the Heart, p. 225), and Boyer (Traité des Maladies Chirurgicales, t. 2, p. 98.)

As far as my information extends, Mr. A. Burns first explained the very different mode of rupture which happens in internal aneurisms: these, he observed, generally burst by actual laceration, and not by sphacelation of the cyst.—(On Diseases of the Heart, p. 225.) But a still more particular account of the process by which external and internal aneurisms burst, is delivered by Mr. Hodgson. When the sac points externally (says this gentleman), it rarely or never bursts by laceration, but the extreme distention causes the integuments and investing parts to slough, and upon the separation of the eschar, the blood issues from the tumour. A similar process takes place when the disease extends into a cavity which is lined by a mucous membrane, as the œsophagus, intestines, bladder, &c. In such cases, the cavity of the aneurism is generally exposed by the separation of a slough which has formed upon its most distended part, and not by laceration. But when the sac projects into a cavity lined by a serous membrane, as the pleura, the peritoneum, the pericardium, &c., sloughing of these membranes does not take place, but the parietes of the tumour having become extremely thin in consequence of distention, at length burst by a crack or fissure, through which the blood is discharged.—(On the Diseases of Arteries, &c. p. 85.)

When the aneurism is of considerable size, the collateral arteries, which originate above the swelling, are manifestly enlarged. Boyer informs us, that in dissecting the lower extremity of a patient on whom Desault had operated eight months previously for a popliteal aneurism, he found in the substance of the great sciatic nerve an artery, whose diameter was equal to that of the radial at the wrist. This vessel had its origin from the ischiatic artery, and descended to the back part of the knee, where it anastomosed with the upper articular arteries. Boyer had also noticed in the same subject before the operation, that one of the branches of the upper internal articular artery was so much enlarged that its pulsation could be plainly felt on the internal condyle of the thigh-bone.—(Op. cit. p. 93.) It is such enlargement of the collateral arteries above the disease, which ensures to the limb below the tumour an adequate supply of blood when the obstruction to its passage through the diseased artery becomes considerable, or when this vessel has been rendered totally impervious by a surgical operation performed for the cure of the complaint.

In the advanced stage of an aneurism, the skin is found extremely thin, and confounded, as it were, with the aneurismal sac. The cavities of the cellular substance near the disease are either filled with serum or totally obliterated by adhesion. The adjacent muscles, whether they lie over the aneurism or to one side of it, are stretched, displaced, dwindled, and sometimes confounded with other parts. It is the same with the large nervous cords situated at the circumference of the tumour: they are pushed out of their natural situation, diminished in size, sometimes adherent to the outside of the sac, and so changed as scarcely to admit of being known again. Lastly, the cartilages and the bones themselves are not exempt from the mischief which the aneurismal swelling produces in all the surrounding parts: they are gradually destroyed, and at length not the least trace of their substance remains, just in the same way as the bones of the cranium are destroyed by fungous tumours of the dura mater.—(See Dura Mater.) Even the cartilages of the larynx and rings of the trachea are sometimes destroyed; this tube is pierced, and the blood escapes into it, or the aneurism bursts into the œsophagus.—(Boyer, Traité des Maladies, Chir. t. 2, p. 99.) As I shall hereafter explain, however, the pressure of an aneurismal tumour more quickly produces an absorption of bone than of cartilage.

While an aneurism is small and recent, it does not generally cause much pain, nor seriously impede the functions of the limb. But when it has increased, several complications are produced. Thus the dragging of the saphenal nerve, by femoral aneurisms, frequently occasions acute pain in the course of this nerve as far as the great toe. The distention of the sciatic nerve by the popliteal aneurism sometimes brings on intolerable pain, which extends to all the parts to which this nerve is distributed, and which can hardly ever be appeased by the topical use of opiate applications. The compression of the veins and lymphatics gives rise to œdema, numbness, and coldness of the limb. And, finally, the long-continued pressure of the aneurism on the neighbouring bones causes their destruction.—(Boyer, t. 2, p. 105.)

In true aneurism, the coats of the artery are not always in the same state, the kind of changes observed depending upon the progress of the tumour. In the early stage of the disease, either the whole cylinder of the vessel, or only a part of its circumference, is dilated; but this period is generally of short duration, especially in arteries of middling size, because their middle coat is capable of less resistance than that of the larger arteries, like the aorta, where this coat is yellowish, firm, and very elastic. As Breschet remarks, this difference of resistance in the middle coat of the aorta and the branches given off from it, accounts for the rarity of true aneurisms either in the small arteries or those of middling size, and their greater frequency in the principal trunk of the arterial system.

At length, in consequence of the increasing distention, some of the coats of the artery possessing the least elasticity give way, and these are found to be the internal and middle coats, while the external one still makes resistance and continues to be more and more dilated by the lateral impulse of the blood.

The second stage of true aneurism is that which is mostly met with; that in which the tumour increases more rapidly, and therefore begins to excite greater attention. The disease when it has attained this form is in point of fact no longer a true aneurism, but a case which Monro distinguished by the name of the consecutive or external mixed false aneurism. In this stage the patient's life is endangered, and death often brought on by the rupture of the tumour. Examinations of the dead subject under these circumstances have frequently led to mistaken notions, and doubtless if various swellings of this kind had not been found in different degrees or stages in the same individual, one might be disposed to join Scarpa in the belief, that no aneurism consists of a dilatation of all the arterial coats.—(Breschet, Fr. transl. of Mr. Hodgson's work, p. 128, 129.)

The false aneurism is always attended with at least a rupture, or giving way of the inner coat of the vessel, and usually with a breach in both this and the muscular coat, the outer elastic tunic forming the pouch in which the blood collects. But after the swelling has attained a certain size, this coat also bursts, and then the blood either becomes diffused, or a large circumscribed space is formed for it by the condensation of the surrounding cellular membrane. False aneurisms, when produced by a wound or puncture, are of course from the

first attended with a division of all the coats of the vessel. This form of the disease is often seen at the bend of the arm, where the artery is exposed to injury in venesection.—(See Hemorrhage.) In this circumstance, as soon as the puncture is made, the blood gushes out with unusual force, and in a bright scarlet, irregular, interrupted current; flowing out, however, in an even and less rapid stream when pressure is applied higher up than the wound. These last are the most decisive marks of the artery being opened; for blood may issue from a vein with great rapidity, and in a broken current, when the vessel is turgid and situated immediately over the artery, which imparts its motion to it. The surgeon endeavours precipitately to stop the hemorrhage by pressure, and in general a diffused false aneurism is the result. The external wound in the skin is closed so that the blood cannot escape, but this does not hinder it from passing into the cellular substance. The swelling thus produced is uneven, often knotty, and extends upwards and downwards along the track of the vessel. The skin is also usually of a dark purple colour. Its size increases as long as the internal hemorrhage continues, and if this should proceed beyond certain bounds, mortification of the limb ensues. Such is the diffused false aneurism from a wound.

The circumscribed false aneurism, from a wound or puncture, arises in the following manner. When proper pressure has been made in the first instance, so as to suppress the hemorrhage, but the bandage has afterward been removed too soon, or before the artery has healed, the blood passes through the unclosed wound, or that which it has burst open again, into the cellular substance. As this has now become agglutinated by the preceding pressure, the blood cannot diffuse itself into its cells, and consequently a mass of it collects in the vicinity of the aperture of the artery, and distends the cellular substance into the form of a sac. Sometimes, though not often, the circumscribed false aneurism originates immediately after the opening is made in the artery. This chiefly happens when the aperture in the vessel is exceedingly small, and consequently when the hemorrhage takes place so slowly that the blood, which is first effused, coagulates, and prevents the entrance of that which follows into the cavities of the cellular substance, and of course its diffusion. False aneurisms, proceeding from the rupture of the inner coats of an artery, are always at first circumscribed by the resistance of the outer tunic.

The circumscribed false aneurism consists of a sac composed of the external coat of the artery, or, in case this has given way, it is composed of an artificial pouch formed among whatever parts happen to be in the vicinity of the burst artery. This cavity is filled with blood, and situated close to the artery, with which it has a communication. Hence in false aneurisms a throbbing is always perceptible, and is more manifest the smaller such tumours are. The larger the sac becomes the less elastic it is, and the greater is the quantity of laminated coagula in it; so that in very large aneurisms of this kind the pulsation is sometimes wholly lost.

The tumour is at first small, and on compression entirely disappears; but returns as soon as this is removed. It also diminishes when the artery above it is compressed; but resumes its wonted magnitude immediately such pressure is discontinued. When there is coagulated blood in the sac, pressure is no longer capable of producing a total disappearance of the tumour, which is now hard. The swelling is not painful, and the integuments are not changed in colour. It continually increases in size, and at length attains a prodigious magnitude.

The following are generally enumerated as the discriminating differences between circumscribed true and false aneurisms: the true aneurism readily yields to pressure, and as readily recurs on its removal; the false one yields very gradually, and returns in the same way; and as it contains laminated coagula, it cannot be reduced in the same degree by compression as an aneurism formed by a dilatation of the arterial coats, where such strata of coagulated blood are usually absent. Frequently a hissing sound is audible when the blood gushes into the sac. The pulsation of the false aneurism is always more feeble, and as the tumour enlarges is sooner lost than that of the true one, which throbs after it has acquired a considerable volume.—(See Richter's Anfangsgr. b. 1.

FORMATION OF ANEURISMS.

If the doctrines of Scarpa, published in 1804, had proved correct, the grand distinction of aneurism into true and false must have been rejected as erroneous: "for," says he, "after a very considerable number of investigations, instituted on the bodies of those who have died of internal or external aneurisms, I have ascertained, in the most certain and unequivocal manner, that there is only one kind or form of this disease, viz. that caused by a solution of continuity or rupture of the proper coats of the artery, with effusion of blood into the surrounding cellular substance; which solution of continuity is occasioned sometimes by a wound, a steatomatous, earthy degeneration, a corroding ulcer, or a rupture of the proper coats of the artery, I mean the internal and muscular, without the concurrence of a preternatural dilatation of these coats being essential to the formation of this disease; and therefore that every aneurism, whether it be internal or external, circumscribed or diffused, is always formed by effusion."—(On Aneurism; transl. by Wishart, Pref.)

According to Scarpa, it is an error to suppose that the aneurism at the curvature or in the trunk of the aorta, produced by a violent and sudden exertion of the whole body, or of the heart in particular, and preceded by a congenital relaxation of a certain portion of this artery, or a morbid weakness of its coats, ought always to be considered as a tumour formed by the distention or dilatation of the proper coats of the artery itself, that is, of its internal and fibrous coats. Scarpa considers it quite demonstrable, that such aneurisms are produced by a corrosion and rupture of these tunics, and consequently, by the effusion of arterial blood under the cellular sheath, or other membrane covering the vessel. If ever there be a certain degree of preceding dilatation, it is not essential to constitute the disease, for it is not a constant occurrence; most aneurisms are unpreceded by it, and in those rare cases in which an aneurism is preceded and accompanied by a certain degree of dilatation of the whole diameter of the curvature of the aorta, there is an evident difference between an artery simply enlarged in diameter, and a pouch which forms an aneurismal sac.

Careful dissections, says Scarpa, will prove that the aorta contributes nothing to the formation of the aneurismal sac, and that this is merely the cellular membrane which, in the sound state, covered the artery, or that soft cellular sheath which the artery received in common with the neighbouring parts. This is raised by the blood into the form of a tumour, and is covered in common with the artery by a smooth membrane.

This eminent professor does not deny that from congenital relaxation the proper coats of the aorta may occasionally yield and become disposed to rupture; but he will not admit that dilatation of this artery precedes and accompanies all its aneurisms, or that its proper coats ever yield so much to distention as to form the aneurismal sac. The root of an aneurism of the aorta never includes the whole circumference of the artery; but the aneurismal sac arises from one side in the form of an appendix or tuberosity. On the contrary, the dilatation of the artery always extends to its whole circumference, and therefore differs essentially from aneurism. Thus, he urges that there is a remarkable difference between a dilated and aneurismatic artery, although these two affections are sometimes found combined together, especially at the origin of the aorta. If we also consider that the dilatation of an artery may exist without any organic affection, the blood being always in the cavity of the vessel; that in an artery so affected there is never collected any grumous blood or polypous layers; that the dilatation never forms a tumour of considerable bulk; and that while the continuity of the proper coats remains uninterrupted, the circulation of the blood is not at all, or not so sensibly changed; we shall be obliged to allow, that aneurism differs essentially from one kind of dilatation of an artery.

Some additional remarks on this topic more recently published by Scarpa will be presently considered.

By dissections of arteries both in the sound and morbid state, Scarpa endeavours to demonstrate what share the proper and constituent coats of the artery have in the formation of the aneurismal sac, and what belongs

to the cellular covering, and other adventitious membranes surrounding the artery.

The covering of an artery is merely an adventitious sheath which the vessel receives in common with the parts in the vicinity of which it runs. On cutting an artery across in its natural situation, the segment of the cut vessel retires and conceals itself in this sheath.

This cellular covering is most evident round the curvature and trunk of the aorta, the carotid, mesenteric, and renal arteries: it is less dense round the trunks of the brachial, femoral and popliteal arteries. The pleura lies over the cellular sheath of the arch of the aorta, and over that of the thoracic aorta; while that of the abdominal aorta is covered by the peritoneum. Both these smooth membranes adhere to and surround two-thirds of the circumference of the vessel. The great arteries of the extremities are not covered in addition to the cellular substance by any smooth membrane of this sort, but by a cellular sheath, which is demonstrably distinct from the adipose membrane, and serves to enclose the vessels, and connect them with the contiguous parts.

When air or any other fluid is injected by a small hole, made artificially between the cellular covering and the subjacent muscular coat of the artery, the injected matter elevates into a tumour the cellular membrane, which closely embraces the artery, without properly destroying its cells, which it distends in a remarkable manner. When melted wax is injected and pushed with much force, the cellular sheath of the artery is not only raised over the vessel like a tumour, but the internal cells of that covering are also lacerated, and on examining afterward the capsule of the artificial tumour, it appears as if it were formed of several layers, rough and irregular internally, smooth and polished externally. The same thing happens when any injection is pushed with such force into an artery as to rupture the internal and muscular coats at some point of their circumference. Nicholls performed this experiment several times before the Royal Society.—(Philos. Trans. an 1728.) As soon as the internal coat is ruptured, the muscular one also gives way; but the external cellular sheath being of an interlaced texture, and the thin laminæ of which it is composed being not simply applied to one another, but reciprocally intermixed, is capable of supporting great distention by yielding gradually to the impulse of the blood, without being torn or ruptured.

Scarpa is farther of opinion that the same phenomena may be observed when the internal coat of the aorta becomes so diseased as to be ruptured by the repeated jets of blood from the heart. In this circumstance, the blood, impelled by the heart, begins immediately to ooze through the connexions of the fibres of the muscular coat, and gradually to be effused into the interstices of the cellular covering, forming for a certain extent a kind of ecchymosis or extravasation of blood, slightly elevated upon the artery. Afterward, the points of contact between the edges of the fibres of the muscular coat being insensibly separated, the arterial blood, penetrating between them, fills and elevates in a remarkable manner the cellular covering of the artery, and raises it after the manner of an incipient tumour. Thus the fibres and layers of the muscular coat being wasted or lacerated, or simply separated from each other, the arterial blood is carried with great force, and in greater quantity than before, into the cellular sheath of the artery, which it forces more outwards; and finally, the divisions between the interstices of the cellular coat being ruptured, it is converted into a sac, which is filled with polypous concretions and fluid blood, and at last forms, strictly speaking, the aneurismal sac. The internal texture, although apparently composed of membranes placed one over the other, is, in fact, very different from that of the proper coats of the artery, notwithstanding the injured vessel and aneurismal sac are both covered externally in the thorax and abdomen with a smooth membrane.

Scarpa has examined a considerable number of aneurisms of the arch and of the thoracic and abdominal trunk of the aorta, without finding a single one in which the rupture of the proper coats of the artery was not evident, and in which, consequently, the sac was produced by a substance completely different from the internal and muscular coats.

The aneurismal sac never comprehends the whole circumference of the vessel. At the place where the tumour joins the side of the tube, the aneurismal sac presents a kind of constriction, beyond which it becomes more or less expanded. This would never happen, or rather the contrary circumstance would occur, if the sac were formed by an equable distention of the tube and proper coats of the affected artery. In incipient aneurisms, at least, the greatest size of the tumour would then be in the artery itself, or root of the swelling, while its fundus would be the least. But whether aneurisms be recent and small, or of long standing and large, the passage from the artery is always narrow, and the fundus of the swelling greater in proportion to its distance from the vessel. The sac is always covered by the same soft dilatable cellular substance which united the artery in a sound state to the circumjacent parts. Such cellular substance in aneurisms of the thoracic aorta is covered by the pleura, and in those of the abdominal aorta by the peritoneum, which membranes include the sac and ruptured artery, presenting outwardly a continued smooth surface, just as if the artery itself were dilated. But if the aorta be opened lengthwise on the side opposite the constriction or neck of the tumour, the place of the ulceration or rupture of the proper coats of the artery immediately appears within the vessel, on the side opposite to that of the incision. The edge of the fissure which has taken place is sometimes fringed, often callous and hard, and through it the blood formed for itself a passage into the cellular sheath, which is converted into the aneurismal sac. If, as sometimes happens in the arch of the aorta near the heart, the artery, before being ruptured, has been somewhat dilated, it seems at first as if there were two aneurisms; but the constriction which the sac next to the artery presents externally, points out exactly the limits beyond which the internal and muscular coats of the aorta had not been able to resist the distention, and where of course they have been ruptured. The partition which may always be seen dividing the tube of the artery from the aneurismal sac, and which is lacerated in its middle, consists of nothing else than the remains of the internal and muscular coats of the ruptured artery.

By carefully dissecting the proper coats of the ruptured aorta in its situation, and comparing them with the cellular substance forming the sac, Scarpa affirms that the truth of the preceding statement may be indisputably demonstrated.

When an incision is made lengthwise in the side of the vessel opposite the rupture, its proper coats are found either perfectly sound, or a little weakened and studded with earthy points, but still capable of being separated into distinct layers. On the contrary, in the opposite side of the aorta, where the rupture is, the proper coats are unusually thin, and are only separable from each other with difficulty, or even not at all; they are frequently brittle like an egg-shell, and are disorganized and torn at the place where they form the partition between the ruptured artery and the mouth of the aneurismal sac. Continuing to separate these coats from within outwards, we arrive at the cellular sheath surrounding the aorta. This sheath being much thickened in large aneurisms, and very adherent to the subjacent muscular coat of the artery at the place of the constriction of the sac, is very apt to be mistaken for a dilated portion of the vessel itself. But even in such cases we may at last separate it, without laceration, from the tube of the artery above and below the injury, and successively from the muscular coat as far as the neck of the aneurism. Then it is clear the muscular coat does not pass beyond the partition separating the cavity of the artery from that of the aneurismal sac, over which it is not prolonged, but terminates at the edge of the rupture like a fringe, or in obtuse points. Errors are more apt to occur in consequence of the aorta and sac being both covered by the pleura or peritoneum.

The portion of the aorta within the pericardium being only covered by a thin reflected layer of this membrane, such layer may also be lacerated when the proper coats give way, and blood be effused into the cavity of the pericardium. Examples of this kind are related by Walter, Morgagni, and Scarpa himself. In the latter instance, on making an incision into the concave part of the aorta, opposite the tumour which had formed under the layer of the pericardium, which had also burst by a small aperture, its internal coat, corresponding to the base of the swelling, was quite rough, interspersed

with yellow hard spots, and actually ulcerated for the space of an inch in circumference. The preparation is preserved in the museum at Pavia.

But all other parts of the aorta having, between them and the pleura and peritoneum, a cellular sheath of a stronger and more yielding nature, which allows itself to be distended into a sac, and being strengthened internally by polypous layers, and externally by the pleura or peritoneum, oppose for a long while the fatal effusion of blood.

Scarpa believes that what he calls the slow, morbid, steatomatous, fungous, squamous degeneration of the internal coat of the artery is more frequently the cause of its bursting than violent exertions of the whole body, blows, or an increased impulse of the heart. This kind of diseased change is very common in the curvature, and in the thoracic and abdominal trunks of the aorta. In the incipient state of such disease the internal coat of the artery loses, for a certain space, its beautiful smoothness, and becomes irregular and wrinkled. It afterward appears interspersed with yellow spots, which are converted into grains or earthy scales, or into steatomatous and cheese-like concretions, which render the internal coat of the artery brittle, and so slightly united to the adjoining muscular coat, that upon being merely scratched with the knife or point of the nail, pieces are readily detached from it, and on being cut it gives a crackling sound, similar to the breaking of an egg-shell. This ossification cannot be said to be proper to old age, since it is sometimes met with in subjects not much advanced in life. The whole of the side of the artery, in that portion which is occupied by the morbid affection, is, for the most part, hard and rigid, sometimes soft and fungous, and in most cases the canal of the artery is preternaturally constricted. In the highest degree of this morbid disorganization true ulcerations are found on the inside of the artery, with hard and fringed edges, fissures, and lacerations of the internal and fibrous coats of the artery.

Having presented the reader with an abridged account of the most important remarks made by Scarpa in support of the doctrine he defends, I now annex his conclusions. 1. That this disease is invariably formed by the rupture of the proper coats of the artery. 2. That the aneurismal sac is never formed by a dilatation of the proper coats of the artery, but undoubtedly by the cellular sheath which the artery receives in common with the parts contiguous to it; over which cellular sheath the pleura is placed in the thorax, and the peritoneum in the abdomen. 3. That if the aorta, immediately above the heart, appears sometimes increased beyond its natural diameter, this is not common to all the rest of the artery, and when the aorta in the vicinity of the heart yields to a dilatation greater than natural, this dilatation does not constitute, properly speaking, the essence of aneurism. 4. That there are none of those marks regarded by medical men as characteristic of aneurism from dilatation, which may not be met with in aneurism from rupture, including even the circumscribed figure of the tumour. 5. That the distinction of aneurism into true and spurious, adopted in the schools, is only the production of a false theory; since observation shows that there is only one form of the disease, or that caused by a rupture of the proper coats of the artery, and an effusion of the arterial blood into the cellular sheath which surrounds the ruptured artery.—(See Treatise on Aneurism, by A. Scarpa, transl. by J. H. Wishart, Edin. 1808.)

Such were the inferences made by Scarpa, in 1804, one of the most distinguished anatomists and surgeons of the present day upon the continent. It has been already stated, that, great as this authority is, several eminent modern surgeons, as Richerand, Boyer, Dubois, Dupuytren, Sabatier, Breschet, &c., did not yield to it, but still contended that in some aneurisms the coats of the artery were dilated. These professors in France coincided with what has been usually taught upon this subject in the surgical schools of Great Britain. Every lecturer here has been accustomed to describe the distinctions of aneurism into true and false, or into some cases which are accompanied with dilatation, and into others which are attended with rupture of the arterial coats. A few years ago Mr. Hodgson, of Birmingham, published a valuable treatise on aneurism, in which work he differs from Scarpa, and joins those surgical writers who believe in the occasional dilatation of the coats of the arteries in this disease. He inquires, "Is every aneurism produced by a destruction of the internal and middle coats of the vessel, and does not a partial dilatation of these coats occasionally precede and give rise to their destruction? I believe that this is frequently the case. We have seen that the disorganization of the coats of an artery, by destroying their natural elasticity, will give rise to permanent dilatation of the whole circumference of the vessel; and there is every reason to expect that a loss of its elasticity in a portion only of the diameter of the vessel, will give rise to a partial dilatation of its coats. Indeed, the proofs of a partial dilatation of the coats of an artery, particularly of the aorta, are incontestably established by the possibility of tracing the coats of the vessel throughout the whole extent of the expansion, and by the existence of those morbid appearances in the sac which are peculiar to the coats of the arteries.

"In the year 1811 (says Mr. Hodgson), I dissected an aneurism of the aorta, which was removed from the body of a young woman by my friend Dr. Farre. The sac was as large as a small melon, and had proved fatal by bursting into the posterior mediastinum, and subsequently into the cavity of the thorax. This aorta exhibited the formation of aneurism by partial dilatation in three distinct stages. The internal coat was throughout inflamed, and presented a fleshy and irregular appearance. At the arch of the aorta there was a dilatation not larger than the half of a small pea. About two inches lower in the same vessel was a second dilatation, which would have contained a hazel nut, and immediately above the the diaphragm was the large aneurism which had proved fatal. I removed that portion of the vessel which contained the smallest dilatation, and macerated it until its coats could be separated without violence. I found that the dilatation existed equally in the three coats of the vessel, and, when separated, each presented the appearance of a minute aneurism. The second dilatation exhibited the same circumstances in a more advanced stage. The coats of the vessels were more intimately adherent to each other than in a natural state, but it was evident that the dilatation consisted in a dilatation of the internal, the middle, and the external coats of the aorta. In the large aneurism the disorganized internal and middle coats could be traced for some distance into the sac, when the parts contained in the posterior mediastinum and the vertebræ formed the remainder of the cyst. There can be little doubt that the sac commenced in a dilatation of the coats of the vessel, similar to those appearances which existed in the superior portion of the dissection, and the artery appeared to illustrate the formation of aneurism by partial dilatation in three distinct stages."—(Hodgson on the Diseases of Arteries and Veins, p. 66. 68.) As far as Kreysig's information extends, nobody before Mr. Hodgson had examined the structure of an aneurismal sac in this accurate manner, viz. by maceration; and the results, he thinks, are not liable to the slightest objections.—(See the German transl. of Mr. Hodgson's work, with notes by Kreysig and Koberwein, p. 109. Hanover, 1817.)

Mr. Hodgson has seen this partial dilatation in almost all the arteries, which are subject to aneurism: at the division of the carotids and iliacs; in the arteries of the brain, &c.; and he agrees with Dr. Baillie (Morbid Anatomy, &c.), Laennec (Cerattius, Beschreib. d. Krankh. Preparate d. Anat. Theatres zu Leip. p. 408, 8vo. 1819), and others, that aneurisms at the origin of the aorta are generally formed by dilatation of the coats of the vessel.

"Partial as well as general dilatation (says Mr. Hodgson) frequently precedes the formation of aneurism in the arteries of the extremities. A gentleman had a large aneurism in the thigh, which had undergone a spontaneous cure. Upon examining the limb after death, the popliteal artery was found to be thickened and covered with calcareous matter. A small pouch, which would have contained the seed of an orange, originated from the side of this artery. This little sac was evidently formed by a dilatation of the coats of the vessel. A man died from the sloughing of an aneurism in the ham; in the femoral artery there was a small aneurism about as large as a walnut. The external coat was dissected from the surface of the tumour to a considerable extent. The internal and middle coats were evidently dilated, and contributed to the formation of the sac. The dilatation of these coats was gradual, and they continued for a considerable dis-

tance to form the sac, when they were inseparably blended with the surrounding parts."—(Op. cit. p. 70.)

When Mr. A. Burns bears testimony to the fidelity and accuracy of Scarpa's general detail, he adds, that perhaps it may not be uniformly found that "the root of an aneurism never includes the whole circumference of the tube of an artery." We have, says he, a preparation in which the reverse has taken place. In this case the whole cylinder of the vessel, from the heart to beyond the curvature, is equally dilated; and dilated to such an extent, that the tumour measures no less than ten inches in circumference. Scarpa limits dilatation, says Mr. Burns, to that state of an artery in which the coats remain in their natural relation to each other, and in which they were not altered in their texture, nor lined on their inner surface with "polypous layers." "This, however, was not the case in the instance which I have brought forward. In it you have seen that the coats were much dilated, and also very much altered in their structure. Externally and internally they had assumed the look of the membranes of the fœtus, only they were thicker and denser, but they were equally gelatinous and nearly as transparent; and on their inner surface, they were crusted over with the laminæ of coagulated lymph. By peeling off this incrustation, after the sac had been inverted, we saw plainly, that although the internal coats were round the complete cylinder of the vessel much diseased, and considerably dilated, yet they were not dilated in the same degree as the external coverings of the artery. At irregular distances, longitudinal rents were formed in the fibrous coats, and these chasms were filled with coagulating lymph. The internal coats over the whole circumference of the vessel had assumed the diseased condition which in aneurism is generally confined to a part of the cylinder. In this tumour all the coats continued for a time to dilate equally, but at length the internal gave way, forming longitudinal rents, through which the external coats could be seen after the lymphatic coating had been scraped off. In this instance, had the sac been dissected in the early stage, it would have presented precisely the same appearances as those described by Dr. Monro, and the one (the aneurism) lately examined by the surgical editor of the London Med. Review." Mr. Burns afterward expresses doubts whether the sac ever acquires a large size without dilatation. The case reported in the latter periodical work was the largest that he knew of, in which all the coats were found uniformly dilated. The sac, which was as large as the fist, was lined throughout with flakes of bone, and though the internal coat of the vessel was thus patched, and extremely thin and brittle, it did not, on minute inspection, any where exhibit a solution of continuity. Mr. A. Burns farther states, that the above case, reported by himself, was the only one out of fourteen which did not corroborate Scarpa's description.—(On Diseases of the Heart, &c. p. 204.) Mr. Wilson, after mentioning the frequency of aneurism in the aorta, carotid, subclavian, and axillary arteries, and its rarity in the brachial, tells us, that he knows of no example of aneurism below the elbow, where the swelling could not be traced to a wound of the coats of the artery. He adds, that true aneurism has not unfrequently occurred in the internal and external iliac arteries, in the inguinal, femoral, and very frequently in the popliteal. It has taken place in the posterior tibial artery, but he knows of no instance of it in the anterior tibial or peroneal arteries. "I have (says he) met with only one instance of true aneurism affecting any of the branches of the aorta which are distributed to the abdominal viscera. In the year 1809, on inspecting the body of a clergyman, in the presence of the late Sir W. Farquahr, a tumour very much resembling the heart in colour, shape, and size, appeared to hang down from the under surface of the left lobe of the liver. When this tumour was opened and carefully inspected, it appeared to have been formed by the left branch of the hepatic artery having become very much enlarged and aneurismal. It had burst, and the blood which had escaped was found in an imperfect cyst, partly in a fluid, and partly in a coagulated state, forming a large proportion of the tumour." This preparation is in Windmill-street.—(See Lectures on the Blood, and on the Anatomy, Physiology, and Surgical Pathology of the Vascular System, p. 379, 380, 8vo. Lond. 1819.)

The facts adduced by Mr. Hodgson appear sufficiently conclusive, and from them the following doctrine is clearly deducible.

First, That numerous aneurisms are formed by destruction of the internal and middle coats of an artery, and the expansion of the external coat into a small cyst, which giving way from distention, the surrounding parts, whatever may be their structure, form the remainder of the sac.

Secondly, That sometimes the disease commences in the dilatation of a portion of the circumference of an artery. This dilatation increases until the coats of the vessel give way, when the surrounding parts form the sac, in the same manner as when the disease is in the first instance produced by destruction of the coats of an artery.—(P. 74.)

The conclusions of Mr. Hodgson, as he himself explains, are supported by the observations of numerous writers.

The learned Sabatier says there can be no doubt that many aneurisms depend upon the dilatation of the arterial coats; but in far more numerous examples the internal tunics are ruptured, and it is the cellular coat alone which separates from them, and enlarges so as to form the aneurismal sac; "de sorte que les artères, qui sont dans ce cas, sont diloriquées, suivant l'expression de Lancisi."

It is difficult to conceive, he observes, how all the coats of an artery can dilate and yield sufficiently to form the investment of such immense tumours as some aneurisms are. Indeed, that very tunic, which composes the greater part of the thickness of the vessel, and which is termed the muscular coat, is known to consist of fibres whose texture is firm, and little capable of bearing extension. However, Haller, in describing a very large aneurism, situated in the aorta, near the heart, relates, that the innermost coat of this vessel was ruptured and torn, the loose jagged edges of the laceration being visible in the aneurismal sac. These were squamous, bony, and of little thickness; while the muscular and cellular coats were quite sound. Donald Monro noticed the same thing in five different aneurisms in the course of the femoral and popliteal arteries of a man who had been confined a long while to his bed after being operated upon for bubonocele. Monro succeeded in tracing the fibres of the muscular coat over the swellings, so that he had no doubt of this tunic being dilated.—(See Médecine Opératoire, t. 3, p. 160—162.)

According to Richerand, when an aneurism is recent and of small size, the dissection of the tumour exhibits a simple dilatation of the arterial coats; while in the other cases, where the aneurism is large, and has existed a considerable time, the internal and middle coats of the vessel are invariably lacerated. In the early stage of the disease, the blood which fills the aneurismal sac is fluid, and, on the contrary, in cases where the internal tunics of the artery are ruptured, the sac contains more or less coagulated lymph. The external or cellular coat composes the greater part of the cyst; and the coagulated lymph, with which it is filled, is arranged in layers, the density of which is described as being greater in proportion to the length of time which they have been deposited. Such as are nearest the sac are, therefore, represented as being most compact, and containing the smallest quantity of the colouring matter of the blood; more deeply, the concretions of lymph resemble simple coagula; and lastly, the blood which is still nearer the arterial tube retains its fluidity.

After the aneurismal sac has been cleansed from the lymph and coagulated blood which it contains, its parietes will appear to be almost entirely formed of the cellular coat of the artery. Towards the bottom may be observed the aperture, arising from the laceration of the internal and middle coats, which, being much less elastic than the external, are ruptured in an early stage of the disease. It is when these two tunics give way, that the aneurismal tumour undergoes a sudden and considerable increase in its size; for then the cellular coat alone has to sustain all the pressure of the blood, which now, becoming effused into a more ample cyst, loses a great deal of its impetus, coagulates and forms fibrous masses; circumstances to which may be ascribed the hardness of the swelling, the weakness of its pulsation, &c.—(Nos. Chir. t. 4, p. 82, ed. 2.)

But this author seems to venture far beyond the

bounds of accuracy, when he represents every small aneurism as exhibiting a dilatation of the arterial coats, unless his meaning refer more particularly to the outer coat alone.

The reality of what are called true internal aneurisms was ably urged by C. F. Ludwig, in a programma written expressly on that subject.—(Diagnostices Chir. Fragm. de Aneurysmate Interno; Lips. 1805.) But an interesting case, exemplifying an aneurismal dilatation of all the coats of the abdominal aorta, has been published by Professor Nægele of Heidelberg. The swelling was as large as a man's head, and weighed about five pounds. The aorta began to be dilated at the point where it passes into the cavity of the abdomen between the crura of the diaphragm. This dilatation extended gradually down to a point about four finger-breadths from the bifurcation of the aorta into the iliac arteries, at which point, strictly speaking, the large aneurismal sac commenced. The length of the whole dilated part of the vessel was eleven inches; that of the sac, six; and its diameter five inches. The artery was not equally dilated in every direction, the expansion being most considerable laterally and forwards. Professor Nægele and Ackermann found that the three coats of the aorta, the internal, muscular, and cellular, were all equally dilated. These gentlemen traced the muscular coat with the scalpel from the top to the bottom of the tumour, and not the slightest doubt could be entertained, that the case was a true aneurism.—(F. C. Nægele, Epistola ad T. F. Baltz, quâ Historia et Descriptio Aneurysmatis, quod in aorta abdominali observavit, continetur. Heidelb. 1816.)

In the valuable cases collected by H. F. Janin, very convincing evidence will be found of there being two kinds of aneurism; one attended with the rupture of the coats of the artery, the cellular coat alone forming the aneurismal sac; and the other, consisting in an equal dilatation of all the coats of the artery. Of the latter species of aneurism, Janin relates three very unequivocal cases.—(See Annales du Cercle Médical, t. 1, Art. 2, 1820.)

After the clear demonstration of an aneurismal sac being occasionally composed of all the coats of an artery, as afforded in the dissections and pathological preparations to which a reference has been made, the reader will be better prepared to judge of the difference existing upon this subject between Scarpa and other modern writers; and, as far as I can judge, the question is now reduced to one, whether any of the dilatations on record, said to comprise all the arterial coats, merit the name of aneurism. We have seen, that he has always unequivocally admitted that the arteries may be dilated, though the kind of dilatation to which he alludes, is thought by him, as well as by A. Burns, and my friend Mr. Hodgson (On Diseases of Arteries, &c. p. 58), to require discrimination in a pathological point of view. "It is proved (says Scarpa) by dissection, that the morbid dilatation is circumscribed by the proper coats of the diseased artery; and that the inner surface of the sac, formed by the partial or total protrusion of the arterial tube, is never filled with polypous laminæ, or layers of fibrine disposed over each other (a fact particularly dwelt upon by Mr. Hodgson, p. 82); which layers never fail to be formed in greater or smaller quantity in the cavity of an aneurism." The opinion that these layers of coagula are not met with in small dilatations of arteries, but are found in large expansions of them, he says, is contradicted by numerous careful observations, and especially by a specimen, actually before him when he was writing, where a morbid dilatation of the arch of the aorta, in the vicinity of its origin from the heart, six inches in length, and five in breadth, was entirely free from any of the lamellated coagula always found in aneurisms. On the contrary, the sac of the aneurism is formed from the parts surrounding the wounded or ruptured artery, into which pouch, the blood, entering as into a natural receiver, and quite out of the current of the circulation, moves only slowly, and constantly deposites these layers of fibrine, and this sometimes in such quantity as to fill the whole cyst. Scarpa, at the same time, particularly explains, that if accidentally furrows or fissures exist on the inside of the morbid dilatation, the fibrine may be deposited in these rough places, but only in them. These fissures and inequalities of the internal surface of the morbidly dilated artery, he regards strictly as so many beginnings of another disease of the vessel, quite different from dilatation, that is, of aneurism subsequent to dilatation.—(See Memoria sulla Legatura delle principali Arterie degli Arti, con una Appendice all' Opera sulle Aneurisma, fol. Pavia, 1817; or the Treatise on Aneurism, transl. by Wishart, ed. 2, p. 119, Edinb. 1819.)

In this manner, no doubt, Scarpa would account for the presence of lamellated coagula in the case reported by Mr. A. Burns (On Diseases of the Heart, p. 306), though the latter gentleman himself, for reasons already detailed in the foregoing pages, did not regard the expansion of all the coats of the artery, as corresponding to the morbid dilatation implied by Scarpa. Thus Scarpa farther agrees with other modern writers, in admitting the possibility of aneurism becoming ingrafted, as it were, on one of these unnatural dilatations, more than one example of which combination were indeed recited in his first work. In that treatise he has asserted, that what he calls morbid dilatation, always extends to the whole circumference of the vessel. But this point seems, from the appendix, to be renounced, as he now observes, "Where the morbid dilatation is partial, or on one side of the artery like a thimble (for very frequently, even in the arch of the aorta, this partial dilatation does not exceed the size of half a bean), the entrance for the blood into this capsule is as large as the bottom of the sac."—(Transl. by Wishart, p. 120, ed. 5.) According to Scarpa, where the morbid dilatation occupies the whole circumference of the arterial tube, the tumour always retain sa cylindrical or oval form; and, if situated in such manner that it can be compressed, it yields very readily to pressure, and almost disappears; and after death is found much smaller than during life. On the contrary, aneurism, whether preceded by dilatation or not, constantly originates from one side of the ruptured artery. The entrance for the blood is small, compared with the size of the fundus of the sac; the tumour assumes an irregular shape; yields with difficulty to pressure; retains nearly the same size in the dead that it had in the living body; and its sac, instead of becoming thinner as the swelling enlarges, as the coats of an artery do when they are simply affected with dilatation, attains greater thickness, the larger the aneurism grows. These essential differences between the two diseases are illustrated by an interesting case, met with by Professor Vacca, where a patient died with an aneurism of one subclavian artery, and a simple morbid dilatation of the whole circumference of the other.—(See Sprengel, Storia delle Operaz. di Chir. trad. Ital. Parte 2, p. 294.)

When these two different affections are situated in the thorax or abdomen, it is impossible to discriminate them from each other before death. The symptoms occasioned by the pressure of the tumour on the viscera, must be nearly the same, whether caused by a morbid dilatation or an aneurism. The means for retarding their fatal termination is also the same in both forms of the disease. With regard to the possibility of cure, however, Scarpa says, that there is great difference; for when the case is an internal aneurism, there may be some slight hope of a radical cure by the efforts of nature and art, which hope can never be entertained in a case of morbid dilatation; a fact which is accounted for by no laminated coagula being deposited in the latter disease.—(On Aneurism, transl. by Wishart, p. 124, ed. 2.) A great deal of the latter statement coincides with the observations of Mr. Hodgson, who particularly notices, that he has never met with lamellated coagula in such sacs, as consist either in a general or partial dilatation of the coats of the vessel.—(On Diseases of Arteries, &c. p. 82.) Whether this ever takes place in such cases may still be a question, because, if Professor Nægele has given a correct description of the aneurism of the abdominal aorta already mentioned, which aneurism was of a large size, and consisted of a dilatation of all the coats of the vessel, there was in this rare example a large quantity of these layers of coagulated blood. Yet, whether the Professor actually means the fibrine, arranged in laminæ, or only common coagulated blood, which, as every one knows, may be found either in the cysts of dilated or of ruptured arteries, may admit of doubt. The statement, therefore, made by Hodgson and Scarpa, may not be contrary to what was really seen by Nægele and Ackermann. The following case,

however, observed by Laennec, and quoted by a modern writer, must (if correctly reported) afford not only an unequivocal specimen of aneurism by dilatation of all the coats of the aorta, but of laminated coagula within its cavity. "In homine enim, qui repente sub atrocissimis pectoris doloribus corruit, præter aortam adscendentem in aneurysma ita expansam, ut neonati infantis caput æquaret, cystidam aneurismaticam immediate supra arteriæ cœliacæ ortam magnitudine nusis juglandis invenit, quæ luculenter ostendit sinum communicantem cum arteriæ cylindro per foramen magnitudine amygdalæ, diametro totius arteriæ illo loco non mutato. Saccus hic cultro anatomico accurate ac subtilliter subjectus, eamdem structuram, easdem ostendit membranas, quibus gaudebat arteria, e cujus latere excreverat: cæterum massis grumosis, sive fibrosis erat impletus. Inde igitur patet, hoc aneurysma sacciforme et laterali et partiali quidem tunicarum aortæ dilatatione ortum esse."—(J. H. G. Ehrhardt, De Aneurysmate Aortæ, p. 13, 4to. Lips. 1820.)

From what has been stated, then, it appears, that there is only one principal point of difference between Scarpa and other writers, and this resolves itself into the question, whether a dilatation of an artery, arising at one particular side of the vessel, and lined by its internal coat, ought not to be regarded as an aneurism, because its communication with the tube of the artery is more capacious than what exists in other aneurisms, where the inner coat has given way, and because it rarely (perhaps never) contains laminated coagula, unless fissures should happen to exist at some points of the inner arterial tunic thus expanded?

The greater number of aneurisms increase gradually, and sooner or later incline to the side on which the least resistance is experienced. De Haen mentions an aneurism of the aorta, which first made its appearance between the second and third ribs of the left side, and which, instead of growing larger, as is usual, subsided, and could neither be seen nor felt for more than a month before the patient's decease, although, on opening the body, a tumour of the arch of the aorta was found, three times as large as the first. De Haen imputes the sudden disappearance of the swelling to its weight, the yielding of the parts with which it was connected, and to its gravitating into the chest, when the patient lay on his right side; for the difficulty of breathing, and other complaints, produced by the pressure on the lungs, underwent a material increase as soon as the tumour ceased to protrude.

The pulsations which accompany true aneurisms continue to be strong, until the inner coats of the vessel give way, or the layers of coagulated blood, lodged in the sac, are numerous. Hence, when soft swellings, situated near any large arteries, lose their pulsatory motion, their course, precise situation, and other circumstances, ought to be most carefully investigated, before any decision is made about the mode of treatment.

A few years ago, I saw a man in St. Bartholomew's Hospital, who had a large swelling of great solidity, occupying the ham, and apparently extending a good way forwards round the condyles of the femur. Its hardness, shape, large size, and entire freedom from pulsation not only then, but at an earlier period, as far as could be collected from the patient's own account, led to the belief, that the case was probably a tumour complicated with exostosis of the femur, and as this opinion seemed to be confirmed by no fluid escaping from a puncture made with a lancet, amputation was performed. To our surprise, however, dissection proved, that the disease was a large diffused popliteal aneurism, in which the spontaneous cure by an obliteration of the sac with coagula was taking place.—(See Med. Chir. Trans. vol. 8, p. 497.)

In many instances the most fatal accidents have happened, in consequence of incisions having been made in aneurisms, which were mistaken for abscesses because there was no pulsation. Vesalius was consulted about a tumour of the back, which he pronounced to be an aneurism. Soon afterward an imprudent practitioner made an opening in the swelling, and the patient bled to death in a very short time. Ruysch relates that a friend of his opened a tumour near the heel not supposed to be an aneurism, and the greatest difficulty was experienced in suppressing the hemorrhage. De Haen speaks of a patient, who died in consequence of an opening which had been made in a similar swelling at the knee, although Boerhaave had given his advice against the performance of such an operation. Palfin, Schlitting, Warner, and others, have recorded mistakes of the same kind.—(Sabatier, t. 3, p. 167.) Ferrand, head surgeon of the Hôtel Dieu, mistook an axillary aneurism for an abscess, plunged his bistoury into the swelling, and killed the patient. "J'ai été témoin d'erreurs semblables, commises par les practiciens non moins fameux; et si des anèurismes externes on passe à ceux des artères placées à l'intérieur, les erreurs ne sont ni moins ordinaires ni de moindre conséquence."—(Richerand, Nosogr. Chir. t. 4, p. 75, éd. 2.)

Notwithstanding a pulsation is one of the most prominent symptoms of an aneurism, it is not to be inferred, that every swelling which pulsates is unquestionably of this description; for, as Mr. Warner has explained, it does happen that mere imposthumations, or collections of matter, arising from external as well as internal causes, are sometimes so immediately situated upon the heart itself, and at other times upon some of the principal arteries, as to partake in the most regular manner of their contraction and dilatation. He details the particulars of a boy, about thirteen years of age, whose breast-bone had been badly fractured, and who was admitted into Guy's Hospital a fortnight after the accident had happened.

The broken parts of the bone were removed some distance from each other. The intermediate space was occupied by a tumour of a considerable size; the integuments were of their natural complexion. The swelling had as regular a contraction and dilatation as the heart itself, or the aorta, could be supposed to have. Upon pressure the tumour receded; upon a removal of the pressure the tumour immediately resumed its former size; all these are allowed to be distinguishing signs of a recent true aneurism. The situation and symptoms of this swelling were judged sufficient reasons for considering the nature of the disease as uncertain: on which account, it was left to take its own course.

"The event was the tumour burst in about three weeks after his admission, discharged a considerable quantity of matter, and the patient did well by very superficial applications."—(Cases in Surgery, edit. 4, p. 155.)

An extraordinary form of disease, having very much the appearance of an aneurism, sometimes presents itself. A swelling, attended with considerable pain and a strong pulsation, is gradually produced high up the arm, and at length attains a very large size. The strength of the throbbings at first leads to the suspicion that the case must be an aneurism; but on careful examination the humerus is found to have given way at a point involved in the disease, and here to be as flexible as if there were a fracture. This circumstance, and the extension of the swelling too far away from the track of the artery, in time raise doubts about the case being an aneurism. The patient ultimately falls a victim to the effects of the disease on the constitution, and when the arm is dissected after death, the tumour is found to consist of a sarcomatous or medullary mass, occupying the central portion of the limb, and accompanied with a solution of continuity extending completely through the whole thickness of the bone. Two cases of this description were admitted into St. Bartholomew's Hospital in the course of the year 1820. One of these patients, a woman, I had an opportunity of seeing; and after her death the real nature of the disease was proved by dissection. My friend Mr. Vincent has seen a similar disease in the leg, resembling aneurism in the circumstance of pulsation, but attended with destruction of a part of the tibia, and a moveableness of the separated ends of the bone.

A few years ago, I saw a large abscess in the situation of the quadratus lumborum muscle, which pulsated so strongly that the case was supposed by several experienced men to be an aneurism of the abdominal aorta. The patient was a boy belonging to Christ's Hospital, and under the care of the late Mr. Ramsden, surgeon to that establishment, by whose discernment the real nature of the case was detected. It is curious that in this instance the pulsations of the swelling suddenly ceased, after having continued in a very strong and manifest way and without interruption for several weeks, during which it was under the observation of the above eminent practitioner.

As Mr. Wilson has observed, any encysted or even solid tumour, situated in the neighbourhood of, or upon a large artery, may have a considerable degree of motion communicated to it from the pulsation of the artery. The thyroid gland, when a bronchocele is formed, occasionally receives a pulsatory motion from the carotid arteries. This may be mistaken for an aneurism, from which disease, however, it can be discriminated by placing our fingers behind the tumour and drawing it forwards, when the pulsation ceases. But there are other criteria for distinguishing a swelling on or near an artery from an aneurism. In such a case the whole tumour moves at once, without any alteration of size. In an aneurism the swelling does not simply move, it expands. A tumour of the thyroid gland, having apparently a pulsatory motion, may be known not to be an aneurism of the carotid, by observing that from its connexion with the larynx it follows the movements of the latter in deglutition. Aneurisms, not of very long standing, and not containing a large mass of laminated coagula, may also be diminished, or rendered more or less flaccid, by pressing the artery leading to the disease.—(See Wilson on the Blood, Anatomy, Pathology, &c. of the Vascular System, p. 385; and Burns on the Heart, p. 257.) In cases of much ambiguity, the stethoscope will sometimes convey the necessary information. In a doubtful instance of aneurism of the groin Mr. Brodie found all obscurity cease on the application of this instrument.—(Sir A. Cooper's Lectures, vol. 2, p. 46.)

The following case, recorded by Pelletan, shows, that an artery running more superficially than natural, may under particular circumstances give rise to the suspicion of an aneurism. A strong, robust man, about forty years of age, was in the habit of going on foot to dine three leagues from Paris every day, on the completion of his business. One day having been this distance and returned, he felt an acute pain along the leg and in the right ankle. The pain did not subside, and a tumour appeared at the lower third of the leg opposite the space between the two bones. The skin was of a yellowish colour from effused blood, and a pulsation existed by which the hand of an examiner was lifted up. There seemed great reason for concluding that the case was an aneurismal swelling. In comparing the affected limb with the sound one, however, Pelletan perceived in the latter a similar kind of throbbing. In short, in both legs the pulsation of an arterial tube could be felt for three inches, and Pelletan distinctly ascertained that in the diseased member the throbbing did not extend to the whole of the tumour, but only lengthwise. By a particular disposition in this individual, the anterior tibial artery, which usually runs along the interosseous ligament, covered by the tibialis anticus and extensor communis digitorum pedis, came out from between these muscles at the middle of the leg, and lay immediately under the skin and the fascia.

The swelling and ecchymosis gradually dispersed, and the symptoms were supposed to originate from the rupture of some muscular fibres.—(Clinique Chir. t. 1, p. 101, 102.)

Whenever an aneurismal sac of immoderate size beats violently and for a long while against the bones, as the sternum, ribs, clavicle, and vertebræ, they are in the end invariably destroyed, so that the aneurismal sac elevates the integuments of the thorax, or back, and pulsates immediately under the skin. Scarpa, with the best modern writers, attributes the effect to absorption in consequence of the pressure.

J. L. Petit saw the condyles of the femur and the upper head of the tibia almost destroyed by an aneurism of the popliteal artery; and another case in which the caries and absorption of bone were very extensive, is reported by Rosenmüller.—(Anhang zu Scarpa üb. d. Pulsadergeschwulste, p. 364.) According to Mr. Hodgson, the carious and corroded state of the bones in aneurism is never attended with the formation of pus; "at least the discovery of pus in its vicinity has not been remarked by those who have examined such cases. In this respect, therefore, it differs essentially from common caries or ulceration of the bones. Exfoliation also is very rarely attendant upon it; from which circumstance one important practical observation is deducible, namely, that if the aneurism be cured the bones will recover their healthy state, without undergoing those processes which take place in the cure of caries or necrosis."—(On the Diseases of Arteries and Veins, p. 80.)

The same author confirms the remark made by Dr. W. Hunter (Med. Obs. and Inquiries, vol. 1, p. 384), Scarpa (On Aneurism, p. 100, ed. 2), and others, that cartilage is less rapidly destroyed by the pressure of aneurism than bone. This fact is strikingly illustrated in a case of aneurism of the thoracic aorta recorded in another modern publication: the bodies of the vertebræ from the fourth down to the ninth were carious; the four lowest in particular: yet the intervertebral cartilages were not materially affected.—F. L. Kreysig, Die Krankheiten des Herzens, b. 3, p. 176, 8vo, Berlin, 1817.)

A case is related by Pelletan, to which I refer the reader, as exemplifying not only the degree in which internal aneurisms may injure the vertebræ, but also the occasional possibility of such diseases being mistaken for rheumatism or a lumbar abscess.—(See Clinique Chir. t. 1, p. 97—100.)

CAUSES OF ANEURISM.

In many instances it is difficult to assign any cause for the commencement of the disease. Among the circumstances which predispose to aneurisms, however, the large size of the vessels may undoubtedly be reckoned. Those trunks which are near the heart are said to have much thinner parietes, in relation to the magnitude of the column of blood with which they are filled, than the arteries of smaller diameter; and since the lateral pressure of this fluid against the sides of the arteries, is in a ratio to the magnitude of these vessels, it follows that aneurisms must be much more frequent in the trunks near the heart than in such as are remote from the source of the circulation.—(Richerand, Nosogr. Chir. t. 4, p. 72, edit. 2.) The whole arterial system is liable to aneurisms; but, says Pelletan, experience proves that the internal arteries are much more frequently affected than those which are external.—(Clinique Chir. t. 1, p. 54.)

The curvatures of the arteries are another predisposing cause of the disease; and, according to Richerand, such cause has manifest effect in determining the formation of the great sinus of the aorta, the dilatation which exists between the cross and the origin of this large artery, and is the more considerable the older the person is: Monro even thought that one-half of old persons have an aneurism at the beginning of the aorta. And with respect to aneurisms in general, which are preceded by calcareous depositions, thickening, and disease of the coats of the vessel, they are most frequently met with in persons of advanced age. Aneurisms from wounds are of course often seen in individuals of every age. In old people the coats of the arteries are subject to a disease which renders them incapable of making due resistance to the lateral impulse of the blood. The disease here alluded to is what is described in a foregoing part of this article, one common effect of which is the deposition of calcareous matter between the inner and muscular coats of the arteries. "People in the early part of life," says Mr. Wilson, "are not very subject to these calcareous depositions; but I have occasionally met with them in the arteries of very young people. I have seen a well-marked deposition of the phosphate of lime in the arteries of a child under three years of age." He adds, that few persons above the age of sixty are free from these ossifications.—(On the Blood, and on the Anatomy, Pathology, &c. of the Vascular System, p. 375, Lond. 1819.)

Though spontaneous aneurisms are most common in old persons, the disease is not absolutely confined to them; for I assisted Mr. Docker at Canterbury in an operation for the cure of a popliteal aneurism in a postillion, whose age must have been under thirty; and Mr. Wilson says that he has met with several instances of the disease in the aorta and other vessels, where the patients were not more than forty years of age.—(Op. cit. p. 376.)

According to Sir Astley Cooper, the time of life when aneurism generally occurs, is between the ages of thirty and fifty; an age when exercise is considerable and strength on the decline. In very old age the disease is not so common. However, he operated successfully on a case of popliteal aneurism where the patient was eighty four or eighty-five years old. He operated with success on another man sixty-nine years of

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age. He has also seen a boy only eleven years old with aneurism of the anterior tibial artery. The man of more than eighty is the oldest, and the boy of eleven the youngest, aneurismal patients he has ever seen.—(See Lectures, vol. 2, p. 40.)

Richerand affirms, that out of twelve popliteal aneurisms which he has seen in hospital or private practice, ten were caused by a violent extension of the leg. This statement, he says, will derive confirmation from the following experiment.

Place the knee of a dead subject on the edge of a firm table, and press on the heel so as forcibly to extend the leg far enough to make the ligaments of the ham snap. Now dissect the parts, cut out the artery, and examine its parietes in a good light, when the lacerations of the middle coat will be observable and rendered manifest by the circumstance of those places appearing semitransparent where the fibres are separated, the parietes at such points merely consisting of the internal and external tunics.—(Nosogr. Chir. t. 4, p. 73, 74, édit. 2.) But the insufficiency of this explanation is clear enough from the fact that such violence as is requisite to break the ligaments of the knee, cannot be imagined to happen in the accidents which ordinarily bring on aneurism in the ham.

The implicit belief also which Richerand seems to place in the idea that the laceration of the middle coat of an artery will bring on an aneurism, while the inner coat is perfect, will appear to be unfounded, when it is remembered that Hunter, Home, and Scarpa even dissected off the external and middle coats of arteries, without being able in this manner to cause an aneurism. Nay, where the experiment has been made of applying a tight ligature to an artery, and immediately removing it again in order to determine whether the division of both the inner coats of the vessel would terminate in an obliteration of the tube of the vessel, no aneurism has been the consequence.

Pelletan accounts for the frequency of popliteal aneurisms somewhat differently from Richerand: speaking of the two principal motions of the knee, viz: extension and flexion, he remarks, that the first of these is so limited that it is actually an incipient flexion necessarily produced by the curvature backward both of the condyles of the femur and those of the tibia. This curvature, which would seem to protect the popliteal artery against any dangerous elongation that might otherwise be caused by a forcible extension of the joint, becomes the very source of such an elongation in persons who are accustomed to keep their limbs bent, or who from this state proceed hastily and violently to extend the leg. The arterial tubes are really shortened when the limbs are in the state of flexion, and lengthened when the extension of the members renders it necessary. Hence, says Pelletan, it is manifest that an habitually shortened state of these vessels, and their sudden elongation, must be attended with hazard of rupturing their parietes.—(Clinique Chirurgicale, t. 1, p. 112.)

The opinion of Pelletan, however, is quite untenable; because Mr. Hodgson has several times repeated the experiment mentioned by Richerand, and found, as that gentleman did, that the coats of the artery were never lacerated unless the degree of violence had been such as to rupture the ligaments of the knee.—(On Diseases of Arteries, &c. p. 64.)

Aneurisms are exceedingly common in the aorta, and they are particularly often met with in the popliteal artery. The vessels which are next to these the most usually affected, are the crural, common carotid, subclavian, and brachial arteries. The temporal and occipital arteries, and those of the leg, foot, fore-arm, and hand, are far less frequently the situations of the present disease. But although it is true that the larger arteries are the most subject to the ordinary species of aneurisms, the smaller arteries seem to be more immediately concerned in the formation of one peculiar aneurismal disease, now well known by the name of the aneurism by anastomosis, of which I shall hereafter speak.

According to surgical writers, the causes of aneurisms operate either by weakening the arterial parietes or by increasing the lateral impulse of the blood against the sides of these vessels. It is said to be in both these ways that the disease is occasioned by violent contusions of the arteries, the abuse of spirituous drinks, frequent mercurial courses, fits of anger, rough exercise, exertions in lifting heavy burdens, &c. In certain persons aneurisms appear to depend upon a particular organic disposition. Of this description was the subject whose arteries, on examination after death, were found by Lancisi affected with several aneurisms of various sizes. I have known a person have an aneurism of one axillary artery, which disease got spontaneously well, but was soon afterward followed by a similar swelling of the opposite axillary artery, which last affliction proved fatal. I have seen another instance in which an aneurism of the popliteal artery was accompanied with one of the femoral in the other limb. Boyer mentions a patient who died of femoral aneurism in La Charité, at Paris, and who had also another aneurism of the popliteal artery equal in size to a walnut.—(Traité des Maladies Chir. &c. p. 102, t. 2.) The greatest number of aneurisms that Sir Astley Cooper has seen in one patient is seven; and it is a remark made by this eminent surgeon, that when an aneurism occurs in the ham, the disease is frequently of a local nature; but that when it is between the groin and ham, disease of other arteries is very commonly met with.—(See Lectures, vol. 2, p. 37.) The most remarkable case, however, proving the existence of a disposition to aneurisms in the whole arterial system, is mentioned by Pelletan: "J'ai pourtant vu plusieurs fois ces nombreux aneurismes occupant indistinctement les grosses ou les petites artères, mais surtout celles des capacités: j'en ai compté soixante-trois sur un seul homme, depuis le volume d'une aveline jusqu'à celui de la moitié d'un œuf de poule."—(Clinique Chir. t. 2, p. 1.)

Aneurisms, and those diseases of the coats of arteries which precede the formation of aneurism, are much less frequently met with in women than men.—(Lassus, Pathologie Chir. t. 1, p. 348.) A few years before John Hunter died, Mr. Wilson heard him remark, that he had only met with one woman affected with true aneurism.—(Anatomy, Pathology, &c. of the Vascular System, p. 376.) Mr. Hodgson drew up the following table, exhibiting the comparative frequency of aneurisms in the two sexes, in different cases of this disease, and also in the different arteries of the body, as deduced from examples either seen by himself, during the lives of the patients, or soon after their death.

	Total.	Males.	Females.
Of the ascending aorta, the arteria innominata, and arch of the aorta . .	21	16	5
Descending aorta	8	7	1
Carotid artery	2	2	
Subclavian and axillary	5	5	
Inguinal artery	12	12	
Femoral and popliteal	15	14	1
	63	56	7

This table does not include aneurisms arising from wounded arteries, nor aneurisms from anastomosis.—(On the Diseases of Arteries and Veins, p. 87.)

Sir Astley Cooper confirms the fact of the much greater frequency of aneurism in the male than the female sex. Women, he says, rarely have aneurism in the limbs. In forty years' experience, he has seen only eight cases of popliteal aneurism in women, but an immense number in men. Most of the aneurisms which he has seen in females have been in the ascending aorta, or the carotids.—(Lectures, vol. 2, p. 41.)

It was observed by Morgagni, and it has been noticed in this country, that popliteal aneurisms occur with particular frequency in postillions and coachmen, whose employments oblige them to sit a good deal with their knees bent. In France, the men who clean out the dissecting rooms and procure dead bodies for anatomists, are said almost all of them to die with aneurismal diseases. Richerand remarks, that he never knew any of these persons who were not addicted to drinking, and he comments on the debility which their intemperance and disgusting business together must tend to produce.—(Nosogr. Chir. t. 4, p. 74, édit. 2.)

Aneurisms are supposed by Roux to be much more frequent in England than France; a circumstance which, before he proves it to be a fact, he vaguely refers to the mode of life and kind of labour to which a

large portion of the population of England is subjected Indeed, he connects this surmise with a reason for the very cultivated state of this part of knowledge in England: thinks that we have been placed in favourable circumstances for perfecting the treatment of aneurisms, and acknowledges that we have contributed more than his countrymen both in the last and present century to the improvement of this branch of surgery. —(Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Françoise, &c. p. 249.) But ere M. Roux ventured into such conjectures, he ought at least to have specified what particular occupations and kind of labour are known by Englishmen themselves to be frequently conducive to aneurism; for, with the exception of postillions and coachmen, of whom there is also abundance in France, I am not aware that any determinate class of persons is found in this country to be affected with particular frequency.

In some instances aneurisms of the axillary artery appear to have arisen from violent extension of the limb.—(See the cases recorded by Pelletan in Clinique Chir. t. 2, p. 49 and 83.) In other examples related by the some practical writer, aneurism arose from reiterated contusions and rough pressure on parts.—(Op. cit. p. 10 and 14.)

The extremity of a fractured bone may injure an artery and give rise to an aneurism, instances of which are recorded by Pelletan (Op. cit. t. 1, p. 178) and Durverney (Traité des Mal. des Os, t. 1). In Pelletan's case, the disease followed a fracture of the lower third of the leg. An aneurism of the anterior tibial artery from such a cause, is also described by Mr. C. White.—(Cases in Surgery, p. 141.)

The following case of an aneurism of the humeral artery after amputation is recorded by Warner: C. D. was afflicted with a caries of the joint of the elbow, which was attended with such circumstances as rendered the amputation of the limb necessary. The operation was performed at a proper distance above the diseased part, and the vessels were taken up with needles and ligatures.

In a few days the humeral artery became so dilated above the ligature upon it as to be in danger of bursting. Hence it was judged necessary to perform the operation for the aneurism, which was done, and the vessel secured by ligature above the upper extremity of its distended coats. Every thing now went on for some time exceedingly well, when suddenly the artery again dilated, and was in danger of bursting above the second ligature. These circumstances made it necessary to repeat the operation for the aneurism. From this time every thing went on successfully till the stump was on the point of being healed; when, quite unexpectedly, the artery appeared a third time diseased in the same manner as it had been previously, for which reason a third operation for aneurism was determined on and performed.

The last operation was near the axilla, and was not followed by any relapse.

Could the several aneurisms of the humeral artery (says Mr. Warner) be attributed to the sudden check alone which the blood met with from the extremity of the vessel being secured by ligature; or is it not more reasonable to suppose that the coats of the artery nearly as high as the axilla were originally diseased and weakened? The latter, in the opinion of this judicious writer, seems the most probable way of accounting for the successive returns of the disease of the vessel; since it is found from experience that such accidents have been very rarely known to occur after amputation, either of the arm or thigh, where nearly the same resistance must be made to the circulation in every subject of an equal age and vigour, who has undergone such operation.

If it should be supposed that the several dilatations of the coats of the vessel, continues Mr. Warner, arose merely from the check in the circulation, it will not be easy to account for the final success of this operation; and especially when we reflect that the force of the blood is increased in proportion to its nearness to the heart.—(See Cases in Surgery, p. 139, 140, edit. 4.) Ruysch has related an observation somewhat similar. —(Obs. Anat. Chir. t. 1, p. 4.)

Aneurisms sometimes follow the injury of a large artery by a gun-shot wound. The passage of a bullet through the thigh, in one example, gave rise to a femoral aneurism.—(See Parisian Chirurgical Journal, vol. 2, p. 109.) The same cause produced an aneurism high up the thigh of a soldier who was under the care of my friend Mr. Collier, at Brussels, after the battle of Waterloo.

PROGNOSIS.

In cases of aneurism the prognosis varies according to a variety of important circumstances. The disease may generally be considered as exceedingly dangerous; for, if left to itself, it almost always terminates in rupture, and the patient dies of hemorrhage. There are some examples, however, in which a spontaneous cure took place, and aneurismal swellings have been known to lose their pulsation, become hard, smaller, and gradually reduced to an indolent tubercle, which has entirely disappeared. After death the artery in such instances has been found obliterated, and converted into a ligamentous cord, without any vestige of the aneurism being felt. Aneurisms are also sometimes attacked with mortification; the sac and adjacent parts slough away; the artery is closed with coagulum; and thus a cure is effected. Lastly, tumours having all the character of aneurisms have been known to disappear under the employment of such pressure as was certainly too feeble to intercept entirely the course of the blood. Such examples of success, however, are not common, and whenever they happen, it is because the entrance of blood into the sac is prevented by the coagulation of that already contained in it, and because the artery above the swelling is filled with coagulum. They must, in fact, have been cured on the very same principle which renders the surgical operation successful.

Nothing is subject to more variety, than the duration of an aneurism previously to its rupture; the tumour bursting sooner or later, according as the patient happens to lead a life of labour, or ease, temperance, or moderation. Even the bursting of an internal aneurism may not immediately kill the patient: a stone-cutter died in the hospital Saint Louis with an enormous aneurism, situated on the left side of the lumbar vertebræ. The body was opened by Richerand, who found that the external tumour consisted of blood, which, after making its way through the muscles, had been effused into a cyst formed in the midst of the cellular substance of the loins. The track through which it came led into another aneurismal sac contained in the abdomen, and situated behind the peritoneum, on the left side of the lumbar vertebræ. In endeavouring to discover whence the extravasated blood proceeded, Richerand found that the abdominal aorta was entire, though in contact with the swelling. The original affection consisted of an aneurismal dilatation of the interior portion of the thoracic aorta, which had burst at the point where it lies between the crura of the diaphram. The blood had probably escaped very slowly, and it had accumulated in the cellular substance round the kidney, so that three cysts had burst successively before the patient died.—(Nosogr. Chir. t. 4, p. 82, édit. 2.)

Every aneurism, so situated that it can neither be compressed nor tied above the swelling, has generally been considered absolutely incurable, except by a natural process, the establishment of which is not sufficiently often the case to raise much expectation of a recovery on this principle. But it should be recollected that sometimes the size of the swelling appears to leave no room for the application of a ligature above it, while things are in reality otherwise, in consequence of the communication between the sac and the artery bearing no proportion to the magnitude of the tumour itself. At the present day, also, enlightened by anatomical knowledge, and encouraged by successful experience, surgeons boldly follow the largest arteries, even within the boundaries of the chest and abdomen, as we shall presently relate, and numerous facts have now proved that few external aneurisms are beyond the reach of modern surgery. It being certain that aneurisms cannot commonly be cured, except by an obliteration of the affected artery, it follows that the circulation must be carried on by the superior and inferior collateral branches, or else the limb would mortify. Experience proves that the impediment to the passage of the blood through the diseased artery obliges this fluid to pass through the collateral branches, which gradually acquire an increase of size. It is therefore a common notion that it must be in favour of the success of the operation, if the disease be of a certain standing;

and in direct opposition to the sentiments of Kirkland, Boyer even asserts that the most successful operations have been those performed on persons who have had the disease a long while.—(Maladies Chirurg. t. 2, p. 116.)

There is this objection to delay, however, that the tumour becomes so large, and the effects of its pressure so extensive and injurious, that after the artery is tied, great inflammation, suppuration, and sloughing often attack the swelling itself, and the patient falls a victim to what would not have occurred had the operation been done sooner.

The large size of an aneurism, as Mr. Hodgson has rightly observed, is a circumstance which materially prevents the establishment of a collateral circulation. When the tumour has acquired an immense bulk, it has probably destroyed the parts in which some of the principal anastomosing branches are situated; or by its pressure it may prevent their dilatation.—(On the Diseases of Arteries and Veins, p. 259.) The practice of permitting an aneurism to increase, that the collateral branches may become enlarged (says this gentleman), is not only unnecessary but injurious, inasmuch as the increase of the tumour must be attended with a destruction of the surrounding parts, which will render the cure of the disease more tedious and uncertain.—(P. 266.)

The most successful operations which I have seen were performed before the aneurismal swellings were very large. However, notwithstanding the great disadvantages of letting the swelling become bulky before the operation, the fact appears scarcely yet to have made due impression, and surgeons are yet blinded with the plausible scheme of giving time for the collateral vessels to enlarge; at least, I infer that things are so, from having lately seen a patient who has been advised to let the operation be postponed on such a ground, though the swelling in the ham was already as large as an egg.

The surgeon should not be afraid of operating, although appearances of gangrene may have taken place on the tumour; for, as Mr. Hodgson remarks, should it burst afterward, it is probable that both extremities of the artery in the sac will be closed with coagulum.—(Hodgson, p. 305.) Sir Astley Cooper tied the external iliac artery in two cases of inguinal aneurism, when gangrene existed, and though the tumours burst no hemorrhage ensued. The coagulum was discharged; the sac granulated; and the sores gradually healed.—(Medico-Chir. Trans. vol. 4, p. 431.)

The effects of the pressure of aneurisms upon the bones are justly regarded as an unpleasant complication, when they take place in an extensive degree, and, according to writers, they may sometimes induce a necessity for amputation.—(Boyer, Traité des Mal. Chir. t. 2, p. 117.) However, I have never seen a case of this description; and Mr. Hodgson, as we have already explained, informs us that the affection of the bones is hardly ever attended with exfoliations, or the formation of pus, so that if the aneurism can be cured, the bones will generally recover their healthy state, without undergoing those processes which take place in the cure of caries or necrosis.—(On Diseases of Arteries and Veins, p. 80.) At the same time there can be no doubt, that where the tumour has been allowed to attain a large size before an attempt is made to cure it, and where from this cause both the neighbouring soft parts and the bones have suffered considerably, the completion of a cure, that is to say, the full restoration of the use of the limb, must be far more distant than in other cases where the cure is attempted in an earlier stage. Here then we see another reason against the pernicious doctrine of waiting for the enlargement of the anastomising vessels in addition to that which has been urged above.

The age, constitution, and state of the patient's health are also to be considered in the prognosis; for they undoubtedly make a great difference in the chance of success after the operation.

The operation, however, should not be rejected on account of the age of the patient, if the circumstances of the case in other respects appear to demand it: for it has often succeeded at very advanced periods of life. "I have seen several aneurisms cured by the modern operation in patients above sixty years of age."—(Hodgson, p. 304.) Similar cases have fallen under my own notice. Sir Astley Cooper, already noticed, has operated with success for a popliteal aneurism on one patient aged 85, and on another 69 years old, with the same favourable result.

When an aneurism exists in the course of the aorta, the violent action of the heart, excited by an operation in the extremities, may cause it to burst, and prove instantaneously fatal. Two cases occurred a few years ago in this metropolis, in which the patients died from such a cause during operations for popliteal aneurisms.—(See Hodgson on Diseases of Arteries, p. 306; London Med. Review, vol. 2, p. 240; and Burns on Diseases of the Heart, p. 226.) Were the co-existence of the internal aneurism known, the operation for the other tumour would be improper, and the surgeon should limit the treatment to palliative means.

Experience proves, however, that the circumstance of there being two aneurisms in the limb should not prevent the operation, which is to be practised at separate periods. Facts in support of this statement are quoted by Mr. Hodgson.—(P. 310.)

OF THE SPONTANEOUS CURE AND GENERAL TREATMENT OF ANEURISMS.

The obliteration of the sac in consequence of a deposition of lamellated coagulum in its cavity, as Mr. Hodgson has well described, is the mode by which the spontaneous cure of aneurism is in most instances effected. The blood soon deposites upon the inner surface of the sac a stratum of coagulum; and successive depositions of the fibrous part of the blood by degrees lessen the cavity of the tumour. At length, the sac becomes entirely filled with this substance, and the deposition of it generally continues in the artery on both sides of the sac as far as the giving off of the next large branches. The circulation through the vessel is thus prevented; the blood is conveyed by collateral channels; and another process is instituted whereby the bulk of the tumour is removed.—(On the Diseases of Arteries, &c. p. 114.) Such desirable increase of the coagulated blood in the sac is indicated by the tumour becoming more solid, and its pulsation weak or ceasing altogether.

Another mode, in which the disease is spontaneously cured, happens as follows: an aneurism is sometimes deeply attacked with inflammation and gangrene; a dense, compact, bloody coagulum is formed within the vessel, shutting up its canal, and completely interrupting the course of the blood into the sac. Hence, the ensuing sphacelation and the bursting of the integuments and aneurismal sac are never accompanied by a fatal hemorrhage; and the patient is cured of the gangrene and aneurism if he has strength sufficient to bear the derangement of the health necessarily attendant on so considerable an attack of inflammation and gangrene.

When a patient dies of hemorrhage, after the mortification of an aneurism, it is because only a portion of the integuments and sac has sloughed, without the root of the aneurism, and especially the arterial trunk, being similarly affected. For cases illustrative of this statement, refer to Hodgson on Diseases of Arteries, p. 103, &c.

A third way, in which an aneurism may be spontaneously cured, is by the tumour compressing the artery above, so as to produce adhesion of its sides, and obliteration of its cavity. This mode of cure must be uncommon: it has been adverted to by Sir E. Home, Scarpa, Dr. John Thomson, and others; but some facts, tending to prove it, have been collected by Mr. Hodgson, and are published in his useful work.—(See p. 107, &c.)

A fourth mode of cure is illustrated in a case related by Sir Astley Cooper: a man, in Guy's Hospital, had an aneurism just below the groin. He was sitting before the fire, when he felt something burst in the upper part of his thigh. On examination he found no blood had escaped, and, in fact, the aneurism had not yet reached the skin, so as to be adherent to it. His thigh, however, was enormously swelled; he was unable to use his limb, and was put to bed. For three days afterward a pulsation was perceptible in the aneurism; but it then ceased, and the size of the limb began to diminish. At the end of four months, the aneurismal swelling had considerably subsided, he could use the limb, and in less than six months he was discharged from the hospital. He afterward fell a victim to the rupture of another aneurism in the abdomen. On examination of the body, it was found that the aneurism

in the thigh, just below Poupart's ligament, had burst under the fascia lata, and the femoral artery had been obliterated by the pressure of the large quantity of effused blood.—(See Lancet, vol. 1, p. 430.)

"The surgical treatment of aneurism (says Mr. Hodgson) consists in the obliteration of the cavity of the artery communicating with the sac, so that the ingress of the blood into the latter is either entirely prevented, or the stream which passes through it is supplied only by anastomosing branches, and consequently the force of the circulation is so much diminished, that the increase of the tumour is prevented, and the deposition of coagulum is promoted. By the absorption of its contents, and the gradual contraction of the sac, the cure is ultimately accomplished. The blood is conveyed to the parts, which it is destined to supply, by collateral vessels, some of which, being gradually enlarged, constitute permanent channels for the circulation. The obliteration of the artery is effected by the excitement of such a degree of inflammation in its coats as shall produce adhesion of its sides. These objects have been attempted by the compression or the ligature of the artery. The latter method constitutes the operation for aneurism."—(P. 165.)

Such are the principles of the ordinary mode of cure; but it appears from certain facts, recorded by Mr. Wardrop, Dr. Bush, and other practitioners, that some aneurisms may be cured by a surgical operation, which was first suggested by Brasdor, and the design of which is to hinder the free transmission of blood through the aneurismal sac by tying the artery on that side of it which is most remote from the heart. This practice, however, is only allowable in certain examples, in which the application of a ligature in the common way is no longer practicable, because its success is much less certain, as might easily be anticipated, since the plan does not comprise the very desirable object of directly preventing the entrance of blood into the aneurismal sac. To this subject, however, we shall presently return.

According to Scarpa, a complete cure of an aneurism cannot be effected, in whatever part of the body the tumour is situated, unless the artery from which the aneurism is derived be, by nature or art, obliterated, and converted into a perfectly solid ligamentous substance, for a certain extent above and below the place of the ulceration, laceration, or wound. When aneurisms are cured by compression, the cure is never accomplished, as some have supposed, by the pressure strengthening the dilated proper coats of the artery, and restoring, especially to the muscular coat, the power of propelling the blood along the tube of the artery, as it did previously to its supposed dilatation. Petit and Foubert thought, that the natural curative process sometimes consisted in a species of clot, which closed the laceration, ulceration, or wound of the artery, and resisted the impulse of the blood, so as still to preserve the continuity of the coats of the artery, and the pervious state of the vessel. Haller imbibed a similar sentiment from experiments made on frogs.

If the foregoing statement of Scarpa, respecting the obliteration of the tube of the adjacent portion of the artery, when an aneurism is cured, had been delivered merely as what is the most common course of things, it would not have been incorrect; but when he denies the possibility of the caliber of the vessel being ever preserved, whether the disease be cured by art or nature, he is exceeding the bounds of accuracy.

Notwithstanding aneurisms cannot in general be cured, as Scarpa has explained, unless the artery be rendered impervious for some extent above and below the tumour, I believe we must make an exception to this observation with respect to the few aneurisms of the aorta (especially those of its arch) which, according to the records of surgery, have been diminished and cured by Valsalva's treatment. In such examples, we are not to suppose that the aorta becomes obliterated at its very beginning; but that the diminution of the quantity of circulating blood, the reduced impetus of this fluid, the lessened distention of the aneurismal sac, the general weakness induced in the constitution, and the increased activity of the lymphatic system, all necessary effects of Valsalva's method, have combined to bring about a partial subsidence of the tumour.

"It is a common opinion (says Mr. Hodgson), that the radical cure of an aneurism cannot take place without the obliteration of the artery from which the disease originates. It is probably owing to this idea, that aneurisms of the aorta have generally been considered as incurable diseases, and consequently that so little attention has been given to their treatment."—(P. 118.) The facts, however, which this gentleman has related satisfactorily prove, 1st, that a deposition of coagulum may take place in an aneurismal sac, to such an extent as entirely to block up the communication between its cavity and that of the artery from which its originates; secondly, that a sac thus filled with coagulum cannot prove fatal by rupture; and, thirdly, that the gradual absorption of its contents, and the consequent contraction of the sac, may proceed to such an extent as to effect the cure of the disease, without any obstruction taking place in the caliber of the vessel from which it originates. See cases 20, 21, 22, &c.—(Hodgson on Diseases of the Arteries, &c. p. 119, &c.) In support of this doctrine, some facts are also cited from Corvisart.—(Essai sur les Maladies du Cœur, p. 313, &c.)

A part of these cases, it is true, are not viewed exactly in this light by Kreysig, who argues (as I think, without much probability), that they might have been only adipose swellings, connected with or formed in, the parietes of the artery, a disease described by Stenzel.—(German transl. of Mr. Hodgson's book, p. 174.)

That a punctured artery may occasionally be healed in this manner, Scarpa himself proves, by a case which he examined, where an aneurism took place from the wound of a lancet in bleeding. In the article Hemorrhage we shall see that Jones's experiments show the same thing, and the particular circumstances in which it may happen. But the occurrence is rare, and Scarpa says that it can hardly be called a radical cure, as the cicatrix is always found in a state ready to burst and break, if the arm be, by any accident, violently stretched or struck where the wound was situated.

In the spontaneous cure of aneurisms, arising from arteries of inferior size to that of the aorta, repeated examinations have proved, that the deposition of coagulum does not in general merely fill up the sac, but obliterates the tube of the artery above and below the disease to the next important ramifications. Yet even here, exceptions probably take place; for Mr. Hodgson has brought forward one instance in which a small sac, which originated from the anterior artery of the cerebrum, was completely filled with firm coagulum, which did not extend into the cavity of the vessel.—(On Diseases of Arteries, p. 132.) And he reports the particulars of a true femoral aneurism, communicated to him by Sir A. Cooper, in which, after the patient's death, the femoral artery was found dilated into a sac, which was lined on all sides with very firm layers of coagulum, in the centre of which was an irregular canal, through which the circulation was continued. As the inside of this canal presented a membranous appearance, it was inferred that the aneurism had been cured.—(Op. cit. p. 134.) Here I may be permitted to remark, that if this case be correctly reported, viz. if it were a true aneurism by dilatation of all the arterial coats, and the inside of it was every where lined by firm layers of coagulum, it amounts to a proof that such a deposition is not entirely confined to aneurisms by rupture, as Scarpa supposes. And, in addition to this fact, I may mention, as referring to the same question, a case of aneurism from dilatation of the arterial coats, observed by Guattani, where the same process took place. "Arteriæ iliacæ ovalem hanc partem aneurysmaticam polyposa substantia variæ densitatis adeo infarctam esse denotebam, ut tunicarum ejusdam forma penitus destructa in uniformem massam, spongiæ cera imbutæ similem, transformata videretur."—(Hist. 17, Collect. Lauth. p. 158.)

Whenever the ulcerated, lacerated, or wounded artery is accurately compressed against a hard body like the bones, it ceases to pour blood into the surrounding cellular sheath, because its sides, being kept in firm contact, for a certain extent above and below the breach of continuity, become united by the adhesive inflammation, and converted into a solid ligamentous cylinder. Molinelli, Guattani, and White have given examples and plates illustrative of this fact. When aneurisms get well spontaneously, the same fact is observed after death, as Valsalva, Ford, &c. have demonstrated. I have myself seen, in St. Bartholomew's Hospital, an instance in which a man had had a spon-

taneous cure of an aneurism in the left axilla, but afterward died of hemorrhage from another aneurismal swelling under the right clavicle: the artery on the left side was found completely impervious. My friend Dr. Albert had under his care, in the York Hospital, Chelsea, a dragoon, who recovered spontaneously of a very large aneurism of the external iliac artery: the tumour sloughed, discharged about two quarts of coagulated blood, and then granulated and finally healed up. Paoli relates a similar termination of a popliteal aneurism. Moinichen and Guattani relate other examples. Hunter found the femoral artery quite impervious and obliterated at the place where a ligature had been applied fifteen months before. Boyer noticed the same fact in a subject eight years after the operation. Petit describes the spontaneous cure of an aneurism at the bifurcation of the right carotid: the subject having afterward died of apoplexy, the vessel, on dissection, was found closed up and obliterated from the bifurcation as far as the right subclavian artery. Desault had an opportunity of opening a patient, in whom a spontaneous cure of a popliteal aneurism was just beginning: he found a very hard bloody thrombus, which extended for three finger-breadths within the tube of the artery above the sac, and was so firm as to resist injection, and make it pass into the collateral branches.

Both the spontaneous and surgical cures of aneurisms have generally two stages: in the first, the entrance of the blood into the aneurismal sac is interrupted; in the second, the parietes of the artery approach each other, and becoming agglutinated, the vessel is converted into a solid cylinder. This doctrine is corroborated by the tumour first losing its pulsation, and then gradually diminishing and disappearing.

In order that compression may make the opposite sides of an artery unite, and thus produce a radical cure of an aneurism, Scarpa says, the degree of pressure must be such as to place these opposite sides in firm and complete contact, and such as to excite the adhesive inflammation in the coats of the artery. The point of compression must also fall above the laceration or wound of the artery; for when it operates below, it hastens the enlargement of the tumour: and Scarpa adds, that, in practice, bandages which are expulsive and compressive are more useful for making pressure than any tourniquets or instruments, many of which are contrived to operate without retarding the return of blood through the veins.

In order that pressure may succeed, the coats of the vessel at the place where it is made, must be sufficiently free from disease to be susceptible of the adhesive inflammation. When the arterial coats round the root of the aneurism are much diseased, Scarpa considers them as insusceptible of the adhesive inflammation, although compressed together in the most scientific manner, and even when tied with a ligature, which only acts by making circular pressure on the vessel.

This statement would appear to derive confirmation from the following fact: Mr. Langstaff amputated the thigh of a person seventy-five years of age; but the vessels were so ossified that they could not be effectually tied, and the patient died within twenty-four hours. It is generally supposed, says Mr. Lawrence, that this condition of the arterial coats is incompatible with their union under the application of the ligature. The opinion should be received, however, with some limitation. In a man fifty-nine years of age, bleeding took place nearly a month after amputation from the ossified femoral artery, and Mr. Lawrence was therefore obliged to expose and tie that vessel again for the suppression of the hemorrhage, when he found a hard tube, which cracked immediately the ligature was tightened: the bleeding, however, never returned.—(See Med. Chir. Trans. vol. 6, p. 193.) This case is mentioned, not with any view of encouraging surgeons to apply ligatures round diseased portions of arteries, a thing which should always be avoided when possible, but to let them be aware that an ossified artery is sometimes susceptible of being permanently closed, when a ligature is put round it. With respect to Scarpa's idea of making pressure operate so as to place the two opposite parietes of the artery at the mouth of the aneurismal sac completely in contact, in order that they may be united by the adhesive inflammation, and the cavity of the vessel be obliterated, I should think, with Mr. Hodgson, that if pressure will succeed only under these circumstances, it will answer very seldom, because, in almost all aneurismal sacs, a sufficient deposition of coagulum will have taken place to prevent the possibility of placing the opposite side of the artery at the mouth of the aneurism in a state of complete contact.—(On Diseases of Arteries, &c. p. 172.) Possibly, however, Scarpa's directions refer to a point of the vessel rather beyond the usual limits of the laminated coagula: and he is particular in recommending the practice only where the aneurism is soft and small.

Some advise trying compression in every case of aneurism, whether small, circumscribed, soft, flexible, indolent, or elevated, diffused, hard, and painful. But in the latter case Scarpa represents compression as decidedly hurtful. He says also that every bandage which compresses the aneurism, and also circularly constricts the affected part, is always injurious. The bandage, likewise, which compresses only the aneurism and directs the point of pressure below the rupture in the vessel; that which, on account of the great size, exquisite sensibility, depth of the root of the aneurism, and fleshy state of the surrounding parts, cannot effectually compress the artery against the bones, so as to bring the opposite sides of the vessel into contact; and lastly, the compression applied to a spontaneous aneurism, attended with a steatomatous, ulcerated, earthy disease of the arterial coats, ought to be considered as more likely to do harm than benefit. In cases of a completely opposite description, bandages have produced, and may produce, a radical cure, and should not be entirely disused.—(Scarpa on Aneurism, ed. 2, p. 221.)

Guattani first employed compression systematically for the cure of aneurisms, and out of fourteen cases in which he adopted the plan, four were cured by it. Mr. Freer details other examples; but, in general, pressure has hitherto been applied to the tumour itself, a method less likely to answer than that of making pressure on a sound part of the artery. Mr. Freer recommends the employment of Sennfio's instrument, or the following method: first, place a bandage, moderately tight, from one extremity of the limb to the other; then put a pad upon the artery, a few inches above the tumour; next, surrounding the limb with a tourniquet, let the screw be fixed upon the pad, having previously secured the whole limb from the action of the instrument by a piece of board wider than the limb itself, by which means the artery only will be compressed when the screw is tightened. The tourniquet should now be twisted till the pulsation in the tumour ceases. In a few hours the limb will become œdematous and swelled, when the tourniquet may be removed, and the pressure of a pad and roller will afterward be enough. By experiments which this gentleman made on the radial arteries of horses, these vessels were found to become inflamed, and to be rendered impervious by such a process.—(Freer, p. 112.) In a modern work Dubois is stated to have cured an aneurism of the thigh by steady pressure on the vessel for twenty-four hours.—(Med. Chir. Trans. vol. 4, p. 437.)

Sir A. Cooper describes another machine for compressing the femoral artery in cases of popliteal aneurism: it was used by Sir W. Blizard.

"The points of support for this instrument were the outer part of the knee and the great trochanter, a piece of steel passing from one to the other; and to the middle of this a semicircular piece of iron was fixed, which projected over the femoral artery, having a pad at its end moved by a screw, by turning which the artery was readily compressed, and the pulsation in the aneurism stopped without any interruption to the circulation in the smaller vessels." But although the patient on whom it was tried possessed unusual fortitude, he was incapable of supporting the pressure of the instrument longer than nine hours.—(Med. and Phys. Journal, vol. 8.) Few patients, indeed, can endure the pressure of such instruments a quarter of this time, when they are put on sufficiently tight to afford any chance of obliterating the artery; and on account of the suffering which they produce, they are rarely used by modern surgeons.

Whenever the treatment by pressure is attempted, the plan should be assisted with repeated bleedings, spare diet, and perfect quietude in bed. Digitalis has also been sometimes prescribed, with the view of lessening the impetus of the circulation. It is likewise a favourite plan with some practitioners to apply snow or powdered ice to the tumour, as I shall notice in de-

scribing Valsalva's treatment of aortic aneurisms. These last applications have been employed for the purpose of promoting the coagulation of the blood within the aneurismal sac, and the consequent obliteration of the cavity of the aneurism and the artery. Various examples in which it has been thought to have produced a cure are recorded by Guerin.—(Recueil Period. de la Soc. de Santé de Paris, No. 3. Pelletan, Clinique Chir.; and Ribes, Bulletins de la Faculté de Méd. de Paris, 1817, No. 1 and 2, p. 284.) The employment of ice, however, is not considered proper in every case. Breschet says, that when the swelling is large, the parts very tense, their texture changed, and the skin thin, the practice is likely to accelerate the formation of a slough; and he confirms a remark made by Mr. Hodgson, that some patients cannot continue this treatment longer than a few minutes, while others find it absolutely insupportable —(Fr. Transl. of Mr. Hodgson's Work, t. 1, p. 212—229.)

The grand means most to be depended upon for curing aneurisms, is tying the artery above the tumour. This more certainly prevents the great ingress of blood into the sac, and, what is quite as important, more certainly excites the adhesive inflammation within the tied part of the vessel, and, by holding the opposite sides of it steadily in contact, brings about their union, and an obliteration of the tube of the vessel, with tolerable regularity. The chief current of blood into the sac is thus stopped, the contents of the aneurism are afterward gradually absorbed, and the tumour dwindles away in proportion. The natural course of the blood being now permanently interrupted in the arterial trunk, it passes more copiously into the collateral branches, and these enlarging and anastomosing with others which originate from the large arteries beyond the obstruction, the necessary circulation is carried on.—(See Anastomosis and Inosculation.)

The ligature of the superficial femoral artery may be performed with the same confidence of success as the ligature of the brachial artery; that is, without any fear of destroying the circulation or depriving the subjacent limb of its vitality. Indeed, the numerous and conspicuous anastomoses which are met with all round the knee, correspond exactly with those which are observed round the elbow, and at the bend of the arm. This is not a peculiarity of the arteries of the extremities, but it is a general rule which nature has followed in the distribution of all the arteries, that the superior trunks communicate with the inferior by means of the lateral vessels. After the principal trunk of an artery is tied, its lateral branches not only carry on the circulation in the parts below the ligature, but do so with greater quickness and activity than they did previously, while the course of the blood was unimpeded through the principal trunk. This evidently arises from the increased determination of blood into the lateral vessels, as well as from the enlargement of the diameter of these vessels. After the amputation of the thigh, while the blood flows in a full stream from the superficial femoral artery, very little or no blood is poured out of the lateral vessels; but as soon as that artery is tied, the blood issues with impetuosity from the small arteries which run along within the vasti and cruræus muscles; and on these smaller arteries being also tied, the blood immediately oozes out from the minute arterial vessels of the muscles and cellular membrane. When the principal trunk of an artery is tied, its lateral branches gradually acquire a much larger diameter. After amputation of the thigh on account of a popliteal aneurism, the size and situation of which could not fail materially to impede the course of the blood through the trunk of the femoral artery, it has often been remarked, that, although both the trunk and the greater and smaller branches had been tied with the nicest accuracy, the patients have been in danger of losing their lives on account of the repeated copious hemorrhages from the innumerable small lateral vessels that had become unusually enlarged. In several cases, during the treatment, and especially after the radical cure, of popliteal aneurism by tying the superficial femoral artery in the upper third of the thigh, all the ramifications of the recurrent popliteal arteries have been felt beating strongly round the knee. We have already noticed that Boyer found in a man who some years previously had been operated on for a popliteal aneurism, but had afterward died from a caries of the tibia, that an arterial branch which runs in the substance of the sciatic nerve was dilated so much as to be equal in diameter to the radial artery. White, in dissecting the arm of a lady who, fifteen years before, had been operated on for an aneurism in the bend of the arm, found the brachial artery obliterated and converted into a solid cylinder for three inches below the place of the ligature, and as far as the division into the radial and ulnar arteries; but the recurrent radial and ulnar branches had become so much enlarged that taken together, they exceeded the size of the brachial artery above the situation of the ligature. In the dead body, it is found that an anatomical injection will pass more freely from one extremity to the other of an aneurismatic than of a sound limb, and this even when no vessels are visibly enlarged. Although it be self-evident that the circulation through the collateral vessels ought to be much more easy and quick the lower down the ligature is applied to the principal trunk; yet experience shows that this difference is not to be estimated very high; for in cases of popliteal aneurism, cæteris paribus, the success is the same, whether the femoral artery be tied very low down or very high up in the thigh.—(Scarpa.)

This facility of the passage of the blood through the lateral vessels is not the same in subjects of all ages; and in the same subject it is not the same in the inferior as in the superior extremity. An age under forty-five, and the operation being done on the arm, which is nearer the source of the circulation than the lower extremity, increase the chance of success. However, notwithstanding these are the opinions of Scarpa, and as general ones may not be incorrect, surgeons in England now operate for aneurisms of the lower extremity, and on patients much older than forty-five, with a degree of confidence which nothing but great success could inspire.

According to Scarpa, the circumstances chiefly preventive of success, especially in the popliteal and femoral aneurisms, are the following: rigidity, atony, or disorganization of the principal anastomoses, between the superior and inferior arteries of the ham and leg; sometimes depending on an advanced age, or on it together with the large size of the aneurism, which by long continued pressure has caused a great change in the neighbouring parts; or sometimes on steatomatous, ulcerated, earthy, cartilaginous disorganization of the proper coats of the artery, not confined to the seat of the rupture, but extending a great way above and below the aneurism, and also to the principal popliteal recurrent arteries, tibial arteries, and, occasionally, to portions of the whole track of the superficial femoral artery. Sometimes the pressure of a large aneurism renders the thigh-bone carious. In such circumstances, the ligature is apt to fail in closing the trunk of the artery; and, if it should succeed, the state of the anastomosing vessels will not admit of a sufficient quantity of blood being conveyed into the lower part of the limb. Hence, when the patient is much advanced in life, languid and sickly; when the internal coat of the artery is rigid, and incapable of being united by a ligature; when the aneurism is of long standing and considerable size, with caries of the os femoris or tibia; when the leg is weak and cold, much swelled, heavy, and œdematous; Scarpa considers the operation contra-indicated. I must, however, declare in this place that I have seen very large aneurisms, as well as aneurisms in persons of advanced age, cured by the Hunterian plan in St. Bartholomew's Hospital; and with respect to the affection of the bones, though it may be an unfavourable circumstance, its consequences are not so serious as those of ordinary caries, as I have already explained.

It appears, then, that the obliteration of the artery for a certain extent above and below the place of rupture, forms the primary indication in the radical cure of aneurism, whether compression or the ligature be employed; all other means are only auxiliary. Internal remedies may be useful, inasmuch as they tend to moderate the determination of the blood towards the place where the artery has been tied or compressed.

In the articles Hemorrhage and Ligature, I have related in detail the effects of the ligature upon a tied artery, and particularly the various processes which arise from its application and terminate in the permanent obliteration of the vessel. In the same places I have explained what are the best ligatures for use, as well as the safest manner of using them. Confining myself,

in the sequel of this article, to what expressly relates to aneurism, I shall here merely annex the following general directions, as stated by Mr. Hodgson.

First, The cord should be thin and round, such a ligature being most likely to effect a clean division of the internal and middle coats of the vessel, and not liable to produce extensive ulceration or sloughing.

Secondly, The ligature should be tight, in order to ensure the complete division of the internal and middle coats, and to prevent its detachment, it being almost impossible, even with the thinnest ligature, entirely to cut through a healthy artery.

Thirdly, The vessel should be detached from its connexions only to such an extent as is necessary for the passage of the ligature underneath it.

Fourthly, The immediate adhesion of the wound should be promoted by all such means as are known to promote that process in general.—(On the Diseases of Arteries, p. 225, 226.)

In the course of his experiments upon brutes, to ascertain the operation of the ligature, Dr. Jones arrived at a fact which offered the probability of leading to an improvement in the operation for aneurism.—(Treatise on Hemorrhage, chap. 3.) When a small, firm ligature is applied to an artery, it causes a division of the internal and middle coats; and if it be afterward removed, an effusion of lymph takes place between the cut surfaces into the cavity of the vessel. If several divisions of the internal and middle coats be thus effected in the vicinity of each other, the effusion of lymph was found by Dr. Jones to be sufficiently extensive to obliterate the cavity of the vessel. In the year 1800, Mr. C. Hutchison tied the brachial arteries of two dogs, and removed the ligatures immediately after their application: in both instances, as he assures us, the complete obliteration of the canal of the artery was the consequence of the operation.—(See Practical Obs. in Surgery, p. 103.) If, immediately after the operation for aneurism, the ligature should be removed, and yet the vessel become obliterated, it would be highly advantageous, as there would then be left in the wound no extraneous substance to prevent its union, or promote secondary hemorrhage by extending the sloughing or ulcerative process too far. It is to be regretted that success has not attended the repetition of the experiment by others. Mr. Hodgson tried it, but the artery did not become impervious.—(See Experiments A and B, p. 228, 229, of this gentleman's work.) Mr. Dalrymple of Norwich made the experiment not less than seven times on horses, and three times on sheep, and failed in every instance to obtain the same result as Dr. Jones. Not only was no coagulum formed, but even when the animal had been suffered to live until the thirteenth, fifteenth, and eighteenth days after the operation, the canal of the artery was not found obliterated. In each case, indeed, its caliber was contracted; but it was still capable of transmitting a lessened column of blood.—(Travers, in Med. Chir. Trans. vol. 4, p. 442.) Thus it appears, that an effusion of lymph is an invariable consequence of the operation, and as Mr. Travers has observed, the want of union is therefore owing to the opposite sides of the vessel not being retained in a state of contact, so as to allow of their adhesion. The presence of the ligature in the common mode of its application effects this object; and for the success of Dr. Jones's experiment it appeared only necessary that the opposite sides of the wounded vessel should be retained in contact, until their adhesion was sufficiently accomplished to resist the passage of the blood through the tube. This object might probably be effected by compression; but the inconveniences attending such a degree of pressure as would retain the opposite sides of an artery in contact at the bottom of a recent wound are too great to admit its employment. It occurred to Mr. Travers, that if a ligature were applied to an artery, and suffered to remain only a few hours, the adhesion of the wounded surfaces would be sufficiently accomplished to ensure the obliteration of the canal; and by the removal of the ligature at this period, the inconveniences attending its stay would be obviated. The danger produced by the residence of a ligature upon an artery arises from the irritation which as a foreign body it produces in its coats. Ulceration has never been observed to commence in less than twenty-four hours after the application of a ligature; while it is an ascertained fact, that lymph is in a favourable state for organization in less than six hours, in a wound the sides of which are preserved in contact.—(Jones, ch. 4, exp. 1.) If it be sufficient, therefore, to ensure their adhesion that the wounded coats of an artery be kept in contact by a ligature only three or four hours, ulceration and sloughing may in a great degree be obviated by promoting the immediate adhesion of the wound. Justified by this reasoning, Mr. Travers performed several experiments, by which he ascertained that if a ligature were kept six, two, or even one hour upon the carotid artery of a horse, and then removed, the adhesion was sufficiently advanced to effect the permanent obliteration of the canal. It appeared probable, that the same result would be obtained upon the healthy artery of a human subject.—(See Travers's Obs. in Med. Chir. Trans. vol. 4, and Hodgson on the Diseases of Arteries and Veins, p. 228, et seq.)

Sir A. Cooper performed one operation for a popliteal aneurism, with the view of ascertaining the efficacy of such a method on the human subject. He completely stopped the flow of blood for thirty-two hours, and then removed the ligature; but the pulsations of the tumour commenced again. He next applied the ligature forty hours longer, at the end of which time no pulsation recurred on the ligature being taken away. On the twelfth day, however, a considerable bleeding took place, and it was necessary to take up the vessel anew.

Mr. C. Hutchison tried this method, as modified by Mr. Travers, in an operation which he performed for a popliteal aneurism in a sailor, in Nov. 1813. A double ligature was passed under the femoral artery. The ligatures were tied with loops or slip knots, about a quarter of an inch of the vessel being left undivided between them. All that now remained of the pulsation in the tumour was a slight undulatory motion. Nearly six hours having elapsed from the application of the ligatures, the wound was carefully opened, and the ligatures untied and removed without the slightest disturbance of the vessel. In less than half a minute afterward the artery became distended with blood, and the pulsations in the tumour were as strong as they had been before the operation. Mr. Hutchison then applied two fresh ligatures; hemorrhage afterward came on; amputation was performed, and the patient died.—(See Practical Obs. in Surgery, p. 102, &c.) Now, as Mr. Hutchison chose to apply other ligatures on finding that the pulsation returned, the above case only proves that the artery is not obliterated in about six hours, and we are left in the dark respecting the grand question, namely, whether the vessel would have become obliterated by the effusion of coagulating lymph and the adhesive inflammation, notwithstanding the return of circulation through it. As for the hemorrhage which occurred, I think it might have been expected, considering the disturbance and irritation which the artery must have sustained in the proceedings absolutely necessary for the application of not less than four ligatures, and the removal of two of them. According to my ideas only one ligature ought to have been used, and none of the artery detached. We also have no description of the sort of ligatures which were employed; an essential piece of information in forming a judgment of the merits of the preceding method. The application, removal, and reapplication of ligatures are not consistent with the wise principles inculcated by the late Dr. Jones, and have in more instances than that recorded by Mr. Hutchison, brought on ulceration of the artery, and hemorrhage.

The limits of this work prevent me from entering into the particulars of the very interesting experiments undertaken by Mr. Travers, upon the arteries of animals, for the purpose of ascertaining the earliest period when a ligature might be removed from an artery, without any risk of the vessel not being duly obliterated. A full detail of them may be seen in another work (See Med. Chir. Trans. vol. 4 and 6), and others, in relation to the same question, may likewise be perused in Scarpa's appendix to his great work on aneurism.—(Memoria sulla Legatura delle principali Arterie degli Arti, &c. fol. Pavia, 1817.) The cases above related, and other considerations, long ago satisfied me that flattering as the suggestion of Dr. Jones was, the plan of removing the ligature previously to its natural separation would never answer in the operation for the cure of aneurism, unless either an obliteration of

the arterial tube would follow with reasonable certainty the taking away of the ligature directly after it had been applied and it had divided the inner coats of the vessel; or, at all events, unless the ligature could be withdrawn at a determinate period, when either the same obliteration would surely ensue, or be already complete; and all this with such regularity and infallibility in every case, that the surgeon would have no chance of being called upon to apply another ligature, do a second operation, or disturb the artery in any kind of way whatsoever.

Mr. Travers, in the prosecution of this inquiry, in which he evinced a full determination to be guided by no motive but the love of truth, at length tried the temporary application of the ligature in a case of brachial aneurism, which he operated upon Feb. 14, 1817. The artery was tied an inch and a half above the bend of the elbow with a noose ligature. The pulsation in the radial artery immediately ceased. On the 16th, at four o'clock in the afternoon, the ligature was removed with little difficulty, after having remained on the artery fifty hours. No pulsation ensued in the vessel below the point where the ligature had been applied, and the case was completely successful.

On the 28th November, 1817, in a case of popliteal aneurism, Mr. Travers tied the femoral artery at one o'clock. On the 29th, at four in the afternoon, the ligature was removed without difficulty after having been on the vessel twenty-seven hours. At this period no pulsation could be felt in the sac; but at seven in the evening a faint pulsation was perceptible. On the 30th, the pulsation, though very distinct, was less strong than before the operation. On the 2d, 3d, and 6th of December the pulsation is described as still continuing. On the latter day pressure was applied by means of a roller from below the knee to the groin, and was continued for a month, during which time the pulsation in the sac evidently became more feeble. On the 10th of January the tumour became tense and severely painful, and no pulsation in it could be distinguished. The next day the swelling was more diffused and less prominent; and on the 12th, as the disease underwent no amendment, Mr. Travers tied the artery again about two inches above the place where the former ligature had been applied. The next day the pain had diminished. The ligature was afterward allowed to separate of itself; and the case went on favourably to the cure. According to Mr. Travers, the first of these cases tends to prove that the continuance of the ligature upon the artery for a period of fifty hours, as certainlyand completely answers the purpose of its application, as if allowed to remain until thrown off by the natural process.

In the second case, Mr. Travers infers from the suspension of pain, and the diminished strength of the pulsation, for a month after the application of the temporary ligature, that a degree of impediment to the current of blood in the artery had been produced; circumstances which once led him to entertain hopes that the cure of the aneurism was gradually accomplishing. At length, however, the increase of the tumour, and the aggravation of pain and inflammatory symptoms, dispelled such expectation, and it was thought necessary to tie the femoral artery a second time, and adopt the common mode.

There are one or two points about this case on which the author does not particularly dwell, though they require consideration, ere one can form a correct judgment of the accuracy of one of his positions, "that nonpulsation of the sac is a sign auspicious or otherwise, simply as it stands connected with increase or diminution of bulk and pain."—(Med. Chir. Trans. vol. 9, p. 415.) The first question is, how are we to account for the sudden accession of pain, the absence of pulsation, the increase of the swelling, and the other changes which happened on the 10th of January? Judging from the particulars given, I should say that at this period the aneurismal sac gave way, and the disease changed from the circumscribed into the diffused form; an alteration which would account for the pulsation being entirely lost, the increase of pain, and the extension of the swelling, &c. Now although the circumstance of the sac giving way, or the increase of pain, swelling, &c. on the 10th of January, may be taken as an argument, that the application of the ligature for twenty-seven hours had failed in producing obstruction enough in the vessel to retard the progress of the disease, we ought to remember that at the time when these changes happened, a trial of pressure was making to which one might impute the change of the aneurism from the circumscribed to the diffused form with quite as much probability, as to the enlargement of the sac by blood sent into it through the imperfectly obliterated artery. However this may be, certain it is, that the second operation was done when no pulsation existed in the swelling; and perhaps, therefore, the case would have been doubly interesting, had the artery not been tied a second time until circumstances had unequivocally proved that this cessation of pulsation, attended as it was with an inflammatory state of the tumour, would not ultimately have ended in the cure of the disease.

Here, however, I may be speaking rather in the spirit of an experimenter whose curiosity has not been fully satisfied than as a surgeon, who should always be governed by the paramount consideration of extricating his patient from danger; and this will appear the more likely when I add that my mind has long been made up about the inexpediency of the temporary ligature as an innovation in surgery. The last case induced Mr. Travers to relinquish the temporary ligature; and among other reflections which incline him to give up the practice, he candidly states, "that the adhesive union is prevented by the enclosure of a foreign body in the wound long before suppuration has commenced. Suppuration is as certain to take place, though the ligature be removed after a few hours, as if it were left to be cast off; and the granulating process is more languidly performed after an interruption in its early stage, for the purpose of removing the obstacle to union, than where no such interruption has been given, and the obstacle has been removed by nature's own means. Hence it follows that the theory which, in removing the ligature within a given time, proposed the double advantage of a quicker as well as a surer process, fails in both points when brought to the test of practice upon the human subject."—(See Med. Chir. Trans. vol. 9, p. 416, 417.)

We have seen that when a temporary ligature which had been applied to the brachial artery fifty hours, was withdrawn by Mr. Travers, pulsation in the aneurismal tumour at the bend of the elbow did not return, and the disease was cured; but that in another instance where the ligature had been allowed to remain on the femoral artery only twenty-seven hours, a feeble pulsation was renewed a few hours afterward in a popliteal aneurism, and as the swelling became painful and more diffused some weeks after this experiment, though no pulsation could then be perceived, the femoral artery was tied a second time, and the ligature left to separate in the usual manner.

But from a case more recently published it would seem that the employment of a temporary ligature for only twenty-four hours on the femoral artery, may obliterate the vessel, and accomplish the cure of a popliteal aneurism. The patient was a seafaring man, aged 32; and the operator, Mr. Roberts, of Caernarvon; Mr. Evans and Mr. Carrey, other surgeons of that town, being present at the application, and also at the removal of the ligature. No pulsation recurred in the tumour; the edges of the wound were brought together with adhesive plaster; and in eleven days the part was quite healed.—(Med. Chir. Trans. vol. 11, p. 100.) This is the strongest case, I believe, which has been adduced in support of the use of the temporary ligature, whether we consider the little time which it was applied, the permanent cessation of all pulsation, the quickness with which the wound healed, or the complete recovery of the use of the limb; for when the patient was met six months after the operation, "he could go to the mast head with as great facility as at any period of his life." This fact proves also that there is a degree of irregularity in the period when the temporary ligature may be removed without the pulsation in the tumour below the constricted part ever returning. Whether the variety is to be referred to temperament, the kind of ligature used, its greater tightness in one case than another, or other circumstances, is not at present determined.

The greatest advocate which this practice has gained is Scarpa, whose sentiments, however, about the most advantageous form of ligatures, and mode of applying them in cases of aneurism, are very much at variance with what is inculcated by the best and most expe-

rienced surgeons in this country. Instead of using a fine ligature, composed of a single piece of thread, twine, or silk, he employs a cord consisting of from four to six threads, according to the size of the artery which is to be tied; and instead of aiming expressly at the division of the internal coats of the vessel with his ligature, as the generality of English surgeons do, for reasons explained in another part of this work (See Hemorrhage), he prefers a largish ligature, and interposes between the artery and the knot a small cylinder of linen spread with ointment, with the view of preventing the inner coats of the vessel from being divided. His reasons for this practice may be explained in a few words: he admits that whenever there is a concurrence of all the circumstances capable of inducing in the tied artery the proper degree of adhesive inflammation, above and below the place where a single circular ligature has been applied, this method is adequate to produce a speedy and steady closure of the arterial tube. But, says he, it sometimes happens, at least in man, that the pressure made by the circular ligature produces the ulcerative process more quickly in the artery than the adhesive inflammation. In fact, the circular ligature ulcerates the artery in general about the third day after the operation; and the adhesive inflammation does not always complete its course in this period of time. During this delay of the adhesive inflammation, the ulcerative process, occasioned by the pressure of the ligature, attacks more quickly even than surgeons generally suppose, the external cellular sheath of the artery, and penetrates into the cavity of the yet pervious vessel—and this of course with increased quickness, when the inner coats of the artery are already divided by the ligature. The dangers of non-adhesion and too rapid ulceration of the artery, Scarpa thinks, are placed at the greatest distance by preserving undivided all the three coats of the vessel under the pressure of the ligature; and hence his partiality to larger ligatures than are now used by the best surgeons in England, and to the interposition of a cylinder of linen between the knot and the vessel, as recommended by Paré, Heister, and Platner. If, however, he has had reason to suspect that a simple circular ligature has frequently failed in England, because other innovations have been occasionally substituted for it, and because we should not have sought for a better, if we had already had the best, how much more vulnerable is his own practice on a similar principle; since, generally speaking, it has not retained half so many approvers as they who still express their preference to other methods, and more especially to the use of a single ligature, uncomplicated with other extraneous substances! Is it probable, he asks, that the single circular ligature, which was formerly used with doubtful success by the greatest surgeons, should not have become, as is pretended, the most certain means of preventing secondary hemorrhage? "It is now wished (says he) to ascribe the failures of Mr. Hunter and of many other operators, not to the circular ligature, but to the improper treatment of the wound in general, and in particular to the introduction into it of lint, and more especially to the irritation occasioned by the ligature of reserve." On the contrary, it is argued by Scarpa, that though Mr. Hunter, after his first trials, simplified the local treatment, though all skilful surgeons merely covered the wound with a pledget of soft ointment, and most of them omitted the reserve-ligature, yet, notwithstanding these reforms, secondary hemorrhage after the use of a simple circular ligature was not rendered less frequent.—(On Aneurism, p. 23, ed. 2.) With respect to the latter general assertion, its incorrectness may be learned by reference to the details of Mr. Hunter's own operations, and by going into the principal hospitals of this metropolis, where the use of a simple circular ligature for the cure of aneurisms very rarely fails, as far as secondary hemorrhage is concerned. Why then did the operation more frequently fail here in former times? The answer is plain: the kind of ligature now employed in England cannot be compared to what was used in Mr. Hunter's time, or even to what was here in fashion five-and-twenty years ago. And besides the universal rejection of ligatures of reserve, practitioners now have a more thorough comprehension of what ought to be avoided in the operation, have a just fear of separating and disturbing the artery too much, know how to appreciate the advantage of closing the wound, and attach due importance to the choice of smaller or more eligible ligatures.—(See Hemorrhage and Ligature.) When, therefore, Scarpa supposes, that in England the practice with the circular ligature in the treatment of aneurism is materially the same now as heretofore, and that secondary hemorrhage is as frequent, he has not availed himself of all the information on this subject, which he might have acquired from Mr. Wishart, the able translator of his writings on aneurism, or from an attentive perusal of Mr. Hodgson's valuable treatise.

In an equality of circumstances, conducive to the success of the Hunterian operation, Scarpa thinks, that the fact is not proved, as it is presumed to be, that the rupture of the internal and middle coats of the artery does excite the adhesive inflammation and union of the artery more effectually than is done by the simple compression and close contact of its two opposite internal parietes in a sound and uninjured state. This remark is partly true, and partly incorrect, at the same time that it involves a question which must be deferred till we come to the article Hemorrhage. The truth in the observation is, that an artery may generally be rendered impervious with tolerable certainty, by compressing its opposite parietes steadily and firmly together for a certain time, without dividing its inner coats: the inaccuracy of it depends upon the fact, that surgeons have no instrument nor contrivance (not excepting even the ligature of four or six threads, with the interposition of the cylinder of linen spread with ointment), which can retain the opposed undivided surfaces of the inner coats of the vessels closely together in the manner commended by Scarpa, and for the due time, without the objection of denuding more of the artery than need be done in the application of a small ligature; or without the serious inconvenience and risk necessarily attending the introduction of a larger quantity of extraneous matter into the wound than is desirable, with the view of averting all chance of the ulceration of the artery reaching beyond prudent limits. And when metallic instruments are used for the same purpose, objections not less real are incurred, as will be hereafter more particularly explained.

Scarpa considers that his mode of ligature ought to be preferred, as combining the triple advantage of preserving entire all the three coats of the artery; of exciting quickly, and in a proper degree, the adhesive inflammation in them; and of retarding, as much as possible, the ulcerative process of the arterial tube.

Partly impressed, however, with the truth of the tenets laid down by Dr. Jones (see Hemorrhage), Scarpa enjoins attention to the following rules: 1. Not to insulate and detach the artery any farther than is necessary for allowing a ligature to be passed around it. 2. Not to let the cylinder of linen exceed a line in length, or a little more, above and below the breadth of the tape which is about a line for the large arteries of the extremities. 3. That the ligature be not too tight. 4. And that it be never applied immediately below the origin of a large lateral branch.—(See Scarpa on Aneurism, p. 44, ed. 2.)

Some farther consideration of Scarpa's mode of applying the ligature will be introduced in the article Hemorrhage; and I now proceed to notice his sentiments concerning the advantage which may be derived from removing the ligature in cases of aneurism, as soon as the tube of the vessel has been obliterated by the adhesive inflammation. From the facts recorded by Scarpa, it is inferred, that with the kind of ligature and the cylinder of linen used in his practice, the closure of the artery by the adhesive inflammation and the two internal coagula is sufficiently far advanced on the third or fourth day after the operation to resist the impulse of the blood; and hence (says he) there is no rational motive for waiting beyond this time for the spontaneous separation of the ligature, or for allowing it, by its farther presence, to ulcerate, and even open the artery at the principal point of adhesion. He then comments on the advantages to the wound, derived from the removal of all extraneous matter from it on the third or fourth day. With respect to the general period of such removal, however, he makes one exception, viz. the case of great and evident debility from sickly constitution, or very advanced age, as it is observed, that in such patients, the reunion of a simple wound is frequently protracted to the sixth day. In cases of this description, Scarpa recommends delaying

the removal of the ligature to the completion of the fifth or sixth day, but under the express condition that the ligature has been applied with the interposition of a cylinder of linen; as it is proved, that a common circular ligature causes ulceration of the artery before the third day, and it is not till the sixth day, that the external coat of the vessel begins to ulcerate, when the other modification of the ligature is adopted.—(P. 50.)

Scarpa supports the preceding advice by four cases, in which his kind of ligature was applied, and withdrawn at the end of the third or fourth day, and the arterial tube obliterated. However, I do not think, that in England, these cases, when minutely and attentively considered, will be regarded as inducements to persevere in the use of temporary ligatures. In every instance the wound is described as suppurating, and sometimes plentifully. In one, the foot mortified, and amputation became necessary. In another, the very day after the disturbance of removing the ligature, the thigh was attacked with erysipelas, and on the eighth day the wound is represented as being foul, and the erysipelas not yet cured.

Independently of the uncertainty of the period when the arterial tube is closed by the adhesive inflammation in various patients, it appears to me, that the disturbance of the vessel and wound, by the steps necessary for the loosening and removal of the ligature, will ever form an insuperable objection to the practice. Scarpa appears to have some apprehension of this kind himself; for he remarks, "In the act of removing the ligature, there can be no doubt it is of great consequence, that the artery be not rudely handled or stretched. And, indeed, if, on untying the running knot, the subjacent knot could be with the same facility untied, we could not wish for a better mode of performing this part of the operation. But the knot, although a simple one, is not so readily untied as the running knot, on account of the moisture with which the threads forming the ligature are soaked, or because the ligature has been previously waxed."—(P. 64, ed. 2.) In fact, his apprehensions then lead him to suggest the scheme of placing, previously to making the knot, a thread longitudinally on each side of the cylinder, and at the time of removing the ligature, the threads are to be drawn in opposite directions, in order to undo the knot, without displacing or stretching the artery. Thus, instead of one small ligature, which is all that an English surgeon leaves in the wound, Scarpa recommends his ligature of four or six threads, a roll of linen, and two other threads; a quantity of extraneous substances, which cannot fail to be a source of serious irritation and mischief. I shall therefore take leave of the proposal of removing the ligature on the third or fourth day, or any other particular day, with expressing my belief, that if there were only the following objection to the plan, it would never be adopted in this country; namely, the advocates for this practice are necessarily obliged to renounce the infinite advantage of bringing the edges of the wound together directly after the operation. Had the suggestion of Dr. Jones proved invariably correct, and the ligature admitted of being withdrawn immediately after the inner coats of the vessel had been divided by it, the case would have been very different, as there would then have been no foreign body at all left in the wound; the parts might have been immediately brought together with the greatest chance of union by the first intention, and no subsequent disturbance, either of the artery or of the wound, would have been incurred.

The next practice which I shall notice, is that of applying two ligatures to the artery, and cutting it through in the interspace. This suggestion may be said to be as ancient as the time of Celsus, who has advised the method to be followed in the treatment of a wounded artery; "Quæ (arteriæ) sanguinem fundunt apprehendendæ, circaque id quod ictum est duobus locis deligandæ intercidendæque sunt, ut in se ipsæ cocant, et nihilominus ora reclusa habeant."—(De Medicinâ, lib. 5, c. 26, § 21.) The fact is curious, though I mention it without the least intention of detracting from the great merits of several modern surgeons, that the Greeks were acquainted with the practice, lately recommended, of tying and dividing the trunk of the artery high above the tumour, as will appear from the following extract:—(Ætius, 4, Serm. Tetr. 4, cap. 10.) At vero quod in cubiti cavitate fit aneurisma, hoc modo per chirurgiam aggredimur: primum arteria superne ab ala ad cubitum per internam brachii parte simplicem sectionem, tribus, aut quatuor digitis infra alam, per longitudinem facimus, ubi maxime adtactum arteria occurrit: atque ea paulatim denudata, deinceps incumbentia corpuscula sensim excoriamus ac separamus, et ipsam arteriam cæco uncino attractam duobus fili vinculis probe adstringimus, mediamque inter duo vincula dissecamus; et sectionem polline thuris explemus, ac linamentis inditis congruas deligationes adhibemus. Afterward we are directed to open the aneurismal tumour at the bend of the elbow, and when the blood has been evacuated, to tie the artery twice and divide it again. If the ancients had only omitted the latter part of their operation, they would absolutely have left nothing to be discovered by the moderns.

This method of applying two ligatures to the artery, and dividing the vessel between them, was revived in France about sixty years ago by Tenon, who, as well as some later surgeons, was totally unacquainted with its antiquity.—(See Pelletan, Clinique Chir. t. 1, p. 192.) At one time it had also modern advocates in Mr. Abernethy and Professor Maunoir of Geneva, each of whom supposed the plan an invention of his own.—(See Surgical and Physiol. Essays, part 3, 8vo. Lond. 1797; and Mémoires Phisiologiques et Pratiques sur l'Aneurisme, &c. 8vo. Genève, 1802.)

When an artery is laid bare and detached from its natural connexions, and the middle of such detached portion tied with a single ligature, as was Mr. Hunter's practice, Mr. Abernethy conceived that the vessel so circumstanced would necessarily inflame and be very likely to ulcerate. The occurrence of bleeding from this cause at first led to a practice, which this gentleman justly censures, viz. applying a second ligature above the first, and leaving it loose, but ready to be tightened in case of hemorrhage. As the second ligature, however, must keep a certain portion of the artery separated from the surrounding parts, and must, as an extraneous substance, irritate the inflamed vessel, it must make its ulceration still more apt to follow. The great object, therefore, which Mr. Abernethy insisted upon, was that of applying the ligature close to that part of the artery which lies among its natural connexions; a just principle, the truth and utility of which still remain incontrovertible, though there may be a better way of accomplishing what Mr. Abernethy intended than the measures which this gentleman was led to recommend.

The peculiarity in Mr. Abernethy's first operation, consisted in applying two ligatures round the artery, close to where it was surrounded with its natural connexions. For this purpose, he passed two common-sized ligatures beneath the femoral artery, and having shifted one upwards, the other downwards, as far as the vessel was detached, he tied both the ligatures firmly.

The event of this case was successful. An uneasy sensation of tightness, however, extending from the wound down to the knee, and continuing for many days after the operation, made Mr. Abernethy determine, in any future case, to divide the artery between the two ligatures, so as to leave it quite lax.

Mr. Abernethy next relates a case of popliteal aneurism, for which Sir Charles Blicke operated, and divided the artery between the ligatures. The man did not experience the above kind of uneasiness; and no hemorrhage ensued when the ligatures came away, although there was reason to think, that the whole arterial system had a tendency to aneurism, as there was also another tumour of this kind in the opposite thigh.

The reasoning which induced this gentleman to revive this ancient practice was ingenious; for when the artery was tied with two ligatures, and divided in the foregoing manner, it was argued that it would be quite lax, possess its natural attachments, and be as nearly as possible in the same circumstances as a tied artery upon the face of a stump. Strictly speaking, however, as Mr. Hodgson first pointed out, an artery tied in two places, and divided in the interspace, cannot be regarded as placed exactly in the same condition, as an artery tied in amputation. In the latter case, the retraction of the vessel corresponds with that of the surrounding parts, which are divided at the same instant, and therefore its relative connexions stand as before the operation. But in the operation for

aneurism, the retraction of the artery takes place, without being attended with a corresponding retraction of its connexions. How far the retraction of the artery is beneficial or injurious is by no means evident; and the advantages arising from it may in most situations be obtained without dividing the vessel, by placing the limb in a bent position. One important object, however, is gained by the division of the artery; namely, that it is generally in that case tied close to its connexions, and it is very evident how liable the application of the ligature in the middle of a denuded extent of the vessel must be to produce ulceration or sloughing of its coats. The same object, however, will be gained by tying the undivided artery close to its connexions at the end nearest to the heart; and the existence of a single ligature at the bottom of the wound will be less liable to give rise to suppuration and the formation of sinuses than the employment of two. When an artery is divided, the portions situated beyond the ligatures must slough, and prove an additional cause of suppuration in the wound. Experience has amply proved the safety of employing a single ligature, and it is at present used by many of the most experienced operators in this country.—(See Hodgson on the Diseases of Arteries, &c. p. 221, &c.)

According to Scarpa, numerous examples of the failure of the plan of applying two ligatures, and cutting through the artery in the interspace, are already generally known to the profession, and there are many expert and ingenious surgeons, who do not dissemble the disadvantage and uncertainty of this practice. He speaks of one failure which occurred to Mr. Abernethy himself. But I entertain doubts how far any inference against the method can be drawn from Monteggia's instance, in which a ligature of reserve had been used. Nor can I understand how a circumstance which Scarpa strongly insists upon, can be well founded; I mean the danger of the ligature being forced off the mouth of the artery by the impulse of the blood. Any risk of this kind cannot exist if the ligature be duly applied, as Dr. Jones has particularly explained; and at all events, how can it be greater here than after amputation, where it is not usually made a subject of complaint? Indeed the several examples of secondary hemorrhage after this method, quoted by Scarpa from the practice of Monteggia, Morigi, and Assalini, may be more rationally imputed either to reserve-ligatures having been also used, or the common fear in Italy of applying the ligatures tightly; in which event one can readily suppose that the ligature might really slip, or by remaining a long time on the vessel might give rise to dangerous ulceration. Thus Morigi speaks of one case in which the bleeding occurred on the nineteenth day.—(Scarpa on Aneurism, p. 14, ed. 2.) On the whole, I am disposed to believe, that when this method has been executed precisely according to Mr. Abernethy's directions, it has not often failed; and I am acquainted with only one case in London in which it was followed by secondary hemorrhage. However, in the year 1807, Mr. Norman of Bath tied the femoral artery with two ligatures, and divided the vessel between them; the upper ligature came away on the sixteenth day after the operation; the lower one on the fifteenth; and the following day a profuse hemorrhage came on, the patient losing a pound of blood. Pressure with a compress and wet bandage was continued for some time, and the wound healed.—(See Med. Chir. Trans. vol. 10, p. 123.) This is the only case of secondary hemorrhage, which he has met with after operating for aneurisms.

Scarpa very properly urges, that the application of two ligatures and dividing the artery in the interspace can never be an eligible mode, where the smallness of the space, the depth of the artery, and the importance of the surrounding parts, do not permit the vessel to be separated and insulated to such an extent as is required for dividing it, with a probability of the division of it being sufficiently distant from the two ligatures. Such, for example, are the cases of ligature of the carotid in the vicinity of the sternum; of the iliac above Poupart's ligament; of the internal iliac, a little below its origin from the common iliac; of the axillary artery between the point of the coracoid process and the acromial portion of the clavicle; or of the subclavian in its passage between the scaleni muscles. Scarpa then comments on the difficulty and even impossibility of taking up the end of the truncated artery again in many situations were hemorrhage to ensue; and he joins Mr. Hodgson in thinking the advantages of the method, even where it is practicable, by no means demonstrated. Nay, he goes farther; for he agrees with Heister, Callisen, and Richter, in setting it down as worse than useless, on account of the portion of the artery between the ligatures being converted into a dead and putrid substance, which rests upon the bottom of the wound, from which it cannot be removed until the two ligatures are separated. Here, deeply impressed with the truth of principles which perhaps he has rather lost sight of in speaking of his own particular method, he comments on the little probability of the wound uniting, under the disadvantage of two ligatures hanging out of it, and of sloughs at its bottom. He argues correctly, that the laying bare and insulating a large portion of artery would often be objectionable on the ground that it could not be done without the surgeon being obliged to apply the principal ligature too near the origin of a large lateral branch; as, for example, would happen in a case of inguinal aneurism, situated an inch and a quarter below the origin of the profunda. Thus a coagulum could not be formed, and the artery would be in danger of not being closed. On the contrary, by employing only a single ligature at an inch and a quarter below the origin of the profunda, the operation would be equally simple and successful.—(Scarpa on Aneurism, p. 19—21, ed. 2.)

The above considerations would certainly lead me to avoid the practice of detaching an artery from its surrounding connexions any more than is absolutely necessary for the conveyance of a single ligature under it; but I fully concur with Sir Astley Cooper in the prudence of using two ligatures, and applying them in the way recommended by Mr. Abernethy, whenever the artery has been extensively separated from its sheath in the operation.—(See Lancet, vol. 1, p. 433.)

The frequent occurrence of accidents after the introduction of Mr. Hunter's operation might have been ascribed to more probable causes than the condition of an undivided artery, upon which the ligature was applied. The employment of numerous ligatures gradually tightened, or the introduction of extraneous bodies into the wound, were alone sufficient to produce ulceration of the artery: and such practices were adopted in most of the cases in which secondary hemorrhage took place.

After the reasons which have been urged against the plan of tying the artery with two ligatures, and dividing it in the interspace, it may appear superfluous to notice a modification of this practice, intended as a security against the slipping of the ligature. But as the proposal has had the approbation of some men of eminence, and I heard of an instance in which it was practised not long ago, the subject may still be worthy of notice.

Sir Astley Cooper has published a case of popliteal aneurism, in which the femoral artery had been tied with two ligatures, as firmly as could be done without risk of cutting it through. "But (says he) as I was proceeding to dress the wound, I saw a stream of blood issuing from the artery, and when the blood was sponged away one of the ligatures was found detached from the vessel. Soon after, the other was also forced off, and thus the divided femoral artery was left without a ligature, and unless immediate assistance had been afforded him, the patient must have perished from hemorrhage." The same kind of accident has occurred in Mr. Cline's practice. For the prevention of it Sir Astley at first tried the method of conveying the ligatures by means of two blunt needles under the artery, an inch asunder and close to the coats of the vessel, excluding the vein and nerve, but passing the threads through the cellular membrane surrounding the artery. When these were tied, and the artery had been divided between them, the ligatures were prevented from slipping by the cellular membrane through which they passed.

Afterward, however, he preferred a different mode of securing the ligature suggested to him by Mr. H. Cline, and it was put to the test of experiment in operating for a popliteal aneurism on Henry Figg, aged 29. "An incision being made on the middle of the inner part of the thigh, and the femoral artery exposed, the artery was separated from the vein and nerve and all the surrounding parts, to the extent of an inch; an

eye-probe, armed with a double ligature, having a curved needle at each end, was conveyed under the artery, and the probe cut away. The ligature nearest the groin was first tied; the other was separated an inch from the first and also tied. Then the needles were passed through the coats of the artery, close to the ligatures between them, and the ends of each thread were again tied over the knots made in fastening the first circular application of the ligatures. Thus a barrier was formed beyond which the ligature could not pass." The event of this operation was successful.—(Med. and Phys. Journ. vol. 8.)

A similar proposal appears to have been mentioned by Dionis, and to have been noticed by some subsequent writers. In the 13th chapter, in Richter's Anfangsgründe der Wundarzneykunst, we read the following passage:

"The artery when drawn out, is to be twice surrounded with the common ligature. This is to be tied in a knot, and, when the artery is large, one end of the ligature is to be passed by means of a needle through the vessel before the knot, then both ends are to be tied together and left hanging out of the wound as in the ordinary way."—(Ed. 3, 1799.)

What power can possibly force the ligature, when tied with due tightness, off the extremity of the vessel? No action of the heart or artery itself, no turgid state of this vessel, could do so. If a piece of string were tied round any tube for the purpose of preventing a fluid from escaping from its mouth, provided the string were applied with due tightness, and the knot in such a manner as not to yield, no fluid could possibly escape, however great the propelling power might be, as long as the string and structure of the tube did not break. And if a ligature were applied so slackly as to slip, who can doubt that hemorrhage would still follow, even though the ligature were carried through the end of the vessel and tied in the foregoing way?

Where ligatures have slipped off very soon after being applied, I conclude that the arteries either could not have been tied with sufficient tightness, perhaps through an unfounded fear of the ligature cutting its way completely through all the coats of an artery, or else that the knot or noose became slack from causes which will be understood by considering what is said on this matter in the article Hemorrhage. The inner coats of the artery, we know from the experiments of Dr. Jones, ought to be cut through when the artery is properly tied, because the circumstance is always useful in promoting the effusion of lymph within the vessel, and the process of obliteration by the adhesive inflammation.

The preceding method is so contrary to the grand principle of always avoiding the detachment of the artery from its surrounding connexions, and is so inconsistent with the wise maxim of doing the operation with as little disturbance of the vessel as possible, that it is not surprising that it should have met with only a small number of followers. In fact, it is not only liable to every objection which can be urged against the double ligature and division of the artery, as formerly proposed by Celsus and a few of the moderns, but on account of its greater tediousness, more extensive separation and destruction of the vessel, and other reasons, is still less worthy of imitation.

With respect to ligatures of reserve, the interposition of agaric, cork, and other hard substances between the knot and the artery, these contrivances are now so fully rejected by all good surgeons, for reasons which will be quite intelligible after the perusal of another part of this work (see Hemorrhage), that I shall not at present detain the reader with animadversions on their danger. As for several kinds of metallic compressors intended to be applied to the exposed artery for the purpose of rendering it impervious, they are inventions which have been made and extolled by some surgeons of high repute, whose names would give importance even to a less meritorious proposition.

Dubois conceived that hemorrhage might sometimes proceed from the circumstance of a ligature making its way too fast through the artery. He thought, also, that the sudden stoppage of the current of blood by a tight ligature might bring on gangrene of the limb, particularly when the aneurism was not of long standing, so that the collateral branches had not had time to enlarge. Dubois, therefore, proposed a method of gradually stopping the flow of blood through the artery; and by this ingenious imitation of the process of nature, to promote the gradual dilatation of the collateral arteries, and obviate all risk of gangrene in the lower part of the limb. This gentleman put his plan in execution, and two instances of success are recorded. The cases were popliteal aneurisms. A ligature was passed under the artery in the manner of Hunter; its two ends were then put through an instrument called a serre-nœud, with which the compression was gradually increased. It is stated, that in one of these cases the plan made the artery inflame and become impervious in the course of the first night, so that on the following day the throbbing of the tumour had ceased. —(Richerand, Nosogr. Chir. t. 4, p. 109, edit. 4.) Here, however, it is to be suspected that the pressure of the apparatus was greater than was calculated; and that the stoppage of the pulsation was more owing either to this cause, or to the coagulation of the blood in the sac and adjoining portion of the artery, than to the process of obliteration, which could hardly have been so rapidly accomplished.

Assalini's compressor is an instrument calculated, as its inventor states, to produce an obliteration of the trunks of arteries, without dividing or injuring their coats. It is nothing more than a small pair of silver forceps, the blades of which are broad and flat at their extremities, between which the artery is compressed. A spring, composed of a piece of elastic steel, is attached to the inside of one of the handles, and by pressing against the opposite handle retains the flat ends of the blades in contact. This spring is intended to be very weak in its operation; but by means of a screw, which passes through the handles, the pressure admits of being regulated and increased at the option of the surgeon.

A representation of Assalini's compressor may be seen in his Manuale di Chirurgia, parte prima, p. 113. In the same book, or in my friend Mr. Hodgson's valuable Treatise on the Diseases of Arteries and Veins, which every practical surgeon ought to possess, a case may be perused in which this instrument was successfully employed by Professor Monteggia, and withdrawn entirely as early as sixty hours after its application. This last distinguished surgeon also used the compressor in an example in which the femoral artery was wounded and bled in an alarming degree. After forty hours the pressure was lessened, and in four hours more, as not a drop of blood issued from the vessel, and there seemed to be no good in leaving an extraneous body in the wound any longer, the instrument was taken out altogether.—(See Assalini's Manuale di Chirurgia, p. 110.)

When Assalini was in England, he acquainted Mr. Hodgson that in two cases of popliteal aneurism, in which he had himself employed this means of obliterating the femoral artery, the instrument was removed at the expiration of twenty-four hours; no pulsation returned in the tumours; and the patients were speedily cured.

With respect to the particular merit of this invention, it certainly possesses the recommendation of ingenuity; but it operates much in the same manner as several other mechanical contrivances, the serre-nœud of Desault, the presse-artère of Deschamps, that of Mr. Crampton (see Med. Chir. Trans. vol. 7), the pincers of Baron Percy, &c. If there be a real advantage in the division of the internal coats of an artery by the ligature, as the experiments of Jones seem to prove, and as many of the best surgeons in this country inculcate (see Hemorrhage and Ligature), then the compressor cannot be an eligible means of obliterating an artery. It may be said, however, that experience has proved its efficacy; but let it be recollected, that almost every method of operating for aneurisms has sometimes answered. Farther experience is requisite to determine whether Assalini's compressor would succeed as often as, or more frequently than, the scientific application of the right kind of ligatures (see Ligature), which may perhaps seem slower in their effect, only because they are not in general removed as early as Assalini's instrument. In fact, the experiments of Mr. Travers have now proved that the ligature is the quickest in its operation.—(See Med. Chir. Trans. vol. 6, p. 643, &c.)

In 1816, some ingenious observations were published by Mr. Crampton, on the effects of the ligature and of compression in obliterating arteries. The purport of

his remarks is to prove, like the later observations of Scarpa: 1st, That the obliteration of an artery can very certainly be effected, independently of the rupture or division of any of its coats; 2dly, That this operation the ligature, so far from being essential to the process not unfrequently defeats it.—(See Med. Chir. Trans. vol. 7, p. 344, 345.)

With respect to the first of these assertions, I presume that all practical surgeons have known and admitted it, especially if the words very certainly be left out. Every system of surgery for half a century past, has recorded the occasional cure of aneurism by different modes of compression, by which the adhesive inflammation is excited in the artery, or the coagulation of the blood in the aneurismal sac brought about. As, however, the most experienced surgeons have found the method less certain than the use of the ligature, it is not represented by any modern writers as deserving equal confidence; though there are circumstances, in which simple pressure may be sometimes tried with the hope of doing away all occasion for an operation. The cases, however, in which compression is applied directly to the artery itself by means of ligatures, with the intervention of other substances as advised by Scarpa, &c. or by various contrivances, like those of the serre-nœud, the presse-artère, and Assalini's forceps, all require the exposure of the artery; and if commendable, therefore, cannot be so on the principle of saving the patient the pain of an operation, but because they are more effectual than the employment of the ligature. This last point remains to be proved. From the comparatively small number of instances in which the preceding modes of compression have been practised, several examples of failure might be quoted.

With regard to Mr. Crampton's second assertion, that the division of the inner coats of the vessel, so far from being essential to the process of obliteration not unfrequently defeats it, I think the last part of the observation is altogether unproved. We must admit that the division of the inner coats is not essential, because arteries sometimes become obliterated under a variety of circumstances in which such division is not made; but still the great question remains whether it renders the process more certain. Mr. Crampton founds his conclusion, that it not unfrequently prevents the obliteration and gives rise to secondary hemorrhage, upon a few very uncommon cases in which aneurismal swellings have taken place above the ligature.—(See Warner's Case, p. 101 of this Dictionary.) Here Mr. Crampton presumes, without proof, that the occurrence happened from the division of the inner coats of the artery, though Mr. Warner himself suspected, with more probability, that it proceeded from a diseased state of the vessel. Besides, this event be it produced in whatever manner it may is so rare, that I only know of three examples of it on record, and have never known it occur during the last 30 years, that I have been in the constant habit of seeing numerous operations performed. In Mr. Warner's time such large ligatures were also in use that it appears to me they were more likely merely to press the sides of the artery together, like Mr. Crampton's presse-artère, than effect a complete division of the inner coats of the vessel, as is accomplished by the small ligatures in modern use.

Those metallic instruments, intended to be applied directly to an exposed artery for the purpose of obliterating it by compression, are liable as Scarpa remarks, to all the inconveniences which are inseparable from the presence of hard bodies, introduced and kept for several days in the bottom of a wound; especially when this is recent, in which case they cannot be retained in a proper direction without difficulty, or exactly at such a depth as will not be attended with hurtful pressure upon the wound itself and important parts in its vicinity. And with regard to the forceps of Assalini, Monteggia has observed, "if the obliteration of the artery is retarded, the forceps equally divides the artery by causing the death of the included portion. I also saw in one case, the extremity of the instrument resting at the bottom of the wound on the subjacent femoral vein, rupture its anterior half also, although we were sure it had not been included by it." —(Instituz. di Chir. ed. 2, t. 2.) And although Cumano in a case of popliteal aneurism, obtained on the fourth day the closure of the femoral artery by means of Assalini's forceps, he does not conceal that the cure of the wound was rather difficult; and in comparing the ligature with the forceps he adds his belief, that if an equal result is derived from both the preference will be given to the ligature, unless the other instrument be brought to such perfection that the inconveniences will be removed from which he found it not exempt, though the operation succeeded.—(Annali di Med. del Dottore Omodei, Settembre, 1807, p. 209, and Scarpa on Aneurism, p. 45, ed. 2.) Some experiments were a few years ago instituted by Mr. Travers, in order to determine the merit of Assalini's forceps compared with the ligature: and his conclusion from the facts elucidated in the investigation is, that the ligature is a more powerful means of effecting the obliteration of the tube of an artery.—(See Med. Chir. Trans. vol. 6, p. 643, &c.)

My friend Mr. Lawrence, a few years ago, extended to operations for aneurism the method of tying the artery with a very small firm silk ligature, the whole of which is immediately afterward cut off with the exception of the noose and knot, and an endeavour then made to heal the wound by the first intention. In a case of popliteal aneurism, Mr. Carwardine, late of Thaxted, tied the femoral artery in this manner, and the wound united entirely by the first intention, not a particle of pus having been formed at any time; and the part continued perfectly sound at the distance of some months from the operation. On the 29th of March, 1817, I saw Mr. Lawrence try the practice in a similar case: with the exception of the integuments, the wound united by adhesion. However, it continued to discharge a small quantity of matter till the end of May, when the ligature came away, and it healed firmly. In an aneurism of the humeral artery, Mr. R. Watson, of Stourport, Worcestershire, tied that vessel and cut off the ends of the ligature, as proposed by Mr. Lawrence. The operation was done on the 2d of March, and the wound was quite healed by the 10th of April. On the 3d of May, a small tubercle which had been felt under the skin in the centre of the cicatrix, appeared above the skin, and proved to be the knot of the ligature. There was no inflammation nor discharge; but the ring of the ligature was firmly impacted in the centre of the cicatrix. In about a week from this time the whole of it was expelled. In another case, where Mr. Hodgson tied the ulnar artery and cut off the ends of the small ligature, the skin healed over the vessel, but a firm almost cartilaginous knot gradually formed, from the centre of which the bit of ligature was extracted five or six months afterward, by a small puncture. For additional observations on this part of the subject, see Med. Chir. Trans. vol. 8, p. 490, &c.

Mr. Carwardine's case is a strong one in favour of this method: but I am not aware that sufficiently numerous trials of it have been made to enable one to form a correct estimate of its merits. With the exception of the example communicated by Mr. Carwardine to Mr. Lawrence, I apprehend that on the whole the cures on record cannot be said to have been completed sooner than others generally have been, in which one end of the small circular ligature was left for the removal of the noose. Thus, in two cases where the practice was tried by Mr. Norman, of Bath, the results were by no means encouraging. In one of these instances, a part of the wound appeared to have united by the first intention, but matter afterward formed, and it was a considerable time before the ulcer healed. The ligature was never seen to come away; but from the circumstance of the suppuration, Mr. Norman apprehends that it must have been voided. In a second example, the attempt to procure a permanent adhesion of the parts over the ligature did not succeed; a long and troublesome suppuration ensued, and the wound was not healed till the latter end of April, though the operation was done on the 7th of March.—(Norman, in Med. Chir. Trans. vol. 10, p. 120—121.) As catgut, however, was employed for the ligatures in these two operations, I do not know that it is fair to consider the method exactly as that recommended by my friend Mr. Lawrence, who particularly directs very small ligatures of dentist's silk to be used. But besides the different material employed, we are left uninformed of the thickness of the catgut; and in this respect also there would probably be no greater similarity between the ligatures of these gentlemen, than there is in regard to the substances of which such ligatures were made.

In favour of catgut as a ligature, when the ends of it are to be cut off, a case published by Sir A. Cooper deserves particular notice. The wound was found completely united on the fourth day after the operation, notwithstanding the patient was eighty years of age. The catgut, previously to its application, was softened in warm water. The recovery was complete; a fact strongly proving the propriety of not rejecting an operation on account of age, if no other objections exist.—(See Surgical Essays, part 1, p. 126.)

From what has been stated in the Lancet, however, it seems that Sir Astley has renounced both the use of catgut ligatures, and the plan of cutting off both ends of each ligature. With respect also to silk ligatures in particular, if we take into the account the little ulcerations, suppurations, and hard knots, which occurred even after their use in this manner, I fear, that though these complaints might be attended with no severe inconvenience, they will deter many surgeons from adopting the innovation; unless it can be proved that these inconveniences, slight as they were, are counterbalanced by the quicker healing of the incision, or some other decided benefit. As a mode attended with the least possible risk of being followed by secondary hemorrhage, however, I consider it inferior to no practice which has yet been suggested; nor do I know of any serious objections to it in any point of view, provided exactly such ligatures are used as Mr. Lawrence recommends.

In cases of aneurism, a single small ligature, composed of dentist's silk, inkle, or twine, is now usually preferred by the majority of the best surgeons in England; but as the right qualities of ligatures are elsewhere considered (see Hemorrhage and Ligature), I need not here dwell upon the subject. It is not meant to assert, that the use of a single ligature is never followed by secondary hemorrhage; for this would be untrue. The accident I believe will sometimes happen after this or any other mode, under certain circumstances, and in unfavourable subjects. A fact of this kind we find recorded, which happened in the practice of a truly eminent and experienced surgeon (see A. Burns on Diseases of the Heart, p. 230); but from the inquiries which I have made, it appears to me proved, that cæteris paribus, a single small ligature, applied with as little disturbance and detachment of the artery as possible, will be more rarely followed by secondary hemorrhage, abscesses, sinuses, &c. than any other known method. Thus, in the several cases reported by Mr. Norman, the single ligature was never followed by any of those inconveniences, which, he justly thinks, will be rarer after this practice than any other, "if the artery be not removed from its situation, or more detached than the ligature separates it."—(See Med. Chir. Trans. vol. 10, p. 123.)

Before entering into the consideration of particular aneurisms, I wish to mention a few other circumstances, worthy the attention of every practical surgeon. The first is the partial entrance of blood into the aneurismal sac, after the artery has been tied at some distance from the tumour. This fact was first particularly pointed out, and its reasons explained by Sir E. Home, who published three examples of its occurrence.—(See Trans. for the Improvement of Med. and Chir. Knowledge, vol. 1, p. 173, and vol. 2, p. 239.) But the circumstance had never, I believe, been considered with due attention, until Mr. Hodgson made it one of the subjects of his reflections in his valuable treatise.

"When an artery is tied close to an aneurismal sac, the ingress of blood into the latter is in most instances prevented; the coagulum which it contains is absorbed, and the membranes of which the sac is composed, gradually contract, until its cavity is permanently obliterated. But when the artery is tied at a distance from the disease, the ingress of blood into the latter is not altogether prevented; for the anastomosing branches which open into the trunk, below the seat of the ligature, convey a stream which passes through the aneurism. The impulse of this current, however, is so trifling that the enlargement of the sac not only ceases, but the deposition of coagulum in it increases, in consequence of the languid state of the circulation. The coagulum accumulates until the cavity of the sac, and the mouth of the artery leading into it, are obliterated," &c.—(See Hodgson on the Diseases of Arteries, p. 266.)

This fact, which is of great importance, both in a practical and pathological point of view, is proved (says this gentleman), 1st, by the occasional recurrence of pulsation in the tumour after the operation; 2dly, by cases in which the cavity of the sac has been exposed, and hemorrhage has been the consequence; and, 3dly, by dissection, in which it has been found, that the cavity of the aneurism, as well as that of the artery from which it originated, was pervious, from the part which was obliterated by the direct operation of the ligature.

For a detail of the facts relative to this interesting point the reader is referred to Mr. Hodgson's valuable publication.—(P. 267, et seq.)

Some very uncommon instances are recorded, in which the return or continuance of pulsation in the tumour is said to have prevented the cure; the aneurismal sac having begun to enlarge again. The two cases of this kind, however, which happened in the practice of Pott and Guerin (Trans. of a Soc. for the Impr. of Med. and Chir. Know. vol. 1, p. 172; and Journ. de la Soc. de Santé, No. 3, p. 197), cannot be well depended upon, as it may be doubted, whether the artery was really tied. Some better established facts, relating to this part of the subject, have been very recently published. One is a case by Dr. Monteath, jun., of Glasgow, which is very remarkable; as the disease, viz. a popliteal aneurism, recurred nine months after the femoral artery had been unequivocally tied in the upper third of the thigh. On the 27th of February, 1819, this gentleman performed the operation, using a single ligature; the pulsation of the tumour in the ham instantly ceased; and the wound healed by the first intention, except where the ligature was situated, which came away on the thirtieth day. By this time, the tumour was diminished to one-half of its original size, and in two months more, only a hard knot was perceptible, in which no pulsation whatever could be felt. After the considerable lapse of time above specified, the patient informed Dr. Monteath, that the tumour had reappeared, being rather larger than a plum. The pulsation in it was distinct, though not so strong as in ordinary aneurism. As the size of the swelling and strength of the pulsation increased gradually, a compress and bandage were applied without confinement; but as this treatment was ineffectual, the patient was afterward kept in bed, bled, and put on a spare diet. A thick compress was placed over the tumour, and the limb was firmly bandaged from the toes to the groin. A trial of this plan for three days not having produced any benefit, a tight tourniquet was applied over the tumour; but the pain was such in half an hour, that the instrument was taken off, from which moment no pulsation was felt. Next day the tumour not only did not throb, but had a firm feel; and the bandage being continued, the cure was gradually completed. Had the disease not yielded to these means, Dr. Monteath meant to have tied the inguinal or external iliac artery, with the view of cutting off the supply of blood to the sac, through the anastomosing branches.—(Scarpa on Aneurism, by Wishart, p. 510—512, ed. 2.)

The following cases were mentioned by Sir Astley Cooper: a man underwent the operation for aneurism; the femoral artery was tied; the pulsation ceased; and the patient in a little while was supposed to be cured of the aneurism, and discharged. Upon his return to labour, however, a swelling arose in the ham, without pulsation. The swelling subsided in consequence of rest; but afterward, while the man was at work, the swelling returned with great pain. At length, as Sir Astley conceived that there was no prospect of the limb becoming useful again, it was amputated. Upon an examination of the parts, he found that the femoral artery, below the place of the ligature, had been conveying blood. It does now and then happen (says he) that a blood-vessel will arise from the artery close above the ligature, and pass into the artery immediately below it, by which means the circulation is produced. Sir Astley then referred to a specimen in the hospital museum, where this fact is illustrated in the brachial artery.—(See Lancet, vol. 1, p. 298.)

The external iliac artery was taken up by Mr. Norman, of Bath, for the cure of an inguinal aneurism, and when the collateral circulation was fully established a few days after the operation, the tumour was again supplied with blood in sufficient quantity to pro-

duce a distinct pulsation; "a fact (says Mr. Norman) of practical importance, as it shows, that though the ligature on the iliac artery stops the direct influx of blood into the tumour, and is the means by which the disease is cured, yet that there exists a necessity for employing strict rest, the antiphlogistic regimen, and, in some cases, the abstraction of blood, to assist nature in her operation of obliterating the aneurism." And in another instance, after the same gentleman had tied the femoral artery for the cure of popliteal aneurism, the pulsation, though stopped for a time in the tumour, afterward recurred in such a degree, that much doubt was entertained whether the disease would have been cured by the ligature on the femoral artery, had not continued and rather powerful pressure been adopted.—(Med. Chir. Trans. vol. 10, p. 99. 118, &c.)

M. Roux, in a late work, has offered some criticisms on the English method of operating for aneurisms. It would hardly be fair play to endeavour to offer a serious refutation of them, because, when he wrote, it was his misfortune not to be duly informed of all the facts and experiments recorded in the inestimable treatise on hemorrhage by the late Dr. Jones. "Still less confident than we are (says Roux) in the treatment by compression, and in the use of topical remedies for the cure of external aneurisms, the English surgeons have immediate recourse to the operation with the ligature. Hunter's method is that which they universally practise. They will not even allow, that there are any cases in which the operation by opening the sac should be preferred, &c. And it is singular, the very same motive which would incline us in some cases of aneurisms, properly so called, to adopt the operation of opening the sac, is alleged by the English surgeons as a circumstance in favour of the Hunterian method. Let us suppose an aneurism so formed, that near the centre of the tumour or rather near the opening, by which the artery communicates with the swelling, are situated the orifices of the collateral arteries, which would be useful for the re-establishment of the circulation. Here it is clear, that in practising the operation by the Hunterian method, that is to say, in tying the artery above the tumour, the last ramifications are not indeed sacrificed; but the orifices and first branches of these collateral arteries. Let there be, for example, at the upper part of the femoral artery an aneurism, which, though formed originally below the origin of the profunda, now extends above it. Here it is manifest that in tying the femoral artery above the swelling, we should lose the important resource of the profunda for re-establishing the circulation in the lower part of the limb. The desire and hope of saving the profunda would in such a case make us adopt the operation of opening the sac, in preference to the Hunterian method; and Scarpa himself, so great an advocate for this last mode, Scarpa, who seems only to have composed his work to cry up this method, makes an exception of the case, which I have just been supposing. The English surgeons, on the contrary, would urge the following objection to the operation by opening the sac in this and other analogous examples. They contend that the ligatures would be applied too near to the origin of the collateral arteries, which are to receive the blood after the operation. They are prepossessed with the idea, that when an arterial trunk is tied at a given point, the too great proximity of the principal collateral arteries disposes to subsequent hemorrhage," &c. (p. 256, 257): a circumstance which Mr. Roux seems to doubt.

Now, before attempting to reply to these observations, we ought to know what exact distance Roux means, when he speaks of the profunda, or a large collateral artery, originating near the opening by which the aneurism communicates with the main artery. Here he is not at all precise; and were he to tie the femoral artery immediately below the point where the profunda arises, he would expose his patient to great danger of bleeding. I say this, well aware of the case which he has adduced to prove the contrary. In the example brought forward, he applied several ligatures (p. 260), some of which were the ligatures d'attente, or loose ligatures left ready to be tightened in case of need. These were of course higher up than the ligature which was tightened. It is therefore impossible, that this last could have been close to the origin of the profunda. There must have been room left for the application of the ligatures d'attente; and be it also recollected, that the French still persist in the use of large flat cords, and not small firm round ligatures, which are now found to be most advantageous.—(See Hemorrhage.) In this part of the Dictionary we shall find that the nearness of a collateral vessel impedes the formation of the internal coagulum, which has a material share in the process by which the artery is closed.

With respect to the circumstance of hemorrhage being more likely to follow when the ligature is placed close below, than at some distance from a great collateral artery, there cannot be a doubt of the fact. Roux when in London saw an occurrence of this kind himself, and has published it in his book. It was a case in which Sir A. Cooper tied the external iliac artery; but the patient died of hemorrhage a fortnight afterward, and, on opening the body, it was ascertained that the obturator artery, which usually arises either from the trunk of the internal iliac, or from the epigastric, proceeded from the external iliac, and arose immediately above the point to which the ligature was applied.—(See Parallèle de la Chir. Angloise avec la Chir. Françoise, &c. p. 278, 279.)

From a preparation, spoken of by Mr. Travers, and some experiments made by the same gentleman, it would appear, that the presence of a collateral branch hinders the formation of the internal coagulum, but will not always prevent the closure of the vessel by the adhesive inflammation. In the preparation referred to, a ligature was applied to the external iliac, between the epigastric and circumflex iliac arteries, "and having been in contact with the former at the angle which it makes at its origin from the iliac, ulceration had taken place, and the bleeding had proved fatal. There was no coagulum formed in the iliac trunk, though the operation had been performed several days, the circulation through the epigastric having continued. But the lymph-plug at the seat of the ligature on the iliac artery was complete."—(Med. Chir. Trans. vol. 6, p. 656.) Indeed, it must be allowed, with this gentleman, that the fluidity of the blood does not prevent the adhesive process, a fact which, he observes, is also proved in the indirect obstruction of a vessel, by means of a temporary ligature or compressor. When, therefore, the vicinity of a large branch to the ligature is spoken of as a circumstance conducive to secondary hemorrhage, I mean, that it is so inasmuch as the internal coagulum is useful in promoting the closure of the vessel, and its formation is prevented.

Brasdor first, and afterward Desault, conceived, that when an aneurism was so situated that a ligature could not be applied to the artery leading to the swelling, a cure might possibly arise from tying the vessel on that side of the tumour which was most remote from the heart. Desault conjectured that by this means, the circulation through the sac would be stopped, the blood in it would coagulate, that the circulation would go on by the collateral arteries, and that the tumour would be finally absorbed. Deschamps tied the femoral artery below an inguinal aneurism; but the progress of the disease, instead of being checked, seemed to be accelerated by the experiment. The operator was obliged, as a last resource, to open the tumour, and try to take up the vessel. In this attempt the patient lost a large quantity of blood, and died eight hours afterward.—(See Œuvres Chir. de Desault, par Bichat, t. 2, p. 563; and Recueil Périodique de la Société de Médecine de Paris, t. 5, No. 17.)

The operation of tying the artery below the tumour was repeated by Sir A. Cooper, not for an aneurism of the femoral artery in the groin, but for an aneurism of the external iliac, where tying the artery above the swelling was impracticable. The femoral artery was therefore tied immediately below Poupart's ligament, between the origins of the epigastric and the profunda. The pulsations of the tumour continued; but the progress of the disease was checked. After a time, indeed, the swelling decreased, and this in so considerable a manner, that hopes began to be entertained that perhaps the external iliac artery might soon admit of being tied above the disease. The ligatures came away without any unfavourable occurrence, and when the wound was healed, the patient was sent into the country for the benefit of the change of air. Afterward, however, the tumour gave way; an extravasation of blood took place in the abdomen and cellular membrane of the pelvis, and the patient died. Sir

A. Cooper had no opportunity of seeing the case, and as the body could not be opened, farther particulars were not obtained.

I believe no additional trials of this practice were made in any part of the world, and that, in fact, the general feeling of the profession was decidedly against it, until my friend Mr. Wardrop lately directed his particular attention to the subject, and both by reasoning and facts exemplified beyond all dispute, that Brasdor's method of operating ought to be adopted in certain aneurisms, the circumstances of which forbid the application of a ligature on the cardiac side of the tumour. Experience has amply proved what I have already repeatedly mentioned, that after the Hunterian operation, some flow of blood frequently continues through the aneurismal sac, owing to the anastomoses, but that the impetus of the stream having been sufficiently reduced by the effect of the ligature, the curative process is not prevented from taking place. The pulsation, which is sometimes felt for the first few days, at length subsides, in consequence of the circulation being stopped by the increased quantity of coagula, and the tumour begins to diminish. It is from facts of this kind that Mr. Wardrop deduces what he calls "a new principle for operating in aneurisms so situated, as hitherto to have been considered beyond the reach of art, and to which the Hunterian principle of operating is totally inapplicable."—(On Aneurism, p. 15, 8vo. Lond. 1828.) Mr. Wardrop observes, that the changes produced by Brasdor's method, both in the artery and the sac, are precisely those which nature employs when she cures the disease by a spontaneous process. No sooner is the ligature applied on the distal side of the aneurismal tumour, than, as after the Hunterian plan, the anastomosing vessels dilate, and perform the function of the obliterated or obstructed trunk. The cases in which the operation has been done prove also what would not have been expected, that the tumour, directly after the application of the ligature, diminishes instead of undergoing enlargement. "If the circulation be turned into a new channel, and if that channel completely fulfil the purpose, the sac, with its contents, as well as the portion of artery extending between the aneurism and the ligature, and also the blood contained in it, will now be in a passive state; and though the blood will continue for a certain time to be influenced by the impulse of the circulation carried on in that part of the vessel which passes into the tumour, still its motion must become not only languid, but its current irregular, a state which, we know, admits of its speedy coagulation. Whenever the coagulation of the blood does take place, then the cure of the aneurism may be said to be accomplished; the sac will contract; the coagulum will be absorbed; some portions in contiguity with the sac will become organized, and consolidate; others, if the quantity be very large, will escape by a process of ulceration through the skin; and ultimately, a gradual coalescence of the tumour will thus take place."—(Wardrop, p. 20.)

{In the Medical Repository for 1823, vol. 7, No. 4, p. 404, Dr. David L. Rogers, then Resident Surgeon of the N. Y. Hospital, has published a paper entitled Observations on Aneurisms, in which this operation is contended for as being applicable to the carotid artery, and to this alone. He is wrong, however, in giving the projection of this operation to Desault, for although it is described in his works by Bichat, yet it was proposed by Brasdor. And as this seems to be a controverted point, I have taken some pains to trace the progress of this improvement, and find that the operation was first proposed by Brasdor nearly half a century ago, so that the projection of the plan unquestionably belongs to him. Bichat next gave directions for its performance in his edition of Desault, and here the error of Allan Burns probably originated, which has been since repeated by so many. Deschamps was the first who performed the operation in a case of femoral aneurism; then Sir A. Cooper repeated it on the external iliac, then Mr. Home's case occurred, all of which were unsuccessful. Mr. Wardrop's first case of carotid aneurism was performed in 1825, by tying the vessel on the anti-cardial side of the sac with complete success. Mr. Wardrop's second trial was not so fortunate, and, as will be perceived, it is questioned whether the artery was tied at all. See Mr. Cooper's remarks on this case, infra. Mr. Lambert next operated as will be seen in this article, without success, and Dr. Bushe's and Dr. Evans's cases were the only successful instances I can find, so that the former of these is the second and the latter the third in which Brasdor's method has succeeded. Dr. Mott's case is therefore the fourth successful instance on record, and certainly the only one in which it has been attempted in America. So much light has been elicited on this dark subject by the cases alluded to, that there can be little doubt but the operation on the distal side of the aneurism will now rescue from the grave many valuable lives, which had otherwise been lost to the world, and abandoned as beyond the resources of our art.—*Reese.*}

In the summer of 1825, Mr. Wardrop first tried Brasdor's method. The case was a carotid aneurism in a female 75 years of age. The disease was so close to the clavicle, that it was quite impracticable to tie the vessel on the cardiac side of the tumour. Immediately the artery was tied, the swelling underwent a diminution. On the fourth day it had lessened by one-third. Afterward the throbbing continued strong for a few days, at the expiration of which it became obscure, and, at the same time, the tumour began to diminish again. Previously to the complete cure, ulceration occurred, and several large masses of coagulated blood were discharged, along with some healthy pus. Three years after the operation, the patient continued to enjoy good health.

December 10, 1826, Mr. Wardrop attempted a similar operation for the cure of a carotid aneurism in another woman aged 57. Some reduction of the throbbing, and other relief, are stated to have ensued; but the patient died of a complication of complaints on the 23d of the following March, 1827. "Up to the day of her death, a tumour remained in her neck of about the bulk of an almond, which pulsated strongly, felt very thin in its coats, and its contents could be readily squeezed out of it, but returned rapidly, when the pressure was removed."—(P. 33.) In the dissection it deserves notice, that the carotid was found completely pervious, and that no cicatrix nor other appearance, enabled Mr. Bennet to ascertain the precise point to which the ligature had been applied.—(P. 35.) These circumstances might raise a doubt about the artery having been tied at all; but, supposing the ligature to have been duly applied, they prove to my mind the failure of the operation, inasmuch as the tumour and carotid artery were probably in almost the same state as if nothing had been attempted. The blood passed freely through them, and was not compelled to circulate through new channels. Without wishing, however, to enter into the question whether the artery were tied or not, I shall dismiss this example with two plain inferences: 1st, that if the artery were tied, the operation failed to bring about the desired obliteration of the vessel and coagulation of the blood in the swelling; 2dly, that if it were not tied, what was done is neither favourable nor unfavourable to the practice of which we are now considering the merits. A third example of the operation is reported in vol. 12 of the Lancet. The carotid was tied above the aneurism by Mr. Lambert, March 1st, 1827, in the presence of Mr. Wardrop, Mr. B. Cooper, and Mr. Callaway. On the third day the tumour seemed much consolidated, and reduced in size. On the tenth day there was some bleeding from the wound; but it was suppressed by the application of a compress wet with cold water; and in a few days, the swelling had entirely disappeared, and all that could be felt of it on pressing the finger deeply down, was a small hard tumour, having a very faint undulatory thrill. Unfortunately, this patient, also a female, fell a victim to hemorrhage on the 1st of May, in consequence of ulceration extending from the cicatrix through the platisma myoides to the artery. Without detailing other appearances noticed in dissection, suffice it to mention, that "at the root of the right common carotid artery was a consolidated tumour of a pyramidal shape. A probe could not be passed upwards from the arteria innominata, and water forcibly injected at this part would not pass, so completely and effectually closed was the lower part of the carotid artery. On making a longitudinal section of the tumour, we observed at its lower part a firm coagulum of blood, of about the size of a French olive. It accurately closed the opening at the base of the carotid, and it was this which afforded the resistance to the probe and injection of water passing upwards from the

arteria innominata. The coats of the artery, surrounding the coagulum, were thickened to about four times their natural size, and lined by a thin layer of fibrine. Above the coagulum, the coats of the artery were thickened to the extent of at least six times their natural size, and, in addition to a layer of fibrine closely adherent to the inner surface of the artery, and continuous with that surrounding the coagulum at the lower part of the tumour, there were three other layers of coagulated lymph.—At the upper part of the thickened portion of the artery, and just above the omo-hyoideus, where the ligature had been applied, was an ulcerated opening on the anterior and tracheal surface of the carotid artery a quarter of an inch in length, and rather less in breadth, covered by a coagulum of dark-coloured lymph, communicating with the opening in the integuments." This case, according to my judgment, must be received as another proof that Brasdor's method is capable of producing those changes in the tumour, artery, and circulation, which, if not succeeded by some accidental untoward occurrence, like the ulceration, leading in this case to fatal hemorrhage, may bring about the perfect cure of the disease.

If any doubt remained of this fact after the cases already cited, it would be dispelled by the results of some other trials of the practice, and more particularly by the history of the case of Mary Covis, aged 36, on whom Dr. Bushe [now Professor of Anatomy and Surgery in Rutgers Medical Faculty of Geneva College, New-York] operated, under very trying and difficult circumstances, with great skill and complete success.—(Lancet, vol. 1, 1828.) The tumour extended from the clavicle on the right side upwards nearly to the os hyoides, pressing the trachea towards the opposite side, and passing under the sterno-mastoid muscle to nearly an inch beyond its outer border. For nine days previously to the operation the patient had not been able to swallow any thing; her respiration was alarmingly obstructed, and her voice nearly lost. In the operation the artery immediately above the aneurism was found dilated, not more than half an inch of its extremity being sound, and on this a single silk ligature was placed. As soon as the artery was tied, the tumour became softer and less prominent, and though she had not swallowed any thing for nine days, she took, before the wound was dressed, about ten ounces of wine and water. The operation was performed September 11th, 1827. April 19th, 1828, the woman was in perfect health. There was then scarcely a remnant of the tumour; the inordinate action of the heart had ceased; and respiration and deglutition were natural. As Mr. Wardrop remarks, the facts recorded prove beyond all dispute, that the future growth of an aneurismal tumour may be arrested, and the disease cured, by placing a ligature on the distal side of the sac, especially if no branch of the artery intervene between the sac and the ligature; for if a considerable branch, and one that afterward enlarged sufficiently, were to be in this situation, the operation would have little or no effect in producing any diminution of the impetus of the blood in the aneurism, from the cavity of which the blood would pass as freely into the enlarged branch as it previously did along the trunk itself. Hence we see why Brasdor's operation will probably be attended with greater success on carotid than other aneurisms, the common carotid artery giving off in its course no branches which might interfere with the principles of the practice.

[Professor Bushe being now engaged in teaching anatomy and surgery in this city, has politely acceded to my request in furnishing me from his note-book, the following case, the practical importance of which in relation to this subject entitle it to a place here. It is referred to in the Lancet, No. 244, vol. 2, May 3d, 1828.

"As every fact that can tend to prove or disprove an unsettled point must be considered more or less valuable, it may not be useless to subjoin a concise account of a patient who, in the summer of 1823, was admitted into the Whitworth Medical Hospital, Dublin, under the care of Dr. Cuming. His complaint on admission was registered as paralysis of the right arm; but a large tumour being discovered in the axilla, the late Professor Todd was called to see the patient; and after careful examination he gave it as his opinion that it was an aneurism, which from its magnitude had lost its pulsation; but to settle the point, he punctured it, and florid blood followed the insertion of a probe. When passed inwards for about three inches, the nature of the case being decided, the man was removed to the Richmond Surgical Hospital; where, from an attack of erysipelas consequent on the puncture, he died in a few days. Mr. Todd requested that I might examine the body, and from notes made after the dissection I abstract the following: 'The aneurism, which was of large size, occupied the right axilla; the sac in many places was almost absorbed, and adhered firmly to the upper and outer part of this cavity; when opened, it contained large quantities of laminated fibrine, and in its centre was a cavity holding about eight ounces of coagulated blood; communicating with the cavity, there was an opening of one-eighth of an inch in the axillary artery, below which the vessel was obliterated for the space of half an inch, corresponding to the situation where the sac so firmly adhered.'—Here then was a case where the aneurism was undergoing a spontaneous cure in consequence of the pressure of the tumour having obliterated the artery on its distal side; and I look upon it as a valuable fact towards confirming the utility of reviving the operation of Brasdor and Deschamps; and so much was I impressed with this opinion, that before Mr. Wardrop published his first essay, I recommended the operation in a case of large carotid aneurism in a public hospital; but my chance was to be laughed at. However, when I again meet the two surgeons who so wantonly ridiculed me, it will be my turn to laugh at them."—*Reese.*]

Mr. Wardrop himself regards Brasdor's operation as not merely applicable to examples in which it is impracticable to place a ligature on the cardiac side of the sac, but as likely to merit the preference when the tumour is large, and likely to inflame after the circulation through the sac is interrupted. This inference he makes from the fact of the immediate diminution of the swelling, which has usually followed the application of the ligature on the distal side of the aneurism. He also deems it probable that in this method there is less risk of hemorrhage from the part of the vessel on which the ligature is applied than in the Hunterian operation. On the principle that it is sufficient for the cure of an aneurism, that the impetus of the blood through it be diminished, as the deposite of lamellated coagula within the sac will then increase, Mr. Wardrop urges the propriety of extending Brasdor's method to aneurisms of the arteria innominata; but the very interesting and valuable cases which he has adduced in confirmation of his views of these particular aneurisms will be more conveniently noticed in the sequel. As an admirer of the improvement of surgery, I must not quit this part of the subject, without expressing the conviction that I entertain of the service which Mr. Wardrop has rendered the profession and the public by his able and enlightened view of a valuable operation, which without his exertions and example might long have remained quite neglected, or briefly mentioned in the history of surgery as a dangerous proceeding, unworthy of farther trials.

[This suggestion of Mr. Wardrop has been acted upon by D. Evans, Esq., surgeon at Belper, Derbyshire, who successfully tied the carotid for aneurism of the innominata and root of the carotid. The details of this splendid operation are so interesting, that I cannot withhold from the profession the record of this highly important and successful triumph of modern surgery over this most horrible disease. It is extracted from the Lancet, No. 271, vol. 1, Nov. 8th, 1828.

"William Hall, ætat. 30, a butcher and horse-dealer, an athletic and spirited young man, about five feet six inches high, has been accustomed to laborious exercise, frequently riding from 70 to 100 miles a day, and has always enjoyed excellent health until the appearance of the following symptoms:—About 14 months ago he was seized with shortness of breath, troublesome cough and tightness over the chest after much exertion, especially in walking fast up a hill.

These symptoms continued until the 6th of March, when he had an attack of bronchitis, which he attributed to cold. His expectoration was copious, consisting of mucus slightly streaked with blood, and his cough came on in violent paroxysms, which were followed by a sense of suffocation.

On the 10th of March, after a fit of coughing, a soft, pulsating tumour about the size of a walnut suddenly made its appearance behind, and extending a little above, the right sterno-clavicular articulation, and

covered externally by the sternal portion of the sterno-mastoid muscle. The tumour was greatly diminished by firm pressure, but could not be made to disappear entirely.

The pulsation of the tumour, which was synchronous with that of the heart, was increased in force by pressure upon the right subclavian artery, and was diminished and sometimes completely arrested by pressure upon the right carotid above the tumour.

The pulsations of the right carotid and subclavian arteries were stronger than those of the left; but there was no apparent difference in the pulsations of the radial arteries.

As soon as the tumour made its appearance, the cough and dyspnœa ceased to be troublesome, and his health was soon re-established. His chest sounded well upon percussion, and the respiratory murmur was distinctly heard all over it. No unnatural pulsation could be detected by the use of the stethoscope between the tumour and the heart. A loud and powerful pulsation was heard over the tumour, unattended with any unusual sound.

In taking into consideration the situation of the tumour, its sudden appearance after a violent paroxysm of coughing, and its soft, pulsating character, together with the symptoms above enumerated, little doubt could be entertained of its nature, and I concluded that the root of the carotid artery was the seat of the disease.

Considering this a favourable case for the operation lately revived, and so ably advocated by Mr. Wardrop, I was induced to obtain the opinion of two eminent surgeons in London respecting its propriety. Both, however, disapproving of the operation, it was therefore determined, with the approbation of my friends, Mr. Bennet and Mr. Brown, of Derby, that a fair trial should be made of Valsalva's plan of treating aneurisms.

The nature of the disease was fully explained to the patient, who fortunately was a man of strong sense and most determined resolution, and from his employment leading him to study the diseases of horses, there was no difficulty in making him comprehend the dangerous tendency of the disease. He therefore submitted with perfect confidence to the proposed plan of treatment; and I cannot sufficiently admire the fortitude and cheerfulness with which he bore the long privation which it was necessary to enforce, and the implicit faith which he placed in all the remedies adopted for his relief.

April 3. He was accordingly ordered to bed, to be bled to the extent of eight ounces every third day; his diet to consist of small quantities of gruel, broth, and tea. Small doses of digitalis were likewise administered. This plan of treatment was continued until the 13th of July. During the first month there appeared some little improvement; his pulse was frequently as low as 47 in the minute, the tumour became harder, its pulsations less forcible and more remote; from which it was supposed that coagula might be forming. The blood hitherto had seemed perfectly healthy, and it was noticed that if the bleeding were delayed beyond the usual time, the symptoms were aggravated.

In the beginning of May a great alteration for the worse took place, which was supposed to be owing to his taking a small quantity of animal food. The blood after each bleeding became buffed; pulse 80 in the minute; the tumour rapidly increasing in the course of a few days, and becoming very painful upon pressure. Twenty leeches were applied without any relief. A few days afterward a diarrhœa supervened, the inflammatory state of the tumour abated, the pain ceased, and the swelling in some degree subsided. After this attack his pulse was never less than 80 in a minute, although the same plan of treatment was rigidly adhered to.

From this time until the 1st of July the tumour remained stationary; but from the latter date until the 20th he gradually got worse; the tumour increased, and now reached as high as the cricoid cartilage, and by its pressure upon the trachea and œsophagus partially impeded respiration and deglutition. His shirt-collar, which, prior to his illness, would button comfortably, could not now be made to meet by more than three inches; his countenance became bleached; pulse more feeble; and it was evident that the lowering system had been carried as far as it could with safety.

Under these circumstances the operation was recommended as the only remaining chance. Its advantages and disadvantages were fairly stated, and the chance of success, although small, made him anxious that it should be performed. Dr. Bennet, of Derby, saw the patient on the 17th, and concurred in the propriety of the operation as a last hope.

On the morning of the 22d of July, the day proposed for the operation, the patient became so agitated that the pulsation of the tumour, of the heart, and the large arteries, especially the abdominal aorta, was perceptible to the eye. The operation was performed in the presence of Messrs. Bennett and Brown, of Derby; Mr. Ingle, of Ashby-de-la-Zouch; and Mr. Walne, of Chancery Lane, surgeons.

In consequence of the tumour extending so high up the neck, there was some difficulty in getting down to the sheath of the artery, which was opened to the extent of half an inch. The artery appeared healthy, and was easily secured by a single ligature of strong silk.

Immediately after tightening the ligature the pulsation in the different branches of the external carotid artery ceased, except a slight fluttering in the extreme branches of the temporal. The pulsation of the tumour continued without diminution.

23d and 24th. He went on well. The pulsation in the tumour was stronger than it was before the operation, and the pulsation of the right radial artery was observed to be more forcible than that of the left.

25th. He became feverish; pulse 120, and full; the right lip of the wound swollen and painful. Six ounces of blood were taken away from the arm, and some saline medicine administered. The blood was much buffed.

26th. Morning. Much better; pulse 92, stronger in the right radial artery than in the left; pulsation in the tumour still very forcible.

Evening. The fever and pain in the tumour returned. He was again bled. Blood still buffed.

27th. Better again this morning. He was taken worse at nine o'clock in the evening. Pulse 100; delirious; anxious countenance and sickness. No diminution in the size of the tumour.

28th. Much better, and continued so all day.

29th. At seven, A. M., he was taken suddenly worse, and appeared to be dying; his countenance ghastly, and covered with perspiration; tracheal rattle, and inability to swallow. He appeared conscious, but could only speak in a whisper; pulsation in the tumour still forcible; the pulse in the right radial artery scarcely perceptible, while the left pulsated as strongly as it did the previous day. These symptoms were accompanied with a profuse ptyalism. He remained in this state for several hours, at the expiration of which time he rallied; and by the evening (with the exception of the salivation, which continued) he appeared quite as well as on the preceding day.

As he continued to improve from this period, it will not be necessary to enter into a daily report of the case. I shall therefore content myself with noticing the most prominent symptoms which occurred. One of the most remarkable was the obliteration of the arteries of the right arm and forearm, which was first observed in the arteries of the forearm on the 29th of July, the eighth day after the operation; for until that day the arteries of the right arm pulsated with greater force than those of the left. The process of obliteration was attended with severe paroxysms of pain, chiefly felt in the course of the brachial and axillary arteries.

The brachial artery after its obliteration was hard and painful to the touch, and felt very like an inflamed absorbent vessel. The right arm wasted, and became partially paralyzed, and continued to diminish for three weeks; at the expiration of which time several anastomosing branches were observed pulsating on the back part of the arm. As these vessels enlarged, the limb improved very slowly, not having yet (Oct. 19) perfectly acquired sensation, nor its muscles the power of obeying volition.

On the 11th day after the operation, he was attacked with intermitting paroxysms of pain in the right side of the head and face, of the same character as the pain in the right arm, though not so violent; this pain ceased within a fortnight. The right side of the head and face became emaciated, and any one looking at him would immediately discover that the right half of the face was much smaller than the left. The blood having since found its way into the temporal and facial

arteries, the right side of the face is now nearly as plump as the left.

The ptyalism, which began on the 29th of July, continued until the middle of September, during which time he spit daily about a pint of saliva; a more generous diet and a small quantity of ale were then allowed, and the salivation subsided.

Three weeks after the operation he was able to sit up to his meals. The first time that he got out of bed, he perceived that the whole of the right side was numbed, and weaker than the left. The pulsation in the tumour, which had hitherto been more powerful than it was before the artery was tied, now (Aug. 15) began to diminish rapidly, and by the 23d of August, the thirty-third day after the operation, had so much subsided, that it was doubtful whether it arose from the passage of blood into the tumour, or from the impulse given to it by the subclavian artery beneath.

In five weeks after the operation, he was sufficiently recovered to be able to take daily exercise in a gig or on horseback, and from this time he has continued to improve in health without interruption.

The obliteration of the right brachial artery is now complete, and above the insertion of the latissimus dorsi the pulsation of the axillary artery can be easily felt.

The pulse in the radial artery is scarcely perceptible in the right arm, increases daily, but is yet far from being of the size of the left. Sensation and susceptibility of the influence of volition are more perfect on the whole of the right side of the body, but still that side is more feeble than the left. The tumour is hard and firm, and has diminished about one-third since the operation. By pressing it from above downwards, a feeble, deep-seated pulsation is felt, but in grasping the tumour and using lateral pressure no pulsation can be perceived.

On the 13th of October the wound was nearly healed; the ligature had not come away, and as it acted as a source of irritation to the small wound, it was cut off level with the skin.

The most peculiar features which this interesting case presented were:—1st, The obliteration of the arteries of the right arm; 2d, The profuse salivation; 3d, The disposition to paralysis of the whole of the right side of the body.

The first two symptoms commenced on the 8th day after the operation; and I think there can be little doubt that the obliteration of the arteries of the arm was accomplished by inflammation extending from the aneurismal sac to the internal membrane of the subclavian artery, and thence to the brachial artery. Might not the active obliteration of such large arteries as those of the arm and forearm, be the cause of the unpleasant train of symptoms which occurred on the 8th day after the operation? The salivation appeared to be connected with the state of the digestive apparatus; for, as soon as ale and a generous diet were allowed, it gradually subsided.

I am at a loss to assign the cause of the numbness and debility of the whole of the right side of the body (which were only observed when he first left his bed), unless they originated in a greater quantity of blood circulating in the left hemisphere of the brain than in the right, which undoubtedly would be the case after the application of a ligature to the common carotid.

What tends to confirm this opinion is, that now (13 weeks after the operation) the balance of circulation in the brain being re-established, the numbness and debility of the right side of the body have nearly disappeared.

In conclusion, it is worthy of notice, that, since the operation, he has become more irritable in temper, and his memory is evidently weaker.

So far as this case has yet proceeded, it amply justifies the operation; and the man probably owes his life to Mr. Wardrop's fortunate suggestion and example. Should any untoward circumstance occur, leading to any other conclusion, it shall be communicated.

It is now five weeks since he resumed his usual avocations, and he regularly attends the markets and fairs of Derby, a distance of seven miles.—*Reese.*]

That Brasdor's operation must sometimes fail, and particularly that it should have failed in the trials made of it by Deschamps and Sir A. Cooper, is not at all surprising. These cases were both inguinal aneurisms; and it does not follow, because the method will answer in carotid aneurisms, that it will answer in aneurisms in every other situation. I should say, indeed, that unless it retard, in a certain degree, the circulation through the sac, it will never answer in any case; and how much this must depend upon the existence or not of one or more branches between the sac and the ligature, is completely obvious.

The memorable instance in which Sir A. Cooper tied the aorta, in a case of inguinal aneurism, extending very high up, and already burst, I shall notice under the head *Aorta.*

I shall finish these general observations on the treatment of external aneurisms, or such as admit more particularly of surgical treatment, with observing, that in England, surgeons now lose few patients either from gangrene in the limb or secondary hemorrhage; and this, notwithstanding they may sometimes prefer applying a ligature above the profunda to cutting open the aneurismal tumour. I firmly believe, that such matchless success is to be totally ascribed to their perfections in the mode of operating; the choice of a proper kind of ligature; the right plan of applying it; the rejection of the employment of several ligatures at a time; and the great care which is taken to promote the healing of a wound as quickly as possible; the avoidance of all unnecessary and hurtful extraneous substances in the wound; and above all, the relinquishment of the formidable proceeding of cutting open the tumour.

In the consideration of particular aneurisms, I shall begin with those which may be cured by a surgical operation; and here we shall be fully satisfied that "l'art de guérir ne triomphe jamais plus heureusement que lorsqu'il peut employer la médecine efficace, c'est à dire, les moyens chirurgicaux ou opératoires."—(*Velletan, Clinique Chir. t.* 1, *p.* 110.)

OF THE POPLITEAL ANEURISM, AND OPERATION FOR ITS CURE.

Notwithstanding the solitary example in which M. A. Severinus, early in the 17th century, tied the femoral artery near Poupart's ligament in a case of aneurism (*De Efficac. Med. lib.* 1, *p.* 2, *c.* 51), the practice of tying arteries wounded either by accident or in the performance of surgical operations, and even the plan of tying the humeral artery for the cure of the aneurism at the bend of the arm, were known long before the operation for the relief of the popliteal aneurism was attempted. The considerable size of the femoral artery, its deep situation, the urgent symptoms of the disease, and ignorance of the resources of nature for transmitting blood into the limb after the ligature of the vessel, are the circumstances which appear to have deterred former surgeons from this operation.

Valsalva treated popliteal aneurisms on the debilitating method, and published one or two equivocal proofs of its success. In Pelletan's first memoir on aneurism, and in the third vol. of Sabatier's Médecine Opératoire, as I shall hereafter notice again, are two cases of axillary aneurisms, which were cured by Valsalva's treatment. But encouraging as such examples may be, experience is not yet sufficiently favourable to this practice to allow it to bear a comparison in point of efficacy with the surgical operation, or to justify the general rejection of this last more certain means of cure. As Pelletan admits, Valsalva's treatment is extremely severe; the event of it doubtful; and should the plan fail, the patient might not be left in a condition to bear an operation, for the success of which it seems necessary that a certain strength of vascular action should exist, in order that the blood may be freely transmitted through such arterial branches as are to supply the places of the main trunk after it has been tied.

The time, therefore, has not yet arrived when surgical operations for the relief of aneurisms should be relinquished.—(*Clinique Chir. t.* 1, *p.* 114.)

The cure of popliteal aneurisms by means of compression is occasionally effected; but it happens too seldom to claim a great deal of confidence, or to lessen in any material degree the utility and importance of operative surgery in this part of practice. Pelletan records the cure of one popliteal aneurism by compression and absolute repose during eleven months (*t.* 1, *p.* 115); Boyer relates two instances (*Traité des Mal. Chir. p.* 204, *t.* 2); one is mentioned by Richerand *Dict. des Sciences Méd. t.* 2, *p.* 96); the practice of Dubois is said to have furnished several examples of

the same success (*vol. cit. p.* 97); and a case, in which Dupuytren effected a cure by compressing the femoral artery by means of an instrument applied just above the place where the vessel perforates the tendon of the triceps muscle, is detailed by Breschet.—(*Fr. transl. of Mr. Hodgson's work, t.* 1, *p.* 249, *&c.*)

The circumstances under which the employment of compression affords the best chance of success have been already mentioned, as well as the prudence of assisting this plan with perfect quietude, venesection, spare diet, and cold astringent applications, especially ice, which was first recommended by Donald Monro, and subsequently highly praised by Guerin.

Aneurisms in general, and among them the popliteal case, are all attended with some little chance of a spontaneous cure; yet this desirable event is too uncommon to be a judicious reason for postponing the operation, especially as it is the usual course of the disease to continue to increase; while in the early stage the cure may be more speedily accomplished. In fact, the experience of modern operators leaves no room for apprehending that the anastomoses will not suffice for the due nourishment of the leg, and consequently proves that waiting beyond a certain time for the enlargement of the collateral vessels to take place is altogether an unnecessary and disadvantageous method. Popliteal aneurisms, as well as other external tumours of the same nature, stand the best chance of a spontaneous cure, when any cause induces a general, violent, and deep inflammation all over the swelling; for then the communication between the sac and the artery is likely to become closed with coagulating lymph, and the pulsation of the tumour to be suddenly and permanently stopped. If in this state the disease sloughs, and the patient's constitution holds out, the coagulated blood in the sac and the sloughs are gradually detached, leaving a deep ulcer, which ultimately heals. An example, in which a popliteal aneurism was cured by such a process, is related in the *Trans. for the Improvement of Med. and Chirurgical Knowledge, vol.* 2, *p.* 268.

In former times, when all hopes of curing a popliteal aneurism by Valsalva's method, by compression, or a natural process, were at an end, amputation of the limb was considered as the sole and necessary means of saving the patient's life. But about fifty years ago, the confidence of surgeons in the sufficiency of the anastomosing vessels or the continuance of the circulation began to increase, and, in opposition to the tenets of J. L. Petit and Pott, experience soon proved, that in general, not only might the patient's life be saved, but his limb also, and this without any operation that could be compared with amputation in regard to severity. On looking back to the history of amputation, we shall find that A. N. Guenault was one of the earliest writers who disapproved of amputation as not truly indispensable for the cure of popliteal aneurism.

It is alleged that Teislere, Molinelli, Guattani, Mazotti, and some other celebrated Italian surgeons, were the first who ventured to tie the popliteal artery for the cure of aneurism. The path, as Pelletan remarks, had been pointed out to them by Winslow and Haller, whose valuable descriptions and plates of the arterial anastomoses about the knee-joint, showed by what means the lower part of the limb would be nourished, after the ligature had been placed on the principal arterial trunk. For almost thirty years, however, the practice of tying the popliteal artery was confined to the Italian surgeons. Pelletan believes that he was the first who attempted such an operation at Paris nearly thirty years ago (alluding to about the year 1780, the Clinique Chirurgicale being dated 1810).

However, this operation of opening the tumour and tying the popliteal artery itself, was a severe and often fatal proceeding, and does not admit of being compared with the Hunterian operation, in point either of simplicity, safety, or success, as I shall explain, after the detail of a few particulars relating to the popliteal aneurism.

On whatever side of the artery the tumour is produced, it can be plainly felt in the hollow between the hamstrings, and in general its nature is as easily ascertained by the pulsation in every part of the tumour. Though the disease may not occur in the popliteal artery so often as in the aorta itself, it certainly is seen more frequently in the former vessel than any other branch which the aorta sends off. As Sir E. Home has observed, this circumstance has never been satisfactorily explained; and, what is rather curious, in many recent instances of this disease the patients have been coachmen and postillions. Morgagni found aneurisms of the aorta most frequent in guides, postboys, and other persons who sit almost continually on horseback; a fact, which he imputes to the concussion and agitation to which such persons are exposed. Some allusion to this subject has already been made in the foregoing pages. Whether an explanation of the frequency of popliteal aneurisms can be correctly referred to the obstruction which the circulation in the artery must experience when the knee is in a state of flexion, may be questioned, though it is on a similar principle that the great frequency of aneurisms of the curvature of the aorta is attempted to be solved.—(*Home in Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 1, *&c. and Monro in Ed. Med. Essays, vol.* 5.)

Were this the only, or even the principal cause, surely one would have reason to expect aneurisms to be at least as frequent in the axilla, and in the bend of the elbow, as in the ham.

The popliteal aneurism was generally supposed to arise from a weakness in the coats of the artery, independently of disease. If this were true, we might reasonably conclude, that except at the dilated part the vessel would be sound. Then the old practice of opening the sac, tying the artery above and below it, and leaving the bag to suppurate and heal up, would naturally present itself. As the arterial coats were found to be altered in structure higher up than the tumour, and the artery immediately above the sac seldom united when tied, but, when the ligature came away, the patient was destroyed by hemorrhage, Mr. Hunter concluded, that some disease affected the coats of the vessel before the actual occurrence of aneurism. Dissatisfied with Haller's experiments on frogs, showing that weakness alone could give rise to aneurism, he tried what would happen in a quadruped, whose vessels were very similar in structure to the human. Having denuded above an inch of the carotid artery of a dog, and removed its external coat, he dissected off the other coats, layer after layer, till what remained was so thin, that the blood could be seen through it. In about three weeks the dog was killed, when the wound was found closed over the artery, which was neither increased nor diminished in size.

It being conjectured that the prevention of aneurism, perhaps arose from the parts being immediately laid down on the weakened portion of the artery, Sir E. Home stripped off the outer layers of the femoral artery of a dog, placed lint over the exposed part of the vessel to keep it from uniting to the sides of the wound, and in six weeks killed the animal and injected the artery, which was neither enlarged nor diminished, its coats having regained their natural thickness and appearance.

These experiments strengthened Mr. Hunter's belief that aneurismal arteries are diseased; that the morbid affection frequently extends a good way from the sac along the vessel; and that the cause of failure in the old operation arose from tying a diseased artery, which was incapable of uniting before the ligature separated. These reflections led him to propose taking up the artery in the anterior part of the thigh, at some distance from the diseased portion, so as to diminish the risk of hemorrhage, and be enabled to get at the vessel again in case it should bleed. The stream of blood into the sac being stopped, he concluded that the sac and its contents would be absorbed, and the tumour gradually disappear, so as to render any opening of it unnecessary.

[Dr. David Hosack was the first surgeon who performed this operation in America, which he did successfully as early as 1808. Three cases of aneurism were cured by him, by the ligature of the femoral artery, and will be found reported in his valuable volume of "Essays on Medical Science," by which it will be seen, that this distinguished gentleman in the former part of his life was an operative surgeon of more than ordinary skill. He has since devoted his energies to teaching the theory and practice, and in the less ostentatious character of a general practitioner has acquired a reputation second only to Rush, with whom his name will be transmitted to posterity as among the most eminent in their profession in this or any other

country. He began his distinguished career as a surgeon, and, like many others, thus laid the foundation of professional distinction.—*Reese.*]

The first operation of this kind ever done was performed on a coachman by Mr. Hunter, in St. George's Hospital, December, 1785. An incision was made on the anterior and inner part of the thigh, rather below its middle, which wound was continued obliquely across the inner edge of the sartorius muscle, and made large in order to facilitate the performance of whatever might be necessary. The fascia covering the artery was then laid bare for about three inches, after which the vessel itself could be felt. A cut about an inch long was then made through the fascia, along the side of the artery, and the fascia dissected off. Thus the vessel was exposed. Having disengaged it from its connexions by means of the knife and a thin spatula, Mr. Hunter put a double ligature under it with an eye-probe. The doubled ligature was then cut, so as to make two separate ones. The artery was now tied with both these ligatures, but *so slightly as only to compress the sides together.* Two additional ligatures were similarly applied a little lower, with a view of compressing some length of artery, so as to make amends for the want of tightness, as it was wished to avoid great pressure on any one part of the vessel. The ligatures were left hanging out of the wound, which was closed with sticking plaster. On the second day, the aneurism had lost one-third of its size, and on the fourth, the wound was every where healed, except where the ligatures were separated. On the ninth, there was a considerable discharge of blood from the apertures of the ligatures, but it ceased on applying a tourniquet, and did not recur. On the fifteenth day after the operation, some of the ligatures came away, followed by a small quantity of matter; and about the latter end of January, 1786, the man went out of the hospital, the tumour having become still less. In the course of the spring, abscesses in the vicinity of the cicatrix followed, and some pieces of ligature were occasionally discharged. In the beginning of July, a piece of ligature about an inch long came away, after which the swelling went off entirely, and the man left the hospital again on the 8th, perfectly well, there being no appearance of swelling in the ham. This subject died of a fever in March, 1787; and on dissection, the femoral artery was found impervious from the giving off of the arteria profunda down to the place of the ligature, and an ossification had taken place for an inch and a half along the course of this part of the vessel. Below this portion the vessel was pervious, till just before it came to the aneurismal sac, where it was again closed. What remained of the sac was somewhat larger than a hen's egg, and it had no remains of the lower opening into the popliteal artery. The rest of the particulars of this dissection are very interesting.—(See *Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 1, *p.* 153.)

This celebrated case completely established the important fact, that simply taking off the force of the circulation is sufficient to cure an aneurism, as the tumour is afterward diminished and removed by the action of the absorbent vessels.

In order to confirm the same fact, Sir E. Home related a case of femoral aneurism which got well without an operation, but on a similar principle to what occurs when the artery is tied. A trial of pressure had been made without avail. The tumour became very large, and such inflammation took place in the sac and integuments that mortification was impending: no pulsation could now be felt in the tumour, or the artery above it. The correct inference of Sir E. Home was, that a coagulum, which we know always occurs in an artery previously to mortification, seemingly to prevent bleeding, had formed in this instance, and in conjunction with the effusion of coagulable lymph about the root of the aneurism, had kept the blood from entering the sac.

Mr. Hunter's second operation was on a trooper. Instead of using several ligatures, which were found hurtful, he tied the artery and vein with a single strong one; but unluckily the experiment was made of dressing the wound from the bottom, instead of attempting to unite it at once; and the event was, that the man died of hemorrhage.

After this case Mr. Hunter's practice was to tie the artery alone with one strong ligature, and unite the wound as speedily as possible.

Having recorded Mr. Hunter's cases, which first established the present method of operating for the cure of popliteal aneurisms, I shall not repeat the strong reasons which exist against the employment of reserve-ligatures; metallic compressors; two ligatures, with the division of the vessel between them; the interposition of pieces of linen, wood, cork, agaric, &c. between the knot and the vessel; the use of large ligatures; and other contrivances, the merits or rather demerits of which have been already fully considered in the preceding section. My next duty is, to explain the method of performing the Hunterian operation, as brought to its modern state of improvement, and adapted to the wise principles which first emanated from the valuable experiments and investigations of Dr. Jones.—(See *Hemorrhage.*)

In the arrangement of the assistants, one of them should be so placed, that if required, in consequence of any accidental wound of that vessel in the operation, he can compress the femoral artery as it passes over the brim of the pelvis: but, as Scarpa justly observes, no pressure of this kind is to be made, unless the accident referred to should happen, because the pulsations of the artery, inasmuch as they indicate the track of the vessel, must tend materially to facilitate the operation. The surgeon is to explore with his fore-finger the course of the artery from the crural arch downwards, and when he comes to the place, where the vibration of this vessel begins to be less distinctly felt, this point is to be fixed upon for the lower end of the external incision. This angle of the wound will fall nearly on the inner edge of the sartorius, just where this muscle crosses the track of the femoral artery, and at the very apex of the triangle formed by the convergence of the triceps and vastus internus. A little more than three inches above the place here fixed upon, the surgeon is to begin with a convex-edged bistoury the incision through the integuments and cellular substance, and carry the wound down the thigh in a slightly oblique line from without inwards, so as to make it follow the course of the artery, as far as the apex of the above-mentioned triangular space, or the point where the vessel passes under the inner edge of the sartorius muscle. In order to make this first external incision with correctness, I consider it a good rule always to take particular notice of the line described by the sartorius on the thigh, the inner margin of which muscle at the place where it meets the artery, as we have seen, forms at once the lower boundary of the incision, and an important guide to the vessel itself. By observing the track of the sartorius attentively, we shall likewise avoid all chance of making the wound too low down, so as to have this muscle intervening between the incision and the artery; a greater source of embarrassment in the operation, and of troublesome consequences afterward, than perhaps any other error; for when this has happened, and the surgeon has not room enough afforded by the higher part of the wound to get at the artery above the sartorius, he is compelled to dissect and raise up this muscle from its natural connexions, ere he can plainly discover the vessel. This inconvenience made a deep impression on me in the first case where I tied the femoral artery; for the intervention of the sartorius in a stout soldier upon whom the operation was done, threw me into the dilemma of either dissecting at the outer edge of this muscle, and drawing it inwards, or of enlarging the wound upwards. The latter proceeding was that to which I gave the preference, because it seemed to me an excellent maxim in this operation to avoid making any farther detachment of parts from their natural connexions than is absolutely necessary; and I knew that when the wound was extended a little higher up, the artery would present itself more superficially, quite unconcealed by any muscle whatever. Strongly, therefore, as my principles have led me to condemn Scarpa's modification of the ligature, his use of from four to six threads, and his interposition of a roll of linen between the knot and the vessel, I feel pleasure in expressing my conviction of one excellence in his mode of operating; an improvement which is now obtaining, if it has not already obtained, the universal approbation of the surgical profession. This amendment consists in making the incision in the upper third of the thigh, or a little higher than the place where Mr. Hunter used to make

the wound. Scarpa's reason for this practice is to avoid the necessity of removing the sartorius muscle too much from its position, or of turning it back, to bring the artery into view, so as to be tied. I have seen the best operators, even professors of anatomy, embarrassed by having the sartorius muscle immediately in their way after the first incision; and as the vessel is more superficial a little higher up, the place is farther from the diseased part of the artery, and there is no hazard of the anastomoses failing to keep up the circulation: this part of Scarpa's practice is highly deserving of imitation.

"The part of the limb (observes Mr. Hodgson) in which the femoral artery can be tied with the greatest facility, is between four and five inches below Poupart's ligament. The profunda generally arises from the femoral artery an inch and a half or an inch and three-quarters below Poupart's ligament; it very rarely arises so low as two inches. If, therefore, the ligature be applied to the femoral artery at the distance of four or five inches below Poupart's ligament, the surgeon will not be embarrassed by meeting with the profunda during the operation, and the chance of causing secondary hemorrhage, by tying the artery close to the origin of this vessel, will be obviated."—(*On the Diseases of Arteries, &c. p.* 434.)

The trouble arising from cutting too low down, so as to have the sartorius intervening between the outer wound and the artery, may be more accurately estimated, when it is known that Desault, for the removal of this inconvenience, considered it right actually to make a complete transverse division of that muscle, a thing which, it is said, may be done without any ill consequences.—(*Boyer, Traité des Mal. Chir. t.* 2, *p.* 145.) I shall not presume, however, to second this last piece of advice, because, though it may have been done by Desault, it appears to me that the artery can always be taken up very well without the proceeding here recommended.

A few years ago Mr. C. Hutchison published a tract, in which he is an advocate for the practice of making the incision at the outer edge of the sartorius, and then raising that muscle and drawing it inwards, in order to arrive at the artery. This advice proceeded from the apprehension that the plan of taking up the femoral artery at the inner edge of the sartorius was attended with risk of injuring the saphena vein and large lymphatics.—(*Letter on the Operation for popliteal Aneurism*, 1811.) The same method is commended by Boyer and Roux (*Nouveaux Elémens de Méd. Opératoire, t.* 1, *p.* 729), when the operation is done low down in the thigh. But as operating in this situation is liable to the several objections of approaching too near the disease, of aiming at taking up the artery where it lies more deeply than it does higher up, and of every inconvenience which may arise from the interposition, dissection, and reflection of the sartorius muscle, the method must be rejected, unless it can be proved that so many disadvantages are fully counterbalanced by other considerations. If the plan which I shall presently recommend be adopted, there will never be the slightest risk of wounding the saphena vein: and, therefore, I do not consider it advisable or necessary, for the avoidance of this accident, to make the wound *precisely upon the sartorius*, as my intelligent friend Mr. Hodgson suggests; a method attended with the inconvenience of having the fibres of that muscle between the external wound and the artery, and perhaps inconsistent with the excellent directions which he afterward delivers concerning the right mode of performing the external incision, when he says, with Scarpa, that this cut should be "continued down to the fibres, which form the inner margin of the sartorius."—(*On the Diseases of Arteries, &c. p.* 436.)

Now, if the point where this margin first lies over the artery be the proper place for the lower termination of the external incision, we shall clearly be deviating from the precise course of the vessel by letting the higher portion of the wound be over the fibres of that muscle. And when it is farther reflected, that the serious evils of wounding the trunks of the lymphatics in this operation are not demonstrated in modern practice, while the saphena vein may always be avoided with certainty and facility, I cannot admit, that there is any solid reason for letting the situation and direction of the external wound be determined by such apprehensions. At all events, for the motives above explained, it should be a fixed maxim in this operation never to extend the wound lower than the point where the inner margin of the sartorius crosses the artery: and then all detachment and displacement of this muscle will be unnecessary, and every embarrassment which might proceed from its interposition between the outer wound and the artery, will be completely avoided.

With the view of preventing injury of the femoral vein, Mr. Carmichael recommends the needle to be introduced on the pubal side of the artery, where the vein presents itself to view, and can be most easily avoided. He remarks, that the only part of the thigh from Poupart's ligament to the tendon of the triceps, in which the femoral vein is not completely covered by the artery, lies within the space which extends from Poupart's ligament to the point where the artery meets the sartorius muscle. At the part of this space most distant from Poupart's ligament, the vein begins to disclose itself at the pubal side of the artery, from beneath which it emerges more and more as it ascends. —(See *Trans. &c. of the Fellows, &c. of the King's and Queen's College of Physicians, Ireland, vol.* 2, *p.* 357.)

The skin and cellular substance are to be divided in the situation and to the extent above specified, down to the femoral fascia, under which the artery lies, and may be felt beating. The next object, therefore, is, to divide the fascia, which is here much thinner than at the outer side of the limb, and may be cut with another stroke of the bistoury; or (what is safer, with the view of abstaining from all chance of wounding the artery), a slight cut may first be made in the fascia, the division of which may then be made to the requisite extent by introducing under it a grooved director, on which the farther incision may be made with perfect security. The fascia is to be divided in the direction of the external wound; but to what extent, is a point on which surgical writers differ, and, indeed, they must here differ, as long as they are not unanimous about the method of applying the ligature round the artery; because if it be intended to use a broad ligature, with a cylindrical piece of linen interposed between it and the artery, or especially if it be designed to apply two ligatures and divide the vessel in the interspace, more of the artery must be exposed, and of course more of the fascia must be cut, than when it is simply meant to surround the vessel with a single small ligature. Such operators also as have contracted the pernicious habit of insulating the artery all round sufficiently far to let them thrust their fingers under it, will likewise require an extensive opening in the fascia. This detachment of the vessel for an inch or more, for the purpose of placing the finger under it, is a measure which deserves to be condemned in the strongest terms, as it is the very thing which produces some risk of injuring the saphena vein, and has a tendency to bring on secondary hemorrhage, inasmuch as it occasions unnecessary handling, stretching, and disturbance of the artery and surrounding parts, and an inevitable division of the vessels by which the arterial coats are supplied with blood.

According to Mr. Hodgson, the extent of the cut in the fascia should be about an inch; for he wisely avoids all unnecessary separation of the artery from its surrounding parts. On the contrary, Scarpa, who insulates and raises the vessel, previously to tying it, insists upon the prudence of cutting the fascia the whole length of the external wound; for, says he, if this practice be neglected, it most frequently happens, that in the succeeding inflammatory stage, the bottom of the wound swells and becomes very tense, and the matter which is formed under the fascia, not finding a ready exit, occasions abscesses which seriously retard the cure. But Scarpa, instead of planning a method of relieving the consequences, might have employed himself more to the purpose in considering how they were to be prevented, and why in his method they most frequently happen. Now, without laying any stress upon two waxed ligatures, each composed of six threads, with an additional extraneous substance, viz. a roll of linen, in the noose, we should be more surprised to hear that the wound after his method did not become affected with swelling, tension, and suppuration, than that these were the usual effects. After describing the division of the fascia, he observes: "*With the point of the fore-finger of the left hand, already touch-*

ing the femoral artery, the surgeon will separate it from the cellular substance, which ties it laterally and posteriorly to the contiguous muscles; and making the point of the same finger pass gradually under and behind the femoral artery (supposing the surgeon has not enormously large fingers), he will raise it alone from the bottom of the wound, or (when it cannot be avoided) along with the femoral vein. If it is along with the femoral vein, the surgeon, holding the artery and vein thus raised, and almost out of the wound, will cautiously separate the vein from the artery with a bistoury or spatula, or simply with his fingers," &c.—(See *Scarpa on Aneurism, p.* 280, *ed.* 2.)

When we combine the irritation and mischief of all this work with the ill effects of filling the bottom of the wound with soft lint, I would ask, what more certain plan could Scarpa or any other person have suggested for bringing on the unpleasant state of the wound which he describes as most frequently taking place!

I shall suppose the fascia has now been divided, under which the surgeon distinctly feels the pulsations of the femoral artery, which is still invested by the cellular sheath. The femoral vein lies directly under this vessel, while the branches of the anterior crural nerve, separated from it by dense cellular substance, are more externally, yet somewhat more deeply situated. The next object, therefore, is to pass a single ligature round the artery, without including, or in any manner meddling with, the subjacent femoral vein, or detaching and disturbing the artery. For this purpose the best direction is that given by my friend Mr. Lawrence, especially when combined with Mr. Carmichael's plan of letting the needle be introduced on the pubal side of the artery: "after dissecting down to the artery, a slight scratch or incision may be made through the sheath, close to the side of the vessel. Then, with a narrow aneurism-needle, nearly pointed at the end, and made as thin at its edge as it can be without cutting, a single silk ligature is to be conveyed round it, the point of the needle being kept in contact with the artery. A needle of this form makes its way easily through the cellular substance, and the vessel is detached only in the track of the instrument."—(See *Med. Chir. Trans. vol.* 6.)

Of the kind of ligature to be employed, I need only say here, that it should be a single one composed of firm materials, in order to avoid the necessity for increasing its diameter more than would be desirable for reasons elsewhere considered.—(See *Hemorrhage* and *Ligature.*) The ligature having been put under the artery, one end of it is to be drawn completely through the track made for it by the needle, which instrument is then to be taken away, leaving the ligature under the vessel. The ligature is now to be tied in a steady, firm manner, but without any immoderate force, which can never be necessary even for the division of the inner coats of the vessel. In this part of the operation, a few practitioners give the preference to what is termed the *surgeon's knot*; and commend this plan of fastening the ligature; a plan which consists in putting the end of the cord twice through the noose, before the constriction is made. The only good of the surgeon's knot is, that it does not so readily slip and loosen as a common one; but Scarpa thinks a simple knot best, as it does not, like the other, prevent the surgeon from calculating the force with which the artery is constricted.—(*On Aneurism, p.* 281, *ed.* 2.) And besides this reason against the surgeon's knot, another objection to it is the irregularity with which a ligature in this form will lie round the vessel. A simple noose should therefore be first made and tightened, and then a second one, so as to form a common knot; and now, as a matter of precaution against the possibility of the ligature slipping and becoming loose, the surgeon, if he pleases, can tie the knot once again. One end of the ligature is next to be cut off near the knot; and the sides of the wound are to be brought together with strips of adhesive plaster, the irritation of sutures being carefully avoided. The remaining end of the ligature should always be brought out at the nearest point of the external wound to the knot on the artery.

The effects which in general immediately follow the operation are, a total cessation of the pulsation of the aneurismal tumour; a manifest sinking and flaccidity of the swelling; a diminution of pain in the seat of the disease; and a strong vibration of the articular arteries round the knee. As Mr. Hodgson has remarked, the unusual influx of blood into the minute ramifications, when a main artery is suddenly rendered impervious, is generally attended with a remarkable increase in the temperature of the limb. After tying the femoral artery for the cure of popliteal aneurism, the same phenomenon occurs, at least after a short time, during which the temperature of the leg and foot frequently continues lower than that of the sound limb. But in a few hours it generally rises, and is sometimes several degrees higher than that of the opposite member. This state lasts several days, at the end of which time, the heat of the limb which has been operated upon will be found to be about the same as that of other parts of the body.—(*Hodgson on Diseases of Arteries, &c. p.* 256.) It is only while the limb is colder than natural, that it ought ever to be fomented or covered with flannel. In particular examples, there is no increase of temperature in the limb, at any period after the operation; a fact which Mr. Hodgson refers to the probability of a collateral circulation having already been established, in consequence of the obstruction to the passage of the blood through the main artery by the accumulation of the coagulum in the aneurismal sac. Of course, unless a collateral circulation be established, the operation cannot succeed, as the limb will mortify; it behooves us, therefore, to be aware of the circumstances which may prevent the due transmission of the blood to the inferior part of the limb. These are ably explained and commented upon in Mr. Hodgson's work: 1st, An extensive transverse wound, by which the principal anastomosing branches are divided. 2dly, Tight bandages and pressure operating so as to obstruct the same vessels. 3dly, The immense bulk of the tumour, and the pressure upon the principal collateral arteries. 4thly, Calculous depositions in the coats of the arteries of the limb. 5thly, Advanced age. 6thly, A languid state of the circulation; a fact indicating the wrongness of venesection, as a general practice after the operation, though it may yet be right to adopt this treatment, where the pulsations return in the tumour with unusual strength, and appear to stop the diminution of the swelling, as already mentioned. 7thly, The abstraction of heat from the limb by cold evaporating lotions; a plan which can only be right when there is a great increase of heat in the limb, a tendency to inflammation, or a return of strong pulsations in the tumour.

Sir Astley Cooper saw a case, in which the application of whitewash occasioned mortification and the patient's death. In cold weather, he always covers the limb with flannel or a stocking, and sometimes puts jars filled with hot water to the feet.—(*See Lancet, vol.* 2, *p.* 42.)

When the operation is done according to the principles laid down in this article, the patient is not too old, nor enfeebled, and the after-treatment is properly conducted, mortification cannot now be said to be a frequent event. In one case, operated upon by Sir Astley Cooper in 1823, the whole of the foot and part of the leg mortified; but it should be noticed, that in this instance the whole limb was extremely swollen previously to the artery being taken up.—(See *Lancet, vol.* 1, *p.* 436.) In all his extensive practice, he has seen but three or four instances of a failure of the operation from gangrene.—(*Lectures, &c. vol.* 2, *p.* 60.) Mr. Liston has related one example which he ascribed to the improper use of fomentations with hot salt water.—(See *Edinb. Med. Journ. No.* 90, *p.* 3.) As, however, the patient seems to have been of a very phlogistic diathesis, and to have been attacked with inflammation of other parts, the reality of the alleged cause appears questionable. I have seen but one example of gangrene, and in that, only one toe, and a portion of the skin of the instep, sloughed in a very debilitated subject. This partial gangrene of the foot has been particularly noticed by Deschamps and Scarpa, the latter of whom regards it as an unusual thing, only likely to happen in old, weak, or unhealthy subjects; and "at any rate (says he) if this should happen in any of these enervated individuals, the patients may console themselves for the loss of one or two of their toes, with the cure of a popliteal aneurism, and the avoidance of a painful and dangerous incision in the ham, and of the tedious suppuration which would have followed it."

Sir Ast. Cooper has known retention of urine brought on by the operation in one or two examples, and the use

of the catheter indispensable.—(*Lectures, &c. vol.* 2, *p.* 58.) Mr. C. Bell met with a case in which the femoral artery divided below the profunda into two equal branches, the most superficial of which was alone noticed and tied in the operation. The patient died of constitutional disturbance, arising from inflammation in the whole course of the sartorius. After two or three days, the pulsation of the tumour, which had been very strong, ceased, in consequence of the coagulation of the blood within the sac; another fact, exemplifying that this desirable change will not be prevented by a current of blood being still propelled through the aneurismal cavity.—(See *Quarterly Journ. vol.* 3, *p.* 607.)

Mr. Liston has recorded a case, in which the pulsasation and tumour returned several months after the operation. "On consulting with Dr. Thomson, it was agreed to try the effect of methodical bandaging, from the points of the toes upwards, and a compress over the tumour, with rest, cold applications, and moderate diet." These means had the desired effect; and the patient did not complain much of those pains which so frequently remain after the operation for aneurism.

According to Mr. Liston, these pains are in general distinctly referable to the sacro-ischiatic nerve and its branches, and are explained by the state of the vessels in the substance of the nerve. In the natural state the neurilemal vessels, when injected, are not larger than sewing threads: but when the enlargement of the collateral branches is requisite, owing to the obstruction of the trunk, they also are called on to contribute their share in the new circulation; and they become enormously distended. In one remarkable specimen, in which the limb was injected and examined fifteen years after the superficial femoral atery had been secured for aneurism in the ham, the vessels in the sacro-ischiatic nerve had attained the size of crow-quills, and were convoluted in an extraordinary manner. The pains in the limb, noticed by Mr. Liston as occurring after the operation, he acknowledges, however, are by no means so severe as those experienced previously, and which are produced by the compression and stretching of the nerves by the sac.—(*Edin. Med. Journ. No.* 90, *p.* 2.)

When the operation succeeds, a considerable portion of the artery above the aneurismal tumour is rendered impervious, the vessel indeed being sometimes converted into a solid cord from the origin of the profunda to that of the tibial arteries.—(*A. Cooper, Med. Chir. Trans. vol.* 2, *p.* 254.) In general, however, the obliteration of the artery is less extensive; a fact particularly noticed in one of Mr. Hunter's cases (*Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, vol.* 1, *p.* 153), and vainly urged by Deschamps, as a proof of the insufficiency of the new method.—(See *Observations et Réflexions sur la Ligature des principales Artères blessés, et particulièrement sur l'Aneurisme de l'Artère poplitée, p.* 76, *Paris*, 1797.) It appears from the observations of Mr. Hodgson, that the artery generally becomes impervious, for the space of three or four fingers' breadth, at the place where the ligature is applied; below which part its tube is unclosed, and continues so for some distance, when the obliteration again commences, and descends along a considerable extent of the popliteal artery to the origin of the inferior articular, or tibial arteries. Thus, says this author, an insulated portion of the femoral artery preserves its cavity, from each extremity of which considerable anastomosing branches arise; the upper branches convey blood into the vessel, and the lower transmit it into anastomosing channels, that originate below the knee. —(*On Diseases of Arteries, &c. p.* 278.) Now, as Mr. Hodgson is unacquainted with any case, except that recorded by Sir Astley Cooper, where, after the modern operation, the artery was obliterated from the seat of disease in the ham to the part at which the ligature was applied, he thinks it probable that, in most instances, a double collateral circulation exists in the limb, after this method of cure.

In consequence of the motion of the blood being more or less impeded in the aneurismal sac by the application of the ligature to the femoral artery, the aneurismal cavity soon becomes completely filled with coagula, which even block up the adjoining portion of the arterial tube. The coagulated blood in the sac is afterward absorbed; and a gradual diminution and final disappearance of the aneurism in the ham ensue; with the exception of a slight induration, which sometimes remains, composed of a remnant of the sac itself, or of the fibrous part of the blood. This slight hardness in the cavity of the ham occasions no inconvenience, and does not hinder the patient from performing the motions of the knee and leg with quickness and safety.—(*Scarpa, p.* 257, *edit.* 2.)

After the operation, the circulation is carried on principally by the arteria profunda, whose branches communicate with the articular arteries of the popliteal, and with arteries sent to the knee by the anterior and posterior tibial. Large branches in the sciatic nerve, sent off by the arteria profunda, communicate very freely with the popliteal artery, the articular, and branches of the posterior tibial. As Sir Astley Cooper has farther explained, the freedom of anastomosis sometimes leads to a reproduction of an aneurism. The femoral artery was tied by Mr. Key, and the patient, after being discharged cured, returned with a painful tumour in the ham, attended with an obscure pulsation. The limb was amputated, and a large artery, passing to the tumour, and situated nearly in the usual place of the femoral, required a ligature.—(*Lectures, &c. vol.* 2, *p.* 60.)

When the advantages of the foregoing method of operating are contrasted with the dangers and severity of the practice of laying open the aneurismal tumour, and applying ligatures round the diseased part of the vessel, it is surprising to find any living surgeons still expressing a preference to the latter mode of treatment under any circumstances whatsoever. Yet Boyer, Roux, and a few of the modern French surgeons, are in this way of thinking, which reminds me of their slowness to adopt, at every opportunity, union by the first intention, one of the greatest and most decided advances to perfection ever made in the practice of surgery. The severity and difficulties of the old method of operating, in cases of politeal aneurism, are most faithfully depicted by Scarpa. In the ham, says he, the artery lies very deep. The space is limited and narrow, within which it can be brought into view and tied, without risk of tying along with it, or of destroying, some of the principal anastomoses formed by the articular arteries of the knee. On account of the depth of the artery, it is difficult to pass any instrument round it, without including other parts; and it is no less difficult to draw the ligature on the vessel with a proper degree of tightness. Scarpa then comments on the disadvantages of tying the lacerated, diseased part of the vessel, which is sometimes so high up, that, in order to apply the ligature above it, it is necessary to cut through the long head of the triceps, and make a passage through into the thigh. Or, the diseased or lacerated part of the artery is situated so low down in the calf of the leg, that it is impossible to avoid including, either in the incision or the ligature, the lower anastomosing articular arteries, on the preservation of which the circulation and life of the subjacent part of the limb in a great measure depend. We must add to all this the violence unavoidably done to the great sciatic nerve, which an assistant must hold drawn to one side of the wound nearly the whole time of the operation. The proceeding is also liable to other great difficulties, as may be seen from a case reported by Masotti (*Dis. sul Aneurysma, p.* 54), where the popliteal artery was so firmly united, and, as it where, confused with the vein, the nerve, the tendons of the neighbouring muscles, and the periosteum, that the cavity of the ham presented the appearance of an intricate mass of parts, not easily separable from one another. Lastly, the operation leaves a large deep wound, laying open the whole cavity of the ham, and followed by copious suppuration, sinuses and necrosis of the heads of the femur and tibia. If the patient be not hurried into the grave by these affections, and even if the parts in the ham heal, he is almost always left with an incurable contraction of his knee, and perpetual lameness. Thus, Masotti (*Op. cit. p.* 17) relates one case, where the subsequent effect caused such destruction of the soft parts in the ham, that not a vestige of artery, vein, or sciatic nerve was left, and the patient remained all the rest of his life with a paralytic leg, and ulcers and fistulæ all round the knee.—(*Scarpa on Aneurism, p.* 251.)

I shall now advert to a few facts in the history of surgery, which eventually led to the bold and successful operations adopted in modern times for the cure of aneurisms of the femoral and popliteal arteries. The earliest case of which the particulars are recorded, amounting to a satisfactory proof that the lower extremity might be duly supplied with blood, notwith-

standing the femoral artery had been tied high up in the thigh, is the example related by M. A. Severinus of a false aneurism of the thigh, about eight fingers' breadth below the groin, caused by a musket-ball wound. In this instance, Severinus tied the femoral artery above and below the aperture in it, and not only was the patient's life saved, but the use of the limb also preserved.—(*Chirurgiæ Efficacis, p.* 2, *Enarratoria.*) The next authentic case of the ligature of the femoral artery, is that reported by Saviard, where Bottentuit, in 1688, tied this artery on account of a false aneurism, the result of a sword-wound, at the inner and upper part of the thigh. The surgeons called into consultation were immediately convinced, that the only thing to be done was to take up the femoral artery; but they were fearful lest the patient should perish of bleeding ere the opening in the vessel could be found; and in case the artery were secured, they apprehended the obstruction of the circulation would be followed by mortification of the limb. The patient was therefore first prepared for his fate by the administration of the sacrament. A band was then applied round the upper part of the limb, and tightened by means of a stick with which it was twisted, a piece of pasteboard being put under the knot, in order to render the constriction less painful. The tumour was then opened, the clotted blood extracted, and the opening in the artery detected by slackening the tourniquet. A curved needle, armed with a double ligature, was then introduced under the femoral artery, and one of the cords was tied above, and the other below the wound in the vessel. Then follows a curious passage, showing the operator's judgment at that time, respecting the impropriety of interposing any cylinder of linen between the knot of the ligature and the artery, as some of the old surgeons at that time used to do, as well as a few of the moderns. "*On ne mit point de petites compresses sur le corps de l'artère au-dessus du nœud, comme font quelques uns, parceque l'on jugea qu'il étoit d'une grande conséquence de lier très-étroitement une artère si considérable, ce que l'on n'auroit pas été sûr de faire en interposant la petite compresse,*" &c. For greater security, assistants who relieved each other in turn kept up constant pressure on the tied part of the vessel for twenty-four hours. In six weeks, the patient recovered, and afterward enjoyed such good health that he went through several campaigns.—(*Saviard, Nouveau Recueil d'Observations Chir. Obs.* 63, 12*mo. Paris*, 1702.)

Now, with respect to these two cases, it merits attention, that though Heister, Morgagni, and others, endeavoured to explain the success, by supposing that each of the patients in question must have had two femoral arteries, both Severinus and Saviard were wise enough to avoid making any such erroneous inference themselves. At a later period, Guattani laid bare the femoral artery, as it passed under Poupart's ligament, compressed it against the ramus of the pubes, by means of graduated compresses retained with a firm roller, and thus obtained the speedy obliteration of the vessel, and cured the aneurism, which had been first injudiciously opened.—(*De Externus Aneurismatibus, Hist.* 15, 4*to. Romæ*, 1772.) In the same book is given the case of an inguinal aneurism, which, when it had continued three months, and become equal in size to a large fist, was attacked with gangrene, whereby the aneurismal sac was quickly destroyed, and the femoral artery was obliterated for a considerable extent from the crural arch downwards. The sloughs were thrown off, however, and the ulcer had in a great measure healed, when the patient fell a victim to debility.—(*Hist.* 17.) Here it is to be remarked, that during the five weeks this man lived after the obliteration of the femoral artery above the origin of the profunda, not only the circulation and life of the whole limb were preserved, but the auxiliary arteries, coming from within the pelvis, proved capable of limiting the progress of the mortification of the parts round the aneurism, and of commencing the healing process in a manner which raised great hopes of a cure. A similar fact is also recorded by Dr. Clarke.—(*Duncan's Med. Comment. vol.* 3.)

[In cases of aneurism in the thigh, it is not always practicable to decide with absolute certainty whether the disease is situated in the femoral artery, or in the *profunda*; and even when it obviously originates with the former, the latter is often deeply involved, particularly when the disease has been of long standing. Many unsuccessful cases have been reported; and I know of one which has failed in the hands of a distinguished surgeon, the aneurismal tumour still remaining, although the femoral artery was tied above the tumour. In this case the disease is no doubt seated in the profunda.

Many surgical writers and teachers have inculcated the doctrine, that when the aneurism is situated in the thigh, the ligature must always be applied *below* the bifurcation, lest the circulation of the limb should suffer. A distinguished surgeon of Philadelphia, preferred opening the sac of a femoral aneurism, and applying his ligature below the profunda, rather than venture to tie the artery higher up. The operation failed, however, and the tumour still remains. That such fears are wholly groundless, may be confidently asserted from analogy, furnished as we are with the knowledge that the innominata, the common iliac, and even the aorta itself, may be obliterated, and yet the anastomosing vessels continue the circulation. But Dr. Whitridge, an accomplished surgeon of Charleston, S. C., has afforded a demonstration in a case of aneurism in the thigh from a gun-shot wound, in which he tied the femoral artery just below Poupart's ligament, and of course above the point at which the profunda goes off. This case has been completely successful, and the patient recovered without any sensible interruption in the circulation, and without any untoward symptom.

The cases in which the femoral artery divides high up, which Professor Godman has shown are by no means unfrequent, may account for the occasional failures of this operation, and should not be lost sight of by the judicious surgeon. As a general rule, however, applicable to all other cases, when the aneurism is situated immediately below the bifurcation, and in the vicinity of the profunda, it is safer, and also better surgery, to apply the ligature above. The action of the profunda may endanger the success of the operation, and the most profound surgeon may sometimes mistake the seat of the disease.—*Reese.*]

These and other cases which might be quoted, furnished ample proof of the efficiency of the anastomosing vessels in the support of the limb, though the femoral artery had been tied, or obliterated in a very high situation.

Besides these facts, surgeons derived every encouragement to attempt the cure of popliteal aneurism, by the ligature of the artery above the tumour, from the elucidations given by Winslow and Haller concerning the numberless inosculations which exist between the upper and lower articular arteries. Haller even drew the conclusion, that if the course of the blood were intercepted in the popliteal artery, between the origins of the two orders of articular branches, such anastomoses would suffice for carrying on the circulation in the leg. And at length, Heister, weighing the anatomical observations of Winslow and Haller, and the facts recorded by Severinus and Saviard, first proposed applying to popliteal aneurisms an operation, which, with the exception of those two cases, had until his time been restricted chiefly to aneurisms of the brachial artery.—(*Dis. de Genuum Structurâ eorumque Morbis. Disp. Chir. Halleri, t.* 4.)

It was in Italy that the earliest operations were undertaken for the cure of popliteal aneurisms, by Guattani, or rather by a German surgeon named Keysler, as would appear from a letter written by Testa to Cotunni.—(See *Pelletan, Clinique Chir. t.* 1.) The success obtained by those surgeons soon led others to imitate them, and by degrees, the practice of tying the femoral artery became common both in cases of aneurism and wounds; and from the observations of Heister (*Haller Disp. Chir. t.* 5), Acrell (*Murray de Aneurysm. Femoris*), Leslie (*Edin. Med. Comment.*), Hamilton (*B. Bell's Surgery, vol.* 1), Burschall (*Med. Obs. and Inq. vol.* 3), Leber (*Dehaen, Ratio Medendi, t.* 7), and Jussy (*Ancien Journ. de Méd. t.* 42), it was proved beyond the shadow of a doubt, that the circulation might continue in the limb after the obliteration of the femoral artery, whether such obliteration were effected by direct pressure or the ligature.

The exact period when the first operation of laying open the tumour and tying the popliteal artery was performed in England, is not, as far as I know, particularly specified. However, judging from the observations made on this practice in the writings of Pott

(*Remarks on Palsy, &c.* 8vo. *Lond.* 1779), of Wilmer (*Cases and Remarks in Surgery*, 8vo. *Lond.* 1779), of Kirkland (*Thoughts on Amputation*, 8vo. *Lond.* 1780), and of others, it is clear that this method of treatment had been often done in this country earlier than the dates of those works, and as would appear with little or no success. The earliest attempt of this kind in France was made by Chopart in 1781 (*Roux, Nouveaux Elémens de Méd. Opératoire, t.* 1, *p.* 556), about five-and-twenty years after the examples set by Guattani in Italy; but Chopart failed in his endeavours to repress the bleeding from the exposed cavity of the tumour, and was therefore obliged to amputate the limb. Subsequently to this attempt, the operation was undertaken by Pelletan in two instances, the terminations of which were successful: consequently, this surgeon may be regarded as entitled to the honour of having proved to his countrymen the possibility of curing the popliteal aneurism, by laying open the tumour, and securing the artery in the ham.

The severity and frequent ill success of this method of operating I have already noticed, nor shall I repeat the objections to it. With respect to the Hunterian practice, the great peculiarities of which were tying the artery at some distance above the disease, and not opening the swelling at all, Richerand seems offended that Hunter's name should be affixed to an operation, which he conceives was in reality the invention of Guillemeau. Here we observe, Ætius again puts in a prior claim, and with much more effect, because the method of which he speaks truly resembled Mr. Hunter's, inasmuch as the vessel is directed to be tied at some distance above the swelling, while Guillemeau only tied the artery close above the disease, and *opened the swelling, a serious deviation from the Hunterian practice.*

Guillemeau, a disciple of Ambrose Paré, having to treat an aneurism at the bend of the arm, the consequence of bleeding, exposed the artery above the tumour, tied this vessel, then opened the sac, took out the coagulated blood, and dressed the wound, which healed by suppuration. After more than a century, Anel, on being consulted about a similar case, tied the artery above the swelling, which was left to itself. The pulsation ceased, the tumour became smaller, and hard, and after some months no traces of the disease were perceptible.

In 1785, Desault operated in the same manner for a popliteal aneurism: the swelling diminished by one-half, and the throbbings ceased; on the 20th day it burst, coagulated blood and pus were discharged in large quantities, and the wound, after continuing a long time fistulous, at length healed. Towards the end of the same year, says Richerand, Hunter applied the ligature somewhat differently; instead of placing it close to the swelling, or directly above it, he put it on the inferior part of the femoral artery.—(See *Nosogr. Chir. t.* 4, *p.* 98, 99, *edit.* 2.)

Unquestionably, Anel did, in one solitary instance, tie the humeral artery immediately above an aneurism at the bend of the arm, and effected a cure without opening the swelling (*Suité de la Nouvelle Méthode de guérir les fistules lachrymales, p.* 251, *Turin*, 1714); but he did not think of applying the plan to the femoral artery, or draw the attention of French surgeons sufficiently to the matter, to make them imitate this operation: on the contrary, the method fell into oblivion, and was never repeated. With regard to Desault's operation, said to have been done in an earlier part of 1785 than Mr. Hunter's first operation, it is only necessary to say, that Desault tied the popliteal artery itself, while the grand object in Mr. Hunter's method was to take up the femoral artery, at a distance from the disease, and that it is this last mode alone which has gained such approbation, and been attended with unparalleled success.

The French surgeons have not practised the Hunterian operation with the same degree of success with which it is now performed in England, and consequently they very commonly pursue the old method of opening the sac, &c. Even Boyer avers his relinquishment of what he calls Anel's plan.—(*Traité des Mal. Chir. t.* 2, *p.* 148.) But we shall not be surprised at their ill success, when we hear that they neglect the right principles on which ligatures ought to be applied to arteries, as explained by Dr. Jones in his work on hemorrhage. Even Baron Dupuytren adheres to the use of ligatures of reserve; and Boyer applies four loose ligatures round the artery, besides two tight ones; and consequently, a large portion of the vessel lies separated from its natural connexions, and irritated by these extraneous substances. Hunter's first operation nearly failed also on account of so many ligatures, none of which were tightened so as to cut through the inner coats of the artery, and thus promote its closure. —(See *Hemorrhage.*) With reference to the operation of popliteal aneurism, *Rosenmuller's Chir. Anat. Plates* deserve to be consulted, *Part* 3, *Tab.* 8 & 9. Scarpa's and Tiedemann's matchless engravings, and Haller's Icones should likewise be examined.

ANEURISMS OF THE LEG, FOOT, FOREARM, AND HAND.

Doubts were not long ago entertained respecting the possibility of curing an aneurism at the upper part of the calf of the leg by tying the femoral artery in the middle of the thigh.—(*Instituto di Ital. Scienze ed Arti, vol.* 1, *parte* 2, *p.* 266.) The author here referred to was led by this uncertainty to have recourse in one instance to the severe method of laying open the tumour, in order to get at the vessel lower down. On this case, Scarpa makes some correct reflections: the operator (says he) assured himself, that, *on compressing the femoral artery at the upper part of the thigh, the tumour at the top of the calf ceased to pulsate; and that, when the compression was continued for some time, the swelling partly disappeared, and became softer.* It ought to have been evident, therefore, that the aneurism might have been cured by tying the trunk of the femoral artery, as described in the foregoing section. In Scarpa's work is a case in which an aneurism at the bifurcation of the popliteal artery was cured by the ligature of the femoral artery. —(See *p.* 451, *ed.* 2.) Mr. Hodgson has seen three aneurisms situated at the commencement of the tibial arteries, cured by the same operation.—(*On Diseases of Arteries, &c. p.* 437.) But, as Scarpa remarks, though the Hunterian operation answers in the cure of aneurism in the bend of the arm, and at the upper part of the calf of the leg, it is not so effectual for aneurisms situated on the back or palm of the hand, or the dorsum or sole of the foot. The free communication which the ulnar and radial arteries keep up with each other in the hand, and the tibial arteries have have in the foot, prevent the operation from succeeding whether the brachial or femoral artery, or one of the two large arteries of the forearm or leg, be tied. In proof of this statement, Scarpa cites two cases of aneurism seen by himself; one on the instep, the other in the sole of the foot; and a third case of the same disease in the latter situation; all of which were found to be incurable by the ligature of the anterior tibial artery. —(*P.* 311.) He thinks, however, that the operation of tying this vessel where it passes over the dorsum of the foot might succeed, if aided by compression, applied so as to stop the current through the other main channel; and he seems to approve of this practice, because the plan of tying the artery above and below the disease (which is the most certain means of cure) could not be done, without extensive incisions in the sole of the foot. In an aneurism at the lower part of the leg, Mr. Hodgson judiciously insists upon the prudence of tying the artery, as near as possible to the tumour, because the recurrent circulation through the large inosculations in the foot might still cause the swelling to enlarge, in consequence of the blood sent into the sac from the lower extremity of the vessel, passing through the aneurismal cavity into branches arising from the artery between the aneurism and the ligature.—(*P.* 438.) However, in one case of aneurism of the anterior tibial artery, Mr. H. Cline applied a ligature just above the tumour without success, and Sir Astley Cooper expressly recommends making an incision in the sac, and applying a ligature both above and below the swelling.—(*Lectures, &c. vol.* 2, p. 63.) When an aneurism arises from the radial, ulnar, or interrosseous arteries near the elbow, tying the brachial will suffice; but if the disease be lower down, the vessel from which it proceeds must be taken up near the swelling.—(*Hodgson, p.* 393.) A case, strikingly illustrative of this truth is recorded by Mr. Liston. J. M. P., aged 19, applied to him on the 28th of July, on account of an aneurism of the left radial artery, about the middle of the forearm, occasioned by a wound. The tumour was as large as a walnut, and so compressible, that it could

easily be made to disappear. Pressure was tried at first, with apparent benefit; but as it did not succeed, the humeral artery was tied on the 8th of August, and with the effect of completely removing the tumour. On the eighteenth day afterward, however, a small slough was detached from the cicatrix, and about three o'clock next morning, a violent hemorrhage took place. Mr. Liston then deemed it necessary to lay open the sac, and tie the artery above and below the wound in it.—(See *Edinb. Med. Journ. No.* 90, *p.* 4.)

Scarpa mentions a case, where the dorsal artery of the thumb was wounded; but as the hemorrhage returned several times, and pressure failed in suppressing it, the surgeon took up the radial artery at the wrist. After cutting off this direct current of blood towards the injured vessel, pressure on the wound proved effectual. Three months afterward, the patient having died, the radial artery was found impervious for three fingers' breadth below where the ligature had been applied, and the dorsal artery was likewise obliterated from the root of the thumb to the beginning of the palmar arch.

Mr. Todd has published a case in which he cured a large aneurismal swelling of the posterior side of the forearm, by tying the brachial artery. From the description, I conclude that the disease was an aneurism by anastomosis, as it is termed; but the particulars given by the author leave us in doubt on this point.—(See *Dublin Hospital Reports, vol.* 3, *p.* 135.)

The manner of exposing and tying the principal arteries of the leg and forearm, will be described under the term *Arteries*.

OF ANEURISMS HIGH UP THE FEMORAL ARTERY.

Several facts already specified in the preceding columns as having occurred many years before the operation of tying the external iliac artery was attempted, amounted to a full proof, that the circulation might go on in the lower extremity notwithstanding the artery in the groin were tied or obliterated. On this point, some of Guattani's cases were most decisive.

The ligature of the external iliac artery, for aneurisms of the femoral artery in the bend of the groin, has now been practised so frequently, and the instances of success are so numerous, that all doubt concerning the propriety and utility of the attempt has entirely ceased. The French, who have evinced great backwardness in espousing the Hunterian method of operating for aneurisms, though it is decidedly one of the greatest improvements in modern surgery, have also shown great reluctance even to believe, much less to practice, the operation of tying the external iliac artery. A Parisian surgeon, however, who was in London a few years ago, saw the thing done, and the eyes of his brethren in the capital of France have since been a little more open. Still, as Roux remarks, "We cannot but blame the indifference with which the operation is mentioned in some of the latest French surgical publications. At this moment (1815) we can reckon twenty-three facts relative to tying the external iliac artery, and on fifteen of the patients it has perfectly succeeded. In these twenty-three operations, I comprehend the two which were done in France; one at Brest, by Delaporte, and the other at Lyons, by Bouchet; cases, the authenticity of which cannot be doubted. In the number of successful cases, is to be comprised Bouchet's operation, since the patient lived more than a year afterward, and then died of the consequences of an inguinal aneurism of the opposite side. Of the other twenty-one operations, fifteen were performed in London only, in the several hospitals of this metropolis, by Abernethy, Ramsden, A. Cooper, Brodie, and Lawrence; gentlemen who would never publish forged cases.

"Sir A. Cooper alone had tied the external iliac artery six times before my journey to London, and during my stay there, I saw him perform the operation once. Four of his patients were entirely well; one of the three others died, the thirteenth week after the operation, of the bursting of an aneurism of the aorta. At this period, the circulation in the limb had been re-established. I saw the limb after it had been injected among Sir A. Cooper's anatomical preparations. Large and beautiful anastomoses existed round the pelvis, between the dilated branches of the internal iliac and femoral arteries. With respect to the sixth patient, the leg mortified, and the thigh was amputated without success. The seventh died of hemorrhage, which took place the fourteenth or fifteenth day after the operation."—(*Parallèle de la Chir. Angloise avec la Chir. Francoise, p.* 275, 276.) Sir Astley Cooper has now tied the external iliac artery in nine cases.—(See *Lancet, vol.* 2, *p.* 44.)

The many facts already published, exemplifying the propriety of this operation, must be highly gratifying to Mr. Abernethy, by whose judgment it was first suggested, and by whose enterprising hand it was first practised.

Mr. Abernethy has been called upon in several cases to take up the external iliac artery, and they all prove that the anastomosing vessels were fully capable of conveying blood enough into the limb below, and that a vessel even of this size could become permanently closed after being tied. Three of the operations done by this gentleman, I was an eye-witness of, and it is therefore with confidence that I can speak of the ease and simplicity of the requisite measures for securing the external iliac artery.—(See *Abernethy's Surg. and Physiol. Essays; and Surgical Observations*, 1804; *Edin. Med. and Surg. Journal for January*, 1807.)

In Mr. Abernethy's first operation, performed in 1796, an incision, about three inches in length, was made through the integuments of the abdomen, in the direction of the artery, and thus the aponeurosis of the external oblique muscle was laid bare. This was next divided from its connexion with Poupart's ligament, in the direction of the external wound, for the extent of about two inches. The margins of the internal oblique and transverse muscles being thus exposed, Mr. Abernethy introduced his fingers beneath them to protect the peritoneum, and then divided them. Next he pushed this membrane, with its contents, upwards and inwards, and took hold of the external iliac artery with his finger and thumb. It now only remained to pass a ligature round the artery, and tie it; but this required caution, on account of the contiguity of the vein to the artery. These Mr. A. separated with his fingers, and introducing a ligature under the artery with a common surgical needle, tied it about an inch and a half above Poupart's ligament.—(*Surg. Essays.*)

The following was the method which Mr. Abernethy adopted, the second time of tying the external iliac artery.

An incision three inches in length was made through the integuments of the abdomen, beginning a little above Poupart's ligament, and extending upwards; it was more than half an inch on the outside of the upper part of the abdominal ring, to avoid the epigastric artery. The aponeurosis of the external oblique muscle being exposed, was next divided in the direction of the external wound. The lower part of the internal oblique muscle was thus uncovered, and the finger being introduced below the inferior margin of it and of the transversalis muscle, they were divided with the crooked bistoury for about one inch and a half. Mr. Abernethy now introduced his finger beneath the bag of the peritoneum, and carried it upwards by the side of the psoas muscle, so as to touch the artery about two inches above Poupart's ligament. He took care to disturb the peritoneum as little as possible, detaching it to no greater extent than was requisite to admit his two fingers to touch the vessel. The pulsations of the artery made it clearly distinguishable, but Mr. Abernethy could not put his finger round it with facility. In order to be able to do so, he was obliged to make a slight incision on each side of it. Mr. A. now drew the artery gently down, so as to see it behind the peritoneum. By means of an eye-probe, two ligatures were conveyed under the vessel; one of these was carried upwards as far as the artery had been detached, and the other downwards; they were firmly tied, and the vessel was divided in the interspace between them.—(*Surg. Observ.* 1804.)

In a third instance of tying this vessel, Mr. Abernethy operated exactly as in the foregoing case, and with complete success.—(See *Edin. Surg. Journ. Jan.* 1807.)

Mr. Freer, of Birmingham, who may be said to claim the honour of having seconded Mr. Abernethy in this new practice, made an incision about one inch and a half from the spine of the ileum, beginning about an inch above it, and extending it downwards about three inches and a half, so as to form altogether an incision four inches and a half long, extending to the base of the tumour. The tendon of the external ob-

lique being exposed, was carefully opened, and also the internal oblique, when the finger being introduced between the peritoneum and transversalis, served as a director for the crooked bistoury, which divided the muscle. Avoiding all unnecessary disturbance, Mr. Freer separated the peritoneum with his finger, till he could feel the artery beating, which was so firmly bound down, that he could not get his finger under it without dividing its fascia. The vessel having been separated from the surrounding parts, a curved blunt needle, armed with a strong ligature, was put under it, and tied very tight, with the intention of dividing the internal coats of the vessel. The operation led to a perfect cure.—(*Freer on Aneurism*, *p.* 83, 4*to.* 1807.)

Mr. Tomlinson, of the same town, was also an early performer of the operation: he applied only one ligature, and, of course, left the artery undivided: the event was attended with perfect success.

The following is Sir Astley Cooper's mode of operating as described by Mr. Hodgson:—A semilunar incision is made "through the integuments in the direction of the fibres of the aponeurosis of the external oblique muscle. One extremity of this incision will be situated near the spine of the ileum: the other will terminate a little above the inner margin of the abdominal ring. The aponeurosis of the external oblique muscle will be exposed, and is to be divided throughout the extent and in the direction of the external wound. The flap which is thus formed being raised, the spermatic cord will be seen passing under the margin of the internal oblique and transverse muscles. The opening in the fascia which lines the transverse muscle through which the spermatic cord passes, is situated in the midspace between the anterior superior spine of the ileum and the symphysis pubis. The epigastric artery runs precisely along the inner margin of this opening, beneath which the external iliac artery is situated. If the finger, therefore, be passed under the spermatic cord, through this opening in the fascia, it will come into immediate contact with the artery which lies on the outside of the external iliac vein. The artery and vein are connected together by dense cellular membrane, which must be separated to enable the operator to pass a ligature by means of an aneurism-needle round the former."—(*On Diseases of Arteries*, *p.* 421, 422.)

The foregoing incision, the convexity of which is turned outwards and downwards, extends from within and a little above the anterior superior spinous process of the ileum, to above and a little within the middle part of Poupart's ligament. As soon as the tendon of the external oblique muscle has been divided, the knife may be put down, and the internal oblique and transverse muscles raised from Poupart's ligament by introducing the finger behind them. Care must be taken to avoid the epigastric artery which runs from the pubis side of the external iliac to the inner side of the incision. Baron Dupuytren, when performing the operation at the Hôtel-Dieu in Paris, in the autumn of 1821, wounded the epigastric artery.—(*See Averill's Operative Surgery*, *p.* 37.) The hemorrhage was so copious that two ligatures were required. The patient afterward died of peritonitis, which, in all probability, was brought on by the disturbance of the parts in the proceedings requisite for securing the ends of the wounded vessel. The external iliac vein must also not be included in the ligature, as such a proceeding would cause a dangerous interruption to the return of the blood. When little of the artery is exposed, one ligature will suffice; in the contrary circumstance it is best to apply two.—(See *Lancet*, *vol.* 2, *p.* 44, 45.)

Mr. Norman, of Bath, who has tried both modes of operating, found that proposed by Sir A. Cooper a more easy way of finding the external iliac artery than the longitudinal incision practised by Mr. Abernethy. "The objection (says Mr. Norman) to Sir A. Cooper's mode of operating in cases where the tumour extends high up, is by no means well founded; for the lower part of the bag of the peritoneum lying on the edge of Poupart's ligament, must in every case be exposed and detached, in order to get at the artery which lies behind the posterior part of that membrane, and this is most easily effected by an incision in the direction of Poupart's ligament; while two-thirds of the longitudinal incision are made on a part of the peritoneum, which lines the abdominal muscles, and the lower portion only of the incision reaches that part of the membrane which is to be separated. The consequences of this are, that the peritoneum is in much greater danger of being wounded, and that the probability of a hernia forming after the cure is much increased by the extensive division of the oblique muscles."—(See *Med. Chir. Trans. vol.* 10, *p.* 101.) As far as I am able to judge, these remarks are well founded, and they coincide with some observations which were made some years ago by Roux, who, while he inclined to Mr. Abernethy's method, saw the disadvantage of letting the direction of the wound in this instance correspond to the course of the artery. Hence, after many trials on the dead subject, he laid down the rule that the beginning of the wound should never be farther than half an inch from, and a very little higher than, the anterior superior spine of the ileum, and that it should be carried very obliquely downwards to the middle of Poupart's ligament.—(See *Nouveaux Elémens de Méd. Op. t.* 1, *p.* 747, *&c.*)

Mr. Todd, also, after repeated trials of Mr. Abernethy's and Sir Astley Cooper's methods on the dead subject, concluded that the plan recommended by the latter afforded the greatest facility of applying the ligature to the artery, because more room was obtained by it, and with less disturbance of the peritoneum, than in the other way. Where, however, it becomes necessary to apply a ligature to a higher part of the artery, in consequence of secondary hemorrhage, Mr. Todd conceives that Mr. Abernethy's method should be adopted —(See *Dublin Hospital Reports*, *vol.* 3, *p.* 92.)

In a case operated upon by Mr Kirby, a hernia followed in the situation where the abdominal muscles had been divided.—(See *Cases with Observations*, *p.* 109, 8*vo. Lond.* 1819.)

In one case, Dr. Post found the peritoneum so thickened and diseased that he could not raise it from the subjacent parts, and he was obliged to make an opening in it. The protruding viscera were then pushed back, and with a needle a ligature was introduced under the artery, the peritoneum being also included in the ligature. Notwithstanding the disadvantageous method of operating, and the return of pulsation in the swelling, the patient had so far recovered in three months that he had regained the use of the limb.—(See *American Med. and Phil. Reg. vol.* 4, *p.* 443.)

In one remarkable case, Mr. Newbiggin, by tying the external iliac artery, cured both an inguinal and a popliteal aneurism together.—(See *Edin. Med. and Surg. Journal, for Jan.* 1816, *p.* 71, *&c.*)

The many operations which have now been done on the external iliac artery have impressed me with a conviction that in subjects under a certain age there is no reason to fear that the anastomoses will not generally suffice for the supply of the lower extremity. Out of twenty-five cases I only know of three in which the limb was attacked with gangrene. These three were patients of Sir A. Cooper, Bouchet of Lyons, and Mr. Collier. The proportion is not so much as one in eight. The three instances of gangrene were not all in the circumstances which permitted the event to be imputed to the anastomoses not having had sufficient time to enlarge, though perhaps Mr. Collier's case was such. On the other hand, we are to notice that Dr. Cole's patient was operated upon a few days after the wound, and yet the limb was duly supplied with blood, and did not become gangrenous. It appears, therefore, to me, that the occasional occurrence of gangrene cannot be admitted as a just reason for delay, until the collateral vessels have had time to enlarge. I believe that in all aneurismal diseases, early operating is the best and most judicious practice. This was one principal cause, as Kirkland observes, which occasioned the bad success of the old surgeons in the treatment of popliteal aneurisms, and he foretold, many years ago, that operations for the cure of aneurisms would answer better if not deferred so long as formerly.—(See *Thoughts on Amputation*, *&c.* 8*vo. Lond.* 1780.) I join Kirkland in this sentiment, not without recollecting that all aneurisms are attended with a chance of getting well spontaneously in the course of time. In saw the inguinal aneurism which did so under Dr. Albert in the York Hospital; but as this also is a rare incident, I do not believe that it ought to influence us against having speedy recourse to an operation. Besides, the cure by inflammation and sloughing appears to me to be attended in reality with more peril than a well-executed operation, and consequently has less recommendations than many may imagine. Had not Dr. Albert's patient been a very strong man, he would certainly have fallen

a victim to the extensive disease which the bursting and sloughing of the tumour created. Thus Delaporte's patient died of the mass of disease which the tumour itself made; for it had been suffered to attain too large a size, so that when it inflamed the effects were fatal.—(See *Richerand, Nosogr. Chir. t.* 4, *p.* 113, *edit.* 4.)

I believe Dr. Wilmot's observation is perfectly correct, that if a comparison were made between the operation of tying the external iliac artery and that of tying the artery in the thigh, we should find the recoveries after the first more frequent in proportion to the number of times it has been done, than after common operations lower down.*—(See *Dublin Hospital Rep. &c. vol.* 2, *p.* 214.)

The greatest artery that conveys blood into the lower extremity, after the external iliac has been tied, is the gluteal; but, besides it, the ischiatic, the obturator, and the external pudic, which anastomoses freely with the internal pudic, are important vessels in keeping up the circulation.

I subjoin a list of some of the successful examples of this operation. Mr. Abernethy, 2 cases (*Surgical Works, vol.* 1); Freer and Tomlinson, 2 (*Freer on Aneurism*, 1807); Sir A. Cooper, 4 (*Hodgson on Diseases of Arteries, p.* 417); Goodlad, 1 (*Edin. Med. and Surg. Journ. vol.* 8, *p.* 32); Brodie, 1 (*Hodgson, op. cit. p.* 419); Lawrence, 1 (*Med. Chir. Trans. vol.* 6, *p.* 205); J. S. Soden, 1 (*Same work, vol.* 7, *p.* 536); G. Norman, 1 (*Same work, vol.* 10, *p.* 95, *&c.*); E. Salmon, 1 (*Same work, vol.* 12); Bouchet, 1 (*Roux, Med. Opératoire, t.* 1, *p.* 744); J. S. Dorsey, 1 (*Elements of Surgery, vol.* 2, *p.* 180, *Philadelphia*, 1813); Mouland, 1 (*Bulletin de la Faculté de Médecine de Paris, t.* 5, *p.* 535); Dupuytren, 1 (*French Transl. of Mr. Hodgson's work, t.* 2, *p.* 215); Dr. Cole, 1 (*Rapport des Travaux de la Société d'Emulation de la Ville de Cambrai*, 1817, or *Lond. Med. Repository*); Dr. Wilmot, 1 (*Dublin Hospital Reports, vol.* 2, *p.* 208, *&c.*); Kirby, 1 (*Cases with Observations, &c.* 8*vo. Lond.* 1819); Dr. Post, 1 (*American Med. and Philos. Register, vol.* 4); Newbiggin, 1 (*Edin. Med. and Surg. Journ. Jan.* 1, 1816); J. C. Warren, 1 (*New-England Journal, or Anderson's Quarterly Journal, vol.* 1, *p.* 136). In this case the epigastric artery arose from the anterior and inner part of the sac, and gave origin to the obturator, while the circumflex ilii originated from the outer part of the sac. All these vessels were greatly enlarged, and the epigastric rendered the necessary detachment of the external iliac troublesome.

Some particulars of the case of ruptured inguinal aneurism, in which Sir A. Cooper tied the aorta, will be hereafter noticed.—(See *Aorta.*)

Rosenmuller's Chir. Anat., Tiedemann's and Scarpa's Plates, in illustration of the operation of tying the external iliac artery, merit notice.

CASES OF GLUTEAL ANEURISM CURED BY TYING THE INTERNAL ILIAC ARTERY.

The gluteal artery is large; from its situation liable to wounds; from its size subject to aneurism. Dr. Jeffray, of Glasgow, was consulted in a case where the gluteal artery had been wounded. He urged the propriety of tying the vessel where it had been injured. This sensible advice was at first rejected, and when the friends at last consented, the operation was too late, as, while preparation was making for it, the tumour burst, and the patient expired in a few moments.

Thenden also mentions an instance in which the gluteal artery was wounded in the dilatation of a gunshot wound, and the patient lost his life.—(See *Scarpa on Aneurism, p.* 407, *ed.* 2.)

Mr. John Bell, however, tied the gluteal artery in a case where it was wounded, and the patient was saved.

[The late Dr. Cocke and Davidge, professors in the University of Maryland, tied the gluteal artery for an aneurism of immense size, with entire success. The patient was one whose gluteal muscles were exceedingly large, and the extent and boldness of the incision rivalled the herculean case reported by Mr. Bell. It will presently be seen that even when the extent of the disease forbids this attempt, the ligature of the internal iliac will afford a means of relief.—*Reese.*]

Mr. Stevens, surgeon in Santa Cruz, the gentleman who has proved the practicableness of putting a ligature round the internal iliac artery, informs us that "one of the first surgeons in London had a patient with gluteal aneurism. The tumour was large; allowed to burst; and the person bled to death.

"I sincerely trust," says he, "that the following case may be the means of preventing such an occurrence in future.

"Maila, a negro woman from the Bambara country in Africa, was imported as a slave into the West Indies in the year 1790. She was purchased for the estate of Enfield Green; now the property of the heirs of P. Ferrall, Esq. I saw her first in the beginning of December, 1812. She had a tumour on the left hip, over the sciatic notch. It was nearly as large as a child's head, and pulsated very strongly. She could assign no cause for the disease. It had commenced, about nine months before, with slight pain in the part; and had gradually increased to its present size. She was now much reduced, in great misery, and ready to submit to any operation.—(See *Medico-Chir. Trans. vol.* 5, *p.* 425.) Mr. Stevens had tied the internal iliac on the dead body, and believed that it might be done with safety on the living. The following is some account of the operation: "On the 27th of December, 1812 (says Mr. Stevens), I tied the artery in the presence of Dr. Lang, Dr. Van Brackle, Mr. Nelthropp, and Mr. Ford, the manager of the estate. An incision, about five inches in length, was made on the left side, in the lower and lateral part of the abdomen, parallel with the epigastric artery, and nearly half an inch on the outer side of it. The skin, the superficial fascia, and the three thin abdominal muscles, were successively divided; the peritoneum was separated from its loose connexion with the iliacus internus and psoas magnus; it was then turned almost directly inwards, in a direction from the anterior superior spinous process of the ileum, to the division of the common iliac artery. In the cavity which I had now made, I felt for the internal iliac, insinuated the point of my fore-finger behind it, and then pressed the artery between my finger and thumb. Dr. Lang now felt the aneurism behind; the pulsation had entirely ceased, and the tumour was disappearing. I examined the vessel in the pelvis; it was healthy and free from its neighbouring connexions. I then passed a ligature behind the artery and tied it about half an inch from its origin. The tumour disappeared almost immediately after the operation, and the wound healed kindly. About the end of the third week the ligature came away, and in six weeks the woman was perfectly well.

This is the first example in which the internal iliac was tied. The operation was not attended with much difficulty or pain, and not an ounce of blood was lost.

Mr. Stevens had no difficulty in avoiding the ureter, which, when the peritoneum was turned inwards, followed it. Had it remained over the artery, Mr. Stevens says that he could easily have turned it aside with his finger.—(See a particular history of this case in *Medico-Chirurg. Trans. vol.* 5, *p.* 422, *&c.*)

A second instance, in which the internal iliac artery was tied, was some time ago communicated to the public. The operation was performed by Mr. Atkinson, of York, on account of a gluteal aneurism. The following are a few of the particulars, as related by this gentleman:—Thomas Cost, aged 29, presented himself at the York County Hospital, April 29th, 1817. He was a tall, strong, active bargeman, not corpulent, but very muscular. He was enduring great pain from a large, renitent, pulsating tumour, situated under the gluteus of the right side; an obvious aneurism. It had existed about nine months, and was the consequence of a blow from a stone. In a consultation with Dr. Lanson and Dr. Wake, the necessity of the operation was determined upon, and it was performed on the 12th of May without any material difficulty or interruption, except such as was the consequence of the division of, and bleeding from, the small muscular arteries. Having got command of the internal iliac artery within the pelvis, which, says Mr. Atkinson, required the complete length of the fingers to accomplish, it was tied. Sufficient proof of its being the identical artery was repeatedly obtained by the pressure upon it stopping the pulsation and causing a subsidence of the tumour. Dr. Wake, Mr. Ward, and all the pupils were quite assured of the circumstance. The artery being then tied, the pulsation of the swelling entirely ceased. Some

[* Dr. Mott has tied the external iliac four times with complete success.—*Reese.*]

delay in placing the ligature arose from the needle not being sufficiently pliable; but for future operations of this kind Mr. Atkinson very properly recommends the ligature to be put round the artery by means of an instrument resembling a catheter, the wire of which has a little ring at its extremity, and can be pushed out some way beyond the end of the tube.

The patient went on tolerably well for some time after the operation; the pulse never exceeded 130, and after a time sunk to 85 or 90. He became exhausted, however, partly by the discharge, and partly by hemorrhage, and died on the 31st of May, about nineteen days after the operation. In the dissection, the cavity on the external part of the peritoneum, in the situation of the incision, was completely filled with coagulated blood. "The ligature, on moving a part of this (blood) with a sponge, readily followed it, and without doubt had been disengaged for some days." The internal iliac, which appeared to have been tied, had separated about an inch and a half from the bifurcation with the external iliac. By "separated" I conclude Mr. Atkinson means, that the upper part of the internal iliac was separated from the continuation of the same vessel.—(See *Medical and Phys. Journ. vol.* 38, *p.* 267, *&c.*) Although this gentleman has not given a very clear account of some part of the dissection, and he has also omitted to describe the place of his external incision, or the exact parts which he divided in the operation, yet I think that all the circumstances of the case taken together leave not the smallest doubt of the internal iliac artery having been actually tied. The complete stoppage of the pulsation as soon as the ligature was applied, and the testimony of several respectable practitioners who were present, seem indeed to remove all ambiguity. The profession is much indebted to Mr. Atkinson for this important communication, which was in some measure required, in order to confirm Mr. Stevens's similar case, as it is well known that some distinguished anatomists and surgeons in this metropolis formerly expressed very strong doubts of the practicable nature of the operation.

The internal iliac artery is also said to have been tied with success by an army surgeon in Russia, upon whom the late Emperor Alexander settled a pension as a reward for the skill displayed in the treatment of the case.—(See *Averill's Operative Surgery, p.* 39.)

[The internal iliac has also been tied in this country *successfully* for the cure of gluteal aneurism by Professor White, the younger, of Berkshire Med. Institution. This case is published in the second number of the American Journal of Medical Sciences, and is also referred to in Johnson's Medico-Chirurgical Review for April, 1828. It is the fourth instance in which it has been ever attempted; and three out of the four have been successful. The only time it was ever performed in Great Britain is the only instance of its failure.—*Reese.*]

In a modern publication are given a few particulars of a case, which was supposed to be an aneurism of the gluteal artery, and cured by means of pressure, a light vegetable diet, gentle laxatives, and digitalis.—(See *Trans. of the Fellows, &c. of the King's and Queen's College of Physicians in Ireland, vol.* 1, *p.* 41, *8vo. Dub.* 1817.) From the very imperfect account here given of the tumour, it is impossible to form any conclusion respecting its nature.

Sandifort has recorded an instance of an aneurism of the internal iliac artery itself.—(See *Tabulæ Anatomicæ, &c. Præcedit Obs. de Aneurismate Arteriæ Iliacæ internæ, rariore ischiadis Nervosæ causa, fol. Lugd.* 1804.)

The common iliac has never been tied in any case of aneurism of the external or internal iliac; but Professor Gibson had occasion to put a ligature round it in an example of gun-shot wound. "The patient lived fifteen days after the operation, and then died from peritoneal inflammation, and from ulceration of the artery. The circulation in the limb of the injured side was reestablished about the seventh day after the artery was tied."—(See *American Med. Recorder, vol.* 3, *p.* 185; *and Gibson's Institutes of Surgery, vol.* 2, *p.* 145. *Philadelphia*, 1825.)

[As an act of justice to my distinguished friend Professor Mott, I here insert a detailed account of this Herculean operation, which Dr. Cooper admits has never before been performed. It is alike honourable to him, to the profession, and to our country. It is introduced entire, as communicated to me by the doctor at my solicitation.

A detailed account of the first operation ever performed upon the *arteria iliaca communis* for the cure of *aneurism*, and especially of the first attempt to apply the ligature to so great a vessel, without dividing the peritoneum, may prove interesting to the profession generally, and must be immediately serviceable to practitioners of surgery.

"On the 15th of March, 1827, I was requested to visit a patient with Dr. Osborn (of Westfield, New-Jersey, about twenty-five miles distant from New-York), whom we found labouring under a large aneurism of the right external iliac artery.

Israel Crane, aged thirty-three years, by occupation a farmer, of temperate and regular habits, having generally enjoyed excellent health, says, about the middle of January he felt some pain about the lower part of the belly, which he attributed to a fall received during the winter. He is in the habit of using great efforts in lifting heavy logs of wood, as his employment at this season consists in carrying wood to market. It, however, was not until a fortnight since that he perceived any tumour about the lower part of the abdomen. Upon examination, the abdomen on the right side was considerably enlarged from about the crural arch, as high as the umbilicus. When the hand was applied to the parietes of the abdomen, a pulsation was felt and rendered visible to some distance. To the touch the tumour beat violently, and appeared to contain only fluid blood. It commenced a little above Poupart's ligament, and reached, judging by the touch, from without near the navel, inwards almost to the linea alba, outwards and backwards filling up all the concavity of the ileum, and reaching beyond the posterior spinous process of that bone.

The rapid increase of this aneurismal tumour occasioned, as the countenance of our patient indicated, the most extreme agony. His sufferings at times were so great that his screams could be heard at a distance from the house. He had been bled several times, taken light food, and was kept constantly under the effect of opium. He was now informed of the serious nature of his case, and that without an operation very little chance of his life remained; with great composure he immediately consented to whatever would give him the best prospect of saving his life.

From the extent and situation of the tumour he was apprized of the uncertain nature of the operation, as well as the difficulty of performing it, and indeed that it would require an artery to be tied, which never had been before operated upon for aneurism. With these views of his situation, he cheerfully submitted to be placed upon a table of suitable height, in a room which was well lighted.

Then, in the presence of Dr. Osborn, Dr. Liddle, and Dr. Cross, the following operation was performed:—

The pubes and groin of the right side being shaved, an incision was commenced just above the external abdominal ring, and carried in a semicircular direction half an inch above Poupart's ligament, until it terminated a little beyond the anterior spinous process of the ileum, making it in extent about five inches. The integuments and superficial fascia were now divided, which exposed the tendinous part of the external oblique muscle; upon cutting which in the whole course of the incision, the muscular fibres of the internal oblique were exposed; the fibres of which were cautiously raised with the forceps and cut from the upper edge of Poupart's ligament. This exposed the spermatic cord, the cellular covering of which was now raised with the forceps, and divided to an extent sufficient to admit the fore-finger of the left hand to pass upon the cord into the internal abdominal ring. The finger serving now as a director, enabled me to divide the internal oblique and transversalis muscles to the extent of the external incision, while it protected the peritoneum. In the division of the last-mentioned muscles outwardly, the circumflex ilii artery was cut through, and it yielded for a few minutes a smart bleeding. This, with a smaller artery upon the surface of the internal oblique muscle between the rings, and one in the integuments were all that required ligatures.

With the tumour beating furiously underneath, I now attempted to raise the peritoneum from it, which we found difficult and dangerous, as it was adherent to it in every direction. By degrees we separated it with

great caution from the aneurismal tumour, which had now bulged up very much into the incision. But we soon found that the external incision did not enable us to arrive to more than half the extent of the tumour upwards. It was therefore extended upwards and backwards about half an inch within the ileum, to the distance of three inches, making a wound in all about eight inches in length.

The separation of the peritoneum was now continued, until the fingers arrived at the upper part of the tumour, which was found to terminate at the going off of the internal iliac artery. The common iliac was next examined by passing the fingers upon the promontory of the sacrum, and to the touch appearing to be sound, we determined to place our ligature upon it, about half way between the aneurism and the aorta, with a view to allow length of vessel enough on each side of it to be united by the adhesive process.

The great current of blood through the aorta made it necessary to allow as much of the primitive iliac to remain between it and the ligature as possible, and the probable disease of the artery higher than the aneurism required that it should not be too low down. The depth of this wound, the size of the aneurism, and the pressure of the intestines downwards by the efforts to bear pain, made it almost impossible to see the vessel we wished to tie. By the aid of curved spatulas, such as I used in my operation upon the *innominata*, together with a thin, smooth piece of board, about three inches wide, prepared at the time, we succeeded in keeping up the peritoneal mass, and getting a distinct view of the arteria iliaca communis, on the side of the sacro-vertebral promontory. This required great effort on our part, and could only be continued for a few seconds. The difficulty was greatly augmented by the elevation of the aneurismal tumour, and the interception it gave to the admission of light.

When we elevated the pelvis, the tumour obstructed our sight; when we depressed it, the crowding down of the intestines presented another difficulty. In this part of the operation I was greatly assisted by Dr. Osborn and my enterprising pupil, Adrian A. Kissam.

Introducing my right hand now behind the peritoneum, the artery was denuded with the nail of the fore-finger, and the needle conveying the ligature was introduced from within outwards, guided by the fore-finger of the left hand in order to avoid injuring the vein. The ligature was very readily passed underneath the artery, but considerable difficulty was experienced in hooking the eye of the needle, from the great depth of the wound and the impossibility of seeing it. The distance of the artery from the wound was the whole length of my aneurismal needle.

After drawing the ligature under the artery, we succeeded by the aid of our spatulas and board in getting a fair view of it, and were satisfied that it was fairly under the primitive iliac, a little below the bifurcation of the aorta. It was now tied; the knots were readily conveyed up to the artery by the fore-fingers; all pulsation in the tumour instantly ceased. The ligature upon the artery was very little below a point opposite the umbilicus.

The wound was now dressed with five interrupted sutures, passing them not only through the integuments, but the fibres of the cut muscles, so as to bring their divided edges together at all parts of the incision which was muscular. Adhesive plaster to assist the stitches, lint and straps to retain it, completed the dressing. The operation lasted rather less than one hour.

He was removed from the table, and put into bed upon his back, with the knee a little elevated upon pillows to relax the limb as much as possible, and to avoid pressure upon it. It was considerably cooler than the opposite leg, and flannels were applied all over it, and a bottle of warm water to the foot. From the habit he had been in of taking largely of anodynes, a tea-spoonful of the tinct. opii was administered, with directions to repeat it in an hour if the pain should be severe.

In less than one hour from the operation, considerable reaction of the heart and arteries took place; he felt, as he stated, altogether relieved from the excruciating agony he had suffered since the aneurism commenced. The whole limb had now recovered its natural temperature.

March 16*th*. The day after the operation, pulse eighty; skin moist; limb warm as the other; complains of some pain at the ligature; ordered a purgative of neutral salts.

17*th*. Pulse eighty, and fuller than yesterday; took ℥ x. of blood from his arm; skin moist; tongue brown; considerable uneasiness in the limb; no pain at the ligature; leg of natural heat; salts had a good effect.

18*th*. Pulse seventy-five; skin moist; tongue white; pain in the limb considerable; no pain at the ligature or in the wound; limb warm.

19*th*. Bled him to-day ten ounces, the pulse being tense, and beating eighty strokes in a minute; repeated the cathartic: suppuration appearing to have taken place, the dressings were removed.

20*th*. Pulse seventy and soft; skin moist; wound looks well; pain in the limb continues; leg warm as the other; cathartic operated well.

21*st*. Pulse seventy and soft; wound looks well; repeated the laxative; pain in the leg rather less; continues warm. There has been at no time tension of the abdomen or any particular uneasiness in that part. The patient thus far has been altogether more comfortable than could have been imagined. He takes more or less opium daily, from the long habit he has been in of taking anodynes.

26*th*. No unpleasant symptom; wound looks well; bled again to ℥ xij., as there was a little tumefaction and inflammation about the wound.

30*th*. Our patient continues to do well; wound dressed daily.

April 3*d*. Not being able to leave the city, I requested Dr. Proudfoot, my late pupil, and a most promising young surgeon, to visit the patient. He reports that he was free of fever; wound all healed but where the large ligature was passing. The ligature appearing to be detached, the Dr. took hold of it and removed it: this was on the eighteenth day from the time of its application. Limb of the natural temperature; enjoined upon him to keep very quiet and in bed.

8*th*. There are no disagreeable appearances whatever; he appears to be doing remarkably well; has been bled once since the last report; takes a purgative every other day, and an opiate every night; pulse as in health; no pain; says he is entirely comfortable; wound is dressed with dry lint.

16*th*. Has improved rapidly since the last report. Two days after the ligature came away he very imprudently got out of bed, without experiencing any difficulty except weakness. Rode out to-day; wound perfectly healed.

April 26*th*. He has been using crutches for a few days to favour the lame leg, which as yet feels rather weak. General health greatly improved.

30*th*. Is perfectly restored in health; has a little stoop in his walk, which he says is occasioned by the external cicatrix. Leg is not yet of its full size, nor quite so strong as the other. From the period of the operation to the recovery of our patient, he did not appear to suffer more pain, or have more unpleasant symptoms, than would ordinarily take place in a flesh wound of equal extent. Much of this, in my opinion, is to be attributed to the prompt and judicious antiphlogistic treatment pursued by Dr. Osborn, to whom I am indebted for the daily reports of the case.

May 29*th*. My patient visited me to-day, having come twenty-five miles; he was so much improved in health that I did not recognise him. Examined the cicatrix, and found it perfectly sound; could not discover any remains of an aneurismal tumour; felt the epigastric artery much enlarged and beating strongly, and a feeble, though distinct pulsation in the femoral artery immediately below the crural arch. The leg has its natural temperature and feeling, and he says it is as strong as the other.

Much credit is due the patient for his firmness on the occasion; although apprized of the great danger attending so formidable an experiment, and the uncertainty of its result; yet with a fortitude unshaken, and a full conviction that it was the only chance of prolonging his life, he cheerfully and resolutely submitted to the operation.

The gratification his visit afforded me is not to be imagined, save by those who have been placed under similar circumstances. The perfect success of so important and novel an operation, with the entire restoration of the patient's health, was a rich reward for the anxiety I experienced in the case, and in a measure compensated for the unexpected failure of my operation on the *arteria innominata*."

Professor Bushe has lately tied the common iliac in a child less than two months old for a congenital aneurism of one of the labiæ. She recovered from the operation, but perished a few weeks afterward from abscess of the knee-joint.—*Reese.*]

ANEURISMS OF THE BRACHIAL ARTERY.

Surgical writings contain many histories of aneurisms in the bend of the arm, produced by the puncture of the brachial artery in venesection, or caused by a deep wound inflicted at the bend of the arm along the inner side of the humerus or in the axilla. Such cases must indisputably be formed by effusion. Although Morand and others have found, that, along with aneurisms caused by a wound of the brachial artery, the diameter of the vessel is sometimes unusually enlarged through its whole length above the seat of the tumour, this enlargement, which is very rare, might have existed naturally before the puncture occurred. Even were it frequent, such an equable longitudinal expansion of the tube of the artery could not explain the formation of the aneurismal sac in the bend of the arm, along the inner side of the humerus, or in the axilla, after wounds.—(*Scarpa, p.* 160.)

The proximate cause of these cases may invariably be traced to the solution of continuity in the two proper coats of the artery, and the consequent effusion of blood into the cellular substance. The effect is the same, whether from an internal morbid affection, capable of ulcerating the internal and fibrous coats of the artery, the blood be effused into the neighbouring cellular sheath surrounding the artery, which it raises after the manner of an aneurismal sac; or the wound of the integuments having closed, the blood issue from the artery, and be diffused in the surrounding parts. The cellular substance on the outside of the wounded vessel is first injected, as in ecchymosis; the blood then distends it, and elevates it in the form of a tumour, and, the cellular divisions being destroyed, converts it at last into a firm capsule or aneurismal sac.—(*Scarpa, p.* 167.)

The circumscribed or the diffused nature of the aneurism, and the rapidity or slowness of its formation, depend on the greater or less resistance to the impetus of the blood, during the time of its effusion, by the interstices of the cellular substance surrounding the artery, and by the ligamentous fasciæ and aponeuroses, lying over the sac. The aponeurosis of the biceps muscle being only half an inch broad, and situated lower than the common place for bleeding, cannot, at least in most cases, materially strengthen the cellular substance surrounding the artery, as is commonly supposed.—(*Scarpa, p.* 168—170.) This author refers the greatest resistance to the intermuscular ligament, which, after having covered the body of the biceps muscle, extends over the whole course of the humeral artery, and is implanted into the internal condyle. This ligamentous expansion has a triangular shape, the base of which extends from the tendon of the biceps to the internal condyle, while the apex reaches upwards along the inner side of the humerus towards the axilla, in the course of the artery. The humeral artery and median nerve, kept in their situation by the cellular sheath and this ligamentous expansion, run in the furrow formed between it and the internal margin of the biceps.—(*Scarpa, p.* 171.) This author anatomically explains many circumstances relative to the diffusion, circumscription, shape, &c. of brachial aneurisms by this intermuscular ligament. While aneurisms, from an internal cause, are not unfrequent in the aorta, thigh, and ham, they are very rare in the brachial artery; though a few such instances are recorded.—(*Scarpa, p.* 174. *Pelletan, Clinique Chir. t.* 2, *p.* 4.)

The mode of distinguishing a wound of the brachial artery in attempting to bleed, and the method of trying to effect a cure by pressure are described in the article *Hemorrhage.*

Anel was the first who tied the brachial artery for the cure of the aneurism at the bend of the arm, in the same way that Hunter did the femoral for the cure of aneurisms in the ham, viz. with one ligature above the tumour, without making any incision upon or into the sac itself.

The operation is performed as follows:—The surgeon having traced the course of the brachial artery, and felt its pulsations above the aneurism, he may either cut down to the vessel immediately above the tumour, or much higher in the long space between the origins of the superior and inferior collateral arteries. The integuments are to be divided in the course of the artery, and also the cellular sheath for the space of about two inches and a half. The surgeon, now introducing his left fore-finger to the bottom of the wound, will feel the denuded vessel, and if it is not sufficiently bare, he must divide the parts which still cover it, observing to introduce the edge of the knife on the side next to the internal margin of the biceps, to avoid dividing any of the numerous muscular branches which go off from the opposite side of the artery. He is then to insulate with the point of his finger the trunk of the vessel, alone if he can, or together with the median nerve and vein, and raise it a little from the bottom of the wound. He is to separate the median nerve and vein for a small space from the artery, and with an eyed needle is to pass a ligature under the latter, and then tie it with a simple knot.

In the operation it should always be recollected that the median nerve lies on the inside of the artery, and, therefore, that the instrument used for putting the ligature under the vessel should be passed from within outwards, by which means the inclusion of the nerve may be most easily avoided.—(*Boyer, Traité des Maladies Chirurgicales, &c. t.* 2, *p.* 193.)

The operation is well described by Mr. Hodgson: "The surgeon divides the integuments along the ulnar margin of the biceps muscle by an incision two inches and a half in length. The thin fascia which surrounds the arm will thus be exposed, and must be cautiously divided in the direction of the external wound. The artery lies immediately under the fascia, close to the margin of the biceps. The median nerve is situated on the ulnar side of the artery which lies between its two venæ comites. The internal cutaneous nerve is also situated under the fascia in the middle of the arm, and lies on the ulnar edge of the median nerve. The cellular membrane which connects these parts is to be divided, until the coats of the artery are fairly exposed. This part of the operation will be effected with facility, if an assistant compress the artery above the wound, so as to stop the circulation through it, and render it in some degree flaccid. The point of an aneurismal needle is then to be introduced close to the ulnar, and brought out on the radial side of the artery, so as to avoid including the median nerve, or the veins which accompany the artery."—(*On Diseases of the Arteries, &c. p.* 391.)

Whoever, after the above directions, says Scarpa, shall have the treatment of a *circumscribed* aneurism in the bend of the arm, will no longer, it is to be hoped, follow the method of those who, supposing the tumour to be formed by the dilatation of the artery, used first to divide the integuments over the tumour, insulated the sac, and sought for the vessel above and below the aneurism, in order to tie it in two places; and then endeavour to make the sac slough away. The operation is now reduced to the greatest simplicity, viz tying the artery merely above the tumour.—(See *Scarpa, p.* 358, 359.)

When the aneurism is *diffused* and accompanied with violent inflammation and swelling of the whole arm, from the excessive distention of the clots of effused blood, Scarpa recommends the old operation of opening the tumour, and tying the artery at the bottom of the sac, above and below the wound made by the lancet. In this method, a tourniquet must be applied to the upper part of the arm, near the axilla; or, if the limb be very painful and swelled, it is better to let an assistant compress the artery from above the clavicle, against the first rib. The incision having been made into the tumour, and the blood discharged, a probe is to be introduced into the puncture in the vessel, from below upwards, so as to raise the artery. This, being separated from the parts beneath and the median nerve, for a small extent, is to have two ligatures put under it, one of which is to be tied above, the other below, the wound in the vessel. Then the tourniquet, or pressure, is to be taken off, and if there be no bleeding, the wound is to be brought together.—(See *Scarpa, p.* 359.) With reference to this operation, Rosenmüller's Chir. Anat. Plates, part 2, tab. 11, Scarpa's plates, Tiedemann's beautiful engravings of the arteries, and Camper's Demonstr. Anat. Pathol. lib. i. are worth consulting.

It was on the brachial artery, that Mr. Lambert

(*Med. Obs. and Inquiries, vol.* 2) made the experiment of closing the puncture in the vessel by means of the twisted suture, under an idea, that the plan would not, like compression, obliterate the arterial tube, and therefore that the risk of gangrene would be lessened. Now, although in the trial which was made the bleeding was permanently stopped, Lambert was mistaken in supposing that the previous state of the wounded part of the artery was preserved by the adoption of the twisted suture, instead of pressure or the ligature. If ever a small puncture in an artery heal, so as to leave the tube of the vessel pervious, it is under the circumstances pointed out by Dr. Jones.—(See *Hemorrhage.*) Had Lambert had an opportunity of examining the state of the vessel some time after the above operation, he would have found its canal obliterated; and had he known the freedom with which the collateral arteries anastomose with the recurrent arteries of the forearm, he would have known how to explain more correctly the re-establishment of the pulse. I need merely add, that as the false idea of preserving the perviousness of the artery was the only foundation for the method, the practice ought never to be revived, as not affording equal security from hemorrhage to what is obtained by the ligature, or even compression.

AXILLARY ANEURISMS.

Aneurisms occasionally take place in the axilla, and make it necessary to tie the subclavian artery. A question here naturally presenting itself is, whether the surgeon should attempt the operation in an early period of the disease, or wait till circumstances are urgent; the aneurism large and far advanced; the arm œdematous and insupportably painful, from the stretching of the axillary plexus of vessels; the patient worn out by suffering and loss of rest; and the tumour in danger of bursting? In all cases of aneurisms, unquestionably, there is a certain chance of the disease getting well spontaneously: and one axillary aneurism, in a man in St. Bartholomew's Hospital a few years ago, had certainly disappeared of itself, as was proved by the account which the patient while living gave of his case, and by the obliteration of the artery, found on inspection after death.

I believe, however, we ought not to suffer our conduct to be too much influenced by the hope of so unfrequent an event, and, from the observations which I have made on this subject, it is my decided opinion, that the operation should never be delayed, so as to allow the tumour to acquire an immoderate size. The operation is always difficult; but the difficulty is seriously increased, when the swelling has extended far towards the breast, and has become so large as to push the clavicle considerably upwards. The several examples in which the subclavian artery has now been successfully tied furnish abundant proof, that the anastomoses are fully competent to the supply of the limb with blood. The plan, therefore, of delaying the operation long, with the view of allowing the inosculating arteries to enlarge, must be as questionable here as in some other cases of aneurism, and at all events, the maxim may be safely advanced, that, previously to the operation, the tumour should never be suffered to acquire an enormous size.

That the limb would receive an adequate supply of blood was well proved, even without the performance of the operation, by cases in which the axillary and subclavian arteries had been rendered impervious by disease; as, for instance, by the pressure of an aneurism of the aorta.—(For an account of such facts, the reader is particularly referred to *Hodgson's Treatise on the Diseases of Arteries, p.* 111; *Journal de Médecine by Corvisart, Leroux, and Boyer, t.* 2, *p.* 29; *Corvisart, Essai sur les Maladies du Cœur, p.* 215.)

"In these cases (says Mr. Hodgson), the only unusual circumstance which was observed during the life of the patients, was the deficiency of the pulse at the wrist. The limbs were well nourished, although a considerable extent of the main artery (the subclavian) was obliterated even before it had given off any branches."—(*P.* 47.)

This vessel was tied by Mr. Hall, in Cheshire, when it had been wounded with a scythe, and its ends exposed; the arm was preserved, though it remained somewhat weakened, which might be owing to the division of some large nerve.—(See *J. Bell on Wounds, p.* 60, *edit.* 3, and *Scarpa, p.* 372.) Mr. White, of Manchester, relates another instance of this vessel being tied, in the case of a wound; but mortification of the limb and death followed. Three of the nerves were found included in the ligature.—(*Lond. Med. Journ. v.* 4.) In cases of wounds of the axillary, or any other large arteries of the extremities, the surgeon, before proceeding to apply a ligature, should first ascertain the precise place of the wound in the artery; and for this purpose, it may sometimes be proper, in certain wounds of the shoulder, to make an incision in the axilla so as to expose the injured part of the vessel; or, if circumstances do not forbid it, the external wound may be dilated, until the exact part where the artery has been wounded is discovered. In proof of the propriety of acting in this manner, and applying a ligature above and below the wound in the vessel, Scarpa quotes a case, in which such practice was successful on a patient under M. Maunoir, of Geneva: the artery had been injured with a sabre near the head of the humerus; but after the wounded part of the vessel had been traced, and secured in the way above suggested, the patient, a boy fourteen years of age, was saved from the dangers of hemorrhage, and recovered the use of his arm, as fast as this was possible, with the loss of the first phalanges of the last three fingers from gangrene.—(See *Scarpa on Aneurism, p.* 412, *ed.* 2, *and Journ. de Méd. t* 40, *Mars*, 1811.)

There are two modes of operating for axillary aneurisms: one, by cutting below the clavicle, in order to take up the axillary artery itself; the other, by making the wound above the bone, for the purpose of securing the subclavian artery at the point where it emerges from behind the anterior scalenus muscle.

The first of these methods has been attempted by Desault, Pelletan, the late Mr. Keate, Mr. Chamberlaine, &c. It was in a case of wound of the axillary artery that Desault operated. An incision, six inches long, was made below the external third of the clavicle; two thoracic arteries cut were immediately tied; the two lower thirds of the great pectoral muscle were next divided with a bistoury guided on a director: a large quantity of coagulated blood was now discharged; and the artery was directly taken hold of, and tied, together with the brachial plexus of the nerves. The arm mortified, and the patient died. This case, we must agree with Scarpa, was not a fair trial of the operation, inasmuch as the inclusion of the plexus of nerves in the ligature was an improper measure, and must have promoted the occurrence of sphacelus. It seems also probable, from the account, that the vein was likewise tied; another serious and objectionable proceeding. Besides, it is worthy of notice, that the case was a wound of the axillary artery, attended with a copious effusion of blood in the cellular membrane. In all examples of this kind, gangrene is more readily induced, than when the case is a mere circumscribed aneurismal tumour.—(See *Œuvres Chir. de Desault, par Bichat, t.* 2, *p.* 553.) As for Pelletan's example, it hardly deserves recital, because the operation in fact was not achieved. His colleagues objected to dividing the pectoral muscle; a random thrust was made with a needle and ligature; but the artery was not included, and the experiment was not repeated.—(See *Clinique Chir. t.* 2, *Obs.* 7, *p.* 49.)

In a case of axillary aneurism, which had actually burst, and the hemorrhage from which could only be stopped by pressing the artery against the first rib, Mr. Keate, the surgeon-general, practised the following operation, which was attended with complete success. His plan was to take up the artery, above the diseased and ruptured part, in its passage over the first rib. Accordingly he made an incision obliquely downwards, divided the fibres of the pectoral muscle that were in his way, and, when he came to the artery, passed a curved, blunt-pointed silver needle, armed double, as he conceived, under the artery, and tied two of the ends. After a careful examination, finding that the artery pulsated below the ligature, he determined on passing another ligature higher up, and nearer to the clavicle: he, therefore, passed the needle more deeply, so as evidently to include the artery. In a few days the swelling of the arm began to subside, the wound suppurated, and the ligatures came away with the dressings. The arm afterward recovered its feeling, and the patient regained, in a great measure, the entire motion of the shoulder, &c.—(See *Med. Review and Magazine for* 1801.)

Mr. Keate's operation is objectionable, inasmuch as it was a dive made with a needle, and attended with great danger of wounding and tying parts which should be left undisturbed.

Mr. R. Chamberlaine, of Kingston, Jamaica, took up the axillary artery below the clavicle, in a patient who had an aneurism in the left axilla, occasioned by a wound with a cutlass on the 5th of October, 1814. On the 10th of January, the tumour had considerably increased, and was less compressible than it had been when first seen by Mr. Chamberlaine. The operation was done on the 17th of January, 1815: "a transverse incision, of three inches in length, was made through the skin and platysma myoides, along and upon the lower edge of the clavicle, three finger's breadth from the sternal end of that bone, and terminating about an inch from the acromion scapulæ. This incision divided a small artery, which was immediately secured. A second incision, of three inches in length, was also made obliquely through the integuments over the deltoid and pectoral muscles, meeting the first nearly in the centre. The cellular membrane and fat lying between them at the upper part were now removed. The next step consisted in detaching the clavicular portion of the pectoralis major, and taking away the fat and cellular membrane lying over the subclavian vessels. The artery was now brought into view, and its pulsations made it clearly distinguishable from the contiguous parts." After several ineffectual efforts, Mr. Chamberlaine succeeded in conveying a ligature under it, by means of an eye-probe, curved for the purpose, and the point of which was brought up with the aid of a pair of forceps. On the 22d of February, the wound was completely healed; the aneurismal tumour reduced to the size of a turkey's egg, and very solid; the arm smaller than its fellow, but its muscular power improving.—(See *Medico-Chir. Trans. vol.* 6, *p.* 128, *&c.*) Mr. Chamberlaine expresses his conviction, that the operation would have been much facilitated, had he been furnished with the instruments described in Mr. Ramsden's work for passing the ligature under the artery: a still better invention, however, for passing a ligature under a deep artery, is the needle lately constructed by Mr. Weiss, surgeons' instrument maker, in the Strand. An engraving and description of this valuable instrument may be found in the *Edin. Med. and Surgical Journal*, *No.* 76.

The subclavian artery might be got at below the clavicle as follows: the surgeon is to begin an incision in the integuments about an inch from the sternal end of this bone. The cut is to run towards the acromion, deviating a little downwards from a line parallel to that of the clavicle. This wound will bring into view some fibres of the great pectoral muscle originating from the last-mentioned bone. These are next to be divided. Some cellular substance will be found underneath, which is to be carefully raised with a pair of dissecting forceps, and cut. The operator will thus arrive at the great subclavian vein, and cephalic vein uniting with it. Under the subclavian vein, and a little farther backwards, more under the clavicle, the subclavian artery may be felt and tied.—(See *C. Bell's Operative Surgery*, *vol.* 2, *p.* 370.)

On the whole, however, I think, Mr. Hodgson's directions for the performance of this operation are the best which have been given. A semilunar incision through the integuments, which is to have its convexity downwards, and to begin about an inch from the sternal end of the clavicle, being continued towards the acromion for the extent of three or four inches, so as to end near the anterior margin of the deltoid muscle, without reaching into the space between the deltoid and pectoral muscle, in order to avoid wounding the cephalic vein. This incision will expose the fibres of the pectoral muscle, which are now to be divided in the direction and extent of the external wound. The flap is then to be raised, by dividing the loose cellular membrane which connects the pectoral muscle to the parts underneath it. The pectoralis minor will now be seen crossing the inferior part of the wound; and, by introducing his finger between the upper edge of this muscle and the clavicle, the surgeon may feel the pulsations of the axillary artery. Here one of the cervical nerves lies above, but in contact with the artery; the other nerves are behind it. In the dead subject, the axillary vein is situated below it; but, in the living, the vein is distended, and conceals the artery. The cellular membrane connecting these parts is to be separated by careful dissection, or by lacerating it with a blunt instrument. A ligature having been drawn under the artery with an aneurism-needle, the ends of the cord are to be raised, and a finger passed down, so as to compress the part surrounded by the ligature. If the artery be included, the pulsation in the aneurism will immediately cease. This precaution is highly necessary, lest one of the cervical nerves should be tied, instead of the artery.—(See *Hodgson on Diseases of Arteries*, *&c. p.* 362.)

When an aneurism extends a certain way inwards, or towards the trachea, the operation below the clavicle becomes impracticable, and it is now requisite to make the incision above that bone, and take up the subclavian artery at the point where it comes out from between the scaleni muscles and lies on the flat surface of the first rib.

In the dead subject without any tumour under the clavicle, this operation is easy enough; but in a living patient the difficulty is much increased by a large axillary aneurism, for then the clavicle is sometimes so much elevated, and the artery lies so deeply, that a ligature can hardly be carried under it without a particular needle for the purpose. This was the case in an attempt which I once saw made by Mr. Ramsden to tie the artery, and in which one of the cervical nerves affected by the pulsation of the artery was mistaken for it and tied, so that the aneurism soon afterward burst, and a fatal hemorrhage arose. Hence the advice given by my friend Mr. Hodgson, always to operate in this case while the tumour is small, cannot be too well remembered. A direction given by Mr. Liston is also important; namely, "before tightening the ligature, try the effect of compression with the fingers on the pulsation, as by taking this precaution (says Mr. Liston) I saved myself and my patient the pain of tying the nerve, which I got hold of in my first operation, in place of the artery."—(*Lancet*, *No.* 195, *p.* 234.) The chief difficulty in the operation is that of passing the ligature round the artery; but it may be done either with an ingenious needle which Mr. Ramsden has described, and which is exactly similar in principle to Desault's *aiguille à ressort*, or with the still preferable instrument constructed by Weiss. Another very ingenious contrivance for tying deep arteries has also been recently proposed by Dr. Prevost of Geneva.—(See *Edin. Med. and Surgical Journ. No.* 79.) The instruments used by Dr. Mott when he took up the arteria innominata will be presently noticed.

In order to avoid the inconveniences of the needles ordinarily used for conveying ligatures under deep arteries, Desault (says Bichat) invented "une aiguille à ressort," composed of a silver tube or sheath, which was straight at one end and bent at the other in a semicircular form. This sheath enclosed an elastic wire, the projecting extremity of which was accurately fitted to the end of the sheath, and perforated with a transverse eye. The instrument was passed under the artery, and as soon as it had reached the other side of the vessel, the sheath was kept fixed, while an assistant pushed the elastic wire, which, rising from the bottom of the wound, presented the aperture or eye to the surgeon, who now passed the ligature through this opening. The wire was next drawn back into its sheath again, and the whole instrument brought from beneath the artery, by which means the ligature was conveyed under the vessel.—(See *Œuvres Chir. de Desault, par Bichat*, *t.* 2, *p.* 560.) Another very ingenious method of passing the ligature under the artery, is that practised by Mr. Key; but as the comprehension of it is difficult without the plate, I shall here merely refer to that gentleman's description of it.—(See *Med. Chir. Trans. vol.* 13, *p.* 10.)

The invention of the foregoing instruments makes a material diminution in the difficulty of taking up the subclavian artery from above the clavicle; nor can it be wondered, that without such assistance, the operation should have baffled even so skilful a surgeon as Sir A. Cooper.—(See *Lond. Med. Review*, *vol.* 2, *p.* 200.)

The following example is the first in which the attempt to tie the subclavian artery by cutting above the clavicle was ever accomplished.

John Townly, a tailor, aged thirty-two, addicted to excessive intoxication, of an unhealthy and peculiarly anxious countenance, was admitted into St. Bartholomew's Hospital on Tuesday, the 2d of November, 1809, on account of an aneurism in the right axilla. The

prominent part of the tumour in the axilla was about half as big as a large orange, and there was also much enlargement and distension underneath the pectoral muscle, so that the elbow could not be brought near the side of the body.

"The temperature of both arms," says Mr. Ramsden, "was alike, and the pulse in the radial artery of each of them was correspondent. After the patient had been put to bed, some blood taken from the left arm, and his bowels emptied, his pulse, which on his admission had been at 130, became less frequent; his countenance appeared more tranquil; and he experienced some remission of the distressing sensations in the affected arm: his relief, however, was of short duration."

The pulsation of the radial artery of the affected arm gradually became more obscure, and soon after either ceased or was lost in the œdema of the forearm and hand. On the evening of the twelfth day, a dark spot appeared on the centre of the tumour, surrounded by inflammation, which threatened a more extensive destruction of the skin. A farther postponement of the operation being deemed inadmissible, Mr. Ramsden performed it the next day in the following manner.

"A transverse incision was made through the skin and platysma myoides, along and upon the upper edge of the clavicle, about two inches and a half in length, beginning it nearest to the shoulder, and terminating its inner extremity at about half an inch within the outward edge of the sterno-cleido-mastoideus muscle. This incision divided a small superficial artery, which was directly secured. The skin above the clavicle being then pinched up between my own thumb and finger and those of an assistant, I divided it from within outwards and upwards, in the line of the outward edge of the sterno-cleido-mastoideus muscle to the extent of two inches.

My object in pinching up the skin for the second incision, was to expose at once the superficial veins, and by dissecting them carefully from the cellular membrane, to place them out of my way without wounding them. This provision proved to be useful, for it rendered the flow of blood during the operation very trifling, comparatively with what might otherwise have been expected; and thereby enabled me with the greatest facility to bring into view those parts which were to direct me to the artery.

My assistant having now lowered the shoulder, for the purpose of placing the first incision above the clavicle (which I had designedly made along and upon that bone), I continued the dissection with my scalpel, until I had distinctly brought into sight the edge of the anterior scalenus muscle, immediately below the angle which is formed by the traversing belly of the omo-hyoideus and the edge of the sterno-cleido-mastoideus; and having placed my finger on the artery at the point where it presents itself between the scaleni, I found no difficulty in tracing it, without touching any of the nerves, to the lower edge of the upper rib, at which part I detached it with my finger nail, for the purpose of applying the ligature.

Here, however, arose an embarrassment which (although I was not unprepared for it) greatly exceeded my expectation. I had learned, from repeatedly performing this operation many years since, on the dead subject, that to pass the ligature under the subclavian artery with the needle commonly used in aneurisms would be impracticable; I had, therefore, provided myself with instruments of various forms and curvatures to meet the difficulty, each of which most readily conveyed the ligature underneath the artery, but would serve me no farther; for being made of solid materials and fixed into handles, they would not allow of their points being brought up again at the very short curvature, which the narrowness of the space between the rib and the clavicle afforded, and which, in this particular case, was rendered of unusual depth by the previous elevation of the shoulder by the tumour.

After trying various means to overcome this difficulty, a probe of ductile metal was at length handed me, which I passed under the artery, and bringing up its point with a pair of small forceps, I succeeded in passing on the ligature, and then tied the subclavian artery at the part where I had previously detached it for that purpose. The drawing of the knot was unattended with pain; the wound was closed by the dry suture, and the patient was then returned to his bed." —(See *Practical Observations on the Sclerocele, &c., to which are added four cases of operations for Aneurisms*, p. 276, *&c.*)

It only seems necessary for me to add, that immediately the artery was tied the pulsation of the swelling ceased; that the arm of the same side continued to be freely supplied with blood, and was even rather warmer than the opposite arm; that the operation, which was severe from the length of time it took up, was after a time followed by considerable indisposition; that the patient died about five days after its performance; that after the artery had been tied, the œdema of the arm and the aneurismal tumour partly subsided; and that, on examination after death, nothing but the vessel was found included in the ligature.

In this publication are descriptions of instruments which will be of great service to any future performer of this operation. The chief one is a needle, resembling that which was invented and used by Desault, and of which I have already endeavoured to give an idea. By means of this instrument, I conceive that the main difficulty of the operation will in future be avoided. Had Mr. Ramsden had its assistance, his patient would have been detained a very little time in the operating theatre, and the event of the case might have been completely successful. Having witnessed all the circumstances of the case, the inference that I drew from them was, that if the operation could have been done in a moderate time, which now seems practicable with the aid of the aiguille à ressort, or the instrument sold by Mr. Weiss, the case in all probability would have ended well. The preceding case is particularly memorable, as being the first instance in which the subclavian artery was scientifically tied, without any random thrust of a needle, and without the inclusion of any part besides the artery in the ligature. It furnished encouragement to repeat the experiment; held out the hope, that axillary aneurisms might be cured as well as inguinal ones; and confirmed the competency of the anastomosing arteries to nourish the whole upper extremity, when the subclavian is tied where it emerges from behind the anterior scalenus muscle.

In the year 1811, the subclavian artery was tied in the London Hospital, in a case of axillary aneurism, by Sir W. Blizard, who found no difficulty in getting the ligature under the artery, with a common aneurism-needle. A single ligature was applied. At first hopes of recovery were entertained; but the patient, who was old and debilitated, afterward sunk and died on the fourth day.—(See *Hodgson's Treatise*, p. 375.)

In the year 1815, Mr. Thomas Blizard tied the subclavian artery in the same hospital. The case was an aneurism in the left axilla, and, like all the other examples of this kind upon record, was attended with great pain in the tumour and limb. There was no pulse in the left radial artery, though there was scarcely any difference in the temperature of both arms. "An incision about three inches in length was made through the integuments at the root of the neck, on the acromial side, and parallel with the external jugular vein. The platysma myoides being divided, the cellular membrane was separated with the finger, until the pulsation of the subclavian artery was felt where the vessel passes over the first rib. The finger being pressed upon this part of the artery, the cellular sheath investing it was carefully opened with the point of a knife. A ligature was then conveyed underneath the artery, by means of a common aneurism-needle, with the greatest facility." As soon as the ligature was tied, the pulsation in the tumour ceased. On the second day after the operation the left arm began to have more feeling, and was as warm as the right. However, difficulty of breathing, twitchings, delirium, &c. afterward ensued, and the patient died on the evening of the eighth day, previously to which event the ring and middle fingers turned black. On opening the body, the pericardium exhibited the effects of a high degree of inflammation, and the heart was covered with flakes of lymph, its posterior surface being of a deep red colour. The inner membrane of the ascending aorta was of a bright scarlet hue, much diseased, and studded with white patches. A reddish appearance was also noticed in the lining of the right carotid, left subclavian, and even the abdominal aorta. The boundaries of the aneurismal tumour were in a state of sphacelation. These are all the circumstances which I wish here to notice; but more particulars may be perused in Mr. Hodgson's work, p. 602.

It is remarkable, that in the cases operated upon in the London Hospital, and some others on record, no difficulty was experienced in passing the ligature under the artery with a common aneurism-needle; a circumstance which must have depended upon the space between the clavicle and the first rib having been less deep in these instances than the two which fell under my own observation, or in others which occurred in the practice of Dr. Colles, Sir Astley Cooper, and Mr. Liston.—(See *Lond. Med. Review, vol.* 2, *p.* 200; *and Edin. Med. and Surg. Journal, January*, 1815, *No.* 64.) In Mr. Key's case, "the depth of the angle in which the artery was enclosed rendering it impossible to pass a ligature under it, about three-quarters of an inch of the clavicular portion of the sterno-mastoid was divided, which afforded sufficient room, and rendered the concluding part of the operation easy; the artery became readily exposed to view, and an armed aneurismal needle was passed with facility under it."—(*Med. Chir. Trans. vol.* 13, *p.* 5.)

In Dr. Colles's first case, the artery was tied before it reached the scaleni muscles, as the tumour, which was in the right subclavian artery, extended from the sternal origin of the sterno-mastoid muscle along the clavicle, a little beyond the arch of that bone, and rose nearly two inches above it, in a conical form, the apex of the cone being situated at the outer edge of the foregoing muscle. After a tedious dissection, it was found that only a quarter of an inch of the artery was sound, and on this portion the ligature was placed. Great difficulty was encountered in passing it round the artery, and the pleura was supposed to have been slightly wounded. Before tightening the ligature the breathing became laborious, and the patient complained of oppression about the heart. These symptoms, indeed, were so violent, that it was judged prudent not immediately to tighten the ligature. On the fourth day, however, the artery was constricted, when the pulse at the wrist ceased, the patient not seeming to suffer much from what had been done. The patient then went on pretty well till the ninth day, when he was seized with a sense of strangling, and pain about his heart, and, becoming delirious, died nine hours after the beginning of this attack. On dissection the aorta was found diseased, and the disease extended into the subclavian artery.

In another instance, Dr. Colles tied this vessel at the point where it emerges from between the scaleni muscles, without any particular difficulty. The operation, however, was soon followed by a train of severe symptoms, delirium, and mortification, and the patient died on the fifth day.—(See *Edin. Med. and Surg. Journ. January*, 1815.)

The first case in which complete success attended the operation of tying the subclavian artery, where it first comes from behind the anterior scalenus muscle, was that under the care of Dr. Post, of New-York. The patient was a gentleman, with an aneurism in the left axilla. Dr. Post performed the operation on the 8th of September, 1817, in the following manner. "An incision, commencing at the outer edge of the tendon of the mastoid muscle, was carried through the integuments about three inches in length, in a direction deviating a little from a parallel line with the clavicle. This divided the external jugular vein, the bleeding from which required a ligature for its suppression; and in proceeding with the operation, three or four arterial branches were cut, which it was also necessary to secure. The subclavian artery was then sought immediately on the outside of the scaleni muscles, and was easily laid bare. Passing over the artery at this place, in contact with it, were three considerable branches of nerves, running downwards towards the chest from the plexus above. These were separated, and a ligature passed under the artery with great facility, by the instrument well adapted to this purpose invented by Drs. Parish, Hartshorn, and Hewson, of Philadelphia. On tying the ligature, all pulsation ceased in the limb." In the afternoon, the temperature of the limb was observed to be rather higher than that of the other arm. On the 17th of September, the aneurismal tumour burst, and about three ounces of dark coagulated blood were discharged. On the 26th, the ligature came away from the subclavian artery. Oct. 11th, the wound was entirely healed; and on the 16th of the same month, the patient required no farther attendance, his only complaints being now a little occasional pain in the fingers, and a superficial sinus at the part where the tumour burst.—(See *Med. Chir. Trans. vol.* 9, *p.* 185, &c.)

Mr. Liston, of Edinburgh, has the honour of being the surgeon that first succeeded, in Europe, in curing an axillary aneurism, by taking up the subclavian artery from above the clavicle, on the 3d of April, 1820. The particulars of the case are very instructing. They prove the risk there always is of tying one of the axillary nerves instead of the artery, unless great caution be employed; and, in fact, Mr. Liston himself first passed his ligature under a nerve, and would have tied it, had he not wisely tried what effect constricting the included part would have upon the pulsation of the tumour. As the subclavian artery seemed diseased at the point where it emerged from behind the anterior scalenus, Mr. Liston cautiously divided this muscle to about its middle, so as not to injure the phrenic nerve. At length, with the aid of an aneurism-needle, he passed a strong round silk ligature under the artery, and laying hold of the loop with a small hook withdrew the needle. In consequence of the great depth of the artery, the knot could not be made with the fingers; but with the assistance of a kind of forceps, each extremity of which had a little notch in it, the business was accomplished.—(See *Edin. Med. and Surgical Journ. No.* 64.)

Several other successful operations of this kind have subsequently been done by English surgeons. One by Dr. Gibbs, in the General Naval Hospital of St. Petersburgh (see *Med. Chir. Trans. vol.* 12, *p.* 531); another by Mr. Bullen, in the Lynn Dispensary (see *London Med. Repository for Sept.* 1823); a third by Mr. Wishart at Edinburgh (see *Edin. Med. and Surg. Journ. No.* 78); a fourth by Mr. Key, in Guy's Hospital (see *Med. Chir. Trans. vol.* 13, *p.* 1); and a fifth by Mr. B. Cooper, in the same establishment.

[Professor Gibson, of the University of Pennsylvania, has cured a case of axillary aneurism occasioned by the reduction of an old luxation of the humerus, by tying the subclavian artery.—(See *American Journal, vol.* 2, *p.* 136.)—*Reese.*]

The instructions delivered by Mr. Hodgson for the performance of this operation, are the best with which I am acquainted. When the subclavian artery (says this gentleman) has emerged from behind the anterior scalenus muscle, it passes obliquely over the flat surface of the first rib, with which it is in immediate contact. The cervical nerves are situated above and a little behind the artery; the subclavian vein passes before it, and underneath the clavicle. If the finger be passed down the acromial margin of the anterior scalenus muscle, the artery will be found in the angle formed by the origin of that muscle from the first rib. The shoulder being drawn down as much as possible, the skin is to be divided immediately above the clavicle, from the external margin of the clavicular portion of the mastoid muscle, to the margin of the clavicular insertion of the trapezius. No advantage whatever, says Mr. Hodgson, is gained by cutting the clavicular attachment of the sterno-cleido-mastoideus. On this point, however, there is some difference of opinion; Mr. Key having found, in his operation, that the division of the clavicular portion of that muscle greatly facilitated the introduction of the ligature under the artery.—(See *Med. Chir. Trans. vol.* 13, *p.* 5 *and* 10.) The exposed fibres of the platysma myoides are now to be carefully divided, without wounding the external jugular vein, which lies immediately under them, near the middle of the incision, and should be detached, and drawn towards the shoulder with a blunt hook. The cellular membrane, in the middle of the incision, is then to be cut, or separated with the finger, until the surgeon arrives at the acromial edge of the anterior scalenus. He passes his finger down the margin of this muscle, until he reaches the part where it arises from the first rib, and in the angle formed by the origin of the muscle from the rib he will feel the artery. The ligature is now to be conveyed under the vessel with an aneurism-needle, or that recommended by Desault.—(*Hodgson on Diseases of Arteries, &c. p.* 376, *&c.*)

Breschet thinks that the safest and easiest method is that adopted by Dupuytren. An incision, three or four inches long, is to be made at the lower and outer part of the neck, and extended to the clavicle. This first incision, situated behind the external edge of the sterno-mastoid muscle, should go through the skin,

the cellular membrane, and platysma myoides. Some venous branches, running into the jugulars, will then be met with, which should be surrounded by a double ligature, and divided in the interspace. A director is then to be introduced under the omo-hyoideus muscle, in order to facilitate its division, and the surgeon will at length reach the external edge of the anterior scalenus. A curved probe-pointed bistoury is then to be gradually and cautiously passed behind that muscle, with the flat surface of the blade against it, and deeply enough to divide the external third, or half of the fibres of the same muscle, or even all of them if requisite. The insulated artery will then be felt at the bottom of the wound, situated in the area of a triangle, the upper side of which is formed by the brachial plexus, the lower by the subclavian vein, and the inner by the scalenus. A ligature is then to be conveyed under the artery by means of the needle invented by Deschamps. —(See *French transl. of Mr. Hodgson's work*, *t.* 2, *p.* 126.) Whether cutting the anterior scalenus and omo-hyoideus will facilitate the operation is questionable; but the assertion that these measures increase its safety, is what I cannot understand.

With respect to tying the subclavian artery on the tracheal side of the scalenus, we have seen, that it was performed by Dr. Colles, and the event was fatal. Descriptions of the operation may be found in Mr. Hodgson's work, p. 382. When I consider the manner in which the subclavian artery, before it passes behind the anterior scalenus, is surrounded by parts of great importance, I can scarcely bring my mind to think, that the measures requisite for taking up the vessel in this situation, will ever leave the patient much chance of recovery. "Between the aorta and scaleni muscles (says Mr. A. Burns) the subclavian arteries are connected with several important vessels and nerves. They are in the vicinity of the nervus vagus, of the recurrent laryngeal nerve, of the sympathetic nerve, of the phrenic nerve, and the subclavian vein; and, on the left side, the subclavian artery is intimately connected with the termination of the thoracic duct. These parts are all grouped together in a very narrow space, and the perplexity of their dissection is farther increased by the interlacement of the different nerves with one another. The natural connexions of these parts are best shown by merely raising the external extremity of the sterno-mastoid muscle. If this be done, the nervus vagus will be brought into view, lying on the forepart of the subclavian artery, almost directly behind the sternal end of the clavicle; and exactly opposite to the nervus vagus, but behind the artery, the lower cervical ganglion of the sympathetic nerve will be brought into view. The recurrent nerve, on the right side, hooks round the subclavian artery, and, in its course towards the larynx, ascends along the tracheal side of the sympathetic nerve. On the left side, it twines round the arch of the aorta, and in mounting upwards, is interposed between the subclavian artery and œsophagus. The subclavian vein lies anterior to the artery, and in the collapsed state, sinks nearer to the thorax;" but, when distended in the living body, it overlaps the artery. The thoracic duct enters the subclavian vein, about the eight of an inch nearer to the acromion than the point where the internal jugular vein empties itself into the subclavian vein. The termination of the thoracic duct is situated between the sternal and clavicular portions of the sterno-mastoid muscle.—(*A. Burns, on the Surgical Anatomy of the Head and Neck*, *p.* 28.)

A case in which an axillary aneurism, unattended with pulsation, was punctured, and the child bled to death, is noticed in a modern periodical work.—(See *Med. Chir. Journ. vol.* 4, *p.* 78.)

For anatomical views of the parts concerned in the operation of taking up the subclavian artery, consult *Rosenmüller's Chir. Anat. Plates*, *part* 2, *tab.* 8 *and* 9; *Tiedemann's and Scarpa's beautiful engravings.*

Some valuable anatomical remarks, in relation to the operation, are given by Mr. A. Burns.—(*Surgical Anatomy of the Head and Neck*, *p.* 28, *&c.*)

In certain cases of subclavian aneurism, it has been proposed to tie the arteria innominata. In the dead subject, Mr. Allan Burns applied two ligatures to it, and after cutting through the vessel in the interspace, he injected the aorta, when the injection was found to pervade the anastomosing vessels of the right arm, and all those of the head. But notwithstanding this fact, and others noticed by Mr. Hodgson, tending to show the probability that a ligature upon the arteria innominata would not prevent the arm and head from receiving an adequate supply of blood, other objections were made to the practice. The principal of these were founded upon the difficulty of the operation in the living body; the inflammation, likely to be excited by it in neighbouring important organs; the danger of hemorrhage from the adhesion of the vessel being likely to be broken by the force of the circulation; and the equal practicableness, in most cases, of tying the subclavian artery on the tracheal side of the scalenus.

Dr. Mott, an eminent surgeon at New-York, impressed with the value of Mr. Allan Burns's remarks upon this subject, has, ever since he became acquainted with them, maintained in his lectures the propriety of attempting to tie the arteria innominata, under particular circumstances of subclavian aneurism. At length, Dr. Mott put this new operation to the test of experience in the New-York Hospital, on the 11th of June, 1818. The case was a subclavian aneurism on the right side, and the patient, a sailor, aged fifty-seven, to whom seventy drops of tinct. opii were first given. Dr. Mott began the first incision directly over the swelling above the clavicle, extended it along this bone and ended it at the trachea, just above the upper portion of the sternum. Here he commenced the second incision, of about the same length as the first, and reaching along the inner margin of the sterno-cleido-mastoideus. Dr. Mott next detached the skin from the subjacent platysma myoides, cut through the latter, and cautiously divided the sternal portion of the mastoid muscle, in the direction of the first incision. The internal jugular vein now presented itself close to the swelling, and adherent to it; a circumstance that rendered the subsequent part of the operation very difficult. After detaching a portion of the latter vein from its connexion, Dr. Mott cut through the sterno-hyoideus and sterno-thyroideus, and turned them back over the trachea. The carotid was now exposed a few lines above the sternum, and after he had separated the par vagum and internal jugular vein from it, they were drawn towards the outer side of the neck. Dr. Mott then laid bare the subclavian artery, which part of the operation he chiefly accomplished with the handle of the scalpel, as there was nothing to be separated but cellular membrane. The subclavian artery was found to be very much enlarged and diseased, and as Dr. Mott recollected that this state of the vessel had seemingly hindered its successful closure in the example operated upon by Dr. Colles, of Dublin, he decided to take up the arteria innominata itself. In detaching the cellular membrane from the lower surface of the subclavian artery, a small branch, situated about half an inch from the innominata, was injured, and the wound was six or eight times filled with blood from it. The hemorrhage was soon suppressed, however, by means of a little pressure. Had not the bleeding been so easily stopped, Dr. Mott would have concluded, from the situation of the vessel, that it was the internal mammary; but if it were not this branch, he conceives it must have been an artery not regularly originating in this situation; perhaps the superior intercostal.

Dr. Mott continued the operation with a small, round-ended, sharp scalpel, until he came to the division of the arteria innominata, which great vessel he traced below the sternum, and after freeing it from all the cellular membrane with the handle of the scalpel, and drawing aside the recurrent and phrenic nerves, he tied it with a round silk ligature, about half an inch from its bifurcation.

Most surgeons, says Dr. Mott, complain of the difficulty of tying large arteries in a deep small wound. Hence, he recommends a set of instruments, invented for the purpose, in Philadelphia, by Drs. Parish, Hartshorn, and Hewson; consisting, 1st. Of several blunt-pointed needles, of various sizes and curvatures, furnished with an eye at each end, and calculated at one end to screw into a strong handle. 2dly. Two strong instruments, with handles, having at one end an eye or hole; they resemble those sometimes used for applying a ligature to the tonsils. 3dly. A small round pointed scalpel. 4thly. A small hook, fixed in a very strong handle.—(*Parish, in Eclectic Rep. vol.* 3, *p.* 229.)

After Dr. Mott had introduced the ligature into the

eye of one of the above-described needles, and screwed the needle into a handle, he pressed with its convexity the cellular membrane and pleura carefully downwards, while he carried it from below upwards round the artery. As the point now appeared on the other side of the vessel, the above-mentioned hook was passed into its eye, and the handle unscrewed from the other end of it, when it was easily drawn out from under the artery, and the ligature left under the vessel.

In this part of the operation, Dr. Mott urges the necessity of being particularly attentive to two important circumstances; one is, to convey the ligature round the artery from below upwards, as the only way to prevent injury of the pleura; and the other is, to fix the hook in the eye of the needle, before the handle is unscrewed from its other end, because, after this has been done, the needle loses all steadiness, and it is then difficult to get the hook into the eye.

With respect to the foregoing instruments, I may observe, that they are superseded by the needle lately constructed by Mr. Weiss.

Dr. Mott now made a noose, pressed it with the fore-finger down to the artery, and tightened it very gradually, in order not to stop the flow of blood through the vessel all at once. A moderate constriction was kept up some seconds, so that the effect of the ligature upon the heart and lungs might be observed; and as no disturbance was produced in the functions of these organs, Dr. Mott tightened the ligature, and stopped the current of blood through the vessel. At this instant, the pulsation of the right temporal and radial arteries ceased. The noose was tightened still more with the above-mentioned ligature irons, and then a second knot was made. Dr. Mott was greatly pleased at finding his patient's countenance remain perfectly unchanged, and no complaint made of pain in any other part. Immediately after the ligature had been applied, the aneurismal swelling lost one-third of its size, and the clavicle could be felt through its whole extent. The divided muscles and detached skin were now brought into their natural situation, the wound closed with three sutures and adhesive plaster, and a compress applied. In the operation three small arteries were tied: the first lay under the sternum, and seemed to be a branch of the internal mammary; the second was a descending branch of the superior thyroideal; and the third a branch of the inferior thyroideal. From two to four ounces of blood were lost, most of which came from an injured small branch of the subclavian. The operation took up about an hour. The curved spatulæ recommended by Dr. Colles, were found very useful for holding the carotid and par vagum aside, while, by their uniform pressure, they materially assisted in restraining the effusion of blood from small vessels, and as taking up little room, were infinitely more convenient in a deep narrow wound, than the fingers of an assistant.

The day after the operation, the veins of the right forearm and hand had a turgid appearance. When the circulation in them was promoted by pressure, they became empty for some distance above the pressed part, but filled again immediately the pressure was removed; a circumstance that seemed to show, that the circulation in this arm, notwithstanding the ligature of the arteria innominata, still went on with great celerity, though no pulse could be felt in the brachial and radial arteries. On the contrary, the pulse was very plain in the front branch of the temporal artery, just above the outer angle of the orbit. The left external carotid beat with unusual force. In a few days, however, the pulse became perceptible again at the right wrist.

My limits will not allow me to enter into all the details of this interesting case: suffice it to mention, that the patient suffered considerable febrile disturbance at some periods after the operation, and it was necessary twice to have recourse to venesection. He was also afflicted with a severe cough. The discharge from the wound was copious and fetid. The main ligature separated on the fourteenth day. On the twentieth day, the patient was sufficiently recovered to walk in the garden. On the twenty-first day, the wound was almost closed; the patient could move his right arm with the same facility as his left, and he was gaining such strength, that no doubts were entertained about the successful result of the operation. On the twenty-third day, hemorrhage came on from the wound: it was stopped by the introduction of lint and the employment of pressure. About twenty-four ounces of blood were lost, whereby the patient was so depressed that the pulse was no longer distinguishable. On the twenty-fourth day, in the evening, he lost four ounces more blood; on account of his restlessness and the painful state of his arm, two grains of opium were administered to him. After one or more returns of bleeding, he died on the twenty-sixth day.

When the body was opened, no traces of inflammation or its consequences were found either in the arch of the aorta, the origin of the innominata or the lungs. The aorta was now slit open longitudinally, and a probe then cautiously passed through it into the innominata, when the instrument went through the latter vessel into the cavity of the wound. The inner coat of the innominata was smooth and soft; but about half an inch from the place where the ligature had cut through the vessel, marks of inflammation were noticed, and a coagulum adhered to the sides of the artery with considerable firmness, so that nature had probably endeavoured, by means of adhesive inflammation, to close the vessel, but had been prevented from completing the salutary process by the destructive ulceration. One portion of the parietes of the innominata was thickened by inflammation, and an anomalous branch, as large as a crow's quill, arose from this artery.

The ulcer was twice as extensive inwardly as it was superficially, reaching laterally to the trachea, and under the clavicle to the swelling. The tripod of great vessels, viz. the innominata, the subclavian, and the carotid, was destroyed by ulceration to the extent of about an inch, and the ends of both the last vessels opened into the wound. At this place the pleura was considerably thickened by a layer of organized lymph.

The inner surface of the carotid was covered with a coagulum, and its coats so much thickened, that a probe could hardly be passed into it. The consolidation reached up to the division into the external and internal carotid. The subclavian was pervious as far as the situation of the disease. The diameter of the brachial and other arteries of the right arm was natural. The external mammary artery was enlarged, but not the internal. The clavicle was carious, and several lymphatic glands under it in the state of suppuration.

Though the result of the operation was unsuccessful, it proves, as Dr. Mott correctly remarks, some interesting points; namely, that tying an artery of such magnitude, and so near the heart, may be done without occasioning any disturbance either in the functions of the brain, the heart, the lungs, or the right arm.

The suppuration, which continually extended itself more and more deeply, is set down by Dr. Mott as the cause of the patient's death; for, as no bleeding took place for several days after the detachment of the principal ligature, it is plain that this must have fulfilled its duty, and that the artery had been closed.—(See *New-York Med. and Surgical Register*, 1818, *vol.* 1.)

[This new and formidable operation, the practicability of which Dr. Mott has thus demonstrated, and the safety of which is now decided in any future aneurism in which it may become necessary, is justly considered one of the most splendid achievements ever accomplished, and is destined to give the author's name immortality; and this, with the successful case of ligature of the iliacus communis, confers upon American surgery imperishable laurels. As an evidence of the estimation in which this operation is held in Europe, I feel a national pride in inserting the following extract of a letter from that distinguished surgeon, Professor Colles, of Dublin, written to Dr. Mott soon after his case of ligature on the innominata had reached him. I think this tribute to the able operator is the more important, since efforts have been made by the envious to detract from the merit of the operation; and it has been publicly stated that the same operation has been performed in Europe, and even by Dr. Colles himself. That this is not the fact will be obvious from the extract which follows, and which I introduce without any farther comment.

"I shall not attempt to say how much the profession is indebted to you for this bold and splendid operation. That it did not succeed I lament on your account; that it will hereafter succeed, there cannot be a doubt in

the mind of any reasoning man. Your feelings during the first twenty-two days after the operation are to be envied. The hopes of success continued so strong and so well founded, while the slight degree of uncertainty as to the issue must have exalted those feelings to the highest intensity. I have never read the account of an operation in which I would rather have been the operator."—*Reese.*]

The arteria innominata was also tied by Graefe on the 5th of March, 1822, in the Clinical Hospital of the University of Berlin, on account of a subclavian aneurism. The carotid was exposed and traced down to the innominata, to which a ligature was applied by means of a blunt tenaculum constructed for the purpose, the vessel being tied at most about an inch from the curvature of the aorta, and two inches from the heart. As soon as the ligature was tightened, the pulsation of the arteries of the right arm, right carotid, and right temporal artery ceased; at the same instant the throbbing of the aneurism stopped, and the tumour became flaccid. The constriction of the cord produced no disturbance of any function. The patient went on so well for several weeks afterward, that no doubt was entertained of his recovery. However, when the wound was nearly healed, hemorrhage came on, and though it was suppressed, and hope began to be again indulged, the bleeding recurred, and the patient died on the sixty-seventh day. Below the ligature the innominata was found closed with lymph. Graefe has written a distinct essay on the method in which the operation was done; the daily particulars of the case, and preparation from it, are placed in the Royal Anatomical Museum at Berlin.—(See *Journ. der Chirurgie von C. F. Gräefe, and Ph. v. Walther*, *b.* 3, *p.* 596, *&c.*, *b.* 4, *p.* 587.) Of Mr. Wardrop's practice of tying the subclavian artery in aneurism of the arteria innominata itself, we shall presently speak.

CAROTID ANEURISMS.

There is no part of the body where the diagnosis of aneurisms is more liable to mistake than in the neck. Here the disease is particularly apt to be confounded with tumours of another nature. We have already cited in this article examples in which aneurisms of the arch of the aorta so resembled those of the carotid as to have deceived the surgeon who was consulted. The swelling of the lymphatic glands, or of the cellular substance which surrounds the carotid artery, the enlargement of the thyroid gland, and especially abscesses, may resemble an aneurism by the pulsations communicated to them by the neighbouring artery. On the other hand, aneurisms of long standing, which no longer throb, and the integuments over which are changed in colour and likely to burst, may the more easily be mistaken by an inattentive practitioner for chronic abscesses, as the neck is remarkably often the seat of such diseases.—(*Boyer, Traité des Maladies Chirurgicales*, *t.* 2, *p.* 185.)

Scarpa mentions one unfortunate patient who was killed by a knife being plunged in a carotid aneurism, on the supposition that the case was an abscess.

I need scarcely observe, that by opening a carotid aneurism a surgeon would expose himself to the disgrace and mortification of seeing the patient die under his hands, as happened in the example cited by Harderus.—(*Apiar. Observationum*, *Obs.* 86.)

The possibility of tying the carotid artery in cases of wounds and aneurisms, without any injurious effect on the functions of the brain, is now completely proved. Petit mentions that the advocate Vieillard had an aneurism at the bifurcation of the right carotid, for the cure of which he was ordered a very spare diet, and directed to avoid all violent exercise. Three months afterward the tumour had evidently diminished; and at last it was converted into a small, hard, oblong knot, without any pulsation. The patient having died of apoplexy seven years afterward, the right carotid was found closed up and obliterated from its bifurcation, as low down as the right subclavian artery.—(*Acad. des Sciences de Paris*, *an* 1765.) Haller dissected a woman whose left carotid was impervious.—(*Opuscula Pathol. Obs.* 19, *tab.* 1.) An example of the total closure of both carotids in consequence of ossification, is stated by Koberwein to be recorded by Jadelot.—(*German transl. of Mr. Hodgson's work*, *p.* 293.) Hebenstreit, vol. 4, p. 266, ed. 3, of his translation of B. Bell's Surgery, mentions a case in which the carotid artery was wounded in the extirpation of a scirrhous tumour. The hemorrhage would have been fatal had not the surgeon immediately tied the trunk of the vessel. The patient lived many years afterward. This is probably the earliest authentic instance in which a ligature was applied to the carotid artery. Mr. Abernethy's case is perhaps the second: and that in which Mr. Fleming, a naval surgeon, tied the common carotid in a sailor who attempted suicide, and who was saved by the operation, is still later, not having occurred till the year 1803.—(See *Med. Chir. Journ. vol.* 3, *p.* 2.)

Dr. Baillie knew an instance in which one carotid was entirely obstructed, and the diameter of the other considerably lessened, without any apparent ill effects on the brain.—(See *Trans. for the Improvement of Med. and Chir. Knowledge*, *vol.* 1, *p.* 121.) Sir Astley Cooper has also recorded an example in which the left carotid was obstructed by the pressure of an aneurism of the aorta; and yet during life no paralysis nor impairment of the intellects had occurred.—(See *Med. Chir. Trans. vol.* 1, *p.* 223.) A similar case is related by Pelletan.—(*Clinique Chir. t.* 1, *p.* 68.)

Mr. Abernethy was under the necessity of tying the trunk of the carotid in a case of extensive lacerated wound of the neck, where the internal carotid and the chief branches of the external carotid were wounded. The patient at first went on well: but in the night he became delirious and convulsed, and died about thirty hours after the ligature was applied. This case fell under my own notice, and the inference which I drew was, that the man died more from the great quantity of blood which he lost, and the severe mischief done to the parts in the neck, than from any effect of the ligature of the artery on the brain.

In another instance in which the common carotid was tied, on account of a wound of the external carotid by a musket-ball, complicated with fracture of the condyle and coracoid process of the lower jaw, every thing went on favourably until the seventh day after the operation. Neither the intellectual faculties nor the functions of the organs of sense had been at all disturbed. But at that period stupor, confusion of ideas, restlessness, a small unsteady pulse, discoloration of the face, and loss of strength came on, followed in the evening by a violent paroxysm of fever. On the eighth day three copious hemorrhages took place from the whole surface of the wound, and on the ninth the man died. In this case, however, the affection of the brain, and the other unfavourable symptoms, would be ascribed by nobody to the effects of the ligature on the carotid, but every one would see the cause in the severe and extensive local mischief produced partly by the musket-ball, and partly by the mode in which the operation was performed, the surgeon having extended his incisions from the parotid gland to within an inch of the clavicle!—(See *Journ. Général de Méd. &c. par Sedillot.*)

That the carotid may be tied without injuring the functions of the brain, and that aneurisms of this artery admit of being cured by the operation, is now fully proved. The following is the second instance in which I have been present at the operation of tying the carotid trunk on account of a wound.

A soldier of the 44th regiment was wounded in the neck with a pike at the battle of Waterloo, and was brought to Brussels. After he had been some little time in the hospital, the bleeding, which had stopped, recurred with great violence, both from the mouth and the external wound itself; and it was therefore judged necessary to tie the common carotid, which was done by my friend Mr. Collier. The operation was performed by making an incision along the inner edge of the sterno-cleido-mastoideus, raising this muscle from the sheath including the artery, &c., and holding aside the jugular and lower thyroid veins, which swelled up every instant to a very large size, so as to overlap the artery. This vessel being disengaged from the nerve was then tied. Though the operation was done by candle-light it was skilfully performed, and reflects great credit on Mr. Collier. A detail of the case may be found in a modern work.—(*Med. Chir. Trans. vol.* 7, *p.* 107.)

Another example in which the carotid artery was tied and the patient saved, in a case where it was wounded with a penknife, was published by Dr. John Brown, surgeon to the county of Meath Infirmary.—

(See *Dublin Hospital Reports, vol.* 1, *p.* 301, *&c.*) In this instance, the internal jugular vein "did not appear, nor was it a source of the slightest inconvenience during the operation."—(*P.* 305.) A case, very analogous to the foregoing, is recorded by Mr. Hodgson, and the event equally successful. "The jugular vein afforded no trouble in the operation: it was not even seen." A gradual improvement of the power of deglutition marked the gradual subsidence of the tumour, which pressed against the pharynx. Nor was any changed perceived in the state of the patient's mind after this operation, who remained as she had been previously, melancholy and dejected.—(*P.* 332.)

Acrel mentions an example in which the carotid artery was wounded by a gun-shot, and the hemorrhage permanently stopped by compression. A similar case is related by Van Horne, in his annotations to the work of Botallus.—(*De Vuln. Sclopetus.*) Baron Larrey has likewise related a case in which the carotid was wounded by a musket-ball, and life saved by the instant application of pressure.—(*Mém. de Chir. Mil. t.* 1, *p.* 309.) However, considering the size of the vessel, and its unfavourable situation for being effectually and steadily compressed, some doubts may be entertained, whether the vessel wounded might not rather have been one of its branches.

November 1, 1805, Sir Astley Cooper operated on Mary Edwards, aged forty-four, who had an aneurism of the right carotid artery: the tumour reached from the vicinity of the chin to beyond the angle of the jaw, and downwards to within two inches and a half from the clavicle.

The swelling had a strong pulsatory motion. The woman also complained of a particular tenderness of the scalp on the same side of the head, and of such a throbbing in the brain as prevented her from sleeping.

An incision, two inches long, was made at the inner edge of the sterno-cleido-mastoideus muscle, from the lower part of the tumour to the clavicle. This wound exposed the omo-hyoideus and sterno-hyoideus muscles, which being drawn aside towards the trachea, the jugular vein presented itself to view. The motion of this vein produced the only difficulty in the operation, as, under the different states of breathing, the vessel sometimes became tense and distended under the knife, and then suddenly collapsed. Sir Astley Cooper introduced his finger into the wound to keep the vein out of the way of the knife, and having exposed the carotid artery by another cut, he passed two ligatures under this vessel by means of a curved aneurism-needle. Care was taken to exclude the recurrent nerve on the one hand, and the par vagum on the other. The ligatures were then tied about half an inch asunder; but the intervening portion of the artery was left undivided.

The pulsation of the swelling ceased immediately the vessel was tied; and on the day after the operation, the throbbing in the brain had subsided, while no diminution of nervous energy in any part of the body could be observed.

The patient was occasionally afflicted with bad fits of coughing, but upon the whole went on at first pretty well. On the eighth day, however, a paralysis of the left leg and arm was noticed, attended with a great deal of constitutional irritation. November 8th, the patient could move her arm rather better; but became unable to swallow solids. Nov. 12th, the palsy of her arm had now almost disappeared. The ligatures came away. Nov. 14th, she was in every respect better; she swallowed with less difficulty; and the tumour was smaller, and quite free from pain. On the 17th, she became very ill; the tumour increased in size, and was sore when pressed. The wound was as large as immediately after the operation, and discharged a sanious serum. Great difficulty of swallowing, and a most distressing cough were also experienced. The pulse was ninety-six, and the left arm again very weak. On the 21st, the patient died, the difficulty of swallowing having previously become still greater, attended with a farther increase of the tumour, the skin over which had acquired a brownish-red colour.

On opening the swelling after death, the aneurismal sac was found inflamed, and the clot of blood in it was surrounded with a considerable quantity of pus. The inflammation extended on the outside of the sac, along the par vagum, nearly to the basis of the skull. The glottis was almost closed, and the lining of the trachea was inflamed and covered with coagulating lymph. The pharynx was so compressed by the tumour, which had been suddenly enlarged by the inflammation, that a bougie of the size of a goose-quill could hardly be introduced into the œsophagus. Sir Astley Cooper concludes with expressing his opinion that *these causes of failure may, in future, be avoided by operating before the tumour is of such size as to make pressure on important parts; or, if the swelling should be large, by opening it, and letting out its contents, as soon as inflammation comes on.*—(See *Med. Chir. Trans. vol.* 1.)

In one case under the care of Mr. Coates, of Salisbury, the making of an opening, about a month after the operation, gave relief by discharging seven ounces of fetid blood and pus; but three weeks afterward, hemorrhage came on from the sac, and the patient was carried off by repeated loss of blood. On dissection, an artery capable of admitting a probe was found to pass into the cavity of the sac.—(See *Med. Chir. Trans. vol.* 11, *part* 2.)

In June, 1808, Sir Astley Cooper operated, in Guy's Hospital, on a man aged 50, who had a carotid aneurism, attended with pain on one side of the head, throbbing in the brain, hoarseness, cough, slight difficulty of breathing, nausea, giddiness, &c. The patient got quite well, and resumed his occupation as a porter. There was afterward no perceptible pulsation in the facial and temporal arteries of the aneurismal side of the face.

On the opposite side, the temporal artery became unusually large. The tumour was at last quite absorbed, though a pulsation existed in it till the beginning of September. The man's intellects remained perfect; his nervous system was unaffected; and the severe pain, which before the operation used to affect the aneurismal side of the head, never returned.

The swelling, at the time of the operation, was about as large as a pullet's egg, and situated on the left side about the acute angle made by the bifurcation of the common carotid, just under the angle of the jaw.

Sir Astley Cooper began the incision opposite the middle of the thyroid cartilage, at the base of the tumour, and extended the wound to within an inch of the clavicle, on the inner side of the sterno-cleido-mastoideus muscle. On raising the margin of this muscle, the omo-hyoideus could be distinctly seen crossing the sheath of the vessels, and the nervus descendens noni was also brought into view. The sterno-cleido-mastoideus was now separated from the omo-hyoideus, when the jugular vein was seen. This vessel became so distended at every expiration as to cover the artery. When the vein was drawn to one side, the par vagum was manifest, lying between that vessel and the carotid artery, but a little to the outer side of the artery. The nerve was easily avoided.

A double ligature was then conveyed under the artery with a blunt iron probe. The lower ligature was immediately tied, and the upper one was also drawn tight, as soon as about an inch of the artery had been separated from the surrounding parts above the first ligature, so as to allow the second to be tied at this height. A needle and thread were passed through the vessel below one ligature, and above the other. The artery was then divided. In a little more than nine weeks, the wound was quite healed, and the patient entirely recovered.—(See *Med. Chir. Trans. vol.* 1.)

Another successful instance, in which the carotid was tied for the cure of an aneurism, is related in a work to which I always have the greatest pleasure in referring.—(See *Hodgson's Treatise on the Diseases of Arteries, p.* 329.)

Mr. Travers tied the carotid artery in a woman, who had an aneurism by anastomosis in the left orbit. The disease had pushed the eye out of its socket. Two small ligatures were applied, which came away on the twenty-first and twenty-second days. No hemorrhage, nor impairment of the function of the brain took place, and the disease in the orbit was effectually cured.—(See *Med. Chir. Trans. vol.* 2.)

Another highly interesting example, in which an aneurism by anastomosis in the orbit was effectually cured by tying the carotid artery, is recorded by Mr. Dalrymple, surgeon at Norwich. This gentleman performed the operation on the 12th of November, 1812. The patient was a female, aged 44. The protrusion of the eye was relieved in proportion as the swelling

diminished. The violent headaches also subsided; but the eyesight was irrecoverably lost.—(See *Med. Chir. Trans. vol.* 6, *p.* 111.)

The carotid artery has sometimes been tied, with the view of enabling the surgeon to cut away swellings from the neck and side of the face, where, from particular circumstances in the cases there was reason to fear a fatal hemorrhage without that preliminary measure.—(See *Goodlad's and Arenat's Cases, in Med. and Chir. Trans. vols.* 7 *and* 12.)

An interesting case, in which my friend Mr. Vincent tied the carotid trunk for an aneurism, is published in the 10th vol. of the latter work.—(*P.* 212, &c.) In this example, the internal jugular vein did not appear to be at all in the way during the operation; some of the fibres of the omo-hyoideus, however, could not be conveniently drawn aside, and were therefore divided. A single ligature was applied; the pulsation in the tumour did not entirely cease, at first, when the artery was tied, but it did so two days afterward; and the swelling was rapidly diminishing. The ligature came away about three weeks after the operation, and there was every hope of a cure; but, between the fourth and fifth week, a considerable swelling occurred between the wound and the jaw, impeding deglutition, but not the breathing. This state was followed by febrile symptoms, increased difficulty of swallowing, an attack of coughing, and impeded respiration. In the hope of affording relief, an incision was made in the tumour, from which a small quantity of pus and coagulum issued; but it was in vain, for the patient was dying. On dissection, the carotid artery was found perfectly closed as far as the division of the arteria innominata. But above where the ligature had been, the vessel was open and inflamed, and pus was found in it. The most remarkable circumstance noticed was globules of air, adhering to the inner surface of the aorta, and other large arteries, and found also under the tunica arachnoidea. The bulk of the swelling in the neck depended upon effusion of serum in the cellular membrane.

In order to get at the carotid artery in the safest manner, Mr. Abernethy has recommended making an incision on that side of it which is next the trachea, where no important parts are exposed to injury, and then to pass a finger underneath the vessel. The par vagum must be carefully excluded from the ligature; for to tie it would be fatal.—(*Surgical Observations*, 1804.)

The cure of carotid aneurisms by the operation has now been so often exemplified, that even to refer to every case upon record would demand more space than I can afford. A successful instance is reported by Macaulay (*Edin. Med. Surg. Journ. April*, 1814); another by Dr. Post, who used two ligatures, and divided the artery in the space between them (*New-England Journ. of Medicine and Surgery, vol.* 3, *p.* 205, *Boston*, 1814); another by Mr. Giles Lyford, proving the sufficiency of a single ligature.—(*Med. Chir. Trans. vol.* 11, *p.* 97, &c.) The case in which Mr. Goodlad tied the carotid, in order to prevent hemorrhage in the removal of a tumour involving the parotid gland, is contained in *vol.* 7, *p.* 112, &c. of the latter book. The example in which the carotid was tied by Dr. Fricke, in the hospital at Hamburgh, for the cure of a diseased parotid, is reported in the *Lancet*, *No.* 182. Some diminution of the swelling, and increased power of swallowing followed; but suppuration took place, and the case ended fatally.

The best anatomical engravings of the parts concerned in the operation of taking up the carotid artery, are those by Tiedemann and Rosenmüller.—(See *Chirurg. Anatom. Abbildungen, th.* 1, *tab.* 7, 8, 9.)

For the particulars of a carotid aneurism cured by the ligature of the artery by M. Dumont, see *Diss. sur l'Aneurisme de l'Artère carotide, par P. J. Vanderhagen, Paris*, 1815. Walther, of Landshut, in the year 1814, tied the carotid artery for the cure of an aneurism with complete success: he applied only a single ligature.—(*Breschet, Fr. transl. of Mr. Hodgson's work, t.* 2, *p.* 83.) In this translation are reported several instances, in which Dupuytren and other continental surgeons applied a ligature to the carotid. Dr. Holscher, of Hanover, has also operated with success.—(See *Lond. Med. Repository, vol.* 16, *No.* 94.)

[Dr. Bushe has lately tied the common carotid for an aneurism situated in the fauces, with complete success. Professor Pattison, of the University of London, when resident in Baltimore, cured an immense aneurism of the internal maxillary by tying the trunk of the carotid. I witnessed this operation, and saw the successful result.—*Reese.*]

Of the plan of tying the carotid above the aneurism, when it is situated so low that the ligature cannot be applied below it, I have also spoken. The facts, by which the propriety of this practice has now been completely established, have also been noticed: they appear to me to reflect considerable credit on Mr. Wardrop, by whom this method of operating has been revived and extended. The practice of tying the carotid for the cure of aneurism of the arteria innominata will be noticed in the ensuing section.

NEW OPERATION FOR ANEURISM OF THE ARTERIA INNOMINATA.

It having been established, that aneurisms may be cured by simply lessening the impetus of the blood flowing through them, and that, although a circulation may yet continue in them for some time, the layers of coagulable lymph within the sac will augment, and ultimately bring about a complete consolidation of the swelling, it occurred to Mr. Wardrop, that in aneurism of the arteria innominata, the progress of the disease might be arrested by tying its two great branches, the carotid and subclavian. Although a certain portion of blood would still continue to pass along the innominata to those branches of the subclavian on the cardiac side of the ligature, the ligature being necessarily placed on the subclavian artery after it emerges from between the scaleni muscles, Mr. Wardrop conceived, that such would yet be the diminution of the impetus of the blood in the sac, that the future increase of the tumour would be prevented, and even a permanent obliteration of the aneurismal cavity would be accomplished.—(*On Aneurism*, *p.* 58.) The knowledge of this principle, indeed, he thinks, may be useful in the cure of many aneurisms, which have hitherto been considered beyond the reach of art. In an aneurism of the innominata, Mr. Mackelcan found that nature had nearly completed a cure of the disease on this principle. The carotid artery was plugged up, and the large aneurismal swelling was filled with a coagulum, leaving only a comparatively small channel for the passage of the blood into the subclavian artery.—(See *Appendix to Wardrop on Aneurism.*) Mr. Wardrop has seen some cases, and several are on record, which illustrate the same important pathological fact, and prove beyond a doubt, that blood can coagulate in an aneurism so as to strengthen the parietes of the sac, and ultimately fill its cavity, without the circulation in the sac being in the first instance either suddenly or entirely interrupted.

It was the knowledge of this fact that led Mr. Wardrop to perform the operation, which he has related. Nature, in the case alluded to, had already instituted a curative process by diminishing the circulation in the carotid artery; and when he found this alone not sufficient to stop the enlargement of the aneurism, he determined to place a ligature on the subclavian. In doing this, he conceived that he was strictly imitating the process which nature herself had commenced.—(*P.* 61.) The case of Mrs. Denmark, aged 45, in whom he tied the subclavian artery, and thus cured an aneurism of the arteria innominata, is highly interesting. The particulars may be read in his own publication, or in the *Lancet* for 1827. Suffice it here to state, that the disease was completely cured. In the appendix to Mr. Wardrop's publication, and in the *Lancet* for Novem ber, 1828, is another highly important case, confirming the accuracy of the principles explained by this ingenious surgeon. It is an example in which Mr. Evans, of Belper, Derbyshire, successfully treated an aneurism of the innominata and root of the carotid, by tying the latter vessel. In the end, the patient, a butcher and horse-dealer, thirty years of age, was well enough to attend regularly the markets and fairs of Derby, seven miles from his home. In the course of the case, three remarkable circumstances occurred: 1st, An obliteration of the large arteries of the right arm. 2dly, A profuse salivation. 3dly, A disposition to paralysis of the right side, supposed by Mr. Evans to have arisen from a greater quantity of blood being sent to the left hemisphere of the brain than to the right. However, as such paralysis has not attended

other operations in which the carotid was tied, the truth of the explanation seems doubtful. The palsy afterward nearly subsided.

[It affords me high gratification to record, that Professor Mott, of this city, has lately performed this operation for the first time it has been attempted in America, by tying the carotid artery for aneurism of the arteria innominata, involving the subclavian and root of the carotid. This is the first time in America in which aneurism has been treated by tying the artery on the anticardial side of the tumour. The report of the case, and its successful result, is contained in the American Journal of the Medical Sciences, No. 10, for February, 1830. Since that report was published the patient has died, and the tumour having been removed, fully establishes the success of the operation. I have had an opportunity of examining the preparation, and found the carotid entirely obliterated and impervious above the aneurismal sac, although the ligature was applied very high on that vessel. The death was occasioned by the displacement and distortion of the trachea and larynx, which are seen lying on the side of the neck, and in no wise connected with the operation, but was the consequence of the long existence of the disease before the oper tion was submitted to.—*Reese.*]

OF ANEURISMS OF THE AORTA, AND VALSALVA'S TREATMENT.

This afflicting and fatal disease is by no means unfrequent, and the arch of the aorta is its most common situation. Dr. Hunter was of opinion that the latter circumstance depended on the forcible manner in which the blood, propelled from the left ventricle of the heart, must be driven against the angle of the curvature of the vessel.

Mr. A. Burns considered aneurism of the thoracic aorta more frequent, perhaps, than that of any other vessel in the body. "I have had (says he) an opportunity of examining fourteen who had died of this disease, but have not seen more than three instances of external aneurism."—(*On Diseases of the Heart, &c. p.* 215.)

These proportions, however, would not correspond to common observation, external aneurisms, taken collectively, being supposed to be about as numerous as those of the aorta alone, a calculation long ago made by Dr. A. Monro, primus.

It was the opinion of Dr. W. Hunter that the aneurismal sac was composed of the dilated coats of the artery, which parts nature thickened and studded with ossifications after the origin of the disease, for the purpose of resisting its increase. Mr. Hodgson, also, in his late excellent publication declares his decided belief, and adduces facts to prove, that many aneurisms of the aorta are formed by dilatation. Scarpa argues, however, that the generality of aneurisms of the aorta are the consequence of a rupture of the proper coats of this large vessel; and that the cellular sheath of the artery is what becomes distended into the thickened and ossified aneurismal sac.

Dr. W. Hunter considered the ossifications of the sac as consequences of the disease: but Haller looked upon such scales of bone in the aorta as the very cause of the affection, by rendering the artery inelastic, and incapable of yielding to each pulsation of the heart.

It is unquestionably true that aneurisms of the aorta are most common in persons who are advanced in life, and it is equally well known, that the aorta of every old subject, whether affected with aneurism or not, is almost always marked in some place or another with ossifications, or rather with calcareous concretions. Such productions appear to occasion a decay or absorption of the muscular and inner coats of the vessel, so that at length the force of the blood makes the artery give way, and this fluid, collecting on the outside of the laceration or rupture, gradually distends the external sheath of the artery into the aneurismal sac, which itself becomes at last of considerable thickness, and studded with ossified specks.

"If any person who is not prejudiced in favour of the common doctrine with regard to the nature and proximate cause of this disease (says Scarpa), will examine, not hastily and superficially, but with care and by dissection, the intimate structure and texture of the aneurism of the aorta, unfolding with particular attention the proper and common coats of this artery, and in succession those which constitute the aneurismal sac, in order to ascertain distinctly the texture and limits of both, he will clearly see that the aorta, properly speaking, contributes nothing to the formation of the aneurismal sac, and that, consequently, the sac is merely the cellular membrane, which in the sound state covered the artery, or that soft cellular sheath which the artery received in common with the neighbouring parts. This cellular substance, being raised and compressed by the blood effused from the corroded or lacerated artery, assumes the form of a circumscribed tumour, covered externally, in common with the artery, by a smooth membrane, such as the pleura in the thorax and the peritoneum in the abdomen."

Scarpa then comments upon the differences of mere dilatation of an artery from aneurism, a subject which has been already fully considered in the foregoing pages.—(*Scarpa on the Anatomy, Pathology, and Surgical Treatment of Aneurism, transl. by Wishart, p.* 55, 56.)

As I have already explained in the preceding columns, the sentiments of this eminent anatomist are not adopted by the generality of surgeons; or rather, his doctrine is not carried by others to the extent which he has insisted upon; and it would be useless repetition to bring before the reader again the facts which prove that his statements are liable to many exceptions. A case, however, recited by Roux, which I have met with since the foregoing pages were printed, merits notice; it was an instance in which a popliteal aneurism, unattended with pulsation, had been mistaken for an abscess and punctured, whereby the patient lost his life. On dissecting the limb, Roux says, "the three coats of the artery participated in the dilatation, and the case was one of the clearest specimens which I have ever seen of a true aneurism."—(*Nouveaux Elémens de Méd. Opératoire, t.* 1, *p.* 517.)

All arguments brought against the possibility of a dilatation of the inner coat, and founded on the inelastic structure of that membrane, must likewise be completely refuted by another fact demonstrated by morbid preparations, collected by Dubois and Dupuytren, where the inner coat of the aorta is alone dilated, protruding through the outer tunics in the form of a distinct swelling somewhat like a hernia.—(*Roux, op. cit. p.* 49.)

In whatever manner aneurisms of the aorta are formed, there are no diseases which are more justly dreaded, or which more completely fill the surgeon as well as the patient with despair. No affliction, indeed, can be more truly deplorable; for the sufferings which are occasioned hardly ever admit even of palliation, and the instances of recovery are so very few, that no consolatory expectation can be indulged of avoiding the fatal end to which the disease naturally brings the miserable sufferer.

The existence of aneurisms of the aorta is scarcely ever known with certainty before they have advanced so far as to be attended with an external pulsation and a tumour that admits of being felt or even seen. In very thin subjects, the throbbing of the abdominal aorta is sometimes unusually plain through the integuments and viscera, and this has occasionally given rise to the suspicion of an aneurism; a circumstance which deserves to be remembered by every surgeon desirous of not pronouncing a wrong opinion. The preternatural pulsations, however, which are liable to be mistaken for those of aortic aneurisms, are of various kinds, and form a subject to which the attention of Dr. Albers, of Bremen, the late Mr. A. Burns, and others, has been very usefully directed.—(See *Abdomen.*)

While thoracic aneurisms of the aorta are accompanied with no degree of external swelling, the symptoms are all equivocal, and might depend on a disease of the heart, angina pectoris, phthisis pulmonalis, &c. However, some difference depends upon the volume, position, and nature of the aneurism. As Laennec observes, simple dilatation, when in a moderate degree, hardly produces any effect, but the most inconsiderable false aneurisms may give rise to very serious disorder. The first and most common of these effects is, the compression of the heart and lungs.—(See *Laennec on Diseases of the Chest, by Forbes, p.* 676, *ed.* 2.) Violent and irregular throbbings frequently occur between the fourth and fifth true ribs of the left side: the same irregularity of the pulse prevails as often proceeds from organic affections of the heart; a dissimilarity of the pulse in the two wrists; the respiration

is exceedingly obstructed; the voice altered; and in a more advanced period of the malady the patient is at times almost suffocated. The pressure of the internal swelling on the trachea, bronchia, and lungs, is sufficient to account for this difficulty of breathing. In many instances the irritation and compression produced by the tumour occasion an absorption of the greater part of the lungs, and abscesses and tubercles throughout the portion which remains. Even the function of deglutition suffers interruption in consequence of the pressure made on the œsophagus, which may even be in a state of ulceration. Thus, in an example recently published, we read that "the cavity of the windpipe was nearly obliterated from the pressure of the aneurism; and the extremities of four of its cartilages lay in the œsophagus, having entered that canal through an ulcer in its coat."—(*Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 3, *p.* 83.)

After what has been stated, it cannot be surprising, that ere the disease manifests itself externally, affections of the lungs or strictures of the œsophagus should often be suspected.—(*Hodgson, p.* 91.)

An aneurism of the arteria innominata, not discovered till after the patient had died of suffocation, gave rise to great difficulty of drawing air into the chest without any other symptom calculated to throw light on the nature of the disease. The aneurismal swelling was situated behind the first bone of the sternum, and pressed upon the trachea. The front of this tube was pushed in by the tumour so as to present a convex prominence on the inner surface, which, however, diminished its area in a very slight degree. Mr. Lawrence adduces this fact to prove that spasm of the air-cells may be the cause of great distress in breathing. "The termination of this case (says he) is the more remarkable, inasmuch as in another patient an aneurism rising out of the arch of the aorta, and pressing on the corresponding part of the trachea, so as to produce ulceration of the internal membrane, under which there was a slight appearance of coagulated blood, caused no affection of the breath at all. The person died of a different complaint, and the discovery of the aneurismal tumour, which was very small, and filled with firm laminated coagula, was quite accidental."—(*Med. Chir. Trans. vol.* 6, *p.* 227.)

Thus we find in thoracic aneurisms, at least previously to their attainment of a certain size, that no regularity prevails even with regard to difficulty of breathing, the symptom which, *à priori*, one might suppose would invariably be present.

Few diseases, according to Laennec, are so insidious as aneurism of the thoracic aorta. He affirms, that "it cannot be known with certainty till it shows itself externally. It can hardly be suspected even when it compresses some important organ, and greatly deranges its functions. When it produces neither of these effects, the first indication of its existence is often the death of the individual, as instantaneously as if by a pistol-bullet." One case, recorded by Mr. Pattison, confirms the same fact, for the patient had only symptoms leading to a suspicion of rheumatism in the neck, and died suddenly of apoplexy.—(*Burns on the Head and Neck, ed. by Pattison.*) Laennec has known persons cut off in this manner who were believed to be in the most perfect health. He admits that percussion will sometimes enable us to detect a tumour of large size existing within the mediastinum, or even in the back; but not to discriminate the nature of the swelling. His experience had not been sufficient to let him pronounce how far the difficulty of diagnosis was likely to be removed by the stethoscope. However, aneurisms of the abdominal aorta, he says, are recognised with the utmost facility by means of this instrument. In this case we are sensible of tremendous pulsations which painfully affect the ear, and the intensity of which is not at all recognised by the hand, even when sufficiently perceptible to the touch. As high up as the cœliac artery the contractions of the auricles are not in the least distinguishable. The sound of the pulsations is described as clear and loud.—(*Laennec on Diseases of the Chest, p.* 678, *&c.*)

I have mentioned that the symptoms of thoracic aneurisms, previously to the formation of any outward swelling, often resemble those of phthisis, and the latter is sometimes actually supposed to be the disease under which the patient is labouring. But there is one distinction between the cases, which is pointed out by Mr. Hodgson, and may be of use, in combination with other circumstances, in facilitating the diagnosis: "in phthisis, the expectoration is either puriform or thick and clotted; but in aneurisms which are not accompanied with disease in the lungs, as far as I have observed, it always consists of a thin frothy mucus.—(*On Diseases of Arteries, &c. p.* 93.)

According to Kreysig's experience, the cough comes on at irregular periods, is violent, and attended with great efforts, the expectorated matter being forced up by the vehemence. He agrees with Mr. Hodgson respecting the general quality of what is expectorated, where thoracic aneurisms are not complicated with diseased lungs; but he says that the matter coughed up also frequently consists of masses of lymph blended with brick-red particles of blood, which masses, when thrown into water, seem as if they were composed of a ball of stringy substances.—(*German transl. of the latter work, p.* 137.)

From a review of many cases of aortic aneurisms, Mr. A. Burns was inclined to think, that when the ascending aorta is aneurismal, the breathing is more affected than when the arch of the vessel is enlarged, but that in the latter case the impediment to deglutition is greatest.—(*On Diseases of the Heart, &c. p.* 244.)

According to Laennec, false aneurisms are most common in the descending aorta; and true ones in the ascending portion of the vessel and its arch. He has never met with any species of false aneurism in the latter situation, but such as is consequent to the true or simple dilatation of the artery.—(See *Laennec on the Diseases of the Chest, p.* 676, *ed. by Forbes.*)

The way in which aneurisms of the thoracic aorta prove fatal, is subject to considerable variety. These swellings do not always destroy the patient by hemorrhage; in numerous instances, the magnitude of the disease so impedes respiration, that death seems induced by suffocation, and not a drop of blood is found internally effused. Frequently (to use the description of Mr. John Bell), before the awful and fatal hemorrhage has had time to occur, the patient perishes of sufferings too great for nature to bear. The aneurismal tumour so fills the chest, so oppresses the lungs, compresses the trachea, and curbs the course of the descending blood, that the system with a poor circulation of ill-oxydated blood, is quite exhausted. And thus, though the patient is saved from the most terrible scene of all, he suffers great miseries; he experiences in his chest severe pains, which he compares with the stabbing of knives; terrible palpitations; an awful sense of sinking within him; a sound within his breast, as if of the rushing of waters; a continual sense of his condition; sudden startings during the night; fearful dreams and dangers of suffocation; until with sleepless nights, miserable thoughts by day, and the gradual decline of an ill-supported system, he grows weak, dropsical, and expires.—(See *Anatomy of the Human Body, by John Bell, vol.* 2, *edit.* 3, *p.* 234, 235.)

Mr. A. Burns saw two examples, in which the patients died instantaneously, though their aneurismal tumours were very small and had not burst. Both these patients were in the early stage of pregnancy.—(*On Diseases of the Heart, p.* 236.)

The situations in which aneurisms of the curvature of the aorta burst, are different in different cases. Sometimes the swelling bursts into the cavity of the chest, or that of the pericardium, and the patient drops suddenly down. According to Laennec, the left cavity of the pleura is by far the most frequent situation in which the thoracic aneurisms of the aorta burst.—(*On Diseases of the Chest, p.* 677.) When the coats of the aorta give way within the pericardium, where they only receive a slight external membranous covering, this is apt to be also ruptured at the same time, so as to bring on copious effusion of blood, which oppresses the action of the heart, and produces immediate death. In other examples, the blood is effused into the trachea or bronchia, and the patient, after violent coughings and ejections of blood from the mouth, expires. Sometimes, after the tumour has become closely adherent to the lungs, it bursts into the air-cells, through which the blood is widely diffused. An example of this termination of the disease was observed by Laennec; who also saw another case, in which, if the patient had lived a little longer, the same occurrence in all probability would have happened. Ehrhardt says, that he is not

aware, that this mode of rupture has been noticed by other writers.—(*De Aneurysmate Aortæ, p.* 21, 4*to. Lips.* 1820.)

The most remarkable local effects of aneurisms of the aorta are those on the vertebral column. They often destroy it to a very great depth. This is entirely the work of interstitial absorption, there never being any mark of suppuration. On the side next the vertebræ, the sac is completely destroyed, and the circulating blood is bounded by the naked bone. In certain cases, the swelling beats its way through the ribs; even the spinal marrow may be injured, and the patient suffer a species of death somewhat less violent and sudden. In one case of an enormous aneurism of the abdominal aorta, reported in No. 259 of the *Lancet*, the left leg and thigh were much wasted and quite paralytic. This seemed to arise from the pressure on the nerves of the lower extremity, and not from injury of the medulla spinalis. But, although aneurisms in the chest do sometimes protrude at the back, a circumstance that depends on the particular situation of the disease (see *Pelletan, Clinique Chir. t.* 1, *Obs.* 7, *p.* 84), they more commonly rise towards the upper part of the breast, where a throbbing tumour occurs, which has caused an absorption of the opposing parts of the ribs and sternum; and sometimes dislocated the clavicles. Corvisart saw an instance, in which an aneurism of the aorta had dislocated the sternal extremity of the clavicle; and Duverney makes mention of a case, in which, besides the displacement and injury of the clavicle, the sternum and scapula were partially destroyed. Guattani speaks of an example, in which the clavicle was bent by a large aneurism, of which a portion as large as a pigeon's egg projected above the bone.—(*Lauth, p.* 168.) And Morgagni has described a case, where the upper bone of the sternum, the sternal ends of the clavicles, and the adjoining ribs were destroyed by the pressure of a large aneurism of the front of the curvature of the aorta, and the disease presented itself externally somewhat in the form of a bile. —(*Epist.* 26, *art.* 9.)

The swelling now pulsates in an alarming way. The blood is only retained by a thin covering of livid skin, which is becoming thinner and thinner. At length a point of the tumour puts on a more conical, thin, and inflamed appearance than the rest; a slough is formed, and on this becoming loose, the patient is sometimes instantaneously carried off by a sudden gush of blood.

An extraordinary case of aneurism of the aorta is related by Dr. C. W. Wells. The disease being unattended with any external swelling, it seems, was not comprehended during the patient's lifetime.

The following is an abstract of the case. Mr. A. B., a gentleman, thirty-five years of age and temperate in his habits, became affected in 1789 with symptoms which were thought to denote the approach of pulmonary consumption. These, however, after some time entirely disappeared. In 1798 he was attacked with a slight hemiplegia, from which he also recovered, with the exception of an inconsiderable sense of coldness in the foot, which had been paralytic. In March, 1804, he complained of being frequently troubled with a noise in his ears, flatulence in his bowels, and pains in his hands and feet, sometimes attended with slight swellings in the same parts. From one or more of these symptoms he was never afterward quite free; but he did not complain of any unusual feelings in his chest. August 11, 1807, he fatigued himself considerably with walking; ate rather a hearty dinner; and, having refreshed himself with some sleep afterward, he played about with his children. While thus amusing himself, he was suddenly seized, between eight and nine o'clock, with great oppression in his chest. He soon afterward became sick, and in the matter thrown up, some streaks of blood were observed. He now went to bed; but, though the weather was warm and he was covered with bed-clothes, his skin felt cold to the attendants. At midnight he laboured under a constant cough, and expectorated mucus tinged with blood. His body was moistened with a cold sweat, and his pulse was extremely feeble; sometimes it was scarcely perceptible. About five in the morning his pulse was feeble and irregular; his breathing difficult, his skin pale and cold, and covered with a clammy sweat. He frequently tossed and writhed his body, as if he was suffering great pain or uneasiness. The mental faculties, however, seemed unimpaired. Shortly afterward he expired, having complained, just before his death, of much heat in his chest, and thrown off the bed-clothes.

The most remarkable circumstance found on opening the body is thus recorded:—"The ascending aorta was distended to about the size of a large orange. The tumour adhered to the pulmonary artery, just before its division into the right and left branches. Within the circumference of this adhesion there was a narrow hole, by means of which a communication was formed between the two arteries."

Dr. Wells concludes with observing, that though such a disease might easily have been imagined, he had found no instance of it in books, and that it had not been observed by any of the surgeons or anatomists in London. He supposed, that the communication between the aorta and pulmonary artery, took place on the evening before the patient's death, when the oppression of the chest was first felt: and that, in consequence of the superior strength of the left side of the heart, a part of the blood which was thrown into the aorta must have been forced into the pulmonary artery, from which circumstance he conjectures most of the symptoms originated.—(*Trans. of a Society for the Improvement of Med. and Chir. Knowledge, vol.* 3, *p.* 85.)

The bursting of an aneurism of the aorta into the pulmonary artery, is then another possible mode in which the disease may prove fatal.

Besides the example of this nature reported by Dr. Wells, several others are detailed by writers.—(See *Bulletin de la Faculté de Médecine, No.* 3, *in which there are two cases; Sue, in Journ. de Méd. continué, t.* 24, *p.* 124; *and in Bulletin de la Faculté, &c. t.* 17, *p.* 16.)

Aneurisms of the arch of the aorta are stated to have adhered to, and burst into, the right auricle of the heart, and thus to have produced instant death.—(See *Med. Chir. Journ. vol.* 6, *p.* 617. *Bulletin de la Société de Médecine à Paris,* 1810, *No.* 3, *p.* 38.)

The cases recorded in which aneurisms of the thoracic aorta have burst into the œsophagus, are beginning to be more numerous than formerly. Bonetus and Morgagni relate no examples of it; nor are there any in the comprehensive treatises of Scarpa and Hodgson. Corvisart speaks of an instance which had been seen by Dupuytren, of which, however, no description is given. Yet the possibility of the occurrence is not a matter of speculation or doubt.

A case of this description is noticed by Matani (*De Aneurism. Præcordiorum Morbis, p.* 120); another is alluded to by Ehrhardt, as being related by Copeland (*Comment. de Aneurismate Aortæ, p.* 22, *et Cerutti Catal. Prop. Pathol.*); an instance is described by Bertin (See *Bulletins de la Faculté de Méd.* 1810, *p.* 14); and a very interesting one, attended with disease of the spinal cord and paralysis, is given by Dr. Molison. —(See *Edin. Med. Chir. Trans. vol.* 3, *p.* 173.)

Sauvages is one of the writers who have adduced proofs of this mode of rupture: *cadavere aperto, inveni ventriculum septem vel octo libris sanguinis distensum, aortam ad brachii magnitudinem, per spatium septem vel octo pollicum dilatatam, et orificium denarii magnitudine aortæ, et œsophago continuo commune, quod tamen quinque cristæ carneæ, veluti valvulæ ex ambitu orificii oriundæ et circumpositæ potuerunt obturare. Per hoc orificium, sanguis ex aorta fluxerat in œsophagum.*—(*Nov. Method. t.* 2, *p.* 298.) A similar case has been recently published by Bricheteau.—(See *Bulletin de l'Athenée de Méd. de Paris, Dec.* 1816.) Laennec met with three examples of death from this cause.—(*On Dis. of the Chest, p.* 677, *ed. by Forbes.*) The same distinguished professor met with an aneurism of the descending aorta, where the tumour had made such pressure on the thoracic duct, that this tube was partly destroyed, and all the lymphatic vessels were found uncommonly turgid.—(*Journ. de Méd. par Corvisart, t.* 2, *p.* 15.) With the exception, perhaps, of one instance given on the authority of Lancisi (*Lauthii Collect. p.* 38), no other example of this description is upon record.

An instance is reported by Corvisart, in which the pressure of an aneurism of the ascending aorta had nearly obliterated the termination of the lower vena cava, and a fatal attack of apoplexy was the consequence.—(*Mal. du Cœur, p.* 342.)

It is well worthy of notice, that aneurisms of the

arch of the aorta may occasion a tumour so much like that of a subclavian aneurism, as to be in danger of being mistaken for the latter disease. An example of this kind is related by Mr. Allan Burns: "a case," says he, "on which several of the most distinguished practitioners of Edinburgh, and almost every surgeon in Glasgow, were consulted. The nature of the disease appeared to be so decided, and its situation in the subclavian artery so clear, that on that subject there was no difference of opinion. Some were, however, of opinion, that an operation might be performed, while others were fully convinced, that the case was hopeless. For myself, I must confess, that I was firmly persuaded, that in the early stage of the disease, an operation might have been beneficial," &c.—(*Surgical Anatomy of the Head and Neck, p.* 30.) After death the vessel which was supposed to have been most materially affected, was found perfectly healthy.—(*P.* 39.)

After detailing all the particulars of this interesting case, Mr. A. Burns observes, that "it corroborates Sir Astley Cooper's remark, that aneurism of the aorta may assume the appearance of being seated in one of the arteries of the neck: an inference drawn from the examination of a case which came under his own observation, and of which he had the goodness to transmit a short history to me, along with a sketch, illustrative of the position of the tumour. In one case, the aneurism was attached to the right side of the aortic arch, and involved a part of the arteria innominata: in Sir A. Cooper's, the tumour arose from the left side of the arch, from between the roots of the left subclavian and carotid arteries. It formed a Florence-flask-like cyst, the bulbous end of which projected at the root of the neck, from behind the sternum, and so nearly resembled aneurism of the root of the carotid artery, that the practitioner who consulted Sir A. Cooper actually mistook the disease for carotid aneurism."—(*Allan Burns, op. cit. p.* 41.)

The preceding statement has received full confirmation from the observation of an intelligent writer. "I have seen (says Mr. Hodgson) several cases of aneurism arising from the superior part of the arch of the aorta, which protruded above the sternum and clavicles, and in one instance, the space between the tumour and the sternum was so considerable, that it was proposed to tie the carotid artery for an aneurism, which dissection proved to arise from the origin of the arteria innominata and from the arch of the aorta."—(*On the Diseases of Arteries and Veins, p.* 90.)

As we have already noticed, aneurisms of the aorta are most frequent at its curvature; but they are also met with on the other portion of this vessel in the thorax, and likewise on that part of it which is below the diaphragm. In subjects, predisposed to aneurisms, such swellings are frequently seen affecting various parts of the aorta at the same time.

When the disease occurs in the abdominal aorta, a preternatural pulsation generally becomes perceptible at some particular point. The pressure of the tumour interferes with the functions of the viscera; the breathing is rendered difficult by the swelling resisting the descent of the diaphragm; the patient suffers at times excruciating internal pains; sometimes he is affected with costiveness; sometimes with diarrhœa; and not unfrequently with incontinence of the urine and feces. At length, an immense external swelling is formed, which pulsates alarmingly, and if the patient survives long enough, destroys him by a sudden external or internal effusion of blood.

Aneurisms within the thorax and abdomen, being entirely out of the reach of operative surgery, have been too commonly abandoned as unavoidably fatal, and when any thing has been done in such cases, it has generally been only with a view of palliation. Moderating the force of the circulation by bleedings and low diet, avoiding every thing that has the least tendency to heat the body, or quicken the motion of the blood, keeping the bowels well open with laxative medicines, and lessening pain with opiates, have been the means usually employed. Of late years, also digitalis, which has a peculiar power of diminishing the action of the sanguiferous system and impetus of the blood, has been prescribed with every appearance of benefit.

That the diminution of the force of the circulation will prevent the increase of an aneurism, Mr. Hodgson considers illustrated by the following circumstance: if two sacs exist in the course of the same artery, the obstruction which is caused by the passage of blood into the upper removes the force of circulation from the lower, which becomes stationary, or its cavity is obliterated with coagulum.—(*On Diseases of Arteries, &c. p.* 149.)

It was the opinion of the celebrated Valsalva, that the utility of a lowering plan of treatment might do more than merely retard the death of aneurismal patients. It was his belief, that the method might entirely cure such aneurisms as had not already made too much progress; and he put it into practice with such rigour and perseverance, that the treatment became considered as particularly his own. The plan alluded to is not described in his writings, but was published in the first volume of the Commentaries of the Academy of Bologna, by Albertini, one of his fellow-students; and several persons, who had learned this method of Valsalva, afterward imparted it to others. Thus, as Morgagni was passing through Bologna, in 1728, Stancazi, a physician of that place, is said to have informed him of Valsalva's practice.—(See on this subject *Kreysig, uber die Herzkrankheiten, b.* 2, *p.* 728.)

After taking away a good deal of blood by venesection, Valsalva used next to diminish the quantity of food gradually, till the patient at length was allowed only half a pint of soup in the morning, and a quarter of a pint in the evening, and a very small quantity of water, medicated with mucilage of quinces, or with the lapis osteocolla. When the patient had been so reduced as to be incapable of getting out of his bed, Valsalva used to give him more nourishment till this extreme debility was removed. Valsalva was sure, that some aneurisms, thus treated, had got well, because every symptom disappeared, and his conviction was verified by an opportunity which he had of dissecting the body of a person that had been cured of this disease, and afterward died of another affection; for the artery which had been dilated was found contracted, and in some degree callous.

Morgagni relates, that this method of treating aneurisms is somewhat like the plan which Bernard Gengha tried with success, as well as Lancisi, and he refers us to the 24th chapter of the 2d vol. of the Anatomy of the one, and to lib. 2, cap. 4, of the Treatise on the Heart and Aneurisms, of the other. But Sabatier tells us, that in consequence of this instruction, he examined both these works, without finding any thing on the subject. However this may be, we are informed by the latter, that he has seen the good effects of the practice in an officer, who had an alarming aneurism in front of the humeral extremity of the clavicle, in consequence of a sword-wound in the axilla. The patient, after having been bled several times, was confined to his bed, and kept to an extremely low diet. He was allowed as drink only a very acid kind of lemonade. He took pills containing alum, and the swelling was covered with a bag full of tan-mill dust, which was every now and then well wet with port wine. By a perseverance in this treatment, the swelling was reduced to a smallish hard tubercle, having no pulsation, and a perfect cure ensued.—(See *Sabatier, Médecine Operatoire, tom.* 3, *p.* 170—172.)

Guerin recommended the application of ice water or pounded ice, to aneurismal swellings; a plan which he represents as being often of itself sufficient to effect a cure. This topical employment of cold applications may be rationally and conveniently adopted in conjunction with Valsalva's practice.

The most interesting and convincing facts in proof of the efficacy of this mode of treatment, were published a few years ago by Pelletan. Indeed, upon the whole, I have no hesitation in saying, that I have never read any modern collection of surgical cases, which have appeared to me more valuable, than those which compose the Clinique Chirurgicale of this experienced writer.* The following extract from a well-written critique on this work will serve to convey to the reader some idea of the important information contained in the memoir on internal aneurisms:—"The intent in the treatment is to reduce the patient gradually to as extreme a degree of weakness as is possible, without immediately endangering life. It is done by absolute rest, a rigorous diet, and bleeding; to these means, M. Pelletan adds the external application of ice, or cold and astringent washes, &c. He has here

detailed many cases from his own practice, of partial or complete success, which cannot be too generally known, as they may be the means of creating in some, and of confirming in others, a good opinion of the only method of treatment, which has been found at all efficacious in a dreadful and not unfrequent organic disease.

Of the cases here recorded, some appear to have been cured; in others, the treatment had marked good effects. In extreme cases, at best, it afforded but partial and temporary relief. We can notice but a few of these cases, which are, in every respect, highly interesting. In one, a robust man, an aneurism at the root of the aorta, with a pulsating tumour of the size of an egg, projecting between the ribs (the edges of which were already partly absorbed), was reduced so as to recede within the ribs in the course of eight days. At the end of this time, the patient refused to submit any longer. The tumour did not appear again for nearly a year, although he returned to very drunken and irregular habits. He died in about two years and a half, with the tumour again appearing, and much increased in volume. The aneurismal sac communicated with the aorta, by a smooth and round opening, opposite to one of the sigmoid valves. There can be no doubt of the efficacy of the treatment in this case; and it is highly probable that his health and his life might have been long preserved, but for his own indiscretion. In a case somewhat similar, but not so far advanced, the patient appears to have been cured. There was a swelling on the right side of the breast, about six inches in circumference, with a very strong beating. The pulsation was accompanied with a pain which stretched towards the scapula and the occiput. It was evident that the disease was an aneurism of the great arch of the aorta. The patient was a crier, of a strong frame, who was accustomed to drink freely. In the first four days, he was bled eight times, drawing three basins, 'palettes,' in the morning, and two in the evening. On the fifth, the pains and the beating were much lessened, but the pulse was still full. He was again bled once. The pulse was in a favourable state as to strength, till the seventh day, when it again rose, and the man was twice bled.

During this time the man was kept to a most rigorous diet. A cold poultice of linseed and vinegar was placed on the tumour, and renewed when it became warm. At the end of eight days, the good effects of this plan were very evident; the pain and the pulsation were gone. The patient, though weak, was in health and tranquil. He was now allowed more food by degrees. At the end of four weeks from the commencement of the treatment, he left the Hôtel-Dieu well. He afterward led a sober life, and became fatter, without any vestige of disease, except a slight and deep pulsation at the part, in which the aorta may always be felt beating in its natural state. He died two or three years after of another complaint. His death was not known, and the body was not examined."—(See *London Med. Review*, *vol.* 5, *p.* 123.)

Pelletan also cured by similar treatment a large axillary aneurism, which was deemed beyond the reach of operative surgery. On the thirteenth day, the patient was reduced to a degree of weakness which alarmed many of the observers. From that time, all pulsation in the tumour ceased. The contents were gradually absorbed; and the patient returned to his former laborious life with his arm as strong as ever. The pulse at the wrist was lost in consequence of the obliteration of the axillary artery, and the limb only receiving blood through the branches of the subclavian artery. "*Il y a beaucoup d'exemples d'aneurismes, guéris spontanément et sans le secours de l'art* (says Pelletan); *mais on ne peut leur comparer le cas que nous venons de décrire: l'état extrême de la maladie, l'energie des moyens employés, et l'effet immédiat et successif qui en est résulté prouvent assez que le succès a été dû tout entier à l'art.*"—(*Clinique Chirurgicale*, *tom.* 1, *p.* 80.)

In this work, we find not less than three cases, in which aneurism of the aorta is stated to have been effectually cured. One instance was greatly relieved; but the disease returned the next year, in consequence of the patient's intemperate mode of life. In another example, an aneurism at the origin of the aorta was cured; but the disease recurred in another part of that vessel, farther from the heart. Even such cases as proved incurable, to the number of fourteen, all received various degrees of palliation from the treatment adopted.

In a modern work of great merit, several other instances are adduced, in which the utility and efficacy of a debilitating plan of treatment are illustrated.—(See *Hodgson's Treatise on the Diseases of Arteries*, *p.* 146, 147, *&c. &c.*) In the same publication, as I have previously explained, there are several interesting facts, which tend to prove, that when the aneurism of the aorta is lessened or cured, this great vessel itself may remain pervious. The progress of the disease is stopped by the blood coagulating in the sac, and closing the communication between the cavity of the aneurism and that of the artery.

It must be confessed, in regard to Valsalva's mode of treatment, that some experienced men do not place confidence in it. Boyer declares himself against it, as not being really efficacious; and he states, that some time ago, it was tried twice in the Hôtel-Dieu of Paris. The first trial was made on a patient with an axillary aneurism, which could not be operated upon on account of its situation; the second on a woman, who had an aneurism of the abdominal aorta. In both cases, the tumour was large, and its parietes reduced to the cellular coat, and the surrounding cellular substance. In these two aneurisms, the progress of the swelling was much more rapid, and its rupture happened precisely at the moment when the treatment had been pushed to the utmost, and there ought to have been the greatest hope.—(*Traité des Maladies Chir. t.* 2, *p.* 121.)

Sir Astley Cooper declares, that he has seen but little benefit result from the treatment of this disease. According to his experience, only two measures are useful; viz. venesection when the pulse is hard and full; and the administration of the carbonate of soda in considerable doses, which, with entire rest, seem to prevent the increase of the swelling. But he adds, that the soda is at length unavoidably given up, on account of its producing petechiæ. Sir Astley believes that the irritability and quickened pulse, produced by antiphlogistic treatment, often do as much injury as the natural force of the circulation.—(*Lectures*, *&c.*, *vol.* 2, *p.* 48.)

Roux expresses his entire disbelief in the possibility of an aneurism of the aorta being ever completely cured by Valsalva's mode of treatment, because he imagines, that such change could not happen without the tube of that great vessel becoming impervious, and of the lower parts of the body then perishing from stoppage of the circulation. But he bears witness to the utility of such treatment, and recites a case which he attended himself, where an aneurism made a considerable projection on the left side of the sternum, where the cartilages of the third and fouth ribs were raised, the throbbings very forcible, and the sense of suffocation such that the patient was obliged to keep himself constantly quiet; yet, says Roux, though the disease now exists, it forms no prominence on the chest; the pulsations can only be obscurely felt between the ribs; the respiration is but slightly oppressed; and the patient is capable of attending to his business. —(*Nouveaux Elemens de Médecine Opératoire*, *t.* 1, *p.* 510, 8*vo. Paris*, 1813. *Fr. Torti, De Aortæ Aneurysmate Observationes binæ, cum animadv. Pauli Valcarenghi*, 8*vo. Cremonæ*, 1741. *D. Sommer, Dis. sistens Aneurysmatis Aortæ Pleuritydem mentientis Casum.* 8*vo. Berol.* 1816.)

ANEURISMAL VARIX, VARICOSE, OR VENOUS ANEURISM.

By these terms, surgeons mean a tumour, arising from a preternatural communication, formed between a large vein and a subjacent artery. Thus, in venesection performed immediately over the artery at the bend of the elbow, if the lancet be carried too deeply, it may transfix the vein, and wound the artery, in which event, the arterial blood, in consequence of the proximity of the two vessels, instead of being effused into the cellular substance, will pass directly into the cavity of the vein, which will become dilated in the form of a varix by the jet of arterial blood into it.

Although Sennertus probably referred to an instance of this disease (*Op. t.* 5, *l.* 5, *cap.* 43), Dr. W. Hunter is undoubtedly the first who gave an accurate description of it. Scarpa is disposed to claim a share of the merit for his countryman Guattani; but, as Mr. Hodgson has remarked, Dr. Hunter's observations on this disease were published in the years 1757 and 1764; whereas, Guattani did not see his first patient until the

year 1769, and his book was not published until the year 1772.

"Does it ever happen in surgery," says Dr. Hunter, "that when an artery is opened through a vein, a communication, or anastomosis, is afterward kept up between these two vessels? It is easy to conceive this case, and it is not long since I was consulted about one, that had all the symptoms that might be expected, supposing such a thing to have actually happened, and such symptoms, as otherwise must be allowed to be very unaccountable. It arose from bleeding; and was of some years' standing, when I saw it about two years ago, and I understand very little alteration has happened to it since that time. The veins, at the bending of the arm, and especially the basilic, which was the vein that had been opened, were there prodigiously enlarged, and came gradually to their natural size, at about two inches above and as much below the elbow. When emptied by pressure, they filled again almost instantaneously, and this happened, even when a ligature was applied tight round the forearm, immediately below the affected part. Both when the ligature was made tight, and when it was removed, they shrunk, and remained of a small size, while the finger was kept tight upon the artery, at the part where the vein had been opened in bleeding. There was a general swelling in the place, and in the direction of the artery, which seemed larger, and beat stronger than what is natural, and there was a tremulous jarring motion in the vein, which was strongest at the part which had been punctured, and became insensible at some distance both upwards and downwards."—(*Med. Obs. and Inq. vol.* 1.)

In the second volume of this work, Dr. Hunter adds some farther remarks on the aneurismal varix.

"In the operation of bleeding, the lancet is plunged into the artery through both sides of the vein, and there will be three wounds made in these vessels, viz. two in the vein, and one in the artery, and these will be nearly opposite to one another, and to the wound in the skin. This is what all surgeons know has often happened in bleeding, and the injury done the artery is commonly known by the jerking impetuosity of the stream, while it flows from the vein, and by the difficulty of stopping it, when a sufficient quantity is drawn.

In the next place, we must suppose, that the wound of the skin, and of the adjacent or upper side of the vein, heal up as usual; but that the wound of the artery, and of the adjacent or under side of the vein, remain open (as the wound of the artery does in the spurious aneurism), and, by that means, the blood is thrown from the trunk of the artery directly into the trunk of the vein. Extraordinary as this supposition may appear, in reality it differs from the common spurious aneurism in one circumstance only, viz. the wound remaining open in the side of the vein, as well as in the side of the artery. But this one circumstance will occasion a great deal of difference in the symptoms, in the tendency of the complaint, and in the proper method of treating it: upon which account, the knowledge of such a case will be of importance in surgery.

It will differ in its symptoms from the common spurious aneurism principally thus:—

The vein will be dilated, or become varicose, and it will have a pulsating jarring motion on account of the stream from the artery. It will make a hissing noise, which will be found to correspond with the pulse for the same reason. The blood of the tumour will be altogether, or almost entirely fluid, because kept in constant motion. The artery, I apprehend, will become larger in the arm, and smaller at the wrist, than it was in the natural state; which will be found out by comparing the size, and the pulse, of the artery, in both arms, at these different places. The reason of which I will speak of hereafter; and the effects of ligatures, and of pressure upon the vessels above the elbow and below it, will be what every person may readily conceive, who understands any thing of the nature of arteries and veins in the living body.

The natural tendency of such a complaint will be very different from that of the spurious aneurism. The one is growing worse every hour, because of the resistance to the arterial blood, and, if not remedied by surgery, must at last burst. The other, in a short time, comes to a nearly permanent state; and, if not disturbed, produces no mischief, because there is no considerable resistance to the blood that is forced out of the artery.

The proper treatment must, therefore, be very different in these two cases, the spurious aneurism requiring chirurgical assistance, as much, perhaps, as any disease whatever; whereas, in the other case, I presume it will be best to do nothing.

If such cases do happen, they will no doubt be found to differ among themselves, in many little circumstances, and particularly in the shape, &c. of the tumefied parts. Thus the dilatation of the veins may be in one only, or in several, and may extend lower or higher in one case than in another, &c., according to the manner of branching, and to the state of the valves in different arms. And the dilatation of the veins may also vary, on account of the size of the artery that is wounded, and of the size of the orifice in the artery and in the vein.

Another difference in such cases will arise from the different manner in which the orifice of the artery may be united or continued with the orifice of the vein. In one case, the trunk of the vein may keep close to the trunk of the artery, and the very thin stratum of cellular membrane between them may, by means of a little inflammation and coagulation of the blood among its filaments, as it were, solder the two orifices of these vessels together, so that there shall be nothing like a canal going from one to the other; and then the whole tumefaction will be more regular, and more evidently a dilatation of the veins only. In other instances, the blood that rushes from the wounded artery, meeting with some difficulty of admission and passage through the vein, may dilate the cellular membrane, between the artery and vein, into a bag, as in a common spurious aneurism, and so make a sort of canal between these two vessels. The trunk of the vein will then be removed to some distance from the trunk of the artery, and the bag will be situated chiefly upon the under side of the vein. The bag may take on an irregular form, from the cellular membrane being more loose and yielding at one place than at another, and from being unequally bound down by the fascia of the biceps muscle. And if the bag be very large, especially if it be of an irregular figure, no doubt, coagulations of blood may be formed, as in the common spurious aneurism."

As Scarpa correctly observes, a concurrence of two circumstances is requisite for the production of an aneurismal varix: 1st, the incision in the vein, and that in the artery must be exactly in the same direction; 2d, the solution of continuity in the integuments and upper side of the vein must heal, while the wound in the deeper side of that vessel and the puncture in the upper surface of the artery remain open, and communicate so readily that the arterial blood finds greater facility in entering from the artery into the vein, than in being effused from the artery into the surrounding cellular substance.

If one of these two circumstances be wanting, either because the wounding instrument has entered the artery a little obliquely from the vein, or because the vein has not been sufficiently near to the artery, on account of the cellular substance between them, the arterial blood most frequently does not produce the aneurismal varix; or, if it does, the disease is always complicated with effusion of arterial blood into the cellular substance, or with an aneurism and aneurismal varix at the same time. In this case the small aneurismal sac serves as a short canal of communication between the artery and the vein (*Med. Facts and Obs. vol.* 4, *p.* 115); two distinct diseases in fact being formed from the same cause, and placed one over the other, viz. an aneurism and an aneurismal varix.—(*Scarpa, p.* 421, *ed.* 2.) The following marks of distinction between aneurism and aneurismal varix are pointed out by the same author: the aneurismal varix always forms a circumscribed tumour; aneurism does not always do so. The cellular substance which constitutes the sac of the aneurism does not always resist so strongly the impetus of the arterial blood as the coats of the vein do. Not unfrequently, therefore, aneurism from being *circumscribed* at first becomes *diffused*; extends along the course of the wounded artery; compresses strongly the surrounding parts; occasions acute pain and inflammation; and the parts are threatened with gangrene. On the contrary, the aneurismal varix is always *circumscribed*, increases very slowly, does not produce much pain, and, as it augments, it always extends more or less above or below the place where venesec-

tion has been done; and this extension is in proportion to the greater or less force with which the arterial blood is thrown from the artery into the vein, and the greater or less resistance made by the valves situated in the vein below the puncture, and according to the greater or less number of veins communicating with the aneurismal varix. The seat of the disease is generally the basilic vein, which appears dilated in an unusual manner, forming an oblong tumour of the size of a walnut, if the disease is recent. In the centre of the swelling is the cicatrix left by the lancet. The vein is less dilated the farther it is from this scar, and in general at the distance of two inches and a half above and below this point the vessel resumes its natural size. The small tumour, as has been explained, pulsates like an artery with a tremulous motion and hissing noise, which is sometimes so great that the patient cannot sleep if he is lying with his head low, and resting on the injured arm. The trunk of the brachial artery, from the axilla down to the place where it has been wounded with the lancet, vibrates with extraordinary force. There is no change of colour nor inflammation of the skin; and the pain is inconsiderable. The swelling is compressible and yielding; but it returns as soon as the pressure is removed from it. When the arm is kept for some time raised up towards the head, the tumour diminishes; and the same thing happens when pressure is made on the communication between the artery and vein, or when a tight tourniquet is applied near the axilla. If the disease be complicated with aneurism, a second pulsating tumour will be found lying under the aneurismal varix.—(*Scarpa, p.* 424, *ed.* 2.)

After relating two cases, illustrative of the nature of aneurismal varix, Dr. W. Hunter proceeds to inquire, "Why is the pulse at the wrist so much weaker in the diseased arm than in the other? surely the reason is obvious and clear. If the blood can easily escape from the trunk of the artery directly into the trunk of the vein, it is natural to think that it will be driven along the extreme branches with less force and in less quantity.

Whence is it that the artery is enlarged all the way down the arm? I am of opinion, that it is the consequence of the blood passing so readily from the artery into the vein, and is such an extension as happens to all arteries in growing bodies, and to the arteries of particular parts when the parts themselves increase in their bulk, and at the same time retain a vascular structure. It is well known that the arteries of the uterus grow much larger in the time of utero-gestation. I once saw a fleshy tumour upon the top of a man's head as large nearly as his head; and his temporal and occipital arteries, which fed the tumour, were enlarged in proportion. I have observed the same change in the arteries of enlarged spleens, testes, &c. so that I should suppose it will be found to be universally true in fact, and the reason of it in theory seems evident."—(See *Med. Obs. and Inq. vol.* 2.)

In thin subjects the median basilic vein is so close to the brachial artery, the track of which it crosses at a very acute angle, that it is almost impossible to open it at this point without risk of wounding the artery at the same time. The bend of the arm indeed is the very situation in which this disease is usually noticed. It is easy to conceive, however, that a venous aneurism may happen wherever an artery of a certain diameter lies immediately under a large vein. Thus, Baron Larrey informs us that his uncle, surgeon to the hospital at Toulouse, saw a case of aneurismal varix, which had been occasioned by a wound of the popliteal vein and artery, and that a history of the disease, accompanied with the pathological preparation, was sent to the former Royal Academy of Surgery at Paris. "The varicose swelling, which was as large as two fists, occupied the whole of the ham in a middle-aged man, who some years previously had been wounded with a sword in that part of the limb. At a consultation, amputation was deemed necessary, and was performed with success. At the bottom of the varicose pouch the communication between the popliteal vein and artery was observed. The sac itself was evidently composed of the vein, the parts of which, adjacent to the varicose swelling, were dilated, especially the lower continuation of the vessel. The popliteal nerve was rendered flat, like a piece of tape, and adherent to the outside of the cyst."—(See *Mém. de Chir. Mil. t.* 4, *p.* 340. *Boyer, Traité des Mal. Chir. &c. t.* 2, *p.* 177.) Two cases are likewise recorded by Mr. Hodgson. In one, the disease was caused in the thigh, about four inches below Poupart's ligament, by the point of a heated iron rod, which had passed through the femoral artery and vein. In the other example, the aneurismal varix was situated in the ham, and was the consequence of a wound in that part with a pistol-ball.—(*Treatise on the Diseases of Arteries, p.* 498.) Larrey records one example of aneurismal varix situated under the clavicle.

P. Cadrieux was wounded with a sabre in a duel, on the 20th of November, 1811: part of the attachment of the sterno-mastoid muscle was divided, the anterior scalenus, the subclavian artery and vein at a very deep point, and probably also a portion of the brachial plexus. A most violent hemorrhage took place, followed by syncope. Pressure was applied to the wound, and the patient conveyed to the hospital at Gros-Caillou. The external wound, which was small, did not bleed at all the following morning; but the clavicle was quite concealed by a large tumour, which throbbed with the arteries, particularly at its lower part. A peculiar noise, like that of the passage of a fluid through tortuous metallic tubes, could also be felt more deeply in the direction of the axillary vein. The arm was quite cold, insensible, motionless, and without any pulse even in the axillary artery itself. On the 22d, the tumour was not larger, but its throbbings were stronger; the jugular vein on the same side was considerably dilated; and the pulsation of the carotid and of the arteries of the opposite arm had augmented. A vein in the right arm was opened, and compresses dipped in camphorated vinegar, muriate of ammonia, and ice applied to the swelling. It would be superfluous here to detail the diet, bleedings, and other parts of the treatment. On the 8th day, the outer wound was quite healed. On the 10th, the veins of the limb were observed to be swelled, and sensibility and warmth were returning in it; though no pulse could yet be felt. The tumour was much smaller, and restricted to a circumscribed place behind the great pectoral muscle; but the hissing sound was still plainer. By degrees the muscles of the arm and forearm regained their power of motion. The hand, however, continued useless, and affected with pricking pains. On the 20th day, the tumour was quite gone; but the hissing sound was unaltered, and the throbbings were still evident in the veins of the neck and arm. The arm was not at all emaciated. On the 55th day, a pulse at the wrist could be slightly felt; the hissing sound had become less distinct; the veins were less turgid, and their throbbing diminished.

A second instance of aneurismal varix, or rather perhaps of a varix of all the veins of the arm, caused by a sword-wound of the axilla, is also recorded by Larrey. He mentions, however, that a pulsation was observable in the most prominent of the enlarged vessels.—(See *Mém. de Chir. Mil. t.* 4, *p.* 341, *&c.*)

Dr. Dorsey, of Philadelphia, published a case of aneurismal varix, which is in several respects interesting. A patient was wounded in the leg with buck-shot; and after the cure of the injury, an aneurismal varix was noticed just below the knee; and in a little time the superficial veins of the limb became dilated, and the hissing noise, characterizing this species of aneurism, could be plainly distinguished. The patient was seen by Dr. Dorsey twelve years after the accident; the veins were then considerably distended from the toes up to the groin, all about which latter part pain was constantly experienced, and some ulcers situated on the foot and ankle could not be healed by any of the remedies which were tried. The patient was under the care of Drs. Physick and Wistar. The enormous distention of the vessels of the leg, and the uncertainty of finding out the communication between the artery and vein, led these gentlemen to tie the first of these vessels in the middle of the thigh. Gangrene soon ensued, and in this state the patient was farther weakened by an unexpected hemorrhage from one of the distended veins; and though the vessel was secured with a ligature, the bleeding recurred, the patient became more and more enfeebled, and at length expired. When the limb was examined after death, the whole of the trunk of the femoral artery was found preternaturally dilated; while all the veins of the limb were considerably distended; a bougie could readily be passed from the popliteal into the posterior tibial artery, which participated in the dilatation, and from

this last artery the instrument could be passed into the vein, through a cyst situated on the inside of the leg below the knee.—(See *Dorsey's Elements of Surgery, vol.* 2, *p.* 210, *Philadelphia*, 1813.)

Professor Scarpa, Dr. Hunter, Mr. B. Bell, Pott, and Garneri mention cases of the aneurismal varix which remained stationary for fourteen, twenty, and thirty-five years. Several cases are related by Brambilla, Guattani, and Monteggia, of a cure having been obtained by means of compression. But as this method of cure, if it does not succeed, exposes the patient to the danger of a complication of the disease with an aneurism, it ought not to be employed, except in recent cases where the tumour is small, and in slender patients at an early period of life, and where both of the vessels can be accurately compressed against the bone.

Two cases are recorded, in which it was necessary to operate in consequence of the disease being joined with aneurism of the artery, and even bursting. The sacs were opened, and a ligature applied both above and below the aperture in the artery.—(See *Park, in Medical Facts and Obs. vol.* 4, *p.* 111; *and Physick, in Medical Museum, vol.* 1, *p.* 65.) The latter form of the disease, which is particularly noticed by Dr. Hunter, and also by my friend Mr. Hodgson, is readily understood by recollecting that the artery and vein, when punctured together, do not always unite in such a manner as to let the arterial blood have a direct passage into the vein; but they may be separated for some distance from each other, so that the blood passes from the artery into the adjacent cellular membrane, where a sac is formed, into which the blood is poured previously to its entrance into the vein.—(See *Gibson's Institutes of Surgery, vol.* 2, *p.* 158, *Philadelphia*, 1825.)

In the winter of 1819, I heard a case read to the Medical and Chirurgical Society of London, from Mr. Atkinson, of York, who had found it necessary to take up the brachial artery on account of the large and increasing size of an aneurismal varix: mortification of the limb ensued. When the aneurism, joined with an aneurismal varix, is circumscribed, but the circumstances such as to require the brachial artery to be tied, this vessel should be exposed and tied above the swelling with a single ligature. It is only when the aneurism is diffused that opening the swelling and applying a ligature both above and below the aperture in the artery are thought necessary.—(See *Scarpa on Aneurism*, *p.* 433, *ed.* 2; *also Guattani, de Cubiti flexuræ aneurysmatibus, in Lauth's Coll. Scriptorum, &c.; and P. Adelmann, Tract. Anat. Chir. de Aneurismate spurio varicoso. Wirceb.* 1824.)

ANEURISM BY ANASTOMOSIS.

This is the term which the late Mr. John Bell, of Edinburgh, applied to a species of aneurism resembling some of the bloody tumours (*nævi materni*) which appear in new-born children, grow to a large size, and ultimately bursting emit a considerable quantity of blood.

Imperfect descriptions of this disease may be traced in writers; though before the publication of Mr. John Bell's Principles of Surgery it was not classed with aneurisms. Thus Desault has recorded a case of this affection for the express purpose of proving that pulsation is an uncertain sign of the existence of an aneurism.—(See *Parisian Chirurgical Journal, vol.* 2, *p.* 73.)

Aneurism by anastomosis often affects adults, increasing from an appearance like that of a mere speck or pimple to a formidable disease, and being composed of a mutual enlargement of the smaller arteries and veins. The disease originates from some accidental cause; is marked by a perpetual throbbing; grows slowly but uncontrollably; and is rather irritated than checked by compression. The throbbing is at first indistinct, but when the tumour is perfectly formed the pulsation is very manifest. Every exertion makes the throbbing more evident. The occasionally turgid states of the tumour produces sacs of blood in the cellular substance, or dilated veins, and these sacs form little tender, livid, very thin points, which burst from time to time, and then, like other aneurisms, this one bleeds so profusely as to induce extreme weakness.

The tumour is a congeries of active vessels, and, according to Mr. John Bell, the cellular substance through which these vessels are expanded, resembles the gills of a turkey-cock or the substance of the placenta, spleen, or womb. The irritated and incessant action of the arteries fills the cells with blood, and from these cells it is reabsorbed by the veins. The size of the swelling is increased by exercise, drinking, emotions of the mind, and by all causes which accelerate the circulation.

In this peculiar disease Dupuytren regards the arteries as being in an aneurismal state; but, besides this circumstance, he says, their extreme ramifications intermix in a thousand different ways, intercepting spaces, and representing cavities like those which are found in the corpora cavernosa; and he imputes the disease to increased activity of the capillary circulation. —(*Fr. transl. of Mr. Hodgson's work, t.* 2, *p.* 300.) It is observed by Mr. Syme, that most surgeons have followed John Bell in believing this disease to consist of a morbid cellular structure through which the blood passes in its course from the arteries into the veins. However, he has long been one of those who maintain that the apparent cells are really sections of enlarged vessels.—(See *Edin. Med. Journ. No.* 98, *p.* 72.)

In the dissection of a pulsating tumour of the scalp in a patient who had died after the operation of tying the carotid artery, Dr. Maclachlan found the branches of this vessel on the head "degenerated into dilated tubes of extreme thinness and transparency; which, apparently yielding to the impetus of the blood, had become elongated, contorted, and ultimately convoluted on themselves, so as to form by this species of doubling the tumours which constituted this singular disease." They felt like placenta, and the larger portion immediately over the ear looked precisely like a bundle of earthworms coiled together.—(See *Glasgow Medical Journ. vol.* 1, *p.* 85.) Two cases are given by Pelletan, fully confirming the view taken of the nature of the disease by Dr. Maclachlan and Mr. Syme.—(See *Clinique Chir. t.* 2.) Boyer, who saw one of these cases, describes all the arteries of the swelling as being dilated, tortuous, knotty, and though very large in some places, in others contracted.—(*Traité des Mal. Chir. t.* 2, *p.* 295.) In the tumour described by Dr. Maclachlan none of the cells spoken of by Mr. John Bell were found; no parenchyma as in the spleen; the bulk of the tumour was formed almost entirely by convoluted, dilated arterial *trunks*, the veins being but little changed from their healthy state. He adds, that these arteries did not appear to communicate more freely than by their ordinary inosculations. Some of these conclusions, as it appears to me, require corroboration by a careful anatomical injection of the vessels.

In the female subject the hemorrhage from the aneurism by anastomosis is sometimes a substitute for menstruation, as the following example illustrates: Ann Vachot, of St. Maury, in Bresse, was born with a tumour on her chin, of the size and shape of a small strawberry, without pain, heat, or discoloration of the skin. As it produced no uneasiness nor inconvenience whatever, it excited little attention, particularly as it did not seem to increase with the growth of the child. For the first fifteen years there was but little alteration; but about the menstrual period it increased suddenly to double the size, and became more elongated in its form. A quantity of red blood was observed to ooze from its extremity. This flux became, in some measure, periodical, and sometimes was sufficiently abundant to produce an alarming degree of weakness. Each period of its return was preceded by a violent pain in the head and numbness.

Before and after the appearance of these symptoms there was no alteration in the size of the tumour; the only difference was a small enlargement of the cutaneous veins, with an increase of heat in the part, occasioning some degree of tenderness.

The menses at length took place, but in small quantity and at irregular periods, without influencing the blood discharged from the tumour or the frequency of the evacuation.

The breasts were not enlarged till a late period, nor did the approach of puberty seem to have its accustomed influence on those glands, &c.—(See *Parisian Chir. Journ. vol.* 2, *p.* 73, 74.)

As far as my observations extend, the true aneurism by anastomosis is a disease with which a surgeon should never tamper; and if it be decided to try any treatment at all, the only prudent plan is either a complete removal of the disease with a knife, or tying the chief arteries which supply the swelling with blood.

The first is the surest mode of relief, and should be preferred, when not forbidden by the magnitude or situation of the tumour.

In performing such an operation, as Mr. Wardrop remarks, the surgeon should avoid cutting into the substance of the tumour; for if this be done, the hemorrhage is violent; whereas, by making the incisions beyond the diseased structure, the flow of blood is much more moderate.—(*Med. Chir. Trans. vol.* 9, *p.* 212.) In a few nævi pressure may be safely tried; but all attempts to get rid of a true aneurism from anastomosis by caustic I should think by no means advisable.

"This aneurism," Mr. John Bell observes, "is a mere congeries of active vessels, which will not be cured by opening it; all attempts to obliterate the disease with caustics, after a simple incision, have proved unsuccessful, nor does the interception of particular vessels which lead to it affect the tumour; the whole group of vessels must be extirpated. In varicose veins, or in aneurisms of individual arteries, or in extravasations of blood, such as that produced under the scalp from blows upon the temporal artery, or in those aneurisms produced in schoolboys by pulling the hair, and also in those bloody effusions from blows on the head which have a distinct pulsation, the process of cutting up the varix, aneurism, or extravasation, enables you to obliterate the vessel and perform an easy cure. But in this enlargement of innumerable small vessels, in this aneurism by anastomosis, the rule is, 'not to cut into, but to cut it out.' These purple and ill-looking tumours, because they are large, beating, painful, covered with scabs, and bleeding, like a cancer in the last stage of ulceration, have been but too often pronounced cancers! incurable bleeding cancers! and the remarks which I have made, while they tend in some measure to explain the nature and consequences of the disease, will remind you of various unhappy cases, where either partial incisions only have been practised, or the patient left entirely to his fate."—(*Principles of Surgery, vol.* 1.)

That Mr. John Bell has comprised in his account of aneurism by anastomosis certain swellings called nævi cannot be doubted; nor, indeed, are the differences between this kind of aneurism and some nævi at all defined even by the best writers on surgery. To the consideration of nævi, however, I have allotted an article, in which the method of extirpating particular forms of the disease by means of a ligature will be explained.

The following case, recorded by Mr. Wardrop, affords a valuable illustration of the nature and structure of one form of this disease. A child was born with a very large subcutaneous nævus on the back part of the neck. It was of the form and size of half an ordinary orange. The tumour had been daily increasing, and when Mr. Wardrop saw it, ten days after birth, the skin had given way, and a profuse hemorrhage had taken place. The swelling was very soft and compressible; when squeezed in the hand it yielded like a sponge, and was reducible to one-third of its original size. On removing the pressure, however, the tumour rapidly filled again, and the skin resumed its purple colour. "Conceiving the immediate extirpation of the tumour the only chance of saving the infant (says Mr. Wardrop), I removed it as expeditiously as possible, and made the incision of the integuments beyond the boundary of the tumour; aware of the danger of hemorrhage, where such tumours are cut into. So profuse, however, was the bleeding, that though the whole mass was easily removed by a few incisions, the child expired.

The tumour having been injected by throwing coloured size into a few of the larger vessels, its intimate structure could be accurately examined. Several of the vessels, which, from the thinness of their coats appeared to be veins, were of a large size, and there was one sufficiently big to admit a full-sized bougie." This vessel was quite as large as the carotid artery of an infant. The boundaries of the tumour appeared distinct, some healthy cellular membrane, traversed by the blood-vessels, surrounding it. On tracing these vessels to the diseased mass, they penetrated into a spongy structure composed of numerous cells and canals, of a variety of forms and sizes, all of which were filled with the injection, and communicated directly with the ramifications of the vessels. These cells and canals had a smooth and polished surface, and in some parts resembled very much the cavities of the heart, fibres crossing them in various directions like the columnæ tendinæ. The opening in the skin, through which the blood had escaped during life, communicated directly with one of the large cells, into which the largest vessel also passed."—(*Wardrop, in Med. Chir. Trans. vol.* 9, *p.* 203.)

In the section on Carotid Aneurisms I have mentioned the cases in which Mr. Travers and Mr. Dalrymple cured aneurisms by anastomosis in the orbit by tying the common carotid artery. Professor Pattison also cured an immense anastomosing aneurism of the cheek and side of the face by taking up the carotid artery.—(See *Med. and Phys. Journ. vol.* 48, *July*, 1822.) These facts prove that aneurism by anastomosis, like many other diseases, sometimes admits of being cured on the principle of cutting off or lessening the supply of blood to the part affected.

However, surgeons must not be too confident of being always able to cure the disease by tying the main artery from which the swelling receives its supply of blood; and the great cause of failure is the impossibility of preventing in some situations the transmission of a considerable quantity of blood into the tumour, through the anastomosing vessels. A case is recorded by Maunoir, in which he applied a ligature for three days to the carotid artery, and obliterated it; yet the benefit effected seemed to be only temporary, as in a short time the tumour was as large as before.—(See *Med. and Phys. Journ. vol.* 48.) In fact, every vessel, artery, and vein around the disease seems to be enlarged and turgid; and the inosculations are so infinite that no point of the circumference of the swelling can be imagined which is free from them. Etienne Dumand was born with two small red marks on the antihelix of the right ear. Until the age of twelve years the chief inconveniences were, a sensation of itching about the part, occasional bleeding from it, and the greater size of this than of the other ear. The disease now extended itself over the whole antihelix, and to the helix and concha; and the upper part of the ear became twice as large as natural. Slight alternate dilatations and contractions began to be perceptible in the tumour, which was of a violet colour, and covered by a very thin skin. Soon afterward any accidental motion of the patient's hat was sufficient to excite copious hemorrhages, which were difficult to suppress, and at the some time that they produced great weakness, caused a temporary diminution of the tumour and its pulsations. At length the disease began to raise up the scalp for the distance of an inch around the meatus auditorius, and the hemorrhages to be more frequent and alarming. Pressure was next applied to the temporal, auricular, and occipital arteries; but as the patient could not endure it, the first two of these vessels were tied, the only benefit from which was a slight diminution in the pulsation and bulk of the swelling. This treatment did not prevent the return of hemorrhage, and therefore forty-three days after the first operation a ligature was applied to the occipital artery, which pro eeding was equally ineffectual. As the disease continued to make progress, the patient entered the Hôtel-Dieu, where, on the 8th of April, 1818, Dupuytren tried what effect tying the trunk of the carotid artery would produce on the swelling. As soon as the ligature was applied, the throbbing ceased, and the tumour underwent a quick and considerable diminution. On the 17th day, slight expansions and contractions of the diseased part of the ear were again perceptible, though the swelling had diminished one-third. An attempt was now made to compress the tumour by covering it with plaster of Paris; a plan which was somewhat painful, though it lessened the size of the disease. After being sixty-three days in the hospital, the patient was discharged, at which period the tumour was diminished one-third; the throbbings had returned, but no unpleasant noises continued to affect the ear.—(See *Breschet's tr. of Mr. Hodgson's work, t.* 2, *p.* 296.)

An infant, six weeks old, was brought to Mr. Wardrop, on account of an aneurism by anastomosis (a subcutaneous nævus) of a very unusual size, situated on the left cheek. The base of the tumour extended from the temple to beyond the angle of the jaw, completely enveloping the cartilage of the ear. At its upper part there was an ulcer, about three inches in diameter, presenting a sloughing appearance. The tumour was

soft and doughy; its size could be much diminished by pressure; there was a throbbing in it, and a strong pulsation in the adjacent vessels. The disease was daily increasing, and several profuse hemorrhages had taken place from the ulcerated part. Mr. Wardrop, knowing, from the case to which I have already adverted, the danger of attempting to extirpate so large a tumour of this nature, was led to try what benefit might be obtained by tying the carotid artery. A few hours after this operation, the tumour became soft and pliable; its purple colour disappeared, and the tortuous veins collapsed. On the second day, the skin had resumed its natural pale colour, and the ulceration continued to extend. On the third, the tumour still diminished. On the fourth, the swelling had considerably increased again; the integuments covering it had become livid, and the veins turgid. The inosculating branches of the temporal and occipital arteries had become greatly enlarged. A small quantity of blood had oozed from the ulcer. After remaining without much alteration, the tumour on the seventh day had again evidently diminished. On the ninth, the ulceration was extending itself slowly, and the tumour was lessened fully one-half. On the twelfth, the child's health was materially improving. The auricular portion of the swelling had now so much diminished, that the cartilage of the ear had fallen into its natural situation. After a poultice had been applied for two days, the central portion of the swelling, which appeared like a mass of hardened blood, was softened, and Mr. Wardrop removed considerable portions of it. On the thirteenth, the child became very ill, and died the following day, exhausted by the irritation of an ulcer, which had involved the whole surface of an enormous tumour. Mr. Wardrop thinks the advantages likely to occur from the plan of tying the main arteries supplying tumours of this nature with blood are, the diminution of the size of the disease; the lessening of the danger of hemorrhage, if the ulcerative process has commenced; and the rendering it practicable to remove the swelling with the knife, though the operation may previously have been dangerous or impracticable. —(See *Med. Chir. Trans. vol. 9, p. 206—214*, &c.) Instead of endeavouring to promote ulceration in any of these cases, my own sentiments would incline me to leave the business of removing the diseased mass quietly to the absorbents, or at most, I would only assist them with pressure, or by covering the tumour with plaster of Paris.

The next case of aneurism by anastomosis, which I shall briefly notice, was one which was under the care of my friend Mr. Lawrence, and situated on the ring finger of the right hand, in a young woman about twenty years of age. The disease was attended with painful sensations extending to various parts of the limb and the breast, and the arm was disqualified for any kind of exertion. In January, 1815, Mr. Hodgson had taken up the radial and ulnar arteries, and the consequences of the operation were an entire cessation of the beating, collapse of the swelling, and relief from pain; but these symptoms all recurred in a few days. Finding compression unavailing, and the sufferings of the patient increasing, Mr. Lawrence proposed amputation of the finger at the metacarpal joint; but as this suggestion was not approved of, he recommended the patient to try the effects of a division of all the soft parts, by a circular incision close to the palm, so as to cut off the supply of blood. This operation Mr. Lawrence performed in the presence of Mr. George Young and myself, in as complete a manner as can possibly be conceived. All the soft parts, excepting the flexor tendons, with their theca and the extensor tendon, were divided. The digital artery, which had pulsated so evidently in the palm of the hand, was fully equal in size to the radial or ulnar of an adult, and was the principal nutrient vessel of the disease. After tying this and the opposite one, we were surprised at finding so strong a jet of arterial blood from the other orifices of these two vessels, as to render ligatures necessary. I can here only add, that the whole finger beyond the cut swelled very considerably; the incision healed slowly; the swelling subsided, but did not entirely disappear; the integuments recovered their natural colour; the pulsation and pain were removed, and the patient so far recovered the use of her arm, that she could work at her needle for an hour together, and use the arm for most purposes.—(See *Wardrop's Obs. on one Species of Nævus, in Med. Chir. Trans. vol. 9, p. 216.*)

For information on aneurism, consult *G. Arnaud on Aneurisms, 8vo. S. C. Lucæ, De Ossescentia Arteriarum Senili, 4to. Marburgi*, 1817. *A. F. Walther, Programma de Aneurysmate, Argent.* 1738. (*Haller, Disp. Chir. 5*, 189.) *A. de Haller, De Aortæ Venæque Cavæ gravioribus quibusdam Morbis Observationes, 4to. Gott.* 1749. *Lauth, Scriptorum Latinorum de Aneurysmatibus Collectio, 4to. Argent.* 1785, *which work contains Asman's Diss. de Aneurysmate*, 1773; *Guattani, de Externis Aneurysmatibus, 4to. Romæ*, 1772; *Lancisi de Aneurysmatibus, Argent.* 1785; *Matani de Aneurysmaticis Præcordiorum Morbis Animadversiones*, 1785; *Verbrugge, Dissertatio Anatomico-Chirurgica de Aneurysmate*, 1773. *Penchienati, Recherches Anat. Pathol. sur les Aneurysmes des Artères de l'Epaule et du Bras; des Artères crurales et poplitées; in Mém. de l'Acad. des Sciences de Turin*, 1784. *Palletta, über die Schlagadergeschwulst; in Kuhn's and Weigel's Ital. Med. Chir. Bibl. bd. 4. R. Caillot, Essais sur l'Aneurysme, Paris, an 7. Weltinus de Aneurysmate Vero. Pectoris Externo Hemiplegiæ Sobole, Basil*, 1750. *Murray, Observationes in Aneurysmata Femoris*, 1781. *Trew, Aneurysmatis Spurii post Venæ Basilicæ Sectionem Orti, Historia et Curatio. See also an account of Mr. Hunter's Method of performing the Operation for the Cure of the Popliteal Aneurism, by Sir E. Home, in Trans. of a Society for the Improvement of Med. and Chir. Knowledge, vol. 1, p. 138, and vol. 2, p. 235. Sabatier, Médecine Opératoire, t. 3, vol. 2. The several volumes of the Medico-Chirurgical Transactions. Cases in Surgery by J. Warner, p. 141, &c. ed. 4. J. B. Heraud, De Aneurysmatibus Externis, Monsp.* 1775. *J. F. L. Deschamps, Obs. et Réflexions sur la Ligature des principales Artères blessés, et particulièrement sur l'Aneurysme de l'Artère poplitée, 8vo. Paris*, 1797. *Richerand's Nosographie Chirurgicale, t. 4, ed. 4. Pelletan's Clinique Chirurgicale, t. 1 et 2. A. Burns's Surgical Anatomy of the Head and Neck, 8vo. Edin.* 1811, *and Observations on Diseases of the Heart, &c. 8vo. Edin.* 1809. *Ramsden's Practical Observations on the Sclerocele, with four cases of operations for Aneurism, 8vo. Lond.* 1811. *Œuvres Chir. de Desault, par Bichat, t. 2, p. 353. S. C. Lucæ quædam Obs. Anat. circa Nervos Arterias adeuntes et comitantes, 4to. Francof.* 1810. *Wells, in Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, vol. 3, p. 81—85, &c. G. P. Scheid, Obs. Med. Chir. de Aneurysmate, 8vo. Hardevici*, 1792. *Corvisart, Essai sur les Maladies et les Lesions Organiques du Cœur et des Grosé Vaisseaux, edit. 2, or transl. by C. H. Hebb, 8vo. Lond.* 1813. *C. Bell's Operative Surgery, vol. 1, ed. 2. John Bell's Principles of Surgery, vol. 1. Richter's Anfangsgr. der Wundarzneykunst, b. 1. A. F. Ayrer über die Pulsadergeschwülste und ihre Chir. Behandlung, Gött.* 1800. *Abernethy's Surgical Works, vol. 1. Monro's Observ. in the Edin. Med. Essays. Various productions in the Med. Observ. and Inquiries. The article Aneurism in Rees's Cyclopædia. J. P. Maunoir, Mémoires Physiologiques et Pratiques sur l'Aneurisme et la Ligature, 8vo. Genève*, 1802. *Freer's Observations on Aneurism, 4to. Lond.* 1807; *and a Treatise on the Anatomy, Pathology, and Surgical Treatment of Aneurism, by A. Scarpa, translated by J. Wishart*, 1808. *The original Italian was published* 1802. *Ant. Scarpa, Memoria sulla Legatura della Principali Arterie delle Arti, con una Appendice all' Opera sull' Aneurisma, fol. Pavia*, 1817. *This tract, and a great deal of valuable additional matter, are contained in the 2d edition of Scarpa's work on Aneurism, by Mr. Wishart, 8vo. Edin.* 1819. *Callisen's Systema Chirurgiæ Hodiernæ, part 2, p. 545, &c. edit.* 1791. *Boyer, Traité des Maladies Chir. t. 2, p. 84, &c. A. C. Hutchison, Letter on Popliteal Aneurism, 8vo. Lond.* 1811. *J. Hodgson on the Diseases of Arteries and Veins, Lond.* 1815, *a work of the greatest accuracy and merit. Transl. into German by Dr. Koberwein, with additions by this gentleman, and Dr. Kreysig, 8vo. Hanov.* 1817; *and also into French, with valuable annotations by Breschet, 2 t. 8vo. Paris*, 1819. *G. A. Spangenberg, Erfahrungen über die Pulsadergeschwülste, in Horn's Archiv.* 1815. *C. H. Ehrmann, la Structure des Artères, &c. et leurs altérations organiques, Strasb.* 1822. *Roux, Nouveaux Elémens de Médecine Opératoire, t. 1. Also, Roux, Voyage fait*

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ANTHRAX (ἄνθραξ a burning coal). See *Carbuncle.*

ANTIMONIAL POWDER; PULVIS ANTIMONIALIS. (Oxidum Antimonii cum Phosphate Calcis.) In all cases where it is desirable to promote the secretions in general, and those of the kidneys, skin, and alimentary canal, in particular, it is proper to have recourse to antimonial medicines. In inflammation of the brain and its membranes, and in that of the greater number of organs of high importance in the system, antimony should be exhibited. For an adult, from two to five grains of pulv. antim. may be ordered, and the dose, if requisite, may be repeated three or four times a day. In order to increase its action on the bowels, it is frequently conjoined with calomel.

Of late, doubts have arisen concerning the efficacy of antimonial powder, Dr. Elliotson having prescribed it even in the dose of 100 gr. apparently without any effect. Mr. R. Philips has attempted to explain the circumstance by the preparation of antimony being the peroxide, which is known to be inert.—(See *Annals of Philosophy for Octob.* 1822. *Pharmacologia by Dr. Paris, p.* 357, *vol.* 2, *ed.* 5, 1822.)

ANTIMONIUM MURIATUM. (*Butter of Antimony.*) Employed as a caustic.

ANTIMONII SULPHURETUM PRÆCIPITATUM. An ingredient in the compound calomel pill, and seldom prescribed in any other form.

ANTIMONIUM TARTARIZATUM. (*Emetic Tartar.*) Of this useful medicine, the best preparation is the vinum antim. tart. every half ounce of which contains one grain of antim. tart. Tartarized antimony, in the dose of gr. ¼, will, if the skin be kept warm, promote a diaphoresis; gr. ½ will procure some stools first, and sweating afterward; and gr. j. will generally excite vomiting, then purging, and lastly perspiration. In very minute doses, as gr. 1-10 or 1-12, combined with squill and ammoniacum, it acts as an expectorant. As Dr. Paris justly remarks, it is decidedly the most manageable, and the least uncertain of all the antimonial preparations, and the practitioner would probably have but little to regret, were all the other combinations of antimony discarded from our pharmacopœias.—(See *Pharmacologia by Dr. Paris, vol.* 2, *p.* 67, *ed.* 5.)

Tartarized antimony is sometimes blended with lard or spermaceti ointment, and used for producing redness and pustules of the integuments, where counter-irritation is indicated.—(See *Unguentum.*)

ANTRUM, *Diseases of.* This cavity is liable to a variety of diseases. Sometimes its membranous lining inflames, and secretes an extraordinary quantity of mucus or pus; at other times, in consequence of inflammation or other causes, it is the seat of various excrescences, polypi, and fungi. Even the bony parietes of the antrum are occasionally affected with exostosis or caries. Sometimes it contains extraneous bodies; and it is even asserted that insects may be generated there, and cause, for many years, very afflicting pains.

COLLECTIONS OF MUCUS AND PUS.

Inflammation of the membranous lining of the antrum sometimes produces an extraordinary secretion of mucus within it, and the collected fluid being confined, the bony parietes of the cavity become expanded in a surprising degree. This disease, says Boyer, is sometimes ascribed to a blow on the cheek, to caries of the teeth, or the projection of one of their fangs into the antrum. But in general, the case takes place unpreceded by any of these causes, and without there being the least ground for suspecting what has given rise to the disorder. It is remarked, however, that collections of mucus within the antrum are most frequent in young subjects: of three patients seen by Boyer, the eldest was not more than twenty.—(*Traité des Mal. Chir. t.* 6, *p.* 139.) As Mr. Hunter has noticed, whether the obliteration of the duct leading to the nose, be a cause or only an effect of the disease, is not easily determined; but from some of the symptoms, there is great reason to suppose it an attendant. "If it be a cause, we may suppose that the natural mucus of these cavities, accumulating, irritates, and produces inflammation for its own exit, in the same manner as an obstruction to the passage of the tears through the ductus ad nasum produces an abscess of the lachrymal sac."—(See *Hunter's Natural Hist. of the Teeth, p.* 174, *ed.* 3.) The most interesting example of the effects of the lodgement of mucus in the antrum is that recorded by Dubois: a boy, between seven and eight years of age, was observed to have at the base of the ascending process of the upper jaw-bone, on the left side, a small, very hard tumour of the size of a nut. As it gave no pain, and did not appear to increase, his parents did not give themselves any concern about it. When he was about sixteen, however, the swelling began to increase, and to be somewhat painful. Before he was eighteen, its augmentation was so considerable that the floor of the orbit was raised up by it; the eye thrust upwards; the palpebræ very much closed; the arch of the palate pushed down in the form of a tumour; and the nostril almost effaced. Below the orbit the cheek made a considerable prominence; while the nose was thrown towards the opposite side of the face, and the skin at the upper part of the tumour, below the lower eyelid, was of a purple red colour and threatening to burst. The upper lip was drawn upwards, and behind it all the gums on the left side were observed to project much farther than those on the opposite side of the face, and at this point alone the thinness of the bony parietes of the antrum was perceptible. The patient spoke and breathed with great difficulty; he slept uneasily, and his mastication was painful. The case was first supposed by Dubois, Sabatier, Pelletan, and Boyer, to be a fungus of the antrum, and an operation was considered advisable. In proceeding to this measure, the first thing which attracted the notice of Dubois was a sort of fluctuation in the situation of the gum behind the upper lip; a circumstance which led him to give up the idea of the

case being a fungus, though he expected that, on making an opening, merely a small quantity of ichorous matter would escape, affording no kind of information. In this place, however, he determined to make an incision along the alveolary process, whereby a large quantity of a glutinous substance like lymph, or what is found in cases of ranula, was discharged. A probe was now introduced, with which Dubois could feel a cavity equal in extent to the forepart of the tumour, and in moving the instrument about, with the view of learning whether any fungus was present, it struck against a hard substance, which felt like one of the incisor teeth, near the opening that had been made. Five days after this first operation, Dubois extracted two incisors and one grinder, and then removed the corresponding part of the alveolary process. As the hemorrhage was profuse, the wound was now filled with dressings, which in two days came away, and enabled Dubois to see with facility all the interior of the cavity. At its upper part, he perceived a white speck, which he supposed was pus, but on touching it with a probe, it turned out to be a tooth, which was then extracted, in doing which some force was requisite. The rest of the treatment merely consisted in injecting lotions into the cavity, and applying common dressings. In about six weeks all the hollow disappeared; but the swelling of the cheek and palate, and the displacement of the nose, still continued. In the course of another year and a half, however, every vestige of deformity was entirely removed.—(*Dubois, Bulletin de la Faculté de Méd. an* 13, *No.* 8.)

With respect to the treatment of collections of mucus in the antrum, by means of injections, thrown into that cavity through the natural opening in it, while the head is inclined to the opposite side, for the purpose of facilitating the escape of the collected fluid, as proposed by Jourdain in 1765 (*Mem. de l'Acad. de Chir. t.* 4, *p.* 357), Deschamps and Boyer are of opinion, that the method is objectionable: not only because it is difficult to find the aperture, which, ere the disease forms an outward swelling, is probably obliterated, but also because the thickness of the mucus collected would make it impossible for the surgeon to wash it out with injections. Hence, Boyer approves of the practice of opening the tumour in an eligible place, and to an extent sufficient for the discharge of the mucus.—(*Deschamps, Traité des Maladies des Fosses Nasales, et de leur Sinus, p.* 231, 8*vo. Par.* 1804; *Boyer, Traité des Mal. Chir. t.* 6, *p.* 145, 8*vo. Paris*, 1818.) Indeed, that Jourdain's proposal was attended with too much difficulty for common practice, was the sentence long ago pronounced upon it by a committee of the Royal Academy of Surgeons in France, nominated for the express purpose of inquiring into the merits of the suggestion. The method of making an opening into the antrum, will be considered in the sequel of this article. As a general rule, I may here remark, that except when a tumour or fungus requires to be extirpated, or a foreign body to be extracted from the antrum, it is quite unnecessary to remove any part of the alveolary process, or cut away any of the bony parietes of the antrum: the drawing of one of the teeth situated below this cavity, and making a perforation in this situation, being the only kind of opening required. This aperture may be preserved as long as necessary, by the introduction of a piece of elastic gum catheter, which is to be fastened to the adjacent teeth, and through which the secretion in the antrum may escape, or lotions be injected.—(See *Deschamps, Traite des Mal. des Fosses Nasales, &c. p.* 234.) However, as Hunter remarks, if the forepart of the bone has been destroyed, even though the case be merely a collection of mucus or pus, an opening may be made on the inside of the lip; but on account of the difficulty of maintaining such an aperture, he still inclines to the practice of drawing one of the teeth.—(*Natural Hist. of the Teeth, p.* 176, *ed.* 3.)

Of all the above cases, abscesses are by far the most common. Violent blows on the cheek, inflammatory affections of the adjacent parts, and especially of the pituitary membrane lining the nostrils, exposure to cold and damp, and, above all things, bad teeth, may bring on inflammation and suppuration within the hollow of the upper jaw-bone. The first symptom is a sensation of pain at first imagined to be a toothache, particularly if there should be a carious tooth at this part of the jaw. Such pain, however, extends more into the nose, than that usually does which arises from a decayed tooth: it also affects, more or less, the eye, the orbit, and the situation of the frontal sinuses.—(See *Hunter on the Teeth, p.* 175, *ed.* 3.) But even these symptoms are insufficient to characterize the disease, the nature of which is not unequivocally evinced till a much later period. The complaint is, in general, of much longer duration than one entirely dependent on a caries of a tooth, and its violence increases more and more, until, at last, a hard tumour is perceptible below the cheek-bone. By degrees the swelling extends over the whole cheek; but it afterward rises to a point, and forms a very circumscribed hardness, which may be felt above the back grinders. This symptom is accompanied with redness, and sometimes with inflammation and suppuration of the external parts. It is not uncommon, also, for the outward abscess to communicate with that within the antrum.

The circumscribed elevation of the tumour, however, does not occur in all cases. There are instances in which the matter makes its way towards the palate, causing the bones of this part to swell, and at length rendering them carious, unless timely assistance be given. There are other cases in which the matter escapes between the fangs and sockets of the teeth. Lastly, there are certain examples, in which the matter formed in the antrum makes its exit at the nostril of the same side, when the patient is lying with his head on the opposite one in a low position. If this mode of evacuation should be frequently repeated, it prevents the tumour both from pointing externally and bursting, as it would do if the purulent matter could find no other vent. But this evacuation of pus from the nostril is not very common; for, according to Mr. Hunter, the opening between the antrum and cavity of the nose is generally stopped up. He even seems inclined to think, as I have already observed, that the disease may sometimes be occasioned by the impervious state of this opening, in consequence of which, the natural mucus of the antrum collects in such quantity, as to irritate and inflame the membrane with which it is in contact, just as an obstruction in the ductus nasalis hinders the passage of the tears into the nose, and causes an abscess in the lachrymal sac. This is a point, however, on which even Mr. Hunter would not venture to speak with certainty; for it is by no means impossible, that the impervious state of the opening is rather an effect than the cause of the disease, since inflammation in the antrum is often manifestly produced by causes of a different kind, and since the opening in question is not invariably closed.

Abscesses in the antrum require a free exit for their contents, and if the surgeon neglects to procure such opening, the bones become more and more distended and pushed out, and finally carious. When this happens, the pus makes its appearance, either towards the orbit, the alveoli, the palate, or, as is mostly the case, towards the cheek. The matter having thus made a way for its escape, the disease now becomes fistulous.

In all cases, whether the pus be simply confined in the antrum, or whether the case be conjoined with a carious affection of the bones, the principal indication is to discharge the matter.

The ancients seem to have known very little about the treatment of diseases of the antrum. Drake, an English anatomist, is reputed to be the first proposer of a plan for curing abscesses of this cavity.—(*Anthropologia Nova. Londini*, 1727.) However, Meibomius was much earlier in proposing, with the same intention, the extraction of one or more of the teeth, in order that the matter might have an opening for its escape through the sockets. This plan may be employed with success. The pus frequently has a tendency to make its way outwards towards the teeth; it often affects their fangs; and, after their extraction, the whole of the abscess is seen to escape through the sockets. But this very simple plan will not suffice for all cases, as there are numerous instances in which there is no communication between the alveoli and the antrum.

Drake, and perhaps before him, Cowper, took notice of the insufficiency of Meibomius's method, and hence they proposed making a perforation through the socket into the antrum with an awl, for the purpose of letting out the matter, and injecting into the cavity such fluids as were judged proper.

M. Jourdain recommended to the French Academy of Surgery, the injection of detergent lotions into the

natural opening of the antrum, by means of a curved pipe introduced into the nostril; but, without dwelling upon the difficulty of putting this method in practice, especially where the opening is closed, many assert on the authority of the French surgeons themselves, that the mere employment of injections is not in these cases an effectual mode of treatment.—(See *Dict. des Sciences Med. t.* 51, *p.* 383.)

In the treatment of abscesses of the antrum, the extraction of one or more teeth, and the perforation of the alveoli, being generally essential steps, we must consider what tooth ought to be taken out in preference to others.

A caries, or even a mere continual aching, of any particular tooth, in general, ought to decide the choice. But if all the teeth should be sound, which is not often the case, writers direct us to tap each of them gently, and to extract that which gives most pain on this being done. When no information can be thus obtained, other circumstances ought to guide us.

All the grinding teeth, except the first, correspond with the antrum. They even sometimes extend into this cavity, and the fangs are only covered by the pituitary membrane. The bony lamella which separates the antrum from the alveoli, is very thin towards the back part of the upper jaw. Hence, when the choice is in our power, it is best to extract the third or fourth grinder, as in this situation the alveoli can be more easily perforated. Though, in general, the first grinder and canine tooth do not communicate with the antrum, their fangs approach the side of it, and from their socket an opening may readily be extended into that cavity.

When one or more teeth are carious, they should be removed, because they are both useless and hurtful. The matter frequently makes its escape as soon as a tooth is extracted, in consequence of the fang having extended into the antrum, or rather in consequence of its bringing away with it a piece of the thin partition between it and the sinus. Perhaps a discharge may follow from the partition itself being carious. If the opening thus produced be sufficiently large to allow the matter to escape, the operation is already completed. But as it can easily be enlarged, it ought always to be so when there is the least suspicion of its being too small. However, when no pus makes its appearance after a tooth is extracted, the antrum must be opened by introducing a pointed instrument in the direction of the alveoli. Some use a small trocar or awl, others a gimlet for this purpose.

The patient should sit on the ground in a strong light, resting his head on the surgeon's knee, who is to sit behind him. Immediately the instrument has reached the cavity, it is to be withdrawn. Its entrance into the antrum is easily known by the cessation of resistance. After the matter is discharged, surgeons advise the opening to be closed with a wooden stopper, in order to prevent the entrance of extraneous substances.

The stopper is to be taken out several times a day, to allow the pus to escape. This plan soon disposes the parts affected to discontinue the suppuration, and resume their natural state. Sometimes, however, the pus continues to be discharged for a long time after the operation, without any change occurring in regard to its quality or quantity. In such instances, the cure may often be accelerated by employing injections of brandy and water, lime-water, or a solution of the sulphate of zinc.

Some surgeons prefer a silver cannula, or a piece of elastic gum catheter, instead of the stopper, as it can always be left pervious except at meals. The examples on record, where the extraction of a tooth and the perforation of the bottom of the antrum were the means of curing abscesses of that cavity, are very numerous.—(See *Farmer's Select Cases, No.* 9; *Gooch's Cases, p.* 63, *new edition*; *Palfyn, Anatomie, &c.*)

If no opening were made in the antrum, the matter would make its way sometimes towards the front of this cavity, which is very thin; sometimes towards the mouth; and fistulous openings and caries would inevitably follow.

When the bones are diseased, the abov plan will not accomplish a cure until the affected pieces of bone exfoliate. A probe will generally enable us to detect caries in the antrum. The fetid smell and ichorous appearance of the discharge, also, leave little doubt that the bones are diseased; and in proportion as the bones free themselves of any dead portions, the discharge has less smell and its consistence becomes thicker.

When there are loose pieces of dead bone or other foreign bodies to be extracted, it is requisite to make a larger opening in the antrum than can be obtained at its lower part. Instances also occur where patients have lost all the grinding teeth and the sockets are quite obliterated, so that a perforation from below cannot be effected. Some practitioners object to sacrificing a sound tooth. In these circumstances, it has been advised to make a perforation in the antrum above the alveolary processes: a method first suggested by Lamorier. It consists in making a transverse incision below the malar process and above the root of the third grinder. Thus the gum and periosteum are divided, and the bone exposed. A perforating instrument is to be conveyed into the middle of this incision, and the opening in the antrum made as large as requisite.—(See *Mem. de l'Acad. de Chir. t.* 4, *p.* 351; *Gooch's Obs. append. p.* 138.) There are some extensive exfoliations of the antrum, where it is absolutely necessary to expose a great part of the surface of the bone, and to cut away the dead pieces which are wedged, as it were, in the livingones. A small trephine may sometimes be advantageously applied to the malar process of the superior maxillary bone.

Surgeons formerly treated carious affections of the antrum in the most absurd and unscientific way; introducing setons through its cavity, and even having recourse to the actual cautery. The moderns, however, are not much inclined to adopt this sort of practice. It is now known, that the detachment of a dead portion of bone, in other terms the process of exfoliation, is nearly, if not entirely, the work of nature, in which the surgeon can act a very inferior part. Indeed, he should limit his interference to preventing the lodgement of matter, maintaining strict cleanliness, and removing the dead pieces of bone as soon as they become loose. But it is to be understood, that examples occasionally present themselves, in which the dead portions of bone are so tedious of separation, and so wedged in the substance of the surrounding living bone, that an attempt may properly be made to cut them away.

TUMOURS OF THE ANTRUM.

Ruysch, Bordenave, Desault, Abernethy, Weinhold, and others, have recorded cases of polypous, fungous, and cancerous diseases of the antrum, and examples of this cavity being affected with exostosis.

The indolence of any ordinary fleshy tumour in the antrum, while in an incipient state, certainly tends to conceal its existence; but such a disease rarely occurs without being accompanied with some affection of the neighbouring parts; and hence, its presence may generally be ascertained before it has attained such a size as to have altered, in a serious degree, the natural shape of the antrum. This information may be acquired, by examining whether any of the teeth have become loose, or have spontaneously fallen out; whether the alveolary processes are sound, and whether there are any fungous excrescences making their appearance at the sockets; whether there is any habitual bleeding from one side of the nose; any sarcomatous tumour at the side of the nostril, or towards the great angle of the eye. When the swelling, however, has attained a certain size, the bony parietes of the antrum always protrude, unless the body of the tumour should be situated in the nostril, and only its root in the antrum. This case, however, is very uncommon.

As soon as a tumour is certainly known to exist in the antrum, the front part of this cavity should be opened, without waiting till the disease makes farther progress. In a few instances, indeed, we may avail ourselves of the opening which is sometimes found in the alveolary process, and enlarge it sufficiently to allow the tumour to be extirpated. If the front of the antrum were freely opened, it would in general be better to cut away the disease in its interior.

A swelling of the parietes of the antrum, in consequence of an abscess, or a sarcomatous tumour in its cavity, may lead us to suppose the case an enlargement of the bones, or an exostosis. The symptoms of the first two affections have been already detailed. One sign of an exostosis, besides the absence of the symptoms characterizing an abscess or a sarcoma, is

the thickened parietes of the antrum forming a solid resistance; whereas, in cases of mere expansion, the dimensions of the surface of the bone being increased, while its substance is rendered proportionally thinner, the resistance is not so considerable.

When such an exostosis depends upon a particular constitutional cause, and especially upon one of a venereal nature, it must be attacked by remedies suited to this affection. But when the disease resists internal remedies, and its magnitude is likely to produce an aggravation of the case, a portion of the bone may be removed with a trephine or a cutting instrument. Such operations, however, require a great deal of delicacy and prudence.

Mr. B. Bell, vol. 4, describes a kind of exostosis of the upper jaw, very different from what I have mentioned, since, instead of its being distinguishable from other diseases of the antrum by the greater firmness of the tumour, the substance of the bone gradually acquires such suppleness and elasticity, that it yields to the pressure of the fingers, and immediately resumes its former plumpness when the pressure is discontinued. If the bone be cut, it is found to be as soft as cartilage, and in an advanced stage of the disease, its consistence is almost gelatinous. The swelling increases gradually, and extends equally over the whole cheek, without becoming prominent at any particular point, or only so in the latter periods of the malady, when the soft parts inflame, and become affected. The complaint is described as totally incurable. Cutting and trephining the tumour, as recommended in other cases of exostosis, only aggravate the patient's unhappy condition.

Mr. Abernethy published an account of a very singular disease of the antrum. The patient, who was thirty-four years of age when the account was written, perceived, when about ten years old, a small tumour on his left cheek, which gradually attained the size of a walnut, and then remained for some time stationary. About a year afterward, the tumour having again enlarged, a caustic was applied to the integuments, so as to expose the bone. The actual cautery was next applied, and an opening thus made into the antrum. After the exfoliation, the antrum became filled with a fungus, which rose out upon the cheek, and could not be restrained by any applications. Part of the fungus also made its way into the mouth, through the socket of the second tricuspid tooth, the other teeth remaining natural. The disease continued in this state nine years, occasionally bleeding in an alarming way. When the patient was in his twentieth year, the whole fungus sloughed away during a fever, and never returned. After this, the sides of the aperture in the bone began to grow outwards, forming an exostosis, which rapidly attained a great magnitude. A small exostosis took place in the mouth, but became no larger than a horse-bean. The exostosis of the maxillary bone was of an irregular figure, and projected from the whole circumference of the aperture a great way directly forwards. Mr. Abernethy compared its appearance, when he was writing, with that of a large tea-cup fastened upon the face, the bottom of which may be supposed to communicate with the antrum. The diameter of the cup, formed by the circular edge of the bone, was three inches and a half; the depth two inches and seven-eighths. The general height of the sides of the exostosis, from the basis of the face, was two inches; its walls were not thick, and terminated in a thin circular edge. The integuments, as they approached this edge, became thinner, and they extended over it into the cavity. The exostosis now reached to the nose in front, and to the masseter muscle behind; above, it included the very ridge of the orbit, and below, it grew from the edge of the alveolary process. A line, that would have separated the diseased from the sound bone, would have included the orbit and nose, and indeed one-half of the face. Mr. Abernethy saw no means of affording the man relief.—(*Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, vol.* 2.) See also a case related by Harrison.—(*New-Lond. Med. Journ. vol.* 1, *p.* 1.)

In a case of fungus, which had distended the antrum, hindered the tears from passing down into the nose, raised the lower part of the orbit, caused a protrusion of the eye, made two of the grinding-teeth fall out, and occasioned a carious opening in the front of the antrum, through which opening a piece of the fungus projected, Desault operated as follows: the cheek was first detached from the os maxillare, by dividing the internal membrane of the mouth, at the place where it is reflected over this bone. Thus the outer surface of the bone was denuded of all the soft parts. A sharp perforating instrument was applied to the middle of this surface, and an opening made more forwards than the one already existing. The plate of bone situated between the two apertures, was removed with a little falciform knife, which, being directed from behind forwards, made the division without difficulty. The opening thus obtained being insufficient, Desault endeavoured to enlarge it below, by sacrificing the alveolary process. This he endeavoured to accomplish with the same instrument, but finding the resistance too great, he had recourse to a gouge and mallet. A considerable piece of the alveolary arch was thus detached, without any previous extraction of the corresponding teeth, three of which were removed by the same stroke. In this manner an opening was procured in the external and inferior part of the antrum, large enough to admit a walnut. Through this aperture a considerable part of the tumour was cut away with a knife, curved sideways, and fixed in its handle. A most profuse hemorrhage took place, but Desault, unalarmed, held a compress in the antrum for a short time; this being removed, the actual cautery was applied repeatedly to the rest of the fungus. The cavity was dressed with lint, dipped in powdered colophony.

On the eighteenth day, the swelling was evidently diminished, the eye less prominent, and the epiphora less visible. But, at this period, a portion of fungus made its appearance again. This was almost entirely destroyed by applying the actual cautery twice. It appeared again, however, on the twenty-fifth day, and required a third and last recourse to the cautery. From this time, the progress of the cure went on rapidly. Instead of fungous excrescences, healthy granulations were now formed in the bottom of the sinus. The parietes of the antrum gradually approaching each other, the large opening made in the operation was reduced to a small aperture, hardly capable of admitting a probe. Even this little opening closed in the fourth month, at which time no vestiges of the disease remained, except the loss of teeth, and a very obvious depression just where they were situated.

In all fungous diseases of the antrum, making a free exposure of them is an essential part of the treatment: if you neglect this method, how can you inform yourself of the size, form, and extent of the tumour? How could you remove the whole of the fungus, through a small opening, which would only allow you to see a very little portion of the excrescence? How could you be certain that the disease was extirpated to its very root? Even when the antrum is freely opened, this circumstance can only be learned with difficulty; and how could it be ascertained, when only a point of the cavity is opened? A portion, left behind, very soon gives origin to a fresh fungus, the progress of which is more rapid, and the character more fatal, in consequence of being irritated by the surgical measures adopted.—(*Œuvres Chir. de Desault, par Bichat, t.* 2.) See also other cases, recorded by Canolles (*Recueil Periodique de la Soc. de Méd. t.* 2, *No.* 9); Eichorn (*Diss. de Polypis in Antro Highmori, Goett.* 1814); Sandifort (*Museum Anat. vol.* 2, *tab.* 30); Leveillé (*Recueil de la Soc., &c. t.* 1, *p.* 24); Weinhold (*Von den Krankheiten der Gesichtsknochen, p.* 27, 4*to. Halle*, 1818).

I imagine, that English surgeons, unaccustomed to use the actual cautery, will peruse with a degree of aversion this means, so commonly employed in France. Nor can I expect that they will altogether approve the use of the mallet and gouge for making a free opening into the antrum. Perhaps it might be better to trephine this cavity with a small instrument for the purpose, and then cut the fungus away. After removing as much of it as possible in this manner, some instrument of suitable shape might be used to scrape the part where the tumour has its root. However, if there be any case in which potent and violent measures, like those of Desault, are allowable, it is the one of which we have just been treating. Inveterate diseases demand powerful means, and tampering with them is generally more hurtful than useful. I have lately been informed of one or two cases, in which the use of the cautery was found necessary in this country, for the stoppage of the bleeding after the removal of fungi from the antrum.

There is an interesting case of a fungus in the maxillary sinus, related in the first vol. of the Parisian Chir. Journal. It was at last cured by opening the antrum, applying the cautery, and tying the portion of the tumour which had made its way into the nose. In the second volume of the same work is an excellent case, exhibiting the dreadful ravages which the disease may produce when left to itself.

Professor Pattison, a few years ago, suggested the expedient of tying the carotid artery, as likely to bring about the dispersion of fungous diseases of the antrum, without the necessity of meddling with the tumour itself. He adverts to three cases, the results of which were, on the whole, favourable to the practice.—(See *Burns on Anat. of the Head, &c. ed. by Pattison.*) I consider that this proposal merits further trials, inasmuch as the operation of taking up the carotid artery is an infinitely less severe proceeding than that of extirpating the disease in the cheek, in the manner practised by Desault.

INSECTS IN THE ANTRUM.

It is said, that insects in this cavity may sometimes make it necessary for the surgeon to open it. This case, however, must be exceedingly rare; and even what we find in authors (*Pallas, de insectis Viventibus intra viventia*) appears so little authentic, that I should hardly have mentioned the circumstance, if there were not, in a modern work (*Med. Comm. vol.* 1), a fact which appears entitled to attention. Mr. Heysham, a medical practitioner at Carlisle, relates, that a strong woman, aged sixty, in the habit of taking a great deal of snuff, was subject, for several years, to acute pains in the antrum, extending over one side of the head. These pains never entirely ceased, but were more severe in winter than summer, and were always subject to frequent periodical exacerbations. The patient had taken several anodyne medicines, and others, without benefit, and had twice undergone a course of mercury, by which her complaints had been increased. All her teeth on the affected side had been drawn. At length, it was determined to open the antrum with a large trocar, though there were no symptoms of an abscess, nor of any other disease in this cavity. For four days, no benefit resulted from the operation. Bark injections and the elixir of aloes, were introduced into the sinus. On the fifth day, a dead insect was extracted, by means of a pair of forceps, from the mouth of the cavity. It was more than an inch long, and thicker than a common quill. The patient now experienced relief for several hours; but the pains afterward recurred with their former severity: oil was next injected into the antrum, and two other insects, similar to the former, were extracted. No others appeared, and the wound closed. The pains were not completely removed, but considerably diminished for several months, at the end of which time they became worse than ever, particularly affecting the situation of the frontal sinus.

Bordenave has published, in the twelfth and thirteenth volumes of the *Mem. de l'Acad. de Chir.* edit. 12mo. two excellent papers on diseases of the antrum. In the thirteenth volume, he relates the history of a case, in which several small whitish worms, together with a piece of fetid fungus, were discharged from the antrum, after an opening had been made on account of an abscess of this cavity, attended with caries.—(*P.* 381.) But, in this instance, the worms had probably been generated after the opening had been made in the cavity; for when they made their appearance, the opening had existed nine months. Deschamps refers to another case, in which M. Fortassin, his colleague at La Charité, found in the antrum of a soldier, whom he was dissecting, a worm of the ascaris lumbricus kind, four inches in length.—(*Traité des Mal. des Fosses Nasales, &c. p.*107.) Such an example is also recorded in one of the volumes of the *Journ. de Méd.* Were a case of this description to present itself in a living subject, it would be advisable to inject oil into the cavity of the antrum, and then endeavour to wash out the extraneous substances, by throwing into the sinus warm water, by means of a syringe.—See *Précis d'Observations sur les Maladies du Sinus Maxillaire, par M. Bordenave, in Mém. de l'Acad. Royale de Chirurgie, t.* 12, *edit. in* 12*mo. Also, Suite d'Observations on the same subject, by M. Bordenave, t.* 13, *of the said work; L. H. Runge, De Morbis Præcipuis Sinuum Ossis Frontis et Maxillæ Superioris, &c. Rintelii*, 1750; *Haller, Disp. Chir.* 1, 205. *Jourdain, in Mém. de l'Acad. de Chir. t.* 4, *p.* 357; *also, his Traité des Dépôts dans le Sinus Maxillaire, &c.* 12*mo. Paris*, 1760; *his Traité des Mal. de la Bouche, t.* 2; *and Journ. de Méd. t.* 21, *p.* 57, *et t.* 27, *p.* 52—157. *This author, who, in* 1765, *suggested to the Royal Academy of Surgery the method of injecting fluid into the antrum, through the natural opening, is said to have been anticipated in the practice by Allouel, who first conceived the plan in* 1737, *and tried it with success in* 1739; *see Boyer, Traité des Mal. Chir. t.* 6, *p.* 149. *Becker, Diss. de Insolito Maxillæ Superioris tumore aliisque ejusdem morbis. Wirceb.* 1776. *Remarques et Observations sur les Maladies du Sinus Maxillaire, in Œuvres Chir. de Desault, par Bichat, t.* 2, *p.* 156. *Desault's Parisian Chir. Journal, vols.* 1 *and* 2. *Medical Communications, vol.* 1. *Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, vol.* 2. *Natural History of the Human Teeth, by John Hunter, p.* 174, 175, *edit.* 3. *Gooch's Chirurgical Works, vol.* 2, *p.* 61, *and vol.* 3, *p.* 161, *edit.* 1792. *Callisen's Systema Chirurgiæ Hodiernæ, t.* 1, *p.* 346, *&c. Dubois, in Bulletin de la Faculté de Médicine, No.* 8. *J. L. Deschamps, Traité des Maladies des Fosses Nasales, et de leur Sinus,* 8*vo. Paris*, 1804. *Eichorn, Diss. de Polypis in antro Highmori, Gött.* 1804. *Liston, Edin. Med. Journ. No.* 68, *P. V. Leinicker, de Sinu Maxillari, ejusdem Morbis, &c. Wurceb.* 1809. *C. A. Weinhold, Ideen über die abnormen Metamorphosen der Highmorshöle, Leipz.* 1810. *C. A. Weinhold, Von den Krankheiten der Gesichtsknochen und ihrer Schleimhaüte, der Ausrottung eines grossen Polypen in der linken Oberkieferhöhle, dem Verhuten der Einsinkens der Gichtischen und Venerischen Nase, und der Einsetzung Künstlicher Choanen,* 4*to. Halle*, 1808. *Also, an account of a Malignant Tumour removed from the Antrum, by T. Irving, in Edin. Med. Journ. Nos.* 83 *and* 84.

[A case of aneurism by anastomosis, situated in the branches of the internal maxillary artery, and cured by tying the carotid, is recorded by Professor Pattison, of the London University. The centre of the tumour occupied the antrum; but the sides of this cavity having been destroyed, the swelling made its way out of it in every direction; upwards into the orbit, from which it had displaced the eye; laterally into the nostril, which it completely filled; and against the septum narium, so as to produce a considerable distortion of the nose. It was as large as a new-born child's head, and attended with profuse and sometimes nearly fatal hemorrhages. Immediately after the performance of the operation, the appearance of the tumour in the nostril underwent a remarkable change; just before the ligature was applied, it seemed ready to burst from distention; but as soon as the direct circulation was stopped, its distention ceased, and its surface became shrivelled. The pulsatory movement, previously perceptible in it, now could not be detected. A daily improvement in the expression of the countenance followed. The swelling entirely disappeared, and the cheek-bone and zygoma, which had been quite concealed by it, again became evident. At the end of two years and a half from the operation, there had been no return of the disease, and the disfigurement was so trifling that it was scarcely perceptible.—(See *A. Burn's Surgical Anatomy of the Head and Neck, p.* 463, *ed.* 2, *with additions by G. S. Pattison, Glasgow*, 1824.) In the same edition the efficacy of tying the carotid for the cure of fungous diseases of the antrum is proved by several interesting cases. This is a subject which seems to me to demand the earnest attention of surgical practitioners.—*Pref.*]

ANUS. The lower termination of the great intestine named the rectum, is so called, and its office is to form an outlet for the feces.

The anus is furnished with muscles which are peculiar to it, viz. the sphincter, which keeps it habitually closed, and the *levatores ani*, which serve to draw it up into its natural situation, after the expulsion of the feces. It is also surrounded, as well as the whole of the neighbouring intestine, with muscular fibres, and a very loose sort of cellular substance. It is subject to various diseases, in which the aid of surgery is requisite: of these we shall next treat.

IMPERFORATE ANUS.

As it is of the utmost consequence that this and other malformations should not remain long unknown,

one of the earliest duties of an accoucheur after delivery should be an examination of all the natural outlets of new-born infants.

The place in which the extremity of the rectum, or the anus, ought to be, may be entirely or partly shut up by a membrane or fleshy adhesion. In other instances, no vestige of the intestine can be found, as the skin retains its natural colour over the whole space between the parts of generation and the os coccygis, without being more elevated in one place than another. In these cases, the intestine sometimes terminates in one or two culs-de-sac, about an inch upwards from the ordinary situation of the anus.—(See *Baillie's Engravings, fasc.* 4, *tab.* 5.) Sometimes it does not descend lower than the upper part of the sacrum; sometimes it opens into the bladder or vagina. Dr. Palmer dissected a case where the colon, after reaching the vicinity of the left kidney, began, as it descended, to form a sigmoid flexure; but previously to its arrival at the concavity of the left ileum, made a sudden turn to the right; and crossing the psoas muscle, reached the projection of the sacrum, where it terminated, *without at all entering the pelvis.* With this malformation was combined an imperforate meatus urinarius, and other considerable deviations of the genital organs from their natural structure.—(See *Medico-Chir. Journ. vol.* 1, 8vo. *Lond.* 1816.)

Sometimes the colon terminates in a sac, and the rectum is entirely deficient.—(See *Beauregard, in Journ. de Méd.* 1, 66.) Instances are also upon record where the rectum opened into the urethra.—(*Bresl. Samml.* 1718, *p.* 702; *Hist. de l'Acad. Royale des Sciences*, 1752, *p.* 113; *Hochstetter, in Med. Wochenblatt*, 1780, *No.* 18; 1783, *No.* 19; *Kretschmar, in Horn's Archiv. b.* 1, *p.* 350.)

When a surgeon is consulted he must not lose much time in deliberation; for if a speedy opening be not made for the feces, the infant will certainly very soon perish, with symptoms similar to those of a strangulated hernia. Mr. C. Hutchison thinks it, however, advantageous not to operate till the expiration of from twenty-four to sixty hours after birth, as within this period no great inconvenience will arise, and the distention of the rectum with meconium is a guidance to the surgeon in making the incisions.—(See *Obs. in Surgery, ed.* 2.) After ascertaining the complaint, which is an easy matter, the surgeon should endeavour to learn whether the anus is merely shut by a membrane or fleshy adhesion, or whether the anus is altogether wanting, in consequence of the lower portion of the cavity of the gut being obliterated or the rectum not extending sufficiently far down.

When a membrane or production of the skin closes the opening of the rectum, the part producing the obstruction is somewhat different in colour from the neigbouring integuments. It is usually of a purple or livid hue, in consequence of the accumulation of the meconium on its inner surface. The meconium, propelled downwards by the viscera above, forms a small roundish prominence, which yields like dough to the pressure of the fingers; but immediately projects again when the pressure is removed. When a fleshy adhesion closes the intestine, the circumstance is obvious to the eye, if the part protrude, as is generally the case. The finger feels greater hardness and resistance than when there is a mere membrane, and the livid colour of the meconium cannot be seen through the obstructing substance.

These last signs alone are enough to convince the surgeon of the necessity of the operation; but they do not clearly show whether the intestine descends as far as it ought in order to form a proper kind of anus. Complete information on this point can only be acquired after the membrane or adhesion has been divided; or else after the child's death, when the operation has proved ineffectual. Though there be no mark to denote where the anus ought to be situated, and no degree of prominence, yielding like soft dough to the pressure of the fingers, and rising again when such pressure is removed; yet it may happen, especially on our being consulted immediately after the child is born, that, notwithstanding the absence of such symptoms, denoting the presence of the meconium, and the natural extent of the intestine, as far as where the anus ought to be, the gut may exist and have a cavity as far as the membrane or adhesion closing it.

When the anus is simply covered with skin, and its place indicated by a prominence arising from the contents of the rectum, we have only to make an opening with a knife, sufficient to let out the meconium. Levret recommends a circular incision in the membrane; but a transverse one is sufficient. A small tent of lint is afterward to be introduced, in order to keep the opening from closing. If the anus be only partly closed by a membrane, the opening may be dilated with tents or bougies; but if the aperture be very small, it is preferable to use the bistoury for its enlargement.

When no external appearance denotes where the situation of the anus ought to be, the case is much more serious and embarrassing; and this, whether the intestine be stopped up by a fleshy adhesion or the coalescence of its sides, or whether a part of the gut be wanting.

However, it is the surgeon's duty to do every thing in his power to afford relief. For this purpose, an incision an inch long or rather more is to be made in the situation where the anus ought to be, and the wound is to be carried more and more deeply in the natural direction of the rectum. The cuts are not to be made directly upwards, nor in the axis of the pelvis, for the vagina or bladder might thus be wounded. On the contrary, the operator should cut backwards, along the concavity of the os coccygis, where there is no danger of wounding any part of importance. In all cases of this kind the surgeon's finger is the best director. The operator, guided by the index finger of his left hand, introduced within the os coccygis, is to dissect in the direction above recommended, until he reaches the feces, or has cut as far as he can reach with his finger. If he should fail in finding the meconium, as death must unavoidably follow, one more attempt ought to be made by introducing, upon the finger, a middle-sized trocar, in the direction best calculated to reach the rectum without danger to other parts, viz. upwards and backwards. The cannula of the trocar may be left in the puncture, and secured there by tapes, so as to afford an outlet for the feces. In some observations on this subject, addressed to the Medical and Chirurgical Society by Mr. Copland Hutchison, he recommends an elastic gum catheter to be substituted for the cannula after a week, and when the tube can be dispensed with, a sponge tent or piece of bougie to be worn 12 out of the 24 hours.—(See also *Obs. in Surgery, ed.* 2, 1826.)

In a very interesting case, recorded in Langenbeck's new Surgical Bibliotheca, the imperforate state of the anus was not discovered till the evening of the 12th day from the child's birth, when hiccough and convulsions had come on. M. Wolff found the abdomen protuberant, hard, and painful when handled, and nausea, vomiting, and great depression of strength prevailed. Next day, he introduced a large lancet a few lines in front of the os coccygis to the depth of an inch without finding the rectum. The puncture was then carried to the depth of two inches, but without effect. With a pharyngotomus, however, he now succeeded in piercing the rectum; and a glyster was administered, which brought away some meconium. Under the use of glysters and tents the child soon recovered.

By such proceedings many infants have been preserved, which would otherwise have been devoted to certain death. Hildanus, La Motte, Roonhuysen, Mr. Copland Hutchison, and others have successfully adopted the practice. Mr. B. Bell met with two cases, in which the intestine was very distant from the integuments, and he was so successful as to form an anus, which fulfilled its office tolerably well for several years; but he found it exceedingly difficult to keep the passage sufficiently pervious. As soon as he removed the dossils of lint, and other kinds of tents, used for maintaining the necessary dilatation, such a degree of contraction speedily followed, that the evacuation of the intestinal matter became very difficult for a long while afterward. He employed, at different times, tents made of sponge, gentian root, and other substances, which swell on being moistened. But they always produced so much pain and irritation that it was impossible to persevere in their use.

Tents of very soft lint, dipped in oil, or rolls of bougie-plaster, cause less irritation than those composed of any other materials.

Though keeping the opening dilated may seem simple and easy to such men as have had no opportunities of seeing cases of this description, it is far otherwise in practice. Mr. B. Bell assures us, that he never met with any disease that gave him so much trouble and

embarrassment as he experienced in the two cases of this sort which occurred in his practice. Although in both instances he made the openings at first sufficiently large, it was only by very assiduous attention for eight or ten months, that the necessity for another operation, and even repeated operations, was prevented. When only the skin has been divided, the rest of the treatment is doubtless more simple; for then nothing more is requisite than keeping a piece of lint for a few days in the opening made with the knife. But when the extremity of the rectum is at a certain distance, though we may generally hope to effect a cure, after having succeeded in giving vent to the intestinal matter, yet the treatment after the operation will always demand for a long while a great deal of attention and care on the part of the surgeon. In a highly interesting example, recorded by Mr. Miller, of Methven, such was the tendency to closure of the new opening, that he was obliged to repeat the operation ten times before the child was eight months old.—(See *Edin. Med. Journ. No.* 98, *p.* 62.) Notwithstanding all these operations, and another one of two hours and three-quarters' duration, performed several years afterward for the extraction of an alvine concretion equal in size to a turkey's egg, the power of the sphincter was perfect. The difficulty of success may be considered as in some measure proportioned to the depth of the necessary incision. In a case like that recorded by Dr. Palmer, to which I have above adverted, the inutility of any attempt to discharge the feces by an operation in the usual site of the anus must be sufficiently obvious.—(*Medico-Chir. Journ. vol.* 1, *p.* 181.)

Sometimes, while the anus appears pervious and well formed, infants suffer the same symptoms as if there were no anus at all. The reason of this depends upon the intestine being occasionally closed by a membranous partition situated more or less upwards, above the aperture of the anus (*Courtial, Nouvelles Obs. sur les Os, p.* 147; *John Wayte, in Edin. Med. and Surgical Journ. April*, 1821; *and Cases in Hutchison's Obs. in Surgery, ed.* 2), and sometimes the symptoms are owing to the termination of the gut in a cul-de-sac. This erroneous formation may always be suspected when an infant, whose anus is externally open, does not void any excrement for two or three days after its birth, and especially when urgent symptoms arise, such as swelling of the belly, vomiting, &c. We are now to endeavour to ascertain whether the rectum is impervious above the anus, by attempting to inject glysters or to introduce a probe. If the gut be shut up there is nothing to be done but having recourse to the method described above, and forming a communication by means of a bistoury guided on the finger, or else with a pharyingotomus. If the obstacle should only consist of a transverse membrane, the operation will be easy and its success highly probable. But if there should be a strangulation or obstruction of the intestine, the case is infinitely more serious.

In the case recorded by Mr. Wayte, the membranous septum was felt by the finger about an inch from the verge of the anus. It was pierced with a pointed probe which was followed by a hydrocele trocar, and afterward by a bougie of larger dimensions. On withdrawing the latter, much meconium, mixed with feces, escaped and continued to be frequently discharged. In a week, however, the opening closed, and a fresh puncture was made, which was maintained by the frequent introduction of bougies. The child proceeded tolerably well until the end of another week, when the passage was again much contracted and the abdomen proportionably distended. On the 20th day from birth, a full-sized trocar was used for restoring the opening, which, however, again had a tendency to close, but was afterward dilated by introducing twice a day bougies, which were increased in size until a rectum bougie of middle size could be passed. The boy now rapidly improved, and every hope of a perfect recovery was entertained, but disease of the os coccygis ensued, and at the end of six months the little patient died hectic.—(See *Edin. Med. and Surg. Journ. vol.* 17.)

When the anus is imperforate, the intestine sometimes opens into the vagina or bladder.—(*Dumas, in Recueil Periodique de la Soc. de Méd. t.* 3, *No.* 13. *L'Eveillé, Rapport des Travaux de la Soc. Philom. vol.* 1, *p.* 145. *Murray, Diss. Atresis Ani vesicalis, Ups.* 1794. *Act. Nat. Cur. vol.* 8, *Obs.* 24, *vol.* 9, *Obs.* 11. *Roestel, in Mursinna's Journ. fur die Chir. b.* 1, *p.* 547. *Obs. Med. Decad.* 2, *No.* 2.) The first case is the least dangerous of such malformations. The intestine may also terminate at two places at the same time, viz. at the usual place, so as to form a proper anus more or less perfect; and also in the vagina.

If these two openings should be ample enough for the easy evacuation of the excrement, nothing can be done at so tender an age; for though voiding the feces through the vagina is a most unpleasant inconvenience, yet there is no effectual means of closing the opening of the intestine in this situation, nor could one be devised which would not seriously incommode the infant.

But when the two openings are exceedingly small, and the alvine evacuations cannot readily pass out, even with the aid of glysters, the opening of the anus ought to be dilated by cannulæ of different sizes. If this method should not avail, the knife must be employed, and the wound dressed as already explained.

For the most part the intestine has only one opening in the vagina. In this circumstance, as in the instance in which the feces have no vent at all, we must make an incision in that place which the anus ought to occupy. The natural course of the feces being opened by this operation, which in such a case is not at all perilous, much less excrement will pass out of the vagina, and of course the infirmity will be diminished. By the introduction of a tube into the new anus, the communication between the rectum and vagina might possibly be obliterated, and a perfect cure accomplished. The opening between the intestine and vagina may also be too small for the easy evacuation of the feces, and even expose the infant to the same sort of dangerous symptoms as would occur if the rectum had no opening at all.

In male infants the rectum sometimes opens into the bladder, and in this circumstance there is generally no anus. The case is easily known by the meconium being blended with the urine, which acquires a thick greenish appearance, and is voided almost continually, though in small quantities. Only the most fluid part of the meconium is thus discharged. The thicker part not getting from the rectum into the bladder, nor from the bladder into the urethra, greatly distends the intestines and bladder, and produces the same symptoms as take place in cases of total imperforation. Hence, without the speedy interference of art to form an anus capable of giving vent to the feces, with which the urinary organs cannot remain obstructed, the infant will inevitably die. This case must, therefore, be treated like the foregoing examples. Though we can hardly hope to prevent altogether the inconveniences resulting from the rectum opening into the bladder, since even a new passage will not completely hinder the feces from following the other course; yet we shall thus afford the child a very good chance of preservation, and the only one which its situation will allow.

In cases in which an outlet for the feces cannot be procured by any of the methods pointed out above, it has been proposed by Littre to make an opening above one of the groins, find out a portion of intestine, open it, fix it in this situation with a few stitches, and thus form an artificial anus. Sabatier was only acquainted with one case in which this proceeding had been actually done, viz. the example where Duret, a French naval surgeon, operated. This gentleman cut into the abdomen at the lower part of the left iliac region, and having opened the sigmoid flexion of the colon, he fixed it near the wound. The child was saved by the formation of an artificial anus; but at the age of twenty-five months it continued to be troubled with a sort of prolapsus of the lining of the bowel.—(See *Recueil Périodique de la Soc. de Méd. t.* 4, *No.* 19; *and Sabatier, Méd. Opératoire, t.* 3, *p.* 336, *edit.* 2.)

An instance has been published by Mr. Pring, in which he made an opening in the colon, near its sigmoid flexure, in a lady, who, in consequence of a scirrhous disease of the rectum, was afflicted with an obstinate and perilous obstruction of the intestinal canal. The patient survived the operation nearly sixteen months, at the end of which time she fell a victim to the disease of the rectum.—(See *London Medical and Physical Journal, vols.* 45 *and* 47.) I should be reluctant to offer any remarks encouraging the repetition of this practice, against which various considerations present themselves, particularly in cases where, besides a mere difficulty of emptying the bowels, another dis-

case exists, which is itself likely to destroy the patient, and is of a nature not capable of receiving any effectual benefit from the bold operation practised in the example related by Mr. Pring.

Callisen conceives that the descending colon may be most conveniently got at by making an incision in the left lumbar region along the edge of the quadratus lumborum muscle; and he prefers this mode of operating to that of making the incision above the groin.—(*Syst. Chir. Hodiernæ, t.* 2, *p.* 688, 689, *ed.* 1800.) Its advantages, however, are not obvious.—(See *Sabatier, Médecine Opératoire, t.* 3, *p.* 330. *Pappendorf, de Ano infantum imperforato, Leipz.* 1783. *Remarques sur Différens Vices de Conformation que les Enfans apportent en naissant, par M. Petit, in Mém. de l'Acad. Royale de Chir. t.* 2, *p.* 236, *edit. in* 12*mo. H. A. Wrisberg, de præternaturali et raro Intestini Recti cum vesica urinaria coalitu, et independente Ani defectu,* 4*to. Gött.* 1779. *Ford, in Med. Facts and Obs. vol.* 1, *No.* 10. *Chamberlaine, in Memoirs of the Med. Soc. of Lond. vol.* 5, *No.* 23. *Richerand, Nosographie Chir. t.* 3, *p.* 437, *&c. édit.* 4. *G. Wayte, in Edin. Med. Journ. vol.* 17. *Lancet, vol.* 1, *p.* 434. *A. C. Hutchison, in Pract. Obs. in Surgery, ed.* 2, 1826. *Miller, in Edin. Med. Journ. No.* 98, *p.* 61. *Jolliet, in Journ. de Méd. par Leroux, t.* 32, *p.* 272.)

ABSCESSES OF THE ANUS.—FISTULA IN ANO.

The custom of giving the appellation of *fistula* to every collection of matter formed near the anus, has, by conveying a false notion of them, been productive of such methods of treating them, as are diametrically opposite to those which ought to be pursued.

A small orifice or outlet from a large or deep cavity, discharging a thin gleet or sanies, made, as Mr. Pott has explained, a considerable part of the idea which our ancestors had of a fistulous sore, wherever seated. With the term fistulous they always connected a notion of callosity; and therefore, whenever they found such a kind of opening yielding such sort of discharge, and attended with any degree of induration, they called the complaint a *fistula*. Imagining this callosity to be a diseased alteration made in the very structure of the parts, they had no conception that it could be cured by any means but by removal with a cutting instrument, or by destruction with escharotics; and therefore they immediately attacked it with knife or caustic, in order to accomplish one of these ends; and very terrible work they often made.

That abscesses formed near the fundament do sometimes, from bad habits, from extreme neglect, or from gross mistreatment, become fistulous, is certain; but the majority of them have not at first any one character or mark of a true fistula; nor can, without the most supine neglect on the side of the patient, or the most ignorant management on the part of the surgeon, degenerate or be converted into one.

Collections of matter from inflammation (wherever formed), if they be not opened in time and in a proper manner, do often burst. The hole through which the matter finds vent is generally small, and not often situated in the most convenient or most dependent part of the tumour: it therefore is unfit for the discharge of all the contents of the abscess; and instead of closing contracts itself to a smaller size, and becoming hard at its edges, continues to drain off what is furnished by the undigested sides of the cavity.

When an abscess near the anus bursts, the smallness of the accidental orifice; the hardness of its edges; its being found to be the outlet from a deep cavity; the daily discharge of a thin, gleety, discoloured kind of matter; and the induration of the parts round about, have all contributed to raise and confirm the idea of a true fistula.

Abscesses about the anus present themselves in different forms.

Sometimes the attack is made with symptoms of high inflammation; with pain, fever, rigor, &c., and the fever ends as soon as the abscess is formed.

In this case a part of the buttock near the anus is considerably swollen, and has a large circumscribed hardness. In a short time the middle of this hardness becomes red and inflamed; and in the centre of it matter is formed.

This (in the language of our ancestors) is called in general a *phlegmon;* but when it appears in this particular part, a *phyma.*

The pain is sometimes great, the fever high, the tumour large and exquisitely tender; but however disagreeable the appearances may have been, or however high the symptoms may have risen before suppuration, yet when that end is fairly and fully accomplished, the patient generally becomes easy and cool; and the matter formed under such circumstances, though it may be plentiful, is good.

On the other hand, the external parts, after much pain, attended with fever, sickness, &c., are sometimes attacked with considerable inflammation, but without any of that circumscribed hardness which characterized the preceding tumour; instead of which the inflammation is extended largely, and the skin wears an erysipelatous kind of appearance. In this the disease is more superficial; the quantity of matter small, and the cellular membrane sloughy to a considerable extent.

Sometimes instead of either of the preceding appearances, there is formed in this part what the French call *une suppuration gangreneuse;* in which the cellular and adipose membrane is affected in the same manner as it is in a carbuncle.

In this case, the skin is of a dusky red or purple kind of colour; and although harder than when in a natural state, yet it has, by no means, that degree of tension or resistance, which it has either in phlegmon or in erysipelas.

The patient has generally, at first, a hard, full, jarring pulse, with great thirst, and very fatiguing restlessness. If the progress of the disease be not stopped, or the patient relieved by medicine, the pulse soon changes into an unequal, low, faltering one; and the strength and the spirits sink in such manner, as to imply great and immediately impending mischief. The matter formed under the skin, so altered, is small in quantity, and bad in quality; and the adipose membrane is gangrenous and sloughy throughout the extent of the discoloration. This generally happens to persons, whose habit is either naturally bad, or has been rendered so by intemperance.

Sometimes the disease makes its first appearance in the induration of the skin, near to the verge of the anus, but without pain or alteration of colour; which hardness gradually softens and suppurates. The matter, when let out, in this case, is small in quantity, good in quality; and the sore is superficial, clean, and well-conditioned. On the contrary, it now and then happens, that although the pain is but little, and the inflammation apparently slight, yet the matter is large in quantity, bad in quality, extremely offensive, and proceeds from a deep crude hollow.

The place also where the abscess points, and where the matter, if let alone, would burst its way out, is various and uncertain. Sometimes it is in the buttock, at a distance from the anus; at other times, near its verge, or in the perinæum; and this discharge is made sometimes from one orifice only, sometimes from several. In some cases there is not only an opening through the skin externally, but another through the intestines into its cavity: in others, there is only one orifice, and that either external or internal.

Sometimes the matter is formed at a considerable distance from the rectum, which is not even laid bare by it; at others, it is laid bare also, and not perforated: it is also sometimes not only denuded, but pierced; and that in more places than one.

All consideration of preventing suppuration is generally out of the question: and our business, if called at the beginning, must be to moderate the symptoms; to forward the suppuration; when the matter is formed, to let it out; and to treat the sore in such manner as shall be most likely to produce a speedy and lasting cure.

When there are no symptoms which require particular attention, and all that we have to do is to assist the maturation of the tumour, a soft poultice is the best application. When the disease is fairly of the phlegmonoid kind, the thinner the skin is suffered to become before the abscess is opened, the better; as the induration of the parts about will thereby be the more dissolved, and, consequently, there will be the less to do after such opening has been made. This kind of tumour is generally found in people of full, sanguine habits; and who, therefore, if the pain be great, and the fever high, will bear evacuation, both by phlebotomy and gentle cathartics: which is not often the case of those, who are said to be of bilious constitu-

tions; in whom the inflammation is of a larger extent, and in whom the skin wears the yellowish tint of the erysipelas; persons of this kind of habit, and in such circumstances, being in general seldom capable of bearing large evacuation.

When the inflammation is erysipelatous, the quantity of matter formed is small, compared with the size and extent of the tumour; the disease is rather a sloughy, putrid state of the cellular membrane than an imposthumation; and, therefore, the sooner it is opened the better: if we wait for the matter to make a point, we shall wait for what will not happen; at least, not till after a considerable length of time: during which the disease in the membrane will extend itself, and, consequently, the cavity of the sinus or abscess be thereby greatly increased.

When, instead of either of the preceding appearances, the skin wears a dusky purplish-red colour; has a doughy unresisting kind of feel, and very little sensibility; when these circumstances are joined with an unequal, faltering kind of pulse, irregular shiverings, a great failure of strength and spirits, and inclination to doze, the case is formidable, and the event generally fatal.

The habit, in these circumstances, is always bad: sometimes from nature, but much more frequently from gluttony and intemperance. What assistance art can lend must be administered speedily; every minute is of consequence; and if the disease be not stopped, the patient will sink. Here (says Pott) is no need for evacuation of any kind: recourse must be immediately had to medical assistance; the part affected should be frequently fomented with hot spirituous fomentations; a large and deep incision should be made into the diseased part, and the application made to it should be of the warmest, most antiseptic kind.

This also is a general kind of observation, and equally applicable to the same sort of disease in any part of the body. Our ancestors have thought fit to call it in some a carbuncle, and in others by other names: but it is (wherever seated) really and truly a gangrene of the cellular and adipose membrane: it always implies great degeneracy of habit, and, most commonly, ends ill.

Strangury, dysury, and even total retention of the urine are no very uncommon attendants upon abscesses in the neighbourhood of the rectum and bladder: more especially if the seat of them be near the neck of the latter.

They sometimes continue from the first attack of the inflammation, until the matter is formed, and has made its way outwards: and sometimes last a few hours only.

The two former most commonly are easily relieved by the loss of blood, and the use of gum arabic, with nitre, &c. But in the last (the total retention), they who have not often seen this case, generally have immediate recourse to the catheter: but the practice is essentially wrong.

The neck of the bladder does certainly participate, in some degree, in the said inflammation. But the principal part of the complaint arises from irritation, and the disease is, strictly speaking, spasmodic. The manner in which an attack of this kind is generally made; the very little distention which the bladder often suffers; the small quantity of urine sometimes contained in it, even when the symptoms are most pressing; and the most certain as well as safe method of relieving it; all tend to strengthen such opinion.

But whether we attribute the evil to inflammation or to spasmodic irritation, whatever can, in any degree, contribute to the exasperation of either, must be manifestly wrong. The violent passage of the catheter through the neck of the bladder (for violent in such circumstances it must be) can never be right.

If the instrument be successfully introduced, it must either be withdrawn as soon as the bladder is emptied, or it must be left in it: if the former be done, the same cause of retention remaining, the same effect returns; the same pain and violence must again be submitted to, under (most likely) increased difficulties. On the other hand, if the catheter be left in the bladder, it will often, while its neck is in this state, occasion such disturbance that the remedy (as it is called) will prove an exasperation of the disease, and add to the evil it is designed to alleviate. Nor is this all; for the resistance which the parts while in this state make, is sometimes so great that if any violence be used, the instrument will make for itself a new route in the neighbouring parts, and lay the foundation of such mischief as frequently baffles all our art.

The true, safe, and rational method of relieving this complaint (says Pott) is by evacuation and anodyne relaxation: this not only procures immediate ease, but does, at the same time, serve another very material purpose; which is that of maturating the abscess. Loss of blood is necessary; the quantity to be determined by the strength and state of the patient: the intestines should also be emptied, if there be time for so doing, by a gentle cathartic; but the most effectual relief will be from the warm bath or semicupium, the application of bladders with hot water to the pubes and perinæum, and, above all other remedies, the injection of glysters, consisting of warm water, oil, and opium. There may have been cases which have resisted and baffled this method of treatment; but Pott never met with them.

A painful tenesmus is no uncommon attendant upon an inflammation of the parts about the rectum.

If a dose of rhubarb, joined with the confect. opii, does not remove it, the injection of thin starch and opium or tinct. thebaic. is almost infallible.

The bearing down in females, as it proceeds, in this case, from the same kind of cause (viz. irritation), admits of relief from the same means as the tenesmus.

In some habits, an obstinate costiveness attends this kind of inflammation, accompanied, not unfrequently, with a painful distention and enlargement of the hemorrhoidal vessels, both internally and externally While a large quantity of hard feces is detained within the large intestines, the whole habit must be disordered; and the symptomatic fever which necessarily accompanies the formation of matter, must be considerably heightened. And while the vessels surrounding the rectum (which are large and numerous) are distended, all the ills proceeding from pressure, inflammation, and irritation must be increased. Phlebotomy, laxative glysters, and a low, cool regimen must be the remedies: while a soft cataplasm applied externally serves to relax and mollify the swollen, indurated piles, at the same time that it hastens the suppuration.

When the abscesses have formed, and are fit to be opened, or when they have already burst, they may be reduced to two general heads, viz.

1. Those in which the intestine is not all interested: and,

2. Those in which it is either laid bare or perforated.

In making the opening, the knife or lancet should be passed in deep enough to reach the fluid; and when it is in the incision should be continued upwards and downwards in such manner as to divide all the skin covering the matter. By these means, the contents of the abscess will be discharged at once; future lodgement of matter will be prevented; convenient room will be made for the application of proper dressings; and there will be no necessity for making the incision in different directions, or for removing any part of the skin composing the verge of the anus.

Notwithstanding all these collections of matter are generally called *fistulæ*, and are all supposed to affect the rectum, the abscess is sometimes really at such a distance from the gut, that it is not at all interested by it; and none of these cases either are or can be originally *fistulæ*.

In this state of the disease, we have no more necessarily to do with the intestine than if it were not there; the case is to be considered merely as an abscess in the cellular membrane.

A short time ago, some interesting remarks on fistula in ano were published in France by Dr. Ribes, whose opinions, however, like those of many other valuable writers, are not invariably free from error; and I have no hesitation in extending this observation to one of his statements, though what he has said is alleged to be deduced from the dissection of not less than 75 persons who had died with fistulæ. No man who has seen much of this part of surgery, can doubt that the most frequent form of the disease is that in which the abscess has only an external opening, and does not perforate the rectum at all, from which, indeed, the matter is sometimes more or less distant. Nor can any experienced surgeon question the truth of Mr. Pott's account respecting the diversity of the

nature of the cases of fistulæ, some being phlegmonous, some erysipelatous, and others more like the carbuncle in their origin, progress, and consequences. But besides these circumstances, another one worthy of notice is, that the presence of fistula in ano by no means implies the previous or present existence of piles. However, notwithstanding these considerations, the doctrine started by Dr. Ribes is, that a fistula is formed by the bursting of an internal pile into the rectum, and the consequent passage of a portion of the contents of the bowel into the orifice. He farther asserts that such orifice is *always* within five or six lines above the junction of the internal membrane of the bowel with the external skin, and that it may usually be seen, if the patient forces the gut gently down, as in going to stool. The only correct part of these statements is, I believe, the account of the common situation of the internal opening, when the abscess communicates with the bowel, which is not always the case.—(See *Recherches sur la Situation de l'Orifice interne de la Fistule de l'Anus, &c. Quarterly Journ. of Foreign Med. No.* 8. *Oct.* 1820.) This part of the account is confirmed by the observations of Larrey.—(*Mém. de Chir. Mil. t.* 3, *p.* 415.)

Suppose a large and convenient opening to have been made by a simple incision; the contents of the abscess to have been thereby discharged; and a sore or cavity produced, which is to be filled up.

The term *filling up*, and the former opinion, that the induration of the parts about is a diseased callosity, have been the two principal sources of misconduct in these cases.

The old opinion, with regard to hollow and hardness, was that the former is caused entirely by loss of substance; and the latter, by diseased alteration in the structure of the parts.

The consequence of which opinion was, that as soon as the matter was discharged, the cavity was filled and distended, in order to procure a gradual regeneration of flesh; and the dressings, with which it was so filled, were most commonly of the escharotic kind, intended for the dissolution of hardness.

On the other hand, the surgeon who regards the cavity of the abscess as being principally the effect of the gradual separation of its sides, with very little loss of substance, compared with the size of the said cavity; and who looks upon the induration round about, as nothing more than a circumstance which necessarily accompanies every inflammation, will, upon the smallest reflection, perceive that the dressings applied to such cavity ought to be so small in quantity, as to permit nature to bring the sides of the cavity towards each other, and that such small quantity of dressings ought not by their quality either to irritate or destroy.

If the hollow, immediately it is opened, be filled with dressings (of any kind), the sides of it will be kept from approaching each other, or may even be farther separated. But if this cavity be not filled, or have little or no dressings of any kind introduced into it, the sides immediately collapse, and, coming nearer and nearer, do, in a very short space of time, convert a large hollow into a small sinus. And this is also constantly the case, when the matter, instead of being let out by an artificial opening, escapes through one made by the bursting of the containing parts.

True, this sinus will not always become perfectly closed; but the aim of nature is not therefore the less evident; nor the hint, which art ought to borrow from her, the less palpable.

In this, as in most other cases, where there are large sores, or considerable cavities, a great deal will depend on the patient's habit, and the care that is taken of it; if that be good, or if it be properly corrected, the surgeon will have very little trouble in his choice of dressings; only to take care that they do not offend either in quantity or quality: but if the habit be bad, or injudiciously treated, he may use the whole farrago of externals, and only waste his own and his patient's time.

By light, easy treatment, large abscesses formed in the neighbourhood of the rectum will sometimes be cured, without any necessity for meddling with the said gut. But it much more frequently happens, that the intestine, although it may not have been pierced or eroded by the matter, has yet been so stripped or denuded, that no consolidation of the sinus can be obtained, but by a division; that is, by laying the two cavities, viz. that of the abscess and that of the intestine, into one.

When the intestine is found to be separated from the surrounding parts by the matter, the operation of dividing it had better (on many accounts) be performed at the time the abscess is first opened, than be deferred to a future one. For, if it be done properly, it will add so little to the pain, which the patient must feel by opening the abscess, that he will seldom be able to distinguish the one from the other, either with regard to time or sensation; whereas, if it be deferred, he must either be in continual expectation of a second cutting, or feel one at a time when he does not expect it.

The intention in this operation is to divide the intestine rectum from the verge of the anus up as high as the top of the hollow in which the matter was formed; thereby to lay the two cavities of the gut and abscess into one; and by means of an open, instead of a hollow or sinuous sore, to obtain a firm and lasting cure.

For this purpose, the curved, probe-pointed knife, with a narrow blade, is the most useful and handy instrument of any. This, introduced into the sinus, while the surgeon's fore-finger is in the intestine, will enable him to divide all that can ever require division; and that with less pain to the patient, with more facility to the operator, as well as with more certainty and expedition, than any other instrument whatever. If there be no opening in the intestine, the smallest degree of force will thrust the point of the knife through, and thereby make one: if there be one already, the same point will find and pass through it. In either case, it will be received by the finger in ano; will thereby be prevented from deviating; and being brought out by the same finger, must necessarily divide all that is between the edge of the knife and the verge of the anus: that is, must by one simple incision (which is made in the smallest space of time imaginable) lay the two cavities of the sinus and of the intestine into one.

Authors make a very formal distinction between those cases in which the intestine is pierced by the matter, and those in which it is not; but although this distinction may be useful when the different states of the disease are to be described, yet in practice, when the operation of dividing the gut becomes necessary, such distinction is of no consequence at all: it makes no alteration in the degree, kind, or quantity of pain which the patient is to feel; the force required to push the knife through the tender gut is next to none, and when its point is in the cavity, the cases are exactly similar. In this statement every man of experience and discernment must agree, notwithstanding the prohibition to the operation, delivered by Dr. Ribes, in every case, in which the internal opening cannot be found: a piece of advice (as it seems to me) fully admitting the occurrence of cases which could not be formed in the manner in which he conceives all fistulæ in ano to be produced, viz. by the bursting of a pile, and the entrance of feces into the orifice.

Immediately after the operation, a soft dossil of fine lint should be introduced (from the rectum) between the divided lips of the incision; as well to repress any slight hemorrhage, as to prevent the immediate reunion of the said lips; and the rest of the sore should be lightly dressed with the same. This first dressing should be permitted to continue, until a beginning suppuration renders it loose enough to come away easily; and all the future ones should be as light, soft, and easy as possible; consisting only of such materials as are likely to promote kindly and gradual suppuration. The sides of the abscess are large; the incision must necessarily, for a few days, be inflamed; and the discharge will, for some time, be discoloured and gleety: this induration, and this sort of discharge, are often mistaken for signs of diseased callosity and undiscovered sinuses; upon which presumptions, escharotics are freely applied, and diligent search is made for new hollows: the former of these most commonly increase both the hardness and the gleet; and by the latter new sinuses are sometimes really produced. These occasion a repetition of escharotics, and, perhaps, of incisions; by which means, cases which at first, and in their own nature, were simple and easy of cure, are rendered complex and tedious.

To quit reasoning, and speak to fact only: In the

great number of these cases, which must have been in St. Bartholomew's Hospital, within these ten or twelve years, *I do aver* (says Pott), *that I have not met with one, in the circumstances before described, that has not been cured by mere simple division, together with light, easy dressings: and that I have not, in all that time, used, for this purpose, a single grain of precipitate, or any other escharotic.*

Let us now suppose the case in which the matter is fairly formed; has made its point, as it is called; and is fit to be let out.

Where such point is, that is, where the skin is most thin, and the fluctuation most palpable, the opening most certainly ought to be made, and always with a cutting instrument, not caustic, as was formerly done.

When a discharge of the matter by incision is too long delayed or neglected, it makes its own way out, by bursting the external parts somewhere near to the fundament, or by eroding and making a hole through the intestine into its cavity; or sometimes by both. In either case, the discharge is made sometimes by one orifice only, and sometimes by more. Those in which the matter has made its escape by one or more openings through the skin only are called *blind external fistulæ*; those in which the discharge has been made into the cavity of the intestine, without any orifice in the skin, are named *blind internal*; and those which have an opening both through the skin and into the gut are called *complete fistulæ*.

Thus, all these cases are deemed fistulous, when hardly any of them ever are so; and none of them necessarily. They are still mere abscesses, which are burst without the help of art; and, if taken proper and timely care of, will require no such treatment as a true fistula may possibly stand in need of.

The most frequent of all are what are called the *blind external*, and the *complete*. The method whereby each of these states may be known is, by introducing a probe into the sinus by the orifice in the skin, while the fore-finger is within the rectum: this will give the examiner an opportunity of knowing exactly the true state of the case, with all its circumstances.

Whether the case be what is called a complete fistula or not, that is, whether there be an opening in the skin only, or one there and another in the intestine, the appearance to the eye is much the same. Upon discharge of the matter, the external swelling subsides, and the inflamed colour of the skin disappears; the orifice, which at first was sloughy and foul, after a day or two are passed, becomes clean and contracts in size; but the discharge, by fretting the parts about, renders the patient still uneasy.

As this kind of opening seldom proves sufficient for a cure (though it sometimes does), the induration, in some degree, remains; and if the orifice happens not to be a depending one, some part of the matter lodges, and is discharged by intervals, or may be pressed out by the fingers of an examiner. The disease, in this state, is not very painful; but it is troublesome, nasty, and offensive: the continual discharge of a thin kind of fluid from it creates heat, and causes excoriation in the parts above; it daubs the linen of the patient; and is, at times, very fetid: the orifice also sometimes contracts so as not to be sufficient for the discharge; and the lodgement of the matter then occasions fresh disturbance.

The means of cure proposed and practised by our ancestors were three, viz. caustic, ligature, and incision.

The intention in each of these is the same, viz. to form one cavity of the sinus and intestines by laying the former into the latter. The first two are now completely, and most properly, exploded.

Hitherto we have considered the disease either as an abscess, from which the matter has been let out by an incision, made by a surgeon; or from which the contents have been discharged by one single orifice, formed by the bursting of the skin somewhere about the fundament. Let us now take notice of it, when, instead of one such opening, there are several.

This state of the case generally happens when the quantity of matter collected has been large, the inflammation of considerable extent, the adipose membrane very sloughy, and the skin worn very thin before it burst.—It is, indeed, a circumstance of no real consequence at all; but from being misunderstood, or not properly attended to, is made one of additional terror to the patient, and additional alarm to the inexperienced practitioner; for it is taught, and frequently believed, that each of these orifices is an outlet from, or leads to, a distinct sinus, or hollow: whereas, in truth, the case is most commonly quite otherwise; all these openings are only so many distinct burstings of the skin covering the matter; and do all, be they few or many, lead and open immediately into the one single cavity of the abscess: they neither indicate, nor lead to, nor are caused by, distinct sinuses; nor would the appearance of twenty of them (if possible) necessarily imply more than one general hollow.

If this account be a true one, it will follow, that the treatment of this kind of case ought to be very little, if at all, different from that of the preceding; and that all that can be necessary to be done, must be to divide each of these orifices in such manner as to make one cavity of the whole. This the probe-knife will easily and expeditiously do; and afterward, if the sore, or more properly its edges, should make a very ragged, uneven appearance, the removal of a small portion of such irregular angular parts will answer all the purposes of making room for the application of dressings, and for producing a smooth even cicatrix after the sore shall be healed.

When a considerable quantity of matter has been recently let out, and the internal parts are not only in a crude undigested state, but have not yet had time to collapse and approach each other, the inside of such cavity will appear large; and if a probe be pushed with any degree of force, it will pass in more than one direction into the cellular membrane by the side of the rectum. But let not the unexperienced practitioner be alarmed at this, and immediately fancy that there are so many distinct sinuses; neither let him, if he be of a more hardy disposition, go to work immediately with his director, knife, or scissors: let him enlarge the external wound by making his incision freely; let him lay all the separate orifices open into that cavity; let him divide the intestine lengthwise by means of his finger in ano; let him dress lightly and easily; let him pay proper attention to the habit of the patient; and wait and see what a few days, under such conduct, will produce. By this he will frequently find, that the large cavity of the abscess will become small and clean; that the induration round about will gradually lessen; that the probe will not pass in that manner into the cellular membrane; and, consequently, that his fears of a multiplicity of sinuses were groundless. On the contrary, if the sore be crammed or dressed with irritating or escharotic medicines, all the appearances will be different: the hardness will increase, the lips of the wound will be inverted, the cavity of the sore will remain large, crude, and foul; the discharge will be thin, gleety, and discoloured; the patient will be uneasy and feverish; and, if no new cavities are formed by the irritation of parts and confinement of matter, yet the original one will have no opportunity of contracting itself, and may very possibly become truly fistulous.

Sometimes the matter of an abscess, formed juxta anum, instead of making its way out through the skin externally near the verge of the anus, or in the buttock, pierces through the intestine only. This is what is called a *blind internal fistula*.

In this case, after the discharge has been made, the greater part of the tumefaction subsides, and the patient becomes easier. If this does not produce a cure, which sometimes though very seldom happens, some small degree of induration generally remains in the place where the original tumour was; upon pressure on this hardness, a small discharge of matter is frequently made per anum; and sometimes the expulsion of air from the cavity of the abscess into that of the intestine may very palpably be felt and clearly heard; the stools, particularly if hard, and requiring force to be expelled, are sometimes smeared with matter; and although the patient, by the bursting of the abscess, is relieved from the acute pain which the collection occasioned, yet he is seldom perfectly free from a dull kind of uneasiness, especially if he sits for any considerable length of time in one posture. The real difference between this kind of case and that in which there is an external opening (with regard to method of cure), is very immaterial; for an external opening must be made, and then all difference ceases. In this, as in the former, no cure can reasonably be expected until the cavity of the abscess and that of the rectum are made

one; and the only difference is, that in the one case we have an orifice at or near the verge of the anus, by which we are immediately enabled to perform that necessary operation; in the other, we must make one.

We come now to that state of the disease, which may truly and properly be called *fistulous*. This is generally defined, *sinus angustus, callosus, profundus: acri sanie diffluens:* or, as Dionis translates it, "*Un ulcère profond, et caverneux, dont l'entrée est étroite, et le fond plus large; avec issue d'un pus acre et virulent; et accompagné de callosités.*"

Various causes may produce or concur in producing such a state of the parts concerned as will constitute a fistula, in the proper sense of the word; that is, a deep hollow sore, or sinus; all parts of which are so hardened or so diseased, as to be absolutely incapable of being healed while in that state; and from which a frequent or daily discharge is made, of thin discoloured sanies, or fluid.

These are divided into two classes, viz. those which are the effect of neglect, distempered habit, or bad management, and which may be called, without any great impropriety, local diseases; and those which are the consequence of disorders whose origin and seat are not in the immediate sinus or fistula, but in parts more or less distant, and which, therefore, are not local complaints.

The natures and characters of these are obviously different by description; but they are still more so in their most frequent event; the former being generally curable by proper treatment, the latter frequently not so by any means whatever.

Under the former are reckoned all such cases as were originally mere collections of matter within the coats of the intestine rectum, or in the cellular membrane surrounding the said gut; but which, by being long neglected, grossly managed, or by happening in habits which were disordered, and for which disorders no proper remedies were administered, suffer such alteration, and get into such state, as to deserve the appellation of *fistulæ*.

Under the latter are comprised all those cases in which the disease has its origin and first state in the higher and more distant parts of the pelvis, about the os sacrum, lower vertebræ of the loins, and parts adjacent thereto; and are either strumous, or the consequence of long and much distemperate habits; or the effect of, or combined with, other distempers, local or general; such as a diseased neck of the bladder or prostate gland, or urethra, &c. &c. &c.

Among the very low people, who are brought into hospitals, we frequently meet with cases of the former kind: cases which, at first, were mere simple abscesses; but which, from uncleanliness, from intemperance, negligence, and distempered constitutions, become such kind of sores as may be called *fistulous*.

In these the art of surgery is undoubtedly, in some measure, and at some time, necessary; but it very seldom is the first or principal fountain from whence relief is to be sought: the general effects of intemperance, debauchery, and diseases of the habit are first to be corrected and removed, before surgery can, with propriety, or with reasonable prospects of advantage, be made use of.

The surgery required in these cases, consists in laying open and dividing the sinus or sinuses, in such a manner that there may be no possible lodgement for matter, and that such cavities may be fairly opened lengthwise into that of the intestine rectum: if the internal parts of these hollows are hard, and do not yield good matter, which is sometimes the case, more especially where attempts have been made to cure by injecting astringent liquors, such parts should be lightly scratched or scarified with the point of a knife or lancet, but not dressed with escharotics; and if, either from the multiplicity of external orifices, or from the loose, flabby, hardened, or inverted state of the lips and edges of the wound near to the fundament, it seems very improbable that they can be got into such a state as to heal smoothly and evenly, such portions of them should be cut off as may just serve that purpose. The dressings should be soft, easy, and light; and the whole intent of them to produce such suppuration as may soften the parts and bring them into a state fit for healing.

If a loose fungous kind of flesh has taken possession of the inside of the sinus (a thing much talked of and very seldom met with), a slight touch of the lunar caustic will reduce it sooner, and with better effect on the sore, than any other escharotic whatever.

Modern writers also speak of a smooth adventitious membrane, which is found to line old fistulæ, and frequently to hinder the success of the operation (see *Quarterly Journ. of Foreign Medicine, &c. No.* 8); a complication which would undoubtedly justify the recourse to measures for the extirpation of such membrane. But I ought to mention my own belief, that a case hindered from getting well by this cause is very rare in comparison with others, in which the cure is prevented by the matter being still more or less confined, and not having as free an outlet as circumstances demand.

The method and medicines by which the habit of the patient was corrected, must be continued (at least in some degree) through the whole cure; and all the excesses and irregularities which may have contributed to injure it must be avoided.

By these means, cases which at first have a most disagreeable and formidable aspect are frequently brought into such state as to give very little trouble in the healing.

If the bad state of the sore arises merely from its having been crammed, irritated, and eroded, the method of obtaining relief is so obvious as hardly to need recital.

A patient who has been so treated has generally some degree of fever; has a pulse which is too hard, and too quick; is thirsty, and does not get his due quantity of natural rest. A sore which has been so dressed, has generally a considerable degree of inflammatory hardness round about; the lips and edges of it are found full, inflamed, and sometimes inverted; the whole verge of the anus is swollen; the hemorrhoidal vessels are loaded; the discharge from the sore is large, thin, and discoloured; and all the lower part of the rectum participates in the inflammatory irritation, producing pain, bearing down, tenesmus, &c. *Contraria contrariis* is never more true than in this instance: the painful, uneasy state of the sore and of the rectum is the great cause of all the mischief, both general and particular; and the first intention must be to alter that state. All escharotics must be thrown out and disused; and in lieu of them, a soft digestive should be substituted, in such manner as not to cause any distention, or to give any uneasiness from quantity; over which a poultice should be applied: these dressings should be renewed twice a day; and the patient should be enjoined absolute rest. At the same time, attention should be paid to the general disturbance which the former treatment may have created. Blood should be drawn off from the sanguine; the feverish heat should be calmed by proper medicines; the languid and low should be assisted with the bark and cordials; and ease in the part must, at all events, be obtained by the injection of anodyne clysters of starch and opium.

If the sinus has not yet been laid open, and the bad state of parts is occasioned by the introduction of tents imbued with escharotics, or by the injection of astringent liquors (the one for the destruction of callosity, the other for the drying up gleet and humidity), no operation of any kind should be attempted until both the patient and the parts are easy, cool, and quiet; cataplasms, clysters, rest, and proper medicines must procure this; and when that is accomplished, the operation of dividing the sinus, and (if necessary) of removing a small portion of the ragged edges, may be executed, and will, in all probability, be attended with success. On the contrary, if such operation be performed while the parts are in a state of inflammation, the pain will be great, the sore for several days very troublesome, and the cure prolonged or retarded, instead of being expedited.

Abscesses and collections of diseased fluids are frequently formed about the lumbar vertebræ, under the psoas muscle, and near to the os sacrum; in which cases, the said bones are sometimes carious, or otherwise diseased. These sometimes form sinuses, which run down by the side of the rectum, and burst near to the fundament.

The treatment of such sores and sinuses can have little influence on the remote situation where the collection of matter is originally formed.—(See *Lumbar Abscess.*)

Fistulous sores, sinuses, and indurations about the

anus, which are consequences of diseases of the neck of the bladder and urethra, called fistulæ in perinæo, require separate and particular consideration.—(See *Fistula in Perinæo.*)

A few years ago M. Roux published a critique on the preference which English surgeons invariably give to Pott's method of operating for the fistula in ano. The chief peculiarity in the French plan, on which he bestows unqualified praise, consists in the use of a kind of director called a gorget, which is usually made of ebony wood, and intended to be introduced within the rectum, with its concavity turned towards the fistula. A steel inflexible director, slightly pointed and without a cul-de-sac, is then passed through the fistula till the point comes into contact with the wooden gorget. A long, narrow, sharp-pointed, straight bistoury is now introduced along the groove of the steel director, till its point meets the groove of the ebony gorget, by cutting upon which all the parts are divided which lie between the internal opening of the fistula and the anus. It may be objected to this method, that it is not always easy to make a director pass at once through the fistula into the rectum. This is acknowledged by Richerand, who adds, that in this circumstance the point of the director may be forced into the rectum without lessening the chance of the success of the operation.—(*Nosogr. Chirurg. t.* 3, *p.* 463, 464, *edit.* 4.) Why then does it matter so much that the surgeon sometimes pierces the rectum with the point of his curved bistoury? Surely th s is as good an instrument for making the puncture as the pointed director. Besides, it appears to me that a flexible silver director is more likely to follow the track of the fistula into the rectum than an unbending iron instrument. I shall say nothing of the awkwardness of using the other wood n director: the finger of the surgeon can always do the office of all such contrivances with greater safety and convenience. M. Roux also censures us for not *cramming* the wound with charpie; for he is not content with merely introducing into it a dossil of lint.—(See *Parallèle de la Chir. Angloise, &c. p.* 296, *&c.*) His countryman Pouteau, however, knew better long ago: for he has expressed his decided conviction of the inutility of cramming the wound with dressings to its very bottom after the third day, when superficial dressings, and the renewal of them as often as cleanliness requires, will be fully sufficient.

For information relative to former opinions concerning *fistula in ano*, refer to *Celsus; Heister's Surgery; Le Dran's Operations; Sharpe's Operations; La Faye's Notes on Dionis. H. Bass, De Fistula Ani feliciter curanda, in Halleri Disp. Chir.* 4, 463. *J. L. Petit, Traité des Mal. Chir. t.* 1 *and* 2, *p.* 113. *Petit is an advocate for making an early opening, like Pott, and all the best writers on this disease. In Kirkland's Medical Surgery, vol.* 2, *may be found an account of the opinions and practice of many former celebrated practitioners. The best modern practical remarks are contained in Pott's Treatise on the Fistula in Ano, in which he has offered also an excellent critique on some opinions of Le Dran, De la Faye, and Cheselden. The reader may also consult with advantage Sabatier's Médecine Opératoire, t.* 2. *J. Howship, Practical Obs. on the Diseases of the Lower Intestines, &c. chap.* 6, *ed.* 3, *Lond.* 1824. *T. Whately, Cases of Polypi, &c., with an appendix describing an approved instrument for the fistula in ano, 8vo. Lond.* 1805. *J. T. Oetzman, De Fistula Ani, 4to. Jenæ*, 1812. *Richerand, Nosographie Chir. t.* 3, *p.* 446, *&c. édit.* 4. *Roux, Voyage fait à Londres en* 1814, *ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 296, *&c., Paris*, 1815. *Callisen's Syst. Chirurgiæ Hodiernæ, t.* 1, *p.* 470. *Schreger, Chirurgische Versüche, b.* 2, *über die Unterbindung der Mastdarmfisteln, p.* 1, 131, 8*vo. Nürnberg*, 1818. *Kothe, Darstellung, &c., der Curmethoden der Afterfisteln, in Rust's Mag. b.* 1, *s.* 259. *T. Ribes, Recherches sur la Situation de l' Orifice interne de la Fistule de l'Anus, et sur les parties dans l'épaisseur desquelles ces ulcères ont leur siège. See Quarterly Journ. of Foreign Medicine, No.* 8. *Fr. Reisinger, Darstellung eines neuenn Verfahrens die Mastdarmfistel, zu unterbinden, &c., 8vo. Augsb.* 1816. *Into the consideration of these plans of curing fistulæ by the introduction of a ligature through them and tying them, I have not judged it advisable to enter, because every method of this kind is most justly banished from the practice of surgery in this country.*

ANUS, PROLAPSUS OF.

Prolapsus ani, technically called also *exania*, or *archoptosis*. In this case the rectum protrudes at the anus, either from mere relaxation of the internal membrane of the bowel, or from a real displacement and inversion of its upper portion, which presents itself as an external tumour. The first form of the disease is that which is most common. The inner coat of the rectum being connected to the muscular by a very loose elastic cellular substance, naturally forms several folds, the use of which is to let this bowel dilate sufficiently for the retention of the excrement. The swelling occasioned by the protrusion of the inner coat of the rectum, or by the actual displacement of the greater part of this bowel, is subject to considerable variety in respect to length and thickness; when small resembling a mere ring; when large and reaching far downwards, having an oblong globular form. The tumour sometimes admits of reduction with ease; sometimes it cannot be returned without difficulty. The disease occurs in persons of all ages; but it is most common in infants and elderly subjects. Such examples as are combined with thickening and relaxation of the inner coat of the rectum, internal hemorrhoids, or other tumours, are sometimes attended with a copious discharge from the anus, and from the prolapsed bowel, of a serous and mucous fluid mixed with blood. The disease may originate from various causes:

1. From circumstances tending to relax and weaken the parts which retain the rectum or its inner membrane in its situation.

2. From various kinds of irritation and pressure on the bowel itself, having the effect of increasing the powers by which it is liable to be forced outwards.

3. From any disease or irritation in the adjacent parts, and affecting the rectum sympathetically.

Hence, a prolapsus ani may be caused by long habitual crying, and great exertions of the voice; violent coughing; sitting long at stool; hard dry feces, and much straining to void them; obstinate diarrhœa in infants, kept up by dentition; dysentery; chronic tenesmus; various diseases of the rectum itself; the abuse of aloetic medicines and emollient clysters; hemorrhoids; excrescences and thickenings of the inner membrane of the rectum; difficulty of making water; the efforts of parturition; the stone in the bladder; paralysis of the sphincter and levatores ani; and prolapsus vaginæ.

Considering the degree of the disease, and the occasional closeness of the stricture, the symptoms are sometimes mild, the rectum generally bearing pressure, exposure to the air, and other kinds of irritation better than any other bowel. But the urgency and danger of a prolapsus ani are greater when the swelling is large, recent, and conjoined with violent pain, inflammation, and febrile symptoms. When complicated with strangulation, the consequences may be a stoppage of the feces, severe pain, swelling, inflammation, and even gangrene within the cavity of the abdomen. In short, all the evils may arise which attend strangulated hernia. The prognosis, therefore, varies according to the different degree, species, cause, and complication of the disease. The recent, small, moveable prolapsus ani, the cause of which admits of being at once removed, may be effectually and radically cured. It should always be recollected, however, that when once the rectum has been affected with prolapsus, a tendency to protrusion from any slight occasional cause generally remains. The habitual prolapsus, which has existed for years, and comes on whenever the patient goes to stool, is the case which is most difficult of relief.

The treatment of prolapsus ani embraces three principal indications:

1. The speedy reduction of the prolapsed part.

2. The retention of the reduced bowel.

3. The removal and avoidance of the causes by which the disease is induced.

In general, when the case is recent and the tumour not of immoderate size, the reduction may be accomplished with tolerable ease, by putting the patient in a suitable posture, with the buttocks raised and the thorax depressed, and by making gentle and skilful pressure either with the palm of the hand or fingers. When difficulty is experienced, the patient, if young or robust, may be bled, and the part be fomented. The

large intestines may also be emptied by means of a mild unirritating clyster, and half an ounce of the oleum ricini should be exhibited. In the habitual prolapsus ani the patient himself is generally accustomed to reduce the part, or it goes up of itself when he lies down. When, however, the inflammation and swelling are urgent, the part ought on no account to be irritated by repeated attempts at reduction. The practitioner should rather have recourse to the antiphlogistic plan, especially leeches, fomentations, or cold washes, and the exhibition of the oleum ricini; and when the swelling has been lessened the reduction may be again attempted. When the reduction is prevented by a spasmodic resistance, the use of an anodyne poultice or fomentations, a clyster of the same quality, the warm bath, and the internal use of opium, are the best means. Should the complaint not give way to the preceding remedies, and the symptoms become more and more pressing, the particular situation of the stricture should be examined with a probe, and divided either with a knife and director or with a concealed bistoury. Some writers speak of the employment of a speculum ani; but on account of the globular form of the disease, it must be difficult of application. Cases are recorded in which the protruded part, either in the state of gangrene or of chronic hardness, thickening, and elongation, has been removed with a knife or ligature.—(See *Cheselden's Anatomy*, &c. 1741; *Kerstens, Historia Sedis prociduæ, resectione feliciter sanatæ*, *Kilon*, 1779; *Whately, in Med. Tracts and Observ. vol.* 8, *No.* 16.)

However, I should apprehend that in the circumstance of gangrene, the measures best calculated for stopping its course, detaching the sloughs, and keeping up the patient's strength, must always be more prudent than such an operation.

The reduction having been effected, it is proper to introduce the fore-finger up the rectum in order to ascertain that no intussusception exists above the anus within the sphincter. The bowel is then to be kept in its place by quietude and the recumbent posture, and if there be a great tendency to relapse it will be proper to apply to the fundament a piece of sponge or compresses, supported with the T bandage. But if such means should not answer, and an habitual prolapsus ani should recur again and again, which is not unfrequent when the disease has been neglected, or its causes have long remained unremoved, the apparatus described by Mr. Gooch may be tried with more hope of success.—(*Chir. Works, vol.* 2, *p.* 150, *edit.* 1792.) Others have used perforated balls of ivory. Callisen found the introduction of a piece of sponge within the rectum, fastened to a silver probe, give effectual support. In France, instruments made of elastic gum have been employed with advantage for supporting the rectum.—(*Richerand, Nosogr. Chir. t.* 3, *p.* 444, *ed.* 4.)

On account of the elasticity and unirritating quality of this substance, I conceive it is better calculated than any other material for the construction of such instruments. It cannot be denied, however, that all foreign bodies in the rectum create serious annoyance. In the female sex, a vaginal pessary, rather prominent behind, usually hinders the recurrence of a prolapsus ani.

The late Mr. Hey published some highly interesting remarks on the cure of the procidentia ani in adults. In one gentleman the disease took place whenever he had a stool, and continued for some hours, the gut gradually retiring, and at last disappearing, until he had occasion to go to the privy again. After each stool, he used to place himself in a chair, and obtain a little relief by making pressure on the prolapsed part; and he then was in the habit of going to bed, where the intestine by degrees regained its natural situation. While the bowel was down there was a copious discharge from it of a thin mucous fluid blended with blood. When the part was up, the anus was constantly surrounded by a thin, pendulous flap of integuments, generally hanging down to the extent of three-fourths of an inch. Around the anus there were also several soft tubercles of a bluish colour, situated at the basis and at the inner part of the pendulous flap. These were evidently formed by the extremity of the rectum. The patient, previously to the establishment of these habitual attacks of prolapsus ani, had been afflicted for several years with pain after each stool, protuberances at the extremity of the rectum, and discharge of blood and mucus. For these complaints he applied to Mr. Sharp, who gave him an ointment to be applied after each stool, some soapy pills to be taken, and recommended the use of a clyster a little before the time of going to stool. The latter remedy, however, could not be adopted, and no material benefit was derived from the others. Some years afterward, when Mr. Hey was consulted, the foregoing symptoms continued; in addition to which there was the grievance of the prolapsus, which came on at every time of going to stool, and lasted for several hours. This judicious surgeon at first advised the patient to wash the prolapsed part with a lotion composed of an infusion of oak-bark, lime-water, and spirit of wine, and keeping on the tumour compresses, wet with this fluid, and supported by the T bandage. The disease, however, was too obstinate to be cured by this treatment. Nor could Mr. Hey succeed in reducing the bowel when it came down. "Although (says he) the prolapsed part of the intestine consisted of the whole inferior extremity of the rectum, and was of considerable bulk, yet the impediment to reduction did not arise from the stricture of the sphincter ani; for I could introduce my finger with ease during the procidentia; but it seemed to arise from the relaxed state of the lowest part of the intestine and of the cellular membrane which connects it with the surrounding parts. My attempt proved vain as to its immediate object, yet it suggested an idea which led to a perfect cure of this obstinate disorder. The relaxed state of the part which came down at every evacuation, and the want of sufficient stricture in the sphincter ani, satisfied me that it was impossible to afford any effectual relief to my patient unless I could bring about a more firm adhesion to the surrounding cellular membrane, and increase the proper action of the sphincter. Nothing seemed so likely to effect these purposes as the removal of the pendulous flap and the other protuberances which surrounded the anus." This operation was performed on the 13th of November. On the 15th the gut protruded and did not gradually retire as it used to do. Mr. Hey attempted to procure ease by means of opiates and fomentations, and avoided immediately trying to reduce the prolapsed part. However, the prolapsus continued so long that the appearance of the part began to alter, and therefore, on the 16th he made an attempt at reduction, and succeeded with great ease. However, as a good deal of pain in the hypogastrium was still complained of, the patient was bled in the evening, and gently purged with the oleum ricini. These means gave relief; but as some pain in the belly yet continued, an opiate was given. A low diet, linseed tea, lac amygdalæ, &c. were ordered, and a little of the oleum ricini every morning, or every other morning, with an opiate after a stool had been procured. "By proceeding in this manner for some days, regular stools were procured without any permanent inconvenience. My patient recovered very well, and was freed from this distressing complaint, which had afflicted him so many years.—(See *Hey's Pract. Obs. p.* 438, *&c. ed.* 2.)

This and some other cases which this gentleman has related, convincingly exemplify the necessity of paying attention to the removal of excrescences, hemorrhoids, and other tumours, situated about the lower part of the rectum, in cases of prolapsus ani; for unless this object be accomplished, the disease may resist every other treatment. Mr. Howship prefers the ligature for the extirpation of the protuberances; but heartily commends the principle of the treatment proposed by Mr. Hey.—(*Pract. Obs. on Diseases of the Lower Intestines, p.* 163, *ed.* 3.) An elderly gentleman, whom I know, was troubled for many years with a prolapsus ani, which used to come on several times a week, sometimes at the privy, and sometimes on other occasions. Several of the first surgeons were consulted, who failed in affording permanent benefit, because they omitted to extirpate some hemorrhoidal excrescences, situated at the lower part of the rectum; for, when these were afterward removed, the prolapsus ani entirely disappeared.

Dupuytren, finding that the excision of piles, which so often accompany prolapsus ani, commonly prevented the return of the latter complaint, was led to cut off more or less considerable portions of the internal membrane of the rectum. However, as in one case a profuse hemorrhage took place, and, in another, a tedious suppuration, he has subsequently adopted the plan of

removing a certain number of the projecting folds, which may be seen converging from the circumference to the margin of the anus. He takes hold of them with ligature-forceps, a little flattened at one end, and cuts them off with scissors curved on their flat side. This practice is similar to that employed by the late Mr. Hey. Dupuytren, in his first method, used to cut away the mucous membrane itself; in the last, only the folds of skin at the margin of the anus are removed. A woman had had a constant prolapsus ani for ten years; when she was in the upright posture, the swelling was ten inches in one diameter, and seven in the other; it hindered her from walking, and continually discharged a mixture of blood and mucus. Dupuytren removed five or six of the projecting folds from without inwards. The patient, who used to have more than twenty stools a day, now went six days without one; on the seventh, however, an abundant evacuation took place, and the prolapsus never returned. Merely simple dressings are needed.—(See *Journ. Universel des Sciences Méd. No.* 81, *Sept.* 1822.)

The last indication in the treatment is the removal and avoidance of all such causes as are known to have a tendency to bring on the complaint. In infants, a fresh protrusion of the rectum may sometimes be prevented by making them sit on a high close-stool, with their feet hanging freely down. Every thing tending to cause either diarrhœa or costiveness should be avoided. In the generality of cases, however, there is an inclination to costiveness, which must be obviated by the mildest means. For this purpose, Mr. Hey used to prescribe half an ounce of the oleum ricini, which is to be taken every morning, or every other morning, as circumstances may require. The same practitioner sometimes also employed, in addition to this medicine, a clyster composed of a pint of water-gruel, and a large spoonful of treacle. The tone of the relaxed intestine is to be restored by the continued use of cold clysters, made with the decoction of oak-bark, alum, and vinegar. In one obstinate case, under the care of Mr. Hey, he recommended the following lotion for washing the part during the state of prolapsus, and he also advised its application to the anus in the intervals, by means of a thick compress, supported by the T bandage. ℞. Aquæ calcis simplicis ℔ij. Cort. quercûs contus. ℥iv. f. infusum per hebdomadam, et colaturæ adde sp. vini rect. ℥iv. ft. lotio.—(See *Hey's Pract. Obs. p.* 442, *ed.* 2.)

Irritability of the rectum may be lessened with opium.

The intussusception of the higher part of the bowel, especially of the colon, or cœcum, causing a protrusion at the anus, is always incurable, as it is not in the power of art to rectify the displacement. Some extraordinary cases prove, however, that large portions of the intestinal canal thus inverted, may be separated and voided, and the patients recover.—(See *Intussusception.*)

According to Mr. Travers, when an artificial anus is complicated with prolapsus, the case very rarely admits of cure.—(See *Inquiry into the Process of Nature in repairing Injuries of the Intestines, p.* 374.)

Surgical writers have been too much in the habit of confounding together prolapsus ani and intussusception. In the latter disease, they have even fallen into the error of supposing, that the whole of the rectum becomes everted, in consequence of the relaxation of the sphincter and levatores ani, and that it then draws after it other portions of the intestinal canal. But they ought to have been undeceived by the strangulation, which sometimes occurs under such circumstances, and which not only throws a great obstacle in the way of the reduction of the displaced part, but even sometimes brings on mortification. Besides, the connexions of the rectum with the neighbouring parts, by means of the cellular substance, which surrounds it, and the attachment of this intestine to the posterior surface of the urinary bladder, render the above origin of the complaint impossible. Such an explanation could only be admitted with regard to those protrusions of the rectum which come on in a very slow manner. It could not apply to certain cases, in which the everted intestine presents itself in the form of an enormous tumour. Fabricius ab Aquapendente met with cases of prolapsus of the rectum, where the tumour was as long as the forearm, and as large as the fist. In the *Mélanges des Curieux de la Nature*, is the description of a tumour of this sort, which was two feet long, and occurred in a woman from parturition. Nor is a more satisfactory reason assigned for these cases, by supposing, that they originate from a relaxation of the villous coat of the rectum, and its separation from the muscular one. We are not authorized to imagine, that such a separation can take place to a considerable extent, nor so suddenly as to give rise to the phenomena sometimes remarked in this disease.

Accurate observations long ago removed all doubt upon this subject. In the *Mémoires de l'Académie de Chirurgie, t.* 11, *ed. in* 12*mo.* is an account of a pretended prolapsus of the rectum, which, after death, was discovered to be an eversion of the cœcum, the greater part of the colon being found at the lower end of this intestine, and most of the rectum at its upper part. This eversion began at the distance of more than eleven inches from the anus, and terminated about five or six from this opening, the tumour formed by the disease having been reduced some time before the child's death. It was impossible to draw back the everted part, in consequence of the adhesions which it had contracted. Another dissection evinced the same fact. A child, having suffered very acute pain in the abdomen, after receiving a blow, had a prolapsus of intestine through the anus, about six or seven inches long. This was taken for a prolapsus of the rectum. After death, the termination of the protruded bowel was found to be the cœcum, which had passed through the colon and rectum.—(See *Intussusception.*)

Schacher de Morbis a Situ Intestinorum Preternaturali, 1721. *Luther, de Procidentia Ani, Erf.* 1732. *Heister, Recti Prolapsus Anatome, Helmst.* 1734. *Gooch's Chir. Works, vol.* 2, *p.* 150, 1792. *Recherches Historiques sur la Gastrotomie, ou l'Ouverture, du bas Ventre, dans le cas du Volvulus, &c., par M. Hevin, in Mém. de l'Acad. Royale de Chir. t.* 11, *p.* 315, *ed. in* 12*mo. Monteggia, Fasc. Pathologici, p.* 91, *Tur.* 1793. *Jordan, De Prolapsu ex Ano, Goett.* 1793. *J. Howship, Obs. on the Diseases of the Lower Intestines, &c. ed.* 3, *Lond.* 1824, *chap.* 4. *Richter's Anfangsgr. der Wundarzn. b.* 6, *p.* 403, *ed.* 1802. *Callisen's Syst. Chirurgiæ Hodiernæ, t.* 2, *p.* 521, *ed.* 1800. *Hey's Practical Obs. in Surgery, p.* 438, *&c. 8vo. ed.* 2, 1810. *Journ. Univ. des Sciences Méd. No.* 19, *Sept.* 1822. *M. J. Chelius, Hanb. der Chir. b.* 1, 773, *Heidelb.* 1826

ANUS ARTIFICIAL.

This signifies an accidental opening in the parietes of the abdomen, to which opening some part of the intestinal canal tends, and through which the feces are, either wholly or in part, discharged.

An artificial anus is always preceded by an injury of the intestinal canal, either a penetrating wound of the abdomen, ulceration of the bowel, and the bursting of an abscess externally; an operation, in which the preternatural opening is purposely made, with the view of saving life, in particular cases of imperforate anus; an accidental wound of the gut in the operation for hernia; or, lastly, and most commonly, mortification of the bowel, the effect of the violence and long continuance of the strangulation of the part. All these cases are farther divisible into such as are attended with a destruction of a portion of the intestinal tube; and into those which are not accompanied with any such loss of substance.

Whatever may be the kind of injury which the bowel has sustained, one thing here invariably happens, viz. the adhesion of the two divided portions of the intestine to the edge of the opening in the parietes of the abdomen. This occurrence, which has the most salutary effect in preventing extravasation of the contents of the bowel in the cavity of the abdomen, is produced by inflammation, which precedes gangrene, and follows wounds.—(See *Œuvres Chir. de Desault, t.* 2, *p.* 352—354.)

When, in strangulated hernia, the case is not relieved by the usual means, or when the necessary operation has not been practised in time, the protruded bowel sloughs; the adjoining part of it adheres to the neck of the hernial sac; and the gangrenous mischief spreads from within outwards. If the patient live long enough, and an incision in the tumour be not now practised, one or more openings soon form in the integuments, and, through these apertures, the feces are discharged until the separation of the sloughs gives a freer vent to the excrement. But when an incision is made, the feces are more readily discharged, and, as

Mr. Travers has related, this is sometimes the best mode of relief.

"In the ordinary situation of hernia (as this gentleman has correctly explained), the portions of intestine embraced by the stricture occupy a position nearly parallel. Their contiguous sides mutually adhere; in the remainder of their circumference they adhere to the peritoneum, lining or forming the stricture. The existing adhesion of the contiguous sides, strengthened by the adhesion of the parts in contact, ensures a partial continuity upon the separation of the sphacelated part. The line of separation is the line of stricture. It commences on that side of the gut which is in direct contact with the stricture. As the separation advances, the opposite adhering sides may perhaps recede somewhat, and a little enlarge the angle of union. But it is ever afterward an angle; and, where the peritoneum is deficient, the canal is simply covered in by granulations from the cellular membrane of the parietes, coalescing with those of the external or cellular surface of the peritoneum."—(*On the Process of Nature in repairing Injuries of the Intestines*, *p.* 360.) It must be confessed, that few surgeons have entertained sufficiently accurate ideas of the changes which happen around the wounded or mortified portion of intestine, when an artificial anus is produced; and, though Desault's account was excellent, as far as it went, it was not until the year 1809, when Scarpa published his valuable work on Hernia, that the whole process of nature on such occasions was completely elucidated. The hernial sac (says he) does not always partake of gangrene with the viscera contained in a hernia, and even when it does slough, since the separation of the dead parts happens on the outside of the abdominal ring, there almost always remains in this situation a portion of the neck of the hernial sac perfectly sound. It may be said, therefore, that in all cases, immediately after the detachment of the mortified intestine, whether it happen within or on the outside of the ring, the two orifices of the gut are enveloped in the neck of the hernial sac, which, soon becoming adherent to them by the effect of inflammation, serves for a certain time to direct the feces towards the external wound, and to prevent their effusion in the abdomen. In proportion as the outer wound diminishes, the external portion of the neck of the hernial sac also contracts; but, *that part which embraces the orifices of the intestine gradually becomes larger, and at length forms a kind of membranous, funnel-shaped, intermediate cavity, which makes the communication between the two parts of the bowel.* However, according to Scarpa's investigation, this adhesion of the neck of the hernial sac, round the two orifices of the gut, does not hinder the latter from gradually quitting the ring, and becoming more and more deeply placed in the cavity of the abdomen. The base of the above-described funnel-shaped membranous cavity corresponds to the bowel, and its apex tends towards the wound or fistula.

But in relation to this part of the subject, there are some other circumstances, which every surgeon should well understand, and his ignorance of them would not be excusable, on the ground of their not having been, like the funnel-shaped membranous cavity, forming the communication between the two orifices of the bowel, only a discovery of recent date; for they were fully explained many years ago. I here allude to the exact position of the two portions of the bowel, with respect to each other, the direction of their orifices, the angle or ridge between them, and the difference in their diameters. The first of these circumstances, viz. the position of the two parts of the bowel, was correctly described by Morand, and, as we have seen, is pointed out by Mr. Travers, who represents them as occupying a position nearly parallel, and cites an interesting observation recorded by Pipelet. The patient was a woman, 56 years old; the loop of spoiled gut was from five to six inches long; the contents of the bowel were discharged through the wound for a considerable time, and an artificial anus was established. Some accidental obstruction occurred; a purgative was given, which operated in the natural way; and, in fifteen days, the wound was healed. She lived in perfect health to the age of 82, when she died of a disease not connected with this malady. Pipelet examined the body, and has given a figure representing the union. The line of the intestine formed an acute angle, where it adhered to the peritoneum, opposite to the crural arch. The cylinder is evidently much contracted. Pipelet particularly dwells upon the angular position and constriction of the tube at the point of union. The lower continuation of the intestinal tube was also remarked to be more contracted than the upper portion; a circumstance correctly referred, by Mr. Travers, to the undilated state of the bowels, situated between the artificial and the natural anus.—(See *Mém. de l'Acad. de Chir. t.* 4, *p.* 164; *and Travers on Injuries of the Intestines*, *p.* 364.) The two ends of the bowel, as Scarpa has observed, are always found lying in a more or less parallel manner by the side of each other; the upper, with its orifice open, and directed towards the external wound by the feces, which issue from it, while the lower, which gives passage to nothing, becomes less capacious, and is retracted farther into the abdomen. Hence, the breach in the intestinal canal is never repaired by the orifices of the upper and lower portions of the bowels reuniting, coalescing, and running, as it were, into each other. Indeed, they meet at a very acute angle; the axis of one does not correspond to that of the other; and their orifices never lie exactly opposite each other. It is in short by means of the funnel-shaped cavity, formed by the remains of the hernial sac, that the two parts of the bowel communicate, and the feces, in order to get from the upper into the lower continuation of the intestine, must first pass in a semicircular track through that funnel-shaped cavity; there being between the orifices of the bowel, directly opposite to the communication between the cavity of the intestine and that of the funnel-shaped membrane, *a considerable projection, or jutting angle, forming a material additional obstacle to the direct passage of the feces from the upper into the lower portion of the intestinal tube.*—(*Scarpa sull' Ernie Memorie, Nat. Chirurgiche, Milano*, 1809.)

Desault, after noticing the efficiency of the adhesions, between the injured part of the bowel and the edge of the opening in the parietes of the abdomen, in preventing extravasation, remarks, that if such adhesions were entire, the abdominal parietes would form a substitute for the portion of the canal which has been destroyed, and the contents of the bowel would continue to pass as usual towards the anus, if the portions of the intestine, separated and adherent to the neighbouring parts, did not form such an acute angle as obstructs the passage of the intestinal matter. The more acute this angle is, the greater is the obstruction; when the two parts of the bowel lie nearly parallel, the entrance into the lower portion of the canal is completely prevented; but, if they meet at a right angle, then more or less of the contents of the upper portion may be transmitted into the lower. The first disposition chiefly happens, when a considerable part of the intestinal canal has been destroyed, or when the tube has been completely divided; while the second posture is principally remarked in all cases where the injury has been less extensive. And it is plain, that the possibility of a cure depends materially on the kind of angle at which the two portions of bowel meet, and that the projection of the internal frænum, or jutting membranous ridge between the two orifices, is always a greater or less obstacle to the cure.

With respect to the diminution which occurs in the diameter of the part of the intestinal canal between the artificial opening and the natural anus, Desault admits the correctness of the observation, but entirely dissents from such authors as have spoken of the change as sometimes proceeding so far, that an obliteration of that portion of the intestinal tube is the consequence. The mucus secreted within it suffices for preventing this obliteration; a secretion which, in these cases, is copious, and is partly voided from the rectum in the form of white flakes. And if any farther proof were needed, that the bowels between the artificial and natural anus remain pervious, it is furnished by the fact, that in cases of artificial anus, the lower continuation of the tube frequently becomes inverted, and protrudes. On the other hand, the kind of obliteration above spoken of, has never been demonstrated by dissection; it was not observed by Lecat, in the examination of the body of a person, who died twelve years after the entire cessation of the passage of feces *per anum;* nor was it found to exist by De-

sault, when he opened a patient who died of marasmus in the Hôtel-Dieu, in consequence of an artificial anus, which communicated with the ileum, and had lasted two years.—(*Œuvr. de Desault*, *t.* 2, *p.* 354—356.)

However proper the formation of an artificial anus may be, in many cases, in which the patient's life depends upon the event, it must be confessed that the consequence is a most afflicting and disgusting infirmity. This truth cannot be denied; though the feces which are discharged, from not having been so long retained in the bowels, may not be so fetid as those which are evacuated in the ordinary way. As the opening, which gives vent to the excrement, is not endued with the same organization as the lower end of the rectum, and as, in particular, it is not furnished with any sphincter capable of contracting and relaxing itself as occasion requires, the feces are continually escaping without any knowledge of the circumstance on the part of the patient. Hence the uncleanly state of the parts around the external opening; and their frequently excoriated fungous state. Some persons in this state, among the number of those whose histories are on record, made use of a metal box, in which their excrement was received. Schenckius relates the case of an officer, who was wounded in the belly, and who allowed his feces to escape into a vessel made for the purpose. Dionis mentions a similar case.

Moscati also communicated to the Academy of Surgery the history of a wounded man, in whom an artificial anus took place, in consequence of a wound in the abdomen below the right hypochondrium. His excrement used to be received in a tin box, fastened to him with a belt. The wound received a leaden cannula, to which the tin box was accommodated.

Uncleanliness is not the only inconvenience of an artificial anus. Persons have been known to be quite debilitated by the affliction, and even ultimately to die in consequence of it. This is liable to happen, whenever the intestinal canal is opened very high up, so that the aliment escapes before chylification is completed, and the nutritious part of the food has been taken up by the lacteals. In this circumstance, the patient becomes emaciated, and sometimes perishes, as Desault had an opportunity of observing; and examples of which are also recorded by Hoin and Le Blanc. In cases of this description, the matter voided has little fetor, and is frequently sourish. In all instances, the matter is evacuated involuntarily, because there is nothing like a sphincter. But when the opening only interests the lower convolutions of the ileum, or, what is more frequent, when it has occurred in the large intestines, the danger is less serious, and patients in this state are often noticed performing all their functions very well; and, with the exception of colic, to which they are subject, enjoying as good health as they did previously to their having the present disease. In such examples, the matter voided is more fetid, its discharge does not follow so quickly its introduction into the stomach, and it is retained for a longer time.

Many patients afflicted with an artificial anus void no feces at all from the rectum; but occasionally, a thick whitish substance, which is the mucous secretion of the portion of the large intestines nearest to the anus. Under certain circumstances, the quantity of this mucus discharged is more copious.—(*Desault*, *vol. cit. p.* 359.)

The most grievous occurrence to which persons with an artificial anus are exposed, is a prolapsus of the bowel, similar to what sometimes happens through the anus, with respect to the rectum. The descent of the bowel is sometimes simple, only affecting a portion of the intestinal canal just above or below the opening. On other occasions the complaint is double, the bowel both above and below the opening being prolapsed. This descent of the intestine forms a tumour, the dimensions of which vary considerably in different subjects. When the protrusion is caused by the upper part of the intestinal canal, the feces are voided at the extremity of the tumour, and when the swelling consists of the lower portion of the bowel, the excrement is evacuated at the base of the prolapsed part. By observing this evacuation when the tumour is double, it is easy to know to which end of the intestinal canal each protruded portion belongs. This consequence of an artificial anus is very serious, because it greatly increases the inconvenience which the patient suffers. Sometimes the tumour is exquisitely sensible; and occasionally, when the eversion of the intestine is considerable, a strangulation is produced, which puts the patient's life in danger.

I apprehend no well-informed surgeon of the present day can doubt that formerly the frequency of artificial ani after hernia was seriously increased by the absurd measures sometimes adopted for the express purpose of preventing them; and as Mr. Travers has rightly observed, the cases reported by the old surgeons, if they prove any thing, prove this: "that the canal had been very generally restored, when the artificial anus was reckoned upon as inevitable, and that where an officious solicitude had been at work to prevent it, showing itself in an active interference with the arrangements of nature, the case has terminated in artificial anus; so that the event either way has been a matter of surprise to the surgeon. The fear of doing too little, or too much, applies only to the pernicious customs of dilating the stricture, displacing, amputating, and sewing the intestine; the general adoption of which practice fully accounts to my mind for the number of artificial ani, which are the sequelæ of hernia."—(*Op. cit. p.* 367.)

The treatment of an artificial anus is either palliative or radical. The first consists in obviating the habitual uncleanliness produced by the involuntary discharge of the intestinal matter, and in relieving such bad symptoms as may arise from the disorder.

The first indication is fulfilled by the employment of silver or tin machines, which are either kept applied to the external opening by means of a spring, or form receptacles placed more or less off the artificial anus, from which the intestinal matter is transmitted through a tube, kept constantly in the opening. In general, says Desault, as elastic gum is supple, light, and capable of taking any shape, it is the best material for the construction of such instruments, which, however, rarely answer their purpose completely, and always give the patient a great deal of trouble.

As for the second indication, Richter, with the view of hindering the too quick escape of the intestinal matter, and the death of the patient from this cause, proposed covering the opening for a certain time with a piece of sponge, supported by an elastic bandage or truss. But Loeffler found this method objectionable, as it was apt to bring on colic, constipation, and an inflamed excoriated state of the skin.

When the outer opening is disposed to contract too much, and inconveniences arise from this change, Sabatier is an advocate for preventing such closure by means of a tent, or skein of silk, introduced into the aperture, and changed very often for the sake of cleanliness; while others prefer a ring of ivory for the purpose. But the irritation produced by the matter imbibed by this sort of tent, and in particular the liability of the bowel to protrude, and be strangulated in the opening of the ivory ring, are found strong objections to these practices; and according to Desault, the sponge employed by Richter also occasions a great deal of excoriation by the irritation of the fluid which is lodged in it.

For the purposes of hindering a protrusion of the gut, of keeping the opening sufficiently pervious, of relieving any uneasiness and tenesmus, of hindering the intestinal matter from escaping in the intervals of dressing, and confining it long enough for the adequate nourishment of the patient, Desault preferred a linen tent or stopper covered by a pad of charpie, compresses, and a tight bandage. At first, says he, the patient feels some uneasiness from this plan, and slight colics may be the consequence of it: but, by degrees, the parts become habituated to their new state, and every thing goes on well. With respect to the employment of tents and plugs with the views above indicated, I am disposed to think the practice can rarely be advisable; and that any necessity for it may be obviated by attention to diet, and the occasional exhibition of laxative medicines and clysters, as will be hereafter noticed. When the gut protrudes, its reduction is to be effected in the same way as a common prolapsus ani; but serious difficulty will occur when the protruded part is inflamed, thickened, and of considerable size. Indeed, surgeons have usually regarded the reduction as impracticable in these circumstances; but according to Desault this is not the case, as compression with a bandage, kept up for some days, will succeed. Care must be taken, however, to leave a sufficient opening

for the passage of the feces. Whatever may be the size of the protrusion, Desault argues, that it should be the invariable rule of the surgeon to endeavour to return the part by the means here suggested.—(See *Œuvres Chir. de Desault*, *t.* 2, *p.* 361, *&c.*)

The radical cure is what is next to be considered. The business of the surgeon is to prevent, if possible, the formation of an artificial anus; but when the event has occurred, and particularly, when the whole or the greater part of the stools is discharged in this way, no attempt must be made to stop up the opening without a great deal of consideration; for any effort of this kind, made under circumstances which do not justify it, may be the means of exposing the patient's life to the most alarming danger. Sometimes, indeed, without any interference of the surgeon, the outward opening contracts, and the issue of the intestinal matter being obstructed, pain and tenesmus are excited; and the same consequences may be produced by any swelling and enlargement of the projecting ridge, situated between the two portions of the bowel. In two cases Puy found this swelling take place in such a degree, that the patients fell victims to the complete stoppage of the intestinal contents. The symptoms which arise are then similar to those which happen in strangulated hernia. Hoin, Le Blanc, and Sabatier also cite instances, in which the patients lost their lives by gangrene, brought on by this species of strangulation.—(*Desault*, *vol. cit. p.* 360.)

There is a period (says Mr. Travers), at which the function of the lower portion of the canal, with a little assistance, may be restored. The natural order of events connected with this recovery has been mistaken and inverted. Practitioners have closed the wound instead of conducting the matter by purgatives and clysters into the large intestines. Now, the wound will never fail to heal, when the matter recovers its accustomed route; but this condition cannot be reversed. The restoration is safest when most gradual; when there is evidence of an existing sympathy between the repair of structure and the return of function. According to the same gentleman, there is reason to believe, that the well-timed exhibition of a single purgative might often prove effectual. "If the food is rapid and little changed in its passage, it should be pultaceous and nutritive, and given in moderate quantity at short intervals; while injections of the same kind should be administered at least twice in twenty-four hours, and retained as long as possible." He states that by such means patients may be nourished for many weeks. If the discharge is sparing, and does not readily escape, he recommends an occasional purgative in less than ordinary quantity. He disapproves of other medicines, especially stimulants, and all such food as is difficult of digestion, giving a general preference to animal food in a gelatinous form. He bestows just praise on strict attention to cleanliness, and, in opposition to Desault and Sabatier, condemns the employment of tents and sponges.—(*Op. cit. p.* 371. 373.)

Numerous cases on record furnish abundance of proof, that the feces, after being voided for several months from the wound produced by the operation for hernia, frequently resume their natural course. Facts of this kind, which in general may be said to be common when the intestine is without loss of substance, are not very rare even when more or less of the bowel has been destroyed by gangrene; and many illustrations of this remark may be found in the writings of De la Peyronie, Louis, Petit, Pott, Le Dran, &c. The greater number of these instances of success, as already stated, were the result of the most simple, unofficious treatment, or rather of the undisturbed, and very little assisted, efforts of nature.

In the radical cure of an artificial anus, the following are the general indications laid down by Desault: 1. To reduce the gut when it protrudes and is everted. 2. To prevent the issue of the feces from the wound, so that they may be obliged to pass on towards the rectum, at the same time that the healing of the external opening is to be promoted. 3. To obviate any internal impediments to the passage of the matter into the lower part of the intestinal canal.

How the first of these objects is to be accomplished in the case of greatest difficulty, that is, when the parietes of the bowel are thickened, has been already explained. Experience proves, says Desault, that the second indication cannot be fulfilled by means of sutures. The best thing for this purpose he represents to be the linen stopper, above spoken of as a means for preventing the protrusion of the bowel. Here it answers the double object of hindering such a protrusion, and filling up the fistulous opening, so as to make the contents of the bowel tend towards the anus. Desault argues that the surgeon need not be apprehensive of the tent doing harm by keeping the wound from healing. The first aim, he says, should be to determine the feces to take their natural route; and when this has been done by closing the external opening, the tent may be removed, and this opening will spontaneously close.

However, when the internal impediment is too great, it must be overcome ere such treatment can be successful. According to Desault, the most frequent impediment here alluded to, is the angle formed by the two portions of the intestine, and it must be enlarged, and rendered less acute, in order that the feces may continue their route. This desirable change he recommends to be effected by introducing long dossils of charpie into the two ends of the bowel, and gradually altering their direction so as to bring it into one same straight line. When the dilatation is sufficient, and the inner angle or ridge is effaced, the long dossils need not be continued. The linen tent, with the precaution of not introducing it too deeply, lest it obstruct the course of the feces itself, will then suffice. When this plan is skilfully managed, Desault says, there will be a great chance of its succeeding, and its beneficial effect will be denoted by a rumbling in the bowels, and frequently by slight colics. At first wind is discharged from the rectum, and soon afterward, the feces begin to come away. On the contrary, if they should not pass with facility, the colic be violent, and an accumulation happen in the upper portion of the intestinal canal, the tent must be withdrawn, and the other cause of obstruction be considered, and, if possible, removed.—(*Vol. cit. p.* 365, *&c.*)

In the preceding columns, I have given a full explanation of the impediment made to the passage of the feces into the lower orifice of the intestinal canal, by the projecting septum or ridge between the two parts of the bowel, and the matter having to traverse the funnel-shaped membranous cavity in quite a semicircular track. A representation of this septum may be seen in Scarpa's work, tab. 9, fig. 1, and also in the sixth plate of Mr. Traver's Inquiry. In one example in which this septum was plainly visible in the wound, Dupuytren introduced into the orifice of the upper part of the bowel a curved needle, and passing it through the projecting septum, brought it out again through the orifice of the lower portion of the gut. Thus he included a considerable part of the septum in a ligature, which was daily made thicker with a view of first exciting inflammation in the two layers of this septum, and thus ensuring their adhesion together, and his next plan consisted in making a division through the part embraced by the ligature, whereby the passage for the feces into the lower portion of the bowel was made quite free. But as the section made by the ligature was too superficial, Dupuytren completed the division of the septum with a knife; but peritonitis and the death of the patient ensued. According to Dr. Breschet, the ligature also proved ineffectual, because its operation was so slow, that adhesions and cicatrization took place behind it as fast as it made its way through the rest of the septum. Hence, the expectation that the feces would sufficiently pass through the aperture made by the ligature was not realized; and in one case quoted by Breschet, though some amendment followed the operation, still the cure was far from being accomplished, as only some of the feces passed out of the natural anus, while the remaining and greater part of them still came through the fistula.—(See *Graefe's Journ. b.* 2, *p.* 300.) In another case, Dupuytren tried to render the layers of the septum adherent by compressing them between the blades of a pair of forceps of particular construction, and afterward he effected the division of the part by augmenting the compression by means of a screw traversing the handles of the instrument. In a case which followed the operation for bubonocele, attended with mortification of the bowel, Dupuytren began with dilating the outer opening with a bistoury, and after ascertaining the position of the septum, between the two orifices of the bowel, he in-

troduced one of the blades of the forceps into each portion of the gut, and closed the instrument with the screw. The part of the instrument situated externally to the ridge or septum, he covered with charpie and a compress. The constriction was soon followed by colic pains and tendency to vomit, complaints which were quickly removed by fomenting the belly. They recurred, however, the instrument became loose, and some discharge ensued. On examination, the septum was found to be partially divided. After the breadth of the instrument had been lessened it was applied again; but when the screw was turned, the patient began to suffer such violent pain over the whole of the abdomen, that it was necessary to diminish the pressure; and as the instrument was afterward separated from the parts in a fit of vomiting, it was withdrawn. A trial was now made to determine the feces towards the rectum by pressure on the external opening; but the plan could not be endured, and the hindrance to the egress of the intestinal matter was so oppressive that it was discontinued. As the forceps used on the foregoing occasion did not take sufficient hold of the septum, nor divide it properly, the instrument was somewhat altered. A particular description of its improved make has been inserted by Breschet in *Graefe's Journal*, *b.* 2, *p.* 302. Dr. Reisinger has published three cases in which it was successfully employed by Dupuytren. In the first of these examples, when the instrument had been applied, it embraced the septum so well, that it could not be displaced from it. The colic attacks, vomiting thirst, furred tongues, and loss of appetite, which ensued, soon gave way after the belly had been fomented; the constriction was then increased, and found to produce less and less indisposition. On the 29th, very little of the feces came out of the artificial anus, and after a short time, five natural evacuations took place. The blades of the instrument were now completely closed, and on taking it out, a slough of membrane was found between the blades; a proof that the septum was destroyed. On the 30th, the patient's health was undisturbed. Clysters were now administered with the view of promoting evacuations in the natural manner; and the next day, the patient had a proper motion without any assistance, and a very small quantity of the feces passed out of the fistulous opening. This aperture was now merely covered with charpie; but as some high granulations were rising, the powder of colophonium was sprinkled on them, and compresses and a bandage were applied. The use of clysters was also daily continued, though the patient voided his feces in the natural way. On discontinuing the external pressure, the quantity of discharge from the fistulous opening increased; and, therefore, on the first of October, the compresses were again applied, and kept on the part with a spring truss. The treatment ended in a perfect cure.

In another case, Dupuytren enlarged the lower angle of the outer opening with a bistoury, and after feeling with his finger that both orifices of the bowel were close to that opening, he applied the forceps. In the evening, the constriction was increased, which was followed by severe colic pains over the whole abdomen. They subsided, however, the following day. From the outer opening, a great deal of slimy excrement was discharged. The constriction was not augmented. On the 5th day, the patient was attacked in the night with pain and vomiting. The following night he was also very restless. Though the belly was not tense, it could not bear to be touched. On the 11th, and 12th days, the patient was nearly free from pain, and by means of clysters, two natural motions were procured; and on the 13th, as the patient was easy, Dupuytren began to make pressure on the fistulous opening. On the 26th, the edges of the aperture were touched with lunar caustic; and on the 28th, a compress supported by a spring truss was applied. The patient was kept constantly in the horizontal posture; the feces began to be voided the natural way regularly, and the opening contracted in the most favourable manner.

I think the generality of surgeons will agree with Dr. Reisinger, that the foregoing treatment cannot be indiscriminately adopted in all descriptions of patients without danger. It should never be tried too soon after the formation of an artificial anus; but time should be allowed for the irritability and sensibility of the gut, and especially of the septum, to be lessened by the effect of the air and the pressure of the feces. Nor should the trial ever be made ere it has been fully ascertained that nature cannot herself bring about the cure. Breschet mentions an example in which the foregoing method could not have been practised, in consequence of the mouth of the lower portion of the bowel having been obliterated by the pressure of a large tent three inches long, which had been worn by the patient two years, and the projecting ridge could not be detected.—(See *Graefe's Journ. der Chir. b.* 2, *p.* 298.) Many other interesting observations on this new proposal may be perused in the memoir by Dr. Breschet, and in Dr. Reisinger's tract, the title of which is given in the list of works at the end of the present article. In order not to incur the risk of extravasation of the feces in the abdomen, the constriction of the septum should never be increased with imprudent haste before the adhesive inflammation has had time to be produced between the layers of which that part is composed.

In cases of artificial anus, the appearance of the mucous coat of the bowel undergoes some change, in consequence of exposure to the air and the contact of extraneous bodies; it becomes redder and less villous, but does not cease to secrete a great quantity of mucus: this is one of the principal reasons why it is so difficult to close the fistulous opening, even when the passage for the feces has been restored. The skin around an artificial anus is also generally very irritable, and rendered exceedingly painful by the contact of the excrement.—(*Breschet, in Graefe's Journ. b.* 2, *p.* 303.)

If after the destruction of the septum, and the re-establishment of a free communication between the two portions of the bowel, the external fistula were not to admit of being healed by pressure and other ordinary means, no doubt could be entertained of the propriety of resorting to the plan of attempting to cure it by paring off the edges and bringing them together with sutures, as is sometimes done by Dupuytren, or on the Taliacotian principles, as successfully exemplified by Mr. G. F. Collier.—(See *Med. and Physical Journ. for June*, 1820.) Dupuytren, for the purpose of making the sides of the fistula remain in contact, or making them approach each other, occasionally applies an ingenious little instrument consisting of two pads, which by means of a screw can be made to embrace the part. An engraving of it may be seen in *Graefe's Journ. b.* 3, *taf.* 3, *fig.* 9. For the closure of the fistula, Dupuytren also sometimes has recourse to the actual cautery.

I shall conclude with the relation of an interesting case of artificial anus complicated with prolapsus, as recorded by my friend Mr. Lawrence.

"If the complaint (a mortified hernia) terminates in the formation of an artificial anus, we must endeavour to alleviate those distressing inconveniences which arise from the involuntary discharge of wind and feces through the new opening, by supplying the patient with an apparatus in which these may be received as they pass off. An instrument of this kind, the construction of which appears very perfect, is described by Richter (*Anfangsgr. der Wundarzn. vol.* 5), from the *Traité des Bandages* of Juville. The patient will be best enabled to adapt any contrivance of this sort to the particular circumstances of his own case. It has been found in some instances, that a common elastic truss with a compress of lint under the pad, has been more serviceable than any complicated instrument (*Parisian Journal, vol.* 1, *p.* 193) in preventing the continual flow of feculent matter from the artificial opening."—(*Treatise on Hernia, p.* 206.)

"I know," says Mr. Lawrence, "a patient with an artificial anus, in whom the gut often protrudes to the length of eight or ten inches, at the same time bleeding from its surface. This is attended with pain, and compels him to lie down; in which position the intestine recedes. The patient has now discharged all his feces at the groin for fifteen years, and has enjoyed tolerable health and strength during that time. His evacuations are generally fluid, but sometimes of the natural consistence. Whenever he retains his urine after feeling an inclination to void it, a quantity of clear inoffensive mucus like the white of an egg, amounting to about four ounces, is expelled from the anus; and this may occur two or three times in the day."—(*P.* 208.)

When the protruded intestine is strangulated, an operation may become necessary for the removal of the stricture.—(*Schmucker, Vermischte Chirurgische Schriften, t.* 2.) Two cases which terminated fatally from this cause are mentioned by Sabatier, in a memoir in the 5th tom. de l'Acad. de Chir. Mr. Lawrence also refers to Le Blanc.—(*Precis d'Opérations de Chir. tom.* 2, *p.* 445.) We should always endeavour to prevent such protrusions when a disposition to their formation seems to exist, by the use of a steel truss, which should indeed be worn by the patient independently of this circumstance. If the tumour has become irreducible by the hand, an attempt may be made to replace it by keeping up a constant pressure on the part, the patient being at the same time confined to bed. By these means, as we have already noticed, Desault (*Parisian Journ. vol.* 1, *p.* 178) returned a very large prolapsus, and by pressure on the opening, the feces were made to pass entirely by the anus, although for four years they had been voided only through the wound.—(*Lawrence, p.* 209, 210.)

In cases of mortified hernia, the wound sometimes closes, except a small fistulous opening which discharges a thin fluid and cannot be healed. Mr. Lawrence has related, in his excellent treatise on hernia, a case in which the feces came from the wound some time after an operation, although the bowel did not appear gangrenous when this proceeding was adopted. —(*P.* 211.)

In the appendix to this work, the author adds some farther account of the case of artificial anus which he has related.—(*P.* 208.) The man is sixty years of age, and appears to be healthy, active, and even younger than he really is. He had had a scrotal hernia which ended in mortification, and involved the testicle of the same side and a large portion of the integuments in the destruction. It is now nearly seventeen years since this event, and the feces have during all this time been discharged from the groin. He has never made use of a truss, nor taken any step, except that of always keeping a quantity of tow in his breeches.

The prolapsed portion of intestine varies in length and size at different times. It was four inches long when Mr. Lawrence saw it, and the basis, which is the largest part, measured nearly six inches in circumference. The prolapsus never recedes entirely, and it has occasionally protruded to the length of eight or ten inches, being as large as the forearm, and emitting blood. This occurrence is painful, and only comes on when the bowels are out of order. Warm fomentations and a recumbent position afford relief and accomplish a reduction of the bowel.

The projecting part is of a uniform red colour, similar to that of florid and healthy granulations. The surface, although wrinkled and irregular, is smooth, and lubricated by a mucous secretion. It feels firm and fleshy, and can be squeezed and handled without exciting pain. The man has not the least power of retaining his stools. When these are fluid, they come away repeatedly in the course of the day, and with considerable force. When of a firmer consistence, there is only one stool every one or two days, and the evacuation requires much straining. Such feces are not broader than the little finger. When the patient is purged, the food is often voided very little changed. This is particularly the case with cucumber. In this state he is always very weak. Ale is sometimes discharged five minutes after taken, being scarcely at all altered. The bowels are strongly affected by slight doses of purgatives.

Consult *Sabatier, in Mém. de l'Acad. de Chirurgie, t.* 5, *4to., and in Médecine Opératoire, t.* 2. *Richter's Anfangsgr. der Wundarzn. b.* 5. *J. R. Tieffenbach, Vulnerum in intestinis lethalitas occasione casus rarissimi, quo colon vulneratum, inversum per* 14 *annos ex abdomine propendens exhibetur; Halleri Disp. Chir.* 5, 61. *Desault, in Parisian Chir. Journal, v.* 1, *or Œuvres Chirurg. par Bichat, t.* 2, *p.* 352, *&c. Schmucker's Chir. Schriften, vol.* 2. *Lawrence on Hernia, ed.* 1. *Callisen's Systema Chirurgiæ Hodiernæ, t.* 2, *p.* 710, *&c. B. Travers, Inquiry into the Process of Nature in repairing Injuries of the Intestines, chap.* 8, *8vo. Lond.* 1812. *Scarpa sull' Ernie Memorie Anatomico-Chirurgiche, fol. Milano,* 1809. *F. Reisinger, Anzeige einer von dem H. Professor Dupuytren erfundenen, und mit dem glücklichsten Erfolge ausgeführten Operationsweise zur Heilung des Anus Artificialis, nebst Bemerkungen, Augsburg,* 1817. *Brosse, in Rust's Mag. b.* 6, *p.* 239. *Liordat, Diss. sur le Traitement de l'Anus contre Nature, Paris,* 1819. *Breschet, in Journ. der Chirurgie von C. F. Graefe und Ph. von Walther, b.* 2, *p.* 273. 479, *Berlin,* 1821: *this memoir, containing the fullest description of Dupuytren's practice, well deserves the careful perusal of every surgeon who wishes to be completely acquainted with the present subject. Hennen's Military Surgery, p.* 407, *&c. ed.* 2, *8vo. Edin.* 1820. *Three cases from gun-shot wounds; the cure effected by aiding nature with the exhibition of occasional laxatives and clysters. All irritating plans were avoided. Scarpa represents the artificial ani which follow wounds, as far more difficult of cure than those which are the consequence of hernia with mortification; yet I have known many of the first description of cases cured.*

AORTA. Aneurisms of this vessel have already been treated of; but there are a few other particulars relating to it which merit notice in a dictionary of surgery.

WOUND OF THE AORTA NOT ALWAYS FOLLOWED BY INSTANTANEOUS DEATH.

A case exemplifying this fact was recorded by M. Pelletan. In the month of May, 1802, a young man was brought to the Hôtel-Dieu. In a duel, he had been run through with a foil, which penetrated above the right nipple, and came out at the left loin. The most alarming symptoms were apprehended; but several days elapsed without any serious complaints taking place. The patient was bled twice, and kept on a very low regimen. Every thing went on quietly for a fortnight. He now complained of severe pains in his loins, and he was relieved by the warm bath. He seemed to be recovering, got up, and went to walk in the garden allotted for the sick; but the pain in his loins quickly returned, attended with difficulty of breathing, constipation, and wakefulness. He now became very impatient, and out of temper with the surgeons for not relieving him.

On the 15th of July, two months after the accident, a deformity of the spine was remarked about the eighth dorsal vertebra. The patient grew rapidly worse, and died in the utmost agony, saying that he felt suffocated; and tearing off his shirt, that his chest might be free from the pressure of all kinds of clothing.

On the body being opened, the right side of the chest was found full of blood, coagulated in various degrees, and an opening, the diameter of which was equal to that of a writing pen, was detected in the aorta above the crura of the diaphragm. All the adjacent cellular substance was injected with blood, and three of the dorsal vertebræ were found carious. No mark of injury was perceptible in any of the thoracic or abdominal viscera.—(*Pelletan, Clinique, Chir. t.* 1, *p.* 92—94.)

THICKENING AND CONSTRICTION OF THE AORTA.

Meckel met with two cases in which the aorta was thickened and considerably constricted just below its arch; yet in both subjects there was every reason to believe that the abdominal viscera and lower extremities had been duly supplied with blood.

This fluid, which could only pass from the heart with great difficulty and in small quantities, had, by regurgitating, lacerated the semilunar valves.—(*Mém. de l'Acad. Royale de Berlin,* 1756. *Obs.* 17 *and* 18.) A similar example is recorded by Stoerck.—(*Ann. Med.* 11, *p.* 171.) An instance, in which a stricture was met with in the aorta opposite to the termination of the canalis arteriosus, is described by Sir Astley Cooper. The little finger could hardly pass through the constriction, which impeded the course of the blood through the heart and lungs, and was attended with a considerable dilatation of the right ventricle.—(*Surgical Essays, vol.* 1, *p.* 103, *8vo. Lond.* 1818.)

OBLITERATION OF THE CAVITY OF THE AORTA.

It is observed by Professor Scarpa, that the whole body may be regarded as an anastomosis of vessels, a vascular circle; and he contends that this remark is so true, that even an obliteration of the aorta itself, immediately below its arch, may take place, without the general circulation of the blood in the body being stopped. Such a disease of the aorta was seen by Paris in the body of a woman. While she lived, the

blood which was expelled from the heart was transmitted into the trunk of the aorta below the constriction, and it got there by passing through the subclavian, axillary, and cervical arteries, into the mammary, intercostal, diaphragmatic, and epigastric arteries. From these latter arteries the blood passed into the vessels of the thoracic and abdominal viscera and those of the lower extremities.—(See *Desault's Journal, t.* 2, *p.* 107. *Brasdor, in Recueil Périodique de la Soc. de Méd. t.* 3, *No.* 18.)

Dr. Graham, of Glasgow, published another example, in which the aorta was completely obstructed, just below the canalis arteriosus. The particulars are detailed in the *Med. Chir. Trans. vol.* 5, *p.* 287.

Dr. Goodison, of Wicklow, in examining the dead body of a woman in the Hospice de la Pitié at Paris, and endeavouring to trace the origin of the inferior mesenteric artery, discovered a hard tumour placed upon the aorta, and accompanied with an obliteration of that vessel from the origin of the inferior mesenteric artery downwards the remainder of its length; the left iliac being also rendered impervious down to its bifurcation, and the right for more than one-half of its length. The corpora sesamoidea of the semilunar valves of the aorta were considerably enlarged, and the mitral and tricuspid valves presented the appearances termed by Corvisart "vegetations." The arch of the aorta was greatly enlarged, and internally was studded with patches of bone. The vessels given off from the trunk, and especially the lumbar arteries, were all noticed to be considerably increased in size. At the obliterated part of the abdominal aorta, there was a firm bony sheath, covering the vessel for about two inches, and filled with a hard fleshy substance which extended farther upwards, and was firmly adherent to the coat of the artery. It was the inner coat itself which was ossified. For a particular account of the vessels which were chiefly enlarged for the purpose of continuing the circulation, I must refer to Dr. Goodison's description. The general appearance of the body was not unhealthy; and the lower extremities, which were not emaciated, must have been well supplied with blood. The history of the case could not be traced. Mr. Crampton having carefully compared Dr. Goodison's narrative with the preparation taken from this subject, refers the obliteration of the aorta to the effects of the process by which an aneurism had been spontaneously cured; in which particular this case is quite different from those reported by M. Paris and Dr. Graham.—(See *Dublin Hospital Reports, vol.* 2, *p.* 193, *&c.* 8*vo.* 1813.)

The next case which I shall notice is one of the most memorable in the annals of surgery, since it was nothing less than an operation in which a ligature was applied to the aorta of a living subject, under circumstances which, at a time when the successful repetition of Brasdor's operation had not been made (see *Wardrop on Aneurism*, 1829), perhaps warranted even this desperate attempt to preserve life. Sir Astley Cooper had often placed ligatures round the aorta in dogs, and found that the blood was readily carried by the anastomoses to their posterior extremities (see *Med. Chir. Trans. vol.* 2, *p.* 158), and he has ascertained, that if the aortic plexus be tied with the artery, the lower extremities are rendered paralytic, and the animal ultimately dies; but if care be taken to include only the vessel in the ligature, these consequences do not take place.—(See *Lancet, vol.* 2, *p.* 47.)

A porter, aged thirty-eight, was admitted into Guy's Hospital, April 9, 1817, for an aneurism in the left groin, situated partly above and partly below Poupart's ligament. The swelling was considerably diffused, and pressure upon it gave a great deal of pain. On the third day from his entrance into the hospital, the tumour increased to double its former size, and the pulsation became less distinct. The blood could be felt in a fluid state within the sac, which was so large that no operation was practicable without opening the peritoneum. Sir Astley Cooper therefore waited, in order to let the man have the chance of a spontaneous cure. Notwithstanding the practice of venesection and compression, the swelling continued to increase, and, on the 20th of June, a bleeding took place from a point of the tumour, where a slough had formed. The bleeding recurred from time to time, and on the 25th he was so much exhausted by loss of blood that his feces passed involuntarily, and his immediate death was only prevented by pressure on the opening. At nine o'clock in the evening, this experienced surgeon made a small incision into the sac above Poupart's ligament, and introducing his finger, tried if it was practicable to pass a ligature round the external iliac artery within the cavity; but the thing was found impossible, as instead of the vessel, "only a chaos of broken coagula" could be perceived. At the moment of withdrawing the finger, two students compressed the aorta against the spine, and the incision was then closed with a dossil of lint. Sir A. Cooper now determined to apply a ligature to the aorta itself. "I made (says he) an incision three inches long into the linea alba, giving it a slight curve to avoid the umbilicus. One inch and a half was above, and the remainder below the navel," the cut being inclined towards the left side. "Having divided the linea alba, I made a small aperture into the peritoneum, and introduced my finger into the abdomen; and then with a probe-pointed bistoury, enlarged the opening into the peritoneum to nearly the same extent as that of the external wound. Neither the omentum nor the intestines protruded; and during the progress of the operation only one small convolution projected beyond the wound." With his finger-nail he scratched through the peritoneum on the left side of the aorta, and then gently moving his finger from side to side, he gradually passed it between the aorta and spine, and again penetrated the peritoneum on the right side of the aorta. A blunt aneurismal needle, armed with a single ligature, was next conveyed under that vessel, and tied, with the precaution of excluding the intestines from the noose. The wound was then closed by means of the quilled suture and adhesive plaster. During the operation the feces were discharged involuntarily, and the pulse both immediately and for an hour after the operation was 144. An opiate was given, and the involuntaty passage of feces soon ceased. The sensibility of the right leg was very imperfect. In the night, the patient complained of heat in the abdomen; but he felt no pain upon pressure; and the lower extremities, which had been cold a little while after the operation, were regaining their heat, but their sensibility was very indistinct. At six o'clock the following morning, the sensibility of the limbs was still imperfect; but at eight o'clock the right one was warmer than the left, and its sensibility returning. At noon the temperature of the right limb was ninety-four; that of the left or aneurismal one, eighty-seven and a half. At three o'clock, an enema was ordered. The heat of the right leg was now ninety-six; that of the left or diseased limb, eighty-seven and a half. It is unnecessary here to detail all the various circumstances which preceded the patient's death. Vomiting, pain in the abdomen and loins, involuntary discharge of urine and feces, a weak pulse, cold sweats, &c. were some of the most remarkable symptoms. At eight o'clock on the second morning after the operation, the aneurismal limb appeared livid and cold, more particularly round the aneurism; but the right leg was warm; and between one and two o'clock the same day, the patient died. On opening the abdomen, there was not the least appearance of peritoneal inflammation, except at the edges of the wound; and the omentum and intestines were of their natural colour. The ligature, which included no portion of intestine or omentum, was placed round the aorta about three-quarters of an inch above its bifurcation. When the vessel was opened, a clot of more than an inch in extent filled it above the ligature; and below the bifurcation another clot an inch in extent occupied the right iliac artery, while the left contained a third, which extended as far as the aneurism. The neck of the thigh-bone was also found broken within the capsular ligament, and not united; an accidental complication. As there were no appearances of inflammation of the viscera, Sir Astley Cooper refers the cause of the man's death to the want of circulation in the aneurismal limb, which never recovered its natural heat, nor any degree of sensibility, though the right leg was not prevented from doing so: hence, says this experienced surgeon, "in an aneurism similarly situated, the ligature must be applied before the swelling has acquired any considerable magnitude."—(*Surgical Essays, vol.* 1, *p.* 114, *&c.*)

Indeed the most important conclusions from this case are:—First, that where no other impediment exists, the circulation will continue in the lower extremities though the abdominal aorta be tied or suddenly obstructed. Secondly, that suffering aneurismal swell-

ings to become very large before the operation is done, exposes the patient to considerable disadvantage, on account of the pressure of the disease upon the surrounding anastomoses, whereby the continuance of the circulation is rendered less certain than it would be were the operation done at an earlier period.

Sir Astley Cooper mentions, that if he were to perform the operation again, he would cut off the two portions of the ligature close to the knot on the vessel, because the irritation of the bowels by them seems to him a source of considerable danger.

[This formidable operation of tying the aorta has again been performed by Mr. James, of Exeter, Eng., very lately, with the hope of preserving the life of an individual afflicted with aneurism, not admitting of the common mode of treatment; but, like the former, it was unsuccessful.

"For cases in which aneurismal tumour is so situated as not to admit of a ligature being applied to the artery leading to the disease, Brasdor's proposal, and the facts and arguments in its favour related by Mr. Wardrop and others, and noticed in the article *Aneurism* of this Dictionary, deserve serious reflection.

In weighing the various reasons both for and against this practice, as well as those either in favour or condemnation of the desperate expedient of tying the aorta, the judicious surgeon will always regard the occasional spontaneous cures of aneurisms as facts of much importance."—*Pref.*

The numerous cases in which the aorta has been found obliterated has emboldened Sir Astley Cooper, Mr. James, and others, to advocate the propriety of tying this vessel in certain cases, and to maintain that it will yet succeed. It should be recollected, however, that in all these cases the obliteration of the vessel was *gradually* produced by disease, and the anastomosing branches became enlarged by a slow and safe process, because one that is perfectly natural. The case, however, is very different when the vessel is *suddenly* closed by a ligature; and this want of parallel in the cases very obviously vitiates the argument drawn from analogy.

Professor Jamieson, of Baltimore, in a valuable paper on traumatic hemorrhage, published in the American Med. Recorder for January, 1829, has detailed a number of experiments performed on inferior animals, in some of which he passed a seton through large vessels, with a view of obstructing their circulation, and thus effecting their gradual obliteration. His success was certainly encouraging, and Dr. Webster, of Philadelphia, has repeated these experiments with similar results. The latter gentleman, in the late Philadelphia edition of "Cooper's First Lines," has introduced some highly interesting and practical remarks on this subject in a note on the subject of aneurism, to which reference may be had, as containing hints of the most invaluable importance.

Future experiments, however, will be necessary to enable the surgeon to arrive at definite conclusions on this most interesting subject.—*Reese.*]

RUPTURE OF THE AORTA WITHIN THE PERICARDIUM.

The surgical writings of Scarpa in relation to the formation of aneurisms have now gained extensive celebrity in the world. It is well known that this author maintains the doctrine, that in all aneurisms the internal and muscular coats of the artery are ruptured, and that the aneurismal sac is not formed of these tunics, but of the dilated cellular sheath which surrounds the vessel. When a large aneurism bursts, there is always a double rupture; one of the artery, another of the aneurismal sac. The last is that which is the immediate cause of the patient's destruction, by altering the *circumscribed* state of the aneurism into the *diffused*.

There are some exceptions, however, to the foregoing statement, and Scarpa has not failed to point them out. When the internal and muscular coats of the aorta are ruptured in a situation where the outside of the vessel is only covered by a thin, tense, closely adherent membrane, such membrane may be ruptured at the same time with the proper coats of the artery, and sudden death be occasioned by the effusion of blood in the cavity of the thorax. These events are liable to happen whenever the proper coats of the aorta are ruptured within the pericardium, where the vessel is only covered by a thin layer reflected from this membranous bag. Waller has recorded one example of this kind, and Morgagni several others. A similar case is related by Scarpa.—(See *Haller, Disput. Chir. tom.* 5. *Acta Medic. Berlin, vol.* 8, *p.* 86. *Morgagni de Sed. et Causis Morb. Epist.* 26, *art.* 7. 17. 21. *Epist.* 27, *art.* 28. *Scarpa on Aneurism, transl. by Wishart, p.* 81. *Also, Hodgson on the Diseases of Arteries and Veins.*)

STEATOMATOUS TUMOURS OF THE AORTA.

Two steatomatous tumours were noticed by Stenzel in the body of a male subject. They were situated in the substance in the membranes of the aorta, immediately below its arch. Notwithstanding these swellings rendered the vessel almost impervious, the man had the appearance of strength and of having been well nourished. *Hæc corpora fere cor magnitudine æquabant ut omnem propemodum exeunti e sinistri cordis thalamo sanguini spatium præcluderent.* De Steatomatibus in principio arteriæ aortæ, &c. Wittemb. 1723.

This is another striking fact, illustrating the great power of the inosculations to carry on the circulation.

APHÆRESIS. (From ἀφαιρέω, to remove.) This term was formerly used in the schools of surgery to signify that part of the art which consists in taking off any diseased or preternatural portion of the body.

APONEUROSIS. Matter often collects under aponeuroses, particularly under those which cover the muscles of the thigh, leg, and forearm. Abscesses are also sometimes met with under the temporal, the palmar, and the plantar fasciæ; in the tendinous thecæ, which include the flexor tendons of the fingers; and occasionally also in the aponeurotic sheath, in which the rectus abdominis muscle is situated.

One particular effect of an aponeurosis, or any kind of tendinous expansion lying between a collection of matter and the skin, is materially to retard the progress of the pus towards the surface of the body. Hence, if the case be allowed to take its own course, the quantity of matter increases, the pus spreads extensively under the aponeurosis in every possible direction, separates the muscles from such fascia and the muscles from each other, and the abscess does not burst till a vast deal of mischief has been produced, together with more or less sloughing of the fascia, tendons, &c. These circumstances cannot happen without a considerable degree of constitutional disturbance, and a permanent loss of the use of certain muscles. Even when a spontaneous opening is formed, and some of the matter escapes, it is often only a very imperfect discharge; for the aperture generally occurs, not in a depending situation, nor over in the main collection of pus, but at a part where the aponeurosis is thinnest, and consequently where the matter has the least resistance to overcome in going to the surface of the body.

In all such cases the chief indication is to make an early and a depending opening with a lancet, so as to prevent the extension of the abscess, and to let the matter escape as fast as it is formed. If a spontaneous opening should have occurred in an unfavourable place, a new aperture must be made in a proper situation; or if the former should be sufficiently depending and near the principal accumulation of matter, but too small, it must be rendered larger with a curved bistoury and a director. Whenever any black dead pieces of fascia or tendons present themselves at the opening, they must be taken hold of with a pair of forceps and extracted.

APPARATUS. Every thing necessary in the performance of an operation, or in the application of dressings. The apparatus varies according to circumstances. Instruments, machines, bandages, tapes, compresses, pledgets, dossils of lint, tents, sponges, basins of water, towels, &c. &c. are parts of the apparatus, as well as any medicinal substances used.

It is a rule in surgery to have the apparatus ready before an operation is begun. All preparations of this kind should be made, if possible, out of the patient's room and presence, as they might agitate and render him timid.

We have been lately censured by a French surgeon for our too common neglect of what has been here recommended. "In France (observes M. Roux) we are careful not to let a patient who is to undergo a serious operation see any of the requisite preparations for it.

We hasten as much as possible the immediate preparatory measures, in order not to prolong unnecessarily the restlessness and moral agitation which the expectation of an operation, and sometimes of the slightest one, always produces. These precautions are neglected by the English surgeons, at least by most of those whom I saw operate. They even neglect them in private practice, where, more commonly than in hospitals, we have to deal with pusillanimous individuals, who are easily alarmed, and whose extreme susceptibility it is of importance to spare. It was in the very room where the patient lay, of course under his eyes, that the table and all the necessary instruments for lithotomy were arranged, at an operation which I saw done in London, during my stay in that capital, by a gentleman at the head of his profession."—(See *Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, p. 105.)

M. Roux, in his visit to London, had also too good reason to complain of the slovenly, objectionable practice of leaving the application of the tourniquet and the dressing of the wound, after a surgical operation, to mere novices and students. I entirely coincide with him, that, in respect to the dressings in particular, a surgeon is bound to extend his attention and solicitude a little beyond the moment when the operation terminates.

APPARATUS MINOR; APPARATUS MAJOR; APPARATUS ALTUS. Three ways of cutting for the stone.—(See *Lithotomy*.)

AQUA PICIS LIQUIDÆ. *Dubl.* Take of tar two pints; water a gallon. Mix them with a wooden rod for a quarter of an hour, and after the tar has subsided let the liquor be strained, and kept in well-corked bottles. This lotion is often used in porrigo and ulcers surrounded with scorbutic redness.—(See *Liquor*.)

ARGENTI NITRAS. (*Nitrate of silver, lunar caustic.*) One of the best caustics. Its utility in stimulating indolent ulcers, and keeping granulations from rising too high, is well known to every surgeon.

Mr. Hunter sanctions the use of the argentum nitratum on the first appearance of a chancre, before absorption can be supposed to have taken place. He directs the caustic to be scraped to a point, like a black lead pencil; so that when it is applied every part of the surface of the chancre may be touched with it; and he advises the repetition of this process till the last slough which is thrown off leaves the sore florid and healthy.

This treatment, when the sore is very small, may sometimes be advisable as a means of lessening the chance of the constitution being infected by absorption. In general, surgeons combine with the plan the moderate use of mercury.

The important use of the argentum nitratum, in the cure of numerous diseases, we shall have occasion to remark in various articles of this work; particularly *Cornea, ulcers of; Iris, prolapsus of; Ulcers; Urethra, strictures of*, &c.

The argentum nitratum is often used in the form of a solution, in the proportion of a drachm of the caustic to an ounce of distilled water. In general, this application ought to be at first more or less diluted with distilled water. Cancerous ulcers and sores about the nose and neighbouring parts of the face, being examples of *lupus*, or *noli me tangere*, are often considerably benefited by the argentum nitratum, both in the solid and fluid state. The solution agrees also very well with certain sores which occur round the roots of the nails of the fingers and toes. The lotion is sometimes applied with a camel-hair pencil; but in general by dipping little soft bits of lint in the fluid, laying them on the part, and covering them with a pledget.

ARSENIC is the chief ingredient in a secret remedy which has long possessed very great celebrity in Ireland for the cure of cancer, and is now well known among surgeons by the name of Plunket's caustic. This application consists of the ranunculus acris, the greater crow-foot, the flammula vulgaris, and the less crow-foot, in the proportion of an ounce of each, bruised and mixed with a drachm of the white oxide of arsenic and five scruples of sulphur. The whole is to be beaten into a paste, formed into balls, and dried in the sun. When required for use, these balls are beaten up with yolk of egg and spread upon a piece of pig's bladder. The use of the ranunculus is to destroy the cuticle, upon which the arsenic would have no effect; for it is to be observed, that Plunket's caustic was employed for the dispersion of tumours as well as for the relief of ulcerated cancers. The application is to remain on the part twenty-four hours, at the end of which time the slough is to be dressed with any simple unirritating ointment. When arsenic was first recommended as an application for cancers, it used generally to be blended with opium. When Plunket's caustic is employed so as to form an eschar over a scirrhous tumour, I conjecture, that if it ever do good, it is not by any specific effect of this arsenical application, but simply as a slough or issue formed near the disease in any other manner. It is highly probable, also, that the swellings which have been thus dispersed, have never been complicated with the structure characteristic of true scirrhi. With respect to cancerous ulcers, Pulnket's caustic sometimes evidently produces a degree of amendment, which, however, rarely lasts for any considerable time; but there are many inveterate ulcerations and anomalous sores which derive permanent benefit from the application, and are even completely cured by it. Some examples of lupus, ulcerations about the roots of the nails, and reputed carcinomatous sores of the lips are of this description.

At Paris an arsenical paste is often used by Dubois and other surgeons of that capital for cancerous sores of the penis and other malignant ulcers. It is composed of seventy parts of cinnabar, twenty-two of sanguis draconis, and eight of the white oxide of arsenic formed into paste with saliva at the time when it is to be employed. "The pain and inflammation that succeed the use of it (says Mr. Cross) cannot be equalled by the severest operation with the knife."—(*Sketches of the Medical Schools of Paris*, p. 45, 8vo. 1815.) Even death may be occasioned by the absorption of the poison, as appears from the two annexed facts; the first of which is recorded by M. Roux in his *Médecine Opératoire*. "The day after the paste was applied, the patient complained of colic and severe vomiting, and in two days perished in convulsions, *et les plus vives angoisses*. The body went quickly into putrefaction. The internal coat of the stomach and a great part of the intestinal canal were inflamed and marked here and there with dark spots." Just before I visited Paris (adds Mr. Cross), I dissected in London a woman who died under similar circumstances, and where the same morbid appearances were presented, &c.—(*Op. cit.*)

Justamond's applications to cancer were generally combinations of arsenic and sulphur. One formula was an ounce of yellow arsenic with half that quantity of Armenian bole, and sometimes as much red precipitate. He also employed a sulphuret of arsenic and a combination of this sulphuret with crude antimony. The arsenical preparation selected for use, was scraped and laid on the middle of the sore, the edges of which were moistened with a combination of the muriate of iron and muriate of ammonia. In some instances we learn that the effects of the treatment were the correction of the fetid smell, melioration of the appearance of the sore, and separation of the cancerous part.

In the Pharmacopœia Chirurgica, Justamond's arsenical caustic is directed to be made in the following manner. ℞. Antimonii pulverizati ℥j. Arsenici pulverizati ℥ij. These are to be melted together in a crucible. The application may be reduced to any degree of mildness by blending with this pulverized caustic a quantity of opium in the form of powder, which was also supposed to act specifically in diminishing pain.

The powder of white oxide of arsenic, unmixed with other substances, has sometimes been sprinkled upon cancerous and other inveterate ulcers, but the practice is now abandoned by every judicious surgeon, on account of the violent pain resulting from it, and the not unfrequently fatal consequences of its absorption. Could I suppose, that a man so rash and ignorant as to revive this murderous practice yet existed in the profession, I should feel disposed to lengthen these remarks; but I am persuaded, that in this country at least, more judgment and knowledge every where prevail. The white oxide of arsenic, however, may be applied with more prudence in other forms; either in one of those already specified, or as a lotion, composed of eight grains of the oxide and the same quan-

tity of subcarbonate of potash dissolved in four ounces of distilled water; or as an ointment, formed by rubbing together one drachm of the oxide and twelve drachms of spermaceti ointment.—(See *A. T. Thomson's Dispensatory*, *p.* 51.)

Feburc's celebrated remedy consisted of ten grains of the white oxide of arsenic dissolved in a pint of distilled water; to which were then added an ounce of the extractum conii, three ounces of the liquor plumbi subacetatis, and a drachm of laudanum. With this fluid the cancer was washed every morning. Febure likewise gave arsenic internally; and his prescription was two grains of the white oxide, a pint of distilled water, syrup of chichory q. s. and half an ounce of rhubarb. Of this mixture a table-spoonful was given every night and morning with half a drachm of the syrup of poppies. Each dose contained about one-twelfth of a grain of arsenic; but in proportion as the patient was able to bear an increased quantity, the dose was gradually augmented to six table-spoonfuls of the solution.

The arseniate or rather superarseniate of potash, is an excellent preparation for internal exhibition. The Dublin Pharmacopœia directs it to be made as follows: take of white oxide of arsenic, nitrate of potassa, each an ounce. Reduce them separately to powder; then having mixed them, put them into a glass retort and place it in a sand-bath exposed to a gradually raised heat, until the bottom of the retort becomes obscurely red. The vapours arising from the retort should be transmitted through distilled water by means of a proper apparatus, in order that the nitrous acid extricated by the heat may be disengaged. Dissolve the residue in four pounds of boiling distilled water, and after due evaporation, set it apart in order that crystals may form. This preparation has long been known under the name of Macquer's arsenical neutral salt. It may be given in the following way: ℞. Potassæ superarseniatis gr. ij. Aq. menthæ viridis ℥iv. Spir. vinosi tenuioris ℥j. M. et cola.

Dosis drachmæ duæ ter quotidie.

The following is Dr. Fowler's method of preparing arsenic for internal use: take of the white oxide of arsenic and pure subcarbonate of potash, each sixty-four grains. Boil them gently in a Florentine flask or other glass vessel, with half a pound of distilled water, until the arsenic is dissolved. To this solution, when cold, add half an ounce of the compound spirit of lavender, and as much water as will make the whole equal to a pint, or fifteen ounces and a half in weight. The dose of this solution, of which the liquor arsenicalis L. P. is an imitation, is as follows: from two years old to four, M. ij or iij to v; from five to seven, M. v to vij; from eight to twelve, M. vij to x; from thirteen to eighteen, M. x to xii; from eighteen upwards, M. xii. These doses may be repeated every eight or twelve hours, the medicine being diluted with thick gruel or barley-water. As the preparation is decomposed by the infusion and decoction of cinchona, it should never be ordered with either of these medicines.

The white oxide of arsenic may be given in the form of pills, made by mixing one grain of it with ten of sugar, and then beating up the mixture with a sufficient quantity of the crumb of bread to form ten pills, one of which is a dose. It will only be in my power to specify here a few of the numerous surgical cases in which the internal employment of arsenic has been proposed. The following are particularly worthy of attention: tetanic affections; cancer; lupus; elephantiasis; inert cases of lepra (See *Bateman's Pract. Synopsis of Cutaneous Diseases*, *p.* 33, *ed.* 3); various unnamed malignant ulcers; certain forms or sequelæ of the venereal disease, or other unintelligible diseases which cannot be subdued by mercury; different cutaneous affections, &c. A longer list of diseases for which a trial of arsenic is suggested, may be seen in some papers published by Mr. Hill.—(*Edin. Med. and Surg. Journ. vols.* 5, 6.)

Arsenic has also been recommended by Dr. J. Hunter for the prevention of hydrophobia.—(See *Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, *vol.* 1.) Later trials of the medicine, however, in this particular case, do not appear to entitle it to any confidence. Dr. Marcet found it quite unavailing, though not less than three drops of Fowler's solution were taken every other hour in two drachms of peppermint or sweetened water.—(See *Med. Chir. Trans. vol.* 1, *p.* 141. 156.) After the symptoms of hydrophobia have once began, arsenic is decidedly useless.

But although it fails in hydrophobia, some facts published by Mr. Ireland, and certain observations and experiments detailed in Dr. Russel's work on Indian serpents, make it appear a truly valuable remedy for the effects of the bites of serpents.—(See *Med. Chir. Trans. vol.* 2, *p.* 393.)

In cases of poison by arsenic, practitioners universally agree respecting the first indication, which is to empty the stomach as quickly as possible with the stomach pump or an emetic. In this country the common practice is to exhibit an emetic of sulphate of zinc or sulphate of copper, which (it is said) ought to be preferred; first, because they do not require much dilution for their action; a circumstance of no small importance where poisons act by being absorbed; and secondly, because they are extremely expeditious; a dose of fifteen or twenty grains producing almost instantaneous vomiting, without exciting that previous stage of nausea which so frequently characterizes other emetics, and which produces a state of the vascular system highly favourable to the functions of absorption.—(See *Pharmacologia, by Dr. Paris*, *p.* 232, *vol.* 1, *ed.* 5.)

On the other hand, instead of the use of violent emetics like antimon. tart. and sulphate of zinc, which Orfila says always increase the irritation created by the poison, he prefers exciting vomiting by making the patient drink large quantities of warm water, milk, water containing sugar or honey, linseed tea, and other mucilaginous fluids, the experiment of tickling the throat with a feather or finger not being omitted. After as much of the poison has been discharged by vomiting as can be thus evacuated, the stomach may be mechanically washed out with the stomach pump; a plan first proposed by Boerhaave and afterward improved by MM. Dupuytren and Renault.—(See *Orfila, Toxicologie Générale*, *t.* 1, *p.* 132, *ed.* 2, 1818. *See also Mr. Jukes's Obs. on this subject in Med. and Phys. Journ. for Nov.* 1822, *and June*, 1823; *also Lancet*, *vol.* 1.) By this means, the contents of the stomach may either be pumped out at once, or any fluid may be first injected and then drawn out again. As arsenic produces its fatal effects chiefly by being absorbed, an important indication, according to this principle, is to administer only such liquids as are least liable to dissolve the arsenic in the stomach. On this account lime-water has been recommended as proper to be drunk after the stomach has been emptied by vomiting. It is remarked by Orfila, that lime-water with milk offers no particular advantage in cases of poison with the solid arsenical acid; but where this acid is fluid, he admits the great utility of lime-water, as in this circumstance, an insoluble arsenite of lime is formed, the action of which is very weak. This last observation is confirmed by experiments on dogs.—(*Toxicologie Générale*, *t.* 1, *p.* 233.)

When inflammation of the abdomen and alarming nervous symptoms prevail, the means of relief are, leeches, venesection, the warm bath, fomentations, emollient clysters and antispasmodic narcotic medicines.

It should also never be forgotten, that the success of the treatment will depend, in a great measure, upon the regimen observed during the patient's convalescence, which is usually tedious; and he should be chiefly nourished with milk, gruel, cream, rice, and beverages of a softening mucilaginous nature.—(See *Orfila*, *t. cit. p.* 235.)

[There can be little doubt that *arsenic* is the basis of the active ingredients of most of the popular nostrums of the day which are set forth in our public papers as infallible remedies for the cure of cancerous affections, as they are termed; and hence the manifold evils which we often witness from such practice. So long ago as in 1786, Dr. Rush favoured the public with an exposition of the nature of the famous cancerous powder of Dr. Martin; its base was arsenic, though like the specifics of our own time it was alleged to be of a vegetable nature. The consequences arising from applications of this character might be noticed at greater length than our author has seen fit to do; and the caution to be deduced from facts of this sort might operate more forcibly if they were better understood. The external application of arsenic ought to be had recourse to only after the severest scrutiny into the peculiar character of the case and constitution affected. Even in small quantities it has produced apoplexy, mental aberration, organic lesion of the stomach, paralysis,

loss of motion, enlargement of the joints, fatal petechiæ, &c. Arsenic, in fact, may be enumerated among that class of poisons which induces nearly the same effects externally applied as well as when taken inwardly. The experiments of Brodie, as well as those of other philosophers, demonstrate, that its influence on the system is no less rapid and dangerous when had recourse to as an external application to denuded surfaces than when applied directly to the stomach. Another peculiarity of its action deserves also farther to be stated: according to Professor Francis (*Lectures on Forensic Medicine*), in *some cases*, even while favourable anticipations from the operation of this powerful agent locally applied are indulged, of a sudden the general health yields, and death *ensues rapidly and unexpectedly*; an occurrence of much consideration in the investigations of the juridical physician.—*Reese.*]

ARTERIOTOMY. (From ἀρτηρία, an artery, and τέμνω, to cut.) The operation of opening an artery, for the purpose of taking away blood for the relief of diseases.—(See *Bleeding.*)

ARTERIES. The process by which a divided or punctured artery is healed is particularly considered under the word *Hemorrhage*; while the general principles, which ought to be observed in the application of the means for the stoppage of bleeding, may be collected partly from the remarks contained in that part of the work, and partly from what is stated in the articles *Amputation*, *Aneurism*, and *Ligature*. As the condition of a bleeding patient admits of no delay, and the preservation of his life entirely depends upon proper measures being immediately taken, no man ought to be suffered to profess surgery who is not competent to the treatment of wounded arteries, whether injured by accident or in a surgical operation. As Langenbeck observes, an ignorant practitioner, when called to a case of serious hemorrhage, is thrown into such consternation, as actually deprives him of the power of rendering prompt assistance. Pale as a corpse, and trembling, he beholds the jet of blood; and, for the sake of appearing to do something, perhaps he applies spirit of wine, or a very tight bandage, and cries out for farther aid; while simple pressure of the thumb upon a certain point in the vicinity of the injury would prevent all this confusion, and a dangerous loss of blood. No part of surgery, in fact, is of higher importance than the treatment of wounded arteries; and it deserves, therefore, to be earnestly studied by every practitioner, whether he move in the higher or the lower sphere of the profession. And as a proof of the necessity of country surgeons making themselves acquainted with the subject, he recites the case of a turf-cutter, who let the instrument with which he worked fall against the lower part of his leg, whereby the posterior tibial artery was wounded. The blood gushed out profusely, and the surgeon who was sent for applied a tourniquet to the popliteal artery, and thus stopped the bleeding for a time; but, unfortunately, the tourniquet was kept so long on the limb, that the foot mortified and sloughed away.—(*Bibl. für die Chir. b.* 1, *p.* 231, 232, *Gött.* 1806.) From the explanations, delivered in the article *Hemorrhage*, it will be seen, that in all bleedings from considerable arteries, nothing is equal to the ligature, as a means of preventing the farther loss of blood; and it may be laid down as a standing rule, that each extremity of the wounded vessel should be tied as nearly as possible to the wound in its coats. As Mr. Hodgson has remarked, "the necessity of tying both ends of a wounded artery is evident from the fact, that the anastomoses in all parts of the body are so extensive, as to furnish a supply of blood, which may pass through the lower extremity of the wounded vessel in a sufficient stream to produce an alarming, and, in some instances, a fatal hemorrhage."—(*On Diseases of Arteries, &c. p.* 469.) This correct observation is followed by a case, in which the bleeding from the lower end of a divided brachial artery caused the patient's death. Of course the inference is, that both extremities of the vessel ought to have been tied directly after the receipt of the wound. With regard to tying the trunk of an artery in a part of the limb where it cannot be exposed with facility, when it is difficult to secure its bleeding extremities, as Mr. Hodgson remarks, the practice "was falsely deduced from a knowledge of the fact, that the ligature of an artery at a distance from the disease will effect the cure of an aneurism. But a more intimate acquaintance with the condition of a limb after such an operation, and the processes by which the cure of an aneurism is effected after the modern operation, afford a complete illustration of the inefficacy and danger of this mode of treating a wounded artery; for it is now fully proved, that when an artery is tied, a stream of blood continues to pass through it below the ligature."—(*P.* 471.) This well-informed surgeon is aware, however, that instances do occur, in which only the upper end of a wounded artery is tied, and yet the patient recovers without hemorrhage from the lower orifice, which is closed by the natural processes.

In the year 1814, in Holland, I took up the femoral artery, in the middle of the thigh, in a case in which the popliteal artery had given way, ten days after the passage of a musket-ball through the ham. I employed only one smallish ligature, which was applied with the precaution of not detaching the artery from its natural connexions. The hemorrhage was effectually stopped, and the wound healed in the most favourable manner. Here, no doubt, the inflammation in the ham had obliterated the portion of the artery immediately below the point at which it had sloughed or ulcerated, and there might even have been from the same cause some deposition of lymph within the upper portion of the popliteal artery, contributing to the success of the operation. But, no doubt, it was the diminution of the impulse of the circulation by the ligature of the femoral artery, which enabled nature to complete the obliteration of the wounded part of the vessel. Sometimes, says Mr. Hodgson, when hemorrhage takes place, a few days after the bleeding from a wounded artery has been stopped by compression, one extremity of the vessel will be pervious, while the other will have closed by the natural processes. Cases have even occurred, in which the upper end of the artery has been closed by the natural processes, while those processes failed in effecting the obliteration of the lower extremity of the vessel, from which a serious hemorrhage took place.—(*Hodgson, op. cit.* 475; *and Guthrie, in New Med. and Phys. Journ. vol.* 4, *p.* 177.) Indeed, in the example in which I took up the femoral artery myself, it was impossible to say positively, whether the blood came from the part of the popliteal artery above or below the slough in it, as no incision was made into the ham.

The principle, respecting the application of a ligature to each end of every large divided artery, is to be extended also to punctured arteries, one ligature being placed above and the other below the opening in the vessel.

From some observations in the article *Aneurism*, p. 125, it will be seen, that when the impulse of the circulation has been lessened by the ligature of the main trunk of an artery, some distance above the wound, the hemorrhage from the more remote portion of the vessel may sometimes be effectually restrained by pressure, which, previously to the stoppage of one great current of blood to the part had proved unavailing. This fact is worth remembering, in cases in which the arteries of the hand or foot are wounded.

Mortification is observed to be more frequent after the ligature of an artery for a wound, than for an aneurism. In wounds, Mr. Hodgson very correctly, I think, refers the difference to the frequent injury of the surrounding parts, and particularly of the veins and nerves, and to the loss of blood, and want of quietude and proper care after the accident. The principal anastomosing vessels are also sometimes divided.—(*P.* 479.)

Having given, in the article *Aneurism*, the necessary directions, how to cut down to and tie many of the principal arteries, I shall conclude the present subject with a few instructions how to take up the arteries of the forearm and leg, as delivered by Scarpa, Mr. C. Bell, Mr. Hodgson, and others. Some directions how to act in a case of wounded axillary artery are likewise subjoined.

In order to lay bare the radial artery at the upper third of the forearm, a finger is to be put on the insertion of the tendon of the biceps. A little below this insertion, an incision, about two inches and a half in length, is to be made in the integuments, in the oblique direction, denoted by the inner edge of the supinator radii longus. The subjacent fascia is then to be divided, and the inner edge of the supinator muscle drawn a little from the outer side of the arm: in the space between that muscle and the flexor carpi ra-

dialis the radial artery immediately presents itself, passing over the tendon of the pronator radii teres and the flexor longus pollicis, and it then runs down between the latter-named tendon and the flexor carpi radialis.—(See *Camper's Demons. Anat. Pathol. lib.* 1, *tab.* 1, *fig.* 2.) A branch of the musculo-spiral nerve lies on the radial side of the artery.

At the wrist, the radial artery may be taken up by making an incision a little way from the ulnar margin of the flexor carpi radialis. Here the artery is covered by a fascia, over which a small branch of the external cutaneous nerve runs; but the vessel is now unaccompanied with the musculo-spiral nerve, which quits it, and passes under the supinator radii longus, a little below the middle of the forearm.

After the radial artery leaves the forepart of the wrist, it may be taken up by making an incision "on the outside of the insertion of the extensor primi internodii pollicis, and the inside of the extensor tertii internodii pollicis. Between these tendons the artery lies very deep, and over it is the extreme branch of the muscular spiral nerve. We find the artery going close to the notch, between the os scaphoides and trapezium."—(*C. Bell, Op. Surgery, vol.* 2, *p.* 373.)

For bringing into view the ulnar artery at the upper third of the forearm, the situation and breadth of the flexor carpi ulnaris muscle must first be ascertained. An incision is then to be made from above downwards, beginning two inches below the inner condyle of the humerus, and following the course of the inner margin of the above muscle to the extent of two inches and a half. The fascia is then to be divided: the flexor carpi ulnaris is to be drawn a little away from the flexor sublimis. In this opening, rather under the margin of the latter muscle, the ulnar artery will be felt with the finger, continuing its course over the flexor profundus. The ulnar nerve is situated on the ulnar side of the artery.

Below the middle of the forearm, the ulnar artery is more superficial, and may easily be taken up by making an incision upon the radial side of the flexor carpi ulnaris, between the tendon of which muscle and that of the flexor profundus digitorum the vessel is situated. The artery, however, will not be reached until a thin aponeurosis under the fascia of the forearm has been divided. The nerve is rather more under the tendon of the flexor carpi ulnaris than the artery. When the ulnar artery arises from the brachial above the elbow, it runs above the fascia, and is easily taken up in any part of its course.

The anterior tibial artery passes forwards between the bones of the leg, about an inch below the upper head of the fibula. In order to take up the vessel in this situation, a free cut must be made through the fascia, extended between the heads of the tibia and fibula. The incision is then to be continued more deeply at the edge of the peronæus longus, following the fascia between this muscle and the origin of the extensor digitorum communis. The artery will be met with on the interosseous ligament.—(*C. Bell, vol.* 2, *p.* 376.)

In order to lay bare the anterior tibial artery, a little above the middle of the leg, the finger is to be passed along the outer side of the spine of the tibia, and the breadth of the tibialis anticus muscle is to be ascertained. Along the outer margin of this muscle, an incision is to be made through the integuments and fascia, two inches and a half in length. The knife is then to be introduced between the outer margin of the tibialis anticus muscle and the extensor longus of the great toe. In this space, at the depth of about an inch, the anterior tibial artery is situated.—(See *Haller's Icon. Anat. fasc.* 5, *tab.* 4.) Cutting down to this artery, near the tarsus, where the vessel passes out between the tendons of the tibialis anticus and extensor muscle of the toes, is an easy operation.

The laying bare of the posterior tibial artery, behind the malleolus internus, is also quite easy: an incision, about two inches long, is to be made between the internal malleolus and the tendo achillis, down to the posterior surface of the tuberosity of the tibia. At this depth, the tendon of the tibialis posticus muscle, and that of the flexor communis digitorum pedis, run as in a furrow. Along with these two tendons, but a little nearer to the os calcis, the posterior tibial artery descends to the sole of the foot.

On the contrary, the depth of the posterior tibial artery at the middle or in the upper third of the leg, makes it very difficult to take up the vessel in these situations. And the difficulties are increased by the spasmodic contractions of the gastrocnemius and soleus muscles. When necessary, however, the artery may be exposed and tied above and below the wound in it, by proceeding as follows: an incision is to be made three or four inches in length, along the inner side of the crest of the tibia, and the origins of the soleus muscle are to be detached from it to the same extent, and reflected. Under the soleus muscle is found the aponeurosis, which separates the muscle of the calf of the leg into superficial and deep-seated. When this fascia has also been divided, the posterior tibial artery may be seen, or felt, deeply situated, running on the tibialis posticus and flexor muscle of the toes.—(See *Haller, Icon. Anat. fasc.* 5, *tab.* 5.)

In taking up the axillary artery when it is wounded, Scarpa believes that nothing tends more to embarrass the surgeon, than an injudicious smallness of the first incision through the skin and such other parts as conceal the wound in the artery. An assistant must compress the vessel, from above the clavicle, as it passes over the first rib. When the weapon has penetrated, from below upwards, directly into the axilla, the surgeon is to make a free dilatation of the wound upon a director or his finger. This must be done to a sufficient height to expose a considerable portion of the artery, and the precise situation of the wound in it.

When the weapon has pierced obliquely, or from above downwards, through a portion of the great pectoral muscle, into the axilla, Scarpa advises the surgeon to cut through the lower edge of this muscle, and enlarge the wound, on a director, or his finger, so as to bring fairly into view the injured part of the artery. The thoracic arteries, divided in this operation, must be immediately tied. The clots of blood are then to be removed, and the bottom of the wound cleaned with a sponge, by which means the opening in the axillary artery will be more clearly seen. As this vessel lies imbedded in the brachial plexus of nerves, the surgeon must take care to raise it from these latter parts with a pair of forceps, before he ties it. Two ligatures will be required; one above, the other below, the wound of the arteries.

ASTRINGENTS. Substances which possess the power of making the living fibres become contracted, condensed, and corrugated. They are employed in the practice of surgery chiefly as external applications, either for restoring diminished tonic power, or checking various discharges. Astringent lotions are deemed eligible local remedies for phlegmonous inflammation.

ATHEROMA. (From ἀθήρα, pap.) An encysted tumour, so named from its pap-like contents.—(See *Tumours, Encysted.*)

AUSCULTATION. Mediate auscultation, or the method of judging of the nature and conditions of various diseases by the particular sound which they communicate to the ear, through the medium of the instrument called the *stethoscope*. Thus, in diseases of the lungs and pleura, the practitioner may derive important information respecting the condition of those organs, by attending minutely to the changes in the sound of respiration, to the sound of the voice and coughing within the chest, and to what is called the *rattle*, and other sounds occasionally heard in the same situation. The stethoscope, then, in many ambiguous cases, must be deemed an instrument of great use in practice. For a particular description of it, however, I refer to Laennec's invaluable work on diseases of the chest, in the translation and improvement of which, by numerous instructive notes, Dr. Forbes has rendered himself a benefactor to medical science. In surgery, the stethoscope is usefully employed in detecting the real nature of various doubtful swellings, particularly those of an aneurismal character. By M. Lisfranc it has been found of considerable service in enabling him to judge with more accuracy of the collision of the sound against calculi, or other substances in the bladder, in the operation of sounding. M. de Kergaradec has used the stethoscope with much success for ascertaining pregnancy, where the history was obscure. It has also been found of great utility in determining the existence and state of various collections of fluids, and particularly of pus; and it has enabled practitioners to ascertain with certainty the communications occasionally existing between abscesses of the liver and the interior of the lungs, as well as the occasional communication of pulmonary abscesses with the abdominal cavity. In

cases of fracture, where the crepitus is obscure, the stethoscope removes all ambiguity. In all diseases about the heart, and large blood-vessels near this organ, much useful information may be derived from the application of the stethoscope; but the method of using it, and the circumstances by which it affords instruction, must be gathered from a careful perusal of Laennec's work.

B

BALSAMUM COPAIBÆ. Exhibited by surgeons principally in cases of gonorrhea, gleet, fluor albus, and piles. The common dose is from ten drops to half a drachm, two or three times a day. Mr. Brande gives the following formula: R. Mucil. acaciæ ℥ iss. Copaibæ ℥ ss. tere simul et adde gradatim aq. menth. vir. ℥ j. Tinct. capsici mv. gutt. ft. Haustus bis vel ter quotidie sumendus.—(See *Manual of Pharmacy*, *p.* 70.)

BANDAGE. The use of bandages is to keep dressings, compresses, remedies, &c. in their proper situation; to compress blood-vessels, so as to restrain hemorrhage; to rectify certain deformities by holding the deranged parts in a natural position; and to unite parts in which there is a solution of continuity. As the application of bandages is an important branch of surgery, authors have not neglected it. Much has been written on the subject, and almost every writer has devised new bandages, perhaps without much benefit to the art. Unfortunately, it is next to impossible to give clear ideas of the numerous sorts of bandages by a printed description of them. The surgeon can only acquire all the necessary instruction from experience and practice. Hence, we shall confine ourselves to a general account of the subject.

Bandages should be made of materials possessing sufficient strength to fulfil the end proposed in applying them, and at the same time they should be supple enough to accommodate themselves to the parts to which they are applied.

Bandages are made of linen, cotton, or flannel. If possible, they should be without a seam or selvage, which sometimes causes unequal and painful pressure.

There are cases in which the bandage should have a degree of firmness that does not belong to the materials usually employed. This circumstance is obvious in hernia, and in all those examples in which there is occasion for elastic bandages. As we have already observed, linen, flannel, and cotton (calico) are the common materials. The first employment of flannel bandages is imputed to the Scotch surgeons, who preferred them to linen ones, in consequence of their being better calculated for absorbing moisture, while, being more elastic, they yield in a greater degree in cases requiring this property; as in the swelling subsequent to dislocations, fractures, &c. It has been asserted, that linen is better than flannel, because more cleanly; but neither one nor the other will continue clean, unless care be taken to change it often enough. Where the indication is to keep the parts warm, flannel is of course preferable both to linen and calico.

In applying a bandage, care must be taken, that it be put on tight enough to fulfil the object in view, without running any risk of stopping the circulation, or doing harm in any other way. If it be not sufficiently tight to support the parts in a proper manner, it is useless; if it be too tense, it will produce swelling, inflammation, and even mortification.

In order to apply a roller skilfully, the part which is to be covered, must be put in its proper situation; the head of the roller held in the surgeon's hand, and only so much unrolled as is necessary for the commencement of the application.

In general, the bandage should be applied in such a manner as will admit of its being most conveniently removed, and allow the state of the subjacent parts to be examined, as often as occasion may require, with the least possible disturbance of them.

For this reason, in fractures of the leg and thigh, the eighteen-tailed bandage is generally preferred to a simple roller. The former may be loosened and tightened, at pleasure, without occasioning the smallest disturbance of the affected limb; a thing which could not be done were a common roller to be employed.

As soon as the bandage has fulfilled the object for which it is applied, and it has become useless, its employment should be discontinued; for, by remaining too long on parts, it may obstruct the circulation, diminish the tone of the compressed fibres and vessels, and thus do harm.

Bandages are either *simple* or *compound*. They are also sometimes divided into *general* and *particular*. The latter often derive their names from the parts to which they are usually applied.

A simple bandage is a long piece of linen or cotton, of an indefinite length, and from three to six inches in breadth. When about to be applied, it is commonly rolled up, and the roller part is termed its *head*. When rolled up from each end, it is called a *double-headed roller* or *bandage*.

The chief of the simple bandages are the *circular*, the *spiral*, the *uniting*, the *retaining*, the *expellent*, and the *creeping*.

The *circular* bandage is the simplest; consisting merely of a few circles of a roller covering or overlapping each other.

The *spiral* bandage is the most frequently used of all; for it is this which is seen in such common employment on the limbs, in cases of ulcers, varices, &c. In applying a common roller to the whole of a limb, the bandage must be carried round the part spirally: for otherwise the whole member cannot be covered. When the leg is the part, the surgeon is to begin by surrounding the foot with a few turns. Then carrying the head of the bandage over the instep, he is to convey it backwards, so as to make the bandage unroll, and apply itself just above the heel. The roller may next be brought over the inner ankle; thence again over the instep, and under the sole; and the surgeon then brings the bandage spirally upwards once more to the outer part of the leg. After this, every circle of the roller is to be applied, so as to ascend up the limb in a gradual, spiral form, and cover about one-third of the turn of the roller immediately below it. The unequal diameter of the limb is one great cause which brings into view the unskilfulness of a surgeon in this common operation; for it prevents the roller from lying smoothly, although spirally applied, unless a particular artifice be dexterously adopted. The plan alluded to is, to double back the part of the roller that would not be even, were the application to be continued in the common spiral way, without this manœuvre. When the bulk of the limb increases very suddenly, it is sometimes necessary to fold, or, as it is termed, *reverse* every circle of the bandage in the above manner, in order to make it lie evenly on the limb. It is manifest, that the pressure of the roller will be greatest where the duplicatures are situated; and hence, when it is an object to compress any particular part, the surgeon should contrive to reverse the turns of the bandage just over the situation where most pressure is desirable.

When a roller is to be applied to the forearm, it is best to put a few of the first turns of the bandage round the hand.

Care must be taken not to make the bandage very tight, if it be intended to wet it afterward with any lotion; for moisture always renders it still more tense.

Mr. John Bell describes the principal purposes for which a roller is employed as follows: "Although in recent wounds it is with plasters and sutures that we unite the parts point to point, yet it is with the bandage that we support the limb, preserve the parts in continual and perfect contact with each other, and prevent any strain upon the sutures, with which the parts are immediately joined; and we often unite parts by the bandage alone. But it is particularly to be observed, that, in gun-shot wounds, and other bruised wounds, though it would be imprudent to sew the parts, since it is impossible that they should altogether unite, yet the gentle and general support which we give by a compress and bandage, prevents them from separating far from each other, unites the deep parts early, and lessens the extent of that surface which must naturally fall into suppuration.

In the hemorrhagy of wounds we cannot always

find the artery; we dare not always cut parts for fear of greater dangers; we are often alarmed with bleedings from uncertain vessels, &c., or from veins as well as arteries: these hemorrhages are to be suppressed by the compress; which compress, or even the sponge itself, is but an instrument of compression, serving to give the bandage its perfect effect. Frequently, in bleedings near the groin or the armpit, or the angle of the jaw, wherever the bleeding is rapid, the vessels uncertain, the cavity deep, and the blood not to be commanded by a tourniquet, and where the circumstances forbid a deliberate and sure operation, we trust to compress and bandage alone.

Bandage is very powerful in suppressing bleeding. At one period of surgery, it took place of every other method, &c. If a compress be neatly put upon the bleeding arteries, if there be a bone to resist the compress, or even if the soft parts be firm below, and the bandage be well rolled, the patient is almost secure. But such a roller must be applied smoothly from the very extremities of the fingers or toes; the member must be thoroughly supported in all its lower parts, that it may bear the pressure above. It is partial stricture alone that does the harm, creates intolerable pain and anxiety, or brings on gangrene. Hemorrhagy requires a very powerful compression, which must therefore be very general, &c. It must not be made only over the bleeding arteries, which is all that the surgeon thinks of in general, &c.

In abscesses, where matter is working downwards along the limb, seeking out, as it were, the weak parts, undermining the skin, and wasting it, insulating and surrounding the muscles, and penetrating to the bones, the bandage does every thing. The expelling bandage, the propelling bandage, the defensive bandage, were among the names which the older surgeons gave to the roller, when it was applied for these particular purposes; and these are properties of the roller which should not be forgotten."—(*Principles of Surgery*, *vol.* 1.)

Soon after this description of some of the chief surgical uses of the roller, Mr. John Bell proceeds to explain in what manner this most simple of all bandages may be put on a limb.

"Practice will convince you that the firmness and neatness of a bandage depend altogether upon these two points; first, upon the turns succeeding each other in a regular proportion; and, secondly, upon making reverses wherever you find any slackness likely to arise from the varying form of the limb. Thus, in rolling from the foot to the ankle, leg, and knee, you must take care, first, that the turns, or, as the French call them, *doloires*, of the roller lie over one another by just one-third of the breadth of the bandage; and, secondly, that at every difficult part, as over a joint, you turn the roller in your hand, make an angle, and lay the roller upon the limb, with the opposite flat side towards it: you must turn the bandage so as to reverse it, making what the French call a *renversée* of the roller at the ankle, at the calf of the leg, and at the knee. You must be careful to roll your bandage from below upwards, and support the whole limb by a general pressure. That you may be able to support the diseased part with a particular pressure, you must lay compresses upon the hollows and upon the bed of each particular abscess, and change the place of these compresses from time to time, so as now to prevent matter sinking into a particular hollow, now to press it out from a place where it is already lodged, and again to reunite the surface of an abscess already completely formed, from which the matter has been discharged."—(*Principles of Surgery*, *vol.* 1.)

In the article *Joints* we have taken notice of the good effects of the pressure of the roller in the cure of some diseases of the knee. Here we shall just introduce Mr. John Bell's sentiments upon the subject: "In a diseased bursa, as in a relaxation of the knee-joint, that disease which, with but a little indulgence, a very little encouragement of fomentations, poultices, bleeding, and low diet, would end in whites welling of the knee, may be stopped even by so simple a matter as a well-rolled bandage."—(*Vol.* 1, *p.* 127.)

The *uniting bandage*, or *spica descendens*, used in rectilinear wounds, consists of a double-headed roller, with a longitudinal slit in the middle of three or four inches long. The roller, having one head passed through the slit, enables the surgeon to draw the lips of the wound together. The whole must be managed so that the bandage may act equally. When there are sutures, this bandage supports the stitches, and prevents their tearing through the skin. When the wound is deep, writers advise a compress to be applied on each side, in order to press the deeper part of its sides together. When the wound is very long, two or three bandages should be employed, and great care taken that the pressure be perfectly equable.

Heister, Henckel, and Richter describe a sort of uniting bandage that allows the surgeon to see the wound, over which only small ligatures cross. This contrivance will be best understood by reference to an engraved representation of it in *Richter's Elements*, *b.* I.

When we make use of a single-headed roller as a *retentive bandage* only, we should remember always to begin the application of it on the side opposite the wound. The obvious reason for so doing is to prevent a farther separation of the lips of the wound, as the contrary manner of applying the roller would tend directly to divide them.—(*Gooch*, *vol.* 1, *p.* 143.)

The intention of the *expellent bandage* is to keep the discharge sufficiently near the orifice of the wound to prevent the formation of sinuses. In general, a compress of unequal thickness is necessary; the thinner part of the compress being placed next, and immediately contiguous to, the orifice of the wound; the thicker part below. Before the bandage is applied the pus must be completely pressed out, and the rolling begin with two or three circular turns on the lower part of the compress. The bandage must then be carried spirally upwards, but not quite so tightly as below. It is afterward to be rolled downwards to the place where it began.

The *creeping* is a simple bandage, every succeeding turn of which only just covers the edge of the preceding one. It is employed in cases in which the object is merely to secure the dressings, and not to make any considerable or equable pressure.

A bandage is termed *compound* when several pieces of linen, cotton, or flannel are sewed together in different directions, or when the bandage is torn or cut so as to have several tails. Such are the T bandage, the suspensory, the capistrum, &c.

The *eighteen-tailed bandage* is one of the most compound. It is now in general use for all fractures of the leg and thigh, sometimes for those of the forearm, and frequently for particular wounds. Its great recommendation is the facility with which it can be undone so as to allow the parts to be examined, and its not creating on such an occasion the smallest disturbance of the disease or accident.

The eighteen-tailed bandage consists of a longitudinal portion of a common roller, and a sufficient number of transverse pieces or tails, to cover as much of the part as is requisite.

Each of the cross-pieces is to be proportioned in length to the circumference of the part of the limb to which it is to be applied; so that in making this sort of bandage for the leg or thigh, the upper tails will be twice as long as the lower ones. After laying the long part of the bandage on a table, fix the upper end of it in some way or another. Then arrange the tails across it in sufficient number to cover such part of the limb as requires the bandage. Each tail must be long enough to extend about two inches beyond the opposite one, when they are both applied. The tails being all arranged across the longitudinal band, they are to be stitched in this position with a needle and thread. When the bandage is intended for the leg, a piece of the longitudinal part of the roller below is to extend beyond the tails. This is usually brought under the sole of the foot, and then applied over the inner ankle directly after the bandage has been put under the limb. Then the surgeon lays down the first of the lower tails and covers it with the next. In this way he proceeds upwards till all the cross-pieces are applied, the uppermost one of which he fastens with a pin. This bandage has a very neat appearance. The tails are said to lie better when placed across the longitudinal piece a little obliquely.—(*Pott.*)

The T *bandage* is for the most part used for covering parts of the abdomen and back, and especially the scrotum, perinæum, and parts about the anus. Its name is derived from its resemblance to the letter T, and it is, as Mr. John Bell remarks, the peculiar bandage of the body. If the breast or belly be wounded, we make the transverse piece which encircles the body very broad; and having split the tail part into two portions, one of

these is to be conveyed over each side of the neck and pinned to the opposite part of the circular bandage, so as to form a suspensory for the latter, and prevent its slipping down. But, says Mr. John Bell, if we have a wound, or disease, or operation near the groin or private parts, the tail part then becomes the most important part of the bandage: then the transverse piece which is to encircle the pelvis is smaller, while the tail part is made very broad. When the disease is in the private parts, perinæum, or anus, we often split the tail according to circumstances; but when the disease is in one groin we generally leave the tail part of the bandage entire and broad.

The *scissum linteum*, or *split-cloth*, is a bandage applied occasionally to the head, and consists of a central part and six or eight tails or heads, which are applied as follows:

When the cloth has six heads, the middle or unsplit part of the cloth is applied to the top of the head. The two front tails go round the temples and are pinned at the occiput; the two back tails go also round the temples, and are pinned over the forehead; the two middle tails are usually directed to be tied under the chin; but, as Mr. John Bell observes, this suffocates and heats the patient, and it is better to tie them over the top of the head or obliquely so as to make pressure upon any particular point.—(*Principles of Surgery, vol.* 1, *p.* 131.)

The old surgeons usually split this middle tail into two parts, a broad and narrow one. In the broad one, they made a hole to let the ear pass through. This broad portion was tied under the chin, while the narrow ends were tied obliquely over the head. As Mr. John Bell has observed, though this gave the split-cloth the effect of eight tails, yet the ancient surgeons did not name it the split-cloth with eight tails. When they split the cloth into eight tails, and especially when they tied the eight tails in the following particular manner, they called the bandage *cancer*, as resembling a crab in the number of its legs. The *cancer*, or *split-cloth of eight tails*, was laid over the head in such a manner that four tails hung over the forehead and eyes, while the other four hung over the back of the head. They were tied as follows: first, the two outermost tails on each side in front were tied over the forehead, while the two middle tails in front were left hanging over the knot. Then the two outermost or lateral tails behind were tied round the occiput. Next the middle tails were tied, the two anterior ones being made to cross over each other and pass round the temples, to be pinned at the occiput; while the two middle tails behind were made to cross each other and pass round the temples so as to be pinned over the ears or near the forehead.—(See *John Bell's Principles, vol.* 1, *p.* 132.)

The *triangular bandage* is generally a handkerchief doubled in that form. It is commonly used on the head, and now and then as a support to the testicles when swelled. The French term it *couvre-chef en triangle*.

The *nodose bandage*, called also *scapha*, is a double-headed roller, made of a fillet four yards long, and about an inch and a half broad. It must be reversed two or three times, so as to form a knot upon the part which is to be compressed. It is employed for the stoppage of hemorrhage, or for securing the compress after the performance of arteriotomy in the temples.

The most convenient bandage for the forehead, face, and jaws, is the *four-tailed one*, or *single split-cloth*.

It is composed of a strip of cloth about four inches wide, which is to be torn at each end, so as to leave only a convenient portion of the middle part entire. This unsplit middle portion is to be applied to the forehead if the wound be there, and the two upper tails are carried backwards and tied over the back part of the head, while the two lower ones are to be tied either over the top of the head or under the chin, as may seem most convenient.

When the wound is on the top of the head, the middle of the undivided part is to be applied to the dressings. The two posterior tails are to be tied forwards, and the two anterior ones are to be carried backwards, so as to be tied behind the head. This is sometimes called *Galen's bandage*. It is curious, that writers on bandages should use the terms *head* and *tail*, synonymously; and hence this *four-tailed bandage* is often called the *sling* with *four heads*. Such confusion of language is highly reprehensible, as it obstructs the comprehension of any, the most simple subject.

If the upper lip be cut, and a bandage needed, which is seldom the case, it is almost superfluous to say, that this bandage will serve the purpose. It serves also in cuts of the lower lip, though in them also we trust rather to the twisted suture than a bandage.

The single split-cloth is particularly useful for supporting a fractured lower jaw, and in such cases, is the only one employed in modern surgery. This bandage, when used for this particular purpose, namely, supporting the lower jaw, is named *capistrum* or *bridle*, because it goes round the part somewhat like a bridle.

"In some cases (says Mr. John Bell), the circumstances require us to support the chin particularly, and then the unslit part of the bandage is applied upon the chin with a small hole to receive the point; but where the jaw is broken, we pad up the jaw-bone into its right shape with compresses pressed in under the jaw, and secured by this bandage. When we are in fear of hemorrhage after any wound or operation near the angle of the jaw, we can give the sling a very remarkable degree of firmness. For this purpose, we tear the band into three tails on each side, and we stitch the bandage at the bottom of each slit, lest it should give way when drawn firm," &c.—(*Principles of Surgery, vol.* 1.)

We have already described one way of applying a handkerchief as a bandage to the head, in our notice of the *triangular one*, or *couvre-chef en triangle*. The other manner of applying the handkerchief, called the *grand couvre-chef*, is as follows:

You take a large handkerchief, and fold it, not in a triangular, but a square form. You let one edge project about three finger-breadths beyond the other, in order to form a general border for the bandage. You lay the handkerchief upon the head, so as to make the lower fold to which the projecting border belongs lie next the head; while the projecting border itself is left hanging over the eyes till the bandage is adjusted. The two corners of the outermost fold are first to be tied under the chin; the projecting border is then to be turned back and pinned in a circular form round the face, while the corners of the fold next the head are to be carried backwards and tied.

After the outer corners of this bandage have been tied under the chin; after the inner corners have been drawn out and carried round the occiput; and after the border has been turned back and pinned; the doubling of the handkerchief over each side of the neck hangs in a loose, awkward manner. It remains, therefore, to pin this part of the handkerchief up above the ear as neatly as can be contrived.—(See *J. Bell's Principles.*)

The grand couvre-chef has certainly nothing to recommend it, either in point of utility or elegance. A common nightcap must always be infinitely preferable to it. In the event, however, of a cap not being at hand, it is proper that the surgeon should know what contrivances may be substituted to fulfil the objects in view.

Having, in the numerous articles of this Dictionary, noticed the mode of applying bandages in particular cases, and allotted a few separate descriptions for such bandages as are not here mentioned, but which are often spoken of in books, we shall conclude for the present with referring the reader for farther information to *Rees's Cyclopædia; John Bell's Principles of Surgery, vol.* 1. *Dict. des Sciences Méd. art. Bandage. Galen and Vidus Vidius are reckoned the best of the old writers on the subject; M. Suc, Thillaye, Heister, Juville, Lombard, Bernstein, and J. Bell, of the modern ones.*

BARK, *Peruvian.* See *Cinchona.*

BELLADONNA. (*Deadly Nightshade.*) A powerful sedative and narcotic. The leaves were first used externally for discussing scirrhous swellings, and they have been subsequently given internally in scirrhous and cancerous diseases, amaurosis, &c. Five grains of them dried are reckoned a powerful dose: one is enough to begin with. At present the extract in doses of one grain gradually increased to five, is more commonly prescribed.

It is said, that the recent leaves powdered, and made into an ointment with an equal weight of lard, more effectually prevent priapism and relieve chordee, when rubbed on the penis, than any other application.—(*Paris's Pharmacologia, vol.* 2, *p.* 110, *ed.* 5.)

From the power which belladonna is known to possess of lowering the action of the whole arterial sys-

tem, it seems to be a fit medicine in many surgical cases where that object is desirable, particularly in examples of aneurism.

Belladonna has the power of producing a dilatation of the pupil, when applied to the eyebrow and eyelids. The late Mr. Saunders was in the habit of employing belladonna a good deal for this express purpose. A little while before undertaking the operation for the congenital cataract, he was accustomed to introduce some dissolved extract of belladonna between the eyelids, or rub the eyebrow and skin about the eye freely with the same application. The consequence was, that if there were no adhesions of the iris to other parts, a full dilatation of the pupil was produced in less than an hour, and the whole of the cataract was distinctly brought into view. This was unquestionably a considerable improvement in practice, as the iris was kept out of danger, and the operation materially facilitated. I allude here more particularly to Mr. Saunders's own method, in which he introduced the needle through the cornea in front of the iris, and then conveyed it to the cataract through the enlarged pupil. Belladonna was also externally applied by Mr. Saunders after the operation, with the view of preventing the edge of the iris from becoming adherent to the edges of the torn capsule. In iritis the same plan is an important part of the treatment. Whenever the state of the eye behind the pupil requires to be minutely examined, the plan of dilating this aperture by means of belladonna very materially facilitates the examination. Stramonium is found to have the same effect upon the iris as belladonna. Some experiments, in which the fact is clearly proved, were detailed many years ago, by a namesake of my own in the United States.—(See *A Dissertation on the Properties and Effects of the Datura Stramonium, &c. by Samuel Cooper, Philadelphia*, 1797. *C. Himbly, De la Paralysie de l'Iris par une application locale de Jusquiame, &c. 2d ed. 12mo. Altona*, 1805. *J. Bailey, Observations relative to the Use of Belladonna in painful Disorders of the Head and Face, 8vo. Lond.* 1818.)

BINOCULUS. (From *binus*, double, and *oculus*, the eye.) A bandage for keeping dressings on both eyes. Its application will easily be understood by referring to *Monoculus*.

BISTOURY. (*Bistoire*, French.) Any small knife for surgical purposes.

BLADDER, *Puncture of.* The making of an artificial outlet for the urine is an operation to which we are obliged to have recourse, after having in vain employed all the other means indicated for the prevention of the bad, and even fatal consequences of a stoppage of the evacuation of this fluid, and distention of the bladder. Various accidents and diseases, both acute and chronic, may occasion this dangerous state, as will be more particularly noticed in the article *Urine, Retention of.*

The bladder, which can conveniently hold about a pint and a half of urine, is no sooner dilated, so as to contain two pints, than uneasy sensations are experienced. The desire of discharging the water now becomes urgent, and if the inclination be not gratified, and the bladder is suffered to be dilated beyond its natural state, it loses all power of contraction, and becomes paralytic. The desire, indeed, continues, and the efforts are renewed in painful paroxysms; but the power is lost, and the bladder becomes more and more distended. When this viscus is dilated in the utmost degree, and neither its own structure nor the space in the abdomen can allow a farther distention, either the bladder must be lacerated, which it never is, so equally is it supported by the pressure of the surrounding parts, or its orifice must expand and the urine begin to flow. After the third day of the retention, the urine often really begins to flow, and whatever descends from the kidneys is evacuated in small quantities from time to time; and at this period, the bladder is distended in as great a degree as it ever can be, however long the patient may survive. This dribbling of the urine, which begins when the bladder is dilated to the utmost, and continues till the eight or tenth day, or till the bladder sloughs, has long been understood, and is named by the French, "*urine par régorgement.*" To practitioners who do not understand it, the occurrence is most deceitful. The friends felicitate themselves, that the urine begins to flow; the surgeon believes it; basins and cloths wet with urine are easily produced; but the patient lies unrelieved. The continued distention of the bladder is followed by universal inflammation of the abdomen. The insensibility and low delirium of incipient gangrene are mistaken for that relief which was expected from the flow of urine, till either hiccough comes on, and the patient dies of fever and inflammation, or the urine gets into the abdomen through an aperture formed by mortification. Let no surgeon, therefore, trust to the reports of nurses and friends, but lay his hands upon the hypogastric region, and tap with his finger, in order that he may distinguish the distended bladder and the fluctuation of urine. As the bladder suffers no farther distention after the third day, why should it burst? Not from laceration; for it is supported by the uniform pressure of the surrounding viscera; not by yielding suddenly, for it is distended to its utmost on the third day of the retention, and yet seldom gives way before the tenth; not by attenuation, for it becomes thickened. The term *laceration* was never more wrongly applied than in this instance; for when there is a breach in the bladder, it is found on dissection to be a small round hole, such as might be covered with the point of the finger. The rest of the viscus and the adjacent bowels are red and inflamed, while this single point is black and mortified! Delay is more dangerous than even the worst modes of making an opening into the bladder, and while life exists, the patient should have his chance.—(See *John Bell's Principles of Surgery, vol. 2, part 1, p. 262, &c.*)

That many patients die after paracentesis of the bladder is an undoubted truth, and this circumstance has rather intimidated practitioners against the operation. It appears to me, however, that in general death may be more fairly ascribed to the effects of the disease than to the puncture of the bladder, and that if this last measure, or the making of an outlet for the urine in some way or another, were not deferred so long as it often is, the recoveries would be more numerous.

Hence, when relief cannot be obtained by the treatment described in the article *Urine, Retention of*; when no urine at all has come away at the end of the third day; or when it only does so in a dribbling manner after this period, while the bladder continues distended, and no catheter can be introduced; the operation should not be delayed. Indeed, in urgent cases, one should rather operate earlier.

No doubt, a man who is exceedingly skilful in the use of the catheter, and knows how to practice with science and judgment all the other means for relieving the retention of urine, will not frequently find it necessary to have recourse to the operation of puncturing the bladder. This is said to have been so much the case with the eminent Desault, that in the course of ten years, he had occasion only once to perform such an operation in the Hôtel-Dieu, where diseases of the urethra are always extremely numerous.—(See *Œuvres Chir. de Desault, par Bichat, tom. 2, p. 316.*) When, however, this superior manual dexterity with the catheter is not the acquirement of the practitioner, the timely performance of the paracentesis of the bladder, or, at all events, the making of an outlet for the urine in some way or another, should not be neglected. It is gratifying to know, however, that at the present day, the absolute necessity for puncturing the bladder is rendered less frequent, not only by the treatment of diseases of the urethra being better understood than formerly, but also by the very great perfection to which the construction of elastic gum catheters is brought; instruments, from which the most essential assistance may frequently be derived. Strictures in the urethra, and enlargement of the prostate gland, are the two cases most frequently producing a retention of urine: and in both of them Sir Astley Cooper considers the operation of puncturing the bladder (with very few exceptions) entirely unnecessary; an opinion with which my own observations lead me fully to concur. In cases of enlarged prostate gland, a skilful surgeon will almost always succeed in introducing a catheter of proper shape and length; and in examples of retention from stricture when relief cannot be afforded by ordinary means, the best plan, generally, is, not to puncture the bladder, but to make a small opening in the part of the urethra between the stricture and neck of the bladder; a part which is most commonly much dilated. I shall next treat of the three modes of puncturing the bladder.

1. *Puncture through the Perinæum.*

This operation is said to have been first done by M. Tolet, a French surgeon, the author of a valuable treatise, entitled, "*Traité de Lithotomie, ou de l'Extraction de la Pierre hors de la Vessie, troisième édition, Paris*, 1681." According to Sabatier, it was customary at the time of Dionis to make the opening with a narrow pointed scalpel, about four or five inches long, which was plunged into the bladder at the place where the incision in the apparatus major terminated.—(See *Lithotomy.*) The escape of the urine indicated when the surgeon had reached the bladder. A straight probe was conducted along the knife, and then a cannula was passed over the probe into the bladder, where it was allowed to remain as long as necessary, care being taken to fix it by means of tapes put through the rings at the broad part of the instrument. The opening was then closed with a linen tent. Dionis first suggested the method of opening the bladder on one side of the perinæum, at the part where Frère Jacques used to perform lithotomy. Dionis conceived that this mode of operating had advantages, because neither the urethra nor the neck of the bladder was injured; a narrow scalpel was first introduced, so as to make a passage for the probe, and along this the cannula was guided into the bladder. The idea of substituting for these unsuitable instruments a trocar of convenient length was exceedingly simple, and for this improvement, which took place in 1721, surgery is indebted to Juncker (see *Conspectus Chirurgiæ, tab.* 97, *p.* 674), unless the following passage be correct: "In the year 1717 or 1718, M. Peyronie showed in the king's garden a long trocar which he had successfully employed in a similar puncture."—(*Desault's Parisian Chir. Journ. vol.* 2, *p.* 267.)

The patient having been placed in the same position as for lithotomy, an assistant is to press with his left hand on the region of the bladder above the pubes, in order to propel that viscus as far downward into the less pelvis as possible, while with his right hand he supports the scrotum. The surgeon is then to introduce the trocar at the middle of a line drawn from the tuberosity of the ischium to the raphe of the perinæum, two lines more forwards than the verge of the anus. The instrument is first to be pushed in a direction parallel to the axis of the body: and its point is afterward to be turned a little inwards. Here, according to Bichat, there is no occasion to convey the cannula so far into the bladder as is done when the operation is performed above the pubes. The portion of this viscus that is pierced, being incapable of changing its position with regard to the other parts in the perinæum, if the cannula only project a few lines into its cavity, it will not be liable to slip out. It would be wrong indeed to carry it in farther; for the pressure of its end against the posterior parietes of the bladder would do harm. Lastly, the cannula is to be fixed in its place, by means of the T bandage.—(See *Œuvres Chir. de Desault, t.* 3, *p.* 320.) A silver cannula, when kept introduced too long, becomes covered with a thick incrustation, which renders its extraction very difficult and painful: care should be taken to prevent the inconvenience, either by withdrawing it entirely, or substituting another for it, according as the circumstances of the case may demand. When Dr. Ehrlich visited London, Mr. Chandler tapped the bladder through the perinæum, and introduced a cannula, which, after remaining in the puncture three weeks, was so thickly covered with an incrustation, that its extraction produced considerable laceration of the parts, and a great deal of inflammation, followed by a urinary fistula.—(See *Dict. des Sciences Méd. t.* 26, *p.* 205.)

Some writers recommend the introduction of the left index finger into the rectum, in order to draw this intestine out of the way; but Sabatier thinks it better to use this finger for pressing on the part of the perinæum where the puncture is about to be made, so as to make the skin tense, and assist in the guidance of the trocar.—(*Médecine Opératoire, t.* 2, *p.* 126.)

The parts divided in the puncture are, the skin, a good deal of fat and cellular substance, the levator ani muscle, and that portion of the lower part of the bladder which is situated on one side of its neck.

The following is the judgment which Bichat has passed upon this method: In the track which the trocar has to pass, there is no part the puncture of which must of necessity give rise to bad symptoms. A surgeon moderately exercised in the practice of this operation is tolerably sure of piercing the bladder, which is opened in the most depending situation, and at a point which constantly bears the same relation to the perinæum. But the position in which the patient is placed for the operation is a great deal more disagreeable than that for the puncture above the pubes. Several assistants are required to fix him, and one is necessary for compressing the bladder in the hypogastric region. There is a possibility of wounding the vessels of the perinæum, and of pricking the nerves which accompany them. If the point of the trocar be carried too much outwards, it may glide over the external side of the bladder. If it be inclined forwards, it may slip between this viscus and the pubes. If it be turned too much inwards, it may pierce the prostate gland. If directed too much backwards, it may wound the vasa deferentia, the rectum, the extremity of the ureter, and the vesiculæ seminales. Also, while the cannula is introduced, the patient can neither walk about nor sit down; but must continually keep himself in bed. Lastly, this mode of operating is frequently counter-indicated by tumours or other common diseases in this part of the body in consequence of retentions of urine.—(*Œuvres Chir. de Desault, par Bichat, t.* 3, *p.* 321.)

The puncture of the bladder from the perinæum is now almost universally abandoned by British surgeons. "We may esteem it fortunate," says Desault, "if the trocar penetrates directly into the bladder, after piercing the fat and the muscles situated between the tuberosity of the ischium and the anus; and as this viscus is subject to much variation in its form, the surgeon will often be defeated, unless he be perfectly clear in his ideas respecting its situation and figure. This disappointment is not without example, and there is sufficient cause to deter a practitioner from performing this operation, independently of the danger of wounding with the trocar the vasa deferentia, vesiculæ seminales, ureter," &c.—(*Parisian Chir. Journ. vol.* 2, *p.* 267.)

If there be now any practitioners who are not averse to the total relinquishment of this method, I think the following caution, given by Sabatier, may be of service to them: perhaps the operation would be more safe if the surgeon were to begin with making a deep incision in the perinæum, as is practised in the lateral way of cutting for the stone, and if he were to desist from plunging the trocar into the bladder until he has assured himself of the situation of this viscus, and felt the fluctuation of the urine.—(*Médecine Opératoire, t.* 2, *p.* 127.) Sir Astley Cooper, in describing this method, also directs an incision to be made in the perinæum as in lithotomy; the bulb of the penis to be pushed towards the patient's right side; the knife then carried within the branch of the ischium till it reaches the prostate gland, which is likewise to be pushed towards the patient's right side; and lastly, the instrument to be passed obliquely upwards into the bladder, the operator's finger resting on the prostate gland.—(*Lectures, &c. vol.* 2, *p.* 314.)

As in cases of inveterate strictures the urethra between the obstruction and the bladder is always dilated, I think, with Mr. C. Bell, that it may sometimes be better practice to cut into such distended portion of the passage than puncture the bladder. On this point many useful remarks may be found in this gentleman's *Surgical Observations, part* 5, *&c.*, the tenor of which I have more particularly considered in the 5th ed. of the *First Lines of the Practice of Surgery.* The practice of opening the urethra behind the stricture, in preference to puncturing the bladder, is also successfully adopted and highly commended by Sir Astley Cooper.—(See *Lectures, &c. vol.* 2, *p.* 315.)

2. *Puncture above the Pubes.*

The invention of the method of tapping the bladder above the pubes was suggested by the possibility of extracting calculi from that viscus by what is usually denominated the high operation. The first performers of the puncture above the pubes are said to have employed a straight trocar, the very same instrument as was used for tapping the abdomen in cases of dropsy. The consequence was, that when such a trocar was too long, its cannula was apt to hurt the opposite parietes of the bladder, so as to occasion inflammation and a slough, on the separation of which the urine was liable to insinuate itself either into the abdomen or rectum, as happened in a case mentioned by Mr. Sharp, where no more urine was discharged through the can-

nula, and the patient died of a sort of diarrhœa. When the trocar is short, the bladder, on subsiding and contracting itself, gradually quits the cannula, which becomes useless, and a necessity for making another puncture may be produced. Whatever pains may be taken to direct the trocar obliquely downwards and backwards, so that the cannula may be, in some degree, parallel to the axis of the bladder, one or the other of these accidents cannot always be prevented.

Their prevention, however, may be effected by merely employing, instead of a straight trocar, a curved one, which will naturally take a suitable direction. This improvement was embraced by Frère Côme, the inventor of the lithotome caché, who also devised a curved trocar for the paracentesis of the bladder, very superior to the instrument of the same shape previously in use.

To this way of operating Mr. Sharp was partial, and Mr. Abernethy has recommended it under certain circumstances. The former remarks that it is an operation of no difficulty to the surgeon, and of little pain to the patient, the violence done to the bladder being at a distance from the parts affected. It is equally applicable, whether the disorder be in the urethra or the prostate gland; and when there are strictures, the use of bougies may be continued, while the cannula remains in the bladder.—(*Critical Inquiry, p.* 125, *ed.* 4.)

Some writers recommend making an incision about two inches long through the linea alba a little way above the pubes, and then introducing a trocar into the bladder. Others deem this preliminary incision quite useless, asserting that the operation may be performed with equal safety and less pain to the patient by puncturing at once the skin, the linea alba, and the bladder. When the trocar has been introduced, the stilet must be withdrawn, and the cannula kept in its position by a riband passed through two little rings, with which it should be constructed, and fastened round the body. The orifice of the cannula should be stopped up with a little plug, so as to keep the urine from dribbling away involuntarily, and taken out as often as may be necessary.—(*Encyclopédie Méthodique: part. Chirurg. art. Paracentèse de la Vessie.*)

The trocar should be introduced in a direction obliquely downwards and backwards: for as this corresponds with the axis of the bladder, the instrument will be less likely to injure the opposite side of that organ.

Nearly all writers advise the puncture to be made an inch or an inch and a half above the pubes. The reasons for so doing are the following: "If the puncture be made close to the os pubis, the bladder in that part, often rising with an almost perpendicular slope, leaves a chasm between it and the abdominal muscles, or, to speak more strictly, a certain depth of membrana cellularis only, so that if the trocar penetrate but a little way, it possibly may not enter into the bladder. If it penetrates considerably, it may pass through the bladder into the rectum, or if not in the operation itself, some days afterward, when by the course of the illness and confinement the patient is more wasted. For the abdominal muscles, shrinking and falling in, occasion the extremity of the cannula to press against the lower part of the bladder, and in a small time to make a passage into the rectum."—(*Sharp, in Critical Inquiry, p.* 127.) Though the reasons here adduced seem at first as formidable as they are numerous, does not the danger of injuring the peritoneum form an objection to plunging in a trocar at the above distance from the pubes? Certain it is, peritonitis would be more apt to be induced by such practice, than by introducing the instrument immediately above the pubes. Richerand decidedly condemns the plan, principally because the higher the puncture is made, the more apt the bladder will be to quit the cannula on the urine being discharged. —(See *Nosogr. Chir. t.* 3, *p.* 472, *ed.* 2.) In Desault's works by Bichat, the puncture is also advised to be made immediately above the pubes.—(*T.* 3, *p.* 318.) Some of Mr. Sharp's objections are removed by taking care to pass the trocar into the bladder in the axis of this viscus, and employing one which is somewhat curved, as Hunter, Frère Côme, Sabatier, &c. have advised. Mr. Sharp confirms the danger of using too long a cannula, by mentioning an accident which occurred in his own practice. Though he introduced the instrument more than an inch and a half above the os pubis, yet having pushed it full two inches and a half below the surface of the skin, its extremity in six or seven days insinuated itself into the rectum.—(*Critical Inquiry, p.* 127.) The instrument, says an excellent writer, should be more or less long, according as the patient is fat or otherwise; but the ordinary length should be about four inches and a half. The curvature should be uniform, and form the segment of a circle, about eight inches in diameter.—(*Œuvres Chir. de Desault, par Bichat, t.* 3, *p.* 317.)

A catheter left in the bladder longer than ten days may gather such an incrustation from the urine, as not only to render the extraction of it painful, but even impracticable. Surgeons, therefore, should never leave the cannula in the bladder quite a fortnight; or if it must be kept introduced so long, Mr. Sharp advises a second one to be introduced, made with an end like that of a catheter.—(*Critical Inquiry, p.* 129.)

Mursinna, however, has reported one example in which a cannula was kept in for a long time without inconvenience.—(*Hecker, Annales der Ges. Medicin.* 1810, *Jul. p.* 39.) I have seen one myself, and two other examples of the same kind are mentioned by Sir Astley Cooper.—(*Lancet, vol.* 2, *p.* 410.)

Mr. Abernethy makes an incision between the pyramidales muscles, passes his fingers along the upper part of the symphysis pubis, so as to touch the distended bladder, and introduces a common trocar of the middle size in a direction obliquely downwards. On withdrawing the stilet, he passes a middle-sized hollow elastic catheter through the cannula into the bladder. The cannula is withdrawn, and the catheter left in till the urine passes through the urethra. After a week, as the instrument begins to be stopped up with mucus, it is taken out, and a new one introduced.—(*Surgical Observations*, 1804.) It might be objected to this plan of employing a hollow bougie, that as it is smaller than the wound, the urine is not kept from passing between the instrument and parts into which it is introduced, as well as through the tube itself. This happened in Mr. Abernethy's case, and though no urine in this instance got into the cellular membrane, it might sometimes do so, because it is not till after inflammation has taken place, that the cavities of the cellular substance are closed with coagulating lymph. After a day or two, however, the cannula of the trocar might be withdrawn and the hollow bougie employed, which would be less likely than the silver one to cause ulceration of the posterior part of the bladder.

The following is one of Sir E. Home's conclusions: "When the puncture is made above the pubes, the cannula which encloses the trocar is not to be removed till the surrounding parts have been consolidated by inflammation, so as to prevent the urine in its passage out from insinuating itself into the neighbouring parts; for wherever the urine lodges mortification takes place. Any advantage, therefore, which may arise from a more flexible instrument remaining in the bladder, is more than counterbalanced by its not filling completely the aperture through the coats of the bladder, and allowing the urine to escape into the cellular membrane."—(*Trans. of a Soc. for Med. and Chir. Knowledge, vol.* 2.)

There is much truth in the following passage: The abdomen is inflamed; the preliminary incisions, which prepare for the introduction of the trocar, sometimes pass through several inches of fat and cellular substance; the incisions must be wide in proportion to their depth; the cannula is no sooner lodged here than it is displaced, in some degree, by the contraction of the bladder, which, when emptied, subsides under the pubes. The cannula stands so obliquely, that the urine never flows with ease, but by running out upon the wound, and by being injected among the cellular substance, it causes the wound to inflame; the wound by its proximity to the inflamed peritoneum soon mortifies, and thus, notwithstanding the temporary relief produced by the emptying of the bladder, the patient dies on the third or fourth day.—(*John Bell's Principles of Surgery, vol.* 2, *p.* 271.)

That this operation is infinitely better than that of making the puncture in the perinæum, is indisputable. There are even now some good surgeons, who seem to prefer it to the method of tapping the bladder from the rectum. In the *Œuvres Chirurgicales de Desault, t.* 3, *p.* 324, it has received the preference; and at *p.* 319 of the same book, a high encomium is bestowed on it in the following terms: "This operation is easy. The little thickness of the parts which are to be

wounded, renders it quick and triflingly painful. The surgeon has occasion for no assistance. The patient is neither intimidated nor fatigued with the posture in which he is put. It is almost impossible to miss the bladder except it be exceedingly contracted. There is no risk of piercing the cavity of the abdomen. Anatomy proves, that here the bladder is in immediate contact with the recti muscles, and that when this viscus is distended with urine, it pushes the peritoneum upwards and backwards, under which membrane it enlarges, and thus makes the point of the trocar become more and more distant from the cavity of the abdomen. The patient may easily lie on his side or abdomen, so as to discharge all the urine contained in the bladder. There are here no nerves nor vessels of which the injury can be dangerous. No difficulty is experienced in fixing the cannula, and the presence of this instrument does not hinder the patient from sitting, standing up, or even walking about in his chamber. When the cannula also is introduced to the lower part of the bladder, this viscus cannot possibly quit it. Lastly, the wound heals with more facility, than that made in any other method."

Respecting this advice to push the cannula so far into the bladder, it is highly objectionable, for the reason already explained. The writer of the preceding commendation seems to me rather too partial. He has told us of the little thickness of the wounded parts, and yet a little before bestowing these praises, he has acknowledged, "*il est rare, que dans cette ponction, on traverse directement la ligne blanche: on passe presque toujours sur ses côtés, et l'on divise le peau, l'aponéurose des muscles larges du bas-ventre, les muscles droits, quelquefois l'un des pyramidales, et la paroi antérieure de la vessie.*"—(*T.* 3, *p.* 318.)

This operation (according to Sir Astley Cooper) is very easily performed; it is not liable to the objections which were formerly made to it, and it is in general safe. In the female it is the only proper one in cases of retention of urine from retroversio uteri, and from an obliteration of the meatus urinarius by cancerous disease; for (says he) opening the bladder through the vagina is a very unsafe and disastrous operation, as the urine afterward dribbles into that passage, where it occasions the highest degree of excoriation, attended with dreadful suffering and constitutional irritation. "It is an operation which ought never to be performed."—(See *Lancet*, *vol.* 2, *p.* 410.)

According to my own judgment, the plan which is about to be described is the safest and best, when the circumstances of the case afford a choice; and I think, that it would be for the benefit of the afflicted if the puncture above the pubes were only performed in cases in which the enormous enlargement of the prostate gland and disease in the rectum prevent it from being safely made from the rectum.

3. *Puncture from the Rectum.*

This method is more generally applicable than either of the two plans above related. It is not, like the puncture in the perinæum, liable to the objection, that the wound is made in diseased or inflamed parts which afterward become gangrenous. Nor is it, like the puncture above the pubes, attended with a chance of the urine diffusing itself in the cellular membrane. It has also the advantage of emptying the bladder completely. The puncture is made sufficiently far from the neck of the bladder not to increase any inflammation existing in that situation; and the operation is really attended with little pain, since there is no skin nor muscles to be wounded; merely the coats of the bladder and rectum, at a point where these viscera lie in contact with each other. In cases of enlarged prostate gland and of disease of the rectum, however, some other method should be chosen, though I am of opinion, that in the first of these cases, puncturing the bladder at all can seldom be absolutely necessary, as the catheter may almost always be introduced by a surgeon who understands the nature of the disease and its alteration of the course of the urethra.

We read in the *Philosophical Transactions* for 1776, of a case of total retention of urine from strictures, where the bladder was successfully punctured from the rectum. The plan was suggested to Mr. Hamilton, who did the operation by his feeling the bladder exceedingly prominent in the rectum when his finger was in the bowel.

The patient was placed in the same position as that for lithotomy; a trocar was passed along the finger into the anus, and pushed into the lowest and most projecting part of the swelling, in the direction of the axis of the bladder. A straight catheter was immediately introduced through the cannula, lest the bladder by contracting should quit the tube, which was taken away, and as soon as the water was discharged the catheter was also removed. Notwithstanding the puncture, the bladder retained the urine as usual until a desire to make water occurred. Then the opening made by the instrument seemed to expand, and the water flowed in a full stream from the anus. The urine came away in this manner two days, after which it passed the natural way with the aid of a bougie, which had been passed through the urethra into the bladder, and which was used till all the disease in this canal was cured.

The method is said to have been originally proposed, in 1750, by M. Fleurant, surgeon of the hospital *La Charité* at Lyons; and Pouteau, in 1760, published an account of it and three cases in which Fleurant had operated. It was also the feel of the bladder on the introduction of a finger *intra anum*, which led the latter surgeon to make the puncture in this situation. The urine was immediately discharged and the cannula supported in its place with the T bandage, until the natural passage was rendered pervious again. But as the cannula was left in the rectum, it annoyed the patient when he went to stool, and the inconvenience was vastly increased by the continual dribbling of the urine from the mouth of the instrument. Hamilton avoided both these inconveniences by withdrawing the cannula at first. In another instance, however, Fleurant left the cannula in the anus and bladder thirty-nine days, without the least inconvenience.

In order to lessen the tenesmus and other inconveniences attending the presence of the cannula, Fleurant suggested that it would be better to employ a tube made of a flexible substance, and some of the moderns approve the plan of passing a flexible catheter through the silver one into the bladder, and withdrawing the latter instrument.

In the first volume of the *Mem. of the Medical Society of London* two cases are related, in which, after tapping the bladder from the rectum, the cannula was immediately withdrawn without any bad effect; and a similar fact is recorded in the *Medical Communications*, *vol.* 1.

A curved trocar, of sufficient length, is the best for performing the operation, and was recommended by Pouteau. As the trocar with a lancet-point may cut blood-vessels which would bleed freely, some authors express their preference to one made with a triangular point.—(*Howship*, *p.* 215.) It should be introduced into the prominence made by the distended bladder, a little beyond the prostate gland, exactly in the centre of the front of the rectum; but not imprudently far up the intestine, lest the peritoneum be injured. For some useful cautions on this head, the profession are indebted to Mr. Carpue, who has very properly adverted to the very low point to which the portion of peritoneum reflected over the rectum descends.—(*Hist. of the High Operation*, *&c. p.* 178, *8vo. Lond.* 1819.)

The trocar should be introduced in the direction of the axis of the bladder, or nearly in an imaginary line drawn from the spot to be punctured to the middle point between the navel and the symphysis pubis.

The patient should be placed nearly in the same posture as that adopted in lithotomy; but the hands and feet need not be bound together, it being sufficient to let the assistants support the legs. The left fore-finger, smeared with oil, is to be introduced up the rectum, where a portion of the distended bladder will be felt behind the prostate gland and between the converging vasa deferentia. The vesiculæ seminales, which are on the outside of the vasa deferentia, are less exposed to injury. Behind the prostate gland, as Sir Astley Cooper correctly explains, there is a triangular space which affords room for the instrument. In the forepart it is bounded by the meeting of the vasa deferentia, which forms the apex of the triangle; the sides are formed by the vasa deferentia, which diverge as they pass from the prostate backwards; while the basis of the triangle is formed by the peritoneum, which is reflected from the posterior part of the bladder to the rectum. Taking advantage of this space of the bladder, which is not

covered by the peritoneum, the trocar is introduced through it into the bladder about three-quarters of an inch behind the prostate gland. The instrument must not be introduced directly behind the prostate, as the vas deferens on one side or the other would certainly be wounded. If the trocar be carried three-quarters or half of an inch behind the prostate, the vasa deferentia will be safe.—(*Lectures, &c. vol.* 2, *p.* 311.) Here the surgeon is to let the end of his finger continue, until, with his right hand, and under the guidance of the left fore-finger, he has brought to the same point the extremity of the curved trocar, the concavity of which is to be kept forwards. Great care must also be taken not to let the stilet project out of the cannula too soon; that is to say, before the end of the tube has been placed exactly upon the spot at which the puncture is to be made.

It is not necessary to retain the cannula in the puncture after the inflammation has consolidated the sides of the wound, and there is no danger of the aperture closing up before another passage is made for the urine. Sir E. Home thinks that after about thirty-seven hours the cannula may be taken out.—(*Trans. of a Soc. for Med. and Chir. Knowledge, vol.* 2.) Indeed, I am not acquainted with any fact showing the ill effect of removing the cannula early; for here the urine has only to pass through a mere opening without any longitudinal extent, like what remains after puncturing above the pubes. The general safety and simplicity of tapping the bladder from the rectum will always recommend this method to impartial practitioners. The wound is made at a distance from the peritoneum, passes through no thickness of parts, and is quite unattended with any chance of the urine becoming extravasated in the cellular substance. Whether the bladder be morbidly contracted and thickened; whether the neck of the bladder be inflamed, it is equally applicable.

I am happy to join the experienced and judicious Mr. Hey with the advocates for this mode of performing the operation; and as his opinion on this subject must have considerable influence, I shall quote the following passage from his valuable work, particularly as the observations confirm some other points adverted to in the present article. "It is sometimes impossible, from various causes, to make a catheter pass through the urethra. The puncture of the bladder then becomes necessary, if the retention of urine continues. This operation may be performed either above the pubes or through the rectum. I have seen it performed in both these methods, but give the preference to the latter. It is more easy to the surgeon, and less painful to the patient. Pouteau's curved trocar is a very convenient instrument, and may be used with safety for puncturing the bladder through the rectum; but the operator should cautiously avoid wounding an artery, which may be felt running towards the anus where the bladder is most protuberant. The finger which is introduced into the rectum to guide the trocar, may be conveniently placed a little on either side of this vessel. It is not always necessary to leave the cannula in the bladder, as the urine sometimes begins to flow through the penis within a few hours after the bladder is emptied. Perhaps this event may be the most frequent when the introduction of the catheter has been prevented by a stricture in the urethra. If the wound becomes closed before the power of expelling the urine is regained, recourse must be had to a repetition of the operation, which gives very little trouble to the patient; neither is he much incommoded by suffering the cannula to remain two or three days in the bladder. This is sometimes necessary, and seldom improper."—(*Hey's Practical Observations in Surgery, p.* 430, 431, *ed.* 2.)

The objections made to the puncture through the rectum are three: first, the annoying tenesmus sometimes produced by the presence of the cannula; secondly, the irritation and ulcerated state of the rectum occasionally resulting from the dribbling of the urine through it; and thirdly, the possibility of a sinus being formed between this bowel and the bladder.—(*A. Bonn, Bemerkungen ueber der Harnverhalt, &c. Leipz.* 1794.) It seems that Sir Astley Cooper knows of some cases in which such inconveniences have followed, and, in particular, one instance in which the patient died of the subsequent diseased state of the rectum. Hence the puncture of the bladder from the rectum is not a practice on which he bestows any commendation.—(See *Lancet, vol.* 2, *p.* 412.)

In the foregoing columns I have briefly adverted to the proposal of cutting into the urethra behind the obstruction, instead of puncturing the bladder. Mr. Grainger, of Birmingham, a few years ago also recommended cutting into the urethra immediately in front of the prostate, and relieving the bladder by the introduction of a female catheter through the gland, or (if that could not be accomplished) by the division of its substance with a scalpel.—(*Med. and Surg. Remarks, &c.* 8*vo. Lond.* 1815.)

Women rarely stand in need of paracentesis of the bladder; an occasional impossibility of introducing the catheter from a retroversion of the womb, and an obliteration of the meatus urinarius by disease, being almost the only cases ever placing them in this condition. The only method applicable to them is the puncture above the pubes, with the exception of the plan of introducing the trocar directly from the vagina into the bladder; a practice which Sir Astley Cooper strongly condemns on account of its leading to the formation of an incurable urinary fistula in the vagina, and a great deal of disease and irritation in that passage from the contact of the urine.

Consult *Sharp on the Operations, chap.* 15, *and his Critical Inquiry. Ambr. Bertrandi, Trattato delle Operazioni di Chirurgia, accresciuto di note, &c. dai Chirurghi G. A. Penchienati e G. Brugnone,* 8*vo. Torino,* 1802. *Bertrandi was an approver of the puncture from the rectum; so was Le Blanc; Opérat. de Chir. t.* 1. *Melanges de Chirurgie, Pouteau, Lyon,* 1760, *p.* 500. *L' Encyclopédie Méthodique, partie Chirurgicale, art. Paracentese de la Vessie. Schmucker, Chir. Wahrnehmungen,* 2 *th. No.* 39: *puncture from the rectum. Sabatier, Médecine Opératoire, t.* 2. *Mursinna, Journ. für die Chirurgie, &c.* 4, *p.* 46. 67. *Cases of puncture from the rectum and above the pubes. In illustration of the operation of puncturing the bladder, Camper's plates are the best: see his Demonst. Anat. Pathol. lib.* 2. *In this work, the danger of letting the end of any long instrument, when introduced, press against the inside of the bladder, is proved by a case in which that organ was perforated by the extremity of a catheter, p.* 11. *Kloss, Diss. de Paracentesi Vesicæ Urinariæ per intestinum rectum, Jen.* 1791. *A. Bonn, Anat. Chir. Bemerkungen über die Harnverhaltung, und den Blasenstich. Leip.* 1794, *prefers the puncture above the pubes. J. Howship, in Pract. Obs. on Diseases of the Urinary Organs, p.* 214, 8*vo. Lond.* 1816, *and in Treatise on Complaints affecting the Secretion and Excretion of the Urine, p.* 412, *Lond.* 1823, *thinks the operation from the rectum generally superior to the other methods. Sir E. Home, in Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 2. *Abernethy's Surgical Observations,* 1804. *John Bell's Principles of Surgery, vol.* 2. *Œuvres Chir. de Desault, par Bichat, t.* 3, *p.* 315, *&c. W. Schmid über die Krankheiten der Harnblase, &c.* 8*vo. Wien,* 1806. *Richerand, Nosogr. Chir. t.* 3, *edit.* 4. *Hey's Practical Observations in Surgery, p.* 430, *edit.* 2. *Parisian Chirurgical Journal, vol.* 2, *p.* 156, *and p.* 265. *S. T. Sömmering über die schnell und langsam tödtlichen Krankheiten der Harnblase, &c. Frankfurt,* 1809. *The author is an advocate for the puncture above the pubes in preference to that through the rectum, which he thinks right only in one case, viz. when the bladder is so contracted that it does not rise out of the less cavity of the pelvis, and the fluctuation of the urine can be felt in the rectum, but not above the pubes. In this opinion he is joined by Langenbeck (Bibliothek, b.* 3, *p.* 719). *Callisen, Systema Chirurgiæ Hodiernæ, t.* 2, *p.* 277, *&c. Chirurgische Versuche von B. G. Schroger, b.* 1, *p.* 211, *&c.* 8*vo. Nurnberg,* 1811, *gives the preference to the puncture above the pubes. Edward Grainger, Med. and Surg. Remarks, &c., with Obs. on the different modes of opening the bladder in retention of urine, &c.,* 8*vo. Lond.* 1815. *Dict. des Sciences Méd. art. Ischurie,* 1818. *C. Bell, Surgical Obs.* 8*vo. part* 5, *Lond.* 1818. *C. Averill, Short Treatise of Operative Surgery, p.* 174, *&c., Lond.* 1823. *Sir A. Cooper's Lectures, vol.* 2, *p.* 306, *Lond.* 1825.

BLADDER. *Tumour extirpated from.* Mr. Warner has recorded a case in which an excrescence, growing from the inside of a young woman's bladder, was successfully removed. The patient, on the 24th of June, 1747, strained herself in endeavouring to lift a great

weight, and she was immediately seized with a pain in the small of her back, and a total retention of urine. In April, 1750, she applied to Mr. Warner, who found that she had never been able, from the moment of the accident, to void a drop of urine without the assistance of the catheter; that she was in continual pain, and had lately been much weakened by having several times lost considerable quantities of blood, occasioned by the force made use of in introducing the instrument into the bladder.

Mr. Warner, upon examining the parts with his forefinger, which he had great difficulty in introducing into the meatus urinarius, discovered a considerable tumour, which seemed to be of a fleshy substance, and took its rise from the lower part of the bladder near its neck. When the patient strained to make water, and the bladder was full, the excrescence protruded a little way out of the meatus urinarius; but upon ceasing to strain it presently returned.

A purgative having been given the day before the operation, and the rectum opened by means of an emollient clyster, Mr. Warner directed the patient to strain so as to make the swelling project. He then hindered it from returning into the bladder by passing a ligature through it, and endeavoured to draw it farther out. The latter object was found impracticable on account of the size of the tumour. Seeing this, Mr. Warner dilated the meatus urinarius on the right side by cutting it upwards about half way towards the neck of the bladder, when, by pulling the swelling forwards, he was enabled to tie its base, which was very large.

For three days after the operation, a good deal of pain was felt in the abdomen. On the sixth day the tumour dropped off. From the first day the urine came away without assistance, and the patient got quite well. The tumour resembled a turkey's egg in shape and size.—(See *Warner's Cases in Surgery, edit.* 4, *p.* 303.)

Perhaps in this example tying the tumour was preferable to cutting it away, even though its base was large; for had the knife been used, there would have been some danger of the bladder becoming filled with blood.

For an account of other tumours of the bladder, I refer the reader to "*A Practical Treatise on the most important Complaints affecting the Secretion and Excretion of Urine, by J. Howship, 8vo. Lond.* 1823."

[A case, in which large quantities of hair, mixed with calculous matter, were from time to time extracted from the bladder through the meatus urinarius, The disease produced severe pain in making water, and other complaints resembling those of stone. At length, Delpech, suspecting that the hairs were formed in some cyst, communicating with the bladder, determined to divide the meatus urinarius. Previously to this measure, every information which could be derived from sounding was obtained; and by manual examination, a tumour, as large as an egg, was felt at the point where the bladder and uterus touch each other. With the lithotome caché, the meatus was cut in the direction towards the symphysis pubis, care being taken not to divide the corpus cavernosum of the clitoris; and, on introducing the finger, a calculus of the shape of a pigeon's egg was felt, which was easily extracted. A large mass of hair and calculous matter was also detected, projecting at the back and right part of the bladder from an opening, the edges of which were so hard and contracted that the extraneous substances required the polypus forceps for their extraction. After thus clearing the aperture of the cyst, Delpech passed his finger into it, when a large quantity of fetid pus gushed out of the meatus. It was also now discovered, that the swelling made a considerable prominence within the bladder, and that it had a circular neck which might be tied. This was afterward done with a piece of silver wire, conveyed round the part by means of the ring at the end of the catheter. Five days afterward, what had been tied sloughed away, and to the surprise of Delpech was of very trivial size, and without any cavity. In short, the ligature had only destroyed the top of the cyst, and the finger could now be passed into a larger opening, and through it into a cavity, corresponding to the swelling felt between the bladder and uterus. The cyst was found in a state of complete suppuration, and Delpech conceived, that the best chance of cure would result from letting an injection pass from a height of six feet, through a pipe, into the cyst, so as to wash it out with some force. This plan created pain in the abdomen, and fever, so that it could not be continued; but, after the discharge of more hair and calculous matter, and a substance as large as a hen's egg, which was covered by scalp and contained a molar tooth, the patient got well. This substance in fact had been the product of conception, and the sac in which it lay extended to the uterus. The case is highly interesting to the practitioner.—(*Delpech, Chirurgie Clinique, t.* 2, *p.* 521, *et seq.*) —*Pref.*]

Bladder, *Hernia of.* See *Hernia.*

Bladder, *Insects discharged from.* The instances in which worms are stated to have been discharged from the bladder are very numerous. Many cases of this kind are referred to in *Voigtel's Handbuch der Pathologischen Anatomie, b.* 3, *p.* 337—342. A few years ago, an interesting example was recorded by Mr. Lawrence.—(See *Med. Chir. Trans. v.* 2, *p.* 382, *&c.*)

Bladder, *Deficiency of.* Numerous examples in which this deviation from the natural structure has occurred are recorded by medical writers. The publications, however, which, as far as I know, contain the most ample information on the subject, are, a Gottingen inaugural dissertation, entitled "*De Vesicæ Urinariæ Prolapsu Nativo,*" by Dr. Roose, late professor in Brunswick, and a paper called "*An attempt towards a systematic account of the appearances connected with that malconformation of the Urinary Organs, in which the ureters, instead of terminating in a perfect bladder, open externally on the surface of the Abdomen,*" *by A. Duncan, jun. in Edin. Med. and Surg. Journal, vol.* 1. In this last production, may be seen references to all the most noted cases on record, both male and female.—(See also *Handbuch der Pathologischen Anatomie von J. F. Meckel, b.* 1, *p.* 650, 8*vo. Leip.* 1812.)

Bladder, *Wounds of.* See *Gun-shot Wounds.* Many cases of rupture of the bladder from blows or falls are recorded, followed by fatal extravasation of urine in the abdomen. Two such instances have been recently detailed by Dr. Cusack.—(See *Dub. Hospital Reports, vol.* 2, *p.* 312, *&c.* 8*vo.* 1818. *Also, C. Montague in Med. Communications, vol.* 2, *p.* 284, 1790.)

BLEEDING. By this operation is understood the taking away of blood for the relief of diseases. Bleeding is called *general*, when practised with a view of lessening the whole mass of circulating blood; *topical*, when performed in the vicinity of the disease, for the express purpose of lessening the quantity of blood in a particular part.

General Blood-letting is performed with a lancet, and is subdivided into two kinds; viz. the opening of a vein, termed *phlebotomy*, or *venesection*; and the opening of the temporal artery, or one of its branches, termed *arteriotomy.*

Topical Blood-letting is performed, either by means of a cupping-glass and scarificator, or leeches, or by dividing the visibly distended vessels with a lancet, as is frequently done in cases of ophthalmy.

[In the Southern and Western States, bleeding is very generally performed by the *spring* lancet, while in the North and East, the *thumb* lancet is almost universally in use. The choice of instruments must of course in every case be left with the operator, although, as a matter of convenience, it may sometimes be proper to yield in this respect to the wishes of a sensitive patient, and hence many surgeons have both at hand, whether they individually prefer one or the other. The use of the thumb lancet is thought by some to require less tact than the other, and hence they advise ignorant and awkward operators to use it; but confiding in their own skill in the use of the spring lancet, they give this the preference in their own hands. From what I have seen, however, in the South, where the spring lancet is in almost every body's hands, and in the North, where it is seldom seen or used at all, I incline to an opposite opinion, although from long habit I employ the spring lancet myself exclusively, when the prejudice of the patient does not forbid. In the hands of an ignorant or awkward phlebotomist, I conceive the *thumb* lancet to be a more dangerous instrument. There is first the risk of transfixing the vein, and then the hazard of wounding the artery beneath it, both the one and the other being greater than with the spring lancet. This latter accident of wounding the artery in the act of bleeding in the median basilic vein, is known to be a very rare occurrence in those parts of the

country where the spring lancet is indiscriminately employed by the most illiterate and awkward. Almost every southern plantation has one or more negro bleeders who employ this instrument, and yet the artery is scarcely ever wounded; while the thumb lancet will be found to be the guilty instrument in almost every case of aneurism from this cause, and hence we find this accident much more frequent in the Northern and Eastern states.

That the thumb lancet is more surgical will not be questioned, but that it is equally safe in the hands of the uninitiated I cannot believe. And the reasons are very obvious: 1st, The cephalic and median cephalic veins are easily accessible with a spring lancet, in those cases where the basilic or median basilic would be preferred with the thumb lancet, because close to the skin, and often much larger. 2d, Even when the latter vein is near the artery the oblique direction generally preferred for the incision secures it from being punctured; and, 3dly, The spring lancet will seldom if ever transfix a vein, for so soon as it enters the cavity of the vein, the non-resistance of the contained blood protects the inferior coat of the vessel, and this yields without being wounded by the force of the spring.

The only accident to which the use of the spring lancet subjects us is, the occasional fracture of the lancet by the force of the spring, by which it is sometimes left in the arm, and thus produces disastrous consequences. I have more than once had to remove the fleam, as the cutting part of a spring lancet is called, from the arm, it having entered the vein, and passed up to the next valve, requiring the slitting up of the vein itself to effect its removal. This accident, however, never occurred under my notice, except with a German fleam, such as is found in the brass lancets as imported; and being made to sell, should always be displaced from the instrument, and substituted by a new one made sufficiently strong.—*Reese.*]

PHLEBOTOMY, OR VENESECTION.

The mode of bleeding most frequently practised is that of opening a vein; and it may be done in the arm, ankle, jugular vein, frontal vein, veins under the tongue, on the back of the hand, &c. In whatever part, however, venesection is performed, it is always necessary to compress the vein, between the place where the puncture is made and the heart. Thus the return of blood through the vein is stopped, the vessel swells, becomes conspicuous, and when opened bleeds much more freely than would otherwise happen. Hence, according to the situation of the part of the body where the vein is to be opened with regard to the heart, the bandage, or other means for making the necessary pressure must be applied either above or below the puncture.

All the apparatus essential for blood-letting, on the part of the patient, is a bandage or fillet, two or more small pieces of folded linen for compresses, a basin to receive the blood, and a little clean water and a towel. The bandage ought to be about a yard in length, and nearly two inches broad, a common riband or garter being frequently employed. The compresses are made by doubling a bit of linen rag, about two inches square. On the part of the surgeon, it is necessary to have a good lancet of proper shape. He should never bleed with lancets with which he has been in the habit of opening any kind of abscesses, as very troublesome complaints have been the consequence of doing so. The shape of the instrument is also a matter of some importance. If its shoulders are too broad, it will not readily enter the vein, and when it does enter, it invariably makes a large opening, which is not always desirable. If the lancet be too spear-pointed, an incautious operator would often run the risk of transfixing the vein, and wounding the artery beneath it. More, however, certainly depends on the mode of introducing the lancet than on its shape.

In blood-letting the patient may lie down, sit down, or stand up, each of which positions may be chosen according to circumstances. If the patient be apt to faint from the loss of a small quantity of blood, and such fainting can answer no surgical purpose, it is best to bleed him in a recumbent posture. But when the person is strong and vigorous, there is little occasion for this precaution, and a sitting posture is to be preferred, as the most convenient both for the surgeon and patient. This, indeed, is the common position. In some cases, however, particularly those of strangulated hernia, it is frequently an object to produce fainting, in order that the bowels may be more easily reduced. In this circumstance the patient may be bled in an erect posture, and the wound made large, as a sudden evacuation of blood is particularly apt to bring on the wished-for swoon. For the same reason, if we wish to avoid making the patient faint, we should then make only a small puncture.

Every operator should be able to use the lancet with either hand, and thus bleed the patient in the right or left arm, as circumstances may render most eligible.

At the bend of the arm there are several veins in which a puncture may be made, viz. the basilic, cephalic, median basilic, and median cephalic. The median basilic vein, being usually the largest and most conspicuous, is that in which the operation is mostly performed; but surgeons should never forget, that it is under this vessel that the brachial artery runs, with the mere intervention of the aponeurosis sent off from the tendon of the biceps muscle. In very thin persons, indeed, the median basilic vein lies almost close to the artery, and nothing is then more easy than to transfix the first of these vessels and wound the last. Hence Richerand advises all beginners to prefer opening the median cephalic, or even the trunk of the cephalic itself, to puncturing either the basilic, or the median basilic, which last are internally situated, and nearer the brachial artery.—(*Nosographie Chirurgicale, t.* 3, *p.* 38, *edit.* 2.)

In fat subjects, the large veins at the bend of the arm are sometimes totally imperceptible, notwithstanding the fillet is tightly applied, the limb is put in warm water, and every thing done to make those vessels as turgid as possible. In this circumstance, if the surgeon has not had much experience in the practice of venesection, he will do well to be content with opening one of the veins of the back of the hand, after putting the member for some time in warm water, and applying a ligature round the wrist. In children, a sufficient quantity of blood cannot always be obtained by venesection; and in this event the free application of leeches, and occasionally the puncture of the temporal artery, are the only effectual methods.

With respect to the choice of a vein in the arm, the most experienced operators give the preference to one which rolls least under the skin. Such a vessel, though sometimes less superficial than another, may commonly be opened with greater facility. The surgeon, however, is always to fix the vein as much as he can, by placing the thumb of his left hand a little below the place where he intends to introduce the lancet.

In bleeding in the arm, the fillet is to be tied round the limb, a little above the elbow, with sufficient tightness to intercept the passage of the blood through all the superficial veins; but never so as to stop the flow of blood through the arteries, which would tend to prevent the veins from rising at all. The veins being thus rendered turgid, the surgeon must choose the one which seems most conveniently situated for being opened, and large enough to furnish as much blood as it may be proper to take away.

Before applying the fillet round the arm, however, the operator should always feel where the pulsation of the artery is situated; and, if equally convenient, he should not open the vein immediately over this part. It is also prudent to examine where a pulsation is situated, on account of the occasional varieties in the distribution of the arteries of the arm. The ulnar artery is sometimes given off from the brachial very high up; and in this case it frequently proceeds superficially over the muscles which arise from the internal condyle, instead of diving under them in the ordinary manner.

When the external jugular vein is to be opened, the surgeon generally makes the necessary pressure with his thumb. The orifice should be made in the direction of the fibres of the platysma myoides muscle; and the vein is not so apt to glide out of the way, when the surgeon makes the puncture just where it lies over a part of the sterno-cleido-mastoideus muscle.

When blood is to be taken from the foot, the ligature is commonly applied a little above the ankle.

The fillet having been put on the arm, the operator

is to take the blade of the lancet, bent to a somewhat acute angle, between the thumb and fore-finger, and, steadying his hand upon the other three fingers, he is to introduce the lancet in an oblique direction into the vessel, till the blood rises up at the point of the instrument. Then bringing up the front edge in as straight a line as possible, the wound in the skin will be made of just the same size as that in the vein. The operator next takes away the thumb of his left hand, with which he steadied the vessel, and allows the blood to escape freely, till the desired quantity is obtained. The arm ought to be kept in the same position while the blood is escaping, lest the skin should slip over the orifice of the vein, keep the blood from getting out, and make it insinuate itself into the cellular substance.

When the blood does not issue freely, most surgeons direct the patient to move his fingers, or turn something round and round in his hand. This puts the muscles of the arm into action, and the pressure which they then make on the veins makes the blood circulate more briskly through these vessels.

The proper quantity of blood being discharged, the fillet is to be untied. The flow of blood now generally ceases; though sometimes, when the orifice is large and the circulation very vigorous, it still continues. In this circumstance, the operator may immediately stop the bleeding, by placing the thumb of his left hand firmly on the vessel, a little below the puncture.

The blood is next to be all washed off the arm, the sides of the wound placed in contact, and the compresses applied and secured with a fillet, put round the elbow in the form of a figure of 8, and regularly crossing just over the compresses.

The patient should be advised not to move his arm much till the fillet is removed, which may be done after twenty-four hours.

In order to open the external jugular vein, the patient's head is to be laid on one side and properly supported. Then the operator is to press upon the lower part of the vein with his thumb, so as to make the part above swell, and then the lancet is to be pushed at once into the vessel, with the cautions already stated.

There is commonly no difficulty in stopping the bleeding, after the pressure is removed. Some practitioners divide the integuments with a scalpel, before the vein itself is opened; but this is quite unnecessary. In this country, the fashion of opening the jugular vein has considerably declined. In fact, the operation is more troublesome, and less certain of succeeding, than venesection in the arm; while the principle which recommended the practice to the old surgeons, namely, that of more effectually discharging, in this manner, blood from the sinuses of the brain, is erroneous; for it is only the external jugular vein that can be safely opened, and this does not receive the blood from the interior of the head.

Blood-letting in the feet is executed on the same principle as in other parts; but as the blood from the veins in this situation generally does not flow with much celerity, it is customary to immerse the feet in warm water to promote the bleeding.

ARTERIOTOMY.

The only arteries of any size from which blood is ever taken in practice, are the trunk and branches of the temporal artery, which lie in such a situation, that they may easily be compressed against the subjacent bones, and the bleeding stopped. When the vessel which the surgeon chooses to open lies very near the surface, or can be ascertained by feeling, or even seeing its pulsation, it may be opened at once with a lancet. But in many instances it is so deeply situated, that it becomes necessary in the first place to make a cut in the skin, and then puncture the vessel.

The bleeding generally stops without any trouble, and may always be suppressed with a compress and bandage. In a very few cases, the blood bursts forth from time to time, and more is lost than is necessary. When this happens, notwithstanding pressure, it is recommended to divide the vessel completely across, which facilitates the process of nature in closing the end of the vessel. Sometimes an aneurism follows, which must be treated on the principles explained in a foregoing article.—(See *Aneurism.*) Cavallini cured the disease by dividing the vessel and compression.—*Collez. di Casi Chir. t.* 2, *Firenze*, 1762.)

TOPICAL BLEEDING.—CUPPING.

This is done by means of a scarificator and a glass shaped somewhat like a bell. The scarificator is an instrument containing a number of lancets, sometimes as many as twenty, which are so contrived that when the instrument is applied to any part of the surface of the body, and a spring is pressed, they suddenly start out and make the necessary punctures. The instrument is so constructed, that the depth to which the lancets penetrate may be made greater or less, at the option of the practitioner. As only small vessels can be thus opened, a very inconsiderable quantity of blood would be discharged, were not some method taken to promote the evacuation. This is commonly done with a cupping-glass, the air within the cavity of which is rarified by the flame of a little lamp containing spirit of wine, and furnished with a thick wick. This plan is preferable to that of setting on fire a piece of tow dipped in this fluid, and put in the cavity of the glass; "a clumsy expedient, adding unnecessarily to the sufferings of the patient by cauterizing the skin; doing harm also by rarifying the air more than necessary within the glass, in consequence of which the edges of the cup compress the cutaneous vessels so much as to obstruct the influx of blood. The larger the glass, if properly exhausted, the less pain does the patient suffer, and the more freely does the blood flow."—(See *Mapleson's Treatise on the Art of Cupping*, *p.* 63—65, 12*mo. Lond.* 1813.) When the mouth of the glass is placed over the scarifications, and the rarified air in it becomes condensed as it cools, the glass is forced down on the skin, and a considerable suction takes place.

This professor of the said art remarks, that when the operation is about to be done, a basin of warm water, a piece of fine sponge, and a lighted candle should be provided. As many of the cupping-glasses as may be judged necessary are to be put in the basin. If sixteen or twenty ounces of blood are to be taken away, four glasses, of a size adapted to the surface to which they are to be applied, will generally be required. Each glass is then to be held for an *instant* over the flame of the spirit-lamp, and immediately placed upon the skin. Upon the quickness with which this is done, the neatness and efficacy of the operation will depend. If dry cupping be only intended, the glasses may be allowed to remain on the skin for a few moments, and be replaced five or six times, with a little variation of their position, in order to prevent the skin from being hurt by their pressure. If the intention be to scarify and take away blood, the glass ought not to remain more than a minute, when the scarificator is to be *instantly* applied; for by the quickness with which the application of the scarificator succeeds the removal of the glass, the patient is saved a degree of pain, which he would otherwise suffer from the making of the punctures. When the glasses are so full as to be in danger of falling off, or the blood is coagulated in them, they should be removed, emptied, and applied again. For the sake of neatness, care should be taken to insert the nail under the upper part of the glass, and remove it so as to keep its bottom downwards, the scarifications being at the same time wiped with a sponge wet in warm water. The glasses also, previously to each application, should be rinsed in warm water, but not dried. For these, and some other useful directions, see *Mapleson's Treatise*, *p.* 64, &c.

Trials have been made of syringes calculated for exhausting the air from cupping-glasses; but the plan is not found so convenient as that above described.

A common pledget, or bit of rag, is usually applied as a dressing for the punctures made with a scarificator.

If a little smarting be not minded, Mr. Mapleson prefers the application of arquebusade water or spirits of wine, as it immediately stops the oozing of blood, and prevents subsequent itching.—(*P.* 69.)

LEECHES.

Leeches are often preferable to cupping, which is attended with more irritation than many surfaces, under particular circumstances, can bear, especially when the topical bleeding is to be frequently repeated; and they can be used in cases in which it would not be safe or convenient to employ the lancet.

Formerly medicinal leeches were very abundant in England, but owing to their now being in greater request, and to the draining and cultivation of waste lands, it is necessary to import large supplies from the

continent, chiefly from Bourdeaux and Lisbon. As much imposition prevails in this branch of commerce, it should be understood, that unless a leech be marked with yellow rings or spots, or with variegated lines running the whole length of the back, it will generally be found useless.—(See *A Treatise on the Medicinal Leech, by J. R. Johnson, p.* 133, 8vo. *Lond.* 1816.) When leeches are to be kept in any considerable quantity, this gentleman recommends them to be placed in a large vessel provided with a false bottom, so perforated as to allow them a ready passage. "This false bottom should be raised from three to six inches above the real bottom, or to such an extent as will admit of a turf of nearly equal dimensions being placed between them It should fit closely to the sides, that the earth may not be disturbed by the frequent introduction of fresh water. It is necessary that the vessel be also furnished with a stop-cock, in order that the water may be drawn off as often as may be considered expedient. But previously to our placing the leeches in this vessel, they should be singly examined. If, on being handled, they contract, and feel hard and firm, it affords the best indication of their being healthy; but should they feel flabby, or exhibit protuberances, or white ulcerous specks on the surface, they should be kept in jars by themselves, the water and the turf of which should be frequently renewed."—(*Op. cit. p.* 138.)

Sometimes leeches cannot be easily made to fix on the part to which they ought to be applied; but they will do so if the place be first cooled with a cloth dipped in cold water, or if it be moistened with cream or milk, and they be confined in the situation with a small glass.

According to Dr. Johnson, the part on which they are intended to fix should be as clean as possible; it should, therefore, be first washed with soap and water, and afterward with water alone, which will be more necessary should any liniment or embrocation have been used. Leeches are often found to bite better when removed from the water at least an hour previously to their application. In the common practice of putting as many of them as may be required into a wine-glass, and inverting it upon the part affected, there is the disadvantage that they frequently retire to the upper part of the glass, and cannot be got down again without some risk of displacing those which have already fastened. To remedy this inconvenience, Dr. Johnson recommends glass vessels of various sizes and figures, but none of them more than an inch deep. But in his own practice he prefers applying leeches with his hand. "Bring a leech towards the part whereon you intend to fix it, and as soon as it begins to extend the head to seek an attachment, endeavour that it may affix itself to the place required." When it evinces no disposition to bite, a little puncture may be made with a lancet, when the animal will fix itself. "When the patient is fearful of the lancet, and one leech only shall have bitten where several are required, it may be of use to remove it, which is readily done by inserting the nail of the finger between its mouth and the skin. The blood then flowing from the orifice will induce the remainder to bite with the greatest avidity. As soon as the leeches are gorged they drop off; this usually happens within ten or fifteen minutes. Sometimes they remain affixed a considerable time, and become indolent; but they are quickly aroused from this state by sprinkling them with a few drops of cold water."—(*Johnson, op. cit. p.* 141.) When they fall off, the bleeding may be promoted, if necessary, by fomenting the part. When the bleeding continues longer than is desirable, a slight compress will usually stop it; but in more troublesome cases the compress must be dipped in brandy or spirits of wine. In young infants the hemorrhage from the bites of leeches has sometimes proved fatal, and the same thing may happen in adults. An example of each fact is related by Beauchene (*Gazette de Santé, Sept.* 1815). When the bleeding is very troublesome, Autenrieth advises pieces of charpie to be pushed into the orifices of the bites; a method which he assures us is perfectly effectual.—(*Tubingen Blätter, b.* 2, *st.* 1, *p.* 57.)

In order to make a leech disgorge, it is usual to throw a little salt upon it: in a few seconds the blood is ejected, the leech assumes a coiled form, and is seldom found fit for use again before the end of four or five days. As salt, however, frequently blisters the leech, it has been proposed to empty the animal by regular and uniform pressure; but though Dr. Johnson considers this plan better than the other, he admits that it is scarcely practicable without injuring the internal structure of the leech. He says, the best method, and that from which the animal suffers the least inconvenience, is pouring a small quantity of vinegar upon its head. Leeches which have been recently applied should always be kept by themselves, and allowed to retain for their nourishment about one-third of the blood which they extract. For a great deal of valuable information respecting leeches, see Dr. Johnson's work, the title of which is above specified.

When leeches are very scarce, their tails may be snipped off while they are sucking, and the blood will then flow, drop by drop, from the artificial opening, as fast as the animals suck it; or, with the same view, an incision may be made with a lancet close to the tail. —(*Johnson, op. cit. p.* 144.)

SCARIFICATION WITH A LANCET

is mostly done in cases of inflamed eyes. An assistant is to raise the upper eyelid, while the surgeon himself depresses the lower one, and makes a number of slight scarifications where the vessels seem most turgid, trying particularly to cut the largest completely across.

ILL CONSEQUENCES SOMETIMES FOLLOWING BLEEDING IN THE ARM.

1. *Ecchymosis.*

The most common is the thrombus, or ecchymosis, a small tumour around the orifice, and occasioned by the blood insinuating itself into the adjoining cellular substance at the time when it is flowing out of the vessel. Changing the posture of the arm will frequently hinder the thrombus from increasing in size, so as to obstruct the evacuation of the blood. But, in some instances, the tumour suddenly becomes so large that it entirely interrupts the operation, and prevents it from being finished. In these cases, however, the most effectual method of preventing the tumour from becoming still larger is to remove the bandage. By allowing the bandage to remain, a very considerable swelling may be induced, and such as might be attended with great trouble. If more blood be required to be taken away, it ought to be drawn from another vein, and, what is still better, from a vein in the other arm.

The best applications for promoting the absorption of these tumours, are those containing spirit, vinegar, or the muriate of ammonia. Compresses wetted with any lotion of this sort may be advantageously put on the swelling and confined there with a slack bandage.

2. *Inflammation of the integuments and subjacent cellular substance.*

According to Mr. Abernethy, the inflammation and suppuration of the cellular substance in which the vein lies, are the most frequent occurrences. On the subsidence of this inflammation, the tube of the vein is free from induration. Sometimes the inflammation is rather indolent, producing a circumscribed and slowly suppurating tumour. Sometimes it is more diffused, and partakes of the erysipelatous nature. On other occasions it is phlegmonous.

When the lancet has been bad, so as rather to have lacerated than cut the parts; when the constitution is irritable, and especially when care is not taken to unite the edges of the puncture, and the arm is allowed to move about, so as to make the two sides of the wound rub against each other, inflammation will most probably ensue. The treatment of this case consists in keeping the arm perfectly at rest in a sling, applying the saturnine lotion, and giving one or two mild saline purges. When suppuration takes place, a small poultice is the best application.

3. *Absorbents inflamed.*

Sometimes, particularly when the arm is not kept properly quiet after bleeding, swellings make their appearance about the middle of the arm, over the large vessels, and on the forearm, about the mid-space between the elbow and wrist, in the integuments covering the flexor muscles. The swelling at the inner edge of the biceps is sometimes as large as an egg. Before such swellings take place, the wound in the vein often inflames, becomes painful, and suppurates, but without any perceptible induration of the venal tube, either at this time, or after the subsidence of the inflammation. Pain is felt shooting from the orifice in the vein, in

lines up and down the arm, and upon pressing in the course of this pain, its degree is increased. On examining the arm attentively, indurated absorbents may be plainly felt, leading to the tumour at the side of the biceps muscle.

The pain and swelling often extend to the axilla, where the glands also sometimes enlarge. Cord-like substances, evidently absorbents, may sometimes be felt, not only leading from the puncture to the swelling in the middle of the arm, but also from this latter situation up to the axillary glands, and from the wound in the vein down to the enlarged glands at the mid-space between the elbow and wrist, over the flexor muscles of the hand.

The enlarged glands often proceed to suppuration, and the patient suffers febrile symptoms. It may be suspected that the foregoing consequences arise from the lancet being envenomed, and from the absorption of the virulent matter; but the frequent descent of the disease to the inferior absorbents militates against this supposition.

When the absorbents become inflamed, they quickly communicate the affection to the surrounding cellular substance. These vessels, when indurated, appear like small cords, perhaps of one-eighth of an inch in diameter: this substance cannot be the slender sides of the vessels, suddenly increased in bulk, but an induration of the surrounding cellular substance.

The inflammation of the absorbents, in consequence of local injury, is deducible from two causes: one, the absorption of irritating matter; and the other, the effect of the mere irritation of the divided tube. When virulent matter is taken up by the absorbents, it is generally conveyed to the next absorbent gland, where its progress being retarded, its stimulating qualities give rise to inflammation, and, frequently, no evident disease of the vessel through which it has passed can be distinguished.

When inflammation of the absorbents happens, in consequence of irritation, the part of the vessel nearest the irritating cause generally suffers most, while the glands, being remotely situated, are not so much inflamed.

The treatment of the preceding case consists in keeping the arm perfectly quiet in a sling, dressing the puncture of the vein with any mild simple salve, covering the situation of the inflamed lymphatics with linen wet with the saturnine lotion, and giving some gently purging medicine.

When the glandular swellings suppurate, poultices should be applied, and if the matter does not soon spontaneously make its way outwards, the surgeon may open the abscess.—(See *Abernethy's Essays on this subject.)*

4. *Inflammation of the Vein.*

When the wound does not unite, the vein itself is very likely to inflame. This affection will vary in its degree, extent, and progress. One degree of inflammation may only cause a slight thickening of the venal tube, and an adhesion of its sides. Abscesses, more or less extensive, may result from an inflammation of greater violence, and the matter may sometimes become blended with the circulating fluids, and produce dangerous consequences, or the matter may be quite circumscribed, and make its way to the surface. When the vein is extensively inflamed, a good deal of sympathetic fever is likely to ensue, not merely from the excitement which inflammation usually produces, but also from the irritation continued along the membranous lining of the vein towards the heart. If, however, the excited inflammation should fortunately produce an adhesion of the sides of the vein to each other at some little distance from the wounded part, this adhesion will form a boundary to the inflammation, and prevent its spreading farther. The effect of the adhesive inflammation in preventing the extension of inflammation along membranous surfaces, was originally explained by Mr. Hunter. In one case Mr. Hunter applied a compress to the inflamed vein above the wounded part, and he thought that he had thus succeeded in producing an adhesion, as the inflammation was prevented from spreading farther. When the inflammation does not continue equally in both directions, but descends along the course of the vein, its extension in the other direction is probably prevented by the adhesion of the sides of the vein to each other.—(See *Obs. on the Inflammation of the internal coats of Veins, in Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, vol.* 1, *p.* 18, *&c.)* More information on this subject will be found under the head of *Veins.*

Mr. Abernethy mentions his having seen only three cases in which an inflammation of the vein succeeded venesection. In neither of these did the vein suppurate. In one about three inches of the venal tube inflamed, both above and below the puncture. The integuments over the vessel were very much swollen, red, and painful, and there was a good deal of fever, with a rapid pulse and furred tongue. The vein did not swell when compressed above the diseased part. In another instance, the inflammation of the vein did not extend towards the heart, but only downwards, in which direction it extended as far as the wrist.

The treatment is to lessen the inflammation of the vein by the same means which other inflammations require, and to keep the affection from spreading along the membranous lining of the vessel towards the heart, by placing a compress over the vein a little way above the puncture, so as to make the opposite sides of the vessel adhere together.

Mr. Abernethy conceives a case possible in which the vein may even suppurate, and a total division of the vessel be proper, not merely to obviate the extension of the local disease, but to prevent the pus from becoming mixed with the circulation. Were such a proceeding deemed right, I think Mr. Brodie's method of cutting the vessel would be best. However, I have never heard of any case in which the practice has been adopted. As for the scheme of tying the vein above the diseased part of it, the severe effects frequently following this method must, as Mr. Dunn has reminded me, render it less eligible than an incision. In the case of an inflamed vein, Dr. Chapman states that nothing is so efficacious as blisters; a practice said to have been first suggested by Dr. Physick.—(See *a fatal case of Inflammation of the vessel from Venesection, in Philadelphia Journ. Feb.* 1824.) I was lately favoured by Mr. Howship with a view of the state of the parts in a case where a lady had died after an inflammation of the veins of the arm, brought on by venesection: they were considerably thickened, and in some cases quite solid and impervious.—(See *Veins.*)

5. *Inflammation of the Fascia of the Forearm, or diffuse inflammation of the cellular membrane.*

Sometimes, in consequence of the inflammation arising from the wound of the lancet in bleeding, the arm becomes very painful, and can hardly be moved. The puncture often remains unhealed, but without much inflammation of the surrounding integuments. The forearm and fingers cannot be extended without great pain. The integuments are sometimes affected with a kind of erysipelas; being not very painful when slightly touched, but when forcibly compressed, so as to affect the inferior parts, the patient suffers a good deal. The pain frequently extends towards the axilla and acromion; no swelling, however, being perceptible in either direction. These symptoms are attended with considerable fever. After about a week, a small superficial collection of matter sometimes takes place a little below the internal condyle: this being opened, a very little pus is discharged, and there is scarcely any diminution of the swelling or pain. Perhaps, after a few days more, a fluctuation of matter is distinguished below the external condyle; and this abscess being opened, a great deal of matter gushes from the wound, the swelling greatly subsides, and the patient's future sufferings are comparatively trivial.

The last opening, however, is often inadequate to the complete discharge of the matter, which is sometimes originally formed beneath the fascia, in the course of the ulna, and its pointing at the upper part of the arm depends on the thinness of the fascia in this situation. The collection of pus descends under the lower part of the detached fascia, and a depending opening for its discharge becomes necessary. This being made, the patient soon gets well.

In these cases the vein is not inflamed; but sometimes the glands of the armpit and just above the elbow swell. The integuments are not much affected, and the patient complains of a tightness of the forearm. Matter does not always form, and the pliability of the arm after a good while gradually returns again.

Mr. Watson relates a case which was followed by a

permanent contraction of the forearm. Mr. Abernethy is of opinion that a similar contraction of the forearm, from a tense state of the fascia, may be relieved by detaching the fascia from the tendon of the biceps, to which it is naturally connected. Mr. Watson seems to have obtained success in his first case by having cut this connexion.

In the treatment of an inflammation of the fascia, or of an extensive quantity of the cellular membrane, in consequence of venesection, general means for the cure of inflammation should be employed, especially numerous leeches, cupping, purgatives, &c. The limb should be kept quiet, and the inflamed part relaxed. As soon as the inflammation abates, the extension of the forearm and fingers ought to be attempted and daily performed, to obviate the contraction which might otherwise ensue.

Mr. C. Bell objects to calling the affection an inflammation of the fascia, because he sees no proof of this part being inflamed; and he conceives that the symptoms proceed from the inflammation spreading in the cellular membrane and passing down among the muscles and under the fascia. On this point I believe him to be quite correct, and that the disorder partakes of the character of diffuse inflammation of the cellular membrane so well described by Dr. Duncan.—(See *Edin. Med. Chir. Trans. vol.* 1.) To this subject, however, I shall return in the article *Erysipelas*. The fascia acts as a bandage, and from the swelling of the parts beneath it binds the arm, but is not itself inflamed and contracted. When necessary to divide the fascia, Mr. Charles Bell thinks it would be better to begin an incision near the inner condyle of the humerus, and to continue it some inches down the arm, rather than perform the nice if not dangerous operation of cutting the fascia at the point where the expansion goes off from the round tendon of the biceps.

When the elbow-joint and forearm continue stiff after all inflammation is over, Mr. C. Bell recommends frictions with camphorated mercurial ointment, &c., and the arm to be gradually brought into an extended state by placing a splint on the forepart of the limb.—(*Operative Surgery, vol.* 1, *p.* 65.)

6. *Ill Consequences of a Wounded Nerve.*

Mr. Pott used to mention two cases in which the patients suffered distracting pains, followed by convulsions and other symptoms, which could only be ascribed to nervous irritation, arising from a partial division of the nerve, and he recommended its total division, as a probable remedy. Dr. Monro related similar cases in which such treatment proved successful.

Hence, it is highly necessary to know the characteristic symptoms of the case, particularly, as all the foregoing cases would be exasperated by the treatment just now alluded to. It is to Mr. Abernethy that we are indebted for several valuable remarks elucidating this subject. He informs us, that the two cutaneous nerves are those which are exposed to injury. Most frequently all their branches pass beneath the veins at the bend of the arm; but sometimes, although the chief rami go beneath these vessels, many small filaments are detached over them, which it is impossible to avoid wounding in phlebotomy.

Mr. Abernethy thinks the situation of the median nerve renders any injury of it very unlikely. If, however, a doubt should be entertained on this subject, an attention to symptoms will soon dispel it. When a nerve is irritated at any part between its origin and termination, a sensation is felt as if some injury were done to the parts which it supplies. If, therefore, the cutaneous nerves were injured, the integuments of the forearm would seem to suffer pain; if the median nerve, the thumb and next two fingers would be painfully affected.

What are the ills likely to arise from a wounded nerve? If it were partially cut, would it not, like a tendon or any other substance, unite? It seems probable that it would do so, as nerves as large as the cutaneous ones of the arm are very numerous in various situations of the body, and are partially wounded in operations, without any peculiar consequences usually ensuing. The extraordinary pain sometimes experienced in bleeding, may denote that a cutaneous nerve is injured. The situation of the nervous branches is such, that they must often be partially wounded in the operation, though they probably unite again, in almost all cases, without any ill consequences. Yet, says Mr. Abernethy, it is possible that an inflammation of the nerve may accidentally ensue, which would be aggravated if the nerve were kept tense, in consequence of its partial division. The disorder, he thinks, arises from inflammation of the nerve in common with the other wounded parts. This gentleman supposes, that an inflamed nerve would be very likely to communicate dreadful irritation to the sensorium, and that a cure would be likely to arise from intercepting its communication with that organ.

The general opinion is, that the nerve is only partially divided, and that a complete division would bring relief. Mr. Pott proposed enlarging the original orifice. It is possible, however, that the injured nerve may be under the vein, and if the nerve be inflamed, even a total division of it at the affected part would perhaps fail in relieving the general nervous irritation, which the disease has occasioned. To intercept the communication of the inflamed nerve with the sensorium, however, promises perfect relief. This object can only be accomplished by making a transverse incision above the orifice of the vein. The incision need not be large, for the injured nerve must lie within the limits of the original orifice, and it need only descend as low as the fascia of the forearm, above which all the filaments of the cutaneous nerves are situated. As the extent of the inflammation of the nerve is uncertain, Mr. Abernethy suggests even making a division of the cutaneous nerve still farther from the wound made in bleeding.

Examples are recorded, in which not only extraordinary pain was occasioned by the prick of the lancet, but erysipelas of the skin, ending in gangrene of the whole limb, and the death of the patient.—(*Richerand, Nosogr. Chir. t.* 2, *p.* 390, *ed.* 2.) A case in which the greater part of the integuments of the arm had been destroyed by erysipelas thus produced, I once saw under the care of Mr. Vincent, in St. Bartholomew's Hospital.

In former times, it was customary to refer many of the bad symptoms occasionally following venesection to a puncture of the tendon of the biceps; but this doctrine is now in a great measure renounced, the experiments of Haller having completely proved that tendons and aponeuroses are, comparatively speaking, parts endued with little or no sensibility.

In the foregoing account, the various ill consequences occasionally arising from venesection are represented separately: no doubt, in some cases, they may occur together.

See *R. Butler's Essay concerning Blood-letting, &c.* 8*vo. Lond.* 1734. *M. Martin, Traité de la Phlebotomie et de l'Artériotomie*, 8*vo. Paris*, 1741. *Quesnay, Traité des Effets et de l'Usage de la Saignée*, 12*mo. Paris. G. Vieusseux, De la Saignée, et de son Usage dans la plupart des Maladies*, 8*vo. Paris*, 1815. *J. J. Walbaum, De Venæsectione, Gott.* 1749. (*Haller, Disp. Chir.* 5, 477.) *B. Bell's System of Surgery. Essay on the ill Consequences sometimes following Venesection, by J. Abernethy. R. Carmichael on Varix and Venous Inflammation, in Trans. of Assoc. Physicians, vol.* 2. *Duncan on Diffuse Inflammation of the Cellular Membrane, in Edin. Med. Chir. Trans. vol.* 1. *Medical Communications, vol.* 2. *Richerand, Nosogr. Chir. t.* 2, *p.* 416, *edit.* 4. *J. Hodgson on the Diseases of Arteries and Veins*, 8*vo. Lond.* 1815. *B. Travers, in Surgical Essays, part* 1, 8*vo. Lond.* 1818. *Chapman, in Philadelphia Journ. Feb.* 1824. *Fretau, sur l'Emploi des Emissions Sanguines, &c.* 8*vo. Paris*, 1816. *Mapleson on the Art of Cupping*, 12*mo. Lond.* 1813; *and Dr. J. R. Johnson's valuable Treatise on the Medicinal Leech, including its Medical and Natural History, with a description of its Anatomical Structure, and Remarks upon the Diseases, Preservation, and Management of Leeches*, 8*vo. Lond.* 1816.

BLEEDING. See *Hemorrhage* and *Arteries*.

BLENORRHAGIA, or *Blennorrhœa*. (From βλέννα, mucus, and ῥέω, to flow.) A discharge of mucus. Swediaur, who maintains that gonorrhœa is attended with a mucous, and not a purulent discharge, prefers the name of blenorrhagia for the disease. However, in treating of gonorrhœa, we shall find, that this last appellation is itself not altogether free from objections.

BLEPHAROPTOSIS. (From βλέφαρον, the eyelid, and πτῶσις, a falling down.) Called also *ptosis*. An inability to raise the upper eyelid.—(See *Ptosis*.)

BLEPHAROTIS. An inflammation of the eyelids.

BLINDNESS. This is an effect of many diseases of the eye. See particularly, *Amaurosis; Cataract; Cornea, opacities of; Glaucoma; Gutta Serena, Hydrophthalmia; Leucoma; Ophthalmy; Pterygium; Pupil, closure of; Staphyloma, &c.*

BLISTERS. Applications which, when put on the skin, raise the cuticle in the form of a vesicle, filled with a serous fluid. Various substances produce this effect; but the powder of cantharides is what operates with most certainty and expedition, and is now invariably made use of for the purpose. The blister plaster is thus composed: ℞. *Cantharidis in pulv. subtillissimum tritæ* ℔j. *Emplastri ceræ* ℔iss. *Adipis præp.* ℔ss. The wax plaster and lard being melted, and allowed to become nearly cold, the powdered cantharides are afterward to be added.

When it is not wished to maintain a discharge from the blistered part, it is sufficient to make a puncture in the cuticle to let out the fluid; but when the case requires a secretion of pus to be kept up, the surgeon must remove the whole of the detached cuticle with a pair of scissors, and dress the excoriated surface in a particular manner. Practitioners used formerly to mix powder of cantharides with an ointment, and dress the part with this composition. But such a dressing not unfrequently occasioned very painful affections of the bladder, a scalding sensation in making water, and most afflicting stranguries. An inflammation of the bladder, ending fatally, has been thus excited. The treatment of such complaints consists in removing every particle of cantharides from the blistered part, which is to be well fomented, and administering freely mucilaginous drinks. Camphor is now suspected to prove more hurtful than useful.

These objections to the employment of salves, containing cantharides, for dressing blistered surfaces, led to the use of mezereon, euphorbium, and other irritating substances, which, when incorporated with ointment, form very proper compositions for keeping blisters open, without the inconvenience of irritating the bladder.

The favourite application, however, for keeping open blisters is the powder of savine, which was brought into notice by Mr. Crowther, in the first edition of his book on the White Swelling. He was led to the trial of different escharotic applications in the form of ointment, in consequence of the minute attention which caustic issues demand; and, among other things, he was induced to try powdered savine, from observing its effects in the removal of warts. Some of the powder was first mixed with white cerate, and applied as a dressing to the part that had been blistered; but the ointment ran off, leaving the powder dry upon the sore, and no effect was produced. Mr. Crowther next inspissated a decoction of savine, and mixed the extract with the ointment, which succeeded better, for it produced a great and permanent discharge. At last, after various trials, he was led to prefer a preparation analogous to the unguentum sambuci P. L. The following formula answers every desirable purpose: ℞. *Sabinæ recentis contusæ* ℔ij. *Ceræ flavæ* ℔j. *Adipis suillæ* ℔iv. *Adipe et cera liquefacta, incoque sabinam et cola.*

The difference of this formula from that which Mr. Crowther published in 1797, only consists in using a double proportion of the savine leaves. The ceratum sabinæ of Apothecaries' Hall, he says, is admirably made: the fresh savine is bruised with half the quantity of lard, which is submitted to the force of an iron press, and the whole is added to the remainder of the lard, which is boiled until the herb begins to crisp; the ointment is then strained off, and the proportion of wax ordered, being previously melted, is added. On the use of the savine cerate, immediately after the cuticle raised by the blister, is removed, it should be observed, says Mr. Crowther, that experience has proved the advantage of using the application lowered by a half or two-thirds of the unguentum ceræ. An attention to this direction will produce less irritation and more discharge, than if the savine cerate were used in its full strength. He found fomenting the part with flannel wrung out of warm water, a more easy and preferable way of keeping the blistered surface clean, and fit for the impression of the ointment, than scraping the part, as has been directed by others. An occasional dressing of the unguentum resinæ flavæ, he found very useful in rendering the sore free from an appearance of slough, or rather dense lymph, which is sometimes so firm in its texture, as to be separated by the probe with as much readiness as the cuticle is detached after blistering. As the discharge diminishes, the strength of the savine dressing should be proportionally increased. The ceratum sabinæ must be used in a stronger or weaker degree, in proportion to the excitement produced on the patient's skin. Some require a greater stimulus than others for the promotion of the discharge, and this can only be managed by the sensations which the irritation of the cerate occasions.

Mr. Crowther tried ointments containing the flowers of the clematis recta, the capsicum, and the leaves of the digitalis purpurea. The first two produced no effect; the last was very stimulating. He also tried caustic potassa mixed with spermaceti cerate, in the proportion of one drachm to an ounce: it proved very stimulating, but produced no discharge. One grain of the oxymuriate of mercury, blended with two ounces of the above cerate, proved so intolerably painful, that at the end of two hours it became necessary to remove the dressing; and the patient was attacked with a severe ptyalism.—(*Practical Obs. on the White Swelling, &c. 2d ed.* 1808.)

Instead of keeping a blister open, it is frequently a judicious plan to renew the application of the emplastrum cantharidis, after healing up the vesication first produced, and to continue in this manner a succession of blisters, at short intervals, as long as the circumstance of the case may demand. Where the skin is peculiarly irritable, and particularly in young children, where the emplastrum cantharidis sometimes acts so violently as to produce sloughing, or, in any cases, where the plaster produces strangury and irritation of the urinary organs, I am informed, that the inconvenience may be avoided, and the cuticle raised very well, if a piece of silk paper be interposed between the plaster and the integuments. Dr. A. T. Thomson recommends for the same purpose a piece of thin gauze wet with vinegar, and applied smoothly and closely over the plaster.—(*Dispensatory, p. 717, ed. 2.*) For infants, a proportion of opium has sometimes been added to the plaster, in order to render its action less violent; a proposal made, I believe, by the late Mr. Chevalier. Others recommend the plan of not letting the blister continue so long applied to children as to other patients.—(See *Paris's Pharmacologia, vol. 2, p. 186, ed. 5.*)

BOIL. See *Furunculus*

BONES, *Diseases of.* See *Antrum, Caries, Exostosis, Joints, Mollities, Necrosis, Osteosarcoma, Rickets,* and *Venereal Disease.* The following works relative to the pathology of the bones, deserve notice:—*F. C. Spoendli, De Sensibilitate Ossium Morbosa, 4to. Gott.* 1814. *A. Murray, De Sensibilitate Ossium Morbosa (Ludw. Script. Neur. 4). O. Murray, Diss. Acad. de Sensibilitate Ossium Morbosa. Frank. Del Op.* 12. *J. G. Sturmius, De Vulneribus' Ossium Helmst.* 1743. *A. Bonn, Tab. Ossium Morbosorum præcipue Thesauri Hoviani, fol. Amst.* 1785—1788. *C. F. Clossius, veber die Krankheiten der Knochen, 12mo. Tubing.* 1799. *A. G. Naumann, de Ostitide, 4to. Lips.* 1818. *R. Nesbitt, Human Osteogeny; two Lectures on the Nature of Ossification, 8vo. Lond.* 1736. *Sandifort, Museum Anatomicum Lugduno Batavæ Descriptum, 2 vol. fol. Lugd.* 1793. *Weidmann, De Necrosi Ossium, fol. Francof.* 1793. *Brodie on Diseases of Joints, 8vo. Lond.* 1818. *Howship, in Med. Chir. Trans. Dr. Cumin, in Edin. Med. and Surgical Journ. No. 82; and various other publications specified at the end of the article Necrosis.*

BOUGIE is a smooth flexible instrument which is introduced into the urethra for the cure of diseases of that passage (see *Urethra*); and is so named from its generally containing wax in its composition, and bearing some resemblance to a wax taper, in French, bougie. However, the kinds of bougies are various, and some of them employed in modern surgery, so far from having any similitude to a wax taper, are formed altogether of metal. They admit of being divided into those which are solid, and others which are hollow, and are more commonly named catheters.—(See *Catheter.*)

The exact period when bougies were first used, is a doubtful point in the history of surgery. By Andrew Lacuna, a Spanish physician, the invention is ascribed to a Portuguese empiric; and in 1551, the same author

published what had been communicated to him upon this subject. In the year 1554, Amatus Lusitanus published a work, in which he refers to several witnesses to prove, that the empirical practitioner above alluded to, had learned from him the use of bougies, while, on the other hand, he candidly owns, that he himself was indebted to Aldereto, of Salamanca, for a knowledge of these instruments. In 1553, however, Aiph. Ferri, of Naples, endeavoured to show, that his acquaintance with the utility of bougies reached as far back as 1548, and, of course, that he had anticipated Lacuna, and perhaps even Aldereto. But, instead of representing himself as the original inventor of bougies, he mentions that they were known to Alexander of Tralles, which, if true, carries back the invention to the sixth century. A. Ferri, also before describing bougies and escharotic ointments, mentions various means of examining the state of the urethra, and, among other things, cylinders made of flexible lead and of different sizes. Escharotic ointments for what were termed *carnosities* of the urethra, and bougies, were also described by Petronius in 1565, and afterward by A. Paré. The oldest bougies, which were wicks of cotton or thread, covered with wax and escharotic plasters, were in time succeeded by those composed of linen smeared with wax. This change was made with the view of letting them have a hollow construction; an improvement which was first noticed by Fabricius ab Aquapendente.—(*Op. Chir.* 1617.)

In the middle of the 17th century, the manner of making and using bougies was well known to Scultetus, as appears from his *Armamentarium Chirurg. tab.* 13, *fig.* 9, 10.

The making of bougies has now become so distinct a trade, that it may be considered superfluous to treat of the subject in this Dictionary. However, though a surgeon may not actually choose to take the trouble of making bougies himself, he should understand how they ought to be made. Swediaur recommends the following composition: ℞. Ceræ flavæ ℔j. Spermatis ceti ℥iij. Cerussæ acetatæ ℥v. These articles are to be slowly boiled together, till the mass is of proper consistence. Mr. B. Bell's bougie plaster is thus made: ℞. Emplastri lythargyri ℥iv. Ceræ flavæ ℥iss. Olei olivæ ℥iij. The last two ingredients are to be melted in one vessel and the litharge plaster in another, before they are mixed. In Wilson's Pharmacopœia Chirurgica, I observe this formula: ℞. Olei olivæ ℔iss. Ceræ flavæ ℔j. Minii ℔iss. Boil the ingredients together over a slow fire till the minium is dissolved, which will be in about four or six hours. The composition for bougies is now very simple, as modern surgeons place no confidence in the medicated substances formerly extolled by Daran. The linen, which may be considered as the basis of the bougie, is to be impregnated with the composition, which is generally wax and oil, rendered somewhat firmer by a proportion of resin. Some saturnine preparation is commonly added, as the urethra is in an irritable state, and the mechanical irritation might otherwise increase it. Of whatever composition bougies are made, they must be of different sizes, from that of a knitting-kneedle to that of a large quill, and even larger. Having spread the composition chosen for the purpose on linen rag, cut this into slips from six to ten inches long, and from half an inch to an inch or more in breadth. Then dexterously roll them on a glazed tile into the proper cylindrical form. As the end of the bougie, which is first introduced into the urethra, should be somewhat smaller than the rest, the slips must be rather narrower in this situation, and when the bougies are rolled up, that side must be outwards on which the plaster is spread.

Daran and some of the older writers, attributed the efficacy of their bougies to the composition used in forming them. On the contrary, Mr. Sharp apprehended that it was chiefly owing to the pressure which was made on the affected part; and Mr. Aikin adds, that as bougies of very different compositions succeed equally well in curing the same diseases in the urethra, it is plain that they do not act from any peculiar qualities in their composition, but by means of some common property, probably their mechanical form.

As the healthy as well as the diseased parts are exposed to the effects of bougies made of very active materials, modern surgeons always prefer such as are made of a simple unirritating composition.

Plenck recommended bougies of catgut, which may be easily introduced into the urethra, even when it is greatly contracted, their size being small, their substance firm, and dilatable by moisture. It is objected to catgut, however, that it sometimes expands beyond the stricture, and gives great pain on being withdrawn. Formerly, catgut bougies were sometimes coated with elastic gum, a valuable material, of which I shall next speak.

The invention of elastic bougies and catheters originated with Bernard, a silversmith at Paris, who in the year 1779 presented some instruments of this kind to the Academy of Surgery, which period was prior to the claim made by Professor Pickel of Wurzburg to the discovery.—(See *Journ. de Méd. an* 1785.)

For the composition of bougies, elastic resin or gum is thought to be very desirable, as it unites firmness and flexibility. Mr. Wilson, in his *Pharmacopœia Chirurgica*, is inclined to think that the art of making these instruments consists in finding a suitable solvent for the Indian gum. As this substance, if dissolved in ether, completely recovers its former elasticity upon the evaporation of this fluid, it is supposed that ether, though rather too expensive, would answer.

I find it positively asserted, however, in a modern work of great repute, that the idea of elastic gum being the substance really employed is a mistake, as the material used is nothing more than linseed oil boiled for a considerable time, and used as a varnish for the silk, linen, or cotton tube.—(See *Dict. des Sciences Méd. art. Bougie.*)

Very cheap and good elastic gum bougies are made by Feburier, No. 51 Rue du Bac, at Paris, who has twelve different sizes. His elastic gum catheters are also well made, though for smoothness and regularity I think they are not equal to some which are now constructed in London; but I believe Feburier's smallest size is rather less than any which are made in this city; an advantage which no doubt our artists will soon be able to give their productions. This ingenious mechanic does not employ catgut in the composition of the elastic gum bougies, for which he is so celebrated. These bougies are most excellent when you can get them to pass; for they dilate the stricture with the least possible irritation. But sometimes they cannot be introduced when a wax bougie can; and from the trials which I have made of them, I conceive this arises from their elasticity and continual tendency to become straight when they reach the perinæum, so that the point presses on the lower surface of the urethra. Hence, when the obstruction is on that side, it must be very difficult to get the end of the bougie over it.

A few years ago, Mr. Smyth discovered a metallic composition of which he formed bougies, to which some practitioners impute very superior qualities. These bougies are flexible, have a highly polished surface of a silver hue, and possess a sufficient degree of firmness for any force necessary in introducing them for the cure of strictures of the urethra. The advocates for the metallic bougies assert, that such instruments exceed any other bougies which have yet been invented, and are capable of succeeding in all cases in which the use of a bougie is proper. They are either solid or hollow, and are said to answer extremely well as catheters; for they not only pass into the bladder with ease, but may also be continued there for any convevient space of time, and thus produce essential benefit. —(*W. Smyth, Brief Essay on the Advantages of Flexible Metallic Bougies*, 8vo. *Lond.* 1804.) The greatest objection which has been urged against them is, that they are attended with a risk of breaking. I have heard of an eminent surgeon being called upon to cut into the bladder, in consequence of a metallic bougie having broken, and a piece of it passing into that organ, where it became a cause of the severe symptoms which are commonly the effect of a stone in the bladder. For the particulars of an interesting case, in which a metallic bougie broke in the urethra, the reader may consult *London Med. Repository, vol.* 9, *No.* 51. The manufacture of metallic bougies, however, is now brought to such perfection, that though they are used to a great extent in modern practice, we rarely hear of their breaking; but it is most prudent not to be too bold with those of small diameter.

The bougie, with its application, says Mr. Hunter, is perhaps one of the greatest improvements in surgery

which these last thirty or forty years have produced. "When I compare the practice of the present day with what it was in the year 1750, I can scarcely be persuaded that I am treating the same disease. I remember, when about that time I was attending the first hospitals in the city, the common bougies were either a piece of lead or a small wax candle; and although the present bougie was known then, the due preference was not given to it nor its particular merit understood, as we may see from the publications of that time."

Daran was the first who improved the bougie and brought it into general use. He wrote professedly on the diseases for which it is a cure, and also of the manner of preparing it; but he has introduced much absurdity into his descriptions of the diseases, the modes of treatment, and the powers and composition of his bougies.

When Daran published his observations on the bougie, every surgeon tried to discover the composition, and each conceived that he had found it out, from the bougies which he composed producing the effects described by Daran. It was never suspected, that any extraneous body of the same shape and consistence would do the same thing.—(See *A Treatise on the Venereal Disease, p.* 116. *Sharp's Critical Inquiry, ch.* 4. *Aikin on the External Use of Lead. Daran, Obs. Chir. sur les Maladies de l' Urètre,* 12*mo. Paris,* 1748 *and* 1768. *Olivier, Lettre dans laquelle on démontre les avantages que l'on peut retirer de l'usage des bougies creuses, &c.* 8*vo. Paris,* 1750. *Desault, Journ. de Chir. t.* 2, *p.* 375, *and t.* 3, *p.* 123, 1792. *Smyth's Brief Essay on Flexible Metallic Bougies,* 8*vo. Lond.* 1804. *Dict. des Sciences Médicales, t.* 3, *p.* 265, *&c.* 8*vo. Paris,* 1812.)

Of armed bougies, as well as of some other kinds, and of the manner of using bougies in general, I shall speak in the article *Urethra, Strictures of.*

BRAIN. For concussion, compression of, &c., see *Head, Injuries of.* For the hernia of, see *Hernia Cerebri.*

BREAST. See *Mammary Abscess; Mamma, Removal of; Cancer, &c.*

BRONCHOCELE. (From βρόγχος, the windpipe, and κήλη, a tumour.) The Swiss call the disease *goitre* or *goître.* Heister thought it should be named *tracheocele.* Prosser, from its frequency in the hilly parts of Derbyshire, called it the *Derbyshire neck;* and not satisfied respecting the similitude of this tumour to that observed on the necks of women on the Alps, the *English Bronchocele.* By Alibert the disease is called *Thyrophraxia.*

1. The simple bronchocele or thyrophraxia is the most common form of the disease, and is a mere enlargement of the thyroid gland. The integuments covering the part are quite unchanged. Women are observed to be more subject to it than men. It is also well known to be in general free from danger, the office of the thyroid gland not being of such importance in the animal economy as to be essential to the continuance of life. Alibert has seen one example in which the tumour became cancerous, and destroyed the mother of a family.

2. The compound bronchocele is that which presents the greatest variety, and astonishes every beholder. Sometimes a more or less voluminous cyst is formed round it, filled with a pultaceous or purulent matter. Sometimes in compound bronchoceles, calcareous and other heterogenous substances are found. In two cases Alibert found on the outside of the enlarged gland a yellow fatty mass; and in a third instance the gland itself formed a true sarcoma.—(*Nosologie Naturelle, t.* 1, *p.* 464, 465, *folio, Paris,* 1817.)

The term *bronchocele* always signifies in this country an enlargement of the thyroid gland, which, with the disease of the surrounding parts, sometimes not only occupies all the space from one angle of the jaw to the other, but forms a considerable projection on each side of the neck, advancing forwards a good way beyond the chin, and forming an enormous mass, which hangs down over the chest. The swelling, which is more or less unequal, in general has a soft, spongy, elastic feel, especially when the disease is not in a very advanced state; but no fluctuation is usually perceptible, and the part is exceedingly indolent. The skin retains nearly its ordinary colour; but when the tumour is of very long standing and great size, the veins of the neck become more or less varicose.

According to Prosser, the tumour generally begins between the eighth and twelfth years. It enlarges slowly during a few years; but at last it augments rather rapidly, and forms a bulky pendulous tumour. Women are far more subject to the disease than men, and the tumour is observed to be particularly apt to increase rapidly during their confinement in childbed. Sometimes bronchocele affects the whole of the thyroid gland, that is to say, the two lateral lobes and the intervening portion; and it is in this kind of case, that it is not unusual to remark three distinct swellings, for the most part of unequal size. Frequently only one lobe is affected; while in many other cases the three portions of the thyroid gland are all enlarged and so confounded together, that they make, as it were, only one connected globular mass. Finally, in some dissections the thyroid gland has been found quite unchanged, the whole of the tumour having consisted of a sarcomatous disease of the adjacent lymphatic glands and cellular membrane.—(*Postiglione, p.* 21.) When only one lobe of the thyroid gland is affected, it may extend in front of the carotid artery, and be lifted up by each diastole of this vessel, so as to have the pulsatory motion of an aneurism.—(*A. Burns's Surgical Anatomy of the Head and Neck, p.* 195, *and Parisian Chirurgical Journ. vol.* 2, *p,* 292, 293.) Alibert believes that he first made the remark that the right lobe was more frequently enlarged than the left.—(*Nosol. Nat. t.* 1, *p.* 465.) The same thing was invariably noticed in every case seen by Mr. Rickwood in the neighbourhood of Horsham in Sussex.—(See *Med. and Phys. Journ. for Aug.* 1823.)

The ordinary seat of bronchocele, as Flajani remarks, is the thyroid gland; but sometimes cysts are formed in the cellular membrane.—(*Collez. d'Oss. t.* 3, *p.* 277.) And Postiglione also observes, that the swelling is sometimes encysted, and filled with matter of various degrees of consistence, resembling honey, &c.; in some cases it is emphysematous, or filled with air; and in other instances it is sarcomatous, having the consistence of a gland, which is enlarged, but not scirrhous. These different characters prove, says he, that the treatment ought not to be the same in all cases.—(*Memoria sulla Natura del Gozzo, p.* 20.)

Bronchocele is common in some of the valleys of the Alps, Apennines, and Pyrences. Indeed, there are certain places where the disease is so frequent, that hardly an individual is totally exempt from it. Larrey, in travelling through the valley of Maurienne, noticed that almost all the inhabitants were affected with goitres of different sizes, whereby the countenance was deformed, and the features rendered hideous.—(*Mem. de Chir, Mil. t.* 1, *p.* 123.) And Postiglione remarks that in Savoy, Switzerland, the Tyrol, and Carinthia there are villages in which all the inhabitants without exception have these swellings, the position and regularity of which are there considered as indications of beauty. —(*Memoria sulla Natura del Gozzo, p.* 22.) In many the swelling is so enormous, that it is impossible to conceal it by any sort of clothing. A state of idiotism is another affliction which is sometimes combined with *goître,* in countries where the latter affection is endemic. However, all who have the disease are not idiots, or cretins, as they have been called; and in Switzerland and elsewhere it is met with in persons who possess the most perfect intellectual faculties. When bronchocele and cretinism exist together, Foderé and several other writers ascribe the affection of the mind to the state of the thyroid gland.—(See *Traité sur le Goitre et le Crétinisme,* 8*vo. Paris, an* 8.) However, this opinion appears to want foundation, since the mental faculties are from birth weak, and in many the idiotism is complete where there is no enlargement of the thyroid gland, or where the tumour is not bigger than a walnut, so that no impediment can exist to the circulation to or from the brain.—(*Burns on the Surgical Anatomy of the Head and Neck, p.* 192.) The direct testimony of Dr. Reeves also proves that in countries where cretins are numerous many people of sound and vigorous minds have bronchocele.—(See *Dr. Reeve's Paper on Cretinism, Edin. Med. and Surgical Journal, vol.* 5, *p.* 31.) Hence, as Mr. A. Burns remarked, the combination of bronchocele and cretinism must be considered as accidental; a truth that seems to derive confirmation from the fact that in some parts of this country bronchocele is frequent, where cretinism is seldom or never seen.

Bronchocele is not confined to Europe; it is met with in almost every country on the globe. Professor Barton, in his travels among the Indians settled at Oneida in the state of New-York, saw the complaint in an old woman, the wife of the chief of that tribe. From this woman Barton learned that bronchoceles were by no means uncommon among the Oneida Indians, the complaint existing in several of their villages. He found also that the disease resembled that seen in Europe, in respect to its varieties. He did not indeed himself see the pendulous bronchocele which descends over the breast; but he understood that it was not uncommon among the women on the banks of the Mohawk river, who wore a particular dress for its concealment. In North America bronchocele attacks persons of every age; but it is most frequently seen in adults; a difference from what is noticed in Europe. Bronchocele is said to be frequent in Lower Canada. Bonpland, the companion of Humboldt, informed Alibert that the disease was endemic in New Grenada, and that it prevailed in such a degree in the little towns of Honda and Monpa, on the banks of the Magdalen river, that scarcely any of the inhabitants were free from it. The blacks and those who led an active, laborious life, however, are reported to escape the complaint. Some of the natives of the isthmus of Darien are said to be terribly disfigured by it.—(*Alibert, Nosol. Nat. t.* 1, *p.* 469. *Also, Observations sur quelques phénomènes peu connus qu'offre le goitre sous les tropiques, dans les plaines et sur les plateaux des Andes, par A. de Humboldt, in Journ. de Physiologie par F. Magendie, t.* 4, *p.* 109, *Paris*, 1824.)

In European women bronchocele usually makes its appearance at an early age, generally between the eighth and twelfth year, and it continues to increase gradually for three, four, or five years, and is said sometimes to enlarge more during the last half year than for a year or two previously. It does not generally rise so high as the ears, as in the cases mentioned by Wiseman. Sometimes, however, this happens, as we see in the case of Clement Desenne, of whom Alibert has given an engraving. In this patient, a part of the tumour, as large as a hen's egg, projected into the mouth.—(*Nosol. Nat. t.* 1, *p.* 466.) The swelling extended from the ears to the middle of the breast. A seton produced a partial subsidence of it; but when it was withdrawn the orifices closed. After two years more, the swelling became painful, suppuration took place, and fifteen pints of matter were discharged; and six ounces every day after the swelling had burst, came away with the dressings for three months; but, notwithstanding all this suppuration, and more afterward, the tumour was only partially lessened. The disease, mostly has a pendulous form, not unlike, as Albucasis says, the flap or dewlap of a turkey-cock, the bottom being the largest part of the tumour. Alibert mentions a case in which the swelling hung down to the middle of the sternum, and the large mass, which was quite a burden to the patient, used to become hard and, as it were, frozen in very cold weather. This author, however, cannot be right, when he adds, that it was an inert body, *destitute of vitality*!—(*Nosol. Nat. t.* 1, *p.* 466.) In another curious instance, the tumour formed a long cylinder which reached down to the middle of the thigh, the diameter becoming gradually smaller downwards.—(*P.* 468.) The common seat of bronchocele is the thyroid gland; but frequently the surrounding cellular membrane is more or less thickened, and contributes to the swelling. Sometimes also the neighbouring lymphatic glands are affected, when its base is widened and extends from one side of the neck to the other. In this circumstance, the swelling gradually loses itself in the surrounding parts, and is not circumscribed as in ordinary instances.—(*Postiglione, Mem. sulla Natura del Gozzo, p.* 20.) It is soft, or rather flabby to the touch, and somewhat moveable; but after afew years, when it has ceased enlarging, it becomes firmer and more fixed. When the disease is very large, it generally occasions a difficulty of breathing, which is increased by the patient's catching cold or attempting to run. In some subjects the tumour is so large, and affects the breathing so much, that a loud whizzing is occasioned; but there are many exceptions to this remark. Sometimes when the swelling is of great size, patients suffer very little inconvenience; while others are greatly incommoded, though the tumour is small. In general the inconvenience is trivial. The voice is sometimes rendered hoarse, and in particular cases the difficulty of speech is very considerable.—(See *Flajani, Collez. d'Oss. t.* 3, *p.* 271.)

The difficulty of respiration, produced by the pressure of the tumour and the enlargement of other glands, as this author remarks, is the most dangerous effect of the disease, since by disordering the pulmonary circulation, it renders the pulse irregular and intermittent, and a strong throbbing is excited in the region of the heart, followed by fatal disease of the lungs themselves; consequences often not suspected to have any connexion with the bronchocele, though it is in reality the immediate cause of them.—(*Vol. cit. p.* 278.)

The causes of bronchocele are little known. To the doctrine that bronchocele is caused by the earthy impregnation of water used for drink, the following objections offer themselves: 1. The water of Derbyshire, in districts where this disease is considered endemic, contains much supercarbonate of lime; but that in common use about Nottingham, where the disease is also prevalent, is impregnated with sulphate of lime. However, that the disease is not produced by water impregnated by sulphate of lime is evident; for, as Alibert observes, the waters of Saint Jean, Saint Sulpice, and Saint Pierre, where bronchocele is frequent, contain much less of this earth than the waters of Upper Maurienne, where the disease is hardly ever noticed, though the houses are built upon a vast quarry of gypsum. The same fact was observed by Bonpland in New Grenada.—(*Nosol. Nat. t.* 1, *p.* 471.) Nor, as Foderé explained, can the cause of the disease be correctly referred to the use of any particular kind of food. Certain localities, however, seem to contribute to its frequency; for this author observes, that the disease is not prevalent in very high places nor in open plains; but that it becomes more and more common as we descend into deep valleys made by torrents, where there is a good deal of marsh, and abundance of fruit-trees. The air is here constantly humid. 2. Abstinence from unboiled water does not diminish or interrupt the gradual progress of the disease. 3. Patients are cured of the disease, who still continue to drink water from the same source as before, without taking any precaution, as boiling, &c. 4. The disease in this country is less frequently found among men. 5. Many instances may be related of a swelling in the neck, sometimes very painful, and generally termed bronchocele, being produced very suddenly, by difficult parturition, violent coughing, or any other unusually powerful effort.—(See *Edin. Med. and Surgical Journ. vol.* 4, *p.* 279.) When the gland is suddenly enlarged during a violent exertion, the distention is said to be produced by the passage of air from the trachea into the substance of the thyroid gland and surrounding cellular membrane. But whether this statement be a fact or not, it is unquestionably true, that in many patients the tumour always increases when they speak loud, sing, or make any effort.—(*Flajani, Collez. d'Oss. &c. t.* 3, *p.* 276; *and Postiglione, p.* 24.) The disease is sometimes seen in scrofulous subjects; but there is every reason to believe that it is quite independent of the other disorder, as Prosser, Wilmer, and Kortum have particularly explained. The following are some points of difference between bronchocele and scrofula, as indicated by Dr. Postiglione. 1. The true bronchocele is simply a local disease of the neck, the constitution being unaffected. On the contrary, scrofula extends its effects to the whole system, attacking not only the lymphatic glands, but also the muscles, cellular membrane, ligaments, cartilages, and bones. 2. Both diseases chiefly occur in young subjects; but bronchocele often begins at a later age than scrofula, and does not, like the latter, spontaneously disappear as the patient approaches puberty and gains strength. 3. Scrofulous glands often suppurate and ulcerate; bronchocele rarely undergoes these changes. 4. The thickening of the upper lips of scrofulous subjects is not an attendant on bronchocele; and while the former patients generally enjoy their mental faculties in perfection as long as they live, the latter disease in certain countries is often joined with cretinism. Scrofula is likewise always hereditary, while bronchocele is not so; no healthy persons become scrofulous by living a long while among scrofulous patients, but many individuals contract bronchocele by going from a country where this disease is unknown, and taking up their residence in places where it abounds. 5. Nature alone often cures

scrofula, while art is rarely successful; on the contrary, bronchocele is seldom cured by nature, but very frequently by art. 6. The muriate of lime, recommended by Fourcroy for the cure of scrofula, is always useless; but in bronchocele it proves a valuable remedy.—(*Postiglione, Memoria sulla Natura del Gozzo, &c. p.* 25.) The error of confounding bronchocele with scrofula is now generally acknowledged. At the Hospital St. Louis, says Alibert, scrofulous patients are numerous, while those with bronchocele are very rare. (*Nosol. Nat. t.* 1, *p.* 465.) In Derbyshire, Genoa, and Piedmont, bronchocele has been attributed to drinking water cooled with ice. To this theory many of the objections concerning the earthy impregnation of water stand in full force; with this additional reflection, that "in Greenland, where snow-water is commonly used, these unsightly protuberances are never met with, nor (says Watson) did I ever see one of them in Westmoreland, where we have higher mountains and more snow than in Derbyshire, in which country they are very common. But what puts the matter beyond a doubt is, that these wens are common in Sumatra, where there is no snow during any part of the year."—(*Watson's Chemical Essays, vol.* 2, *p.* 157.) The above opinion was also refuted by Fodere, who remarks, that the Swiss who reside at the bottom of the glaciers are the least subject to the disease. Bronchoceles are also said to be unknown in Lapland.

Respecting the influence of particular water in bringing on the disease, Dr. Odier gives credit to the opinion, because it has appeared to him that distilled water prevented the increase of the tumour, and even tended to lessen its bulk.—(See *Manuel de Médecine Pratique*, 8vo. *Genev.* 1811.) However, that every explanation hitherto devised of the causes of bronchocele is quite unsatisfactory, is fully proved by the observations of the celebrated Humboldt. Persons afflicted with bronchocele (he remarks) are met with in the lower course of the Magdalen river (from Honda to the conflux of the Cauca); in the upper part of its course (between Neiva and Honda); and on the flat high country of Bogota, six thousand feet above the bed of the river. The first of these three regions is a thick forest, while the second and third present a soil destitute of vegetation; the first and third are exceedingly damp, the second is peculiarly dry; in the second and third regions, the winds are impetuous; in the first the air is stagnant. To these striking differences, we will add those relative to temperature. In the first and second regions, the thermometer keeps up all the year between 22 and 33 centigrade degrees; in the third, between 4 and 17 degrees. The waters drunk by the inhabitants of Mariquita, Honda, and Santa Fé de Bogota, where bronchoceles occur, are not those of snow, and issue from rocks of granite, freestone and lime The temperature of the waters of Santa Fé and Mompox, drunk by those who have this disease, varies from nine to ten degrees. Bronchoceles are the most hideous at Mariquita, where the springs which flow over granite are, according to my experiments, chemically more pure than those of Honda and Bogota, and where the climate is much less sultry, than upon the banks of the Magdalen river. Perhaps it may be thought that the atony of the glandular system (?) depends less upon the absolute temperature than upon the sudden refrigeration of the atmosphere, the difference of temperature in the night and day; but in the Magdalen valley, where the constancy of low tropical regions prevails, the extent of the scale that the thermometer pervades in the course of the whole year, is only a small number of degrees, &c.—(*Humboldt, in Journ. de Physiologie par F. Magendie, t.* 4, *p.* 116.)

The same distinguished observer confirms previous accounts of the variety of bronchoceles among the original copper-coloured natives of America and negroes. It appears, also, that in South America bronchocele is progressively extending itself from the lower provinces to the flat elevated regions of the Cordilleras; and this in so serious a degree that in 1823 the subject was adverted to in a report made to Congress by M. Restreppo, one of the Colombian ministers.

An observation lately made by an intelligent writer would lead one to conclude, that cretinism depends upon malformation of the head. Speaking of goitre, as it appears among the inhabitants of the valley of Maurienne, Baron Larrey informs us, that in many of these people, with this frightful deformity is joined that of the cranium, of which the smallness and excessive thickness are especially remarkable.—(*Mém de Chir. Milit. t.* 1, *p.* 123.) Dr. Leake thinks that tumours of this sort may be owing to the severity of the cold damp air, as they generally appear in winter, and hardly ever in the warm dry climates of Italy and Portugal. The latter part of the observation, however, is not correct, for Doct. Postiglione, and other Italian writers, assure us that the disease is extremely common in some of the warmest parts of Italy. "*Qui in Napoli, e per tutto il regno, si veggono molt gozzuti, mai non in numero tale, come in Casoria, ed in pochi altri villaggi.*" —(*P.* 21.) Prosser is inclined to consider the bronchocele as a kind of dropsy of the thyroid gland. similar to the dropsy of the ovary; and he mentions that Dr. Hunter dissected one thyroid gland which had been considerably enlarged, and contained many cysts filled with water. These, he erroneously concludes, must have been hydatids. Dr. Baillie remarks, that when a section is made of the thyroid gland affected with this disease, the part is found to consist of a number of cells containing a transparent viscid fluid.

In all probability the ordinary bronchocele is entirely a local disease, patients usually finding themselves in other respects perfectly well. The tumour itself frequently occasions no particular inconvenience, and is only a deformity. There is no malignancy in the disease, and the swelling is not prone to inflame or suppurate, though, as Dr. Hunter remarks, abscesses do occasionally form in it. Alibert's case of bronchocele becoming cancerous is singular. Mr. Gooch never knew life to be endangered by this sort of tumour, however large; a remark very much at variance with the observations of some other practitioners; but he had seen great inconvenience arise from it when combined with quinsy. In fact, the pressure of a large bronchocele may not only greatly afflict the patient, by rendering respiration difficult, but actually cause death by suffocation.—(See *Obs. sur un Goitre volumineux, comprimant la Trachée-artère; par L. Winslow, in Bulletin de l'Athénée de Méd. &c.*) "Some persons, as Alibert remarks, have the disease all their lives without suffering any inconvenience from it; some experience a suffocating oppression of the breathing; and in others there is an impediment in the circulation, and a tendency to apoplexy, arising from the strangulation which afflicts them."—(*Nosol. Nat. t.* 1, *p.* 466.) Dr. Hunter says, that the bronchocele frequently appears two or three years before or after the commencement of menstruation, and that it sometimes spontaneously disappears, when this evacuation goes on in a regular manner. Mr. A. Burns affirms the same thing. On the contrary, according to Prosser, this change in the constitution hardly ever affects the tumour.

TREATMENT OF BRONCHOCELE.

That certain localities, perhaps not yet correctly understood, contribute to the origin of this disease, is well proved by a fact stated by Alibert, viz. that change of air has more effect on the complaint than medicines, as he has known many Swiss ladies who came to Paris with bronchoceles, in whom the tumour subsided after they had resided some time in that city.—(*Nosol. Nat. t.* 1, *p.* 473.)

A blister, kept open, has put a stop to the growth of the tumour; but this method is not much followed at present, as better plans of treatment have been discovered. A few years ago the favourite mode of curing bronchocele consisted in giving internally burnt sponge, and occasionally a calomel purge, at the same time that frictions were made upon the tumour itself. The utility of burnt sponge in the treatment of bronchocele, as Dr. Coindet and others have now fully proved, depends upon the iodine in its composition.

The efficacy of burnt sponge was thought to be greatest, when exhibited in the form of a lozenge composed of ten grains of this substance, ten of burnt cork, and the same quantity of pumice-stone. These powders were made into the proper form with a little syrup, and the lozenge was then put under the tongue and allowed to dissolve. To the latter circumstance much importance was attached. Some practitioners gave a scruple of burnt sponge alone, thrice every day, while others added a grain of calomel to each dose. A purge of calomel was ordered about once a week or fortnight, at long as the patient persevered in the use of the calcined sponge; but when mercury was combined with

ach dose of this medicine, no occasional purgative was deemed requisite.

External means may very materially assist the above internal remedies. Frequently rubbing the swelling with a dry towel; bathing the part with cold water; rubbing the tumour two or three times a day with the liq. ammon. acet. or the camphor liniment; are the best steps of this kind which the surgeon can take.

"In the treatment of bronchocele," says Mr. A. Burns, "repeated topical detraction of blood from the tumour is highly beneficial. Electricity also has sometimes a marked effect; but there is no remedy which I would more strongly advise, than regular and long-continued friction over the tumour. By perseverance in this plan, a bronchocele, treated in London, was materially reduced in the course of six weeks. Its good effects I have likewise witnessed myself; and it is a remedy highly recommended by Girard in his '*Traité des Loupes.*' It has also been much used in scrofulous tumours by Mr. Grosvenor of Oxford, and by Mr. Russell of Edinburgh.—(*Surgical Anatomy of the Head and Neck, p.* 204.)

Mr. A. Burns recommends the friction to be made with flannel covered with hair-powder, and the part to be rubbed at least three times a day, for twenty minutes.

In two cases of bronchocele related by Dr. Clarke, the patients were cured by "the steady use of the compound plaster of ammoniac and mercury, conjoined with the internal exhibition of burnt sponge and occasional purgatives."—(See *Edin. Med. and Surgical Journal, vol.* 4, *p.* 280.)

We learn from Professor Odier, that, in Geneva, bronchocele used to be cured by burnt sponge exhibited in powder or infused in wine, and combined with purgatives to prevent the cramps of the stomach, which sometimes accompany the disappearance of the swelling. Muriate of barytes has likewise been recommended.—(See *Manuel de Médecine Pratique.*)

Mr. Wilmer, credulously imputing great influence to the changes of the moon, used to begin with an emetic the day after the full moon, and to give a purge the ensuing day. The night following and seven nights successively he directed the above-mentioned lozenge to be put under the tongue at bedtime, and administered every noon a bitter stomachic powder. On the eighth day the purge was repeated, and in the wane of the succeeding moon, the whole process, except the emetic, was renewed.—(*Cases in Surgery, Appendix.*) This, which is often called the Coventry plan of treatment, is said to be greatly assisted by rubbing the tumour with an ointment containing tartar emetic.

Prosser succeeded with his medicines, though the patient was nearly twenty-five years old, and the swelling had existed more than twelve years. It is said, that no instance of cure has been known after the patient was twenty-five. Prosser orders one of the following powders to be taken early in the morning, an hour or two after breakfast and at five or six o'clock in the evening, every day, for a fortnight or three weeks. The powder may be taken in a little syrup or sugar and water: ℞. Cinnab. ant. op. levigat. milleped. ppt. et pulv. ää gr. xv. Spong. calcin. ʒj. M.

These powders should be taken for two or three weeks, and then left for a week or nine days before a repetition. At bedtime every night, during the second course of the powders, some purgative pills composed of mercury, the extractum colocynthid. comp. and rhubarb, are to be administered; and in general it will be proper to purge the patient with manna or salts, before beginning with the powders. Prosser put no faith in external applications.

Some have recommended giving two scruples of calcined egg-shells every morning, in a glass of red wine; half a drachm of the sulphuret of potash every day, dissolved in water; or ten or fifteen drops of the *tinct. digit.* twice a day, the dose being gradually increased. Muriated barytes, cicuta, and belladonna have also been exhibited. Postiglione commends the muriate of lime as a medicine possessing great efficacy. The remedy is made in a bolus with honey, to which is sometimes added burnt sponge, with cinnamon in powder. He employs also frictions with flannel, liniments, and sometimes purges with calomel. The bolus is placed under the tongue, and allowed to dissolve there.—(*P.* 59, *&c.*)

Sir J. Wylie, physician to the emperor of Russia, prescribes three grains of the submuriate of mercury, three of the ammoniacal muriate of iron, four of burnt sponge, and ten of the bark of laurus cassia, divided into twelve doses, one of which is given twice a week with a gentle anodyne at night. He also directs twenty-four lozenges to be made, by triturating an ounce of burnt sponge with an equal quantity of the powder of gum arabic, and fifteen grains of cinnamon, first blended with a sufficient quantity of the syrup of orange-peel. One of these lozenges is put under the tongue daily and allowed to dissolve there. Lastly, to the tumour itself he applies a plaster composed of half an ounce of litharge, a drachm of the submuriate of mercury, and 10 grains of antim. tartariz.—(*Alibert, Nosol. Nat. t.* 1, *p.* 474.)

The virtues of burnt sponge in the cure of certain forms of bronchocele are now ascertained to be owing to the iodine which it contains. Iodine was discovered in 1813 by Courtois, manufacturer of saltpetre at Paris; but six years elapsed before it was tried as a medicine. From the first memoir of Dr. Coindet, addressed in 1820 to the Helvetian Society of Natural Sciences, it appears, that as he was searching for a formula in the work of Cadet de Gassicourt, he found that Russel had recommended the ashes of the *fucus vesiculosus*, or bladder wrack, under the name of æthiops vegetabilis, for the cure of bronchocele; and he was led from analogy between this substance and burnt sponge, so long celebrated for its efficacy in the treatment of bronchocele, to suspect that iodine was the active principle of both. "The great and unequalled success which resulted from its use in the treatment of bronchocele, at once indicated the power of iodine as a therapeutic agent, and encouraged Dr. Coindet to pursue his researches in rendering it an efficient article of the materia medica; and about the close of the same year, when Dr. Coindet had employed iodine in treating goitre for six months at least, his conjecture was confirmed by the discovery which Dr. Fyfe of Edinburgh made, that this substance was actually contained in the ashes of the burnt sponge," &c.

"It has been generally understood among the profession, that the happy conjecture which introduced iodine into medical treatment, originated with Dr. Coindet, of Geneva; yet we find that his claim to this honour is disputed by one of his countrymen, Dr. J. C. Straub, of Hofwyl, in the canton of Berne.

Dr. Straub, whose communication is found in Professor Meisner's Physical Intelligence of the General Helvetian Society for 1820, states, that before the discovery of iodine, attempts had been made to compound a substitute for burnt sponge, but without success; and that this failure and his observation of the similarity of smell between iodine, burnt sponge, and other marine productions, led him to suspect the existence of iodine or its salts in these substances, and that its absence in the artificial compounds was the cause of failure in these experiments. This conjecture, which appears to have been made previously to 1819, led Dr. Straub to examine the real burnt sponge, and he informs us, that though his time did not permit him to ascertain exact quantities, yet he obtained from 1½ oz. of burnt sponge as much iodine as to render his conjecture probable, and to be astonished that the ingredient should have escaped notice. He was therefore at once induced to think of its use in medicine; and in the same paper from which we obtain these facts, impressed with the poisonous quality ascribed by Orfila to iodine, he recommended first the trial of its salts, especially the hydriodates of soda and lime, and then that of the substance itself.

The communication of Dr. Straub is dated Dec. 1819, and was actually published in Professor Meisner's periodical work in February, 1820, five months at least before the first memoir of Dr. Coindet was communicated to the Helvetian Society of Natural Sciences at Geneva. It is unnecessary to have recourse to any supposition of injustice done to Dr. Straub; much less would it be right to deprive Dr. Coindet of the merit of originality in substituting the direct and certain action of iodine, for the irregular and sometimes inert qualities of burnt sponge in the treatment of goitre. Coincidence of this kind is not uncommon in science; in the present instance, the ingenuity of Dr. Straub does not diminish the merit of Dr. Coindet."—(See *Edin. Med. and Surg. Journal, No.* 80, *p.* 210, *&c.*)

That iodine is a medicine of considerable efficacy in

bronchocele, not a doubt can be entertained, after the many cases now recorded in proof of the fact; and that it will be found useful in some other chronic tumours, especially those of a scrofulous nature, seems highly probable, if such probability be no already converted into certainty. In bronchocele, friction with the ointment on the swelling may often be advantageously conjoined with the use of one of the preparations for internal exhibition.

In the *Archives Générales de Médecine* for July, 1823, Dr. Coster mentions the opportunity which he had had of remaining eight months at Geneva with Dr. Coindet, and of observing correctly the good effects of iodine in enlargements of the thyroid gland and in scrofulous tumours. Dr. Coindet first of all employed this medicine under the form of alcoholic tincture, and obtained very surprising effects from its administration in goître. He next tried friction on the tumour itself with an ointment composed of the hydryodate of potass and lard; and the success of this practice was so great, that of nearly one hundred individuals affected with goître, whose cases Dr. Coster collected, more than two-thirds were completely cured by it. Soon after these successful results, iodine was employed sometimes internally and sometimes in the form of friction in scrofula. "I shall not affirm (says Dr. Coster) that success was as uniform in the latter as in the former disease, but it is certain, that scrofulous tumours yield sooner to the action of iodine than to that of any other remedy at present known: when the tumours, whether of the thyroid gland, or of the lymphatic glands, are hard and renitent, experience proves, that the effects of iodine are much more prompt when the frictions are preceded by the application of leeches and a low regimen. Notwithstanding these precautions, however, the tumour sometimes continues stationary." In such a case, Dr. Coster put the tumour twice a day, for ten or twelve minutes, under the influence of the positive pole of the voltaic pile, taking care to change sides each time of using it; so that, in the morning, he made use of friction with iodine on the right side and the action of the pile on the left, and in the evening applied the friction to the left side and the galvanism to the right. In twenty days not the least trace of the bronchocele was left. It is stated, that in this instance, the voltaic pile, unassisted with the frictions of iodine, was as ineffectual as the friction by itself had been. By the internal and external use of iodine, I lately dispersed a bronchocele which had formed in the neck of a young lady, aged about 12, who was brought to my house by my neighbour Mr. Blair. The disease began to diminish in less than a week from the commencement of the treatment, and in six weeks the cure was complete. An interesting case, in which a similar plan was attended with success, is recorded by Dr. Roots.—(See *Med. Chir. Trans. vol.* 12, *p.* 310.) Another instance of its decided efficacy is reported by Dr. Barlow, of Bath (see *Edin. Med. Journ. No.* 79, *p.* 337); but whoever wishes to have a large and convincing body of evidence on this point, should consult the cases and observations published by Dr. Manson, of Nottingham, where bronchocele is said to be endemic. He gives the results of one hundred and twenty cases of bronchocele in which he administered iodine. Fifteen were in males, and one hundred and five in females. When the disease was complicated with diseased lymphatic glands, the thyroid gland first yielded and then the others. In the fourth case a scrofulous swelling of the foot yielded during the use of iodine. Of the hundred and twenty cases referred to, eighty-seven were cured, ten much relieved, and only two or three discharged without relief.—(See *Manson's Medical Researches on the Effects of Iodine in Bronchocele, Paralysis, Chorea, Scrofula, Fistula Lachrymalis, Deafness, Dysphagia, White Swellings, and Distortions of the Spine. Lond.* 1825.) Some farther notice of this gentleman's practice, as well as the results of Mr. Buchanan's experience will be taken in the articles *Ear, Iodine, Joints, Scrofula, Vertebræ, &c.* For the preparation and doses of *Iodine, see this word.*

In South America, a remedy for bronchocele called *aceyte de sal*, was found, by M. Roulin, to contain a proportion of iodine.—(See *Magendie, Journ. de Physiologie, t.* 5, *p.* 273.) The same gentleman has also proposed the trial of chlorine, or the free hydro-chloric acid.

Petit, Heister, and Schmucker make mention of inveterate bronchoceles which gradually subsided in consequence of suppuration. Volpi states, that such ulcerations are not unfrequent. He has published two facts of this kind which occurred after a nervous fever; and he records a third case, where the swelling inflamed in consequence of a blow, suppurated, and sloughed so as entirely to disappear.—(See *Léveillé, Nouvelle Doctrine Chir. t.* 4, *p.* 128.) A similar fact is recorded by Zipp.—(*Siebold, Samml. Chir. Beob. b* 2, *p.* 229.)

The disease in its inveterate form has also been sometimes removed by the application of caustic (*Mesny in Journ. de Médecine, t.* 24, *p.* 75; *Timæus, Cas. p.* 283); the establishment of issues (*Jeitteles, Obs. Med.*); the making of an incision into the swelling, or the introduction of a seton through it.—(*Foderé, Essai sur le Goître et le Crétinage, p.* 75; *Klein, in v. Siebold, Sammlung Chir. Beobacht, b.* 2, *p.* 11; *Flajani, Collezione d'Osservazioni di Chirurgia, t.* 3, *p.* 283.)

Bronchoceles have sometimes been removed by the part having been accidentally or purposely burnt to a considerable depth (*Motte, in Blegny, Zodiac. ann.* 2 *Febr. Obs.* 11; *Severinus de Efficaci Medicina, p.* 220.) The disappearance of bronchoceles has also been known to follow a wound.—(*Schmidmüller über die Ausführungsgänge der Schilddruse, p.* 37, *Landshut*, 1805.) A. Burns sometimes employed blisters, and found them useful.—(*Surgical Anatomy of the Head and Neck, p.* 204.) With respect to caustic, which is spoken of by Celsus (*lib.* 7, *cap.* 13), Flajani states, that its operation is tedious and painful, and attended with danger; and what he says about the practice of an incision is not more encouraging. When the disease contains a cyst, he prefers making an opening with a trocar, though he confesses that this plan is apt to be followed by a relapse, when the cyst is very thick and hard; in which circumstance, it will be necessary to have recourse either to an incision or the seton, for the purpose of exciting suppuration. Should the disease, however, be merely composed of one cyst of moderate size, Flajani recommends its entire removal. "Of all these methods (says he) proposed for the extirpation of bronchoceles, the seton is the least dangerous, and by means of it a radical cure may be generally effected without any severe symptoms, as I have found by experience in many cases. On the contrary I have been an eye-witness of the fatal consequences induced by the other plans. I was called to assist a gentleman, about forty years of age, brought to death's door by a bleeding, which arose from the application of caustic to the forepart of the neck. As tourniquets, bandages, &c. proved quite ineffectual, it was indispensable to make pressure on the part with the finger of an assistant, for twenty-four hours, ere the hemorrhage could be stopped; a copious suppuration ensued; and it was three months before the parts were healed. I was likewise present (says he) at the opening of a similar, but larger swelling in the same situation, the disease having afflicted an elderly respectable patient for several years. The incision caused the evacuation of a small quantity of serum, contained in the cellular membrane; but the following day the tumour inflamed, the difficulty of respiration increased, and for some days the patient was in great danger. At length suppuration was established, followed by a destruction of a great deal of the cellular membrane and several sinuses, and in five months the patient lost his life. On examination of the body, the lungs were found tuberculated, an effect of the impediment to the circulation of the blood through the smaller vessels of those organs."—(*Flajani, Collezione d'Osserv. t.* 3, *p.* 283, 8*vo. Roma*, 1802.)

The first proposer of the employment of setons for the cure of diseases of the thyroid gland, is perhaps not exactly known; but it is certain that the method has been known, and occasionally practised, ever since the middle of the last century. "Dr. Monro, senior, (as a well informed writer has observed) mentions in his lectures that he has seen a dropsy in the centre of the gland, complicated with bronchocele, cured by a seton, although the glandular swelling still continued."—(*A. Burns on the Surgical Anatomy of the Head and Neck, p.* 191.) This statement is given on the authority of some MS. notes taken by Dr. Brown, from Dr. Monro's lectures. According to Girard, many cases in his time had been communicated to the Royal

Academy of Surgery at Paris, in which the disease had been got rid of either by means of a seton, drawn through the swelling, or the application of an issue.—(*Lupiologie, &c. 8vo. Paris*, 1775. The occasional success of setons was also adverted to by Richter in the year 1788.—(*Bibliothek, b. 9, p. 478.*) And the plan is spoken of in another work, published in 1790, as being eligible where the disease is conjoined with a cyst.—(*Encyclopédie Méthod. partie Chir. t. 1, p. 231.*) The practice was particularly noticed by Foderé in his valuable treatise on bronchocele; and Alibert mentions the seton as being used at the Hospital St. Louis.—(*Nosol. Nat. t. 1, p. 466, fol. Paris*, 1817.)

In November, 1817, Dr. Quadri, of Naples, tried this practice, which he erroneously supposed to be quite new. "By means of a trocar-pointed needle, six and a half inches long, I passed (says he) a seton from above downwards through the gland, at the depth of about four lines from its surface. Suppuration took place in forty-eight hours. On the 18th of November the seton escaped, when the matter was squeezed out; and the irritation occasioned by replacing it, produced an abscess on the right side of the neck, which was opened on the 23d, when it was found that the suppuration had effected the destruction of nearly the whole gland." The woman, who was thirty-six years of age, was seen by Dr. Somerville, in April, 1818, with the circumference of her neck lessened, from sixteen to thirteen inches, French measure. In another case referred to, a seton was passed through each side of the thyroid gland, and the result was a removal of the tumour on the side where the seton was maintained long enough; but on the opposite side the seton being withdrawn too early, the matter collected in a sac; and at the end of four months a sinus and discharge still continued, the patient refusing to have a counter opening practised. When the seton does not prove stimulating enough, Dr. Quadri sometimes enlarges it, or attaches to it escharotic or irritating substances. He also frequently uses two setons. In one example, in endeavouring to perforate the gland rather deeply, Dr. Quadri appears to have injured the larger branches of the thyroid arteries, as more than an ounce of blood was discharged, and the tumour swelled as if injected with blood. The bleeding, however, ceased spontaneously. He states that the seton has been passed through the tumour not less than sixteen times, the direction being varied in every instance, without untoward accident; and he is confident, that unless the needle be pushed deep enough almost to touch the thyroid cartilage, the trunks of the thyroid arteries will not be exposed to injury, while the branches in the track of the needle will not cause any danger. He insists also upon the propriety of retaining the seton in the tumour a considerable time; and observes, that it remains to be ascertained whether this practice will answer in every description of bronchocele? For these and several other cases and particulars, the profession is indebted to Dr. Somerville.—(See *Med. Chir. Trans. vol. 10, p. 16, &c.*)

Mr. Gunning applied a seton in a case of bronchocele in St. George's Hospital; but in this instance the irritation brought on sloughing, and the patient after a time died. The particulars of this case, and of three successful examples of the practice in England, have been lately recorded. One of the successful cases was treated by my friend Mr. James, of Exeter, another by Mr. A. C. Hutchison, who has taken the trouble to collect the history of them, and the third by Dr. A. T. Thomson.—(See *Med. Chir. Trans. vol. 11, p. 235.*) Percy and Dupuytren have also employed setons in bronchocele with success. The plan, however, is sometimes inefficient, as is proved by two cases under Dr. Kennedy, of Glasgow.—(See *London Med. Repository, No. 99, Feb.* 1822.) The exact nature of cases relieved by this practice, and their difference from other examples, which are benefited by treatment of a different kind, are still desiderata in surgery.

The diseased thyroid gland has been successfully extirpated; but the operation is one of so much danger, that it ought never to be attempted except under the most pressing circumstances. The many large arteries naturally distributed to the gland itself; their still greater size in bronchocele; and the vicinity of the carotid arteries, and important nerves, render the undertaking a thing of no common difficulty.

Mr. Gooch relates two cases, which do not encourage practitioners to have recourse to the excision of enlarged thyroid glands. In one, so copious an hemorrhage took place, that the surgeon, though equally bold and experienced, was obliged to stop in the middle of the operation. No means availed in entirely suppressing the bleeding, and the patient died in a few days. In the other, the same event nearly took place, the patient's life being saved only by compressing the wounded vessels with the hand, day and night, for a whole week, by persons who relieved each other in turn. This was found the only way of stopping the hemorrhage, after many fruitless attempts to tie the vessels.

Hemorrhage is not the only risk: Dupuytren removed a large bronchocele that caused dangerous pressure upon the trachea: the whole gland was taken away, and the four thyroid arteries and many veins secured. Only a few spoonfuls of blood were lost. The woman, however, died soon after the operation, with pale face, hurried respiration, cold skin, sickness, &c., denoting injury of some important nerves.

I do not mention these facts to deter surgeons from the operation altogether, because it is proved by modern experience, and especially by six cases in which Dr. Hedenus, of Dresden, has successfully removed the thyroid gland, that not only it is occasionally a necessary proceeding, but one that may be well accomplished by a skilful operator, as will be particularly explained in a future article.—(See *Thyroid Gland.*) When bronchoceles by their pressure dangerously obstruct respiration, deglutition, and the return of blood from the head; and when the disease resists the efficacy of iodine, a seton, blisters, and every other plan of treatment found deserving of trial; what can be done with the view of saving the patient, but the bold operation of cutting away the swelling, or that of exposing and tying one or both of the upper thyroid arteries?

When the quantity of blood flowing into a tumour is suddenly and greatly lessened, the size of the swelling commonly soon undergoes a considerable diminution. The experiment was once made by Sir W. Blizard: he tied the arteries of an enlarged thyroid gland, and, in a week, the tumour was reduced one-third in its size. The ligatures then sloughed off, repeated bleeding took place from the arteries, and by the extension of hospital gangrene, the carotid itself was exposed. The patient died; yet, as Mr. A. Burns observes, this does not militate against a repetition of the experiment; as the same thing might have happened from merely opening a vein, and, in the confined air of a hospital, has actually happened.—(*Surgical Anatomy of the Head and Neck, p. 202.*)

In fact, the rationality of the experiment prevented surgeons from being intimidated by the failure in question; and, with that laudable spirit for the improvement of operative surgery every where diffusing itself through the profession, other gentlemen were soon found who had judgment enough to make farther trials of the practice. In a young man, twenty-four years of age, whose breathing was much impeded by a bronchocele, and whose upper thyroid arteries were very large, and affected with strong pulsations, Walther, of Landshut, tied the left of these vessels, the left side of the gland being the largest. The operation was done on the 3d of June, 1814. An incision, an inch and a half in length, was made in the direction of the inner edge of the sterno-cleido-mastoid muscle, where the throbbing of the artery was quite distinct. By a second stroke of the knife, the platysma-myoides was divided in the same direction, and to an equal extent. The vessel was then exposed by a cautious dissection, and separated from the surrounding parts, and one arterial branch which was divided was immediately secured. A ligature composed of three silk threads, was then conveyed with an aneurism-needle under the left thyroid artery, and tied with two simple knots. The wound was then closed with adhesive plaster, and the ends of the ligatures brought out at the angles. The ligature on the large artery came away on the 12th day; and, without any febrile symptoms, or other bad consequences, the wound was perfectly healed on the 23d day. As early as the third day after the application of the ligature, the left part of the tumour began to be less tense, and the throbbing feel in it soon ceased. By degrees it dwindled away, becoming as it lessened harder, and, as it were, cartilaginous. In a

fortnight, the left half of the swelling was one-third smaller than before the operation; and, at length, only one-third of it remained, while the right side also was somewhat smaller. On the 17th of June, Walther took up the right superior thyroideal artery, which was more difficult to get at, as it lay more deeply, and was much concealed under the enlarged gland, which had pushed it out of its natural situation. The operation lasted three-quarters of an hour, and several large and small arteries which were cut were tied. With respect to the thyroid artery itself, it could not be tied without including a part of the gland in the ligature. No unfavourable symptoms followed this second operation; the ligatures were detached in good time, and the wound healed up very well. The right portion of the bronchocele also now diminished; but though it was originally smaller than the left, it did not dwindle away so completely as the latter. The remains of the tumour, however, two years afterward, produced no inconvenience, and respiration was quite easy.—(See *Neue Heilart der Kropfes, &c. von Ph. Fr. von Walther*, p. 25, *&c.* 8vo. *Sulzbach*, 1817.) On the 29th of December, 1818, Mr. H. Coates, of Salisbury, took up the superior thyroideal artery for the cure of a bronchocele, which, in a young woman aged seventeen, made pressure on the trachea and œsophagus, attended with a great noise in breathing. The superior thyroideal arteries were in this instance large, and pulsated strongly. Mr. Coates cut down upon the left of these vessels, separated it from its accompanying nerve, and passed under it a small round ligature, which was drawn moderately tight and tied. The next day there was headache, and some swelling of the neck and side of the head, with increased difficulty of swallowing and febrile symptoms. These complaints, however, were relieved by bleeding and antimonial medicines. The ligature came away on the 9th day; and on the 14th, the wound was completely healed. On the 14th of February, the breathing being much improved, and the tumour reduced nearly to one-half of its former size, the patient was well enough to be discharged from the infirmary.—(See *Med. Chir. Trans. vol.* 10, *p.* 312.) My friend, Mr. Rose, once mentioned to me a case, in which a similar operation done by Mr. Brodie, did not produce any material diminution of the tumour.

Dr. Parry has remarked a frequent coincidence, either as cause or effect, between enlargement of the thyroid gland and cardiac diseases.—(*Elements of Pathology, &c. p.* 181.) And another modern writer mentions, that he has lately seen three cases of this complication.—(*Medico-Chir. Journ. vol.* 1, *p.* 181.) A case is detailed by Flajani, where the disease was accompanied with extraordinary palpitations of the heart.—(See *Collezione d'Osservazioni, &c. di Chirurgia, t.* 3, *p.* 270.) In the instance here referred to, there was great irregularity of the pulse, and the oppression of the breathing was such, that the patient was obliged to submit to venesection at least every month, whereby he was rendered quite emaciated.

[The prevalence of goitre in different parts of the U. States is stated by our author, and several American writers have described the disease as existing in various parts of our country, whose geological features very widely differ in many respects. In Vermont, in New-York, in Pennsylvania and Ohio, the disease is by no means unfrequent. Professors Barton and Gibson, of Philadelphia, have communicated many valuable observations on this disease. More recently, Professor Francis, of New-York, has made a series of observations on goitre as it appears in the western part of the state of New-York. From the communication with which he has politely favoured me, the following abstract is prepared. I may add, that agreeably to the facts deduced from the changes which our country undergoes in the progress of improvement, we have the strongest reasons to infer that as the climate and cultivation are meliorated, the instances of the existence of this disease will doubtless become less frequent.

However frequent cases of goitre may have formerly been in the state of New-York, the fact is certain, that they are much more rare at present. Even the representations of the late Dr. Dwight, relative to the great prevalence of the disease, though among the most recent with which we have been favoured, are to be received with allowance. That in particular portions of our western country repeated examples are to be found, may be known by any accurate observer. But "in the village of Utica, (says Dr. Francis) which contains between 4 and 5000 inhabitants, no case of bronchocele could be pointed out, and this village occupies the site of old Fort Schuyler, on the Mohawk, the vicinity of which has been referred to as the spot where goitre was peculiarly prevalent. I am strengthened in the accuracy of this statement relative to the almost total disappearance of goitre in this neighbourhood, by the testimony of Dr. Coventry. A similar remark may be made with regard to the former frequency of the disease throughout the extensive region from Utica to Buffalo. The late Uriah Tracy, in his excursion through this country some years since, was led to believe that bronchocele prevailed in the old settlements as well as the new, and thought it incidental to the country at large. In my late visit I made special inquiry as to the present condition of the health of the inhabitants, and am persuaded that the instances of goitre are much more rare than at the period of Mr. Tracy's observations. The number of cases which came under my notice during the tour were twenty-three. These were at Herkimer, Manlius, Syracuse, Onondaga, Batavia, Williamsville, and Buffalo; and I saw more cases in the neighbourhood of Buffalo than at any other place. In other parts of the state the disease may be seen, particularly in the county of Alleghany."

To assign a satisfactory cause for this disease is difficult, perhaps impossible. Dr. Barton has endeavoured to show that goitre and intermittent and remittent fevers have one common origin, and argues this opinion from the simultaneous prevalence of these diseases, from the frequency of glandular affections where intermittents abound, and from the opinion that persons afflicted with goitre are exempt from intermittents, though in the midst of these diseases. Dr. Coventry inclines to ascribe it to drinking water impregnated with alum. Dr. Dwight advocates the more current opinion that these affections originate from the lime contained in the water drank in those regions. Dr. Francis ascribes the production of the disease chiefly to humidity, and hence it prevails most in the vicinity of lakes and rivers where vegetation abounds. He says, it increases with the rainy seasons, and is diminished when the weather becomes cold and dry, and hence argues the reason of its disappearance as the country becomes cleared. He however does not altogether reject the agency of certain waters in aggravating if not producing the disease.

Of the 23 cases examined by Dr. Francis, two only were in male subjects, and one of them an adult Indian, in Niagara county. He saw it in an infant but a few months old, and he subscribes to the opinion that it often depends on constitutional causes, and is sometimes hereditary.

In Oneida county, Dr. Francis learned that goitre prevailed among sheep, and Foderé gives us a similar fact of its occurrence among dogs. The doctrines of Hunter and others, in considering the sexual functions connected with this disease, are sustained by its greater prevalence among women, and also according to Dr. F. by some well-known facts connected with parturition.

Dr. Coventry has removed several cases of goitre by the simple expedient of the patient wearing the muriate of soda about the neck. The recent plan of Mr. Holbrook, of employing steady pressure, has been tried in this country with some success. The efficacy of burnt sponge has often been seen, but instances of its failure are not unfrequent. The iodine has been used of late years with the best effects, and Dr. Congdon, of Buffalo, has reported its entire success in a number of cases.

Dr. Francis informs me, that in a subsequent journey through this state, he found a number of interesting cases, and that the disorder in every instance afflicted the female sex, and in eight or ten cases it was obviously associated with the function of menstruation and parturition. The left portion of the gland was most frequently the seat of the disease, but in no instance was it connected with idiocy. He reports one instance of the entire cure of a formidable case which occurred in a young married female, who, upon leaving the neighbourhood of Catskill and removing to the southern states, after a residence of three years, was entirely relieved of her goitre.

I can add my own testimony to the value of the iodine, having witnessed its success in a number of cases which had resisted the other remedies ordinarily employed.

The operation of removing the gland by the knife has been performed in this country with success, but is seldom advised, and will not be often repeated.—*Reese.*]

Albucasis gave the first good account of bronchocele. Wilmer's Cases and Remarks in Surgery, with an Appendix on the Method of curing the Bronchocele in Coventry, 8vo. *Lond.* 1779. *Prosser, An Account and Method of Cure of Bronchocele, or Derby-neck*, 8vo. *Lond.* 1769. *Also*, 3d *edit.* 4to. *Lond.* 1782. *Memoirs of the Med. Society of London, vol.* 1. *Gooch's Chirurgical Works, vol.* 2, *p.* 96; *vol.* 3, *p.* 157. *Desault's Parisian Chirurgical Journal, vol.* 2, *p.* 292. *Œuvres Chirurgicales de Desault, par Bichat, t.* 2, *p.* 298. *V. Malacarne, Lettre sur l'Etat de Cretin: (Frank, Del. Op.* 6.) *Edin. Med. and Surgical Journ. vol.* 4, *p.* 279. *Odier's Manuel de Médecine Pratique*, 8vo. *Genève*, 1811. *Dr. Reeves's Paper on Cretinism, in Edin. Med. and Surg. Journal, vol.* 5. *Traité du Goître, et du Cretinisme, par F. E. Fodoré*, 8vo. *Paris, an* 8. *Richter's Anfangsgründe der Wundarzneykunst, b.* 4, *kap.* 13, *von Kropfe. Surgical Anatomy of the Head and Neck, by A. Burns, p.* 191, *&c. Larrey, Mémoires de Chirurgie Militaire, tom.* 1, *p.* 123; *t.* 3, *p.* 199, *&c. J. F. Ackermann, über die Kretinen, eine besondere Menchenabart in den Alpen.* 8vo. *Gotha*, 1790. *B. S. Barton, A Memoir concerning the Disease of Goître, as it prevails in different parts of North America*, 8vo. *Philadelphia*, 1800. *Memoria Patologico-Practica sulla Natura di Gozzo, &c. del Dottor Prospero Postiglione*, 12mo. *Firenze*, 1811. *Kortum, Comment. de Vitio Scrofuloso, t.* 2. *Giuseppe Flajani, Collezione d' Osservazioni e Riflessioni di Chirurgia, t.* 3, *p.* 270, *&c.* 8vo. *Roma*, 1802. *Quadri, in Med. Chir. Trans. vol* 10, *p.* 16. *Dict. des Sciences Méd. art. Bronchocele. Ph. Fr. Walther, Neue Heilart des Kropfes durch die Unterbindung der obern Schildrusen Schlagadern nebst der Geschichte eines durch die Operation geheilten Aneurismäs der Carotis* 8vo. *Sulzbach*, 1817. *H. Coates, in Med. Chir. Trans. vol.* 10, *p.* 312, *&c. Gautieri Tyroliensium, Carynthiorum, Styriorumque Struma; Viennæ*, 1794. *Maas, Diss. de Glandula Thyroidea tam Sana quam Morbosa, &c. Wirceb.* 1810. *Hausleutner, über Erkenntniss, &c. des Kropfes, in Horn's Archiv. b.* 13, 1813. *Mühlbach der Kropf. nach seiner Ursache, Vehütung, und Heilung. Wien*, 1822. *Hedenus, Tractatus de Glandula Thyroidea, &c. Lips.* 1822. *Lassus, Pathologie Chirurg. t.* 1, *p.* 408, *&c. Petit, Œuvres Posthumes, t.* 1, *p.* 255. *Haller, Opuscula Pathologica, Obs.* 5, *p.* 16. *J. L. Alibert, Nosologie Naturelle, t.* 1, *p.* 464, *&c. fol. Paris*, 1817. *A. C. Hutchison, Cases of Bronchochele, or Goître, treated by Seton: Med. Chir. Trans. vol.* 11, *p.* 235, *&c. A. de Humboldt, Observations sur quelques Phénomènes peu connus qu' offre le Goître sous les Tropiques, dans les Plaines et sur les Plateaux des Andes; in Journ. de Physiologie par F. Magendie, t.* 4, *p.* 109, 8vo. *Paris*, 1824. *Observations on the remarkable Effects of Iodine in Bronchocele and Scrofula; being a translation of three Memoirs published by J. R. Coindet, M. D. Lond.* 1821. *J. C. Straub, in Naturwissenschaftlicher Anzeiger der Allgemeiner Schweizerischer Gesellschaft, &c. herausgegeben von Fr. Meisner*, 4to. *Bern. Feb.* 1820. *Brera, Saggio Clinico sull' Iodio, &c. Padova*, 1822. *W. Gairdner, L. D., Essay on the Effects of Iodine, with Practical Observations on its use in Bronchocele, Scrofula, &c. Lond.* 1824. *H. S. Roots, in Med. Chir. Trans. vol.* 12, *p.* 310. *Coster, in Archives Générales de Médecine, Juillet*, 1823. *J. Kennedy, in Lond. Med. Repository for Feb.* 1822. *Dr. A. Manson, Medical Researches on the Effects of Iodine in Bronchocele, &c. Lond.* 1825. *M. Roulin, Note sur quelques Faites relatifs à l' Histoire des Goîtres; in Magendie's Journ. de Physiologie Expér. t.* 5, *p.* 266. *J. A. W. Hedenus, Ausrottung der Schildrüse, in Journ. der Chir. von C. F. Graefe und Ph. Von Walther, b.* 2, *p.* 237, *&c. or Journ. of Foreign Medicine, vol.* 5, *p.* 317, *&c. For the best plates of the disease see Dr. Baillie's Series of Engravings, &c. fasc.* 2, *tab.* 1.

BRONCHOTOMY. (From βρόγχος, the windpipe, and τέμνω, to cut.) This is an operation by which an opening is made into the larynx or trachea, either for the purpose of making a passage for the air into and out of the lungs, when any disease prevents the patient from breathing through the mouth and nostrils; or of extracting foreign bodies, which have accidentally fallen into the trachea; or, lastly, in order to be able to inflate the lungs in cases of suspended animation. The operation is also named *tracheotomy*. Its practicable nature and little danger are founded on the facility with which certain wounds of the windpipe, even of the most complicated kind, have been healed, and on the nature of the parts cut, which are not furnished with any vessel of consequence.

When the incision is made in the larynx, the operation is termed *laryngotomy*. With respect to bronchotomy, its performance cannot be regarded as either difficult or dangerous: "*Dummodo* (says Fabricius ab Aquapendente), *qui secat sit anatomes peritus, quia sub hoc medico et artifice omnia tutissimè et felicissimè peraguntur.*"

Bronchotomy is occasionally practised in order to enable the patient to breathe, when respiration through the mouth and nostrils is impeded by disease.

Cynanche laryngea sometimes creates a necessity for the operation, and this is particularly the case when the disease is situated in the edges of the rima glottidis, which opening becomes so contracted, as scarcely to leave the smallest space. For this reason, and on account of the tension of the ligaments of the glottis, the voice is rendered excessively acute and hissing, as it were. The suffocation is imminent; the lungs not being expanded, the blood accumulates in them, and the return of the blood from the head is more or less impeded. There can be little doubt, that many patients who have perished under these circumstances, might have been saved by a timely incision in the trachea. The majority of writers who have treated of bronchotomy as a means of preventing suffocation in inflammatory diseases of the larnyx, have regarded this operation as the ultimate resource. Both the Greeks and Arabians were of this sentiment; and Avicenna only recommends bronchotomy in violent cases of cynanche, when medicines fail, and the patient must evidently die from the unrelieved state of the affection. Rhazes also advised the operation only when the patient was threatened with death. Thus, in former times, though practitioners were aware of the principle on which bronchotomy became necessary, they generally found the operation fail, because it was delayed too long, and rarely done ere effusion had commenced in the lungs.

Bronchotomy, says Louis, will always be done too late, when only practised as an extreme measure. In cases of inflammation about the throat, the danger of perishing by suffocation, as this author remarks, has been known from the very dawn of medicine. The advice of Hippocrates to remedy this urgent symptom, is a proof of it; and he observes, that the danger is evinced when the eyes are affected and prominent, as in persons who have been strangled, and when there is great heat about the face, the throat, and neck, without the appearance of any external defect. He recommends *fistula in fauces ad maxillas intrudenda, quâ spiritus in pulmones trahatur.* No doubt he would have advised more, had it not been for the doctrine of his time, that wounds of cartilages were incurable.

This method, defective as it was, continued till the time of Asclepiades, who, according to Galen, was the first proposer of bronchotomy. Since Asclepiades, this operation has always been recommended and practised in case of quinsy threatening suffocation, notwithstanding the inculcation of Cælius Aurelianus, who treated it as fabulous. The mode of doing it, however, has not been well detailed by any body who put it in practice, except Paulus Ægineta, who is precise and clear. "We must (says he) make the incision in the trachea, under the larynx, about the third or fourth ring. This situation is the most eligible, because it is not covered by any muscle, and no vessels are near it. The patient's head must be kept back, in order that the trachea may project more forwards. A transverse cut is to be made between two of the rings, so as not to wound the cartilage, only the membrane." The knowledge of this method, and its advantages in cases of the *angina strangulans*, when practised in time, ought, according to Louis, to have rendered its performance a general practice.

The convulsive angina of Boerhaave, which particu-

larly affects those who can only breathe well in an upright posture, has also been adduced as a case demanding the prompt performance of bronchotomy. Mead, in his *Precepta et Monita Medica*, mentions a case, in which the patient had been bled very copiously twice in the space of six hours, but he died notwithstanding this large evacuation. The same author noticed in Wales, especially on the seacoast, an epidemic catarrhal quinsy, which carried the patients off in two or three days. In these instances, bleeding was not of much use, and bronchotomy, which was not performed, was the only means by which the patients might have been saved.

In angina and croup, some modern practitioners are less sanguine in their expectation of benefit from bronchotomy than Louis was. From the observations of Dr. Cheyne, it would appear that in croup, the operation cannot be necessary for the purpose of admitting air into the trachea; for in those who have died of the disease, he has found a pervious canal of two-eighths of an inch in diameter, and through a tube of such diameter, even an adult can support respiration for a considerable time. According to the same writer, bronchotomy is equally unfitted for the removal of the membrane formed by the effusion of lymph; for, from its extent, variable tenacity, and adhesions, this is, in almost every case, totally impracticable; and even could the whole membrane be removed, still the function of respiration would be but little improved, the ramifications of the trachea and bronchial cells remaining obstructed.—(See *Cheyne's Pathology of the Larynx and Bronchia.*)

No doubt, Dr. Cheyne's statement of what is found in the dead subject is correct; and yet the operation may be necessary to prevent suffocation, which might otherwise be induced, partly by the diminution of the natural passage for the air by disease, and partly by the action of the muscles of the glottis; a circumstance to which Dr. Cheyne has not assigned sufficient importance. On this point, the sentiments of Mr. C. Bell are more correct; speaking of the membrane of croup, formed by the effusion of coagulable lymph, and of the cause of death in these cases, he says, "It has not appeared to me that it was the violence of the inflammation which destroyed the patient, nor the irritation directly from the inflamed membrane; but that the presence of this secreted membrane, acting like a foreign bo y, at the same time occasions spasms in the glottis, obstructs the passage, and confines the mucus. But I am bound to state in the strongest terms, that death is ultimately a consequence of effusion in the lungs, occasioned by the continued struggle and difficulty; for on opening the chest I have uniformly found, that the lungs did not collapse, and that the bronchiæ were full of mucus. This corresponds with the symptoms; for, before death, the violence of the cough and struggle has given place to coldness and insensibility, with a pale swelling of the face and neck, and *when the child has fallen into this state, giving freedom to the trachea will be of no avail.*"—(*Surg. Obs. p.* 16.)

In the cases of croup which Mr. Chevalier examined after death, he found the trachea obstructed with mucus, and he believed, that it is more by this secretion than by that of coagulable lymph that suffocation is finally produced. At all events, he succeeded in saving a boy on the point of suffocation, by making an incision in the trachea, and letting out an ounce, or an ounce and a half, of reddish brown, frothy mucus. And a case, of a very similar description, in which the same practice answered, I attended, a few years ago, with Mr. Lawrence and Dr. Blicke. This case, however, was different from Mr. Chevalier's, in the circumstance of a tube being required for a couple of days after the operation, when the removal of the instrument was followed by no inconvenience.

Pelletan joins several modern writers in representing bronchotomy as generally useless in cases of croup; the only example in which he thinks the operation might be serviceable being that in whicht he disease is confined to the larynx; a case which he sets down as uncommon, and difficult to be distinguished. "*En supposant enfin l'angine avec concrétion bien caractérisée, on se trouvera encore entre la crainte de pratiquer une opération inutile, si les concrétions se prolongent jusque dans les bronches, et l'impossibilité de juger si ces concrétions sont bornées au larynx. C'est en effet dans ce seul cas que l'operation peut être fructueuse; elle facilitera la respiration pendant que la nature, aidée de l'art, travaillera à dissoudre, détacher, et faire expectorer les fausses membranes qui oblitèrent la glotte et le larynx.*"—(*Clinique Chir. t.* 1, *p.* 28.)

Of course, the degree of success which will attend the practice of bronchotomy, in cases of this nature, must always mainly depend upon the operation being done early enough, and in cases where the lungs are not too seriously affected; for if the effects of pneumonia are far advanced, the patient's chance of recovery will be hopeless, whether the trachea be opened or not. In order, also, to have a reasonable chance of success, in cases threatening suffocation from inflammation of the parts about the fauces, as sometimes happens, the operation must not be deferred too long. We see this fact exemplified in two cases recorded by Flajani; in one, where the operation had not been allowed till a late period of the disease, the patient died; in the other, where the practice was adopted earlier, life was preserved.—(*Collezione d'Osservazioni, &c. t.* 3, *p.* 230—233.)

A few years ago, Dr. Baillie published three cases, in which death was produced in the adult subject, and in a very few days, by a violent inflammation of the larynx and trachea. The disease had a strong resemblance to croup; yet was different from it. There was not the same kind of ringing sound of the voice as in croup, and no layer of coagulable lymph was formed upon the surface of the inner membrane of the larynx and trachea, which, according to Dr. Baillie, uniformly attends the latter disease. In one of these cases, the cavity of the glottis was found to be almost obliterated, by the thickening of the inner membrane of the larynx at that part. The inner membrane of the trachea was likewise inflamed; but in a less degree. The lungs were sound. If, in thirty hours, no relief should be derived from bleeding ad deliquium, and the exhibition of opiates, Dr. Baillie conceives, that, in this sort of case, it might be advisable to perform the operation of bronchotomy at the upper part of the trachea, just under the thyroid gland. This operation, he thinks, would probably enable the patient to breathe till the inflammation in the larynx, more especially at the aperture of the glottis, had time to subside.—(See *Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 3, *p.* 275. 289.)

An acute affection of the membrane of the glottis, proceeding rapidly to a fatal termination by suffocation, has also been particularly described by Drs. Farre and Percival.—(See *Med. Chir. Trans. vols.* 3 *and* 4.) In some bodies, which Mr. Lawrence examined after death, he found appearances analogous to those mentioned by the above physicians. "The patients died of suffocation: but the progress of the complaint was much slower than in those cases; the symptoms were not acute, nor did the inspection of the parts disclose any evidences of active inflammation. The membrane covering the chordæ vocales was thickened, so as to close the glottis, and a similar thickening extended to a small distance from these parts, accompanied with an œdematous effusion into the cellular substance under the membrane. The epiglottis did not partake of the disorder. In one or two instances, this thickened state of the membrane was the only change of structure observed; but in others it was attended either with ulceration of the surface near the glottis, appearing as if it had been formed by an abscess, which had burst, or with a partial death of one or more of the cartilages of the larynx, viz. the arytenoid, thyroid, or crycoid. The rest of the air-passages and the lungs were healthy."—(*Med. Chir. Trans. vol.* 6, *p.* 222.)

In such examples, this gentleman is a zealous advocate for the early performance of bronchotomy, and he has cited several instances in which this operation was successfully performed, both for the relief of quinsy and the extraction of foreign bodies from the trachea.

What Bayle called *l'œdeme de la glotte*, no doubt, was the same kind of disease as that noticed by Mr. Lawrence: one case of it, in which tracheotomy was performed with success, and another in which the patient died suddenly, suffocated in consequence of the operation not being done, have been published by Liston.—(See *Edin. Med. and Surg. Journ. vol.* 19, *p.* 568.)

The affections of the larynx, requiring bronchotomy, would seem, indeed, to be more numerous and diversified than is usually supposed: thus, Mr. C. Bell mentions the case of a medical student, who was attacked with shivering, fever, and sore throat, and in three days

died of suffocation. On dissection, no obstruction in the larynx was observed, but only an inflammation of its membrane, and a spot like a small-pox *pustule* upon the margin of the glottis.—(*Surgical Obs. part* 1, *p.* 14.)

Children sometimes inadvertently drink boiling water from the spout of a tea-kettle. "The effects of this accident (says Dr. Hall) are not, as might be supposed, *à priori*, the symptoms of inflammation of the œsophagus and stomach, but of inflammation of the glottis and larynx, resembling those of *croup;* and the case constitutes another instance, in which the operation of laryngotomy, or of tracheotomy, may be performed with the effect of preventing impending suffocation, and perhaps of saving life."—(*Med. Chir. Trans. vol.* 12, *p.* 2.) The cases and remarks collected by Dr. Hall, Mr Gilman, and Mr. Stanley, on this new subject, cannot fail to be highly interesting to practitioners. In a case of the foregoing description, Mr. Wallace, of Dublin, performed tracheotomy with success.—(See *Lond. Med. and Phys. Journ. for July*, 1822.) Mr. Burgess, who has seen five cases, in which boiling water was taken into the throat, thinks that death, when it follows, is almost always produced by, obstructed respiration. In one of the examples which he has recorded, bronchotomy was the means of saving the child.—(See *Dublin Hospital Reports, vol.* 3.)

Great mechanical injury of the larynx, caused by a blow or fall, may create the necessity for bronchotomy, as is proved by a case lately reported by Mr. Liston.—(See *Ed. Med. and Surgical Journ. vol.* 19, *p.* 570.)

[There is no inconsiderable diversity of opinion among eminent surgeons as to the propriety of performing bronchotomy in cases of croup; and those who oppose the operation, very plausibly allege, that in the membranous stage of croup no advantage can result from the operation, however favourable the condition of the sufferer may be in other respects. The views of the celebrated Cheyne would seem to put beyond doubt the inutility of the operation as already noticed by our author, because it is inadequate to the removal of the artificial membrane which is effused in the advanced stage of cynanche trachealis. I am not prepared, from my own experience, wholly to decide the difficulty. We have evidence sufficient, I think, to justify an occasional recourse to this exercise of surgical skill; but there is still another means of relief, not stated by our author, that may fitly be introduced here, which will often render this operation unnecessary, even in those cases in which it is confidently recommended by some, and certainly ought to be fully tested before we avail ourselves of so doubtful a remedy.

In that stage of croup which has been aptly termed the fatal stage, from its so generally proving such, and which is characterized by the existence of the membrane, the vitriolic emetics have been introduced with decided success.

This practice was first introduced by Professor Francis, of New-York, in 1813; and since the report of his success, has become very generally adopted in this country, and with singular success. I have now in my possession a specimen of an entire membrane lining the trachea, detached and thrown up under the powerful emetic action of the blue vitriol, after venesection, blisters, calomel, polygala senega, and all the approved remedies had been tried ineffectually.

I regret that the limits assigned me preclude my inserting the interesting detail of the cases reported by Dr. Francis, in his valuable paper published on this subject, and have to content myself with referring to the *N. Y. Med. and Phys. Journ. vol.* 3, *p.* 58, *et seq.*, only remarking, that in the almost hopeless state in which the sequela of inflammation are so threatening, *calomel*, in large doses, is among the most efficient auxiliaries to which we can have recourse. "After the existence of the membrane," observes Dr. F., "and when the powers of life are on the wane, it is a judicious and sometimes an available resource;" and he admits, that in the cases in which he found the vitriolic emetics successful, their agency was probably favoured by that potent mercurial.

I find a similar practice has been adopted by Dr. Hoffman, of Vienna, who first used the vitriolic emetics in 1820; and so highly does he estimate them, that he declares their action to be a *specific* in this stage of croup. This is unquestionably saying too much in their behalf; yet certainly they are entitled to high consideration, and ought never to be omitted in these almost hopeless cases.—*Reese.*]

2. The compression of the trachea by foreign bodies, lodged in the pharynx, or by tumours, formed outwardly, and of sufficient size to compress the windpipe, but not admitting of immediate removal, is an equal reason for operating more or less expeditiously, according to the symptoms. Mr. B. Bell mentions two instances of suffocation from bodies falling into the pharynx. Respiration was only stopped for a few minutes; but the cases were equally fatal, notwithstanding the employment of all the usual means. This author thinks, that bronchotomy would have been attended with complete success, if it had been performed in time. The operation should also be done, when the trachea is dangerously compressed by tumours. The author of the article *Bronchotomie*, in *l'Encyclopédie Méthodique*, says, that about twenty years ago he opened a man, who had died of an emphysema, which came on instantaneously. He had had, for a long while, a bronchocele, which was of an enormous magnitude towards the end of his life. The cavity of the trachea was so obliterated, that there was scarcely room enough to admit the thickness of a small piece of money. Doubtless, bronchotomy, performed before the emphysema made its appearance, might have prolonged this man's days.

In cases of this last description, Desault would have advised the introduction of an elastic gum catheter into the trachea from the nose, in order to facilitate respiration. This practice, I believe, has not hitherto been attempted by English surgeons.—(See *Œuvres Chir. de Desault, t.* 2, *p.* 236, &c.)

Habicot successfully performed this operation on a lad fourteen years old, who, having heard that gold, when swallowed, did no harm, attempted to swallow nine pistoles, wrapped up in a piece of cloth, in order to hide them from thieves. The packet, which was very large, could not pass the narrow part of the pharynx; and here it lodged, so that it could neither be extracted nor forced down into the stomach. The boy was on the point of being suffocated by the pressure which the foreign body made on the trachea; and his neck and face were so swollen and black, that he could not have been known. Habicot, to whose house the patient was brought, attempted in vain, by different means, to dislodge the foreign body. At length, perceiving the patient in evident danger of being suffocated, he resolved to perform bronchotomy. This operation was no sooner done, than the swelling and lividity of the face and neck disappeared. Habicot pushed the pieces of gold down into the stomach with a leaden probe, and the pistoles were, at different times, discharged from the anus, eight or ten days afterward. The wound of the trachea soon healed.—(See *Mem. de l'Acad. de Chirurgie, tome* 12, *p.* 243, *edit. in* 12*mo.*)

In such a case Desault would have introduced an elastic gum catheter into the larynx, instead of performing bronchotomy, which could not answer, were the foreign body low down.—(See *Œuvres Chirurg. de Desault, t.* 2, *p.* 247.)

3. Foreign bodies in the trachea may render it necessary to practise bronchotomy. Here I ought rather to say, perhaps, laryngotomy, which by several modern surgeons is deemed most applicable.—(*Desault; C. Bell, Surg. Obs. part* 1, *p.* 47, &c.)

Louis, in an excellent memoir on extraneous substances in the trachea, has proved, more convincingly than all other preceding writers, the necessity of the operation in circumstances of this kind. The following case fell under his observation.

On Monday, the 19th of March, 1759, a little girl, seven years of age, playing with some dried kidney-beans, threw one into her mouth and thought she had swallowed it. She was immediately attacked with a difficulty of breathing and a severe convulsive cough. The little girl said she had swallowed a bean, and such assistance as was thought proper was given her. Want of success was the cause of several surgeons being successively sent for, who vainly employed the different means prescribed by art for extracting foreign bodies from the œsophagus, or forcing them into the stomach. A fine sponge cautiously fastened to the end of a whalebone probang, was repeatedly introduced through the whole extent of the œsophagus. The little girl, who made a sign with her finger, that the foreign body was situated in the middle of the neck, thought that she felt some relief when the sponge was conveyed below the place which she pointed out. She had every now and then a violent cough, the efforts attending which produced convulsions in all her limbs. Degluti-

tion was unobstructed; and warm water and oil of sweet almonds had been swallowed without difficulty. Two whole days had been passed in sufferings, when the relations called in Louis. The little girl, with all possible fortitude and sense, was several times held in her friends' arms ready to die of suffocation. Louis, well aware of what had happened, came into the room where the patient was. She was sitting up in her bed, suffering no other symptom than a very great difficulty of breathing. Louis inquired where she felt pain, and she made such a sign in reply, as left no doubt concerning the nature of the accident. She put the index finger of her left hand on the trachea, between the larynx and sternum. The fruitless attempts which had been made in the œsophagus with a view of dislodging the foreign body; the nature and the smallness of this body, which was not such as would be stopped in the passage for the food; and the facility of swallowing, were negative proofs that the bean was not in the œsophagus. Respiration was the only function disturbed; it was attended with difficulty and a rattling in the throat. The little girl expectorated a frothy fluid, and she pointed out so accurately the painful point where the object producing all her sufferings was situated, that Louis did not hesitate to declare to the relations, from this single inspection, that the bean was in the windpipe, and that there was only one way of saving the child's life, which was to make an incision, for the purpose of extracting the foreign body. He apprized them, that the operation was neither difficult nor dangerous, that it had succeeded as often as it had been practised, and that the very pressing danger of the case only just allowed time to take the opinion of some other well-informed surgeons, respecting the indispensable necessity for such an operation. Louis thought this precaution necessary in order to acquire the confidence of the parents, and to shelter himself from all reproach in case the event of the case should not correspond with his hopes. Louis went home to prepare all the requisites for bronchotomy, and in two hours he was informed the surgeons who were consulted waited for him. After Louis went away, the child had become quiet, and was now lying on its side asleep. The opinion he had delivered had been ill explained by the friends and attendants, and had been discussed before his return. They who had been rendering their assistance, on the supposition that the foreign body was in the œsophagus, evinced surprise at the proposal of extracting by an operation a substance, the presence of which in any part of this tube was not obvious. Louis explained his advice in regard to bronchotomy, and did not expect a doubt to be set up against so positive a fact. It was objected, that a substance as large as a bean could not insinuate itself into the trachea. He brought every one into his sentiment by a short explanation of cases of this sort with which he himself was acquainted. The little girl was examined; she was better than when Louis saw her before, and a very palpable emphysema was seen above the clavicle on each side of the neck, a symptom which did not exist two hours previously. This swelling made Louis conclude, that the urgency for the operation was still greater. The friends, whose confidence had been shaken by the opposition he had experienced in bringing about unanimity, were in the greatest embarrassment when they were told, that the child might die of an operation which he had represented as only a simple incision free from all danger. Louis was repeatedly asked, if he would be responsible for the child's life during the operation, and he in vain replied, that if there were any thing to fear during the operation, it would be from the accident itself and not from the assistance rendered. This distinction was not perceived, and Louis withdrew, at the same time refusing his consent to the exhibition of two grains of emetic tartar, the effect of which would be useless and might be dangerous. The medicine was given in the night: the child was fatigued with its operation and quite unbenefited. On Tuesday morning, Louis found the little girl very quiet, and they who had paid their visits earlier, found her wonderfully well. The respiration, however, continued to be still attended with a rattling noise, which Louis had observed in the evening when the breathing was much more laborious. The child was nearly suffocated several times in the course of the day, and died in the evening, three days after the accident.

Bordenave, who had seen the patient, informed Louis of the child's death on Friday. The body was opened before a numerous assembly of persons. After making a longitudinal incision through the skin and fat along the trachea, between the sterno-hyoidei muscles, Bordenave slit open the trachea, cutting three of its cartilages. At this instant every one could see the bean, and Louis took it out with a small pair of forceps. It was manifest, from the ease with which this foreign body was extracted, that the operation would have had on the living subject the most salutary effect. The relations had to regret having sacrificed a child which was dear to them to an irresolution and a timidity which the most persuasive arguments could not remove.—(*Mém. de l'Acad. Royale de Chirurgie, t.* 12, *p.* 293, *&c. édit. in* 12*mo.*)

This case strikingly illustrates the symptoms which result from the presence of foreign bodies in the trachea, and shows the only surgical proceeding which can be of use. But among the phenomena apparently difficult of explanation, is the calm which at intervals followed the afflicting cough.—(See *Dr. Hunt's Case in Med. Chir. Trans. vol.* 12, *p.* 27.) Anatomy, however, has dispelled much of the doubt of this matter. It is known, that the whole canal of the trachea is much less sensible than the rima glottidis. A foreign body, like a bean, may remain a certain time in that canal without much inconvenience, the passage being only somewhat obstructed, according to the position of the substance. It may even remain several days, months, or years, without producing any symptom of its presence, except a trivial sensation of obstruction, and this is what happens when the body lodges in one of the ventricles of the larynx. Facts of this kind are to be found in Tulpius, Bartholine, and many other observers. But when the extraneous substance quits its situation and is carried into the trachea, the irritation which it produces there, and particularly about the larynx, occasions coughing; and if, in the fits, the foreign body should become fixed between the lips of the glottis, it may cause instantaneous death, as probably has happened in many of the cases of suffocation from extraneous substances.

Another remarkable circumstance which deserves more attention, as it confirms the presence of a foreign body in the trachea, is the emphysema which appeared about the clavicle towards the termination of the case. Louis did not believe that any of the persons who saw the patient could entertain a just idea of the origin of this symptom. The supposition that the obstruction which the foreign body caused, for two days, to the free passage of the air, might have occasioned a forcible distention of the trachea, and a rupture of the membrane which connects together the cartilaginous rings of this tube, was dispelled by the examination after death. The windy tumour had not originated in the circumference of the trachea; here its limits were only seen. The very substance of the lungs and the mediastinum were emphysematous. The air confined by the foreign body had ruptured the air-cells during the violent fits of coughing, and thus insinuated itself into the interlobular cellular substance of the lungs. Thence it had passed into the cellular substance of the lungs; and afterward into that connecting the pleura pulmonalis with the outer surface of these organs; and by the communication of these cells with each other, it had produced a prodigious swelling of the cellular substance between the two layers of the mediastinum. The emphysema, in its progress, at length made its appearance above the clavicles. The swelling of the lungs and the circumjacent parts, in consequence of the insinuation of air into the cellular substance, is a manifest cause of suffocation. The tumefaction appears to be so natural an effect of the presence of a foreign body in the trachea, that one can hardly believe it is not an essential symptom, though before Louis no author had made mention of it.

Foreign bodies in the trachea, however, do not always cause death so suddenly, which may be owing to their smallness, their smoothness, or the situation in which they are fixed. An example is related in the *Ephemer. Cur. Naturæ, Decad.* 2. *Ann.* 13. As a monk was swallowing a cherry, the stone of the fruit passed into the trachea. A violent cough and excessive efforts, as it were, to vomit, were the first symptoms of the accident, and of these the patient thought he should have died. A sleep of some hours followed this terrible

agitation, and the patient afterward did not feel the least inconvenience during a whole year. At the end of this time he was attacked by a cough attended with fever. These symptoms became worse and worse every day. At length the patient evacuated a stone as large as a nutmeg. It was externally composed of tartareous matter, to which the cherry-stone had served as a nucleus. A copious purulent expectoration followed the discharge of the foreign body, and the patient died consumptive some time afterward. No mention is made of the body being opened; but from the symptoms, there is every reason to believe, that an abscess must have arisen in the substance of the lungs from the presence of the foreign body. That foreign bodies in the trachea, even when they do not induce pressing symptoms of suffocation, may ultimately kill the patient by inducing disease of the lungs, is proved by several cases on record, and particularly by one which occurred to Desault: a cherry-stone was lodged in one of the ventricles of the larynx; the patient would not consent to an operation, and died in two years *d'une phthisie laryngé*.—(See *Œuvres Chir. de Desault, t.* 2, *p.* 258.)

Some valuable observations confirming the necessity of an early recourse to bronchotomy, in cases where foreign bodies are lodged in the trachea, have been published by Pelletan. In one case, in which a bean had fallen into a child's trachea, and in which the most urgent symptoms of suffocation had prevailed for four days, and convulsions during the last thirty-six hours of this space of time, Pelletan performed the operation, which a timid practitioner, under whose management the patient was first placed, had neglected to do at an earlier period. Upon the incision being made into the trachea, the bean was immediately thrown out to the distance of two feet, and the child for a time was relieved. The little boy was so extremely weak, that it was at one time supposed he was dead. However, with some assistance, he gradually revived, even regained his senses, called his parents, and asked for such things as he wanted.

This hopeful state lasted eight or ten hours, after which convulsions came on again, and the child died fourteen hours after the operation.

Notwithstanding the turgid appearance of all the blood-vessels of the brain, as detected after death, the little boy had yet received a degree of relief at the instant of the foreign body being extracted. Pelletan deems it unnecessary to insist on the great possibility of success that would have attended the operation had it been performed at an earlier period.

Of such success, Pelletan gives us the following example.

In the month of May, 1798, a child about three years old, was brought to the Hôtel-Dieu, who, in playing with some French beans, and putting them into its mouth, let one of them slip into the trachea. For three days the child was afflicted with a continued cough, and sometimes the symptoms of suffocation were most pressing. The time had been spent in administering emetics, introducing instruments into the œsophagus with the design of forcing the foreign body into the stomach, and in inspiring the relations with a pernicious confidence, arising from the very long intervals of repose which the child experienced, during which, however, a rattling in the throat continued, a characteristic mark of the accident. Pelletan immediately decided to perform the operation. The child was very fat, and this circumstance, together with the small diameter of the trachea at this age, rendered the exposure of the anterior portion of the tube difficult. Pelletan was at this moment struck with the reflection, that bronchotomy should never be attempted except by men of science, coolness, and experience in operations. The rings of the trachea, however, were at length cut, and there was no sensible interval between the incision and the expulsion of the foreign body. The bean had swelled considerably with the moisture. The child seemed restored to life; it spoke freely; it was only troubled with coughing, the effect of a small quantity of blood insinuating itself into the trachea, which fluid was instantly rejected again. This event has the appearance of convulsions, and may alarm those who do not understand it; but according to Pelletan, it is the guarantee of the patient's life, by expelling incessantly and without difficulty, whatever happens to get into the trachea. The wound was healed in twenty days, and the child's voice was not perceptibly altered.

In another interesting case recorded by the same writer, a pebble was lodged in the windpipe, and the case, not being understood, was treated for about three weeks as a simple inflammation of the lungs. At last bronchotomy was performed, and by placing the child in a horizontal position the stone was soon discharged through the incision. The patient was immediately relieved; but the effects of the inflammation of the lungs, and injury which these organs had sustained, could never be cured, and the child died phthisical eight months afterward.

Pelletan details other cases in which the foreign body, being fixed in the trachea, could not be forced out by the breath as soon as the incision had been made, but required farther means to disengage it. In one instance Pelletan made a long cut in the windpipe of a child; but nothing made its appearance. A probe, wrapped round with some oiled linen, was then introduced several times up and down the larynx without creating a great deal of uneasiness, and the child continued to respire very well through the opening in the trachea. The foreign substance was presently brought to the wound and extracted: it proved to be part of the jaw of a mackerel, with many sharp teeth in it. This child soon experienced a perfect recovery.

In another instance, a young man came to the Hôtel-Dieu, in consequence of being afflicted for six weeks with a severe cough, frequently accompanied with a sense of suffocation. These complaints, on inquiry, were ascertained to arise from a button-mould having fallen into the trachea. An opening was therefore made in this tube; but though the button could be felt, it could not be extracted with the finger. The cricoid cartilage was now divided, and the foreign body taken out of the left ventricle of the larynx. The man recovered.

In one case related by Pelletan, a piece of tendon of veal got down the glottis, and gave rise to most dangerous symptoms. The foreign body was described as being so large that this surgeon could not but suppose that the complaints were owing to its lodgement in the œsophagus, as it seemed to be incapable of entering the glottis. The introduction of instruments down the pharynx, however, produced do relief; but, on dividing the thyroid cartilage, Pelletan passed his finger within the larynx, and, without knowing it, pushed the piece of tendon towards the glottis, when, with the aid of a probang, it was forced into the pharynx and swallowed. The patient experienced immediate relief, and got quite well.—(*Clinique Chir. t.* 1.)

With respect to bronchotomy or laryngotomy, for cases in which extraneous substances are supposed to be lodged in the trachea, one important caution seems necessary, viz. whenever the foreign body is above a certain size, a probang should be passed down the œsophagus before the windpipe is opened, for very similar symptoms to those which proceed from extraneous substances in the trachea may be caused by the lodgement of foreign bodies in the œsophagus. In fact, bronchotomy has actually been performed, while the extraneous substance was in the œsophagus, from which last situation no attempt was made to displace it, and the patient lost his life.—(See *Œuvres Chir. de Desault, t.* 2, *p.* 261.) Examples in which various extraneous bodies have been successfully extracted by means of bronchotomy, are recorded by Engel.—(*Sendschreiben an Schmid, &c. Augsp.* 1750; *Guincourt, Journ. de Méd. vol.* 12, *p.* 44; *Heister, Wahrnehmungen, b.* 1, *p.* 1026; *Wendt, Hist. Tracheotomiæ, &c., Urastisl.* 1774. *Dr. Hunt, in Med. Chir. Trans. vol.* 12, *&c.*)

4. Bronchotomy has been proposed in cases in which the tongue is so enlarged as totally to shut up the passage through the fauces. Richter mentions an inflammation of the tongue, in which it became four times larger than in the natural state. Valescus had made the same observation: "*Ego aliquando vidi ità magnificatam linguam propter humores, ad ejus substantiam venientes, et ipsam imbibentes, quod quasi totum os replebat, et aliquando ex ore exibat.*"—(*Lib.* 2, *cap.* 66.) Such prodigious swellings of the tongue are said sometimes to occur in malignant fevers and the small-pox. They are also sometimes quite accidental, as, for instance, the cases which happen from the stings of insects, or the unskilful employment of mercury. Mr

B. Bell gives an example of the latter sort. He says, that the patient had taken in a very short time so large a quantity of mercury, that the part became alarmingly swollen in a few hours, and, though all the usual remedies were tried, none had the least effect. Bronchotomy was delayed till the patient was nearly suffocated; but he was restored as soon as an opening was made in the trachea. Some have objected to this practice, alleging that scarifying the tongue will bring relief in time.—(*Encyclopédie Méthodique: partie Chirurgicale, art. Bronchotomie.*) Malle's observations on the swelling of the tongue, and the most effectual means of relieving it, seem to confirm the latter sentiment.—(*Mém. de l'Acad. de Chirurgie, t.* 14, *p.* 408, *&c. édit. in* 12*mo.*)

In cases of the preceding description, Desault would have advised the introduction of an elastic gum catheter from the nose into the trachea, in order to enable the patient to breathe, until the swelling of the tongue had subsided.—(See *Œuvres Chir. de Desault, t.* 2, *p.* 246.)

5. Bronchotomy has been recommended when both the tonsils are so enlarged as very dangerously to impede respiration. Here the inflammatory swelling is not meant; this commonly soon suppurates, and the spontaneous bursting of the tumour, or the opening of it with a pharyngotomus, generally removes all necessity for so extreme a measure. But even in acute inflammation and great enlargement of the palate, tonsils, &c. attended with imminent danger of suffocation, the practice has been sometimes deemed necessary, as the cases cited from Flajani in the preceding columns are sufficient to prove. The disease, however, which I here wish particularly to specify, as sometimes rendering bronchotomy indispensable, is a chronic enlargement of the tonsils, the case mentioned in the article *Tonsils*. From the remarks on the disease, however, it will be seen that more is to be expected from the excision of the tonsils than from the operation now in question. Besides, before the glands are so large as to threaten suffocation, they should be cut away in preference to performing bronchotomy, which might relieve the urgency, but could not remove the cause of the difficulty of breathing. In general, there is no urgent danger of suffocation till the swelling is such as not only to shut up the posterior aperture of the mouth, but also the posterior openings of the nostrils, which is exceedingly rare. In cases of obstructed respiration from enlargement of the tonsils, Desault preferred the introduction of the elastic catheter from the nose into the larynx, to the operation of bronchotomy. It is not common for a polypus to make this operation necessary. Boerhaave, however, mentions a case, in which the patient was suffocated as the surgeon was going to extirpate a tumour of this kind: no doubt this patient might have been saved if bronchotomy had been previously performed. Polypi growing in the larynx itself are very rare, but examples are recorded; and if such tumours happen to obstruct the glottis the patients are instantly suffocated. Some instances of this kind are related by Bichat. The only mode of getting at such swellings so as to extirpate them, is by performing bronchotomy.—(See *Œuvres Chir. de Desault, t.* 2, *p.* 254, 255.)

6. Lastly, bronchotomy has been recommended to be done on persons recently suffocated or drowned. Detharding is the first author who has treated of the necessity of this operation in the latter case, in a letter addressed to Schroeck, entitled *De Methodo subveniendi Submersis per Laryngotomiam.* Haller approves of the practice, provided the mucous secretion with which the lungs are loaded should require to be discharged in this manner. Detharding maintains that drowned persons have no water in their chests or air-vessels of the lungs, and that they perish suffocated for want of air and respiration, and that while the person is under water the epiglottis applies itself so closely over the glottis, that not one drop of water can pass. But these assertions are quite contrary to numerous experiments made by Louis, who drowned animals in coloured fluids, and proved that such as are drowned inspire water, with which the air-vessels and cells are quite filled. Louis also opened men who had perished under water, but in them he never found the epiglottis applied to the glottis in the manner described by Detharding; indeed, anatomy proves the impossibility of its being so. Dotharding's theories were wrong, and, as he did not use any power to distend the lungs with air, his mere practice of bronchotomy must have been useless. When there is a free communication between the cells of the lungs and the atmosphere, the air will not expand these organs if the inspiratory muscles can no longer act. Hence, after opening the trachea, and letting as much water run out of this tube as possible, the pipe of a pair of bellows should be introduced, and the air blown into the lungs.

Detharding was right in his opinion, that drowning is a species of suffocation, and that the privation of oxygen gas is the cause of death. Hence the propriety of introducing air into the lungs as speedily as possible, whenever animation has not been so long suspended that every hope of restoration is over. Indeed, it is proper to distend the lungs with air in all cases in which animation has been recently suspended by suffocation, immersion under water, or by noxious vapours and gases. This measure is highly proper, in conjunction with electricity or galvanism; the communication of warmth to the body; the application of strong volatiles to the nostrils; rubbing the body with warm flannels; and the injection of warm wine or brandy and water into the stomach through a hollow bougie. However, tobacco clysters, which have had the sanction of the Royal Humane Society, should be reprobated, as the qualities of this plant are peculiarly destructive of the vital principle, and not simply stimulating. I am sorry to find this last means commended by so respectable a surgeon as Baron Larrey, who joins the rest of the French surgeons in condemning electricity and bronchotomy. He speaks in favour of opening the jugular vein, exposing the body to the fire, friction, &c. On dissecting the bodies of some drowned persons, Larrey found, as Louis had done long since, that the air-tubes of the lungs were filled with water instead of air, and that the epiglottis was raised and applied to the os hyoides.—(See *Mémoires de Chir. Militaire, t.* 1, *p.* 83—85.

There are many modern practitioners who consider bronchotomy needless in cases of suspended animation, because it is contended, that, as the patient is always destitute of sensation, a tube may easily be passed into the trachea from the nose or mouth, for the purpose of inflating the lungs. Either the curved pipe of a pair of bellows may be introduced into the glottis through the mouth, or an elastic gum catheter may be passed into the trachea from the nose. "*On peut mettre ce moyen à exécution* (says Pelletan) *chez les asphixiés, ou les enfans nouveaux nés, qui ne respirent pas; parceque, dans ces différens cas non seulement il n'y a pas d'inflammation, mais même toute sensibilité est suspendue, et la canule est commode pour souffler de l'air dans les poumons, en même temps qu'elle peut causer une irritation salutaire. M. Baudeloque, mon célèbre confrère, m'a temoigné se servir habituellement, et avec succès de ce moyen pour appeler à la vie les nouveaux nés dont la respiration ne s'établit pas.*"—(*Clinique Chir. t.* 1, *p.* 29.) Desault likewise conceived, that the lungs might be easily inflated without performing bronchotomy.—(*Œuvres Chir. t.* 2, *p.* 339.) Mr. A. Burns adopts the same sentiment.—(*Surgical Anatomy of the Head and Neck, p.* 384.) My own individual opinion upon this subject is, that if a surgeon knows that he can inflate the lungs as completely and expeditiously without performing bronchotomy, as he can by making an incision in the trachea, he is right in dispensing with the latter operation. But in the generality of cases of suspended animation (that of new-born infants excepted, where bronchotomy would be an objectionable undertaking), I much doubt whether in actual practice bronchotomy will not be found the best and most speedy means of enabling the surgeon to distend the lungs with air. If you follow Desault's suggestion, I contend that you are likely to be some minutes longer in getting the elastic catheter from the right nostril into the larynx, than you would be in cutting into the trachea and introducing into the incision the muzzle of a pair of bellows. Supposing the elastic catheter introduced, will you now be able to distend the lungs with air in an adequate degree, an object of the highest moment? A pair of bellows seems to me almost essential to this purpose. I shall say nothing on the probability of many practitioners coming to the patient unprovided with the requisite sort of tube.

If a pair of bellows with a curved pipe be employed, many surgeons would be a considerable time in getting

the nozzle into the glottis; and, in the mean while, every spark of life might be extinguished. On the other hand, bronchotomy (performed by a man of ordinary care and skill) is an operation free from danger. It may be executed with a penknife if no better instrument be at hand; and when the incision has been made, a pair of common bellows will suffice for the inflation of the lungs. Did I conceive that bronchotomy were a perilous operation; that the lungs could be effectually distended without the employment of bellows; that the object could generally be accomplished as expeditiously without cutting into the trachea; I should be as ready to join in the condemnation of this last proceeding as any contemporary writer. Greatly, however, as I respect most of the authors who differ from me on this point, the reasons I have assigned prevent me from subscribing to their sentiment. Desault, who may be regarded as the founder of the doctrine, concerning the inutility of bronchotomy, it is also to be observed, spoke only from theory, and not actual practice, in these cases.

With respect to the performance of the operation, no preparation is necessary, as delay only increases the danger. The patient being seated in an arm-chair, or, what is better, laid on a bed, with his head hanging backwards, an incision is to be made, which is to begin below the cricoid cartilage, and to be continued downwards about two inches, along the space between the sterno-thyroidei muscles. Care should be taken not to cut the lobes of the thyroid gland, lest a troublesome and dangerous bleeding be occasioned; and, as the left subclavian vein lies a little below the upper part of the first bone of the sternum, the incision should never extend so low as this point. The knife must not be carried either to the right or left, in order to avoid all risk of injuring the large blood-vessels situated at the sides of the trachea. The incision in the integuments having been made, the sterno-thyroidei muscles are to be pushed a little towards the sides of the neck, so as to bring the trachea fairly into view. Many authors recommend the point of the knife to be then introduced between the third and fourth cartilage of the trachea, and the opening to be enlarged transversely. It is true that in this way an opening may be safely made, large enough to allow a small cannula to be introduced. It is safer, however, in all cases, to enlarge the opening in the perpendicular direction, by cutting from within outwards. There is no advantage in avoiding a wound of the cartilages of the trachea, the only reason assigned for cutting the membrane between them, in a transverse direction; while a sufficiently large opening cannot thus be safely obtained, in cases in which it is necessary to introduce the nozzle of a pair of bellows, in order to inflate the lungs. In short, it is safer and better in every instance, to make the wound in the trachea in a perpendicular manner.

I have stated, that bronchotomy may be performed by a man of ordinary skill without hazard. It is far otherwise with a careless practitioner. We read in Desault's work, that in one instance the carotid artery was wounded. The following cautions, given by Mr. A. Burns, seem entitled to notice. "The arteria innominata is in risk in some subjects. I have seen it mounting so high on the forepart of the trachea, as to reach the lower border of the thyroid gland. Even the right carotid artery is not always safe. I am in possession of a cast, taken from a boy of twelve years of age, which shows the right carotid artery crossing the trachea in an oblique direction. In this subject, that vessel did not reach the lateral part of the trachea till it had ascended two inches and a quarter above the top of the sternum.

Where both carotid arteries originate from the arteria innominata, there is considerable danger in performing the operation of tracheotomy; for in such cases, the left carotid crosses the trachea pretty high in the neck. Professor Scarpa has seen a specimen of this distribution in a male subject, and I have met with five.

These varieties in the course of the arteries are worthy of being known and remembered; they will teach the operator to be on his guard, since he can never, *à priori*, ascertain the arrangement of the vessels with any degree of certainty. It will impress on his mind the impropriety of using the knife farther than merely to divide the integuments and fasciæ. If he then clear the trachea with the fingers, he will never injure any of the large arteries. When with the finger he has fairly brought the trachea into view, he ought to examine carefully, whether any of the large arteries lie in front of it; and if he find one, he ought to depress it towards the chest, before he penetrates into the windpipe.

In cutting into the trachea, the preferable plan is to cut the rings from below upwards, avoiding injury of the thyroid gland."—(See *A. Burns on the Surgical Anatomy of the Head and Neck*, *p.* 393, 394.)

As Mr. Francis White, of Dublin, was performing tracheotomy in a case of cynanche laryngea, "on separating the edges of the sterno-thyroid muscles, the two thyroid veins were exposed, *together with a considerable arterial branch*, the pulsation of which was quite perceptible, directing its course upwards towards the cross-slip of the thyroid gland." Mr. White states, that the artery here spoken of was the branch which Mr. Harrison in his work on the Surgical Anatomy of the Arteries, describes under the appropriate name of middle thyroid artery; and though looked upon as an irregular distribution, it is sufficiently frequent to make it necessary for the surgeon to be upon his guard.—(See *Dublin Hospital Reports*, *vol.* 4, *p.* 563.)

When bronchotomy is performed for the purpose of inflating the lungs, the cut in the windpipe must be made somewhat larger than when an opening is required merely to enable the patient to breathe through a small cannula. The larger size of the pipe of the bellows is the reason of this circumstance.

When a cannula is introduced, care must be taken not to pass it too far into the wound, lest it injure the opposite side of the trachea. This is a caution on which Fabricius ab Aquapendente dwells very strongly, and with good reason.

When tracheotomy has been performed in a case where mucus is secreted in such abundance, that the patient is threatened with suffocation from its accumulation, and his inability to cough it up, owing to the wound in the windpipe, Dr. Cullen is an advocate for the use of a large cannula for the sake of permitting free expiration, the only substitute for coughing, which the patient can no longer effect.—(See *Edin. Med. Journ. No.* 94, *p.* 82.)

Small as the vessels may be which are divided in bronchotomy, they occasionally bleed so much as to create apprehension, and even prevent the continuance of the operation. There is a case in Van Swieten's Commentaries confirming this remark. A Spanish soldier, aged twenty-three, was in the most urgent danger from an inflammation of his throat. It was thought nothing could save him except bronchotomy. After the longitudinal cut in the skin, and the separation of the muscles, the trachea was opened between two of the cartilages; but the blood insinuated itself into this canal, and excited so violent a cough, that the cannula could not be kept in by any means, though it was replaced several times. Louis remarks, that in this instance the patient's head should have been turned downwards, in order to keep the blood from flowing backwards into the trachea. It is asserted, that the opening of this tube was not always opposite the external wound, in consequence of the convulsive action of the muscles, and that the patient on this account could hardly breathe. Hence, Vigili was induced to slit open the trachea, down to the sixth cartilaginous ring; and it was only then that he inclined the patient's head forwards. The bleeding now ceased, the patient breathed with ease, and on the second day the inflammation was so much better, that respiration went on without the aid of the opening in the trachea.

The most simple and natural mode of obviating all trouble from the entrance of blood into the trachea, is to tie any bleeding branch of the thyroid artery or vein before the windpipe is opened.

Sometimes the cannula becomes obstructed with mucus or clots of blood. Such an accident nearly suffocated a patient at Edinburgh. An ingenious person happening to be at hand, suggested the introduction of a second cannula into the first; the second one being taken out and cleaned as often as necessary, and then replaced.

The use of the cannula must be continued as long as the causes obstructing respiration remain. Thus, in one very interesting case of cynanche, detailed in a

modern publication, the patient, thirteen months after the operation, had not been able to discontinue the tube.—(See *Med. Chir. Journ. vol.* 5, *p.* 7.) This example was attended in its progress with a singular circumstance, viz. the expulsion through the cannula of several portions of calcareous matter or bone. In the case operated upon by Mr. F. White, the tube had been worn two years; and in the well-known case of Mr. Price of Plymouth, the instrument had been worn ten years.—(See *Dublin Hospital Reports, vol.* 4, *p.* 565, 566.)

When respiration is suspended by the presence of a foreign body in the trachea, and the extraneous substance does not make its appearance at the opening, a trial may be made to discover its situation by means of a bent probe. When it lies downwards, which it hardly ever does, the wound in the trachea may be enlarged in this direction, and the body extracted with a pair of curved forceps. The extraneous substance is mostly forced out by the air, as soon as the incision in the trachea is opened. When it cannot be immediately found, some practitioners (Heister and Raw) have succeeded by keeping the lips of the wound asunder with a leaden cannula, by which means the force of the air in expiration has in a few hours expelled the foreign body.

Richter gave the preference to a curved cannula; and since his time many surgeons have chosen to use such an instrument, though if it be double the inner tube cannot be so easily introduced as that of a straight one; and no doubt the chief disadvantage of the latter has often proceeded from its having been made of too great length.

In some instances, like that referred to above, a cannula has been borne quietly in the trachea; while in others, it has produced so much irritation, cough, and sense of choking, as to render its immediate removal necessary. Mr. Lawrence, in speaking of the obstruction of the glottis from the disease already adverted to in this article, observes, that when the cannula causes inconvenience, he should advise a longitudinal incision, of about half an inch, in the middle of the trachea, and the removal of a thin slip of the tube, which would leave an artificial opening for respiration, equal in size to the natural one.—(See *Med. Chir. Trans. vol.* 6, *p.* 249.) The same plan was followed by Mr. F. White, and is also sanctioned by Mr. Carmichael.—(See *Dublin Hospital Reports, vol.* 4, *p.* 563, *&c.*, and *Trans. of Assoc. Physicians, vol.* 3, *p.* 174.) When this practice is not adopted, Mr. Carmichael recommends the use of as large a cannula as can be introduced.

On the continent the operation of laryngotomy, which was first advised by Vicq d'Azyr, and recommended by Desault, is frequently preferred to tracheotomy. The surgeon makes an incision over the anterior part of the thyroid cartilage, punctures the crico-thyroid membrane, and, if it be necessary, introduces a director and slits the thyroid cartilage upwards. A single opening in the crico-thyroid membrane would suffice for the introduction of a cannula for the purpose of enabling the patient to breathe; but for the extraction of foreign bodies it would be necessary also to cut the thyroid cartilage. The fact that extraneous substances, when they are loose, are almost always lodged at the upper part of the larynx, proves that laryngotomy, in such cases, must commonly be most advantageous; and according to Desault, even when the foreign bodies are lower down in the trachea, they may in general be most easily extracted with the aid of a pair of curved forceps. In this country laryngotomy has been less commonly practised, though commended a few years since by Mr. Coleman, and more recently by Mr. C. Bell.

"Of the three situations (says Mr. Lawrence), in which it has been proposed to make the opening, viz. in the thyroid cartilage, between that and the cricoid, or in the trachea, I consider the first as the least eligible. Besides the objection from the ossification of the cartilage, and the danger of wounding or otherwise injuring the chordæ vocales, there is the inconvenience in the case of angyna laryngea, arising from the swollen and thickened state of the membrane, which may actually impede the passage of the air. I am not aware of any objection to a transverse opening between the thyroid and cricoid cartilages. The prominence of the former in the neck serves as a guide to the part which should be opened. Whether bronchotomy or laryngotomy ought to be selected, must of course depend upon the nature of the case: in cases of cynanche, the proximity of the inflamed parts would be an objection to laryngotomy; while in examples of foreign bodies within the glottis this operation may generally be most advisable for reasons already explained. It is absurd to think of confining one mode of operating to different cases."—(See *Medico-Chir. Trans. vol.* 6, *p.* 248.)

Of the operation performed in the membranous space Mr. C. Bell entertains a favourable opinion. He directs us to slit up the membrane and open the incision with the handle of the knife, when the patient will immediately breathe with ease. Here, says he, there is nothing to alarm the most timid operator. No great turgid veins are opened; the cut is made above the thyroid gland, and above the anastomosing branch of the thyroid arteries. The part is strongly marked by the prominence of the thyroid cartilage above, and the ring of the cricoid cartilage below. "If the occasion be temporary, a simple slit of the membrane will be found sufficient. If necessary, a transverse cut will afford any degree of opening. If a round hole be desired, the four corners left by the incisions may be snipped off," or the edges of the opening may be kept asunder by means of the double wire of a catheter, the middle part of which lies on the wound, while the ends are bent round the neck and tied by a ligature behind. In Mr. C. Bell's cases, less annoyance was caused by this contrivance than by a tube

[Bronchotomy is frequently performed in this country for the removal of foreign bodies from the trachea, but seldom with any other intention. The situation most generally selected is between the thyroid and cricoid cartilages. Sometimes the foreign body escapes through the wound, or may be extracted by the forceps; at other times, so soon as the air is admitted into the lungs, the force of the respiration expels it through the mouth. I have known several cases in which, although the operation afforded immediate relief to the respiration, yet the escape of the foreign body did not take place for several hours; and in one instance days had elapsed, when it was coughed up with great violence.—*Reese.*]

Hevin sur les Corps Etrangers qui sont arrêtés dans les premières Voies, et qu'il faut tirer par Incision, in Mém. de l'Acad. Royale de Chirurgie, t. 3, *p.* 131, *&c. édit.* 12*mo. Louis, Mémoire sur une Question Anatomique relative à la jurisprudence, où l'on établit les principes pour distinguer, à l'inspection d'un corps trouvé pendu, les signes du suicide, d'avec ceux de l'assassinat. Habicot, Question Chirurgicale, par laquelle il est demontré que le Chirurgien doit assurément pratiquer l'Opération de la Bronchotomie, &c.*, 12*mo. Paris* 1620. *Louis, Mémoire sur la Bronchotomie, in Mém. de l'Acad. de Chirurgie, t.* 12, *edit.* 12*mo. Second Memoir on this subject, inserted by the same writer in the said volume. De la Rescission des Amygdales, t.* 14, *p.* 283, *&c. Précis d'Observations sur le Gonflement de la Langue, &c. par M. de la Malle, t.* 14, *p.* 408. *Lescure, sur un portion d'Amande de Noyau d'Abricot dans la Trachée Artère, t.* 14, *p.* 427. *Suite d'Observations sur les Corps Etrangers dans la Trachée Artère, t.* 14, *p.* 432. *Expériences sur les Cas, par M. Favier, t.* 14, *p.* 445. *De la Martiniere, sur les Corps Etrangers, dans la Trachée Artère, op. cit. t.* 5, 4*to. Bertrandi, Traité des Opérations de Chirurgie, p.* 402, *&c. edit.* 1784. *Sabatier, de la Médecine Opératoire, tom.* 2, *p.* 283, *édit.* 1. *Œuvres Chir. de Desault, par Bichat, t.* 2, *p.* 236, *&c. Pelletan, Clinique Chirurgicale, t.* 1, *first Memoir. Cheyne, Pathology of the Larynx and Bronchia, Edin.* 1809. *A. Burns, Surgical Anatomy of the Head and Neck, p.* 377—401. *J. F. Double, Traité du Croup,* 8*vo. Paris,* 1811. *Richter's Anfangsgründe der Wundarzneykunst, b.* 4, *p.* 225, *&c., Göttingen,* 1800. *Lawrence on some affections of the larynx which require the operation of bronchotomy, in Medico-Chir. Trans. vol.* 6, *p.* 221, *&c. Baillie, in Trans. of a Society for the Improvement of Med. and Chir. Knowledge, vol.* 3. *Troussel-Drelincourt, Corps Etrangers arrêtés dans les Voies aëriennes, Nouveau Journ. de Méd. par Beclard, &c. t.* 7, *p.* 101. *Philos. Trans.* 1730, *No.* 416, *art.* 5. *Journal de Médecine t.* 38, *p.* 358. *J. A. Albers, Comm. de Trachitide Infantum, vulgo Croup vocata,* 4*to. Lips.* 1816. *Case of Chronic Infl. of the Larynx, in which laryngotomy was performed. See Méd. Chir. Journ. April,* 1820. *F. J.*

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BUBO. (Βουβών, the groin.) Modern surgeons mean by this term a swelling of the lymphatic glands, particularly of those in the groin and axilla.

The disease may arise from the mere irritation of a local disorder; from the absorption of some irritating matter, such as the venereal poison; or from constitutional causes.

Of the first kind of bubo, that which is named the *sympathetic* is an instance. Of the second, the venereal bubo is a remarkable specimen.—(See *Venereal Disease.*)

The *pestilential bubo*, which is a symptom of the plague, and *scrofulous* swellings of the inguinal and axillary glands, may be regarded as examples of buboes from constitutional causes.—(See *Scrofula.*)

The inguinal glands often become affected with simple phlegmonous inflammation, in consequence of irritation in parts from which the absorbent vessels passing to such glands proceed. These swellings ought to be carefully discriminated from others which arise from the absorption of venereal matter. The first cases are simple inflammations, and only demand the application of leeches, the cold saturnine lotion, and the exhibition of a few saline purges; but the latter diseases render the administration of mercury advisable.

Sympathetic is the epithet usually given to inflammation of glands from mere irritation; and we shall adopt it without entering into the question of its propriety.

The sympathetic bubo is mostly occasioned by the irritation of a virulent gonorrhœa. The pain which such a swelling gives is trifling compared with that of a true venereal bubo, arising from the absorption of matter, and it seldom suppurates. However, it has been contended that the glands in the groin do sometimes swell and inflame from the actual absorption of venereal matter from the urethra, in cases of gonorrhœa, and if this were true the swellings would be venereal; but this doctrine is now nearly exploded. —(*Hunter on the Venereal, p.* 57.)

The manner in which buboes form from mere irritation will be better understood by referring to the occasional consequences of venesection, in the article *Bleeding.* The distinguishing characters of the venereal bubo are noticed in the article *Venereal Disease.*

BUBONOCELE. (From *βουβών*, the groin, and *κήλη*, a tumour.) A species of hernia, in which the bowels protrude at the abdominal ring. The case is often called an *inguinal hernia*, because the tumour takes place in the groin.—(See *Hernia.*)

BUNYON. An inflammation of the bursa mucosa, at the inside of the ball of the great toe.—(See *Brodie's Pathological and Surgical Obs. on the Joints, p.* 356, *ed.* 2.)

BURNS are usually divided into three kinds. 1st. Into such as produce an inflammation of the cutaneous texture, but an inflammation which, if it be not improperly treated, almost always manifests a tendency to resolution. 2dly. Into those which occasion the separation of the cuticle, and produce suppuration on the surface of the cutaneous texture. 3dly. Into others in which the vitality and organization of a greater or less portion of the cutis are either immediately or subsequently destroyed, and a soft slough or hard eschar produced.—(See *Thomson on Inflammation, p.* 585, 586.)

Suppuration is not always an unavoidable consequence of the vesications in burns; but it is a common and a troublesome one. "In severe cases it may take place by the second or third day; often not till a later period. It often occurs without any appearance of ulceration; continues for a longer or shorter time; and is at last stopped by the formation of a new cuticle. In other instances, small ulcerations appear on the surface or edges of the burn. These spreading form extensive sores, which are in general long in healing, even where the granulations which form upon them have a healthy appearance."—(*Op. cit. p.* 595.)

Burns present different appearances, according to the degree of violence with which the causes producing them have operated, and according to the kind of cause of which they are the effect. Burns which only irritate the surface of the skin are essentially different from those which destroy it; and these latter have a very different aspect from what others present which have attacked parts more deeply situated, such as the muscles, tendons, ligaments, &c. Scalds, which are the effect of heated fluids, do not exactly resemble burns occasioned by the direct contact of very hot metallic bodies, or some combustible substance on fire. As fluids are not capable of acquiring so high a temperature as many solids, scalds are generally less violent than burns in the injury which they produce; but in consequence of liquids often flowing about with great rapidity, and being suddenly thrown in large quantities over the patient, scalds are frequently dangerous on account of their extent. It is worthy of remark, that the danger of the effects of fire is not less proportioned to the size than the degree and depth of the injury. A burn that is so violent as to kill parts at once, may not be in the least dangerous, if not extensive; while a scald, which perhaps only raises the cuticle, may prove fatal if very large. The degree of danger, however, is to be rated from a consideration both of the size and violence of the injury. The worst burns which occur in practice arise from explosions of gunpowder or inflammable gases, from ladies' dresses catching fire, and from the boiling over of hot fluids in laboratories, manufactories, &c.

Burns, which only destroy the cuticle and irritate the skin, are very similar to the effects produced by cantharides and rubefacients. The irritation, which such injuries excite, increases the action of the arteries of the part affected, and they effuse a fluid under the cuticle, which becomes elevated and detached. Hence, the skin becomes covered with vesicles or bladders, which are more or less numerous and large, according to the manner in which the cause has operated. But when the skin or subjacent parts are destroyed, no vesicles make their appearance. In this circumstance a black eschar is seen; and when the dead parts are detached, there remains a sore more or less deep, according to the depth to which the destructive effects of the fire have extended.

The parts may either be killed at the moment of the injury by the immediate effect of the fire, or they may first inflame, and then mortify.

In all cases of burns, the quantity of injury depends on the degree of heat in the burning substance; on the duration and extent of its application; and on the sensibility of the burnt part.

When a large surface is burnt, mortification sometimes makes its appearance with great violence, and very quickly after the accident; but in general, the symptom the most to be dreaded in such cases is inflammation. The pain and irritation often run to such a pitch, that, notwithstanding every means, there is frequently immense trouble in keeping down the

inflammation. When the burnt surface is very large, the effects of the inflammation are not confined to the part which was first injured; but even cause a great deal of fever; and in certain cases, a comatose state, which may end in death.

It has been observed, that persons who die of severe burns seem to experience a remarkable difficulty of breathing and oppression of the lungs. These organs and the skin, are both concerned in separating a large quantity of water from the circulation, and their participating in this function may perhaps afford a reason for respiration being often much affected, when a large surface of skin is burnt. However, the kidneys perform the same office, and they are not particularly affected in burnt patients; so that the asthmatic symptoms frequently noticed in cases of burns, are probably owing to a sympathy between the lungs and skin, or else to causes not at present understood.

According to Dupuytren, extensive and deep burns always bring on inflammation of the mucous membrane of the alimentary canal: a circumstance said to explain those curious instances of death which so often occur when the ulcers are on the point of healing.—(See *Medecine Operatoire par Sabatier, edit. de MM. Sanson et Beguin.*)

Two general methods of treating burns have at all times been followed. One consists in the application of substances which produce a cooling or refrigerant effect; the other in the employment of calefacient or stimulating substances. Dr. Thomson is satisfied, that each of these different modes may have its advantages in particular cases.—(*Lect. on Inflammation, p.* 588.)

The practice mostly resorted to in this country some years since, is explained by Mr. B. Bell. When the skin is not destroyed, but seems to suffer merely from irritation, relief may be obtained by dipping the part affected in very cold water, and keeping it for some time immersed. This author states, that plunging the injured part suddenly into boiling water would also procure ease; an assertion, however, much to be doubted, and a practice not likely to be followed. In some cases, emollients afford immediate relief; but in general, astringent applications are best. Strong brandy or alcohol is particularly praised. At first the pain is increased by this remedy; but an agreeable soothing sensation soon follows. The parts should be immersed in the spirit, and when this cannot be done, soft old linen soaked in the application should be kept constantly on the burn. The liquor plumbi superacetatis dilutus is recommended. It is said to prove useful, however, only by being astringent, as equal benefit may be derived from a strong solution of alum, &c. Such applications were frequently made with the view of preventing the formation of vesicles; but Mr. B. Bell always remarked, that there was less pain when the blisters had already appeared, than when prevented from rising, by remedies applied immediately after the occurrence of the injury.

The applications should be continued as long as the pain remains; and in extensive burns creating great irritation, opium should be prescribed. The stupor with which patients so situated are often attacked, receives more relief from opium than any thing else.

Some recommend opening the vesications immediately; others assert, that they should not be meddled with. Mr. B. Bell thinks that they should not be opened till the pain arising from the burn is entirely gone. At this period, he says, they should always be punctured; for when the serum is allowed to rest long upon the skin beneath it has a bad effect, and even induces some degree of ulceration. Small punctures, not large incisions, should be made. All the fluid having been discharged, a liniment of wax and oil, with a small proportion of the superacetate of lead, is to be applied.

On the subject of opening the vesications in burns, Dr. Thomson believes, that the diversity of opinion arises from the different effects resulting from the particular manner in which the opening is made. "If a portion of the cuticle be removed so as to permit the air to come into contact with the inflamed surface of the cutis, pain and a considerable degree of general irritation will necessarily be induced; but if the vesications be opened cautiously with the point of a needle, so as to allow the serum to drain off slowly, without at the same time allowing the air to enter between the cuticle and cutis, the early opening of the vesications will not only not occasion pain, but will give considerable relief, by diminishing the state of tension with which the vesications are almost always, in a greater or less degree, accompanied. When opened in this manner, the vesications often fill again with serum; but the punctures may be repeated as often as is necessary, without any hazard of aggravating the inflammation. Great care should be taken in every instance, to preserve the raised portion of cuticle as entire as possible," &c.—(See *Lectures on Inflammation, p.* 595.)

When there is much irritation and fever, blood-letting, and such remedies as the particular symptoms demand, must be advised. On account of the pulse being frequently small, quick, and vibratory, bleeding is at present not often employed. As Dr. Thomson remarks, however, it may become necessary in patients of a strong, robust constitution, in whom the symptomatic fever assumes an inflammatory type. He has often seen a single bleeding procure great relief in these cases; and he does not remember a case where bleeding was followed by injurious effects.—(*P.* 594.) When the skin ulcerates, the treatment does not differ from what will be described, in speaking of *Ulcers*.

When burns are produced by gunpowder, and the skin more or less destroyed, cooling emollient applications were formerly thought most effectual, and a liniment composed of equal proportions of lime-water and linseed-oil gained the greatest celebrity. Even at this day, the application is very often employed. Mr. B. Bell advises it to be put on the parts by means of a soft hair-pencil, as the application and removal of the softest covering are often productive of much pain. The same author admits, however, that there are some cases in which Goulard's cerate, and a weak solution of the superacetate of lead, more quickly procure ease than the above liniment.

The sloughs having come away, the sores are to be dressed according to common principles.—(See *Ulcers.*)

When burns are produced by gunpowder, some of the grains may be forced into the skin: these should be picked out with the point of a needle, and an emollient poultice applied, which will dissolve and bring away any particles of gunpowder yet remaining.

Burnt parts which are contiguous, frequently grow together in the progress of the cure. The fingers, toes, sides of the nostrils, and the eyelids, are particularly liable to this occurrence; which is to be prevented by keeping dressings always interposed between the parts likely to become adherent, until they are perfectly healed.

The sores resulting from burns are perhaps more disposed than any other ulcers to form large granulations, which rise considerably above the level of the surrounding skin. No poultices should now be used. The sores should be dressed with any moderately stimulating, astringent ointment: the ceratum calaminæ or the unguentum resinæ with the pulv. hydrarg. nitrat. rub. is now generally preferred: and if the part will allow of the application of a roller, the pressure of it will be of immense service in keeping down the granulations, and rendering them more healthy. When these methods fail, the sores should be gently rubbed with the argentum nitratum.

In the dry and hot state of the skin Dr. Thomson is an advocate for diaphoretics. "Laxatives (says he) are often necessary; but it is in general best to employ only the gentler sort, on account of the trouble and pain which moving always gives the patient. Anodynes are often required, not only to procure sleep, but even a temporary alleviation of the pungency of the pain which the burn occasions. A mild vegetable and farinaceous diet should be used during the period of the symptomatic fever. Animal food, wine, and other cordials may be required in the progress of a suppurating burn; but they are not necessary at first, and when given in this stage, are almost always injurious."—(See *Lectures on Inflammation, p.* 594.)

With respect to the topical applications recommended by this gentleman, he generally prefers, in cases of superficial burns, cooling and refrigerant remedies. When there are vesications, and suppuration takes place without ulceration, he advises us, after refrigerants have ceased to produce beneficial effects, to use the linimentum aquæ calcis. However, where the progress of cicatrization is slow, he recommends, instead

of this liniment, ointments containing lead or zinc, particularly the ceratum calaminæ.

In the ulcerating state of suppurating burns, he prefers emollient cataplasms. But when the discharge continues, or becomes more profuse under the use of poultices, they are to be left off, and astringent washes employed, such as lime-water, the compound decoction of oak-bark, a weak solution of sulphate of copper, &c.

Where the parts are destroyed and converted into sloughs, Dr. Thomson does not think it matters much whether vinegar, oily liniments, turpentine, spirits of wine, or emollient poultices be at first employed. He acknowledges, however, that the poultice is the remedy under the application of which the separation of the dead parts is most easily and agreeably accomplished. "The question (says he) at present most deserving the attention of medical practitioners with regard to the use of the warm emollient poultices in burns is, whether we should apply it immediately after the burn has been received, or interpose for some hours, as has been so strongly recommended, dressings with vinegar, spirits of wine, or oil of turpentine. My own experience has not been sufficient to enable me to determine this point to my entire satisfaction. Yet I think it right to state to you, that in a number of trials made at different times, I have had occasion to see burns to which common emollient poultices had been from the first applied, slough and granulate faster, and in a more kindly manner, than similar burns in the same persons, to which in some instances the Carron oil (lin. aq. calcis), and in others again oil of turpentine, were applied at the same time with the poultices."—(See *Lectures on Inflammation*, p. 609.)

MR. CLEGHORN'S PLAN.

This gentleman, who was a brewer at Edinburgh, was induced to pay great attention to the effects of various modes of treating burns, on account of the frequency of these accidents among his own workmen. His observations led him to prefer the immediate application of vinegar, which was to be continued for some hours, by any of the most convenient means, until the pain abated; and when this returned, the vinegar was repeated. If the burn had been so severe as to have produced a destruction of parts, these, as soon as the pain had ceased, were covered with a poultice, the application of which was continued about six or, at most, eight hours; and after its removal, the parts were entirely covered with very finely powdered chalk, so to as take away every appearance of moisture on the surface of the sore. This being done, the whole burnt surface was again covered with the poultice. The same mode was pursued every night and morning until the cure was complete. If the use of poultices relaxed the ulcers too much, a plaster or ointment, containing the acetate of lead, was applied; but the chalk was still sprinkled upon the sore.

With respect to general remedies, Mr. Cleghorn allowed his patients to eat boiled or roasted fowl, or in short any plainly dressed meat which they liked. He did not object to their taking moderate quantities of wine, spirits and water, ale, or porter. He never had occasion to order bark, or any internal medicines whatever, and he only once thought it necessary to let blood. When the patient was costive, Mr. Cleghorn ordered boiled pot-barley and prunes, or some other laxative nourishing food, and sometimes an injection, *but never any purgative*, as he remarked that the disturbance of frequently going to stool was distressing to a patient with bad sores. Besides, he thought that a hurtful weakness and languor were always (more or less) brought on by purgatives. From the effects too which he felt them have upon himself, and observed them to have upon others, they did not seem to have so much tendency to remove heat and feverish symptoms as is generally supposed, and he believed that they more frequently carried off *useful* humours than *hurtful* ones.

Diluted sulphuric acid was not found to answer so well as vinegar, and the latter produced most benefit when it was fresh and lively to the taste.

In cold weather Mr. Cleghorn sometimes warmed the vinegar a little, placed the patients near the fire, gave them something warm internally, and kept them in every respect in a comfortable situation. His object in so doing was to prevent the occurrence of tremblings and chilliness, which in two instances, after employing cold vinegar, took place in an alarming degree.

The account of Mr. Cleghorn's plan was published by Mr. Hunter.—(See *Med. Facts and Observations, vol.* 2.)

SIR JAMES EARLE'S PLAN.

This gentleman was an advocate for the use of cold water or rather ice; and published several cases of extensive burns, in which this method was employed with the best effect. Cold water was enumerated by Mr. B. Bell among the applications to burns, and it was not uncommonly used long before Sir James Earle communicated the result of his experience to the public. The method indeed is very ancient. "Cold is a remedy (says Dr. J. Thomson) which has long been employed to diminish the inflammation of superficial burns. Rhazes directs, that in recent burns cloths dipped in cold water, or in rose-water cooled with snow, be applied as soon as possible to the parts which have been injured, and that these cloths be renewed from time to time; and Avicenna says that this practice often prevents the formation of blisters."—(*Lectures on Inflammation, p.* 589.) Sir James Earle's publication, however, had the good effect of drawing considerable attention to the subject, and of leading surgeons to try the method in a great number of instances in which other more hurtful modes of treatment might otherwise have been employed. The burnt parts may either be plunged in cold water, or they may be covered with linen dipped in the same, and renewed as often as it acquires warmth from the part. The application should be continued as long as the heat and pain remain, which they will often do for a great many hours. —(See *Essay on the means of lessening the Effects of Fire on the Human Body*, 8vo. *Lond.* 1803.)

Some caution, however, in the application of cold becomes necessary when a scald is of very large size, or situated upon the trunk of the body. In extensive burns, superficial as they may be, the patient is liable to be affected with cold shiverings; and these shiverings may be greatly aggravated by exposure and by the application of cold. Perhaps, therefore, in these examples warm applications ought to be preferred.—(*Dr. J. Thomson's Lectures on Inflammation, p.* 591.)

BARON LARREY'S PLAN.

It seems to me, that on the subject of burns there is, even at the present day, as much contrariety of sentiment as in any part of surgery whatsoever. After all the praises which of late years have been heard of vinegar, cold applications, oil of turpentine, &c., a French surgeon, whose talents and opportunities of observation entitle his opinion to the highest attention, has recently censured the employment of all such remedies. Larrey, though a military surgeon, has had occasion to see numerous burns, in consequence of explosions. He declares, that he has been long struck with the bad effects of repellents, such as fresh water with the muriate of ammonia, oxycrate, the liquor plumbi subacetatis, and the solution of opium in ice-water. He recommends dressing all deep burns with fine old linen spread with saffron ointment, which, he says, has the quality of diminishing the pain and preventing irritation, by keeping the nervous papillæ from coming into contact with the air, or being pressed by the linen and clothes. This ointment is to be continued till suppuration takes place, after which Larrey employs the ointment of styrax for promoting the detachment of the eschars, and checking the extension of the sloughing. As soon as the dead parts have separated, he again has recourse to the saffron ointment, for which he gradually substitutes dry lint, with strips of linen spread with cerate. When the vessels exceed the level of the edge of the sore, he touches them with the argentum nitratum, and he occasionally applies a weak solution of the oxymuriate of mercury, or of the sulphate of copper.

Larrey prescribes emollient and antispasmodic beverages, which are to be taken warm, such as milk of almonds, containing nitre, and properly sweetened; hydromel, rice ptisan, &c. His patients are never deprived of light nourishment, such as broths, jellies, eggs, soups, &c. He has found this simple treatment, which he calls soothing and gently tonic, almost always successful.—(See *Mém. de Chir. Militaire, t.* 1, *p.* 93.)

DR. KENTISH'S PLAN.

From what has been stated, it appears, that in cases of burns, cold and hot, irritating and soothing, astringent and emollient applications have all been outwardly

employed without much discrimination. But the internal treatment has always been of one kind, and both the ancients and moderns agree in advising blood-letting, cooling purges, and, in short, the whole of the antiphlogistic plan. If we except Mr. Cleghorn, who condemned purges, and allowed stimulants internally, Dr. Kentish has been almost the only advocate for the latter means.

The fanciful theories advanced by Dr. Kentish, lead him to believe, that as burns are injuries attended with increased action, there are two indications for restoring what he terms *the unity of action:* viz. the excitement or action of the part is first to be gradually diminished; secondly, the action of the system is to be increased to meet the increased action of the part, holding this law as the system in view: *That any part of the system, having its action increased to a very high degree, must continue to be excited, though in a less degree, either by the stimulus which caused the increased action, or some other having the nearest similarity to it, until by degrees the extraordinary action subsides into the healthy action of the part.*

With this view, holding the part to the fire seems, to Dr. Kentish, the best mode of relief; but as parts of the body are injured to which this cannot be done, the most stimulant applications must be used; for in this class there is little fear of any of them being greater than that which originally caused the accident. The strongest rectified spirits, made still stronger by essential oils, are proper, and may also be heated as much as the sound parts can bear. These and many other applications of the same class, says Dr. Kentish, will give the most speedy relief. They are to be continued only for a certain time, lest they cause the very ill which they are given to cure. They are then to be succeeded by less stimulant applications, until the parts act by common natural stimuli.

The internal mode of relief is to give those substances which most speedily excite the system to great action, such as ether, ardent spirits, opium, wine, &c., by which means the solution of continuity of action is allowed to last the shortest time possible, and the unity of action is restored, which constitutes the cure.

Suppose, for instance, as a local application, we at first apply the strongest alcohol, heated to the degree which the sound part would bear without injury; it should afterward be gradually diluted until it becomes proof spirit, and the heat should be diminished, although gradually, as cold is always pernicious, bringing on that tendency to shiver which should ever be continually guarded against, as being a most hurtful symptom, and the forerunner of a violent sympathetic fever. To prevent this, the external heat should be kept at a high temperature, and the action of the whole system raised in as great a degree as may be safe. By this means the action of the whole is made to meet the increased action of the part, by which the lessening of the increased action of the part to join the action of the whole is rendered more easy. Thus there is, says Dr. Kentish, a unity of intention by both the external and internal means, leading to the restoration of the unity of action, and the cure is performed.

It may be said, these circumstances can only take place when there is an increased action; and when the parts are destroyed, other means should be used, emollients, &c. In replying to this remark, Dr. Kentish distinguishes burns into two kinds; one, in which the action of the part is only increased; and another, in which some parts have increased action, while other parts are destroyed. It is of little consequence, says Dr. Kentish, what is applied to the dead part, as the detachment of an eschar depends upon the action of parts which remain alive, and not upon what is applied to those which are dead. However, he never saw an instance of a burn in which, though some parts were totally destroyed, there were not always other parts in which there was only increased action. Now as our duty is always to save living parts, our mode of cure in the first instance will always be the same; viz. to cure the parts which have only an increased action, in the doing of which the dead parts will not be the worse, as their separation is a process of the system which requires time, and, if the injury is to any extent, draws forth the joint efforts of the system, and even, says Dr. Kentish, calls up the energy of its powers to violent fever. This state should be supported by every artificial aid, in order to bring the parts to suppuration, otherwise the subject falls in the contest; for if the living parts have not the power to throw off the dead, the dead will assimilate the living to themselves, and a mortification ensue.

When the living parts have been preserved (continues Dr. Kentish), which, according to this treatment, will be in the course of two or three days, the dead parts will be more plainly observed, and the beginning of the process to throw them off will be commencing. This process must be assisted by keeping up the powers of the system by stimulant medicines and a generous diet. The separation of the eschars will be greatly promoted by the application of the stimulus of heat by means of cataplasms frequently renewed. These may be made of milk and bread, and some camphorated spirit or any essential oil sprinkled upon the surface. Such means need only be continued until the suppuration is established.

After Dr. Kentish had supported the system to suppuration, he then found that gradually desisting from his stimulant plan diminished the secretion of pus, and wonderfully quickened the healing process.

When some parts are destroyed, there must be others with increased action; and in this case, according to Dr. Kentish, the foregoing mode will be the best for restoring the living parts, and promoting the separation of the dead ones. Suppuration having taken place, the exciting of the system by any thing stimulant, either by food or medicine, should be cautiously avoided. Should the secretion of pus continue too great, gentle laxatives and a spare diet are indicated. If any part, as the eyes for instance, remain weak, with a tendency to inflammation, topical bleedings, or small quantities of blood taken from the arm, are useful. For the purpose of defending the new skin, camphorated oil, or camphorated oil and lime-water in equal parts, are good applications. Wounds of this kind heal very fast, when the diminution of pus is prevented by attention to diet; if the patient's strength require support, small doses of bark taken two or three times a day in some milk will answer that purpose, without quickening the circulation as wine, ale, or spirits are apt to do. By attention to these principles (continues Dr. Kentish), I can truly assert that I have cured very many extensive and dangerous burns and scalds in one, two, three, and four weeks, which in the former method would have taken as many months; and some which I believe to have been incurable by the former method.

After explaining his principles, Dr. Kentish takes notice of the various substances which have commonly been employed. Of these he would chiefly rely on alcohol, liquor ammoniæ subcarbonatis, ether (so applied as to avoid the cooling process of evaporation), and spirit of turpentine.

In applying these, we are directed to proceed as follows: the injured parts are to be bathed, two, or three times over, with spirits of wine, spirits of wine with camphor, or spirit of turpentine, heated by standing in hot water. After this a liniment, composed of the ceratum resinæ softened with spirit of turpentine, is to be spread on soft cloth, and applied. This liniment is to be renewed only once in twenty-four hours, and, at the second dressing, the parts are to be washed with proof spirit, or laudanum, made warm. When the secretion of pus takes place, milder applications must be made, till the cure is effected.

The yellow ointment stops the pores of the cloth, impedes evaporation, and thus confines the effect of the alcohol to the burnt surface. The first dressings are to remain on four-and-twenty hours. Dr. Kentish thinks it of importance, that the injured surface should be left uncovered as little as possible. It is therefore recommended to let the plasters be quite ready, before the old ones are removed, and then only to take off one piece at a time.

It will seldom be necessary to repeat the application of alcohol, or that of oleum terebinthinæ. The inflammatory action will be found diminished, and, according to Dr. Kentish's principles, the exciting means should therefore be diminished. Warm proof spirits, or laudanum, may be substituted for the alcohol, and the unguentum resinæ flavæ is to be mixed with oleum camph. instead of turpentine. If this should be found too irritating, Dr. Kentish recommends ceratum plumbi acetatis, or cer. calaminæ. Powdered chalk is to be used to repress the growth of exuberant granulations, and to absorb the pus. In the cavities of separated eschars,

and in the furrows between sloughs and living parts, he introduced powdered chalk. Then a plaster is applied, and, in tedious cases, a poultice over the plaster.

With respect to the internal treatment, the author observes, that great derangement of the system arises in certain persons from causes which in others produce no effect; and that this depends on a difference in the degree of strength. Hence, he concludes that as strength resists the sympathetic irritative actions of parts, and weakness induces them, we should, in all cases, make the system as strong as we can, immediately upon the receipt of the injury. In considerable burns, he supposes a disproportion of action to take place between the injured parts and the system at large, or what he styles a solution of the continuity of action; and that, by a law of the system, a considerable commotion arises, for the purpose of restoring the equilibrium, or enabling the constitution to take on the action of the part. Hence, Dr. Kentish is of opinion, that the indication is *to restore the unity of action of the whole system, as soon as possible*, by throwing it into such a state as to *absorb the diseased action*, and then gradually bring down the whole to the natural standard of action by nicely diminishing the exciting powers. Ether and alcohol, or other stimulants, are to be immediately given in proportion to the degree of injury; and repeated once or twice within the first twelve hours, and afterward wine or ale is to be ordered, till suppuration takes place, when it will be no longer necessary to excite the system.

In a second essay, Dr. Kentish remarks, that, in the first species of burns, *in which the action of the part is only increased*, he has not found any thing better for the first application than the heated oleum terebinthinæ and ceratum resinæ, thinned with the same. In superficial burns, when the pain has ceased, he considers it advisable to desist from this application in about four-and-twenty hours, and use at the second dressing a digestive, sufficiently thinned with common oil, beginning, on the third day, with the ceratum lap. calaminaris. This author has frequently seen secondary inflammation excited by the remedy. The most certain remedy for this unpleasant symptom is a digestive ointment thinned with oil, or a plaster of cerate, and over that a large warm poultice. The cerate will finish the cure. Should there be much uneasiness of the system, an anodyne, proportioned to the age of the patient, should be given.

The growth of fungus, and the profuse discharge of matter, are to be repressed, as already mentioned, by sprinkling powdered chalk on the surface, and by the use of purgatives, in the latter stages. The chalk must be very finely levigated.

Dr. Kentish's theories are, as far as I can judge, visionary: they may amuse the fancy, but can never improve the judgment. They are nearly unintelligible; they are unsupported by any sort of rational evidence; and, as being only the dreams of a credulous, sportive imagination, they must soon decline into neglect, if not oblivion. However, in making these remarks, it is far from my intention to extend the same animadversion to the mode of treatment insisted upon by Dr. Kentish, which forms a question which cannot be determined by reason, but by experience.

OF DRESSING BURNS WITH RAW COTTON.

In America, it is asserted that the best application for superficial burns is *raw cotton*, thinly spread out, or carded, and put directly on the injured part.—(See *Dallam on the Use of Cotton in Burns, in Potter's Medical Lyceum, p. 22; and Gibson's Institutes and Practice of Surgery, p. 62, vol. 1, 8vo. Philadelphia*, 1824.) According to Professor Gibson, it is only in superficial burns that this practice answers; but Dr. Anderson, of Glasgow, who has tried it on a large scale, represents it as applicable to injuries, whether occasioned by scalding or actual fire, whether superficial or deep, recent or old, vesicated or sphacelated. He states, that it has been long adopted by the inhabitants of the Greek islands. One of its advantages, he says, is, that, except in cases of deep injury, the cure is always accomplished without any appearance of cicatrization.—(See *Glasgow Med. Journ. vol. 1, p. 209.*) Another is the avoidance of the pain always attending the frequent renewal of other kinds of dressings; for this is left unchanged a considerable time. Some care, says Dr. Anderson, is necessary, both in preparing and applying the cotton. For this purpose, it should be finely carded, and disposed in narrow fleeces, so thin as to be translucent; by which means it can be applied in successive layers, and is thus made to fill up and protect the most irregular surfaces. The burnt parts, if vesicated, are to be washed with tepid water, and the fluid evacuated by small punctures. Or, if more deeply scorched, they may be bathed with a spirituous or turpentine lotion. The cotton is then applied, layer after layer, until the whole surface is not only covered, but protected at every point, so that pressure and motion may give no uneasiness. On some parts, it will adhere without a bandage, especially when there is much discharge; but, in general, a support of this kind is useful. Where the vesications have been broken, and the skin is abraded, or where there is sphacelus, more or less suppuration always ensues; and, in such cases, Dr. Anderson admits, the discharge may be so great as soon to soak through the cotton, and become offensive, particularly in summer, so that it may be necessary to remove the soiled portions. This, however, he advises to be done as sparingly as possible, care being taken to avoid uncovering or disturbing the tender surface.—(*Op. cit. p.* 213.) According to Dr. Anderson, there appears to be a twofold effect from this kind of treatment. The primary effect arises from the *exclusion of the air*, and the slowly conducting power of cotton, by which the heat of the part is retained, while a soft and uniformly elastic protection from pressure is afforded. The secondary effect, he says, depends entirely on the sheath, or case, formed by the cotton, absorbing the effused serum or pus, and giving the best possible substitute for the lost cuticle. "But in order that the full benefit may be derived from this substitute, and to ensure an equable and continued support to the tender parts, until the new skin is formed, it is absolutely necessary that the cotton should not be removed, except under particular circumstances, until the real cuticle is sufficiently formed to bear exposure."—(*P.* 217.) As Dr. Anderson admits, the theory is of little consequence; and we shall not, therefore, criticise it. The merit of the practice can be determined only by experience. We have noticed, that Gibson restricts the plan to superficial burns; and when it is recollected, that in other cases the discharge would soon convert the unchanged cotton into a most fetid mass of scabs, putridity, and even maggots, one can hardly doubt that his statement is correct. It is true, the fetor may be counteracted by wetting the cotton in a solution of chloride of lime; but directly this is done, the soft elastic property of that substance is lost, and the method is not essentially different from that in which linen and lint are applied, after being wet with the linimentum calcis, or other fluid applications; and would equally require frequent change. If much constitutional irritation be evinced after the cotton has been for some time applied, Dr. Anderson confesses, that it may be necessary to let out the discharge, or even remove the cotton altogether. "We are then to be guided by the symptoms and appearances, whether to reapply the same dressings, or first restore a more healthy action in the constitution."—(*Op. cit. p.* 218.)

[The "*exclusion of the air*" is the true indication in the treatment of *burns*; but it is imperfectly fulfilled by the carded cotton. In superficial burns, salt has long been a domestic application, and can only act in this way; yet when the part is completely covered with a layer of salt, the relief is immediate, and in superficial burns is permanent.

Some surgeons, in this country, treat all kinds of burns on the refrigerant plan; among whom Professor Davidge, of Maryland, was among the most prominent. He uniformly directed a saturnine solution to be applied to all recent burns, and persevered in until the acute inflammation was subdued, when he used Turner's cerate as the subsequent dressing. Dr. Kentish's plan is, however, most popular in this country, and alcohol, spirits of turpentine, and the mixture of linseed oil and lime-water are in almost universal use.

As, however, the relief afforded in burns is generally the result of the exclusion of the air from the raw surface, the modern practice introduced on the continent of covering burns with *wheat flour*, or other farinaceous material, will be found by far the most immediate in its action, and the most successful in its results; and this application is adapted to every species of burns, "whether occasioned by scalding or actual fire, whether superficial or deep, recent or old, vesicated or sphace-

tated." In the most desperate burns, where the injury is extensive and the destruction of the cutis almost universal, the patient is unable to sustain either the refrigerant treatment, or any modification of Dr. Kentish's plan. In these shocking cases, if the flour be applied all over the injured surface until the air is entirely excluded, the pain is almost annihilated; and from the most excruciating torture, the patient is instantly placed under circumstances of comparative comfort. The flour should be repeatedly applied, and persevered in, until the acute inflammation is removed, or, in common parlance, "the fire is out." No other application or dressing will be necessary until the acute stage is past; and then the plan of Dr. Kentish, modified according to the circumstances of the case, will be found adequate to the restoration of the injured surface, however extensive. I can confidently recommend this practice, having witnessed its success in the most hopeless cases.—*Reese.*]

The cicatrix of a burn is often of great extent, and, on this account, the subsequent absorption of the granulations on which the new skin is formed (a process by which the magnitude of the scar is afterward lessened) is so considerable, as to draw the neighbouring parts out of their natural position, and occasion the most unpleasant kinds of deformity. Thus, burns on the neck are apt to cause a distortion of the head, or even draw down the chin to the breast-bone; and in the limbs, such contractions as fix the joints in one immoveable position. Simply dividing these contractions again mostly fails altogether, or only produces very partial and temporary relief, as, after the cicatrization is completed, the newly formed parts are absorbed, and the contraction recurs. A few years ago, a proposal was made, by my friend Mr. Earle, to cut away the whole of the cicatrix, and then bring the edges of the skin as much towards each other as possible, in the transverse direction, with strips of adhesive plaster. In one case, in which, from the fore part of the upper arm, to within about two inches of the wrist, a firm tense cicatrix of an almost horny consistence extended, which kept the elbow immoveably bent to a right angle, this gentleman performed such an operation. After removing the cicatrix, the flexor muscles at first made some resistance to the extension of the limb; but by degrees they yielded, and the arm was brought nearly to a right line. The whole limb was kept in this position by means of a splint and bandage. In the end, the contraction was cured, and the use of the limb restored."—(See *Med. Chir. Trans. vol.* 5, *p.* 96, *&c.*)

Probably, as this patient was a young growing subject, only six years of age, the operation would have proved equally successful, if a simple division of the contracted skin had been made, and the arm kept extended for a length of time by the use of a splint. It is hardly necessary to observe, that cutting a large cicatrix entirely away, must always be a severe, and sometimes a dangerous operation; therefore, the avoidance of it, if possible, cannot but be desirable.—(See *B. Bell's System of Surgery. Medical Facts and Observations, vol.* 2. *J. Sedillot, de Ambustione Theses,* 4*to. Parisiis,* 1781. *Richter's Anfangsgründe der Wundarzneykunst, b.* 1. *Earle's Essay on the Means of lessening the Effects of Fire on the Human Body,* 8*vo. Lond.* 1799. *Kentish's two Essays on Burns, the first of which was published in* 1798. *Robert Lyall, in Edin. Med. and Surg. Journ. vol.* 7. *p.* 313. *Hedin, Diss. sistens Observationes circa vulnera ex combustione, &c.* 4*to. Upsaliæ,* 1804. *Larrey, Mémoires de Chirurgie Militaire, t.* 1, *p.* 93—96. *Boyer, Traité des Maladies Chir. t.* 1, *p.* 160. *Nodes Dickinson, Remarks on Burns and Scalds, chiefly in reference to the principles of treatment at the time of their infliction, suggested by a perusal of the last edition of an Essay on Burns, by E. Kentish, M. D.* 8*vo. Lond.* 1818. *Lectures on Inflammation, by John Thomson, p.* 585, *&c. Edin.* 1813. *Lassus, Pathologie Chir. t.* 2, *p.* 391. *Anderson, in Glasgow Medical Journ. vol.* 1. *Pearson's Principles of Surgery, p.* 171, *edit.* 1808. *Gibson's Institutes of Surgery, vol.* 1, *Philadelphia,* 1824.)

BURSÆ MUCOSÆ. These are small membranous sacs, situated about the joints, particularly the large ones of the upper and lower extremities. For the most part, they lie under tendons. Mr. Brodie comprehends also under the same head, the membranes forming the sheaths of tendons, as they have the same structure, and perform a similar office. The celebrated Dr. A. Monro, of Edinburgh, published a very full account of the bursæ mucosæ and their diseases. These parts are naturally filled with an oily kind of fluid, the use of which is to lubricate surfaces, upon which the tendons play in their passage over joints. In the healthy state, this fluid is so small in quantity, that it cannot be seen without opening the membrane containing it; but occasionally such an accumulation takes place, that very considerable swellings are the consequence. Tumours of this sort are often produced by bruises and sprains; and now and then by rheumatic affections. They are not often attended with much pain, though in some cases it is very acute, when pressure is made with the fingers. The tumours yield, in a certain degree, to pressure; but they rise again, with an appearance of elasticity not remarked in other sorts of swellings. At first they appear to be circumscribed, and confined to a small extent of the joint; but sometimes the fluid forming them is so abundant that they extend over a great part of the circumference of the limb. The skin when not inflamed retains its usual colour.

In this morbid state of the bursæ mucosæ, they contain different kinds of fluids, according to the cause of the disease. When the tumour depends on a rheumatic affection the contents are ordinarily very fluid. They are thicker when the cause is of a scrofulous nature. When the disease is the consequence of a bruise or sprain, the effused fluid often contains hard concretions, and as it were cartilaginous ones, which are sometimes quite loose, and more or less numerous. Mr. Brodie states, that they have the appearance of small melon-seeds, and are not unusual when the inflammation is of long standing. Such substances may frequently be felt with the fingers.

In the greater number of instances, inflammation of the bursæ mucosæ occasions an increased secretion of synovia. In other cases the bursa is distended with a somewhat turbid serum, containing floating portions of coagulable lymph. The inflammation sometimes leads to the formation of an abscess; and occasionally the membrane of the bursa becomes thickened, and converted into a grisly substance. Mr. Brodie has seen it at least half an inch in thickness, with a small cellular cavity in the centre containing synovia. In other instances, however, though the inflammation has lasted a considerable time, the membrane of the bursa retains nearly its original structure.—(*Pathological and Surgical Obs. on the Joints, p.* 351, *ed.* 2.)

According to the same authority, the disease may be the consequence of pressure, or other local injury; the abuse of mercury; rheumatism, or other constitutional affection; and, in such cases, the complaint is frequently joined with inflammation of the synovial membrane of the joints.—(See *Joints.*) Sometimes it has the form of an acute, but more commonly that of a chronic inflammation.

While the swellings are not very painful, an attempt may be made to disperse them, by warm applications, friction (particularly with camphorated mercurial ointment), or blisters, kept open with the savin cerate. But if these tumours should become very painful, and not yield to the above methods, Dr. Monro recommends opening them. This author was continually alarmed at the idea of the bad effects of air admitted into cavities of the body; and hence, in the operation, even in opening the bursæ mucosæ, he is very particular in directing the incision in the skin, not to be made immediately opposite that made in the sac.

In the beginning, Mr. Brodie recommends the use of leeches and cold lotions; and afterward, that of blisters or stimulating liniments. In particular cases, he says, these means should be combined with such constitutional remedies as circumstances indicate. When the disease is of long standing, the preternatural secretion of the fluid will often continue after the inflammation has entirely subsided. If blisters now fail in procuring its absorption, Mr. Brodie recommends friction; and if this be unavailing, he considers it advisable to discharge the fluid by a puncture. The presence of loose substances in the bursa, he thinks, may of themselves keep up a collection of fluid.

Dr. Monro met with cases in which amputation became indispensable, in consequence of the terrible symptoms brought on by opening a bursa mucosa.

On account of such evil consequences, which are imputed to the air, though they would as often arise

were the same practice pursued in a situation in which no air could have access at all, it has been recommended to pass a seton through the swelling, and to remove the silk, after it has remained just long enough to excite inflammation of the cyst, when an attempt is to be made to unite the opposite sides of the cavity by pressure.

This practice is sometimes approved of by Mr. Brodie on other grounds: he has noticed, that after the whole cavity of the bursa has been converted into an abscess, and this has been cured, no fluid generally collects there again. Hence, he has sometimes been induced to pass into the puncture a seton or tent, or (what he deems better) the blunt end of a probe, for the irritation of the inner surface of the bursa. This practice I tried very successfully on a young woman who was under my care last year. I punctured the bursa below the patella, and discharged about an ounce of fluid, resembling white of egg. The disease had existed several months, and the bursa was much thickened. I kept the puncture open about ten days, during which time there was a discharge from it of the same kind of fluid without any tendency to suppuration. I therefore introduced a tent into the opening, by which means the necessary degree of inflammation was excited, the bursa suppurated, and the disease was soon permanently cured, without any severe symptoms. At the same time, I believe Mr. Brodie to be perfectly right in cautioning surgeons against the indiscriminate adoption of this practice. Inflammation and suppuration of a large bursa (he says) sometimes disturb the constitution so much, that it might be prudent merely to make a puncture, and keep the patient afterward perfectly quiet. He mentions a diseased bursa mucosa, which he had seen between the lower angle of the scapula and the latissimus dorsi, and which was not much less than a man's head. In this case, death followed the constitutional disturbance excited by a puncture and the seton. In another example, seen by this judicious surgeon, where the patient was in bad health, and the due observance of quietude was neglected, puncturing a diseased bursa mucosa was soon followed by death.—(*Op. cit. p.* 360.)

One or two similar cases, which happened in St. Bartholomew's Hospital, have also been communicated to me. In some instances, the making of too free an incision into the bursa mucosa has been followed by extensive phlegmonous erysipelas of the whole limb, ending in death.

When the coats of a bursa mucosa are much thickened, and cannot be restored to their natural condition, Mr. Brodie says, that the bursa, if superficially situated, may be removed with as much facility as an encysted tumour. This practice, however, he has only as yet applied to the bursa between the patella and the skin, though he entertains no doubt of there being other superficial bursæ which would also safely admit of removal.

Consult *Monro's Description of all the Bursæ Mucosæ, &c. with remarks on their accidents and diseases, &c. fol. Edin.* 1788. *C. M. Koch, De Morbis Bursarum tendinum mucosarum. And, particularly, B. C. Brodie's Pathological and Surgical Observations on the Joints, chap.* 9, *ed.* 2, 8*vo. Lond.* 1822.

C

CÆSAREAN OPERATION. Called also *Hysterotomia*, from ὑστέρα, *uterus*, and τομὴ, *sectio*. Pliny, book 7, chap. 9, of his Natural History, gives us the etymology of this operation. "*Auspicatius* (says he) *enectâ parente gignuntur, sicut Scipio Africanus prior natus, primusque Cæsar à cæso matris utero dictus; quâ de causâ cæsones appellati. Simili modo natus est Manlius qui Carthaginem cum exercitu intravit.*"

From this passage we are to infer that the Cæsarean operation is extremely ancient, though no description of it is to be found in the works of Hippocrates, Celsus, Paulus Ægineta, or Albucasis. The earliest account of it in any medical work, is that in the Chirurgia Guidonis de Cauliaco, published about the middle of the fourteenth century. Here, however, the practice is only spoken of as proper after the death of the mother, and is alleged to have been adopted only at such a conjuncture in the case of Julius Cæsar.—(See *Cap. de Extractione Fœtus.*) Vigo, who was born towards the close of the fifteenth century, takes no notice of the Cæsarean operation; and Paré, who greatly improved the practice of midwifery, thinks this measure only allowable on women who die undelivered.—(*De Hominus Generatione, cap.* 31.) Rousset, who was contemporary with Paré, collected the histories of several cases, in which the operation is said to have been successfully performed; and, after the publication of these, the subject excited more general interest.

By the *Cæsarean operation* is commonly understood that in which the fœtus is taken out of the uterus, by an incision made through the parietes of the abdomen and womb. The term, however, in its most comprehensive sense, is applied to three different proceedings. It is sometimes employed to denote the incision which is occasionally practised in the cervix uteri, in order to facilitate delivery; but this particular method is named the *vaginal Cæsarean operation*, for the purpose of distinguishing it from the former, which is frequently called, by way of contrast, the *abdominal Cæsarean operation*. With these cases we have also to class the incision which is made in the parietes of the abdomen for the extraction of the fœtus, when, instead of being situated in the uterus, it lies in the cavity of the peritoneum, in consequence of the rupture of the womb, or in the ovary, or Fallopian tube, in consequence of an extra-uterine conception.

VAGINAL CÆSAREAN OPERATION.

Disease, malformation, or a preternatural position of the cervix uteri, may render this practice indispensable. A scirrhous hardness of the neck of the uterus is the most frequent. When the induration is such that the cervix cannot be dilated, and the patient is exhausting herself with unavailing efforts, the parts should be divided in several directions. This has been successfully done under various circumstances. Cases have been met with, in which the cervix uteri presented no opening at all; and yet the preceding operation proved quite effectual. Such is the example which Dr. Simson has inserted in the third volume of the Edinburgh Essays. A woman, forty years of age, became pregnant, after recovering from a difficult labour, in which the child had remained several days in the passage. She had been in labour sixty hours; but the neck of the womb had no tendency to dilate. Dr. Simson, perceiving that its edges were adherent, and left no opening between them, determined to practise an incision, with the aid of a speculum uteri. The bistoury penetrated to the depth of half an inch, before it got quite through the substance which it had to divide, and which seemed as hard as cartilage. As the opening did not dilate, in the efforts which the woman made, it became necessary to introduce a narrow bistoury on the finger, in order to cut this kind of ring in various directions. There was no hemorrhage; and the only additional suffering which the patient encountered, arose from the distention of the vagina. As the child was dead, Dr. Simson perforated the head, in order to render the delivery more easy.

Strong convulsions at the moment of parturition, may create a necessity for the vaginal Cæsarean operation. These sometimes subside as soon as the membranes are ruptured and the waters discharged, so as to lessen the distention of the womb. However, if the convulsions were to continue, and the cervix uteri were sufficiently dilated, the child should be extracted with the forceps or by the feet, according to the kind of presentation. On this subject Baudeloque has recorded a fact, which was communicated to the Academy of Surgery by Dubocq, professor of surgery at Toulouse. The woman was forty years of age, and had been in convulsions two days. She was so alarmingly pale, that she could scarcely be known. Her pulse was feeble and almost extinct, and her extremities were cold and covered with a clammy perspiration. The edges of the opening, which was about as large as a crown piece, felt, as it were, callous; and hardly had this aperture been dilated, when delivery took place spontaneously. The child was dead. The symp-

toms were appeased, and the woman experienced a perfect recovery. Another case, in which the indurated cervix uteri was successfully divided, is recorded by Lambron, a surgeon at Orleans.—(See *Dict. des Sciences Méd. t.* 23, *p.* 297.)

A considerable obliquity of the neck of the womb, combined with a pelvis of small dimensions, may also be a reason for the performance of the vaginal Cæsarean operation. Not that such obliquity always occasions that of the rest of the uterus; nor is the neck of this viscus invariably directed towards that side of the pelvis which is opposite to its fundus, although this is sometimes the case. In the latter circumstance, as the contractions of the uterus do not produce a dilatation of its cervix, which rests upon the bones of the pelvis, the adjacent part of that organ is dilated and pushed from above downwards, so as to present itself in the form of a round smooth tumour, without any appearance of an aperture. Such a case may have fatal consequences. Baudeloque furnishes us with an instance. A woman in her first pregnancy, not being able to have the attendance of the accoucheur, whom she wished, put herself under the care of a midwife, who let her continue in labour-pains during three days. When the accoucheur came, on being sent for again, the child's head presented itself in the vagina covered with the womb. The portion of the uterus which included the fœtus, was in a state of inflammation. The os tincæ was situated backwards towards the sacrum, hardly dilated to the breadth of a penny-piece, and the waters had been discharged a long time. The patient was bled, and emollient clysters were administered. All sorts of fomentations were employed. She was laid upon her back with the pelvis considerably raised. The accoucheur had much difficulty in supporting the head of the child, and keeping it from protruding at the vulva, enveloped as it was in the uterus. Notwithstanding such assistance, the patient died.

So fatal an event, says Sabatier, might have been prevented, by making the woman lie upon the side opposite the deviation of the uterus, and employing pressure from above. If these proceedings had failed in bringing the os tincæ towards the centre of the pelvis, this opening might have been brought into such position by means of the finger, in the interval of the pains, and kept so until it were sufficiently dilated for the membranes to protrude.

This is what was done by Baudeloque in one case, where the womb inclined forwards and to the right. The os tincæ was situated backwards. The waters escaped and the head advanced towards the bottom of the pelvis, included in a portion of uterus The whole of the spherical tumour which presented itself could be felt with the finger; but no opening was distinguishable; and the swelling might also be seen on separating the labia from each other and opening the entrance of the vagina. It became necessary to keep the patient continually in bed, and to have the finger incessantly introduced; but she was not sufficiently docile to submit to such treatment. Fortunately, the unexpected appearance of two officers of justice, forty-eight hours after the commencement of the labour, had the effect of making her more manageable. It was time for her to become so; for the uterus had now become tense, red, and painful. The abdomen was also so tender, that it could scarcely bear the contact of the clothes. Febrile symptoms had begun, and the ideas were beginning to be confused. Baudeloque made her lie down; and he pressed with one hand on the abdomen, for the purpose of raising the uterus, while with the other he pushed the head a little way back, in order that he might reach the os tincæ, which he now brought with his finger towards the centre of the pelvis, and kept there for some time. The efforts of the patient being thus encouraged, she was delivered in about a quarter of an hour. The infant was of a thriving description, and the case had a most favourable termination.

When the obliquity of the uterus is such, that the os tincæ cannot be found, and the mother and fœtus are both in danger of perishing, it is the duty of the practitioner to open the portion of the womb that projects towards the vulva. Lauverjat met with a case of this description in his practice. A woman, pregnant with her first child, suffered such extreme pain in her labour, that Lauverjat was solicited to ascertain the real state of things. He was surprised to find the vulva completely occupied by a body which even protruded externally and yielded to the pressure of the fingers, except during the labour-pains. In examining this tumour he could only find at its circumference a cul-de-sac, half an inch deep, without any aperture through which the child could pass. Other practitioners, who were consulted about this extraordinary case, were also anxious to learn what had happened. They found in the tumour a laceration, which only affected a part of the thickness of its parietes. This laceration was deemed the proper place for making an incision. The operation having been done, the finger was passed into the cavity in which the child was contained. A large quantity of turbid fluid was discharged. The child presented and passed through the opening, with a trivial laceration on the right side. Lauverjat, having passed his hand into the utherus, was unable to find either the os tincæ or the cervix. No particular indisposition ensued, and the lochia were discharged through the wound, which gradually closed. In the course of two months the os tincæ and neck of the uterus were in their natural position again.—(*Lauverjat, Nouvelle Méthode de pratiquer l'Operation Césarienne. Paris,* 1788.)

When the case is a scirrhous induration of the cervix uteri, or a laceration of the parietes of this viscus at the place where it projects into the vagina, the vaginal Cæsarean operation is attended with no difficulty. It is performed with a blunt-pointed bistoury, the blade of which is wrapped round with lint to within an inch of the point. The instrument is to be introduced, under the guidance of the index finger, into the opening presented by the uterus, and the aperture is to be properly enlarged from within outwards, in various directions. But when the scirrhous hardness of the cervix presents no opening at all, or when the part of the uterus projecting in the vagina is entire, the incision should be made from without inwards, with the same kind of knife. Too much caution cannot be used in introducing the instrument, in order that no injury may be done to the child, which lies directly beyond the substance which is to be divided. No general direction can here be offered, except that of proceeding slowly, and of keeping the index finger extended along the back of the knife, so that it may be immediately known when the substance of the womb is cut through, into the cavity of which the finger ought to pass as soon as the knife. If it should be necessary to extend or multiply the incisions, the cutting instrument should be regulated in a similar manner with the same finger. The cervix uteri having been divided, the expulsion of the child is either to be left to nature, or to be promoted by the ordinary means. The operation that has been described requires no dressings. If the bleeding should prove troublesome, we are recommended to apply to the incision a dossil of lint wet with vinegar or spirit of wine.—(See *Sabatier, Médecine Opératoire, t.* 1.) The chief object would here be to prevent adhesions between the cervix of the uterus and the upper part of the vagina.—(*Dict. des Sciences Méd. t.* 23, *p.* 298.)

ABDOMINAL CÆSAREAN OPERATION.

This is a far more serious operation than that which has just now been treated of, and is the proceeding to which the term Cæsarean operation is more particularly applied.

There are three cases in which this operation may be necessary. 1. When the fœtus is alive and the mother dead, either in labour, or the last two months of pregnancy. 2. When the fœtus is dead, but cannot be delivered in the usual way, on account of the deformity of the mother, or the disproportionate size of the child. 3. When both the mother and child are living, but delivery cannot take place from the same causes, as in the second example.

In many instances, both mother and child have lived after the Cæsarean operation, and the mother even borne children afterward.—(See *Heister's Institutes of Surgery, chap.* 113. *Mém. de l'Acad. de Chirurgie, t.* 1, *p.* 623, *t.* 2, *p.* 308, *in* 4*to. Edin. Med. Essays, vol.* 5, *art.* 37, 38. *Edin. Med. and Surgical Journal, vol.* 4, *p.* 179. *Med. Chir. Trans. vol.* 9 *and* 11, *&c.*) Very recently an example has been recorded, in which Dr. Müller, of Lowenburg, in Silesia, performed the Cæsarean section, and saved both the mother and the child.—(*Magazin fur die gesammte Heilkunde,* 1828; *b.* 28, *p.* 146.)

An instance of similar success is reported by C. H. Graefe.—(*Journ. fur Chirurgie, &c. b. 9, s. 1.*) Two successful cases, in which both women and children were operated on at the hospital of Maestricht, by M. Bosch.—(*Bibl. Med.* 1823.) And in a valuable periodical work, one example is reported from Hufeland's Journal, where the mother and twins were all saved by the operation.—(See *Quarterly Journ. of Foreign Medicine, &c. vol. 4, p. 625.*)

The most extraordinary case of Cæsarean operation on record, is one performed by a negro girl on herself, who recovered.—(See *New-York Med. and Physical Journ. March*, 1823.) Dr. Mosely mentions the case of a negro woman at Jamaica, who opened her side with a butcher's knife, and extracted a child, which died of locked-jaw. The woman recovered.—(See *Ryan's Manual of Midwifery, p. 280.*)

In England, the operation has been attended with remarkably ill success; and perhaps there is not one unequivocal example, in which the mother has here survived the true Cæsarean operation. In the third edition of this work, indeed, I referred to the case recorded by Mr. James Barlow, of Chorley, Lancashire, who made an incision into the abdomen, extracted a dead child, and saved the mother's life.—(See *Medical Records and Researches, p. 154, 1798; also, J. Barlow's Essays on Surgery and Midwifery.*) My friend Dr. Gooch, however, having obligingly communicated to me his doubts, and those of Dr. Hull, respecting the reality of an incision having been made in this instance into the uterus, I am glad to have the opportunity of expressing my perfect conviction of the more correct view of the case taken by these physicians. "I suspected from the first (says Dr. Hull), that Mr. Barlow was deceived in this case, from the account he gave of the *remarkable thinness of the uterus.* And I had formed an opinion, that the *child had escaped through a laceration of the uterus into the abdomen*, enveloped in the secundines, and that he had merely divided the membranes, when he fancied he had divided the uterus." Dr. Hull then proceeds to explain the confirmation of his own sentiments by those of Mr. Howarden, a very intelligent practitioner at Blackrod, who assisted at the operation. In fact, the particulars stated by this gentleman leave no doubt, that the fœtus had escaped through a laceration of the uterus into the cavity of the abdomen.—(See *Hull's Defence of the Cæsarean Operation, &c. p. 72.*) The case also referred to by Mr. D. Stewart (see *Edin. Med. Essays, vol. 5*), where the labour had endured twelve days, and the life of the mother was saved, after the dead fœtus had been extracted by a midwife, was also probably of the same nature: at all events, the want of authentic particulars, and the circumstance of the operation having been done by a woman, leave the true nature of the case questionable.

If, therefore, when we speak of the Cæsarean operation, we mean that in which the parietes of the abdomen and those of the uterus are divided by the surgeon, and the fœtus extracted, I believe, that as far as the history of the practice extends in this country, it cannot be said, that the mother has ever recovered after such a proceeding; though, some years ago, a calculation was made, that the operation had been done not less than eighteen times in Great Britain; and since then it has been repeated in several instances with the same ill success.—(See *Henderson's Case, in Ed. Med. and Surg. Journ. vol. 17.*) It is said now, indeed, to have been performed about thirty times in the British dominions.—(See *Ryan's Manual of Midwifery, p. 270.*) Several of the children, however, are stated to have been saved. And in the case operated upon in April, 1826, by Mr. Crichton, of Dundee, the infant was preserved, though the mother sunk eight hours after the operation.—(See *Edin. Med. and Surgical Journ. No. 96, p. 54.*) On the continent, the practice has proved infinitely more successful; for of 231 cases of this operation to be found in the records of medicine, 139 are said to have terminated successfully.—(*Kellie in Edin. Med. and Surgical Journ. vol. 8, p. 17.*) No doubt, the ill success of the Cæsarean operation in England was correctly explained by Dr. Hull: "In France, and some other nations upon the European continent, the Cæsarean operation has been, and continues to be, performed where British practitioners do not think it indicated; it is also had recourse to early, before the strength of the mother has been exhausted by the long continuance and frequent repetition of tormenting, though unavailing pains, and before her life is endangered by the accession of inflammation of the abdominal cavity. From this view of the matter, we may reasonably expect, that recoveries will be more frequent in France than in England and Scotland, where the reverse practice obtains. And it is from such cases as these, in which it is employed in France, that the value of the operation ought to be appreciated. Who would be sanguine in his expectation of a recovery under such circumstances, as it has generally been resorted to in this country, namely, where the female has laboured for years under *malacostion* (*mollities ossium*), a disease hitherto in itself incurable; where she has been brought into imminent danger by previous inflammation of the intestines, or other contents of the abdominal cavity; or been exhausted by a labour of a week's continuance, or even longer?" Dr. Hull thus refutes the opinion of Mr. W. Simmons, that our ill success was owing to climate, or some peculiarity in the constitutions of the females of this island.—(See *Hull's Defence of the Cæsarean Operation, p. 10.*)

The general readiness of continental practitioners to have recourse to the Cæsarean section has been sometimes censured, because they have even operated in cases in which the patients had previously borne children in the natural way. According to Dr. Ryan, however, there are but four such cases on record: "One by Nagele in his *Erfahrungen und Abhandl. aus dem Gebiete des Krankheiten des Weiblichen Geschlechts;* another by Henderson, in the *Edin. Med. and Surg. Journ. No. 66*; a third by Meier, in *Siebold's Journ.*; and a fourth in the same Journ. by Berger."—(See *Ryan's Manual of Midwifery, p. 279.*) Certainly, if a woman had already borne children in the natural way, the fact should be received as a strong argument against the necessity of the operation, but perhaps not as an absolute prohibition, since every thing must depend on the actual dimensions of the lower aperture of the pelvis in relation to the size of the existing fœtus.

When the fœtus is contained in the womb, and cannot be expelled, by reason of the invincible obstacles to which I have already referred, and embryotomy, or the practice of sacrificing the fœtus and extracting it it piecemeal by the vagina, be deemed improper, the Cæsarean operation should be practised, before the mother and fœtus both perish from the violence of the pains, hemorrhage, convulsions, &c.

For this purpose it is necessary to make an extensive incision in the integuments of the abdomen, and in the uterus. Some have thought that cutting the parietes of the belly would be mortal; while others have believed a wound of the uterus equally dangerous. Hence such persons have condemned the operation on the principle that religious reasons do not authorize taking one life to save another. All the opponents of the Cæsarean operation fear the hemorrhage which they say must follow. Indeed, if the uterus were not to contract sufficiently when the fœtus and after-birth had come away, the bleeding would really be perilous. But when, by means of the Cæsarean operation, the fœtus is extracted, together with the placenta and membranes, the uterus contracts just as it does after a natural labour. Besides, even when the mother is alive, the operation is not commonly done till the uterus evinces a propensity to deliver itself, and begins to contract. The womb being delivered of its contents, the incision becomes closed, the vessels obliterated, and there is no fear of hemorrhage. The wound must also make so irritable an organ more disposed to contract; but whatever arguments may be adduced, it is enough to say in this case, *Artem experientia fecit, exemplo monstrante viam.* Rousset, in 1581, published a work in French, entitled *Hystérotomie, ou l'Accouchement Césarean.* This book, in 1601, was translated into Latin, and enlarged with an appendix by the celebrated Bauhin. Even then the practice of the Cæsarean operation on the living mother had its defenders. Bauhin relates, that in the year 1500 a sow-gelder performed the Cæsarean operation on his wife, *tam feliciter, ut ea postea gemellos et quatuor adhuc infantes enixa fuerit.* This is said to be the first instance in which the operation was ever done on the living mother with success. Many other cases were afterward collected and published.

The possibility of operating successfully on the

living mother was proved with great perspicuity and accuracy by Simon, in the *Mémoires de l'Acad. de Chirurgie, t.* 1, 4*to.* Here we are presented with a collection of sixty-four Cæsarean operations, more than a half of which had been done on thirteen women. Some of these had undergone the operation once or twice; others five or six times. There was one woman in particular who had undergone it seven times, and always with success. This seems to prove, notwithstanding all assertions to the contrary, that the operation for the most part succeeds. But if the life of the mother should not invariably be preserved, the Cæsarean operation ought not to be rejected on this account; it ought always to be done when relief cannot be obtained by other means; just as amputation and lithotomy are practised, though they are not constantly followed by success. Would any thing be more cruel than to abandon a mother and her child, and leave them to perish while there is any hope of saving them both? It is true, that when a pregnant woman dies of any inward disorder, and not from the pains and efforts of labour, the fœtus is sometimes still alive in the uterus; but in cases of death after difficult labours, and the great efforts made by the uterus to overcome the obstacles to parturition, the fœtus is generally dead; and the operation therefere is less likely to be availing.—(See *Bertrandi, Traité des Opérations de Chirurgie, chap.* 5.)

It is the opinion of the best writers upon this subject, that whenever a woman dies at all advanced in pregnancy the performance of the Cæsarean operation is highly proper. The propriety of this practice in such circumstances was known to the ancient Romans; for by a decree of Numa Pompilius, no woman who died pregnant was suffered to be buried, ere her body had been opened, with the view of preserving the infant for the use of the state.—(*Sprengel, Geschichte der Chir. th.* 1, *p.* 371.) Experience has proved, that when the fœtus has not attained the period at which parturition commonly happens, it will sometimes survive the operation a considerable time, and that when it is full grown its life may be most happily preserved. Although instances are cited, in which the fœtus in utero has been found alive upwards of four-and-twenty hours after the death of the mother, little stress should be laid on such prodigies. The operation ought to be done without any delay. Even then we are not certain of saving the infant's life. In the greater number of instances the fœtus perishes at the same time with the mother, and from the same causes. The cases which are recorded of the fœtus being extracted alive after the death of the mother, are numerous: I shall here only refer to three, two of which rest on the unimpeachable authority of Flajani, who was himself the operator.—(*Collezione di Osservazioni, &c. di Chirurgia, t.* 3, *p.* 144—146.) In one of these instances, the operation was done on a woman killed by violence in the ninth month of pregnancy; the child lived six hours; in the other, a fœtus was extracted from a woman who had died of typhus fever in the seventh month, and though the operation was not done till she had been dead about an hour, the child was taken out alive, and continued to live full ten minutes. A living child was also taken out of its mother by Vesling, after her death by typhus.—(*Welsch. Obs. Med. Episagm. No.* 74, *p.* 47; *Sprengel, Geschichte der Chir. th.* 1, *p.* 374.) On the 15th of April, 1820, Mr. Green, of St. Thomas's Hospital, extracted by the Cæsarean operation, from a woman suddenly killed in the ninth month of pregnancy by the passage of a stage coach over her, a fœtus that lived 34 hours after its removal from the uterus.—(See *Med. Chir. Trans. vol.* 12, *p.* 46.) With respect to the statements of Cangiamila, a Sicilian practitioner, I join Sprengel in considering them as incredible exaggerations: five instances are given, in which the fœtus was taken out of the mother from fifteen to twenty-four hours after her death, and yet it continued to live. Cangiamila says, that at Syracuse, in the course of eighteen years, the operation had been practised twenty times under the same circumstances; that at Girgenti, thirteen children were saved out of twenty-two women who had died pregnant; and that in twenty-four years, at Montereali, twenty-one children were preserved in the same manner.—(*Embryologia Sacro. Venet.* 1763, *fol.*) As Sprengel remarks, one might almost suppose from this account, that in Sicily pregnancy was generally fatal.

If the mother should happen to die in labour, and the neck of the uterus were sufficiently dilated, or disposed to be so, an attempt should be made to accomplish delivery in the ordinary way; for examples have occurred in which women, supposed to be dead in this circumstance, were in reality alive. Hence we find that the Senate of Venice, in 1608, enacted a law, by which practitioners were liable to punishment in case they neglected to operate with as much caution on a pregnant woman supposed to be dead, as on a living subject; and rules to be observed were again issued by the same government in 1720.—(*Seb. Melli, La Commare levatrice, p.* 108, 4*to. Venez.* 1721; *Personé, Diss. sopra l'Operaz. Cesar. p.* 15, 8*vo. Venez.* 1778.) A law to the same effect was likewise made in 1749, by the king of Sicily, who decreed the punishment of death to those medical men who omitted to perform the Cæsarean operation on such women as died in the advanced stages of pregnancy. In the Journal des Sçavans de Janvier, 1749, the following case, confirming the propriety of such caution, was inserted by Rigaudeaux, surgeon to the military hospital at Douay. This practitioner having been sent for to a woman, to whose residence he was unable to proceed till two hours after her apparent death, he had the sheet with which she was covered removed, and perceiving that the body retained its suppleness and warmth, he tried whether the fœtus could not be extracted in the ordinary way, which was easily effected as soon as the feet were got hold of. The first endeavours to save the child were very unpromising; but after a few hours they had the desired effect. As the woman continued in the same state five hours afterward, Rigaudeaux recommended that she might not be buried before her limbs were quite cold and stiff. He afterward had the satisfaction to learn that she was also restored to life. This remarkable case happened on the 8th of June, 1745, and both the mother and child were living at the period when Rigaudeaux published the observation.

Supposing, however, delivery in the ordinary manner to be impracticable, at all events the Cæsarean operation ought to be performed with the same cautions as if the mother were alive, only one incision being made for the purpose of opening the uterus.

Almost all the insurmountable obstacles to delivery originate from the bad conformation of the pelvis, depending upon rachitis; though they are not an invariable consequence of it, since there are women extremely deformed, in whom no imperfection of the pelvis exists, while it prevails in others whose shape is but trivially disfigured. An examination of the dimensions of the pelvis is the right mode of ascertaining whether there is really such an impediment to parturition. In order that the dimensions may not be an obstacle to delivery, the distance between the upper edge of the sacrum and the os pubis ought to be three inches and a half; and the distances between the tuberosities of the ischium and between each of these protuberances and the point of the os coccygis, three inches. Women have indeed been known to be delivered without assistance, although the first of the above distances was only two inches and a half; but then the heads of the children were so elongated, that the great diameter was nearly eight inches, while that which extends from one parietal protuberance to the other was reduced to two inches five or six lines, and the infants were lifeless. If they are to be born alive, they must be taken out of the womb by the Cæsarean operation; but the latter proceeding should never be adopted without a certainty that they are actually living; for when dead they may be extracted in a way that is attended with much less risk to the mother.

It is not always an easy matter to ascertain with certainty whether a fœtus in utero be living or dead. If it has entirely ceased to move, after being affected with a violent motion, the probability is that it is no longer alive. But to be certain, manual examination is necessary, which may be practised in two ways. One consists in pressing upon the uterus, through the parietes of the abdomen. If the child lives, such pressure makes it move, and the motion can be plainly felt and distinguished. In the other method, one hand is employed in pressing upon the uterus externally, while with the fingers of the other hand passed up the vagina, corresponding pressure is also to be made. The uterus is likewise to be allowed to descend as far as possible, in order to induce the

fœtus to move. When no decisive indications can be thus obtained, it becomes necessary to rupture the membranes, if they have not already given way, introduce the hand into the uterus, and put a finger into the child's mouth, for the purpose of making it move its tongue. The finger may also be applied to the region of the heart, so as to examine whether this organ is beating; and the umbilical cord may be touched, in order to ascertain whether there is still a pulsation in it. When none of these proceedings furnish unequivocal information, the conclusion is that the child is dead, and its extraction is indicated, unless the narrowness of the parts be such that the hand cannot be passed into the uterus, in which case, the Cæsarean operation is indispensable.

But how are we to form a judgment respecting the dimensions of the pelvis? And how can we know whether that diameter which extends from the upper edge of the sacrum to the os pubis, is long enough to allow the passage of the child? The proper conformation of this part is known by the roundness and equality of the hips, both in the transverse and perpendicular direction; by the projection of the pubes; by the moderate depression of the sacrum; by an extent of four or five inches from the middle of this depression to the bottom of the os coccygis; by an extent of seven or eight inches from the spinous process of the last lumbar vertebra to the highest part of the mons veneris, in a woman moderately fat; and by there being an interspace of eight or nine inches between the two anterior superior spinous processes of the ossa ileum.

These general calculations, however, are insufficient. In order to acquire more correct opinions, double compasses have been employed. The branches of the first being applied to the top of the sacrum and middle of the mons veneris, three inches are to be deducted from the dimensions indicated by the instrument, viz. two inches and a half for the thickness of the upper part of the sacrum (which is said to be constant in subjects of every size), and half an inch for that of the os pubis. In women who are exceedingly fat, some lines must also be deducted on this account. Hence, when the total thickness of the pelvis measured in this direction is seven inches, there will remain four for the distance from the upper part of the sacrum to the os pubis, or for the extent of the lesser diameter of the upper aperture of the pelvis.

For taking the measurement internally, a kind of sector was invented by Coutouly. It bears a considerable resemblance to the instruments employed by shoemakers for measuring the feet. It is passed into the vagina, with its two branches approximated, until one arrives opposite the anterior and upper part of the sacrum, when the other is to be drawn outwards, so as to be applied to the pubes. The distance between the branches is judged of by the graduations on the instrument. This was named by its inventor a pelvimeter. According to Sabatier, it is not always easy to place it with accuracy; its employment is attended with some pain; and there are particular cases in which it cannot be used.

Instead of this contrivance, the celebrated Baudeloque recommended a means which seems to be very safe and simple. The index finger of one hand is to be introduced into the vagina to the upper part of the projection of the sacrum. The finger, having the radial edge turned forwards, is then to be inclined anteriorly till it touches the arch of the pubes. The point of contact being then marked with the opposite hand, the length from the point in question to the end of the finger is to be measured. This length, which indicates the distance between the sacrum and the bottom of the symphysis pubis, usually exceeds that of the lesser diameter of the pelvis by about six lines. Baudeloque acknowledges that this measurement is not exactly accurate; but he believes it will do very well, because, unless the narrowness of the pelvis be extreme, two or three lines hardly make any difference in the facility of parturition.

The following is the description of the pelvis of the woman twice operated upon by Dr. Locher: the ossa pubis, which should be on the same level with the promontory of the sacrum, were found perpendicularly under it; so that the child necessarily extended the abdominal integuments by its own weight, into a pendulous bag overhanging the thighs. For the same reason, nothing could be felt of the child by examination per vaginam. The sacrum, instead of closing the pelvis behind by a semicircular curve, which forms a kind of conductor for the child in parturition, stretched nearly horizontally backwards. A representation of this pelvis, with a few other particulars, may be seen in a modern publication.—(*Med. Chir. Trans. vol.* 11, *p.* 199.)

The pelvis may be every where well formed, and yet present an insurmountable obstacle to delivery, in case an exostosis, lessening its dimensions, should exist on one of the bones which compose this part of the skeleton. Pineau met with a case of this description in a woman who died undelivered. The tumour originated from one of the ossa pubis. A steatomatous swelling, situated with the head of the child in the upper aperture of the pelvis, might produce the same effect unless it were detected, and could be pushed out of the way, so as to make room for the fœtus to pass. Baudeloque mentions a swelling of this kind. It was six or seven inches long, and an inch and a half in width. The extremity of it, which was as large as half a hen's egg, had a bony feel, and contained nine well-formed teeth, the rest of the mass being steatomatous. It had descended into the lesser pelvis, below the projection of the sacrum, and a little to one side. It might have been taken for an exostosis of this last bone. The labour-pains continued sixty hours, and the propriety of performing the Cæsarean operation was under consideration. Baudeloque was averse to this proceeding. He recommended turning the child and extracting it by the feet, because he thought that the pelvis was sufficiently capacious to admit of delivery. The event proved that it was three inches nine lines from before backwards, and four inches nine lines transversely. The fœtus was soon easily extracted. The assistance of the forceps was necessary to get out the head. The child was still-born. The mother, exhausted with numerous unavailing efforts, only survived between fifty and sixty hours. Baudeloque was of opinion that a defective regimen also tended to occasion her death.

Among the insurmountable obstacles to delivery may be reckoned such a displacement of the uterus that this viscus protrudes from the abdomen and forms a hernia. The records of surgery have preserved some examples of this extraordinary occurrence. Twice has the Cæsarean operation been performed, and in one of the two cases, the woman survived so long that hopes were entertained of her recovery. Indeed, as Sabatier observes, why should not the operation succeed in such a case, where the uterus is only covered by the integuments, and there is no occasion to cut into the abdomen, just as well as other instances in which it is indispensable to divide the muscles, and open the cavity of the belly? In the other case on record, delivery was effected in the ordinary way, either by raising the abdomen and keeping it in this position with towels skilfully placed, or by making pressure on the uterus, which had the beneficial effect of making this organ resume its proper situation.

Having shown the absolute necessity for the Cæsarean operation under certain circumstances, it remains to consider the proper time for performing it, the requisite preparatory means, and the method of operating.

With regard to the time of operating, practitioners do not agree upon this point: some advising the operation to be done before the membranes have burst and the waters been discharged; others not till afterward. The arguments in favour of the first plan are, the facility with which the uterus may be opened without any risk of injuring the fœtus, and the hope that the viscus will contract with sufficient force to prevent hemorrhage. The advocates for the second mode believe, that in operating after the discharge of the waters, there is less danger of the uterus falling into a state of relaxation, in consequence of becoming suddenly empty after being fully distended, and that this method does not demand so extensive an incision. Hence they recommend, as a preliminary step, to open the membranes. Whatever conduct be adopted, it is essential that the labour should be urgent and unequivocal, that the cervix uteri should be effaced, and that the os tincæ should be sufficiently dilated to allow the lochia to be discharged; but at the same time, says Sabatier, if the operation is not to be done till after the escape of the waters, there ought not to be too much delay, lest the patient's strength should be exhausted,

and the violent efforts of labour should bring on an inflammatory state of the parietes of the uterus.

The propriety of emptying the rectum and bladder is so evident, that it is unnecessary to insist upon it. This precaution is more particularly requisite in regard to the latter of these viscera, which has been known to rise so much over the uterus as to conceal the greater part of it. Baudeloque had occasion to remark this circumstance, in a woman upon whom he was operating. The bladder ascended above the navel, and presented itself through the whole extent of the opening made in the parietes of the abdomen.

The instruments, dressings, &c. which may be wanted, are two bistouries, one with a convex edge, the other with a probe-point; sponges, basins of cold water acidulated with a little vinegar; long strips of adhesive plaster; needles and ligatures; lint; long and square compresses; a bandage to be applied round the body, with a scapulary, &c.

For the purpose of undergoing the operation, the patient should be placed at the edge of her bed, well supported; her chest and head should be moderately raised; her knees should be somewhat bent, and held by assistants, one of whom ought to be expressly appointed to fix the uterus by making pressure laterally, and from above downwards, so as to circumscribe, in some degree, the swelling of the uterus, and prevent the protrusion of the bowels. These things being attended to, the integuments are to be divided with the convex-edged bistoury to the extent of at least six inches. The place and direction of this incision differ with different operators.

In the most ancient method, it was customary to make the incision between the outer edge of the rectus muscle, and a line drawn from the anterior superior spinous process of the ileum, to the junction of the bone of the first rib with its cartilage. This cut was begun a little below the umbilicus, and was continued downwards as far as an inch above the pubes. After the integuments had been divided, the muscles, aponeuroses, and peritoneum were cut, and the uterus cautiously opened. The left index finger was then introduced into this viscus, the wound of which was dilated by means of the probe-pointed bistoury.

This manner of operating is subject to great inconveniences. The place where the incision is made is the situation of muscles, the fibres of which have a different direction, and, on contracting, separate the edges of the wound, and make it gape. The considerable blood-vessels which ramify there, may be the source of perilous bleeding. The bowels can protrude in that situation more readily than any where else. When the position of the uterus is oblique, and when, consequently, the edges of this viscus are turned forwards and backwards, and its surfaces to the right and left, the incision will be made in one of the lateral portions of the uterus, where the trunks of its blood-vessels are known to be situated, and sometimes even the Fallopian tube and ovary may be cut. The fibres of the uterus are cut transversely, so that the edges of the incision are apt to gape, instead of being in contact. This last circumstance may the more readily permit the lochia to escape into the abdomen, inasmuch as the uterus is cut nearly through its whole length, and there is no cavity in which they can accumulate in order to be discharged through the cervix of that organ.

The linea alba has been frequently considered the most eligible place for making the incision. As Sabatier informs us, it was the method adopted by Soleyrès and Deleurye, and it has the recommendation of Baudeloque, because there are fewer parts to be cut, and when the uterus is exposed, an incision parallel to its principal fibres may be made in its middle part. Soleyrès thought that this plan of operating originated with Platner and Guérin, a surgeon at Crepi en Valois Platner says: *Incidentar juxta lineam albam, plagâ majore quæ ab umbilico ad ossa pubis ferè descendit, tum abdominis musculi, tum peritonæum, ubi tandem vitandum ne violetur arteria epigastrica.* Guérin, in his case, made an incision six inches long, which began a little above the umbilicus and extended to within an inch and a half of the pubes. He afterward divided the fat, muscles, and peritoneum, in order to get at the uterus, the anterior part of which was opened, the wound being made rather in the body than the fundus of that viscus. Deleurye will not admit that these writers actually divided the linea alba, because they speak of having cut muscles which in reality do not exist in that situation; and he attributes the honour of the invention to Varoquier, a surgeon of Lisle, in Flanders; but the method was known to Mauriceau, as we may be convinced of by the following passage, extracted from the chapter in which he treats of the Cæsarean operation: "*La plupart veulent qu'on incise au côté gauche du ventre; mais l'ouverture sera mieux au milieu entre les muscles droits, car il n'y a en ce lieu, que les tégumens et les muscles à couper.*" Lauverjat, who has made this remark, and cited the Latin edition of Mauriceau, page 247, also observes, that the incision in the linea alba was practised by a contemporary of La Motte, a circumstance which Sabatier has not been able to ascertain.—(*Médecine Opératoire, tom.* 1.) The following would be the proper manner of operating in the linea alba. The operator should first divide the integuments perpendicularly, so as to expose the linea alba, making the wound about six inches long. An opening should then be carefully made through the aponeurosis, into the abdomen, either at the upper or lower part of the linea alba in view. A curved bistoury is then to be introduced into the opening, and the tendon and peritoneum cut from within outwards, as far as the extent of the wound in the integuments. The latter cut should be cautiously made with the crooked bistoury, guided by the fore-finger of the left hand, lest any of the intestines be accidentally injured. The uterus must next be carefully opened, making an incision in it of the same length as the preceding wound. The fœtus is to be taken out through the wound, and then the placenta and membranes. In this way, M. Artiste lately operated so as to save both mother and child.—(See *Edin. Med. and Surg. Journ. vol.* 4, *p.* 178.)

This mode of operating, as Sabatier observes, gives more hopes of success than the plan first described: but he argues, that such hopes have not been realized by experience. Though the operation may have been more easy, he contends that the edges of the wound in the skin, and those of the incision in the uterus, have had no tendency to remain in a state of proximity to each other, because the linea alba is the point on which all the large muscles of the abdomen principally act, and because the contraction of the uterus invariably takes place from above downwards. Sabatier alleges that the wound in this viscus has been found to incline to one of its sides, for the same reasons as occur in operating at one of the sides of the abdomen. He also states, that the incision has been concealed under the integuments of the upper part of the pubes, and that the presence of the bladder hinders the wound from being carried sufficiently far down. Perhaps, says he, a part of these inconveniences which depend upon the contraction of the uterus, and the return of this organ to its natural state, might be avoided by extending the incision to its highest part. Baudeloque has advised this plan with the view of preventing the fatal extravasations in the abdomen, which frequently follow this operation. Sabatier, however, has doubts whether in operating in the linea alba, the wound can be carried high enough. Besides, he maintains, that this precaution would not prevent the wound from gaping, nor the greater tendency of the lochia to be extravasated in the abdomen than to accumulate in the uterus, and be discharged through the os tincæ.—(*Médecine Opératoire, tom.* 1, *p.* 274, 275.)

In this country (where, indeed, the Cæsarean operation has proved most unsuccessful) the linea alba is preferred, I believe, by the majority of practitioners. That the method is not always attended with the formidable objections urged against it by Sabatier, is quite certain: the case lately published by Dr. Chisholm is a decisive proof of this assertion.—(See *Edin. Med. and Surgical Journ. vol.* 4, *p.* 178, 179.)

There is a third method of performing the abdominal Cæsarean operation. It consists in making a transverse incision five inches in length, through the parietes of the abdomen, between the rectus muscle and the spine, and in a situation more or less high, according to the more or less elevated position of the uterus. This plan was recommended by Lauverjat, in a publication entitled, *Nouvelle Méthode de pratiquer l'Opération Césarienne. Paris,* 8*vo.* 1788. Lauverjat acknowledges that the method had been suc-

cessfully practised by different persons before himself; and especially in one instance, which was particularly remarkable, as, in consequence of the first incision having been made too high up, it became necessary to make a second one, which extended obliquely from the other. However, according to Sabatier, Lauverjat has as much merit as if he had invented the plan, since he has given a better explanation of its advantages than any of his predecessors.

The side on which the operation is to be done is in itself a matter of indifference. But if the liver or spleen were to project, one ought to avoid it. Also, if the uterus were to incline more towards one side than the other, it would be proper to operate on the side where this viscus could be most conveniently exposed. The patient being put in a proper position and held by assistants, and her abdomen kept steady by an attendant, who must apply the palms of his hands to the sides of the uterus, the integuments, muscles, and peritoneum are to be divided with the usual precautions. The uterus is then to be opened, and the wound in it enlarged in the requisite degree, by means of a probe-pointed bistoury. Should the placenta present itself, care must be taken not to injure it, for fear of opening one of the arteries of this mass which communicate with the umbilical arteries of the child, or of leaving a portion of it in the uterus; but it should be separated, in order to facilitate breaking the membranes at its circumference. The child is next to be extracted. This part of the operation is subject to no general rule. Delivery being accomplished, we are recommended to introduce through the vagina anodyne injections, in order to lessen spasm, and wash out the coagula. This method is preferable to that of clearing out the uterus with the hand. Sabatier most properly condemns the plan formerly advised by Rousset and Ruleau, of passing up the neck of this viscus a catheter for the purpose of washing out the lochia, as well as the absurd proposal of employing a seton to promote their escape. Should the lochia not pass readily outwards, we are recommended to introduce the finger occasionally into the cervix uteri, so as to free it from the coagula which may obstruct it.

Sabatier observes, that nearly all authors who have spoken of the Cæsarean operation, whether performed at the sides of the abdomen, or in the linea alba, have advised keeping the edges of the wound in the skin, muscles, and peritoneum together, by means of the interrupted or twisted suture, care being taken to place at the lower part of the incision a tent, in order to prevent adhesion, and leave a free issue for whatever discharge may take place from the abdomen. Others have been content with recommending the use of adhesive plasters and the uniting bandage.

Sabatier condemns sutures as painful and irritating, and he states that the other means only act upon the skin, without fulfilling the object in view, because the integuments have no fixed point, and the divided muscles tend to contract. He assures us, that in the last mode of operating, the edges of the wound may be brought into contact by merely laying the patient upon her side. Besides, he remarks, that there are not many muscular fibres cut, those of the transversalis being only separated from each other. He affirms, that this manner of operating also favours the approximation of the edges of the wound in the uterus, in consequence of this organ contracting most extensively in the perpendicular direction. It is likewise asserted, that as the uterus has only been opened at its upper part, it affords in its middle and lower portions a large cavity, which does not communicate with the abdomen, and in which the lochia may easily accumulate, and afterward be discharged by the natural way. The only dressings advised by Sabatier are, a large pledget, compresses, and a moderately tight bandage round the body. These are to be changed when soiled with the matter or discharge. In this country practitioners would not neglect to bring the edges of the wound as much as possible together, by means of strips of adhesive plaster; for though they may not act with so much effect in this situation as many others, they undoubtedly assist in promoting the main aim of the surgeon, which is to heal at least all the upper part of the incision, if possible, by the first intention. I have no doubt there are many who would be advocates for sutures. In this country, the last method of operating has also been tried.

Mr. Wood, of Manchester, performed the Cæsarean operation, in a case in which parturition was prevented by deformity of the pelvis. The incision was made nearly in a transverse direction, on the left side of the abdomen, about five inches in length, beginning at the umbilicus. This part was fixed upon because the nates of the child could be felt there, and it was evident that no intestine was interposed between the abdominal parietes and the uterus. There was scarcely any effusion of blood, either from the external wound or from that of the uterus, though the latter was made directly upon the placenta. Instead of dividing the placenta, Mr. Wood introduced his hand between it and the uterus, and laying hold of one of the child's knees, extracted the fœtus with ease. His hand readily passed between the placenta and uterus; this produced a hemorrhage, but not in any considerable degree, for the whole quantity of blood lost did not exceed seven or eight ounces. After the uterus was emptied, the intestines and omentum protruded at the wound. These having been reduced, the integuments were brought into contact with sutures and adhesive plaster. This operation, however, did not save the woman's life; she died on the fourth day after its performance.—(See *Med. and Physical Journ. vol.* 6.) As I have already explained, the ill success of the Cæsarean operation in England has been such, that not a single case has yet happened in which the life of the mother has been preserved after the child was truly extracted from the womb by incision. The probable reason of this circumstance I have also noticed. Abroad, however, the success of the practice forms quite a contrast to what has occurred in this country, the operation having been often done so as to save the lives both of the mother and child, of which an interesting example was recently published by Dr. Locher, of Zurich.—(See *Med. Chir. Trans. vol.* 9, *p.* 11.) And in vol. 11 of the same work, may be read a case in which Dr. Meyer, of Minden, lately saved a woman by the operation, but the fœtus was dead. Likewise an example in which Dr. Spitzbarth, in 1819, preserved the lives both of the infant and mother, and another interesting relation of two Cæsarean operations performed by Lorinser, on a woman still living at Nimes, in Bohemia.—(See also *Siebold's Journ. für Geburtshulfe, &c. vol.* 3, *part* 1, *Frankf.* 1819.) In 1801, Dr. Schlegel, of Merseburg, likewise operated on a woman who recovered, notwithstanding the bowels became strangulated, and she is still living, with a hernia in the situation of the wound.—(*Schweighäuser, Archiv. des Accouchemens, p.* 135, 8*vo. Paris*, 1797.) The Cæsarean section has been successfully performed by Graefe, at Berlin, the woman and child both having been saved.—(*Journ. b.* 9.) And besides this and various other instances of success already referred to, another was afforded in April, 1823, in the practice of Vanderfurh.—(See *Revue Méd.*)

[In the *Western Journal of Medical and Physical Sciences* for April, 1830, Dr. Richmond, of Newton, Ohio, reports a successful case of Cæsarean operation, performed in 1827. He was under the necessity of performing the operation at midnight, on the spur of the moment, without a consultation, and under most unfavourable circumstances. After he had divided the uterus and the placenta, which was attached directly under his incision, he found it impossible to remove the fœtus, until he had divided the muscles of the back, near the upper lumbar vertebræ, when it was extracted with facility. The mother recovered entirely in four weeks.

The necessity for the operation arose from malconformation of the os tincæ and vagina. On examining the patient per vaginam, since her recovery, Dr. Richmond found the whole depth of the vagina only two-thirds of a finger's length, its anterior coat being a kind of septum passing obliquely upwards, from before backwards, leaving about one and a half inches between it and the fourchette, and the abnormal os tincæ would not be discovered by the most minute examiner. He inclines to the opinion, that it is an unnatural hymen, and he describes a kind of tube extending from the os uteri to within three-fourths of an inch of the meatus urinarius; impervious below, but probably entering obscurely into the vagina. He offers no theory on the manner in which conception had taken place. The woman was unmarried at the time, but has since lived with a husband two years, but no conception has

taken place. This is the first and only instance of the successful performance of the Cæsarean section in the United States.—*Reese.*]

OF OPERATING WHEN THE FŒTUS IS EXTRA-UTERINE.

Delivery cannot possibly happen in the ordinary way, when the fœtus is situated in the ovaries, or Fallopian tube, or in the cavity of the peritoneum. However, there are many instances recorded of ventral pregnancies, which the mothers survived, the dead fœtus having been discharged by fragments out of an abscess in the parietes of the abdomen. A remarkable case under Mr. Gunning, in St. George's Hospital, I had an opportunity of seeing a few years ago, in which the child was discharged piecemeal from an abscess on the fore part of the abdomen; and I have lately seen another case under Dr. Blicke, of Walthamstowe, in which portions of bone and a great deal of matter have been voided through the vagina, though the swelling is altogether on the right side of the abdomen.

Practitioners are occasionally called upon to do a very similar operation to the Cæsarean, when the child has passed into the cavity of the peritoneum, in consequence of the rupture of the uterus. Unfortunately, such an accident is not uncommon, and though the causes of it may not be obvious, nothing is more certain than that the fœtus itself is entirely passive, and has no share in producing the misfortune. The symptoms, by which the event can be known, are not always easy of comprehension. When, however, the pains have been violent; when the last, after being excessively severe, has been followed by a kind of calm; when the countenance loses its colour, the pulse grows weak, and the extremities become cold and covered with a cold sweat; when the abdomen is generally flat and only partially affected with a swelling, occasioned by the fœtus, which either continues to move, or is dead and motionless; when the patient complains of a moderate degree of heat about the belly; and lastly, when the child shrinks from the touch of the accoucheur; it is manifest that the uterus is lacerated. If the child has passed completely into the abdomen, gastrotomy is the only resource. Should a part of it, however, yet remain in the uterus, it may be extracted with the aid of the forceps, if the head presents, or by the feet, provided only the upper part of the body be in the abdomen.

Baudeloque quotes three instances of gastrotomy, performed on account of the rupture of the uterus. The first is that inserted by Thibaud Dubois, in the *Journal de Médecine*, for May, 1760. Every preparation was made for a natural labour, when, after excessively violent pains about the upper and left part of the uterus, the child disappeared. Thibaud opened the abdomen, though not till some hours after the accident. The infant was dead; but the mother experienced no ill effects after the operation, except such as are usual after ordinary labours.

The second and third cases were communicated to the French Academy of Surgery in 1775, by Lambron, a surgeon of Orleans. He practised the operation twice on the same woman with success. In the first instance, he operated eighteen hours after the rupture of the uterus. The child was dead. An ill-conditioned abscess formed near the wound; but the patient got quite well in the course of six weeks. She was pregnant again the following year, and the uterus was once more ruptured. Lambron now had recourse to the operation without delay. The child betrayed some signs of life, but soon died. The mother not only survived; but afterward became pregnant again, and had a favourable delivery.

In a foregoing column, I have adverted to the case in which Dr. Locher, of Zurich, saved both the mother and child by the Cæsarean operation, performed in the linea alba. After her recovery, a small point of the wound, not exceeding two or three lines in length and breadth, required a long time to be quite healed, though no particular inconvenience was experienced from it. Some time afterward the cicatrix gave way again, and a portion of omentum protruded, which was reduced, when a piece of bowel came out, and was also returned. The edges of the wound were then brought together; but a small superficial ulcer continued open in spite of every effort to close it. In 1818, the year following that in which the Cæsarean operation had been performed on her, she became pregnant again, and the chief particularity which happened during gestation, was an increase in the size of the preceding ulcer, which became three inches in width. The sore, however, was covered with charpie, and the integuments well supported with adhesive plaster. On the 23d of May, she was seized with labour-pains; and about seven in the evening, she complained all at once of a very acute pain, and at the same moment voided a considerable quantity of blood from the vagina. On examining by this passage, nothing was discovered; but, when the hand was applied below the navel, in the line of the old wound and under the ulcer, a circumscribed firm swelling was felt, caused by the child's head, of which the sutures were plainly discernible. Dr. Locher naturally concluded, that the uterus had burst, so as to allow the child to escape, and the hemorrhage was thus easily explained. A repetition of the Cæsarean operation was deemed indispensable. The place of the incision was determined by the round swelling, caused by the child's head. An incision, six inches in length, was made into the abdomen, where a quantity of coagulated blood was found. When this had been removed, the membranes presented themselves, exhibiting a bluish hue, and after they had been opened, the head of the child immediately appeared. The navel-string passed round the neck, which was also compressed in the opening of the uterus. The child evinced no signs of life. The placenta came away during the attempts to reanimate the child. The uterus contracted, and there was little bleeding. This patient, after a good deal of indisposition, and occasional approaches to a perfect recovery, was at length attacked with inflammation of the stomach and bowels, and died on the 9th of July. The uterus was found contracted to a small size, with an opening of about the size of an almond, on its anterior surface, with a rounded callous edge. This aperture, Dr. Locher thinks, had remained ever since the first operation, and had allowed the escape of the child in the second labour; a circumstance which may be doubted, as the hemorrhage indicated the period when the uterus had been lacerated, as this gentleman indeed has in one place particularly noticed himself.—(See *Med. Chir. Trans. vol.* 11, *p.* 182, *&c.*) An almost incredible case is related of what may be called a Cæsarean birth, effected solely by the powers of nature, and, as would appear, by a sudden rupture of the uterus and parietes of the abdomen, after the patient had been in labour three days.—(See *Essays and Obs. Physical and Literary, vol.* 2.)

A laceration in the uterus, or the wound made in this viscus in the Cæsarean operation, may give rise to dangerous and even fatal symptoms of strangulation if any of the intestines insinuate themselves into the preternatural opening. When such an occurrence happens in the performance of the preceding operation, the intestine must be directly withdrawn and replaced. If the accident were to happen, when the child is extracted in the natural way, the bowel is to be pushed back into the abdomen from the uterus. Were the occurrence to take place several days after the operation, Sabatier inquires, what ought to be done? A surgeon is said to have pushed back the intestine from the uterus as late as the third day. Sabatier thinks, that later it could not be done. In this circumstance, Baudeloque advises the operation suggested by Pigrai, namely, that of opening the abdomen and withdrawing the bowel from the place in which it is incarcerated. But there are serious objections to this proceeding. There is no certainty that the intestine is strangulated, and if it were so, the adhesions which are soon formed, would frustrate the design of the operator.

Gastrotomy has not only been recommended for cases where the child has passed into the abdomen through a rupture of the uterus; it has likewise been advised for instances, in which the fœtus has grown in the Fallopian tube, ovary, or cavity of the abdomen. Here, indeed, the operation deserves to be called Cæsarean; for, in addition to the incision in the skin and muscles of the abdomen, it is necessary to open the pouch in which the child is contained. The instances of conception in the Fallopian tube are not uncommon. Those in the ovary and cavity of the peritoneum are more rare. Sabatier conjectures, that most of the cases reported to be of the latter kind, if attentively examined, would have been found to be in reality conceptions in the Fallopian tube.

Extra-uterine conceptions hardly ever arrive at maturity. However, the fœtus formed in the Fallopian tube has sometimes been known to attain the term of nine months, and then die, either from the impossibility of its expulsion, or from the insufficiency of the nourishment afforded it. The pouch in which it was contained, and the neighbouring parts, have then inflamed, and after becoming connected together by numerous adhesions, have suppurated. The abscess has burst, partly at some point of the circumference of the belly, and partly into the rectum; and the dead fœtus has been discharged piecemeal with the matter.

In other examples, the fœtus, instead of giving rise to the abscesses, has become ossified with the enveloping membranes, and continued in this state many years, without any other inconvenience to the patient than what depended on the size and weight of the tumour within the abdomen.

Most frequently, however, the pouch containing the fœtus bursts about the middle of the ordinary period of gestation, and the child passes into the cavity of the peritoneum. At the same moment, the blood-vessels ramifying on the parietes of the containing parts usually pour forth into the abdomen so much blood, that the patients generally die in the space of a few hours.—(See *a case by Dr. Clarke in Trans. of a Society for the Improvement of Medical and Chirurgical Knowledge. Also another, adverted to by Mr. C. Bell, in Med. Chir. Trans. vol. 4, p. 340.*)

Two facts of this kind fell under Sabatier's observation. The women were in the end of the fourth month of pregnancy. Excepting a swelling, which affected only one side of the abdomen, and frequent dragging pains in this cavity, there was no indication of any thing extraordinary. In other respects the patients were well. They were both, all on a sudden, attacked with extremely acute pains which lasted two or three hours. A more violent suffering than the rest was followed by entire ease. The abdomen subsided, and became, as it were, flat. An equal moderate warmth diffused itself over this part of the body. The skin lost its colour. Almost continual syncopes occurred. The pulse was feeble and concentrated. The whole body was covered with a cold sweat, and the women died. The rapid course of these symptoms rendered it impossible for Sabatier to be of any service. The patients were actually dying when he was called to them. The examination of their bodies evinced, that the abdomen contained a large quantity of blood; that the fœtuses lay on the intestines, connected with the lacerated Fallopian tube by means of the umbilical cord; and that the tube itself, which was strongly contracted, presented no other tumour, except that which depended on the after-birth.

There is nothing that announces an extra-uterine pregnancy with sufficient certainty to justify any positive conclusion respecting the nature of the case, before the ordinary time of parturition. In many women the gravid uterus inclines to one side, and numerous pregnant females have dragging pains, which may depend upon other causes. Things, however, are different when the fœtus has lived to the ordinary period of parturition, and the woman is attacked with labour-pains; because, besides the unequivocal signs of the presence of a child in the abdomen, the womb is empty, and is little changed from its common state. Should we now, asks Sabatier, have recourse to the Cæsarian operation, just as if the fœtus were in the womb? Can we be sure, that the pouch which contains the child, will contract itself like the uterus, and that the incision which is in contemplation, will not give rise to a fatal hemorrhage? Would it be easy to separate and remove the whole of the placenta? How could the discharge, analogous to the lochia, find an outlet, and would not its extravasation in the abdomen be likely to prove fatal? Sabatier thinks, that the risk which is to be encountered, is much less when things are left to nature. The child, indeed, must inevitably perish. It will either give rise to abscesses, with which it will be discharged in fragments, or it will remain for a length of time in the abdomen, without any urgent symptoms. Sabatier also calls our attention to the great precariousness of an infant's life, and expresses his opinion, that there can be no difficulty in deciding what conduct ought to be adopted. Happily, practitioners are not often placed in circumstances so delicate, and extra-uterine conceptions mostly perish before the end of the common period of gestation. We have then only to second the efforts of nature; either by promoting suppuration, if it should seem likely to occur, by making a suitable opening, or enlarging one that may have formed spontaneously; by extracting such fragments of the fœtus as present themselves; by breaking the bones when their large size confines them in the abscess, as Littre did in an instance where the abscess burst into the rectum; and lastly, by employing suitable injections.—(*Sabatier, Médecine Opératoire, t.* 1.)

An extremely uncommon case of extra-uterine conception was related a few years ago by Josephi; the fœtus having at length passed into the bladder by ulceration, and caused such affliction as rendered an incision into that receptacle indispensable, with the view of extracting the parts of the fœtus lodged in it. The operation was done above the pubes; but the internal mischief already existing was so great, that the patient did not recover.—(*Ueber die Schwangerschaft ausserhalb der Gebärmutter; Rostock*, 1803, 8vo.)

Govei, p. 401, relates a case of ventral conception, in which instance the Cæsarean operation was done, and the child preserved. A lady, aged twenty-one, had a tumour in the groin, which was at first supposed to be an epiplocele, but an arterial pulsation was perceptible in it. In about ten weeks the swelling had become as large as a pound of bread. Govei, solicited by the lady, opened the tumour. He first discovered a sort of membranous sac, whence issued a gallon of a limpid fluid. The sac was dilated, and a male fœtus found, about half a foot long, and large in proportion. It was perfectly alive, and was baptized. After tying the umbilical cord, the placenta was found to be attached to the parts just behind, and near, the abdominal ring; but it was easily separated. Govei does not mention whether the mother survived; but the thing would not be very astonishing, considering the situation of the fœtus. Bertrandi says, he was unacquainted with any other example of the Cæsarean operation being done, in cases of extra-uterine fœtuses, so as to save both the mother and infant. This eminent man condemned operating, in ventral cases, on the ground that the placenta could not be separated from the viscera, to which it might adhere, or, if left behind, it could not be detached, without such inflammation and suppuration as would be mortal. But if, in addition to such objections, says Bertrandi, the operation has been proposed by many, and practised by none, we may conclude, that this depends on the difficulty of judging of such pregnancies, and of the time when the operation should be attempted. He puts out of the question the dilatations which have been indicated for extracting dead portions of the fœtus, and also Govei's case, who operated without expecting to meet with a fœtus at all.—(*Bertrandi, Traité des Opérations de Chirurgie, chap.* 5.)

Whenever the Cæsarean operation, or gastrotomy, has been performed, the practitioner is not merely to endeavour to prevent inflammation, heal the wound, and appease any untoward symptoms which may arise; he should also prevail upon the mother to suckle the child, in order that the lochia may not be too copious; and, after the wound is healed, she should be advised to wear a bandage, for the purpose of hindering the formation of a ventral hernia, of which, according to surgical writers, there is a considerable risk.

[The following case of extra-uterine conception is here inserted as being perfectly unique in its kind. No such case is to be found referred to in *Ploucquet's Lit. Med. Digest*, nor in any of the numerous periodicals which enrich the profession. It occurred in the practice of Drs. Cotton and Harlow, of Georgia, and was communicated to Prof. Francis, of New-York. The subject was a negro woman, aged 30 years. On the night of the 23d of Jan. 1819, she was taken in labour. There appeared no doubt that she had arrived at the full time of labour. Her labour-pains ceasing, she was attended to for a few days for dropsical symptoms, under which she suffered greatly. On the 4th of February, she was again taken in labour. The pains, however, shortly after entirely ceased; and after five weeks she expired. On examination after death, the following facts presented themselves. In the first place, Drs. Harlow and Cotton drew off from the abdomen three and a half gallons of an extremely turbid and offensive fluid. On opening the abdomen, the first thing that

presented itself was the child, extending itself across the abdomen; its head in the right, its feet in the left, hypochondriac regions; its back immediately to the umbilicus of the mother. It was as large a child as either of them had ever seen at birth, and perfectly formed. *The funis was of the usual size, about six inches in length, and inserted into the fundus uteri without the intervention of a placenta.* The uterus was about the size of an orange; its coats very much thickened and indurated, with a small quantity of a thin glassy fluid within its cavity. The abdominal viscera were all diseased, save the bladder. The liver retained its original shape and position, but looked more like a mass of glue than organized animal matter. The spleen had gone into a state of complete decomposition. As to the omentum, there was not the slightest vestige left. The bladder appeared to be the only viscus that had escaped uninjured from this digression in nature. The bowels had firmly adhered in one uniform mass from the stomach to the rectum, and to the posterior and lateral parietes of the abdomen.—(See *New-York Med. and Phys. Journal, vol.* 1.)

The case of extra-uterine fœtus in which Dr. MacKnight of New-York operated with success, is often referred to.—(See *Lond. Med. Society's Trans. vol.* 4.) This interesting case confirms the views of those who believe in the entire production and perfection of the human fœtus *extra-uterum.*—(*Thacher's Med. Biography.*) But even this operation is not entitled to the epithet Cæsarean, and therefore does not detract from the claims of Dr. Richmond, who opened the uterus itself.—(See *the preceding note, p.* 221.)

Gastrotomy has been performed for the removal of extra-uterine fœti several times in America, with complete success.

Mr. Wm. Baynham, of Virginia, member of the Royal College of Surgeons, London, succeeded, as early as 1791, in removing an extra-uterine fœtus from the abdomen, after it had lain there ten years. He thus preserved the life of a valuable woman, who was otherwise sinking into the grave, with hectic fever and the most dangerous symptoms.

In 1799, he repeated the operation with the like success on a servant woman of Mrs. Washington's, Fairfax Co., Virginia. In the publication of these cases in the *N. Y. Med. and Phys. Journal, vol.* 1, Mr. B. has performed a valuable service to the profession, in the judicious remarks with which he accompanies the report.

In the same work, Dr. J. Augustine Smith, now Professor of Anatomy in the University of New-York, has published a case in which he performed this same operation in 1808, in the city of New-York, with the most satisfactory result. I have not been able to find any other cases of success in this operation in this country, except those of Dr. MacKnight, Mr. Baynham, and Professor Smith, and must refer to the journals I have named for their interesting details.

The following cases of Cæsarean operation are extracted from the *N. Y. Med. and Phys. Journal, vol.* 2, *for* 1823; and as two of them were self-performed, and the other accomplished by an illiterate female accoucheur, they will be found interesting in a high degree. The recovery of these women should be regarded as extraordinary escapes, rather than as affording encouragement rashly to attempt this great and dangerous achievement.

"In the afternoon of Jan. 29th, 1822, (says Dr. S. M'Clellen), I was called upon by Mr. Kipp, of Nassau, to consult with Dr. Bassett on the case of his servant girl, who, he said, was in a deplorable situation. I immediately repaired to his house, and found the patient to be a girl fourteen years of age, one-fourth black. She had a firm pulse, and complained of little or no pain. Dr. B. informed me, that she had a wound in her abdomen, near the centre of the epigastric region, from which he had extracted a full-grown fœtus, that was in part protruded, together with a considerable portion of her intestines. The placenta having two umbilical cords attached to it, he had removed from the same orifice, and had also introduced his hand into the uterus per vaginam, &c.

On examination I found an irregular incision of about four inches in length, extending in a diagonal direction, as respects the abdomen, about two inches above the umbilicus, and an incision of about two inches in length at nearly a right angle with the former, extending towards the sternum. The lower part of the abdomen was considerably distended with blood.

Our attempts were in the first place directed to the evacuation of the blood contained in the abdomen, which was partly effected by a change of posture and slight compression. We then brought the lips of the wound in contact by the interrupted suture, dressed it with lint spread with emollient unguent, and secured the whole with a broad bandage. After administering an anodyne, we left her for the night. I did not see her again, but was informed by Dr. B. that she never had any very *violent* symptoms.

The second day he bled her, gave her a cathartic, and pursued the antiphlogistic regimen a few days, when the febrile excitement subsided. An ordinary use of tonics was then resorted to, and in a few weeks the patient was perfectly recovered.

The circumstances attendant on the infliction of the wound were these. While the family was at dinner, she went a distance of perhaps fifty rods from the house, and placed herself on a snow-drift, near a fence, where she was first discovered by her master in the act of covering something with snow, which afterward proved to be a naked child. As soon as she perceived that she was observed, she immediately ran to the house, with the second child hanging out at the wound, together with a considerable portion of her intestines; laid by her razor and large needle, which were the instruments she had previously prepared for the operation, and shortly began to complain.

I should judge from the appearance of the blood upon the snow, there being three several places where she evidently stopped, that the incision was made *immediately* preceding the rupture of the membranes, and that the first child was delivered *per vias naturales*, the third pain after the rupture.

As some of the greatest discoveries in every department of science are made by accident, or without any particular previous design, may not the conduct of this desperate girl give a useful hint for an improvement in the Cæsarean operation, consisting in a division of the uterus diagonally, near the fundus, instead of the ordinary method?"

The following is the case of Alice O'Neal, inserted in the Medical Essays and Observations published by a society in Edinburgh, by Mr. Duncan Stewart, surgeon in Dungannon, in the county of Tyrone, Ireland.

Alice O'Neal, aged about thirty-three years, wife to a poor farmer near Charlemont, and mother of several children, in January, 1739, took her labour-pains; but could not be delivered of her child by several women who attempted it. She remained in this condition twelve days: the child was judged to be dead after the third day. Mary Donally, an illiterate woman, but eminent among the common people for extracting dead births, being then called, tried also to deliver her in the common way: and her attempts not succeeding, performed the Cæsarean operation, by cutting with a razor, first the containing parts of the abdomen, and then the uterus; at the aperture of which she took out the child and secundines. The upper part of the incision was an inch higher, and to a side of the navel, and was continued about six inches downwards in the middle between the right *os ileum* and the *linea alba*. She held the lips of the wound together with her hand, till one went a mile and returned with silk and the common needles which tailors use. With these she joined the lips in the manner of the stitch employed ordinarily for the hare-lip, and dressed the wound with whites of eggs, as she told me some days after, when, led by curiosity, I visited the poor woman who had undergone the operation. The cure was completed with salves of the midwife's own compounding.

In about twenty-seven days, the patient was able to walk a mile on foot, and came to me in a farmer's house, where she showed me the wound covered with a cicatrix; but she complained of her belly hanging outwards on the right side, where I observed a tumour as large as a child's head; and she was distressed with the *fluor albus*, for which I gave her some medicines, and advised her to drink the decoctions of the vulnerary plants, and to support the side of her belly with a bandage. The patient has enjoyed very good health ever since, manages her family affairs, and has frequently walked to market in this town, which is six miles' distance from her own house.—(*Essays, vol.* 5.)

In the year 1769, a negro woman (belonging to Mrs

Bland, a midwife) at Mr. Campbell's grass plantation at the Ferry, between Kingston and Spanish Town, in Jamaica, being in labour, she performed the *Cæsarean operation* on herself, and took her child out of the left side of her abdomen, by cutting boldly through into the uterus.

She performed this operation with a butcher's broken knife, about two inches and a half long—the part which joined to the handle. The position of the child was natural; she cut through near the *linea alba*, on her left side, and cut into the child's right thigh, which presented at the part, about three lines deep, and two inches and a half long. The child came out by the action of its own struggling. A negro midwife was sent for to her, who cut the navel cord and freed the child; and returned the part of the navel cord adhering to the placenta, and a considerable portion of the intestines also, into the abdomen, which had come out of the wound with the child.

The surgeon who attended the plantation was sent for, a few hours after the accident happened; and judging, from the situation in which he found her, that some dirt had been put into the wound, by the old midwife, with the intestines, he cut open the stitches that had been made, and carefully washed the parts clean, extracted the placenta at the wound, and then stitched it up again.

On the third day, after she had recovered from her low state from the loss of blood, which was considerable, a fever came on, which was removed by cooling medicines; she then took bark for ten days. The wound was fomented and dressed properly, and was soon cured; and the woman was well in six weeks' time from the accident, and able to go to her work.

The child died on the sixth day, with the *Jaw-falling*, as it is called; but came into the world healthy and strong.

The woman continued perfectly well, menstruated regularly, and was with child again a year or two afterward. She attempted the same operation again; but was watched and prevented, and had a regular and proper labour. She had borne three children before this affair, all with natural and easy births. She was an impatient and turbulent woman, whose violence of temper was the only cause assigned for her conduct.—(*Mosely on Tropical Diseases.*)—*Reese.*]

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CALCULUS. Calculi form in the ducts of the salivary glands; in the kidneys, bladder, urethra, gall-bladder, &c. A paper on calculi formed in the lachrymal sac is contained in Graefe's new Journal.—(*Journ. fur die Chir. No. 1, Berlin*, 1820.) For an account of stones in the bladder, refer to *Urinary Calculi.*

[CALCULOUS DEGENERATION OF THE SCROTUM. The following singular case is communicated by Professor Mott. It was first published in the *Philadelphia Journal* for 1827.

"In the practice of surgery we frequently observe very singular morbid alterations of texture, which are worthy of being recorded notwithstanding our inability to account for their production. None of the works that we have examined contain a description of such a degeneration as that we are about to describe, nor have we ever met with another instance of a similar kind. It may, therefore, be useful to state the fact, as a contribution towards a more complete history of the morbid anatomy of the scrotum.

In the summer of 1824, I was requested to visit J. R. aged about seventy-three, a wealthy farmer, residing upon Long Island. His health had been declining for two or three years from an affection of his stomach, accompanied, as he stated, with an uncommon disease of the scrotum. The latter complaint had so far increased within the last year, as materially to injure his health, in consequence of an ulceration and very fetid discharge therefrom.

The constant and severe burning which he experienced in the region of the pylorus, with an ejection of the contents of the stomach shortly after eating, together with frequent acrid eructations and costiveness, led to the fear that there was some organic derangement of the lower orifice of the stomach.

As the disease of the scrotum was the particular object of my visit, I requested permission to examine it. It exhibited a monstrous, and to me a very unique appearance, reaching fully two-thirds the length of his thighs, being from twelve to fifteen times its ordinary bulk, and studded, particulary on each edge (it being flattened anteriorly and posteriorly) with several dozen tumours, of a stony hardness, covered with the integuments, from the size of nutmegs to that of a large pea. It resembled an enormous bunch of grapes, or more closely some morbid conditions of the pancreas and spleen which we have occasionally met with. The tumours had all a very white appearance, and the integuments of two or three of the largest, having been ulcerated for upwards of a year, poured forth a constant and very fetid discharge. At these openings white bodies were seen, which, when touched with a probe, felt of a stony hardness. A white substance resembling mortar was discharging from these openings, which resulted from the crumbling away of the calculi,

and the combination of this subetance with the fluid from the ulcers.

This state of the scrotum was of upwards of twenty years' duration, and had been gradually increasing, the tumours multiplying as the scrotum augmented in size. The patient knew of no cause to which it could be ascribed.

From its size and weight, as well as the loathsome nature of the discharge, he becam desirous to have it removed if practicable and proper. His health being sufficiently good, and the testes appearing to move freely in the diseased mass, led me to recommend that the operation should be performed.

An incision was made around the root or base of the scrotum, beginning on each side of the under part of the penis, at a point a little above the scrotum, so that some integument of this part of the penis in a diseased state was also removed, and carried down to the perinæum, leaving an angular portion of the scrotum below of about an inch in length. Cautiously cutting through the diseased integuments and the subcutaneous cellular structure, the vaginal coat of each testis was readily discovered and avoided. The whole of the morbid mass was removed by cautious dissection, leaving the tunica vaginalis on each side sound and unopened. Numerous arteries were secured during the dissection in the integuments, as well as several large ones in the septum scroti.

The perinæal portion of the scrotum was susceptible of very considerable elongation, but it was altogether insufficient to cover the testes. A new covering for them, therefore, could only be looked for from the granulatory process. Light dressings of lint, compress, and a T bandage were applied for the first two days, followed by emollient poultices to favour the second mode of healing.

Suppuration and granulation being well established, the new scrotum was increased and fashioned by the use of adhesive straps.

His complete recovery from the operation, and the reproduction of a scrotum, was not interrupted by any circumstance. Three years have now elapsed, and he enjoys excellent health, being occasionally obliged to take for a week or two a few grains of the subnitrate of bismuth, to remove the affection of his stomach, which, before the operation was performed, threatened to become an organic disease."—*Reese.*]

CALCULUS IN THE INTERIOR OF THE EYE. See *Eye, &c.*

CALLUS, *new bone*, or the substance which serves to join together the ends of a fracture, and for the restoration of destroyed portions of bone.

1. The old surgeons believed callus to be a mere inorganic concrete, a fluid poured out from the extremities of the ruptured vessels, which was soon hardened into bone. They always described it as an "exudation of the bony juice," and imagined that it oozed from the ends of broken bones, as gum from trees, sometimes too profusely, sometimes too sparingly. The reunion of broken bones, and the hardening of callus, they compared with the glueing together of two pieces of wood, or the soldering of a broken pot.—(*A. Paré.*) They also conceived, that callus sometimes flowed into the joints, so as to form a clumsy, prominent protuberance. They imagined that callus was a juice which congealed at a determinate period of time, and they therefore had fixed days for undoing the bandages of each particular fracture. They supposed, that its exuberance might be suppressed by a firm and well-rolled bandage, and its knobby deformities corrected by pillows and compresses; that it might be softened by frictions and oils, so as to allow the bone to be set anew. All their notions were mechanical; and their absurd doctrines have been the apology for all the contrivers of machines, from Hildanus down to Dr. Aiken and Mr. Gooch.

2. By Galen and Duhamel, however, a second doctrine was entertained, which imputed the formation of callus altogether to the periosteum and medullary texture, which were supposed to produce two solid rings round the fracture, the interspace between them being afterward effaced.

3. A third opinion, maintained by Bordenave, and the best modern observers, is, that the process of nature, in the production of callus, bears a great resemblance to the changes which take place in the reunion of the soft parts.

A bone is a well-organized part of the living body; that matter, which keeps its earthy parts together, is of a gelatinous nature. The phosphate of lime, to which a bone owes its firmness, is deposited in the interstices of the gluten, undergoing a continual change and renovation. It is incessantly taken up by the absorbents, and secreted again by the arteries. It is this continual absorption and deposition of earthy matter which forms the bone at first, and enables it to grow with the growth of the body. It is this unceasing activity of the vessels of a bone which enables it to renew itself when it is broken or diseased. In short, it is by various forms of one secreting process, that bone is formed at first, is supported during health, and is renewed on all necessary occasions. Bone is a secretion, originally deposited by the arteries of the bone, which arteries are continually employed in renewing it. Callus is not a concrete juice, deposited merely for filling up the interstices between fractured bones, but it is a regeneration of new and perfect bone, furnished with arteries, veins, and absorbents, by which its earthy matter is continually changed, like that of the contiguous bone. Indeed, there could be no connexion between the original bone and callus, were the latter only the inorganic concrete, as it was formerly supposed to be.

Notwithstanding the more accurate opinions now entertained concerning callus, the supposition is still very common, that the slightest motion will destroy callus, while it is being formed. But, says Mr. John Bell, it is an ignorant fear, proceeding merely from the state of the parts not having been observed; for, when callus forms, the perfect constitution of the bone is restored; the arteries pour out from each end of a broken bone a gelatinous matter; the vessels by which that gluten is secreted expand and multiply in it, till they form between the broken ends a well-organized and animated mass, ready to begin anew the secretion of bone. Thus, the ends of the bone, when the bony secretion commences, are nearly in the same condition, as soft parts which have recently adhered; and it is only when there is a want of continuity in the vessels, or when a want of energetic action incapacitates them from renewing their secretion, that callus is imperfectly formed. This is the reason why, in scorbutic constitutions, in patients infected with syphilis, in pregnancy, in fever, or in any great disorder of the system, or while the wound of a compound fracture is open, no callus is generated.—(*John Bell's Principles of Surgery, vol.* 1, *p.* 500, 501.) How far some of the latter statement is correct, or not, will be seen in the article *Fractures.*

For some time the secretion of earthy matter is imperfect; the young bone is soft, flexible, and of an organization suited for all the purposes of bone; but hitherto delicate and unconfirmed; not a mere concrete, like the crystallization of a salt, which, if interrupted in the moment of forming, will never form; not liable to be discomposed by a slight accident, nor to be entirely destroyed by being even roughly moved or shaken. Incipient callus is soft and yielding; it is ligamentous in its consistence, so that it is not very easily injured; and in its organization it is so perfect, that when it is hurt, or the bony secretion interrupted, the breach soon heals, just as soft parts adhere, and thus the callus becomes again entire, and the process is immediately renewed.

In consequence of the above circumstances, if a limb be broken a second time when the first fracture is nearly cured, the bone unites more easily than after the first accident; and Mr. J. Bell even asserts, that when it is broken a third and a fourth time, the union is still quicker. In these cases the limb yields, it bends under the weight of the body which it cannot support; but without any snapping or splintering of the bone, and generally without any over-shooting of the ends of the part, and without any crepitation.

Callus is found to be more vascular than old bone. Mr. J. Bell mentions an instance of a bone, which had been broken twelve years before he injected it, yet the callus was rendered singularly red. When a recently formed callus is broken, many of its vessels are ruptured, but some are only elongated, and it rarely happens that its whole substance is torn. It is easy to conceive how readily the continuity of the vessels will be renewed in a broken callus, when we reflect on its great vascularity and the vigorous circulation excited by the accident in vessels already accustomed to the secretion of bone. These reasons show why a broken or bent callus is more speedily united than a fractured bone.

While the ends of a broken bone are connected together by a flexible substance of cartilaginous consistence, Dupuytren calls this bond of union the *provi-*

sional callus, which generally lasts until the thirtieth or fortieth day. In a later stage the intervening cartilaginous matter ossifies; the swelling of the soft parts subsides; and in from six to twelve months the callus or new bony matter filling the medullary canal is absorbed, whereby the latter is restored. The callus remaining after the completion of this process, Dupuytren terms *definitive*.

When bones granulate, says Mr. Wilson, the granulations at first appear exactly similar to those of the soft parts, and, as in the soft parts, take place to restore any loss which the bones may have suffered. This process is very similar to that of the first formation of bone. In the skull membrane was first formed; and here, also, in the process of restoration the granulations change into membrane, and then into bone. In cylindrical bones, the granulations first produce a species of cartilage, and this is afterward converted into bone. Thus, in the restoration of bone, nature is guided by the same laws which prevail in its first formation. If the granulations thrown out on the surface of a bone be viewed in a microscope, they appear to form a number of small points like villi, the bases of which first become similar to cartilage, and then to bone. "The preparations from the surface of granulating stumps show the extreme delicacy of the first bony threads, and also their mode of uniting laterally with each other."—(*On the Structure, Physiology, and Diseases of the Bones, &c. p.* 197, 8*vo. Lond.* 1820.)

And in another place he repeats, "I have examined several skulls on the death of the persons, at different periods, from days to years after pieces of bone had been removed, and before vacancies had been completely filled up; but I never could in any of them discover the least appearance of cartilage." A membrane here always precedes the formation of bone.—(*P.* 210.) For additional observations on callus see *Fracture. N. M. Muller, De Callo Ossium; 4to. Norimb.* 1707; *Duhamel in Mém. de l'Acad. Royale des Sciences, an* 1741, *p.* 92 *et* 222; *Boehmer, De Callo Ossium è rubia tinctorum radicis pastu infectorum, 4to. Lips.* 1752; *Dethleef, Diss. exhibens Ossium Calli generationem et naturam per fracta in animalibus rubiæ radice pastis ossa demonstratam. 4to. Goett.* 1753; *A. Marrigues, Sur la Formation du Cal. Paris,* 1783. *A. M'Donald, de Necrosi, &c. Edin.* 1799. *The works of Troja, David, Blumenbach, and Koehler, as specified at the conclusion of the article Necrosis. J. F. Meckel, Handb. der Pathol. Anatomie. Leipzig,* 1818, *b.* 2, *p.* 62. *G. Breschet, Recherches Historiques et Exper. sur la Formation du Cal. Paris,* 1819. *J. Wilson, On the Structure, Physiology, and Diseases of the Bones, p.* 208, 8*vo. &c. Lond.* 1820.

CALOMEL. (Submuriate of mercury; hydrargyri submurias, L. P.) Its extensive utility in numerous surgical diseases will be conspicuous in a large proportion of the articles in this work. When prescribed as an alterative the common dose is a grain once or twice a day; when ordered as a purgative, from three to eight grains may be given; and when directed with the view of exciting salivation, one or two grains, conjoined with opium, are usually administered night and morning.

CAMPHOR is used externally, chiefly as a means of exciting the action of the absorbents, and thus dispersing many kinds of swellings, extravasations, indurations, &c. Hence it is a common ingredient in liniments. It has also the property of rousing the action of the nerves and quickening the circulation in parts on which it is rubbed. For this reason, in paralytic affections it is sometimes employed. Perhaps there is no composition that has greater power in exciting the absorption of any tumour or hardness than camphorated mercurial ointment.

In cases of delirium, depending on the irritation of local surgical diseases, and in some descriptions of mortification, camphor is occasionally prescribed. It has also been recommended as singularly useful for the relief of stranguries, even those depending on the opetion of cantharides. But although it may occasionally have succeeded, when given with this view, it not only does not always do so, but it has been known to cause an opposite effect, sometimes producing great scalding in voiding the urine, and sometimes pains like those of labour.—(*Medical Trans. vol.* 1, *p.* 470.) In chordee its utility is generally acknowledged. Persons who cannot procure rest unless they take very large doses of opium, sometimes find smaller ones answer, if combined with camphor.—(See *Brande's Manual of Pharmacy, p.* 46.)

CANCER. (Derived from *cancer*, a crab, to which a part affected with cancer and surrounded with varicose veins was anciently thought to have some resemblance.) *Carcinoma.*

The disease has two principal forms, one named *scirrhus* or *occult cancer*; the other, *ulcerated* or *open cancer*. According to the usual definition, as Mr. Pearson observes, an indolent scirrhus is a hard and almost insensible tumour, commonly situated in a glandular part and accompanied with little or no discoloration of the surface of the skin. But when the disease has proceeded from the indolent to the *malignant* state, the tumour is unequal in its figure, it becomes painful, the skin acquires a purple or livid hue, and the cutaneous veins are often varicose.—(*Principles of Surgery*, § 331. 343.) The pain is remarked to be acute and lancinating, and its attacks recur with more or less frequency. At length the tumour breaks, and is converted into cancer, strictly so called, or the disease in the state of ulceration.

The female breast and the uterus are particularly subject to the disease. The breasts of men are but rarely affected. The testes, lips (especially the lower one of male subjects), the penis, the lachrymal gland and eye, the tongue, the skin (particularly that of the face), the tonsils, the pylorus, the bladder, rectum, prostate, and a variety of other parts, are recorded by surgical writers as having frequently been the seat of scirrhus and cancer. They seem, however, to have comprehended an immense number of different malignant diseases under one common name, and in many of the cases called cancerous there are no vestiges of the true scirrhous structure.

OF SCIRRHUS, OR CANCER NOT IN THE ULCERATED STATE.

Mr. Abernethy has given a matchless history of this affection as it appears in the female breast, where it most frequently occurs, and can be best investigated. Sometimes, as he has remarked, it condenses the surrounding substance so as to acquire a capsule; and then it appears, like many sarcomatous tumours, to be a part of new formation. In other cases the mammary gland seems to be the nidus for the diseased action. In the latter case the boundaries of the disease cannot be accurately ascertained, as the carcinomatous structure, having no distinguishable investment, is confused with the rest of the gland. Sir Everard Home also remarks, that when the disease originates by a small portion of the glandular structure of the breast becoming hard, which is very commonly the case, it is readily distinguished by the hard part never having been perfectly circumscribed, and giving more the feel of a knot in the gland itself than of a substance distinct from it. In each of these instances carcinoma begins at a small spot, and extends from it in all directions, like rays from a centre. This is one feature distinguishing this disease from many others, which at their first attack involve a considerable portion, if not the whole, of the part in which they occur. The progress of carcinoma is more or less quick in different instances. When slow, it is in general unremitting. Mr. Abernethy thinks, that though the disease may be checked, it cannot be made to recede by the treatment which lessens other swellings. On this point, however, he is not positive; for surgeons have informed him, that diseases which eventually proved to be carcinomatous, have been considerably diminished by local treatment. With great deference to Mr. Abernethy, I may be allowed to remark in this place, that every tumour which ends in cancer is not from the first of this nature, though it has in the end become so; consequently, it may at first yield to local applications, but will not do so after the cancerous action has commenced. Hence Mr. Abernethy's opinion, that a true carcinomatous tumour cannot be partially dispersed, at least remains unweakened by the fact that some tumours have at first been lessened by remedies, though they at last ended in cancer. Sir E. Home's observations tend to prove that any sort of tumour may ultimately become cancerous.

Without risk of inaccuracy we may set down the backwardness of a scirrhous swelling to be dispersed or diminished, as one of its most confirmed features,

This obdurate and destructive disease excites the contiguous parts, whatever their nature may be, to enter into the same diseased action. The skin, the cellular substance, the muscles, and the periosteum, all become affected if they are in the vicinity of cancer. This very striking circumstance distinguishes carcinoma, says Mr. Abernethy, from several other diseases. In what this author calls *medullary sarcoma*, the disease is propagated along the absorbing system; but the parts immediately in contact with the enlarged glands do not assume the same diseased action. Neither in the *tuberculated* species does the ulceration spread along the skin, but destroys that part only which covers the diseased glands. According to Mr. Abernethy, a disposition to cancer existing in the surrounding parts, before the actual occurrence of the diseased action, was a circumstance noticed by Mr. Hunter. Hence arose the following rule in practice: *That a surgeon ought not to be contented with removing merely the indurated or actually diseased part, but that he should also take away some portion of the surrounding substance in which a diseased disposition may probably have been excited.* In consequence of this communication of disease to the contiguous parts, the skin soon becomes indurated, and attached to a carcinomatous tumour, which in like manner is fixed to the muscles or other part over which it is formed.

As a carcinomatous tumour increases, it generally, though not constantly, becomes unequal upon its surface, so that this inequality has been considered as characteristic of the disease. A lancinating pain is common; but it is not experienced in every case without exception. It is also a symptom attending other tumours, which are unlike carcinoma in structure, and it cannot, therefore, be deemed an infallible criterion of the nature of the disease.—(*Abernethy's Surgical Works, vol.* 2, *p.* 69, *&c.*)

A hard and painful glandular swelling, having a disposition to become cancer, says Richter, is the common, but inadequate and erroneous definition of scirrhus. The disease is not regularly attended with swelling; sometimes scirrhous parts diminish in size and shrink. Hardness is not a characteristic property; for many tumours which are not scirrhous, are exceedingly indurated. The disease is not always situated in a gland; it frequently attacks structures which cannot be called glandular; and hard glandular swellings are often seen which do not partake of scirrhus. The disposition to cancer cannot be enumerated among the marks of scirrhus, since it is not discoverable till carcinoma has actually commenced. Its termination in open cancer is not an invariable occurrence; and other tumours become cancerous to which no one would apply the term scirrhi.—(*Anfangsgr. der Wundarzn. b.* 1.)

With regard to the observation that *tumour* is not an essential character of carcinoma, Mr. C. Bell admits its correctness only in a certain sense: "It is true (says he) that there is not always an increase of the dimensions of the whole breast; on the contrary, true carcinoma is often accompanied with a contraction and diminution of the general bulk. But what is true of the breast or mamma is not true of the tumour; for the proper structure of the gland either shrinks or is compressed; and sometimes the surrounding fat is diminished by absorption, so that the whole mass is less than the natural breast, or than what the breast was before the commencement of the disease. But still the diseased part is properly a tumour: there we see an increased mass, a preternatural growth, or new matter, corresponding to the old definition, *morbosum augmentum*. But farther, and in respect to the adipose membrane, the fat is not always diminished in carcinoma mammæ, but sometimes quite the contrary; and this difference in it will sometimes produce a variety in the external character, when there is none in the disease actually or in the internal structure. Sometimes, from the diminution of fat, the irregular tuberculated structure of this disease will be apparent to the eye and to the touch: while in another patient the breast will be large, full, and smooth, only marked more than naturally with large blue veins, and having an ulcer like a hole dug in the centre of the breast."—(*C. Bell, in Med. Chir. Trans. vol.* 12, *p.* 220.) These observations fully agree with those which some attention to the appearances of cancer have enabled me to make.

Scientific surgeons ought undoubtedly to have a definite meaning when they employ the term scirrhus; the word is generally used most vaguely; and, perhaps, influenced by its etymology, surgeons call an immense number of various morbid indurations scirrhi, which are not at all of a malignant or dangerous character.

I have always considered scirrhus as a diseased hardness, in which there is a propensity to cancerous ulceration, and a greater backwardness to recede than exists in any other kind of diseased hardness, although the skin may occasionally not break during life, and a few scirrhous indurations may have been lessened.

Though Richter states that this disposition cannot be discovered till carcinoma has actually taken place; though Mr. J. Burns and Sir E. Home affirm that other indurations and tumours may terminate in cancer; though Mr. Abernethy shows that sarcomatous and encysted tumours may end in most malignant diseases, and such as equal cancer in severity (*Chir. Works, p.* 83); yet it is now well ascertained, that in all these instances, the changes which precede cancerous ulceration bear no resemblance to those of a true malignant scirrhus.

The puckering of the skin, the dull, leaden colour of the integuments, the knotted and uneven feel of the disease, the occasional darting pains in the part, its fixed attachment to the skin above, and muscles beneath and in the breast, the retraction of the nipple, form so striking an assemblage of symptoms, that when they are all present, there cannot be the smallest doubt that the tumour is a scirrhus, and that the disease is about to acquire, if it have not already acquired, the power of contaminating the surrounding parts and the lymphatic glands to which the absorbents of the diseased part tend.

As Sir Everard Home has observed, the truly scirrhous tumour, which is known to be capable of changing into the true open cancer, when allowed to increase in size, is known to be hard, heavy, and connected with the gland of the breast; and, when moved, the whole gland moves along with it. The structure of a scirrhous tumour in the breast is different in the various stages of the disease; and a description of the appearances exhibited in the three principal ones, may give a tolerable idea of what the changes are which it goes through previous to its breaking, or becoming what is termed an open cancer.

When a section is made of such a tumour in an early stage, provided the structure can be seen to advantage, it puts on the following appearance: the centre is more compact, harder to the feel, and has a more uniform texture than the rest of the tumour; and is nearly of the consistence of cartilage. This middle part does not exceed the size of a silver penny; and from this, in every direction, like rays, are seen ligamentous bands of a white colour and very narrow, looking, in the section, like so many extremely irregular lines passing to the circumference of the tumour, which is blended with the substance of the surrounding gland. In the interstices between these bands the substance is different, and becomes less compact towards the outer edge. On a more minute examination, transverse ligamentous bands, of a fainter appearance, form a kind of net-work, in the meshes of which the new-formed substance is enclosed. This structure accords with what Dr. Baillie describes as presenting itself in cancerous diseases of the stomach and uterus.

In a more advanced stage of the tumour, the whole of the diseased part has a more uniform structure; no central point can be distinguished; the external edge is more defined and distinct from the surrounding gland; and the ligamentous bands in different directions are very apparent, but do not follow any course that can be traced.

According to Mr. C. Bell, it is the ligamentous bands which produce the retraction of the nipple, by extending between its ducts and destroying its spongy texture. —(*Med. Chir. Trans. vol.* 12, *p.* 233.)

On dissection, Sir Astley Cooper observes, that the breast is one solid mass like cartilage, with very little vascularity except at its edges, and internally fibrous. When the breast has acquired any magnitude, he says, there is generally an opening in it, in which case it has the appearance internally of being worm-eaten and spongy. In the situation of the ulceration it is very vascular, and bloody serum is met with. The absorb-

ent glands put on the same character as the scirrhous breast. The cellular membrane, skin, and muscles are also affected. Sometimes the diseased glands above the clavicle press upon the thoracic duct, and thus interrupt the transmission of chyle into the blood. Hence the appetite is sometimes voracious, though the patient is rapidly wasting. In the chest, on the same side as the disease, hydrothorax prevails, and the absorbents on the pleura are in a morbid state, and small white spots, like pins' heads, are visible. Traces of scirrhous disorder Sir Astley Cooper likewise represents as occasionally existing in the liver, uterus, &c. —(See *Lancet, vol.* 2, *p.* 373.)

When the tumour has advanced to what may be called cancerous suppuration (which, however, does not always happen in the centre before it has approached the skin and formed an external sore), it exhibits an appearance totally different from what has been described. In the centre is a small irregular cavity filled with a bloody fluid, the edges of which are ulcerated, jagged, and spongy. Beyond these there is a radiated appearance of ligamentous bands, diverging towards the circumference; but the tumour near the circumference is more compact, and is made up of distinct portions, each of which has a centre, surrounded by ligamentous bands, in concentric circles.

It is remarked by Sir Everard Home, that in some instances scirrhus has no appearance of suppuration or ulceration in the centre, but consists of a cyst filled with a transparent fluid and a fungous excrescence, projecting into this cavity, the lining of which is smooth and polished. When a large hydatid of this kind occurs, a number of very small ones have been found in different parts of the same tumour; and in other cases there are many very small ones, of the size of pins' heads, without a large one. These hydatids are by no means sufficiently frequent in their occurrence to admit of their forming any part of the character of a cancerous tumour.—(*Obs. on Cancer, p.* 156, *&c.* 8*vo. Lond.* 1805.)

In the fourth chapter of this work the author relates two cases of hydatids found in the breast. In the first, the contents of the cyst were bloody serum; in the second, a clear fluid. These two cases of simple hydatids in the breast, unconnected with any other diseased alteration of structure, led Sir E. Home to consider more particularly the nature of such hydatids as are sometimes found in cancerous breasts: he believes that they form no real part of the disease, but are accidental complaints superadded to it; and that, as they occur in the natural state of the gland, they are much more likely to do so in disease.—(*Op. cit. p.* 108. 159.) These *hydatid* or *encysted* swellings of the breast are not always regarded as true scirrhi, and in particular Sir Astley Cooper and Mr. C. Bell describe them, according to my judgment very correctly, as a different form of disease.

Sir E. Home defines what he means by cancer as follows:—"As cancer is a term too indiscriminately applied to many local diseases for which we have no remedy, though they differ very much among themselves, it becomes necessary to state what the complaints are which I include under this denomination. The present observations respecting cancer apply only to those diseased appearances which are capable of contaminating other parts, either by direct communication or through the medium of the absorbents; and when they approach the skin, produce in it small tumours of their own nature, by a mode of contamination with which we are at present unacquainted.

There is a disease, by which parts of a glandular structure are very frequently attacked, particularly the os tincæ, the alæ of the nose, the lips, and the glans penis. This has been called cancer, but differs from the species of which we are now treating, in not contaminating the neighbouring parts with which it is in contact; and neither affecting the absorbent glands nor the skin at a distance from it. It is, properly speaking, an eating sore, which is uniformly progressive; whereas, in cancer, after the sore has made some progress, a ridge is formed upon the margin, and the ulceration no longer takes that direction. It also differs from a cancer in admitting of a cure in many instances and under different modes of treatment.

From the facts which have been stated (*see the cases detailed in this gentleman's work*), it appears that *cancer is a disease which is local in its origin.* In this respect the cases (alluded to) only confirm an opinion very generally received among medical practitioners; but in favour of which no series of facts had been laid before the public of sufficient force entirely to establish the opinion."—(*P.* 145, *&c.*)

Sir E. Home endeavours to establish a second point, that *cancer is not a disease which immediately takes place in a healthy part of the body; but one for the production of which it is necessary that the part should have undergone some previous change connected with the disease.* In proof of this, the first two cases in his work are brought forward, and the innumerable instances in which a pimple, small tumour, or wart upon the nose, cheek, or prepuce may remain for ten, fifteen, or thirty years, without producing the smallest inconvenience; but at the age of sixty or seventy, upon being cut in shaving, bruised by any accidental violence, or otherwise injured, assumes a cancerous disposition.

All the cases of induration of the gland of the breast, or of indolent tumours in it, which have continued for years without producing any symptom, and after being irritated by accidental violence have assumed a new disposition and become cancerous, admit of the same explanation; and are adduced as so many proofs of the truth of this latter position.—(*P.* 147, *&c.*)

With regard to the common opinion, that the production of scirrhus of the breast is connected with the cessation of the menses, Sir Astley Cooper also expresses his belief, that if a person has a tumour, not originally of a malignant nature, in the breast, an undue action may afterward be excited in it when the change of life takes place; and the disease then assumes the character of scirrhus.—(*Lancet, vol.* 2, *p.* 376.)

However, the doctrine, that certain tumours may change their nature and alter into cancer, is one which is sometimes looked upon with suspicion. "Improper treatment may without doubt exasperate diseases, and render a complaint, which appeared to be mild and tractable, dangerous or destructive; but to aggravate the symptoms, and to change the form of the disease, are things that ought not to be confounded. I do not affirm (says Mr. Pearson) that a breast which has been the seat of a mammary abscess, or a gland that has been affected by scrofula, may not become cancerous; for they might have suffered from this disease had no previous complaint existed; but these morbid alterations generate no greater propensity to cancer, than if the parts had always retained their natural condition. There is no necessary connexion between cancer and any other disease; nor has it ever been clearly proved that one is convertible into the other."—(*Pract. Obs. on Cancerous Complaints, p.* 8.) To the latter way of thinking, Mr. Abernethy also inclines; for in speaking of the occurrence of cancer in parts previously diseased in another manner, he confesses, that his own observations have not led him to believe that this change is common. "Cases of tumours, which have remained indolent for twenty or more years, becoming cancerous at an advanced period of life, are not unfrequently met with;" but (says Mr. Abernethy) the patients "might have been liable to the formation of a cancerous disease, even if no diseased structure had previously existed." A degree of indecision, however, appears to be thrown upon this statement by the admission, that cancer is more likely to begin in parts previously diseased.—(*Surg. Works, vol.* 2, *on Tumours, p.* 87.)

The following are some of the most distinguishing characters of scirrhus. A scirrhous induration seldom acquires the magnitude to which almost all other tumours are liable to grow, when no steps are taken to retard their growth. According to Sir Astley Cooper, the swelling gradually grows from the size of a marble, until it acquires two or three inches in diameter; "for (says he) it rarely happens that the true scirrhous tubercle increases to a very considerable bulk, and this circumstance is one of its criteria."—(*Lectures, &c. vol.* 2, *p.* 177.) Many scirrhi are attended even with a diminution or shrunk state of the part affected.

Scirrhi are generally more fixed and less moveable than other sorts of tumours; especially, when the latter have never been in a state of inflammation.

With the exception of fungus hæmatodes, other diseases do not involve in their ravages indiscriminately

every kind of structure, skin, muscle, cellular substance, &c., and the integuments seldom become affected before the distention produced by the size of such swellings becomes very considerable. In scirrhous cases, the skin soon becomes contaminated, discoloured, and puckered.

Some few tumours may be harder and heavier than a few scirrhi, but the reverse is commonly the case.

As other indurations and tumours may assume the cancerous action, and even end in cancerous ulceration; and as some true scirrhi, when not irritated by improper treatment, may continue stationary for years; the occurrence of actual carcinoma cannot prove that the preceding state was that of scirrhus. The only criterion of the latter disease is deduced from the assemblage of characters already specified; for except the peculiar puckering, and speedy leaden discoloration of the skin, no other appearances, considered separately, form any line of discrimination.

The white ligamentous bands around a scirrhus form a very characteristic mark of the complaint, at least as it presents itself in the female breast; but these cannot be detected till the disease has been removed. Hence, the prudence of taking away a considerable portion of the substance surrounding every scirrhous tumour. Were any of these white bands left, the disease would inevitably recur.

Mr. Pearson has never yet met with an unequivocal proof of a primary scirrhus in an absorbent gland, and (says he) "if a larger experience shall confirm this observation, and establish it as a general rule, it will afford material assistance in forming the diagnosis of this disease.—(*Pract. Obs. on Cancerous Complaints*, *p.* 5.) Sir E. Home, however, has given the particulars of one case which seemed to him to have commenced in one of the lymphatic glands, situated between the nipple and the axilla.—(*Obs. on Cancer*, *p.* 161.) The position laid down by Mr. Pearson, that when the disease originates in those glands, it will rarely be found to be of a cancerous nature, may yet be generally correct.

OF CANCER IN THE STATE OF ULCERATION.

According to the observations of Mr. Abernethy, the diseased skin covering a carcinomatous tumour of the breast generally ulcerates before the swelling has attained any great magnitude; a large chasm is then produced in its substance, partly by a sloughing and partly by an ulcerating process. Sometimes, when cells contained in the tumour are by this means laid open, their contents, which are pulpy matter of different degrees of consistence and various colours, fall out, and an excoriating ichor issues from their sides. This discharge takes place with a celerity which would almost induce belief, that it can hardly result from the process of secretion. When the diseased actions have, as it were, exhausted themselves, an attempt at reparation appears to take place, similar to that which occurs in healthy parts. New flesh is formed, constituting a fungus of peculiar hardness, as it partakes of the diseased actions by which it was produced. This diseased fungus occasionally even cicatrizes. But though the actions of the disease are thus mitigated; though they may be for some time indolent and stationary; they never cease, nor does the part ever become healthy.

In the mean while, the disease extends through the medium of the absorbing vessels. Their glands become affected at a considerable distance from the original tumour. The progress of carcinoma in an absorbent gland is the same as that which has been already described. The disease is communicated from one gland to another, so that after all the axillary glands are affected, those which lie under the collar-bone, at the lower part of the neck, and upper part of the chest, become disordered. Occasionally, a gland or two become diseased higher up in the neck, and apparently out of the course which the absorbed fluids would take. As the disease continues, the absorbent glands, in the course of the internal mammary vessels, become affected. In the advanced stage of carcinoma, a number of small tumours, similar in structure to the original disease, form at some distance, so as to make a kind of irregular circle round it.

The strongest constitutions now sink under the pain and irritation which the disease creates, aggravated by the obstruction which it occasions to the function of absorption in those parts to which the vessels leading to the diseased glands belong. Towards the conclusion of the disease the patient is generally affected with difficulty of breathing and a cough.—(See *Abernethy's Surgical Works*, *vol.* 2, *p.* 72, *&c.*)

The general condition of the patient is excellently described by Mr. C. Bell. After noticing the hectic fever which preys upon her, he observes, "the countenance is pale and anxious, with a slight leaden hue; the features have become pinched, the lips and nostrils slightly livid; the pulse is frequent; the pains are severe. In the hard tumours the pain is stinging or sharp; in the exposed surface it is burning and sore. Pains like those of rheumatism extend over the body, especially to the back and lower part of the spine; the hips and shoulders, &c. Successively the glands of the axilla, and those above the clavicle, become diseased. Severe pains shoot down the arm of the affected side: it swells in an alarming degree, and lies immoveable. At length, there is nausea and weakness of digestion. A tickling cough distresses her. Severe stitches strike through the side; the pulse becomes rapid and faltering: the surface cadaverous; the breathing anxious; and so she sinks."—(*Med. Chir. Trans. vol.* 12, *p.* 223.)

One of the most deplorable effects occasionally resulting from cancer is, so great a fragility of the bones that those of the limbs are broken by the most trifling causes, as merely turning in bed, &c. Sir Astley Cooper mentions several examples of this fact. In the collection of St. Thomas's Hospital is the thigh-bone of a Mrs. Edge, which broke on her merely rising in bed; and also the thigh-bone of another cancerous patient that was fractured by her turning in bed.—(*Lectures, &c. vol.* 2, *p.* 184.) Other cases are recorded by surgical writers.—(See *Fragilitas Ossium.*) It seems that the scirrhous substance is deposited in the structure of the bones, as the sternum of Mrs. Edge above mentioned fully illustrates; and in the museum at St. Thomas's are two curious specimens of diseased spine, in which much of the bone is absorbed, and scirrhous tubercles deposited in the spaces produced by absorption. In the above species of carcinoma, described by Mr. Abernethy, the part is peculiarly hard, and rarely attains considerable magnitude. He admits, however, that there are varieties, and speaks of another case in which the integuments sometimes remain pale and pliant; "and a surgeon who first sees the breast in this state, may doubt whether the disease be actual cancer or common sarcoma. The substance of the tumour is also much less hard than in the specimen first described; yet it is more compact and weighty than most other diseases of the same bulk which are not carcinomatous. If the history of the disease accords with that of carcinoma; that is to say, if it began in a small district, and regularly and unabatingly attained its present magnitude; if the surface of the tumour be unequal, having produced in various parts roundish projecting knobs, the disease will almost invariably be found to be carcinoma. The skin will soon adhere to one or more of these prominences; it will ulcerate and expose the subjacent parts; and the future progress of the disease will accord to that of the harder and smaller specimen," except that the absorbents are much less liable to be affected.—(*Vol. cit.* 85.)

The edges of a cancerous ulcer are hard, ragged, and unequal, very painful and reversed in different ways, being sometimes turned upwards and backwards, and on other occasions inwards. The whole surface of the sore is commonly unequal: in some parts there are considerable risings, while in others there are deep excavations. The discharge for the most part is a thin, dark-coloured, fetid ichor; and is often possessed of such a degree of acrimony as to excoriate, and even destroy, the neighbouring parts. In the more advanced stages of the disease, a good deal of blood is often lost from the ulcerated vessels. A burning heat is universally felt over the ulcerated surface; and this is the most tormenting symptom that attends the disorder. Those shooting, lancinating pains, which are generally very distressing in the occult state of the complaint, become now a great deal more so. Notwithstanding cancerous diseases are not always situated in glandular parts, the situation of such sores affords some assistance in the diagnosis; for six times as many cancerous affections occur in the lips and female breasts, as in all the rest of the body together.—(*B. Bell.*)

According to Mr. C. Bell, true carcinoma of the breast belongs to that period of life when the uterine functions cease. Menstruation becomes irregular, both in respect to time and quantity. Long intervals occur, after which the discharge is profuse, with unusual disturbance of the general system. The mamma, in particular, sympathizes with the condition of the uterus; pains shoot through it and it swells; and when the general fulness and tension subside, a partial hardness, an indurated lump, is left, with irregular margins, which mix with the substance of the breast. The hardness extends until the whole gland is unusually firm, the disease becoming at the same time tuberculated, or knobby and irregular. The veins enlarge, and assume a deep blue colour. In the mean time, the strength declines, and the patient becomes emaciated. The nipple is now not only drawn in and incapable of erection, but retracted in comparison with the irregular convexity of the mamma. In a later stage, the skin is puckered and tucked in. These parts now firmly adhere to the subjacent mass, and sometimes there is bleeding from the nipple, in which case, the axillary glands are affected early.

A true carcinoma, continues Mr. C. Bell, may begin very differently. A small hard tumour is felt deeply seated in the mamma. It is difficult to distinguish whether or not it is a part of the proper gland. It becomes painful, approaches the surface, becomes attached to the mamma and to the skin, and is gradually incorporated with them. The skin becomes discoloured, the surface moist, and the patient is apprehensive of the occurrence of a sore. At length the part does ulcerate, and begins to discharge. The bottom of the sore is foul and sloughy; the smell is offensive; and the constitution sympathizes with the state of the sore. The whole gland is now hard, and adherent to the pectoral muscle. The edges of the sore are particularly hard, and present a dark red, glazed appearance. They are not everted and curling, but rather depressed under the general convexity of the tumour. This will certainly be the appearance in a fat woman. The chasm is deep, with solid, abrupt, sharp edges. In proportion as its depth increases, the surrounding hardness extends, and the whole breast feels of a stony hardness.

Cancer of the breast sometimes assumes another form, which is also well described by Mr. C. Bell: although the disease commences in the mamma, it rather propagates itself by extending its peculiar structure to the cutaneous glandular texture. Around the nipple, tubercles are felt in the skin, which extend to the skin of the breast, neck, and shoulders, and soon become painful. At first they assume a high red colour; then a yellowish transparency in the centre. They do not suppurate and break; but change into corroding ulceration.

It is a form of the same disease, says Mr. C. Bell, when the breast presents a tumour, elevated, tuberculated, and remarkably firm, without any elasticity, but, on the contrary, fixed to the side, and presenting one consolidated mass. The surface is granular, and of a deep, or rather dark red colour, with a bluish cast, somewhat like the colour of a peach. This tumour ulcerates and sloughs, and bleeds profusely. The disease is propagated by tubercles under the skin towards the sternum and clavicles; and it is a case soon accompanied with effusion in the chest.—(*C. Bell, in Med. Chir. Trans. vol.* 12, *p.* 216. 220.)

By some of the old writers the causes of cancer were referred to the presence of worms, which destroyed the parts, and produced all the local mischief. Strange as this doctrine may appear, one very analogous to it was adopted by the late Dr. Adams.—(*Obs. on Morbid Poisons.*) When hydatids found their way into a solid substance, he supposed that the effect would be cancer; and he conjectured that the success of an operation would depend in a great measure upon these animals being confined in a common cyst, for then they could be entirely removed; whereas if they were unconnected, some of the smaller ones would be likely to remain. The absurdity of this doctrine, however, and the eccentric reasoning by which it is supported, make it quite unnecessary here to fatigue the reader with a particular explanation of it. Though hydatids are occasionally found in tumours which have been called cancerous, they are not found often enough to make any part of the character of the disease; and they are met with in cases in which there is not the least vestige of such disorder.

After cancer had continued some time, it was formerly believed that the matter was absorbed into the blood, and all the humours contaminated. Hence was explained the fatal and rapid relapses after an apparent cure. However, the effects of absorption are supposed by more modern writers to be confined to the lymphatic glands, which intervene between the sore and the heart; for beyond these it is said that the absorbed matter is changed in its properties.—(*J. Burns on Inflammation, vol.* 2.)

With respect to the causes of cancer, the disease is very frequently imputed to blows, pressure, and other accidental injuries; but there are almost always other circumstances concerned which have more influence than the accidental violence. "Although (as Sir Astley Cooper remarks) the disease operates on some particular part of the body, it is always preceded by a state of constitution which has excited it. He who looks at this disease in the light merely of a local affection, takes but a narrow view of it. A blow or a bruise, inflicted on a healthy person, would be followed by common inflammation only, which would lead to the removal of the matter effused. But if a blow were received on the breast when the constitution was disposed to the formation of scirrhous tubercle, it would be the cause of a particular action being excited in the part injured, and might lay the foundation of this complaint. Yet the formation of scirrhous tubercle does not entirely depend on constitutional derangement; there must be also a peculiar action excited in the part." In order to prove that the disease must depend on constitutional derangement and an altered action in the part unitedly, Sir Astley Cooper observes, that if a scirrhus be cut into, all the horrors of cancer will be the result of the injury; but if the cut be made in the healthy parts around the disease no cancerous ulceration follows, and the wound heals. In short, he argues that the disease is the effect of a specific action in the part, preceded by a disposition in the constitution to its production.—(See *Lancet, vol.* 2, *p.* 378.)

In the breast cancer frequently commences without any previous accidental injury of the part; a fact tending to establish the correctness of such writers as represent the disease to be of a constitutional nature. In these cases there is always an irregularity or disappearance of the menses; and the affection of the mamma may be supposed to depend on sympathy between it and the uterus. Certain it is, that cancer is very frequent about the time of life when the menstrual discharge ceases.

It is a commonly received opinion, that cancer is an hereditary disease, or observed to prevail a good deal in particular families. Sir Astley Cooper has known it occur in three sisters.—(*Lectures, &c. vol.* 2, *p.* 186.) Sir Everard Home has endeavoured to reconcile this to the doctrine of the disease being at first entirely of a local nature; circumstances which seem incompatible: "It is now universally admitted (says he) that children take after their parents in the general structure of their bodies, and therefore will be more or less liable to have the different solids of which they are composed, disturbed by the same causes; and when a violence of any kind is committed upon them, it may be productive of the same diseases. In some families, the venereal disease shall always appear in the form of gonorrhœa [?]; in others again, rarely or never in that form, but in that of chancre [?]. Strictures in the urethra are common in some families: they have taken place in a father and all his sons from very slight causes; such indeed as would not have produced the disease in others. Yet stricture cannot be called hereditary, because it is a local complaint, arising from a local inflammation, differing in different people, according to the natural irritability of the parts which are affected. In this way, and this only, can cancer run in families, and be an hereditary disease," &c.—(*Obs. on Cancer, p.* 150.) The observations which this gentleman has published respecting cancer are unquestionably some of the most valuable which have yet been collected; but I am doubtful about the correctness of one term which is frequently met with in his work, viz. *cancerous poison.* At all events, I am not at present acquainted with any facts which satisfactorily demonstrate the existence of such virus; and from some circumstances briefly mentioned in the *First Lines of the Practice of Surgery*, the reality of a poison of this nature would seem at least questionable. In support of the belief in the existence

of a cancerous virus, it has been observed, however, "that we scarcely ever see glands diseased out of the course which the absorbed matter would naturally take, though they are affected in this manner in diseases which can be propagated by irritation."—(*Abernethy's Surg. Works, vol. 2, on Tumours, p. 75.*)

Undoubtedly cancer is most common in elderly persons; but, according to some writers, no age is exempt from the disease. Mr. J. Burns has seen it distinctly marked and attended with a fatal event in children of five years old: he mentions two instances of the eye being affected in such subjects: though, from the late observations of Mr. Wardrop, we may now reasonably suspect that these examples were really cases of fungus hæmatodes. An instance, in which a cancerous disease of the breast began at the age of fifteen, is related by Sir E. Home.—(*Obs. on Cancer, &c. p. 50.*)

Sir Astley Cooper has frequently seen the disease at all ages between thirty and seventy. He does not recollect more than two cases in which the nature of the tumour was decidedly scirrhous in persons under thirty years of age. He has seen one case in a patient aged ninety-three; another in an individual of eighty-six; and he has removed an ulcerated scirrhus from a person seventy-three years old, who got well. According to Sir Astley's experience, the disease most frequently occurs about the age of fifty. The tumours met with in women under thirty, and often called scirrhi, he says, are only simple chronic enlargements, not disposed to malignant action, and not requiring removal.—(*Lectures, &c. vol. 2, p. 185.*)

Age makes a great difference in the whole class of carcinomatous tumours; and as Mr. C. Bell has remarked, the same disease distinguishable by obvious signs will run its course rapidly, and with every symptom aggravated, in a woman of forty-five, while it will remain stationary for years in a woman of sixty or seventy.—(*Med. Chir. Trans. vol. 12, p. 216.*) Sir Astley Cooper also states that when it occurs in very advanced age, it is slow in its progress, and does not in general shorten life.—(*Lectures, &c. p. 185.*)

According to Sir Astley Cooper, married women, who bear no children, and single women, are more subject to this complaint than such as have large families. He thinks it very probable that the natural change which the breast undergoes in the secretion of milk has some power in preventing this disease. But he admits that the circumstance of a woman having borne children is not a perfect security against the complaint; and he knew one individual with this disease who had been pregnant seventeen times.—(*Lancet, vol. 2, p. 375.*)

This gentleman's experience confirms a remark made by other writers, that grief and mental anxiety seem frequently to have a great share in the production of scirrhus of the breast.—(*Vol. cit. p. 379.*)

TREATMENT OF CANCER.

Cancers have sometimes been supposed to be a general disorder of the system; sometimes merely local affections. This is a point of much importance in practice; for if cancers are originally only local affections, no objection can be made to extirpating them. They who think that cancer is a constitutional disease, will have much less confidence in the operation, which they may even regard as useless, perhaps hurtful, inasmuch as it may convert a scirrhus into an open cancer, or bring on the affection in some other part.

Some practitioners, however, reject the doctrine of cancer depending on constitutional causes; and Sir E. Home's sentiments, in opposition to the opinion, have been laid before the reader. When cancer breaks out again in the same part, after the performance of an operation, it is often owing to some portion of the disease having been blameably left behind, or to the operation having been put off too long. How likely it is that some of the cancerous disease may be left unremoved by the operator, is obvious on considering the manner in which the white bands, resembling ligament, shoot into the surrounding fat; and that even the fibres of the muscles beneath a cancerous disease are frequently affected. At the same time, it must be allowed that the disease is sometimes to all appearances so freely and completely removed, that its recurrence may be imputed, perhaps with equal probability, to the continued operation of the same unknown cause which originally produced the first cancerous mischief. Sir Astley Cooper and many other very experienced men, both of the past and present time, consider cancer as decidedly a complaint connected with a peculiar state of the constitution. But if this be true, it may be asked, how can any cure be expected from the removal of the part, as the continued operation of the same constitutional causes must occasion a relapse? And so they sometimes do, no doubt, independently of the accident of any portion of the disease not being completely removed with the knife. However, experience proves that the operation frequently effects a radical cure, and no other organ is afterward attacked; which is analogous to what is seen after the amputation of a scrofulous limb; a case in which frequently no other part is afterward attacked, though the constitution is unsound.

From the description which Sir Astley Cooper has given of the dissection of persons destroyed by scirrhus, it must be inferred, not only that the disease is constitutional, but that the hope of radically curing it, either by medicines or an operation, must very often fail in advanced cases. He says, that a scirrhus in the breast is generally accompanied by several smaller tumours of the same character in different parts of the glandular structure. He notices the deposition of the scirrhous matter in the axillary glands, and those above the clavicle. On the left side, he says, the latter sometimes press upon the termination of the thoracic duct. According to his observations, the glands behind the cartilages of the ribs, when the disease is on the sternal side of the nipple, are generally diseased. The axillary glands on the other side of the body he has also seen in the same state. The lungs are often found inflamed, and adherent to the pleura; serum is effused in the chest; and the pleura costalis studded with scirrhous tubercles. He also describes the liver, uterus, ovaries, and bones as participating in the morbid changes.—(See *Lectures, &c. p. 182, vol. 2.*) Under such circumstances the inutility of any treatment must be obvious.

Until late years, the accounts given of the results of operations for cancers were so unpromising, that they deterred many patients from undergoing a timely operation; which, for cancerous complaints, is the only remedy with which we are as yet acquainted entitled to much confidence. As Mr. B. Bell remarks, the great authority of Dr. Alexander Monro must have had no inconsiderable influence even with practitioners, in making them much more backward in undertaking the extirpation of cancers than they otherwise would have been. "Of near sixty cancers," says he, "which I have been present at the extirpation of, only four patients remained free of the disease at the end of two years: three of these lucky people had occult cancers in the breast, and the fourth had an ulcerated cancer on the lip."—(*Edin. Med. Essays, vol. 5.*) Dr. Monro also observes, that in those in whom he saw the disease relapse, it was always more violent, and made a quicker progress than it commonly did in others on whom no operation had been performed. Hence, he questions, "whether ought cancerous tumours to be extirpated, or ought the palliative method only to be followed?" and, upon the whole, he concludes against their extirpation, except in such as are of the occult kind, in young healthy people, and have been occasioned by bruises or other external causes.

More modern experience, however, has afforded a very different result, and given ample encouragement to the early performance of an operation, and even to making an attempt to cut away the disease, in every instance, both of the occult and ulcerated kind, when such a measure can be so executed as not to leave a particle of the cancerous mischief behind.

Mr. Hill, in 1772, published some valuable remarks on the present subject. At this period, he had extirpated from different parts of the body eighty-eight genuine cancers, which were all ulcerated, except four; and all the patients, except two, recovered of the operation. Of the first forty-five cases, only one proved unsuccessful; in three more the cancer broke out again in different parts; and, in a fifth, there were threatenings of some tumours, at a distance from the original disease. These tumours, however, did not appear till three years after the operation; and the woman was carried off by a fever before they had made any progress. All the rest of the forty-five continued well as long as they lived; or are so, says Mr. Hill, at this day. One of them survived the operation above thirty years; and fifteen were then

alive, although the last of them was cured in March, 1761.

Of the next thirty-three, one lived only four months; and, in five more, the disease broke out afresh, after having been once healed. The reason why, out of forty-five cases, only four or five proved unsuccessful, and six, out of thirty-three, was as follows: "The extraordinary success I met with (says Mr. Hill) made cancerous patients resort to me from all corners of the country, several of whom, after delaying till there was little probability of a cure, by extirpation or any other means, forced me to perform the operation, contrary both to my judgment and inclination."

Upon a survey, in April, 1764, made with a view to publication, the numbers stood thus: Total cured, of different ages, from eighty downwards, sixty-three; of whom there were then living thirty-nine. In twenty-eight of that number, the operation had been performed more than two years before; and, in eleven, it had been done in the course of the last two years. So that, upon the whole, after thirty years' practice, thirty-nine, of sixty-three patients, were alive and sound; which gives Mr. Hill occasion to observe, that the different patients lived as long, after the extirpation of the cancers, as, according to the bills of mortality, they would have done, had they never had any cancers, or undergone any operation.

The remaining twenty-five, which complete the eighty-eight, were cured since the year 1764. Twenty-two of these had been cured at least two years; and some of them, it may be remarked, were seventy, and one ninety years old.

In the year 1770, the sum of the whole stood thus: Of eighty-eight cancers, extirpated at least two years before, not cured, two; broke out afresh, nine; threatened with a relapse, one; in all, twelve, which is less than a seventh part of the whole number. At that time, there were about forty patients alive and sound, whose cancers had been extirpated above two years before.

Mr. B. Bell, who was present at many of these cases, bears witness to Mr. Hill's accuracy; and the former very judiciously states, that "from these and many other authenticated facts, which, if necessary, might be adduced, of the success attending the extirpation of cancers, there is, it is presumed, very great reason for considering the disease, in general, as a local complaint, not originally connected with any disorder of the system." With respect to Mr. Bell's opinion, that a general cancerous taint seldom, or perhaps never, occurs, but in consequence of the cancerous virus being absorbed into the constitution from some local affection, much doubt attends even this supposition, though the practical inference from it is what cannot be found fault with, viz. in every case of real cancer, or rather in such scirrhosities, as from their nature are known generally to terminate in cancer, we should have recourse to extirpation as early as possible; "and, if this were done soon after the appearance of such affections, or before the formation of matter takes place, their return would probably be a very rare occurrence."—(*System of Surgery*, *vol.* 7.)

Sir Astley Cooper admits, that the operation is followed by a return of the disease in many cases, the average number of which, however, he does not state, though he says that they do not amount to one-fourth. —(*Lancet*, *vol.* 2, *p.* 383.)

How often is the operation determined upon, because the nipple is retracted, and true cancer thereby announced! Yet, says Mr. Charles Bell, with reference to the cause of this change, as previously explained, "it is quite clear, that if the nipple be fully retracted, and if this has been evident for any considerable time, the operation has been too long deferred."——(*Med. Chir. Trans. vol.* 12, *p.* 233.)

Sir Astley Cooper is adverse to the performance of the operation when dyspnœa is present; for he has known patients die in two or three days, who had been operated upon while labouring under that symptom. On examination after death, water was found in their chests, and tubercles in the pleura.—(*Lancet*, *vol.* 2, *p.* 373.)

The same experienced surgeon gives it as his opinion, that a breast should never be removed, unless the patient has undergone a course of alterative medicines, as Plummer's pills and the compound decoction of sarsaparilla, or (what he prefers) the infusion of gentian with soda and rhubarb. Thus the constitution may be improved, and the danger of a relapse diminished.—(*Vol. cit. p.* 379.)

After comparing the different accounts of success given by Monro and Hill, well might Richter say: "*Jure sane dixeris, de uno eodemque morbo hos viros loqui, dubitari fere potest.*"—(*Obs. Chir. fasc.* 3.)

MEDICINES AND PLANS WHICH HAVE BEEN TRIED FOR THE CURE OF SCIRRHUS AND CANCER.

It is a contested point, whether a truly cancerous disease is susceptible of any process, by which a spontaneous cure can be effected. It appears certain, however, that a violent inflammation, ending in sloughing, may sometimes accomplish an entire separation of a cancerous affection, and that the sore left behind may then heal. Facts, confirming this observation, are occasionally exemplified in cases where caustic is used, and accidental inflammations have led to the same fortunate result, as we may be convinced of by examples recorded by Sir Everard Home, Richerand, &c. The latter writer, adverting to the effort which nature sometimes makes to rid herself of the disease by the inflammation and bursting of the tumour, takes the opportunity to relate the following case. A woman, aged forty-eight, of a strong constitution, was admitted into the hospital of St. Louis, with a cancerous tumour of the right breast. The swelling, after becoming softer, and affected with lancinating pains, was attacked with an inflammation, which extended to the skin of the part, and all the adjacent cellular membrane. The whole of the swelling mortified, and was detached. A large sore, of healthy appearance, remained after this loss of substance, and healed in two months.—(*Nosographie Chir. t.* 1, *p.* 381, *edit.* 2.)

In general, however, it must be confessed that inflammation renders things worse instead of better, and by converting occult cancers into ulcerated ones, hastens the patient's death, or at all events renders the cure more difficult, and forbids any attempts, which, on such a principle, might be made for his relief.

Of the general remedies, narcotics, as conium, opium, belladonna, &c. have been employed with most hope.

Cicuta, or conium maculatum, owed its reputation to the experimenting talent of Storck, who has written several treatises on it. According to him, cicuta possesses very evident powers over cancer, and has cured a great many cases; but in less prejudiced hands it has not been found successful; and even in many of the instances adduced by Baron Storck of its utility, it is by no means proved that the disease was really cancer. The public have now little or no reliance on this medicine, as a means of relieving cancer. Mr. J. Burns declares, that in cancerous ulceration, he never knew hemlock produce even temporary melioration.—(See *Conium*.)

Belladonna was highly recommended by Lambergen During its use, he kept the bowels open with clysters, administered every second day. The dose should be, at first, a grain of the dried leaves, made into a pill. The quantity may be gradually increased to that of ten or twelve grains. The extract is now frequently exhibited, the dose being at first one grain, and afterward increased by degrees to five. The reputation of belladonna has not been supported by any decided success in cases of true cancer.

Hyosciamus has often been tried in cancerous cases, and was held in great estimation by the ancients. Mr. J. Burns says, he has employed it occasionally, but with little effect. The common dose, at first, is three grains of the extract.

Aconitum has also been given; and, as it is a very powerful and dangerous narcotic, a patient usually begins with only half of a grain of the extract night and morning. Solanum dulcamara, Paris quadrifolia, phytolacca, &c. have also been recommended; but they are now hardly ever employed, which is a sufficient proof of their inefficacy. Mr. J. Burns tried the hydrosulphuret of ammonia, without any benefit. Richter prescribed the laurus cerasus, but without any decided success.

Digitalis lessens vascular action, and may act on scirrhi like abstinence, bleeding, &c. It has, however, no specific virtue in curing cancerous diseases.

Opium is seldom employed, with the intention of curing cancer, although probably it has just as much power of this kind as other narcotics, which have been

more frequently used. For the purpose of lessening the pain of cancerous diseases, it is very freely prescribed.

Tonics sometimes improve the general health; but they never produce any specific effect on the local disease.

Justamond thought arsenic a specific for cancers. Farther experience has not, however, confirmed the truth of this opinion, though there are many practitioners who continue to think highly of the efficacy of this mineral in certain forms of disease, which have sometimes been classed with cancer; and in many cases of lupus, and malignant ulcers of the tongue and other parts, it may really possess greater claims to farther trial than perhaps any other medicine yet suggested. It unquestionably cures numerous ill-looking sores on the face, lips, and tongue, and is one of the best remedies for lupus. Mr. Hill observes: "Experience has furnished me with some substantial reasons for considering arsenic as a medicine of considerable merit, both with regard to actual cancer and scirrhus, which may one day terminate in that horrible species of ulcer; and although I cannot as yet say it will remove the one, or cure the other, as certainly and safely as mercury commonly does a syphilitic swelling, or open sore, yet it will, in a great majority of cases, retard the progress of the true scirrhous tumour, and often prevent its becoming cancer. In some, it has appeared to dissipate such swellings completely."—(See *Edin. Med. and Surgical Journ. vol.* 6, *p.* 58.)

Mercury, in conjunctionwith decoctions of guaiacum, sarsaparilla, &c., has been recommended, but as Mr. J. Burns remarks, no fact is more certainly ascertained, than that mercury always exasperates the disease, especially when in the ulcerated state. Plummer's pills and the other alteratives approved of by Sir Astley Cooper, as medicines to be given previously to an operation, with the design of lessening the chances of a return of the disease, have been already noticed.

Sulphate of copper has been tried; but, at present, it retains no character as a remedy for cancer. The same may be said of muriated barytes.

The carbonate (rust) of iron was particularly recommended by Mr. Carmichael. Besides the carbonate of iron, he sometimes prescribed the tartrate of iron and potass, and the phosphate, oxyphosphate, and suboxyphosphate of the metal. Some constitutions can bear these preparations only in small quantities; they affect most patients with constipation, and many with headache and dyspnœa. These circumstances, therefore, must be attended to in regulating the dose. The above gentleman has seldom given less than thirty grains, in divided doses, in a day, or exceeded sixty. He prefers the suboxyphosphate for internal use, and states, that it answers best in small doses frequently repeated. It should be blended with white of egg, have a little pure fixed alkali added, and then be made into pills with powdered liquorice. Aloes is recommended for the removal of costiveness. When half a grain is combined with a pill containing four grains of carbonate of iron, and taken thrice a day, the constipation will be obviated. When the internal use of iron brings on headache, difficult respiration, a quick, sometimes full pulse, which is also generally hard and wiry, excessive languor, lassitude, &c., and such symptoms become alarming, the iron is to be left off, and four grains of camphor given every fifth hour.

At the same time that preparations of iron were internally administered, Mr. Carmichael employed externally, for ulcerated cancers, the carbonate, phosphate, oxyphosphate, and arseniate of iron, blended with water, to the consistence of a thin paste, which was applied once every twenty-four hours. To occult cancers, the same gentleman applied a solution of the sulphate of iron ℥j. to ℔j. of water. The acetate of iron, diluted with eight or ten times its weight of water, was also used. These lotions were put on the part affected by means of folded linen, wet in them, and covered with a piece of oiled silk to prevent injury of the clothes.—(See *An Essay on the Effects of the Carbonate and other preparations of Iron upon Cancer, &c. 2d ed.* 8vo. *Dublin*, 1808.)

Many remedies have acquired celebrity in cases of cancer, because very bad and malignant diseases, only supposed to be cancers, have got well under their use. Such is probably the case with the carbonate of iron.

The only mode of treatment which Mr. Pearson has ever seen do any particular benefit to cancer, is that of keeping the patient on a diet barely sufficient for the support of life, such as barley-water alone, tea, &c. A milk diet has also been recommended.

With respect to the effects of a very low diet, Sir A. Cooper protests strongly against the plan: if the patient be already weak, he says, you will thus render her still weaker, and soon bring her to the grave: in proportion as the strength declines, the pulse is quickened. He farther declares, that we possess no medicine which has any specific power over the disease, though the state of the constitution may sometimes be improved by Plummer's pills given at bedtime, and the following draught in the day. ℞. Infus. gentian, ℥iss. Tinct. columbæ, ℥j. Ammon. carbon. gr. v. Sodæ carbon. ℥ss. Misce. Climate he also regards as having no particular effect on scirrhous disease. Sir A. Cooper only sanctions the use of steel medicines when the uterine secretion is defective. In such cases, he recommends the compound calomel pill at night, and the following draught twice a day. ℞. Vini ferri ℥j. Ammon. carbon. gr. vij. Aq. menth. vir. ℥j. Tinc. cardam. c. ℥ss. He also approves of anodynes for the relief of the suffering; as the tinct. opii, the liquor opii sedativus, or the black drop, combined with the camphor mixture, and a little of the spir. ætheris comp. One of his patients derived much relief from the following pill. ℞. Ext. stramonii gr. ½. Camph. gr. ij. M. ft. pil. Bis terve in die sumend.—(See *Lectures, &c. vol.* 2, *p.* 193.)

The old surgeons commonly dressed cancerous sores with narcotic applications. Vesalius used cloths dipped in the juice of the solanum; while others employed it mixed with the oil of roses and preparations of lead and antimony. Others had recourse to the hyosciamus; but of late years hemlock poultices have been the favourite narcotic application; and in many cases, as Mr. J. Burns observes, they have undoubtedly abated pain and diminished fetor; but this is all which can reasonably be expected. He thinks carrot poultices better than those of hemlock, as they produce as much ease and more powerfully diminish the fetor.

Sir Astley Cooper has no confidence in the utility of evaporating lotions. Warm applications he also represents as improper. The dressing which he mostly prefers, is a plaster, made by blending ℥j. of the extract of belladonna with ℥j. of soap cerate. When inflammation is present, he does not object to the use of leeches. All local applications, as well as internal medicines, he considers as merely palliatives, unpossessed of any power of curing really scirrhous diseases.

The fetor of cancers, having been thought to resemble that of the sulphuret of potash (liver of sulphur), and the oxygenated muriatic acid being the best agent for decomposing and destroying such smell, it has been recommended as an application to cancerous sores. It may correct the fetor; but it will never accomplish a cure. Carbonic acid has been said not only to correct the fetor, but in some instances, completely to cure the disease. It was long ago proposed, says Mr. J. Burns, by Peyrilhe, and was again brought forward by Dr. Ewart. Experience, however has not shown that the efficacy of carbonic acid, in cases of cancer, is very great. Fourcroy remarks, "After the first applications, the cancerous sore appears to assume a more favourable aspect; the sanies which flows from it becomes whiter, thicker, and purer, and the flesh has a redder and fresher colour; but these flattering appearances are deceitful, nor do they continue long, for the sore speedily returns to its former state, and its progress goes on as before the application." The best method of applying carbonic acid is by means of a bladder, the mouth of which is fastened round the sore with adhesive plaster. The air is introduced by a pipe inserted at the other end.

Sometimes the fermenting poultice is employed.

Digitalis, as a local application, is entitled to about as much confidence as cicuta.

Tar ointment, gastric juice, absorbent powders, &c. have been tried, but without any evident good.—(See *J. Burns on Inflammation, vol.* 2.)

Mr. Fearon rejected all internal remedies, as inefficient in the treatment of cancer, and, in the early stages of the complaint, recommended a method of practice, founded on his idea of the inflammatory na-

ture of the disease. "In the beginning of scirrhous affections of the breast and testis, the mode I have adopted of taking away blood, is by leeches repeatedly applied to the parts. In this course, however, I have often been interrupted by the topical inflammation produced by these animals around the parts where they fastened. In delicate female habits, I have often lost a week, before I could proceed to the reapplication of them. When the symptoms lead me to suspect the stomach, uterus, or any of the viscera, to be so affected that the complaint either is, or most probably soon will become cancerous, I then have recourse to general bleedings. But whether topical or general, perseverance for a sufficient length of time is necessary. Though the pulse never indicated such practice, yet the patients have not suffered by repeated bleedings; on the contrary, when they passed a certain time without losing blood, they felt a return of their symptoms, and of their own accord, desired to be bled again. To this plan of repeated bleedings, I joined a milk and vegetable diet, avoiding wine, spirits, and fermented liquors." Mr. Fearon used also to keep the belly open, and employ saturnine applications.

Of the method of treating cancer by pressure, I have spoken in another work (*First Lines of the Practice of Surgery, vol.* 1), and therefore in this place I need merely repeat, that it is a practice, which none of the best modern surgeons think entitled to approbation.

From the preceding accounts, we may infer that scarcely any reliance is to be placed on any known remedy or plan in any cases of real scirrhi, and ulcerated cancers. The operation is the only rational means of getting rid of the disease; and to waste time, so as to allow the disorder to increase in a serious degree, merely for the sake of trying various unpromising medicines, is conduct unworthy of a wise surgeon's imitation.

Perhaps, in early cases, it may be right to make trial of arsenic, conium, preparations of iron, those of iodine, and, in particular, of the ointment of the hydriodate of potass, which Dr. Wagner found capable of dispersing one swelling reputed to be cancerous.—(See *Revue Méd. Juin*, 1823.) In France, this ointment is also applied to various tumours. Dr. Wagner's contained only eighteen grains of the hydriodate of potass to six drachms of lard; but in France the proportions are as much as two drachms of the first article to an ounce of the second. But the practitioner should beware of devoting too much time to medicines which will in all probability prove inadequate to the object for which they are exhibited. Graefe is also alleged to have succeeded in bringing about an absorption of the whole of the diseased breast, by applying an ointment, composed of ℥j. of hydriodate of potass, and ʒij. of lard. Mr. Hill, of Chester, has recorded one case, very favourable to the farther trials of iodine. The cancer was in the ulcerated state. He dressed it with an ointment consisting of ℥j. of the hydriodate to ʒj. of lard; and gave the patient internally thirty drops at a time of a solution of thirty-six grains of the hydriodate in an ounce of distilled water. The result was such amendment of the disease, that a cure was confidently expected; but, in the end, the ulcer resumed its former dimensions and malignant character.—(See *Edin. Med. Journ. No.* 87, *p.* 283.) Upon the whole, the operation is what we should generally adopt, as the surest and the safest means of getting rid of cancerous diseases. As I have before remarked, the operation is always admissible, when every particle of the disease can be removed by it. Even large open cancers, if they can be entirely cut away, are often capable of being effectually cured.

The removal of cancerous disorders, even in the slightest and most trivial cases, should always be effected with the scalpel, in preference to caustic; the the use of which, though it may sometimes succeed by producing a complete destruction of the diseased parts, causes severe agony, and in the event of its not acting sufficiently on all the diseased parts, often renders the complaint more aggravated, and kills the patient, and this in a very short space of time.

In cases of cancer, the irritation generally occasioned by every application of the caustic kind, together with the pain and inflammation which commonly ensue, are strong objections. Plunket's remedy, which is chiefly arsenic, is equally objectionable. Nor can you at once so certainly extirpate every atom of cancerous mischief with any caustic, as you can with the knife; for with this you immediately gain an ocular inspection of the surface surrounding the disease, so as to see and feel whether the disordered parts are completely removed, or whether any portion of the disorder requires a farther employment of the instrument. With respect to the pain, that of caustics is infinitely greater, more intolerable, and more tedious, than that occasioned by the knife. When caustic also fails in destroying every particle of the disease at once, it almost always tends to enlarge, in a very rapid way, the original boundaries of the mischief. For an account of the method of removing scirrhi and ulcerated cancers, see *Mamma, Removal of.*

[There is, perhaps, no disease to which our "flesh is heir," which has been so fruitful of empiricism, or has yielded so great a harvest of wealth and reputation to ignorant and mischievous charlatans, as that of cancer. And so great have been the evils of malpractice in the treatment of this disease, and so fatal have been the several caustic plasters which are imposed on the public, that it is matter of surprise that such impositions have not been made the subjects for the enforcement of the penalties of our medical police.

Our author has given us a lucid and judicious description of the various modifications of cancer, and one which will enable the young surgeon readily to make out his diagnosis. But his chief difficulty will be to convince his patient and friends that every indolent tumour, tedious ulcer, irritated gland, or protracted phlegmoid or erysipelatous local inflammation, is *not a cancer*. Those numerous cancer-doctors who swarm in many of our cities, gain their reputation for success by pronouncing all such local affections to be cancers, and then applying their cancer-plaster until they form a new surface which soon granulates and heals by cicatrization. The cure of cancer is then published, and thousands of certificates, under oath, are deluging the country, attesting such cures in patients, many of whose constitutions are utterly unsusceptible of cancerous disease in any of its forms. Hence it is that we hear of more cancers being cured in New-York by these empirics than there are cases of the genuine disease in the United States; more cures in a year than there are cancers in a century. Within three years I have known more than a hundred instances of these impositions. Sometimes in children a nævus materni, or an aneurism by anastomosis, is treated by a cancer-plaster; and Dr. Mott mentioned to me, a short time since, that he saw a child with *ranula* under the treatment of one of these leeches, who had already inserted a caustic plaster beneath the tongue by a complex apparatus. Very often an indurated gland, an indolent ulcer, an obscure tumour, has come under my notice, which had been already doomed to the caustic as the worst kind of cancer, although neither possessed any specific character whatever.

All these impositions, however, are comparatively innocent; because, for the most part, they only inflict a scar on the skin, and a wound on the pockets of those who become their victims. But they stop not with these lesser crimes; with their reputation their hardihood increases, and they decide every morbid alteration in the structure of the female breast to be a cancerous mamma, and predict the surgeon with his knife, and death in the rear, as the certain results of delay in eating out this cancer and its roots. I have known many wives and mothers ruined for life by submitting to the experiments of ignorance and folly on diseases of the glandular structure, which required, for the most part, no medical attention. And in one instance I saw a patient die, the widowed mother of a number of children, of what is called *arsenical fever*, produced by a plaster applied to the mamma, for an ir considerable tumour which had existed for years, but which her fears, the terror of her friends, and the wickedness of one of these cancer-doctors had magnified into a malignant cancer. She was in perfect health when the arsenic was applied; the eschar formed was large and deep; an extensive inflammation succeeded, involving the other breast and the axiliary glands, from which she was soon bedridden, and lingered eleven months, dying of the remedy, not the disease. This is only one among a number of instances in which death has resulted in this city from similar means.

It will perhaps be expected that I should refer, in this place, to the treatment of cancerous mamma by compression, a remedy which some years since attracted a con-

siderable share of public attention. I know not with whom the practice originated, but recollect that the late Dr. Ezra Gillingham, of Baltimore, wrote a paper on this subject a few years since, in which he extolled the practice of compression, and seemed to anticipate very important results from this mode of treatment. He applied pressure with a piece of sheet lead and a suitable bandage in the case of his mother, and thought he had effected a cure; but a few months overthrew his hopes, the disease returned, and after the extirpation of one breast by the knife, she died of the disease at last.

It must be admitted that even the knife affords very equivocal benefit in cases of well-marked cancer, and hence in this country a prejudice very extensively exists against the operation of removing the mamma. The frequent failures of the operation may be attributed very frequently to its long postponement. If the patient refuse to submit to the knife for months, and even years after the specific characteristics of the disease are plainly developed, and until the axilla has become involved, it would be surprising indeed if recovery should ensue, especially in the prostrated condition of the body ordinarily found to exist under such circumstances.

So numerous are the instances of the return of the disease in other and even remote parts of the body, and this too after the best advised and most skilfully performed operations, that many surgeons are of opinion that cancer is always a constitutional disease, and they therefore look upon the operation for the removal of cancers as altogether palliative. A more probable opinion, however, is that expressed in the note on Osteo-sarcoma, which is but a modification of carcinoma, that the disease is at first purely local; but if not removed in its incipient state, very soon involves the whole body, and hence the success of early operations. But although the disease may be most generally purely local, and unconnected with any vitiated, scrofulous, or scorbutic state of the system, yet it will be found most generally to involve the whole gland, although the characteristic evidences of cancer may only exist in a very small part of the structure. Hence when any portion of the mamma is affected with a disease of this kind calling for the operation, it will be unsafe to extirpate only the part diseased, but every portion of the entire breast must be removed, else the disease will, in a majority of instances, very soon return. Some surgeons attribute its return to the inflammation consequent upon the operation; but it is difficult to believe that an affection of specific character can result from any ordinary inflammation after a surgical wound, unless there be some portion of the diseased structure left behind. Either this must be admitted, or else it will follow that the whole system is contaminated with the specific action, for otherwise the inflammation following other operations might be expected to degenerate into cancer. Dr. Hosack has a paper on this subject in vol. 2 of his Essays, published in 1824.—*Reese.*]

Much additional information respecting cancer is contained in the *First Lines of the Practice of Surgery*, ed. 5. *Le Dran's Operations in Surgery*, p. 87, &c. ed. 2. *B. Bell's Surgery*, vol. 2. *Justamond's Account of the Methods pursued in the Treatment of Cancerous and Scirrhous Disorders*, 8vo. *Lond.* 1780; *also, his Surgical Tracts*, &c. 8vo. *Lond.* 1789. *James Hill, Cases in Surgery*, 8vo. *Edin.* 1772. *Vindungus ab Harting, De Optima Cancrum Mammarum extirpanda ratione. Alsdorf*, 1720. (*Haller, Disp. Chir.* 2. 509.) *L. Rouppe, De Morbis Navigantium liber, accedit Obs. de Effectu Extracti cicutæ Storckiano in Cancro*, 8vo. *Lugd.* 1764. *G. Dowman, on the Nature, &c. of a Scirrhus*, 8vo. *Lond. A. Storck, An Essay on the Medical Nature of Hemlock*, &c. 8vo. *Lond.* 1760. *C. Molinarius, Historia Mulieris a Scirrho curatæ*, 8vo. *Vindob*, 1761. *G. Tabor, De Cancro Mammarum, eumque novo extirpandi Methodo. Trajecti*, 1721. *C. 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CANCER SCROTI. CHIMNEY-SWEEPERS' CANCER. See *Scrotum.*

CA'NCRUM ORIS. A deep, foul, irregular, fetid ulcer, with jagged edges, on the inside of the lips and cheeks, attended with a copious flow of offensive saliva. According to Mr. Pearson, this disease is seldom seen in adults; but most commonly in children from the age of eighteen months to that of six or seven years. The gums, as well as the lips and cheeks, are sometimes affected; in which circumstance the teeth are generally carious and loose. The ulceration is occasionally attended with abscesses, which burst either through the cheek, lip, or just below the jaw. Exfo-

liations are not unfrequent, and when the disease is neglected, extensive sloughing sometimes happens.

Living in a marshy situation, unwholesome food, and inattention to cleanliness, are suspected to be conducive to this disorder. Its causes seem not to be understood; but it is remarked that the disease prevails most in houses where children are crowded together. The complaint is sometimes suspected to be contagious.

Though children are the usual subjects of it, grown-up persons do not always escape its attacks.

The treatment consists in extracting diseased teeth and loose pieces of bone; directing a milk and vegetable diet, with a prudent quantity of fermented liquors; and prescribing bark, sarsaparilla, and elm bark with sulphuric acid.

The best external applications are, diluted mineral acids; burnt alum; the decoctum cinchonæ, with sulphate of zinc; tincture of myrrh; lime-water, with spirit of wine, &c.—(See *Pearson's Principles of Surgery, ed.* 2, *p.* 287.)

CANTHARIDES. Spanish or French flies, with which the common blistering plaster is made. In surgery they are also prescribed in incontinence of urine, gleets, &c. The tincture is sometimes added to stimulating liniments to increase their effect. When applied to the skin or taken into the stomach, they have a peculiar tendency to act upon the urinary organs, and especially to irritate and inflame the neck of the bladder, and occasion strangury. In children, these effects are particularly frequent.—(See *Blisters.*)

[Under the article *Tincture of Cantharides* will be found some practical remarks on the effects of this remedy in several diseases. I would therefore only remark in this place, although not strictly appertaining to surgery, that the internal exhibition of cantharides will be found to possess extraordinary virtues in overcoming an habitual propensity to abortion which the female constitution sometimes acquires. I have known this remedy succeed after thirteen successive abortions had occurred, notwithstanding all the efforts made to prevent its repetition. Its use should be continued in increasing doses until strangury is induced, which result may be hastened by applying a dilute unguent of cantharides to a blistered surface.—*Reese.*]

CAPELINA. (From *capeline*, a woman's hat.) A double-headed roller, the middle of which is applied to the occiput. After two or three circles the rollers intersect each other upon the forehead and occiput; then one being reflected over the vertex to the forehead, the other is continued in a circular track. They next cross each other upon the forehead, after which the first head is carried back obliquely towards the occiput, and reflected by the side of the other. The last is continued in a circular direction; but the first is brought again over the sagittal suture, backwards and forwards, and so continued till the whole head is covered. By the ancients this bandage was sometimes applied in cases of hydrocephaius: it has no advantage, however, and is now hardly ever used.

CAPILLARY FISSURE. A very minute crack in the skull. The term came into use from its presenting the appearance of a hair.

CAPISTRUM. See *Bandage.*

CARBUNCLE. (From *carbo*, a burning coal.) *Anthrax.* This is a very common symptom in the plague; but comes on also sometimes as a primary disease. The first symptoms are great heat and violent pain in some part of the body, on which arise one or several vesications, attended with great itching and a burning heat; below which a circumscribed but very deep-seated and extremely hard tumour may be felt. In some respects it resembles the furuncle; but differs from it in having no central core, and in terminating in gangrene under the skin instead of suppuration.—(See *Gibson's Institutes, vol.* 1, *p.* 50, *Philadelphia,* 1824.) It soon assumes a dark red or purple colour about the centre, but is considerably paler towards the edges. A blister frequently appears on the apex, which, as it occasions an intolerable itching, is often scratched by the patient. The blister being thus broken, a brown sanies is discharged, and an eschar makes its appearance. Many vesications of this kind are sometimes produced upon one tumour.—(*Bromfield's Obs. vol.* 1.)

Carbuncles have been distinguished into the *benign* and *malignant* kinds; but as far as the disease can be judged of at present in this country, the distinctions are only founded upon the different degrees of violence with which it makes its attack. Some carbuncles are said to be *pestilential*, while others are not at all infectious. Fortunately, all cases met with in this island are of the last sort; for no opportunities of remarking the pestilential anthrax have occurred in England since the deplorable periods of 1665 and 1666.

The carbuncle sometimes appears in persons affected with typhoid fevers, in which case it is attended with great weight and stiffness of the adjacent parts; the patient is restless and pale, the tongue white, or of a deep red, and moist; the pulse low, urine sometimes pale, sometimes very turbid, with all the other symptoms, in an exaggerated degree, which attend typhoid fevers. The patient often complains much of his head, either from pain or giddiness. Sometimes he is drowsy; at other times he cannot get the least sleep. Occasionally he is delirious. The case is also apt to be attended with chilliness or rigors, and profuse perspirations. The patient is sometimes costive, sometimes afflicted with a profusion of stools: he generally complains of loss of appetite, nausea, and vomiting, takes but little nourishment, complains of difficulty of breathing, and is extremely low with palpitations of the heart, and sometimes faintings.—(See *Bromfield's Obs. vol.* 1, *p.* 122.)

Sometimes a little slough, of a black colour, appears in the middle of the tumour. This was supposed by the ancients to be a part of the body burned to a cinder or hard crust, by the violence of the disease. By some authors, the carbuncle is considered as a sort of gangrenous affection of the cellular substance.—(*Latta.*) The progress of carbuncles to the gangrenous state is generally quick. Their size is various; they have been known to be as large as a plate. Considerable local pain and induration always attend the disease. The skin, indeed, has a peculiar feel, like that of brawn. As the complaint advances, several apertures generally form in the tumour. Through these openings there is discharged a greenish, bloody, fetid, irritating matter. The internal sloughing is often very extensive, even when no sign of mortification can be outwardly discovered.

The constitution is often so low and exhausted, that death follows. The carbuncle, indeed, is most frequent in old persons, whose constitutions have been injured by voluptuous living; and hence we cannot be surprised that the local disease, influenced by the general disorder of the system, should very often assume a dangerous aspect.

The degree of peril may generally be estimated by the magnitude and situation of the tumour, the number of such swellings at the same time, the age of the patient, and the state of his constitution.

With regard to the local treatment, the grand thing is to make an early and free incision into the tumour, so as to allow the sloughs and matter to escape readily. Also, with the view of facilitating the escape of the discharge and internal sloughs of the cellular membrane, it is a good plan to remove, with a pair of scissors, a part of the dead skin, as soon as its detachment is sufficiently advanced.—(See *Dict. des Sciences Méd. t.* 2, *p.* 184.)

As much of the contents as possible is to be at once pressed out, and then the part is to be covered with an emollient poultice. Indeed, until the tumour is opened, no applications are more proper than emollient poultices, and when an incision has been made they are far preferable to any detergent antiseptic injections, made with bark, tincture of myrrh, &c., or to any lotions made with the sulphates of copper and zinc, nitrate of silver, &c. Fomentations also afford considerable relief, both before and after an opening has been made. As the discharge is exceedingly fetid and irritating, it will be necessary to put on a fresh poultice two or three times a day. The use of the poultice is to be continued till all the sloughs have separated, and the surface of the cavity appears red, and in a granulating state, when soft lint and a pledget of some unirritating ointment should be applied, together with a compress and bandage. The manner in which the disease is protracted by not making a proper opening in due time cannot be too strongly impressed upon the mind of every practitioner, and it may justly be regarded as a frequent reason of the fatal terminations of numerous cases. Mr. Bromfield forcibly inculcates

the necessity of making a timely opening for the discharge of the sloughs; for, says he, in case you rely on the opening made by nature, the thin matter only will be discharged, the sloughy membranes will remain, and the orifice close up.—(See *vol.* 1, *p.* 128.)

It was formerly not an uncommon custom to remove the most prominent portions of carbuncles with the knife, or to destroy them with the actual and potential cauteries. The French in particular are partial to the method of burning the swelling with a hot iron, the employment of which is sanctioned by Pouteau.—(See his *Œuvres Posthumes.*) Even now they sometimes touch the apex of the swelling with boiling oil, the muriate of antimony, or the actual cautery, especially when the pain is excessively severe; and the practice is alleged to be the most expeditious mode of relief. In America, emollient poultices are continued until vesications appear, openings form, and a bloody serum begins to be discharged; the surface of the tumour is then freely covered with caustic vegetable alkali, which of course produces a good deal of pain, but this soon subsides, and the severe burning agony peculiar to the complaint is now quite removed. It was Dr. Physick who first explained the proper period for the application; without which knowledge, Professor Gibson says, much mischief has resulted from ill-timed incisions, and the actual and potential cauteries. —(*Institutes of Surgery, vol.* 1, *p.* 52.)

In England the disorder is generally subdued by milder means. With respect to the constitutional treatment, the continental surgeons, in the beginning of the case, before a slough has formed, usually prescribe gentle diaphoretic drinks, containing a sufficient quantity of tartrate of antimony to open the bowels. After this stage, they have immediate recourse to tonics and cordials. It should always be remembered, that the disease is for the most part met with in bad constitutions, and in persons who are weak and irritable. Hence, it is only when there is a full strong pulse, and the complaint is just beginning, that bleeding is allowable. Bark, the sulphate of quinine, camphor, wine, opium, ether, are the internal medicines most commonly needed. The diluted sulphuric acid is also highly proper, as well as aromatics and a nourishing diet. As the pain is very severe, opium is an essential remedy. The constitutional treatment is analogous to that of mortification, and for this reason I do not deem it necessary to enlarge the present article by expatiating on this part of the subject.—(See *Mortification.*)

In many of the southern parts of Europe, a malignant species of carbuncle appears to be endemic, contagious, and very often fatal.

[In the United States, carbuncles not unfrequently occur, and occasionally they present a most malignant aspect. They are for the most part seated on the back near the spine; varying in their situation from the cervical to the lumbar vertebræ; but they do occur on almost every part of the body, and some of the worst I have ever seen existed on the scalp.

The local treatment in this country, when the disease is of malignant character, is most generally a poultice or cataplasm of bark and yest, frequently renewed, washing the part often with brandy. At the same time greater reliance is placed on the internal remedies, which are designed to prevent sphacelus, viz. bark, wine, serpentaria, porter, and other tonics. In the 2d volume of Dr. Hosack's essays will be found the narrative of the successful treatment of an interesting case.—*Reese.*]

For an account of this form of this disease, I would particularly advise the reader to consult *Richerand Nosogr. Chir. t.* 1, *p.* 210, *&c. édit.* 4, *and Larrey, Mémoires de Chirurgie Militaire, t.* 1, *p.* 104, *&c. Ant. Tosi, De Anthrace seu Carbunculo Tractatus, 4to. Venetiis,* 1576. *This tract, notwithstanding its antiquity, is said to contain useful precepts: see Dict. des Sciences Méd. t.* 2, *p.* 184. *Bromfield's Chirurgical Cases and Obs. vol.* 1. *L'Encyclopédie Méthodique, partie Chir., art. Anthrax. Pearson's Principles. Richter's Anfansgr. der Wundarzn. b.* 1. *Boyer, Traité des Maladies Chir. t.* 2, *p.* 50, *&c. Physick's Case of Carbuncle, with Remarks on the Use of Caustic in that Disease, in the Philadelphia Journ. of the Med. and Physical Sciences, vol.* 2, *p.* 172. *W. Gibson, The Institutes and Practice of Surgery, vol.* 1, *p.* 50, *&c. Philadelphia,* 1824.

CARCINOMA. (From καρκίνος, a crab.) See *Cancer.*

CARIES. (From κείρω, to abrade.) Caries is a disease of the bones, supposed to be very analogous to ulceration of the soft parts; and this comparison is one of great antiquity, having been made by Galen. However, by the generality of the ancients, caries was not discriminated from necrosis.

It was from the surgeons of the eighteenth century, that more correct opinions were derived respecting caries. Until this period, writers had done little more than mention the complaint and the methods of treating it. Some new light was thrown upon the subject by J. L. Petit, in his remarks upon exostosis and caries.—(*Mal. des Os, t.* 2, *chap.* 16, *p.* 27.) But as he only spoke of the disorder as one of the terminations of exostosis, he has not entered far into the consideration of it. The best observations on caries were first made by Dr. A. Monro, *primus.*—(*Edin. Med. Essays, vol.* 5, *art.* 25.) This memoir contains the earliest correct ideas of *dry caries*, or *necrosis*, which is rightly compared to mortification of the soft parts, and named *gangrenous caries.*

The bones, like other parts of the body, are composed of arteries, veins, absorbent vessels, nerves, and a cellular texture; they are endued with vitality; they are nourished, they grow, waste, are repaired, and undergo various mutations according to the age of the individual; and they are subject to diseases analogous to those of the soft parts. To the phosphate of lime, which is more or less abundantly distributed in their texture, they owe all their solidity; and, perhaps, it is to the same earthy substance, that the difference in their vital properties and in their diseases, from those of the rest of the body, is to be referred. In fact, this particular organization and inferior vitality of the bones are generally supposed to account for the small number, peculiar character, and generally slow progress of their diseases.—(*Dict. des Sciences Méd. t.* 4, *p.* 80.)

Bones of a spongy texture are more frequently attacked by caries than such as are compact. Hence the vertebræ; astragalus, and other bones of the tarsus; those of the carpus; the sternum; the bones of the pelvis, and the heads of the long bones, are often affected; and the bones of young persons are unquestionably more frequently the seat of caries than those of old subjects.

But, as a modern writer has observed, though the soft and spongy bones are most subject to caries, they sometimes suffer a degree of injury sufficient to produce the death of a portion of their texture. This remark is illustrated by a case, where a musket-ball had struck the head of the tibia, in which after death a sequestrum was found, with a cloaca leading down to it.—(*Liston, in Edin. Med. and Surg. Journ. No.* 78, *p.* 50.)

According to the observations of Mr. Syme, when caries occurs in the tables of the skull, or the cylindrical bones, it is uniformly preceded by a morbid expansion of the compact structure into a state resembling that which naturally belongs to those where the disease usually resides. He notices, that the shafts of bones, and especially that of the tibia, are frequently enlarged and thickened, in consequence of chronic inflammation, and at the same time loosened in their texture, so as to present nearly the same appearance as that of the spongy articulating extremities. "In bones so altered, caries occasionally occurs, or I should rather say, a condition resembling caries, since it differs from this disease in one important feature, viz. *incorrigibleness.* I have hardly ever known this pseudo-caries resist the local application of blisters, and internal use of oxymuriate of mercury; and I have felt very uncomfortable in seeing extensive incisions, rasping, trephining, actual cauteries, &c. employed ineffectually to cure complaints admitting of such easy remedy."—(See *Edin. Med. and Surg. Journ. vol.* 31, *p.* 257.)

In necrosis, the bone is entirely deprived of life; in caries, the vital principle exists, but a morbid action is going on, whereby the texture of the bone is altered, and rendered softer and lighter than natural. But though these disorders are essentially different from each other, they frequently occur together in the same part, as Mr. Liston has correctly explained.—(*Edin. Med. and Surg. Journ. No.* 78, *p.* 50.)

In the most common species of caries, a loose fungous flesh grows out of the interstices formed on the

surface of the diseased bone, and bleeds from the slightest causes; while in the soft parts a sinus generally leads down to the caries, and emits a very fetid, dark-coloured sanies. These symptoms, however, as well as the tendency in the accompanying ulcer or sinus to produce large fungous granulations, are more constant in cases of necrosis than in those of caries, some of which may remain a very considerable time unattended with any outward sore, abscess, or sinus as we see illustrated in the caries produced by various diseases of the joints. And, indeed, particular forms of caries (if they deserve that name) are rarely accompanied with suppuration: a fact to which I shall again advert.

"The absorption of bone, like that of soft parts (says Dr. Thomson), may be distinguished into interstitial, progressive, and ulcerative. We have ample proofs of the interstitial absorption, or that which is daily-hourly, and unceasingly taking place from every part of the substance of bone, in the deposition and removal of phosphate of lime, that has been tinged with madder. If too much earth be removed, the quantity of animal matter will be relatively increased, and a disposition given to softness of the bones—a state which exists in the bones of children in the disease called the rickets, and in the bones of older people in that denominated mollities ossium, or the rickets of grown people.

I have already had occasion to mention the effects of the progressive absorption of bone, as manifested in the progress of aneurisms and other tumours to the skin; but the formation of pus is by no means a necessary, constant, or even frequent attendant on the progressive absorption in bone. Hydatids in the brains of sheep, tumours growing from the pia or dura mater in the human body (see *Dura Mater*), or aneurism seated over the cranium, or within the cavity of the chest, are often the cause of the whole substance of a bone being removed, layer after layer, by progressive absorption, without the formation of a single particle of pus.—(See *Aneurism.*) This state of the bone has often been confounded, but improperly, with that state of the bone which arises from ulcerative absorption, the state which is properly denominated caries, and in which one or more solutions of continuity may be produced upon the surface, or in the substance of the bones. The ulcerations occasioned in bones by the venereal disease afford by far the best marked examples of the effects and appearances of ulcerated absorption, or caries in bones," &c.—(See *Thomson's Lectures on Inflammation*, *p.* 389.)

Caries has been divided into three kinds, according to the nature of its causes: 1. Caries from external causes; 2. From an internal local cause, where no outward injury of the bone, and no internal constitutional disease can be suspected to have produced the disorder, and where the affection can be removed by local means. The caries of the finger-bones from whitlows is quoted as a specimen of this form of the disease. Perhaps, however, the case is generally rather an instance of necrosis. 3. From a general internal cause, or constitutional disease, in which cases, besides local remedies, it is necessary to employ such medicines as are calculated to obviate the particular affection of the system, whence the diseased state of the bone has originated.

But, in addition to these general divisions of the subject, there are many circumstances in relation to the varieties of caries which may be said yet to lie in obscurity. If, as a modern writer remarks, the situation of the bones, the nature of their organization, and the slowness of their diseases would let an attentive observer trace the formation, developement, and progress of caries, no doubt there would be noticed a diversity in its symptoms corresponding to its different species; and probably it would be found that a venereal or scrofulous caries would vary in its origin and progress as much from a caries arising from a purely local cause, as a venereal or scrofulous ulcer differs from the kind of ulceration that follows a common abscess.—(*Dict. des Sciences Méd. t.* 4, *p.* 84.) The *worm-eaten* caries, as it has been termed, which penetrates the whole substance of a bone, and gives it an appearance as if it had been bored in hundreds of places, is a very different affection from some other forms of the disease, whether superficial or extending to the deeper texture of the bone.

Mr. Syme regards the distinction of caries into the *dry*, *moist*, *worm-eaten*, &c. only as the result of the confusion of caries with other morbid states of the osseus tissue. The dry is in reality necrosis, as already noticed. A carious bone, after maceration, according to Mr. Syme, looks as if it had been burned; being harder, whiter, and more brittle than usual, and always attended with more or less excavation, so as to expose the cellular structure. It much resembles a piece of loaf sugar, which has been partially dissolved by momentary immersion in hot water.—(See *Edin. Med. and Surg. Journ. vol.* 31, *p.* 257.)

Abscesses situated in the vicinity of bones are frequently thought to be the cause both of necrosis and caries. This was the ancient doctrine, and it has found various advocates in modern times, especially Mr. Liston.—(See *Edin. Med. and Surg. Journ. vol.* 20, *p.* 52.) Hence, the rule to open such abscesses at an early period, in order to prevent the bone from being affected. If some abscesses, like those which form over the anterior surface of the tibia and mastoid process of the temporal bone, be frequently attended either with caries or necrosis, the latter is mostly the cause, and not the effect of the suppuration. Pus, which is a bland, unctuous, inodorous fluid, never attacks the soft parts with which it is in contact until its qualities are changed by exposure to the air. When an abscess forms in the anterior part of the parietes of the abdomen, the peritoneum of that part, naturally a thin membrane, instead of being destroyed, becomes thick and strong enough to resist the extension of the abscess towards the cavity of the abdomen. So also when an abscess is formed over a bone, not originally diseased or hurt by the same causes which produced the abscess, and not injured by being kept exposed, or by astringent escharotic applications, neither caries nor necrosis is likely to happen. On the contrary, the periosteum, like the peritoneum, becomes thickened, and granulations are formed over it. In the opinion of Mr. Syme, caries cannot, like necrosis, be induced directly by the effect of violence. It depends, he says, upon a peculiar morbid action, which is probably in all cases preceded by inflammation. "Many people think that pressure, such as that of an aneurism, causes absorption of bone, and gives rise to an appearance which might be mistaken for caries by an inexperienced or careless observer, but could never for a moment impose upon any one acquainted with the distinctive characters of the disease. The surface exposed by simple absorption differs in no respect from that which would have appeared if the excavation had been effected by violence. We do not here perceive the hardness, whiteness, and brittleness of caries; neither is there any matter secreted from it; and so soon as the caries is removed the disease ceases. The effect of pressure in causing absorption without inducing caries, is well seen in those common cases of necrosis where internal exfoliation occurs, and the confined pus makes a way for its escape, since the sides of these passages, so produced, the cloacæ as they are called, are in no respect carious, or unfit for healthy action. Deep-seated collections of matter ought to be evacuated early to relieve the patient from pain, or prevent extension of the fluid, but no apprehension need be entertained of caries being produced by its pressure."—(*Syme, vol. cit. p.* 258.)

But though this gentleman thinks that inflammation generally, if not always, precedes caries, he represents this consequence as not invariably following inflammation or even suppuration. "In cases of compound fracture, amputation, excision of joints, &c. we every day see bone suppurate and granulate in the most satisfactory manner. We observe the same thing occasionally in joints, which become anchylosed after being the seat of abscess." At the same time, Mr. Syme believes that suppuration of bone, which either takes place spontaneously, or in consequence of slight external injury, is very frequently followed by caries, much more so than when it results from a wound which does not heal by the first intention.

Mr. Syme has found that caries seldom affects the bone to a great depth. "Thus we often see an articulating extremity carious over its whole external surface, and sound in the centre. At other times we find it hollowed out into a cavity, the surface of which is carious, while the external shell is sound. The very limited extent of the disease often contrasts remarkably with the extreme obstinacy and severity of the symp-

toms. Thus there is in my possession a thigh-bone which I took from the body of a woman who had laboured under caries of the trochanter major for thirteen years; yet the whole disease may be covered by the point of a finger, and is not thicker than a sixpence." —(*Syme, in Edin. Med. Journ. v.* 31, *p.* 257.)

The venereal disease is sometimes a cause of caries; sometimes of necrosis; frequently of both affections together, and in other instances of exostosis. When it attacks the bones of the nose, its destructive effects arise partly from necrosis, and partly from caries, and the face is sadly disfigured. The bones of the palate are sometimes altered in the same manner; but on other occasions the effect upon them is chiefly necrosis.

In cases of cancer of the breast the sternum and ribs are sometimes found carious. I believe that in such cases the disease of the bones has nothing in its own nature entitling it to be regarded as cancerous. It is a mere effect of the original disorder; and if the carious bone could be removed together with every particle of the disease of the soft parts, a cure would probably follow. Or supposing the carious bone were the only portion of the disease left, it is conceivable that the case might yet end in a cure. At the same time it is proper to recollect what has been mentioned in the article *Cancer*, that Sir Astley Cooper refers in his Lectures to some bones taken from cancerous subjects, where the scirrhous substance is deposited in their structure.

[Under the article *Trephine* I have noticed a very remarkable case of caries from syphilis occurring in the cranium, together with its successful treatment. The celebrated Richerand, of Paris, has several times removed carious ribs, and this operation has since been repeated by Dr. M'Clellan, of Philadelphia, and by Dr. M'Dowell, of Virginia.—*Reese.*]

Caries arising from syphilis most commonly affects the tibia, cranium, ossa nasi, ossa palati, and sternum; and I believe is mostly complicated with a greater or less degree of necrosis.

Caries of the vertebræ is known by peculiar symptoms, among which a paralysis of the inferior extremities and lumbar abscesses are the most remarkable.

Cæteris paribus, caries from an external or a local internal cause is less dangerous than that which proceeds from a constitutional disease, particularly when the latter is difficult of cure.

Caries of the spongy part of the bones is more difficult to cure than a similar affection of the compact parts. Caries of the carpal and tarsal bones is particularly obstinate. These bones being in close contact, the affection cannot easily be prevented from spreading from one to the other. Amputation is often the only means of cure. The same is frequently the case when the spongy heads of the long bones forming the large joints become carious. Even this mode of relief is not practicable when the head of the bone lies very deeply, like that of the os femoris.

Caries of the ossa ileum is also observed to be particularly difficult of removal.

Caries from scrofula, the most frequent case of all the examples of this disorder of the bones (*Wissmann*), is more difficult of cure than that from syphilis and scurvy; for some efficacious remedies against the latter diseases are known; but scrofula cannot be said to be within the reach of medicine. The prognosis is less favourable in old than young subjects, and much depends on the extent of the disease, the patient's strength, and the state of the soft parts.

When caries arises from constitutional disease, internal remedies are of course indicated. Thus mercurial and sudorific medicines put a stop to caries from syphilis; while vegetable diet and acids cure both the scurvy and the caries dependent on it.

According to writers the indications in the treatment of caries are, either to produce a change in the action of the diseased portion of bone, whereby it may regain a healthy state, or to destroy it altogether.

In the caries from constitutional causes, the first object seems to be brought about by the operation of such remedies as remove the original disease; and I should much doubt whether, in these cases, any very active local treatment is necessary or free from objection. Of course, this remark is meant to apply only to examples in which we possess some medicine or plan which is known to be a tolerably sure remedy for the general disease. This is not the case in caries from scrofula, and here issues, blisters, friction, with other local means, are unquestionably advantageous.—(See *Joints* and *Vertebræ*.) But surgeons have proceeded farther, and not content with issues, blisters, fomentations, &c. as means for quickening the action of the diseased bone, they have commonly recommended applying directly upon it the strongest stimulants, as the tincture of aloes or myrrh, a solution of the argentum nitratum, concentrated vinegar, or diluted muriatic acid.

For the destruction of caries, the actual and potential cauteries and cutting instruments have been employed.

On the continent, and particularly in France, the plan of touching carious parts of bones with the actual cautery, after bringing them fairly into view by the previous use of the knife, is still pursued. It is thought that the burning iron acts by changing the caries into a necrosis, irritating the subjacent sound parts, and exciting that action of the vessels, by which the dead or diseased part of the bones must be thrown off. Such is the doctrine inculcated by Boyer, and such is the practice sanctioned by some surgeons of the present day, among whom I find Mr. Liston.

Mr. Hey succeeded in cutting away a carious part of the tibia. He began the operation by dissecting off the granulations of flesh which had arisen from the bone, and then sawed out, by means of a circular-headed saw, a wedge of the tibia two inches in length. The removal of this portion brought into view a caries of the cancelli almost as extensive as the piece already removed. With different trephines, suited to the breadth of the caries, Mr. Hey removed the diseased cancelli of the bone quite through to the opposite lamella. As the caries extended in various directions, it was not possible to remove the whole of it with a trephine without removing also a large portion of the sound part of the bone, which Mr. Hey wished to avoid. By the assistance, therefore, of a strong sharp-pointed knife, he pursued the caries in every direction, until every part was taken away which had an unsound appearance. The wound was simply dressed with dry lint; the whole surface was speedily covered with good granulations; and a complete cure was obtained without any exfoliation.

Mr. Hey concludes this subject as follows: "I have treated some other cases of caries of the tibia in the same manner, and with equal success. Where the extent of the caries is not so great as to prevent a complete removal of the morbid part, this method is extremely useful, and far superior to the use of the potential or actual cautery.

The trephine is not wanted where the cancelli of the bone are not affected with the caries. The diseased parts of the lamella may be removed with gouges or small chisels. Granulations of flesh will then arise from the sound parts of the bone, and become united with the integuments, which ought to be preserved as far as is possible."—(*Pract. Obs. on Surgery.*)

Mr. Syme also regards excision as the best method of destroying carious bone, since (he says) "more can be done by the gouge, or cutting pliers, in a few seconds, than by the actual cautery in as many weeks or months;" and he strongly objects to the application of the cautery to the bone after the excision of the carious part.—(*Edin. Med. Journ. v.* 31, *p.* 260.) On this point, every judicious surgeon must, I think, agree with him.

Dr. Nicol, surgeon to the Northern Infirmary of Inverness, has lately published the result of his experience in caries; and he finds that, when excision is not practicable, the next most effectual treatment consists in applying nitrate of silver to the carious part, and exhibiting the compound decoction of sarsaparilla. —(See *Edin. Med. and Surg. Journ. No.* 94.)

In the treatment of caries, particularly of that form of it which accompanies white swellings, Mr. Liston considers ointments and poultices as unlikely to be productive of much good. In the first or inflammatory stage, he praises topical bleeding, practised with moderation, and followed by issues, sinapisms, blisters, or the antimonial ointment. However, he thinks the most effectual remedy is the moxa. "In all deep-seated pains of the joints (says Mr. Liston) this remedy affords the most speedy and complete relief, at the expense but of a trifling pain of no long duration. The pain does not appear to be greater than that arising from the formation of an eschar by potass, or any other of the potential cauteries, and lasts only during the time

of the application, while the violent pain does not subside, perhaps, for twelve hours after the employment of the potass."—(*Edin. Med. and Surg. Journ. No.* 78, *p.* 54.)

When caries is fairly established, and the integuments have given way, the same author represents the indications to be, either the immediate removal of the diseased bone, or the employment of means calculated to make it be thrown off by the constitution. "The first indication (he says) is to be accomplished by the proper use of trephines, perforators, gouges, gravers, scoops, saws, and forceps of different kinds, for dividing or extracting; the second, by cauteries, actual or potential. In general, a combination of both is required.

In caries of the long bones, it becomes in general necessary to enlarge the opening through the outer lamella, by the application of the trephine, and perhaps by the use of a small saw, or cutting forceps, so as to connect the different perforations, and thus obtain access to the diseased cancelli. The scoop, or graver, will answer well for the rest of the work. In most instances the actual cautery is next applied very freely, by which means the whole of the diseased surface will be thrown off, and healthy granulations fill up the breach."—(*Op. cit. p.* 56.)

In the Medico-Chirurgical Trans. cases have been recorded by Mr. Dunn, and Mr. C. Hutchison, in which several of the tarsal bones in a state of caries were cut out, and the foot preserved. The same practice seems to be followed by Mr. Liston, with the addition of the cautery. He observes, that when the disease is seated in one of the tarsal or carpal bones, and entirely limited to it, its simple removal will be sufficient. But when one is quite destroyed, and the surfaces of others with which it is articulated are affected, these surfaces must also be cut out, and *the operation finished by the free application of the cautery.* The principle which Mr. Liston lays down is, that *the cautery is indispensable, whenever the cancellated texture of a bone is encroached upon.* The knife for such operations, he says, should have a strong, sharp point and edge, with a thick back and firm handle. A scoop, graver, or gouge, and strong pliers, with some pairs of cutting forceps, will (with the cauteries for such cases as require them) complete the apparatus. The bone-forceps, with the cutting edges in a line with the handles, as used by Mr. Liston for some years in these operations, as well as amputation, are strongly commended, more especially when the metacarpal or metatarsal bones are to be in part removed. In these operations, Mr. Liston has never found saws of the least use; and in several trials of the chain saw which he witnessed, it either broke, or got so wedged that great difficulty was experienced in disengaging it, and bringing the operation to a conclusion. He does not approve of the half-headed trephine, because the bone must be denuded much higher than where the division is to be made, in order to let the centre pin be fixed. The annular saw he also disapproves of, on account of the extensive division of the integuments, which its use requires. He does not enter into any particular reasons against Hey's saws, which have been found so useful by other practitioners; and the rotation saw lately invented by Professor Thal, of Copenhagen, is mentioned, but its merits not examined. In short, whatever some surgeons would execute with a saw in the operations under consideration, Mr. Liston would perform with his bone-forceps, or cutting pliers and other means. The facts which he has reported show clearly enough that the forceps used by him is a very efficient instrument; and it is no slight circumstance in its favour, that Baron Dupuytren strongly commends it, and has publicly used it.—(*Liston in Edin. Med. and Surg. Journ. No.* 78.)

If surgeons are often censurable for inert measures in a variety of diseases, I believe they cannot be blamed for the same kind of inactivity in the treatment of caries, where they run, perhaps, into the opposite extreme; and, too confident in their knowledge of the causes and nature of the disease, they often make themselves too officious, and rather disturb than promote the salutary processes of nature.—(See *J. L. Petit, Traité des Mal. des Os, Paris*, 1741. *A. Monro, in Edin. Méd. Essays, vol.* 5. *Weidmann de Necrosi Ossium, Francof.* 1733. *Callisen, Systema Chirurgiæ Hodiernæ, vol.* 1, *p.* 493. *Boyer, Traité des Maladies Chir. t.* 3, *p.* 453, *et seq. Paris*, 1814. *Richerand, Nosogr. Chir. t.* 3, *p.* 134, *edit.* 4, *Paris*, 1815. *Dict. des Sciences Méd. t.* 4, *p.* 78, *&c. J. Wilson on the Structure, Physiology, and Diseases of the Bones, &c. p.* 263, 8*vo. Lond.* 1820. *L. Wissmann, De Rite Cognoscendis et Curandis Nudatione, Carie et Necrosi Ossium,* 8*vo. R. Liston, Essay on Caries, in Edin. Med. and Surg. Journ. No.* 78. *A good description of the different kinds of caries is yet a desideratum.*)

[There is one peculiar and somewhat novel species of caries, which has received the attention of several American writers, and to which some European writers have recently referred. I allude to the *caries of the jaw-bone* occurring among children, and which has been denominated by Marshall Hall a *gangrenous ulcer*, affecting the jaw-bones of children. This disease seems in a variety of instances to be preceded by febrile irritation, and derangement of the digestive organs. It is often found under circumstances in which a great number of children occupy the same apartments, as in workhouses, alms-houses, penitentiaries, &c.; but it sometimes arises spontaneously or sporadically, without any ostensible cause. It has been attributed to impoverished or bad diet, to spoiled grain, and to illy ventilated apartments. In some instances it has been supposed to originate from an injudicious use of mercurials, and I have seen several cases of the disease justly attributed to this agency; but they were all found in children who gave unequivocal evidences of scrofulous diathesis, where mercury should always be given with caution.

But it often occurs without any mercurial treatment having been premised. Indeed, Hall asserts that the malign effects of mercury cannot be associated with the symptoms of this species of caries; and this opinion was probably justified by his observation on the cases which came under his notice. Dr. Francis says, that the cases occurring in his practice, so far as he could ascertain, were in nowise associated with mercurial treatment.

In 1808, a number of cases of this disorder appeared in the New-York Alms-House, and were described by Dr. Sherril. It also occurred again in the New-York Penitentiary, after that institution was removed out of the city, and into a pure and wholesome air, as reported by the late Dr. Dyckman, and it has occasionally reappeared since.

Sometimes it has been known to occur among the sequela of variola and scarlatina. It has been observed, that the children most liable to this kind of caries, were between two and five years of age, and whose constitutions had suffered from abdominal or gastric irritation. When it prevailed as it did here in 1812 to some extent, some patients were found to labour under it much older, and one or two adults. It prevailed most in cold weather, and seemed to be connected with seasons of great humidity. The rapidity of the disease in its tendency to a fatal termination, was sometimes truly astonishing, though in some few instances the patients lingered out from ten to fourteen days, and now and then cases are reported as having continued twenty and even thirty days, although in a number of instances it did not last as many hours; sphacelus occurring thus suddenly and the patient sinking immediately.

Sometimes the upper, more frequently the lower jaw, and occasionally both, seemed to be involved from the commencement, and an entire necrosis was very early found to exist. "The disease," according to Dr. Francis, "frequently began about the edge of the gums, in contact with the incisores teeth. The soft parts became tumid with hardness and pain. Sometimes the greater part of the side of the face assumed an erythematous aspect, without any premonitory signs; and this was subsequently marked by spots of a dark purple or brown colour. Sometimes the part speedily became sphacelated, the sloughing commenced, and emitted a fetid exhalation. The tongue was loaded with a foul sordes, and the breath exceedingly offensive, when coma would supervene, and death suddenly ensue. In other instances, the teeth would become loose in the commencement of the disease, and not unfrequently drop out on the slightest exertion or motion of the jaw. The necrosis would, in some cases, involve full one side of the jaw, and the ulceration extend equally over the soft parts, and affect the ala nasi, the nose itself, and the cheek nearly to the orbit

of the eye. Very soon the sphacelated flesh fell in, and the internal structure of the mouth would be exposed, while the lips would become tumid, painful, and discoloured. These morbid changes, to greater or less extent, were found to involve very speedily the teeth, alveolæ, mucous surfaces, and cheeks."

In the account of this caries as it occurred in the Philadelphia Alms-House as furnished by Dr. Coates, of that city, we have in many respects a similar narration of symptoms. At one time, when the disorder was at its height, threatening several patients with destruction, Dr. C. found upwards of 70 children out of a population of 240 were more or less afflicted by the ulcerations characteristic of this disease.

I have dwelt thus much on this species of caries, because our knowledge on the subject is chiefly derived from our own physicians and surgeons, while the reports of foreign hospitals are almost silent on the subject.

The treatment of this disease as most generally recommended is, after paying due attention to cleansing the primæ viæ, to rely on bark, wine, serpentaria, and the mineral acids, while the yest and bark poultice is constantly applied to the parts, as in other gangrenous affections. But the external means most useful was found to be a weak solution of the *sulphate of copper* applied as a wash to the ulcerated parts.—(See *Sherrill on the Diseases of Dutchess County. Hall in Edin. Med. and Surg. Journal, vol.* 15. *Coates in the Amer. Med. and Surg. Journal; and Francis's Letter on Caries of the Jaws of Children.*)

For farther valuable information, see *Cases of the excision of Carious Joints, by H. Park, surgeon in the Liverpool Hospital, and P. F. Moreau, de Bar-sur-Ormar, M. D. de l'ecole de Paris. With Observations by James Jeffrey, M. D. Professor of Anatomy and Surgery in the College of Glasgow.—Reese.*]

CASTRATION. The operation of removing a testicle. For an account of the cases rendering this measure necessary, see *Testicle, Diseases of.* The manner of operating is as follows: The patient being laid on a table of convenient height, the integuments covering the spermatic vessels in the groin are to be divided. This incision should begin, as nearly as possible, opposite to the opening in the abdominal muscle, and should be continued to the lower part of the scrotum.

The manner of beginning this incision is differently described by writers: some of them advising that the skin be held up by an assistant; others that the knife be used perpendicularly in this as in other parts. The latter mode is generally preferred by English surgeons. The length of the division is a more important consideration. A small wound will indeed serve to lay bare the spermatic cord; but it will not permit the operator to do what is necessary afterward with dexterity or facility; and as the scrotum must either, at first or at last, be divided nearly to the bottom, it had better be done at first. The spermatic cord is next to be laid bare by another incision, that will divide the external pudendal artery, the bleeding from which may be checked by an assistant putting his finger on it. The spermatic cord having been detached from its surrounding connexions, the operator, with his finger and thumb, separating the blood-vessels from the vas deferens, must pass a ligature between them, and having tied the former only, must cut through the whole cord, at a quarter or half inch distance from the said ligature, according as the state of the process and testicle will admit. This done, he is then, with the same knife with which he has performed the former part of the operation, to dissect the testicle out from its connexion with the scrotum: the loose texture of the connecting cellular substance, the previous separation of the testicle from the spermatic cord, and the help of an assistant to hold up the lips of the wound, will enable him to do this with very little pain to the patient, and great facility to himself.

Besides the facility which a free incision in the scrotum affords to removing the testicle, the division being carried quite to its lower part, prevents the accumulation of matter there, which would seriously retard the healing of the wound.

Mr. S. Sharp once castrated a man, whose testicle weighed above three pounds, and some of the vessels were so varicose and dilated, as nearly to equal the size of the humeral artery.—(*Operations of Surgery, chap.* 10.)

Desault first divides the cord, and, holding its upper end between the index finger and thumb of his left hand, he then takes up the arteries with a pair of forceps, and they are immediately tied by an assistant.—(*Œuvres Chir. par Bichat, t.* 2.) The spermatic artery will be found in the anterior part of the cord; and, as soon as this vessel has been tied, the surgeon is to secure another, which accompanies the vas deferens, the latter part being carefully excluded from the ligature.—(See *Sir A. Cooper's Lectures, &c. vol.* 2, *p.* 161.)

The spermatic artery, and any scrotal vessels which require to be taken up, should be tied with fine silk ligatures, as recommended by my friend Mr. Lawrence.—(See *Med. Chir. Trans. vol.* 6, *p.* 197.)

Pott used to fill the cavity of the wound with lint; but Desault, and all the modern surgeons of this country, bring the edges of the wound together, and endeavour to heal as much of it as possible by the first intention. Some, with this view, use sutures and sticking plaster; others only the latter, aided with compresses and a T bandage.

The plan of dressing adopted by Mr. Lawrence, consists in retaining the edges of the skin in apposition with two or three sutures, and then applying a narrow strip of simple dressing. A folded cloth, kept constantly damp, is also laid over the wound.—(*Med. Chir. Trans. vol.* 6, *loc. cit.*) Sir A. Cooper also employs two sutures: one opposite the end of the cord; the other at the mid-point between the first suture and the termination of the incision.—(*Lectures, &c. vol.* 2, *p.* 161.) With respect to sutures, unless the sticking plaster be wet, so as to loosen it, some doubt may be entertained of their utility; and I have remarked, that considerable irritation and an extensive erysipelas sometimes follow their employment. Roux also noticed their bad effects in a case which occurred during his visit to this country.—(See *Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 121.)

It is somewhat extraordinary, that Larrey should condemn the plan of uniting the wound, though, indeed, we cannot be surprised at his delivering this advice, when we recollect, that he disapproves of healing the stump after amputation by the first intention. The passage relative to dressing the wound after castration, seems to be a contrast to the sensible observation which generally prevail in this author's publication: "*Il ne faut pas réunir les bords de la plaie, comme l'ont conseillé quelques practiciens, parcequ'ils doivent suppurer, et que la suppuration est nécessaire!*"—(*Mém. de Chirurgie Militaire, t.* 3, *p.* 426.)

Larrey is joined by Roux and the rest of the French surgeons on this point. The main reasons stated by the latter writer for not bringing the wound together are, that secondary hemorrhage cannot be well guarded against, except by filling the part with charpie; that the redundance and looseness of the skin render it difficult to keep its edges in exact contact, without removing a portion of it, and using sutures, which are objectionable; and that suppuration cannot commonly be prevented, because there is a large quantity of loose cellular substance in the wound, which substance readily suppurates.—(*Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, &c. p.* 119, *&c.*) By applying cold water and gentle compression to the part, I believe, however, such hemorrhage may generally be averted, and the union of the wound materially expedited. As a judicious writer observes, "In the London hospitals, complete union by the first intention is seldom or never accomplished: yet by attempting it the wound is much diminished, and the cure of it rarely delayed later than three or four weeks; whereas the wound when stuffed with lint is usually not healed in less than seven or eight weeks."—(See *Sketches of the Medical Schools of Paris, by J. Cross, p.* 144.)

Sometimes one or more vessels begin to bleed soon after the patient is in bed, although they effused no blood just after the removal of the testicle. Keeping the dressings and scrotum continually wet with the cold saturnine lotion very often suffices for the prevention and suppression of such hemorrhage: if not, the wound must be opened again and the vessels tied.

J. L. Petit made some useful remarks on this operation. The vessels of the scrotum, says he, are not the only ones which may be the source of hemorrhage. Anatomists know that the septum which divides this part into two cavities, is furnished with an artery that

is not considerable, but which becomes materially enlarged in the case of a sarcocele or other tumour. It is sometimes so considerable that it causes a bleeding, which makes a surgeon who has had no previous opportunity of seeing the occurrence exceedingly uneasy. Such hemorrhage, says Petit, may be easily suppressed with a ligature; and he assures us that he has seen a surgeon dress the patient three times without ever suspecting that the bleeding for which the applications were a third time removed, proceeded from this artery.—(*Petit, Traité des Maladies Chir. t.* 2, *p.* 524, 525.)

The same experienced and able surgeon also acquaints us, that he has more than once extricated from trouble persons who knew not how to stop the bleeding after the operation. He has seen some of them take off the dressings several times without discovering the wounded vessel. As they imagined that the only hemorrhage which could follow castration must be from the spermatic artery, they contented themselves with examining the ligature on the cord and increasing the compression, in order to stop the bleeding; but finding their attempts fail, they were compelled to seek assistance. On being sent for, M. Petit found that the blood did not issue from the cord, but from a small artery under the skin, at the inferior angle of the wound. He easily stopped the hemorrhage, and explained, not only that the cord had no share in the accident, but that it is generally suspected without foundation. Indeed, says he, the least constriction will stop the bleeding from the spermatic artery; it is not essential to tie it:—"I myself am content with cutting the cord, so as to leave it rather longer than usual, and apply no ligature: I press it against the os pubis, near the ring of the external oblique; I lay over it a linen compress, half as thick as the finger, two inches in length, sufficiently broad to cover the part, and yet narrow enough to be placed entirely within the wound. Over this compress I put dossils of lint; I fill the scrotum with plain lint, and then cover the whole with compresses, observing to put one which is thicker than the rest above the pubes, immediately over that which I have laid upon the cord, so that the bandage may make moderate pressure on this last part, yet sufficient to prevent bleeding."—(*Op. cit. p.* 526, 527.)

This quotation is not made with the view of inducing any modern operator to imitate the preceding practice, which, indeed, the advantages of the present mode of dressing the wound entirely forbid, as well as the greater security of the ligature; but the passage is cited for the express purpose of impressing on the mind of the young surgeon, that in general, after the removal of a diseased testis, there is more risk of bleeding from the vessels of the scrotum than those of the cord. I have never seen hemorrhage from the spermatic artery give trouble after the operation, but have often known surgeons obliged to take off the dressings on account of bleeding in the scrotum.

I believe the most likely way of avoiding this disagreeable occurrence is to imitate Mr. Tyrrell, "always to allow the patient to become warm in bed before the dressing is completed;" for, until this period, it is not known what vessels in the scrotum will bleed.—(See *Sir A. Cooper's Lectures, &c. vol.* 2, *p.* 161.)

In every operation in which a considerable portion of skin is to be divided, and particularly in this and in the amputation of women's breasts, it should always be remembered that, as the division of the skin (the general organ of sensation) is the most acute and painful part of what is done by the knife, it cannot be done too quickly, and should always be done at once: the scrotum should constantly be divided to the bottom, and the circular incision in the skin of a breast always made quite round, before any thing else be thought of. If this be not executed properly and perfectly, the operation will be attended with a great deal of pain which might be avoided, and the operator will be justly blameable.—(*Pott.*)

When the diseased testicle is exceedingly large, or a part of the scrotum is diseased, the surgeon should take care to remove the redundant or morbid portion of the skin, by including the piece which he designs to take away within two long elliptical incisions, which are to meet at the upper and lower part of the swelling. In this manner, as Mr. Samuel Sharpe has observed, the hemorrhage will be much less, the operation greatly shortened, the sloughing of the distended skin prevented, and the recurrence of cancerous disease rendered less likely.—(See *Treatise of the Operations, chap.* 10.)

Mr. Lawrence concurs with M. de la Faye in thinking it best always to remove a large piece of the scrotum with the testicle, by which means the surface of the wound is lessened.—(See *Med. Chir. Trans. vol.* 6, *p.* 196.) Sir Astley Cooper approves of the practice when inflammation has rendered the testicle adherent to the scrotum, as being preferable to a tedious and painful dissection for the separation of the parts.—(See *Lectures, &c. vol.* 2, *p.* 160.)

If the tumour be of a pyriform figure, perfectly smooth, and equal in its surface and free from pain, notwithstanding the degree of hardness may be great, and the surgeon may, in his own opinion, be clear that the tumour is not produced by water, but is a true scirrhus, it is an excellent rule to make a small opening through the scrotum into the forepart of the tunica vaginalis, previously to the commencement of the operation, as recommended by Mr. Pott, so that if the case be one of water or blood, its nature may be ascertained, and perhaps the testicle saved. "My reason for giving this advice (says Mr. Pott) is, that I was once so deceived by every apparent circumstance of a true, equal, indolent scirrhus, that I removed a testicle, which proved upon examination to be so little diseased, that had I pierced it with a trocar previous to the operation, I could, and certainly should have preserved it." The best way is to make a small opening with a lancet or knife; and not to introduce a trocar in the manner advised by Pott, because it would be highly censurable to injure the testicle, and put the patient to unnecessary pain, even though that organ might be found diseased, and to require removal.

It is well known that the agony of tying the cord is immensely increased by including the vas deferens; and as no good results from so doing, the practice deserves the severest reprobation, notwithstanding the opposite opinion of Mr. Pearson (*Pract. Obs. on Cancer, p.* 74), and the writer of the article *Castration* in Rees's Cyclopædia.

Cases are even recorded in which the inclusion of the whole of the spermatic cord appears to have occasioned severe and perilous consequences, and these in so great a degree, that it was found necessary to cut and remove the ligature. Sometimes, says Petit, patients on whom castration has been performed, suffer more or less acute pain in the kidneys The suffering often becomes insupportable and highly dangerous, the belly being swelled, tense, and painful; the patient being affected with syncopes and affections of the heart, sometimes with vomiting and a retention of urine: lastly, a universal inflammation of the belly, and a violent fever, accompanied with delirium, are occasionally the fatal consequences of this operation. Petit was required to visit a patient who had been in this deplorable state for twenty-four hours, after having suffered castration, and this distinguished surgeon could impute the sudden and violent symptoms to nothing except the ligature on the spermatic cord; consequently, he advised the ligature to be removed. The patient received some slight relief from this step, and after having been bled twice within a short space of time, he found himself a great deal better; but as the dressings became wet with blood, apprehension of bleeding began to be entertained. Petit therefore had recourse to moderate compression of the cord, in the manner above related. No hemorrhage ensued; the case afterward went on well; and the patient recovered sooner than was expected.—(*Traité des Maladies Chir. t.* 2, *p.* 527, 528.)

In the operation of removing a testicle, one caution seems particularly necessary, viz. if the cord should be at all enlarged, the surgeon ought carefully to examine whether the augmentation of its size may not be owing to a portion of intestine or omentum that is contained within it.—(*Sabatier, Médecine Opératoire, t.* 1, *p.* 332, *édit.* 1.) In one case of extirpation of the testicle, "after the operation was completed and the wound dressed, the patient being seized with a fit of coughing, to the astonishment and dismay of the surgeon, the dressings were forced off by a protrusion of several convolutions of small intestines: from this it was proved that the patient had had a hernia; but the

diseased enlargement of the testicle had acted as a truss, and prevented the rupture from coming down." —(See *Operative Surgery, by C. Bell, vol.* 1, *p.* 226; *also p.* 224.)

There is another circumstance which merits attention in the performance of this operation: when there are reasons which oblige us to divide the cord high up, and this part has not been tied before such division is made, it may be drawn up by the cremaster within the abdominal ring, and some difficulty may be experienced in securing the spermatic arteries. Mr. B. Bell saw this happen twice, and the patients lost their lives from hemorrhage. Hence, when it is necessary to cut through the cord near the ring, perhaps it may be best always to apply the ligature first, observing not to include the vas deferens. However, were the cord, previously to the application of ligatures to its arteries, to happen in any instance to be drawn up within the ring, a surgeon would be guilty of most supine neglect to let the patient die of bleeding; for, as Mr. C. Bell has remarked, we may follow the cord with perfect safety even to the origin of the cremaster, which pulls it up, if attention be paid to the course of the cord, obliquely upwards and outwards within the inguinal canal. Mr. Cline was present at the removal of a testicle, after which the spermatic could not be found: he therefore slit up the inguinal canal, and brought it into view again. In order to avoid this inconvenience, Sir Astley Cooper approves of the practice of passing a temporary ligature through the cord as soon as it has been exposed.—(See *Lectures, &c. vol.* 2, *p.* 61.)

It sometimes happens that abscesses form in the remains of the spermatic cord after the operation of castration. Such suppuration may frequently be prevented by the employment of bleeding directly after the operation, and repeating the evacuation on the first access of the inflammation of the part concerned. Besides venesection, low diet, neutral salts, diluents, &c. are indicated, and the part should be covered with an emollient poultice. When pus is completely formed, the abscess should be opened.

When the symptoms subside, says Petit, they who are little versed in practice are apt to fancy the abscess cured; but they are sometimes mistaken. The matter is not always sufficiently near the surface to be felt, and in this circumstance the aponeurosis of the external oblique muscle is so tense, that it hinders the fluctuation from being distinctly felt. Indeed, as the matter finds a lodgement under this aponeurosis, following the course of the sheath of the vessels, there is reason to fear that it may lead to additional inflammation and suppuration, and extend up the duplicature of the peritoneum to the loins. In these cases, the abscess occasionally makes its way outwards, and the dressings are inundated with matter; but if this should not happen quickly, the sooner the tumour is opened the better. The opening ought unquestionably to be made wherever the fluctuation is plainly distinguishable; but, as Petit has remarked, the tension of the aponeurosis of the external oblique muscle makes the undulation of the matter less readily and plainly perceptible than if the abscess were only in the fat. Therefore, in order to avoid mistake, this surgeon advises us to feel at the abdominal ring, as in general the pus can be more readily felt here than in other situations. If matter is felt and no resistance is experienced, Petit advises the finger to be passed into this opening; and in case the seat of the abscess should be found to be under the aponeurosis, we are recommended to divide with a probe-pointed bistoury, the skin and fat immediately covering the ring; then to separate the fibres of this aperture, as it were, without cutting them.—(See *Traité des Maladies Chir. t.* 2, *p.* 529, 530.) No doubt this surgeon meant that the division of the tendon ought to be made in the direction of its fibres. A few years ago, the operation for a bubonocele was performed, and as the testicle was found diseased, the surgeon made a complete division of the spermatic cord, tied the spermatic arteries, and then left the testicle in its natural situation. After a time, the absorbents had diminished the part to a very small, inconsiderable tumour.—(*H. Weinhold, in Journ. der Pract. Heilkunde von C. W. Hufeland und K. Himly*, 1812, *zehntes stück, p.* 112.) This case merits attention, because it is the first instance, I believe, in which such practice was ever tried. Subsequently the following work has been published: *Nouvelle Méthode de traiter le Sarcocele, sans avoir recours à l'Extirpation du Testicule; par C. Th. Maunoir, 8vo. Génève*, 1820. The new plan consists in dividing and tying the spermatic arteries, and leaving the rest of the cord and the testis undisturbed.

When disease, not merely an œdematous swelling, extends far up the cord, Pott, and the best surgeons of the present day, consider the operation of castration as too late. In such cases, Lisfranc has seen Dubois pull down the cord and then divide it, and Baron Dupuytren cut up the inguinal canal to the internal ring; but all the patients died.—(*C. Averil, Operative Surgery, p.* 103, *Lond.* 1823.)

Consult *Le Dran's Operations. Sharp's Operations of Surgery, chap.* 10. *Pott on the Hydrocele, &c. Sabatier, De la Méd. Opér. tom.* 1. *Bertrandi, Traité des Opér. de Chirurgie, chap.* 11. *Œuvres Chirurgicales de Desault, par Bichat, tom.* 2, *p.* 449. *Larrey, Mémoires de Chirurgie Militaire, tom.* 3, *p.* 423, *&c. Pearson on Cancerous Complaints. J. L. Petit, Traité des Maladies Chirurgicale, tom.* 2, *p.* 519, *&c. C. Bell's Operative Surgery, vol.* 1. *Richerand's Nosographie Chirurgicale, tom.* 4, *p.* 281, *&c. ed.* 2, *&c. A long account of the particular sentiments of several eminent surgeons is to be found in Rees's Cyclopædia, art. Castration. Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 119, *&c. Lawrence, in Med. Chir. Trans. vol.* 6, *p.* 196, 197. *Sketches of the Medical Schools of Paris, by J. Cross, p.* 139, *&c. Sir A. Cooper's Lectures on the Principles and Practice of Surgery, vol.* 2, *p.* 159, *8vo. London*, 1825.

CATAPLASMA ACETI. Made by mixing a sufficient quantity of vinegar with either oatmeal, linseed meal, or bread-crumb. When linseed is employed, it is best to add a little oatmeal or bread-crumb, in order to keep the poultice from becoming hard. The vinegar poultice is generally applied cold, and is principally used in cases of bruises and sprains.

CATAPLASMA ACETOCÆ. *Sorrel poultice.* ℞. *Acetosæ* lbj. To be beaten in a mortar into a pulp.

CATAPLASMA ALUMINIS. Made by stirring the whites of two eggs with a bit of alum, till they are coagulated. In cases of chronic and purulent ophthalmy, it has been applied to the eye, between two bits of rag, and it has been praised as a good application to chilblains which are not broken.

CATAPLASMA BYNES. (Malt.) ℞. *Farinæ bynes. Spumæ cerevisiæ*, q. s. This is applied to cases of gangrene and ill-conditioned extending sores. It is used in instances similar to those in which the cataplasma fermenti is employed, and, by giving out carbonic acid gas, is supposed to operate as a gentle stimulus, and as a corrector of fetid effluvia.

CATAPLASMA CARBONIS. Made by mixing powdered charcoal with linseed meal and warm water, and is applied to improve the condition of several kinds of unhealthy sores.

CATAPLASMA CEREVISIÆ. Made by stirring some oatmeal or linseed meal in strong beer grounds. It is used in the same cases as the cataplasma fermenti and cataplasma bynes.

CATAPLASMA CONII VEL CICUTÆ. ℞. *Herbæ cicutæ exfoliatæ* ℥ ij. *Aquæ fontanæ* lbij. To be boiled till only a pint remains, when as much linseed meal as necessary is to be added.

Hemlock poultice is an excellent application to many cancerous and scrofulous ulcers, and other malignant sores; frequently producing a great diminution of the pain of such diseases, and improving their appearance. Justamond preferred the fresh herb, bruised.

CATAPLASMA DAUCI. ℞. *Radicis dauci recentis* lbj. Some bruise the carrots in a mortar into a pulp; while others recommend the carrots to be first boiled. Carrot poultice is employed as an application to ulcerated cancers, scrofulous sores of an irritable kind, and various inveterate malignant ulcers.

CATAPLASMA DIGITALIS. Made by mixing linseed meal with a decoction of the leaves of the plant. It is said to have great sedative virtues, to be adapted to the same cases as the cicuta poultice, and even to be more beneficial.

CATAPLASMA FARINACEUM. The bread and milk poultice, made by putting some slices of bread-crumb in milk, and letting them gently simmer over the fire in a saucepan, till they are properly softened. The mass is then to be mixed and stirred about with a spoon, and spread on linen, in order to be applied. This

poultice, which is of the emollient kind, is with many persons the common one for all ordinary purposes. Most surgeons, however, employ, instead of it, the linseed poultice, which is cheaper, more readily made, not apt to turn sour, and, in all common cases, quite as advantageous in every respect.

CATAPLASMA FERMENTI. *Fermenting poultice.* ℞. *Farinæ tritici* lbj. *Cerevisiæ spumæ, Yest dictæ*, lbss. These are to be mixed together and exposed to a moderate heat, till the effervescence begins. In cases of sloughing, and many ill-conditioned ulcers, this is an application of great repute.

CATAPLASMA LINI. *Linseed poultice.* ℞. *Farinæ lini* lbss. *Aq. ferventis* lbiss. The powder is to be gradually sprinkled into the hot water, while they are quickly blended together with a spoon.

This is the best and most convenient of all the emollient poultices for common cases, and it has nearly superseded that of bread and milk, which was formerly much more frequently employed.

Mr. Hunter speaks in the following terms of the linseed poultice and its uses.

"Poultices are commonly made *too thin*, by which means, the least pressure, or their own gravity, removes them from the part: they should be thick enough to support a certain form when applied.

They are generally made of *stale* bread and milk. This composition, in general, makes too *brittle* an application; it breaks easily into different portions from the least motion, and often leaves some part of the wound uncovered, which is frustrating the first intention.

The poultice which makes the best application, and continues most nearly the same between each dressing, is that formed of the meal of linseed; it is made at once, and when applied, it keeps always in one mass.

The kind of wound to which the above application is best adapted, is a wound made in a sound part, which we intend shall heal by granulation. The same application is equally proper when parts are deprived of life, and consequently will slough. It is therefore the very best dressing for a *gunshot* wound, and probably for most *lacerated wounds*; for *lint* applied to a part that is to throw off a *slough*, will often be retained till that slough is separated, which will be for eight, ten, or more days."

CATAPLASMA MURIATIS SODÆ. ℞. *Pulveris Lini, Micæ panis ää. partes æquales. Aq. sodæ muriatæ* q. s. This is used for diminishing scrofulous tumours and glands. When it excites too much irritation in the skin, a linseed poultice may be substituted for it, until this state has subsided.

CATAPLASMA PLUMBI SUBACETATIS.

℞. Liquoris plumbi subacetatis drach. j.
Aquæ distillatæ lib. j.
Micæ panis q. s.—Misce.

Practitioners who place much confidence in the virtues of lead, externally applied, often use this poultice in cases of inflammation.

CATAPLASMA QUERCUS MARINI. This is prepared by bruising a quantity of the marine plant commonly called *sea tang*, which is afterwards to be applied by way of a poultice.

Its chief use is in cases of scrofula, white swellings, and glandular tumours.

When this vegetable could not be obtained in its recent state, a common poultice of sea-water and oatmeal was substituted by the late Mr. Hunter and other surgeons of eminence.

CATARACT. (From *καταράσσω*, to confound or disturb; because the disease confounds or destroys vision.) *Γλάυκωμα. Υπόχυμα. Gutta opaca. Suffusio. Der Graue Staar.*

A cataract is usually defined to be a weakness or impediment to sight, produced by opacity of the crystalline lens or its capsule. Professor Beer applies the term to every perceptible obstacle to vision, situated in the posterior chamber, between the vitreous humour and the uvea.—(*Lehre von den Augenkrankheiten, b.* 2, *p.* 279, 8*vo. Wien*, 1817.)

Hippocrates and the ancient Greeks described the cataract as a disease of the crystalline lens, under the name of *γλάυκωμα*; but no sooner had Galen promulgated the doctrine of the lens being the immediate organ of sight, than the correct opinion of the ancient founder of medicine began to decline, and for many ages afterward, had no influence in practice. In fact, the seat of the cataract was entirely forgotten, till about 1656, when first Lasnier, and afterward Borel, Bonetus, Blegny, Geoffroi, &c. revived the truth which had been so long extinct; and they and a few others believed that the disease was situated in the crystalline lens. The bulk of practitioners, however, remained ignorant of this fact even as late as the beginning of the eighteenth century, when the several publications of Maître-Jan, Brisseau, St. Ives, and Heister combined to render the truth universally known. In 1708, the celebrated M. Mery, who had hitherto joined in the belief that the cataract was not a disease of the lens, communicated to the Academy of Sciences a memoir, in which he acknowledges the correctness of the statement made by Brisseau and Maître-Jan, that vision can take place without the assistance of the crystalline lens; and he recommended a clergyman who had a cataract to have the lens extracted, which was successfully done by M. Petit.

A cataract, even in its highest degree, does not always produce complete blindness. For the most part, its formation takes place slowly; the cases in which it originates very quickly, being but few, and those in which it is suddenly produced in a complete form still more unusual.

The characteristic symptoms commonly remarked when a cataract is slowly formed are the following: 1. All objects, especially white ones, seem to the patient to be covered by a thin smutty or dusty cloud, which, as the late Mr. Ware observed, is generally perceptible by the patient before any opacity is visible in the pupil. 2. The decline of vision bears an exact proportion to the increasing opacity distinguishable behind the pupil. 3. In most cases, the opacity is first discerned behind the pupil, most plainly also at the central point, the instances in which it first presents itself at the edge of the pupil being less frequent. 4. In eyes with a light-coloured iris, the greater progress a cataract makes, the more clearly can one perceive at the edge of the pupil a blackish ring, which partly arises from the shadow of the iris falling on the cataract, but chiefly from the dark-coloured pupillary edge of the iris, which, in a clear pupil, cannot be seen, but now that a grayish surface lies behind it, is rendered very manifest. This blackish ring is said by Mr. Guthrie to be very evident in cases of soft cataracts, and to arise from the back of the pupillary edge of the iris being pushed forwards by the size of the lens. But if the dilatation be increased to its full extent, by the application of the extract of belladonna, an internal blacker circle will be seen to surround the turbid or muddy part behind the iris, and the patient sees better for a short time.—(*Operative Surgery of the Eye, p.* 197.) 5. As a cataract generally begins at the central point behind the pupil, such objects as are placed directly in front of the eye, are most difficultly seen, even in the early stage of the disease, but those which are latterly placed, especially when the light is not too strong, and of course the pupil a good deal dilated, can yet be seen tolerably well. 6. Hence, when the opacity at the central point behind the pupil is at all considerable, the patient is completely blind in a strong light, while, on the contrary, in a moderately dark room, a degree of vision is yet enjoyed. When the opacity is not far advanced, the eyesight may be improved for a short time by the patient's turning his back to the light. 7. Persons with incipient cataracts derive the greatest palliative aid from the use of convex glasses, because objects are magnified by them; but they only answer while the opacity is inconsiderable. 8. To such patients, the flame of a candle seems to be enveloped in a whitish misty halo, which always becomes broader the farther the patient is from the light. When the cataract is far advanced, the flame of the candle cannot be seen, and the patient can only indicate the place near which the light is, or say whether it is close or at a distance. 9. Lastly, a cataract which forms slowly produces, in the course of its progress, no change in the mobility of the iris; and if this effect sometimes takes place where the disease is very completely developed, the nature of the case is now so manifest that no surgeon is in any danger of mistaking the complaint for amaurosis.

The characteristic appearances of amaurosis are entirely different. 1. The opacity, perceptible behind the pupil, is at a considerable distance from this opening,

as may be best seen when the eye is viewed sideways. 2. The opacity is somewhat concave. 3. Its colour inclines rather to a greenish or reddish cast than to gray. 4. The decline of the eyesight is not at all in a ratio to the degree of opacity, the patient being almost blind. 5. The pupil is more or less dilated; the iris nearly or quite motionless, its pupillary edge being here and there thrown into an angle, and of course it is not exactly circular. 6. Even the cornea itself is not quite so clear and transparent as in the natural state. 7. The temporary increase or diminution of blindness, so common in patients with incomplete amaurosis, never depends, as in those with cataracts, upon the degree of dilatation of the pupil or the degree of light, but upon causes which tend either to depress or excite the system. 8. The misty halo which such amaurotic patients perceive around the flame of a candle, is not like a whitish cloud, but has all the hues of the rainbow: indeed, the flame itself presents these colours, and when the patient goes to some distance from it, it generally seems split. 9. At no period of the complaint are spectacles of any service in enabling the patient to see better. Such objects as are situated to one side cannot be seen more plainly than those which are directly in front of the eye.—(See *Beer's Lehre von den Augenkr. b.* 2, *p.* 281—284.) 10. The sight is not temporarily improved by the application of belladonna.—(See *Guthrie's Operative Surgery of the Eye*, *p.* 212.)

According to this author, the first and most important division of cataract is into the *genuine* and *spurious:* for the obstacle to vision, situated in the posterior ch mber, between the vitreous humour and uvea, and making what is termed a cataract, may be either within the limit of the capsule of the lens, or between the anterior layer of that capsule and the uvea. The first case is the *genuine*, the second the *spurious* cataract.

A genuine cataract, when a primary disease, and unattended from the first with other morbid effects in the eye, is mostly a single independent affection; on the contrary, as the spurious cataract is generally the consequence of internal ophthalmy, it is almost always more or less combined with a partial opacity of the anterior layer of the capsule, and, of course, with a genuine cataract.

The first variety of genuine cataract noticed by Beer is that which he calls *lenticular:* it always begins in the centre or very nucleus of the lens, mostly presenting a dull, yellowish gray colour, which is somewhat deeper at the centre than at the margin of the pupil; a character retained even when the disease is in its most complete stage. The lenticular cataract is always formed very slowly, and, except when the iris is too dark-coloured, it is more or less attended with a blackish ring at the edge of the pupil, which ring becomes plainer as the disease advances. A genuine lenticular cataract never causes any alteration in the expansion or contraction of the iris; nor does it even in its highest degree deprive the patient of all power of vision, who, in shady places, or when the pupil is artificially dilated with hyosciamus or belladonna, is often capable of distinguishing pretty well many objects which are placed laterally with respect to the eye. A lenticular cataract is usually at some distance from the uvea, so that the extent of the posterior chamber is manifest, while the opacity presents more or less of a convex appearance, and never that of very white cloudy specks. Frequently, as Beer observes, the lenticular cataract is unattended with any change in the capsule, or the liquor of Morgagni. In most cases of senile cataract, not preceded by inflammation, the capsule is said to remain transparent.—(*Travers, Synopsis of the Diseases of the Eye*, *p.* 207, 8vo. *Lond.* 1820.)

The second species of genuine cataract noticed by Beer is the *capsular*, which he thinks should not be called *membranous*, as the expression may lead to mistake. The disease seldom commences in the centre of the pupil, and usually arises at its margin in the form of distinct, very white, shining points, streaks, or specks; its colour, therefore, is always very light, and never altogether uniform, even when the disease is completely formed. The dotted or mottled appearance of this cataract is also particularly noticed by Mr. Travers.—(*Synopsis of the Diseases of the Eye*, *p.* 207.) The blackish ring which, when the iris is light-coloured, is even more evident in this than the lenticular cataract, is here not owing to the shadow of the iris, but to its dark border; for this cataract is too near the iris for any shadow to be formed. This observation, however, is somewhat at variance with what Mr. Travers has remarked; for when a transparent circumference can be seen on dilating the pupil with belladonna, he has never found the capsule opaque; and he believes that the black rim may be considered as the diagnostic mark of the transparency of the capsule. But when the opacity of the lens is diffused, this sign is of course absent.—(*Med. Chir. Trans. vol.* 4, *p.* 288.) The disease also has some effect on the motions of the iris, at least their quickness. A capsular cataract never remains long the only affection, but is followed by disease of the lens itself; a fact, says Beer, which cannot surprise us, when we consider that it is through the medium of the capsule, that the particles of the lens are incessantly undergoing the changes of removal and reproduction.

The capsular cataract is subdivided by Beer into the *anterior capsular cataract*, the *posterior capsular cataract*, and the *complete capsular cataract*, in which both the front and back portions of this membrane are opaque.

The *anterior capsular cataract*, which is not at all unfrequent, does not continue long in this form after it has attained a high degree, but, according to Beer, becomes combined with an opacity, and, according to Mr. Travers, with a slow absorption of the lens itself.—(*Synopsis, &c. p.* 207.) "When the capsule is completely opaque (says Mr. Travers), we can hardly judge of the texture of the lens." But in such examples, "the lens is commonly diminished in bulk; it undergoes a waste after the opacity of the capsule, so as in process of time to become a membranous cataract. This I conceive to be owing to the obliteration of the vessels of the capsule, from which those of the lens are derived. When the capsular opacity is congenital, it is either purely capsular or only a very small piece of lens remains. When the capsule turns opaque from injury, the lens is soon greatly reduced in bulk, as appears from the falling in or concavity of the iris, which loses its support, and is demonstrated in the operation. This observation renders the operation with the needle appropriate to the cataract in which the capsule is opaque, in cases which are not very recent."—(*Med. Chir. Trans. vol.* 4, *p.* 286.) In the anterior capsular cataract, according to Mr. Guthrie, the lens does not generally undergo any diminution, but, for the most part, an enlargement, in consequence of becoming opaque and soft. But he admits, that the reverse is frequently the case in infants, only a small portion of the lens being left, and the rest of the contents of the capsule fluid.—(See *Operative Surgery of the Eye*, *p.* 233.) The anterior capsular cataract may be known by its light gray and, in some places, completely chalk-white colour, intersected by shining, mother-of-pearl-like streaks and spots. As the capsule is at the same time thicker than natural, the posterior chamber is lessened, and the cataract is not unfrequently close to the uvea, especially when the lens has also completely lost its transparency. In this stage, the movements of the iris are likewise rendered less quick, and the shadow at the margin of the pupil is entirely absent. Hence, vision is not only hurt, but quite impeded, in regard to any correct sensation of light, whether the patient be in a light or shady situation; and frequently a faint light is completely invisible to him.

The *posterior capsular cataract* belongs to the rarer forms of the disease of the eye; but, says Beer, when it happens, *the lens always participates in the opacity much more quickly than occurs in the anterior capsular cataract.* Hence, the disease can never be observed up to its perfect developement. Respecting the state of the lens, some difference prevails between the statement of Beer and that of Mr. Travers: the latter gentleman informs us, that where the opacity of the posterior capsule is met with, which he agrees with Beer in considering as very rare, *the lens and anterior capsule are usually transparent;* "and when this is not the case, and the cataract escapes with a posterior fold of opaque capsule, it is always accompanied with a considerable discharge of vitreous humour."—(*Synopsis of the Diseases of the Eye*, *p.* 209.) And in speaking of the opacity of the posterior capsule, in another work, he informs us, that he has not observed that, in this case, the lens undergoes any diminution.—(*Med. Chir. Trans. vol.* 4, *p.* 286.) Like the anterior capsular cataract, it is denoted by a whitish-gray, unequal, variegated colour; but no light-coloured, chalk-white spots and streaks are ever discernible, which, while the lens re-

tains its transparency, may be owing to the distance of the cataract from the pupil. However, the opacity situated behind the pupil always seems concave when the eye is inspected, not from before, but from every side of it. While the posterior half of the capsule is not completely opaque, the lens is not materially affected; the eyesight is only more or less weakened; and sometimes, especially with the aid of a magnifying glass, a tolerable degree of vision is enjoyed, notwithstanding the considerable opacity behind the pupil. This species of cataract has not itself any influence over the motions of the iris, and after the lens becomes opaque, it is not softened.

Though the *complete capsular cataract* is not the rarest species of genuine cataract, it cannot be said to be very common. In addition to the symptoms of the anterior capsular cataract, it presents few, yet decided, characters which indicate it previously to an operation: viz. the iris is nearly motionless, the cataract lying close to that organ; the posterior chamber for the same reason is effaced; and an inexperienced surgeon might really suppose the anterior portion of the capsule were adherent to the uvea, unless he convinced himself of the contrary by producing an artificial dilatation of the pupil with hyosciamus or belladonna. Sometimes the iris even seems thrust out, by this large cataract, towards the cornea in a convex form; and the patient can only perceive the strongest kinds of light. Though such is the statement of Beer, I concur with Mr. Guthrie in regarding the above characters, which may attend any large soft cataract, as well as the complete capsular one, as by no means a demonstration of the existence of the latter.—(*Operative Surgery of the Eye, p.* 235.)

The third species of genuine cataract is the *cataracta Morgagniana*, which some term the milk cataract, and others confound with the purulent cataract. It is one of the rarest forms of the disease; so rare, indeed, that Mr. Travers regards the case as purely hypothetical.—(*Synopsis of Diseases of the Eye, p.* 208.) The following is the form of disease described by Beer under this name; it proceeds from a total conversion of the lens into a milky fluid, or thin jelly, frequently attended with a complete capsular cataract. Its origin is said to be always quick, and an immediate effect of chemical injuries of the eye. The following are the symptoms of the case, while it is uncomplicated with disease of the lens and capsule; a state which can never continue long. Though the colour is milk-white, it is delicate and thin, like that of diluted milk. The whole pupil seems cloudy, but whenever the eyeball moves suddenly and violently, or the eyelid is rubbed over the eye, the opaque substances change their shape and position. The posterior chamber is nearly annihilated, which may be owing to the quantity of fluid or gelatinous substance collected. While the lens and capsule are not materially changed, the sight suffers only a diminution, though it is very cloudy, and small objects cannot be distinguished at all.

When, however, the lens and capsule become opaque, vision is quite abolished, a certain power of knowing light from darkness only remaining. Not unfrequently, says Beer, when the lens itself is in a dissolved state, the capsule is partially opaque, the eye is kept quiet for a few minutes, and the patient stands or sits in an upright posture, two rows of opaque matter can be plainly seen; the upper being the least white of the two; the lower presenting a chalky whiteness. However, as soon as the patient suddenly or violently moves his eye or head, or the eyelid is rubbed over the eye, both these rows of opaque matter disappear, and the colour of the opacity behind the pupil again seems uniform.

The fourth species of genuine cataract described by Beer, is the *capsulo-lenticular cataract*, to which he conceives the liquor of Morgagni in an altered state may likewise often contribute, as may be inferred from the prodigious size of this cataract. It is by no means uncommon, and is attended with the following characteristic symptoms. The colour of the opacity, close to the uvea, is partly chalk-white, partly like that of mother-of-pearl, and in many places both these colours can be evidently seen disposed one over the other, that of mother-of-pearl, however, being always most superficial. Exposure of the eye to the most vivid light scarcely causes any motion of the iris, but the pupil is circular, without any angles in it. After the application of the extract of henbane or belladonna, the iris contracts again exceedingly slowly, and the pupil is long in returning to its former diameter. Besides the obliteration of the posterior chamber, the anterior one itself is mostly diminished, in consequence of the iris being pushed towards the cornea by the very large size of the cataract, and hence the sensation of light is very indistinct.

The capsulo-lenticular cataract is not unfrequently the consequence of a slow inflammatory process in the iris, the lens, and its capsule; and hence several varieties of this case, and its not unfrequent combination with a spurious cataract; all which different modifications, says Beer, should be correctly understood previously to an operation, in order to form a just prognosis of its event, and to know what method of operating ought to be adopted.

Of these varieties the first is the *capsulo-lenticular cataract, conjoined with slight depositions of new matter upon the anterior capsule of the lens.* These afterformations upon the front layer of the capsule, as Beer calls them, put on very different appearances, and accordingly receive various appellations. For instance, the *marbled capsulo-lenticular cataract*, when the chalk-white new-formed substances upon the anterior layer of the capsule are so arranged as to resemble the variegated appearance of marble. The *window* or *lattice capsulo-lenticular cataract*, when the new-deposited substances cross each other, leaving darker-coloured interspaces. The *stellated capsulo-lenticular cataract*, when the new matter runs in concentric streaks towards the middle of the pupil. The *central capsulo-lenticular cataract*, when a single elevated, white, shining point is formed on the anterior capsule, while the rest of this membrane is tolerably clear, and the lens not completely opaque. The *dotted capsulo-lenticular cataract*, when the front layer of the capsule presents several distinct unconnected depositions on its surface. The *half-cataract*, or *cataracta capsulo-lenticularis dimidiata*, when one-half of the front layer of the capsule is covered with a white deposite. In all these, and some other examples, says Beer, the lens is found to be converted to its very nucleus into a gelatinous or milky substance.

The second variety of the capsulo-lenticular cataract pointed out by Beer, is the *encysted*, indicated by its snow-white colour; sometimes lying so close to the uvea as to push the iris forwards towards the cornea; and at other times appearing to be at a distance from the uvea. These circumstances, as Beer remarks, almost always depend upon the position of the head; for when this is inclined forwards, the cataract readily assumes a globular form, and projects considerably towards the anterior chamber. Frequently, this variety of the capsulo-lenticular cataract constitutes the kind of case to which the epithets *tremulous* or *shaking*, and *swimming* or *floating* are applied. According to Beer, the reason of such unsteadiness in the cataract is owing to the broken or very slight connexion of the capsule of the lens with the neighbouring textures. The same author has never seen any case of this kind, which had not been preceded by a violent concussion of the eye or adjacent part of the head. Both layers of the capsule are opaque, and sometimes considerably thickened. The third variety of the capsulo-lenticular cataract described by Beer, is the *pyramidal* or *conical*, which is one of the rarer forms of the disease, and always brought on by violent internal inflammation of the eye, especially affecting the lens, its capsule, and the iris. It may be known by a white, almost shining, conical, more or less projecting, new-formed substance, which grows from the centre of the anterior layer of the capsule, and is almost in close contact with the pupillary margin of the iris. Hence the iris is always quite motionless, and the pupil angular. Sometimes this growth from the capsule extends itself so far into the anterior chamber, as nearly to touch the inner surface of the cornea, and sometimes actually to adhere firmly to it: a circumstance, says Beer, which is very constant in the conical staphyloma of the cornea, though not discoverable till the operation is performed. The power of discerning light is feeble and indistinct, and sometimes entirely abolished. Mr. Guthrie (as I think) very correctly regards this case as an advanced degree of the disease presently described under the name given to it by Beer, of *lymph-cataract:* it ought, indeed to be classed as a *spurious* cataract.—(See *Guthrie's Operative Surgery of the Eye, p.* 246.)

The fourth variety of the capsulo-lenticular cataract is the *siliquose*. Though principally met with in young

children, it is not one of the most uncommon affections in adults, and in the former it is often falsely regarded as a congenital complaint. When this cataract is extracted either from children or grown-up persons, Beer says, that the dried shrivelled, capsule is always found round the equally dry nucleus of the lens, like a husk, or shell. In children, however, he says, that the nucleus of the lens is often scarcely perceptible, while in adults it is always of considerable size, and this may be the reason why this cataract in children does not present so bright a yellow-white colour as it does in grown-up persons. In infants, in which it is frequently seen in the first weeks of their existence, it is manifestly produced by a slow and neglected inflammation of the lens and its capsule, arising from too strong light. In adults, the inflammation exciting this form of cataract is always owing to external violence; yet Beer supposes, that a considerable diminution of cohesion between the capsule and the adjacent textures must likewise have a principal share in bringing on the disease, which, in grown-up persons, is constantly preceded by a concussion of the eyeball, from the cut of a whip, the lash of a horse's tail, &c. Professor Schmidt had never seen this kind of cataract, except in boys and girls, who in their early childhood had been afflicted with convulsions; and hence, he thought, that the cause of the disease was owing to a partial loosening of the capsule from its natural connexions by the violence of the convulsive paroxysms.—(*Abhandlung über Nachstaar und Iritis nach Staar-Operationen. Wien*, 1801, 4*to.*) However, Beer assures us, that he has seen infants, scarcely two months old, affected with this cataract, which had not been preceded or followed by any convulsions; while a much larger number of children with the same kind of cataract had fallen under his notice, where more or less severe blows on the head had been received. With respect to the convulsions, spoken of by Schmidt, he also questions whether they and the cataract might not be owing to the same cause, viz. the preceding inflammation within the eye? In children, says Beer, this form of cataract may be known by its light-gray, whitish, though seldom very white colour, its diminutive size and considerable distance from the uvea, and by the freedom with which the iris moves when no adhesions exist at any points between this organ and the cataract, as occasionally happens; a proof of the previous inflammation of the capsule, lens, and neighbouring textures. The eyesight is never quite impeded, but only much diminished. On the contrary, in adults, as Beer has remarked, this cataract invariably presents a dazzling white hue, and only a few points of it are of a smutty yellowish-white colour, whence the case has been sometimes termed the *gypsum-cataract*. It is not convex, but rather flat; it does not approach the iris; and when free from adhesions to the uvea, which are more likely to happen in adults, it has no effect on the motion of the iris. Vision is generally entirely lost, with the exception of the power of discerning the light, and even this faculty is sometimes destroyed in consequence of the previous violence done to the eye, whereby not merely the lens and its capsule, but also the retina, have suffered.

According to Beer, one of the rarest varieties of the *capsulo-lenticular cataract* is that *accompanied with a cyst of purulent matter*. It is indicated by a deep lemon colour, very slow motion of the iris, manifest abolition of the posterior chamber, slight convexity of the iris, trivial perception of light, and the weak, unhealthy constitution of the patient. The purulent cyst, which sometimes contains a very fetid matter, and was therefore called by Schiferli the *putrid cataract*, (*Theoretische-Praktische Abhandlung über den Grauen Staar*, 8*vo. Jena and Leipz.* 1797), may sometimes be taken out, without being broken, together with the whole capsule of the lens, with the aid of the forceps, or cataract-tenaculum, as was first correctly remarked by Professor Schmidt. In one single example, Beer found the cyst of matter between the lens and the anterior portion of its capsule. Mr. Travers has likewise seen an example of suppuration within the capsule, which projected through the pupil in a globular form, and was filled with pus. The case happened in a lad, and had been preceded by a severe blow on the eye.—(*Synopsis of the Diseases of the Eye*, *p.* 206.)

The sixth and last variety of the capsulo-lenticular cataract mentioned by Beer, is the well-known case described by the French under the name of *cataracte barrée*, the *bar-cataract*, and by Schmidt under the appellation of the *cataract with a girth or zone*. The case, says Beer, is one of the least frequent. The diagnosis is easy; for, behind the diminished, more or less angular pupil, the cataract can be plainly seen, to which is attached, either in a more or less perpendicular or horizontal direction, a chalk-white, generally very shining, and thickish kind of bar or girth, which is closely adherent at both its extremities to the pupillary margin of the uvea, and sometimes reaches, but often only on one side, more or less towards the ciliary processes. The iris is therefore completely motionless, the uvea not being merely adherent to the substance forming what is termed the *bar* or *girth*, but also closely connected with the whole front portion of the capsule. The perception of light is either very indistinct or quite lost, and not unfrequently the globe of the eye is somewhat smaller than natural. Beer says, that he has never met with this variety of cataract, except after violent internal inflammation of the eye. He describes the substance composing the *bar* or *girth* as being of various consistence, and sometimes firm and almost cartilaginous. In two cataracts of this sort, which he extracted from a boy twelve years of age, he found the *bar*, strictly speaking, ossified, and the capsule, which was nearly cartilaginous, was adherent to a very small, firm nucleus of the lens, though they were yet capable of separation. In a dead subject Beer also examined such a cataract, in which the outer end of the *bar* scarcely extended to the greater ring of the uvea, but the inner end reached over the ciliary processes to the ciliary ligament, from which latter part it was inseparable.—(*Lehre von den Augenkr. b.* 2, *p.* 302.)

OF SPURIOUS CATARACTS.

The most frequent, according to Beer, is what he names the *lymph-cataract*. It is, without exception, the effect of an inflammation which is chiefly situated in the iris, the lens, and its capsule. Hence it is frequently combined with a genuine cataract. The nature of the disease may be known from the patient's account, that the present blindness has been preceded by a painful tedious affection of his eye and head: and from an examination of the eye itself, in which the pupil will be found more or less diminished and angular; the iris either perfectly motionless or nearly so; the eyesight, and even sometimes the perception of light, more or less impeded or lost, and this not merely in proportion to the quantity of lymph observable immediately behind the pupil, but also in proportion to other morbid effects produced in the organ of inflammation. Lastly, the surgeon may notice, directly behind the pupil, a plastic lymph, either in the form of a delicate kind of net-work, or of a thick web of a snow-white colour. Sometimes in this variety of spurious cataract, though very little coagulating lymph appears upon the anterior portion of the capsule of the lens, and what is effused, as well as the lens itself, is almost clear and transparent, yet the eyesight is considerably impaired; and on more careful examination of the pupil, something of a dark-brown colour is perceived, which often projects, at several points behind the pupillary edge of the iris, a good way towards the centre of the pupil. In this substance one may discern, with a good magnifying-glass, new vessels extending from those of the uvea, and formed by the previous inflammation, by means of which vessels this mass and the delicate layer of lymph are connected with the capsule of the lens. According to Beer's sentiments, it is only the real lymph-cataract which rightly deserves the epithet *membranous*, which is sometimes wrongly applied to the *capsular cataract;* for, says he, *the lymph-cataract alone consists of an adventitious membrane, formed by inflammation*, of a web of plastic lymph, which may be very thin, and semi-transparent, while the lens and its capsule are nearly quite clear, though the patient may be almost or completely blind, when the effects of the inflammation have extended to the choroides and retina.

The *spurious purulent cataract* is much less frequent than the lymph-cataract. In neglected cases of hypopium (see *this word*), where the pupil is already quite covered with pus, the greater part of the effused matter is sometimes absorbed, and the pupil can be seen again, but, immediately behind it, a quantity of coagulating lymph can be discerned, as in the lymph-cataract, sometimes even projecting partly into the an-

terior chamber, but blended with particles of purulent matter, so as to give it a light-yellowish tinge and a clustered appearance. The pupil is always diminished, adherent to the morbid substance, and angular; the motionless iris projects towards the cornea; and not only the eyesight, but even the perception of light, is completely lost, or the latter at least much diminished.

A rare variety of spurious cataract, described by Beer, is the *blood-cataract*. Either from some considerable injury of the eye, a large quantity of blood is extravasated in the chambers, and slowly absorbed during the ophthalmy caused by the violence, a part of it, however, remaining in the posterior chamber, in the form of small clots encysted in the lymph, which was effused during the inflammation; or else in the course of a more tedious and neglected case of hypopium, blood is effused in the chambers of the eye, and not mixing with the pus, still continues in the same form behind the pupil, after the matter has been absorbed. In the first example, this cataract looks like a reddish web, interwoven with silvery streaks or threads; the pupil, though angular, is seldom contracted; the iris nearly or quite motionless; and not only is the light clearly distinguished, but a partial degree of vision sometimes retained. On the contrary, in the second instance, the opacity behind the pupil is very dense, white, studded with reddish or brownish points or specks, having a clustered appearance, and frequently projecting through the pupil into the anterior chamber; while the pupil itself is very small and angular, the iris quite incapable of motion, and generally either no perception of light remains, or only a very confined indeterminate sensation of it. Beer says, that this cataract may easily be mistaken for lymph, and that its difference can only be made out with a good magnifying glass.

The *dendritic cataract* of Schmidt, the *arborescent cataract* of Richter, or the *choroid cataract*, as Beer observes, is not one of the least frequent of the spurious cataracts, and is invariably the consequence of a violent concussion of the globe of the eye, with or without a wound, whereby a portion of the tapetum of the uvea is loosened, and becomes placed upon the anterior layer of the capsule, more or less resembling in its appearance the arborescent form of the stone termed a dendritis. Immediately after such a concussion of the eyeball, the patient complains of a serious diminution and confusion of vision. Whoever examines the eye only superficially, will certainly not discern the pieces of the tapetum lying upon the yet perfectly transparent capsule of the lens, for the most careful inspection will be necessary for the purpose, and sometimes the aid of a magnifying-glass will be requisite. But as the lens and its capsule are mostly at the same time loosened from their connexions, they likewise generally become deprived of their transparency, and as soon as this has happened, the displaced portion of the tapetum can be readily seen. When inflammation ensues, the flakes of the tapetum become closely adherent to the front layer of the capsule of the lens, and even the pupillary edge of the uvea acquires the same kind of connexion, so that the perception of light is diminished. But, says Beer, when inflammation follows, the pupillary margin of the uvea remains free, the iris is perfectly moveable, the light clearly distinguishable, though the lens and its capsule be entirely opaque, and sometimes the flakes of the tapetum resembling the arborescent *streaks* of the dendritis alter in shape, size, and position, but never completely disappear, though they may not closely adhere to the capsule.—(*Lehre von den Augenkr. b.* 2, *p.* 303. 309.)

A particular case is described by Mr. Guthrie, as more truly deserving the name of *choroid* cataract; it arises, without any blow or concussion of the eye, in consequence of a low or anomalous inflammation of the iris. The pupil closes nearly to a point, which remains sufficiently free from opacity for sight to take place with the aid of spectacles. "On the subsidence of the inflammation, the iris, by the natural efforts of the part, or under the influence of belladonna, is drawn towards its outer circle or circumference, and the pupil is apparently enlarged; but the uvea, in retracting, does not keep pace with its anterior part, or leaves attached to the capsule of the lens so considerable a portion of its pigment as to prevent the passage of the rays of light through it, while the pupil, at a distance, seems to be of its natural size and blackness." A minute inspection, however, shows that the pupil is nearly closed. Mr. Guthrie adds, that the operation for closed pupil, by division (the only proper one), is not advisable as long as the patient can see well enough for the common purposes of life.—(See *Operative Surgery of the Eye*, *p.* 249.)

Another classification of cataracts, which is of great importance to an operator, is that which is founded upon their consistence; for, as Beer remarks, this makes not only a great difference in the prognosis, but also in the choice of a method of operating.

When the opaque lens is either more indurated than in the natural state, or retains a tolerable degree of firmness, the case is termed a *firm* or *hard cataract*. When the substance of the lens seems to be converted into a whitish or other kind of fluid, lodged in the capsule, the case is denominated a *milky* or *fluid cataract*. When the opaque lens is of a middling consistence, neither hard nor fluid, but about as consistent as a thick jelly or curds, the case is named a *soft* or *caseous cataract*. When the anterior or posterior layer of the crystalline capsule becomes opaque, after the lens itself has been removed from this little membranous sac by a previous operation, the affection is named a *secondary cataract*.

The harder the cataract is, the thinner and smaller it becomes. In this case, the disease presents either an ash-coloured, a yellow, or a brownish appearance: according to Beer, its colour is very dark. The interspace between the cataract and pupil is considerable. The patient distinctly discerns light from darkness, and, when the pupil is dilated, can even plainly perceive large bright objects. In the dilated state of the pupil, a black circle surrounding the lens is very perceptible. The motions of the iris are free and prompt; and the anterior surface of the cataract appears flat, without any degree of convexity.—(*Richter's Anfangsg. der Wundarzn. p.* 177, *b.* 3. *Beer, vol. cit. p.* 309.)

Beer says, that it is only the genuine lenticular cataract which can be hard, and it is chiefly met with in thin, elderly persons; but, with respect to the opinion that all cataracts in old persons are firm, he says, this is frequently contradicted by experience. In cataracts extracted from thin, aged individuals, the lens is sometimes found dwindled, as hard as wood, nearly of a chestnut-brown colour, and with its two surfaces as flat as if they had been compressed. This case has sometimes been denominated the *dark-gray cataract*, and is very difficult to make out previously to an operation, being liable to be mistaken for an incipient amaurosis. Hence, in order to judge of it effectually, the pupil should always be dilated with hyosciamus or belladonna.

To the firmish, consistent kind, Beer refers several capsulo-lenticular cataracts, namely, the *encysted* and *conical*, or *pyramidal cataracts*, that to which he applies the epithet *dry siliquose*, the *gypsum cataract* in particular, and the *bar cataract*, which at least is always partly firm, as well as all the varieties of *spurious cataract*.—(*Beer*, *b.* 2, *p.* 309.)

The fluid or milky cataract has usually a white appearance; and irregular spots and streaks, different in colour from the rest of the cataract, are often observable on it. These are apt to change their figure and situation, when frequent and sudden motions of the eyes occur, or when the eyes are rubbed and pressed; sometimes also these spots and streaks vanish and then reappear. The lower portion of the pupil seems more opaque than the upper, probably because the untransparent and heavy parts of the milky fluid sink downwards to the bottom of the capsule. The crystalline lens, as it loses its firmness, commonly acquires an augmented size. Hence, the fluid cataract is thick, and the opacity close behind the pupil. Sometimes, one can perceive no space between the cataract and margin of the pupil. In advanced cases, this aperture is usually very much dilated, and the iris moves slowly and inertly. This happens because the cataract touches the iris and impedes its action. The fluid cataract is sometimes of such a thickness, that it protrudes into the pupil, and presses the iris so much forwards as to make it assume a convex appearance. Patients who have milky cataracts, generally distinguish light from darkness very indistinctly, and sometimes not at all; partly, because the cataract, when it is thick, lies so close to the iris, that few or no rays

of light can enter between them into the eye; partly, because the fluid cataract always assumes, more or less, a globular form, and therefore has no thin edge through which the rays of light can penetrate.—(*Richter's Anfangsgr. der Wundarzn. b.* 3, *p.* 174, 175.)—Mr. Travers believes, that fluid cataracts are rarely contained in a transparent capsule, and his experience has taught him, that this membrane is partially opaque, presenting a dotted or mottled surface. The opaque spots are most distinguishable when viewed laterally. —(See *Med. Chir. Trans. vol.* 4, *p.* 284.)

According to Beer, a fluid cataract is mostly conjoined with a complete opacity of the capsule: its diagnosis, therefore, is commonly very difficult, and sometimes its nature cannot be known with certainty, until an operation is undertaken. When the capsule is opaque only in some places, he states, that the following circumstances may be noticed. The cataract lies close to the uvea, and when the patient inclines his head forwards, the cataract presses the iris towards the cornea, and the anterior chamber becomes evidently smaller; but when he lies upon his back, the cataract recedes in some degree from the uvea. The power of distinguishing the light is unequivocal. When the head is kept quiet for a long time, a thick sediment and a thinner part can be plainly remarked in the cataract; during which state, that is, while the two substances are undisturbed, the patient can sometimes distinguish large well-lighted objects, as through a dense mist; but when the head or eye is quickly moved, these two substances become confused together again, and the cataract again presents a uniform white colour.—(*Vol. cit. p.* 312.) It cannot be denied, says Beer, that what is called the *congenital* cataract, and which presents itself in infants soon after birth, when their eyes have been exposed to immoderate light, is not unfrequently fluid; but, in such cases, it must not be presumed, that the lens is always in this state; for, in fact, the cataract is often of that sort which Beer describes under the name of *dry siliquose.*

Sometimes the opaque lens is of a middling consistence, neither hard nor fluid, but about as consistent as thick jelly, curds, or new cheese. Cases of this description are termed soft or caseous cataracts. The consistence here spoken of may be confined to the two surfaces of the lens, or may exist in its very centre. The first case is the most frequent. The diagnosis is not difficult; for it always has a light-gray, grayish-white, or sea-green colour. When it is far advanced, it quite impedes the eyesight, and sometimes considerably interferes with the perception of light.—(*Beer, b.* 2, *p.* 310.) As the lens softens in this manner, it commonly grows thicker and larger, even acquiring a much greater size than the fluid. It is not unfrequent to meet with caseous cataracts of twice the ordinary size of a healthy crystalline lens. The motions of the iris are very sluggish.—(*Richter's Anfangsgr. der Wundarzn. p.* 178, *b.* 3.) Indeed, Beer says that it is sometimes requisite to use the hyosciamus (or rather belladonna) in order to ascertain that no adhesions exist between the uvea and the cataract, for in such cases the posterior chamber is very often completely abolished, as the more caseous the lens is, the larger it is; and hence likewise the black ring at the edge of the pupil is not at all owing to the shadow of the iris, but entirely to the dark border of the iris at the margin of that opening. According to Beer, the colour of such cataracts is never uniform, but more or less speckled; the spots, however, either have no determinate outline, or they seem like mother-of-pearl fragments, into which the cataract crumbles when extracted or couched, or else they assume the appearance of clouds.—(*Beer, b.* 2, *p.* 311.) According to Mr. Travers, the caseous cataract has a heavy, dense appearance, uniformly opaque, a clouded, not a fleecy whiteness, and sometimes a greenish or dirty white tinge.—(*Med. Chir. Trans. vol.* 4, *p.* 285.) He farther states, that what he terms the *flocculent* or *fleecy*, and the *caseous* or *doughy* cataracts, are most frequently met with; the *fluid* or *milky* cases, and those called *hard*, being comparatively rare.—(*Op. et. loc. cit.*)

In estimating the consistence of cataracts it is now universally admitted, that their size is a better criterion of it than their colour; and "the larger and more protuberant the lens pressing forwards into the pupil and against the iris, the greater is the certainty of its being soft."—(See *Guthrie's Operative Surgery of the Eye, p.* 209.)

As Beer observes, a cataract which is recent and has originated suddenly, especially in young subjects, requires much more circumspection, ere an operation is determined upon, than a cataract which has already existed a long while, and the formation of which has been only gradual, particularly in an old subject; for the first case is more frequently owing to a concealed slow kind of inflammation than is generally supposed —(*Vol. cit. p.* 314.)

Formerly, cataracts were denominated *ripe* or *unripe;* terms which, previously to the time of Mr. Pott, who fully exposed their impropriety, often led to the error of supposing that every cataract must acquire an increase of consistence with time, a hardness indicated by a pearly colour, and be thereby rendered more fit to be depressed or extracted. "This opinion (as Mr. Guthrie has observed), founded on the hardness or softness of the cataract, as dependent upon its duration, is contradicted by experience; for cataracts of fifteen or twenty years' duration, and of a pearly colour, have been extracted perfectly soft, while others, of one year's standing and of a milky colour, have been found hard. Neither is the relative state of blindness under these particular circumstances a more just criterion; patients having been found almost entirely blind with a soft cataract, while through a hard one they could still distinguish objects and colours.—(*Operative Surgery of the Eye, p.* 190.) A cataract was also called ripe as soon as it was in a state which would admit of no increase, whether the eyesight was completely lost or only diminished, and whether the pupil was entirely occupied by it or not. Thus, says Beer, the *siliquose cataract*, in its most advanced stage, never totally fills the pupil, and the patient can sometimes even discern colours; nor does the *floating capsulolenticular cataract* fill the pupil in a greater degree; and yet both these cases are completely ripe for an operation. On the other hand, to the unripe cataracts belong the *central cataract of the capsule and lens, the posterior capsular cataract* and *the slight degree of lymph cataract.* Most of these cataracts, after perhaps remaining for years in this state, not unfrequently all of a sudden become complete upon an accidental and slight attack of ophthalmy; but sometimes they remain unchanged during life.—(*Beer, b.* 2, *p.* 316.)

Another very useful and practical division of cataracts is into those which are called *simple local*, and into others which receive the name of *complicated.* A *simple local* cataract is so denominated by Beer when the patient is in every other respect perfectly healthy, and no disease prevails in any other part, however distant from the eye. A cataract may be *complicated* in three ways; for it may be attended either with other simultaneous disease in the eye itself or its appendages, when the case is termed a *local complicated cataract;* or there is some other disease prevailing in the system, either unconnected or connected with the production of the cataract, which then has the epithets *general complicated* applied to it; or, lastly, both descriptions of complication exist together, the *complete complicated cataract.* According to Mr. Guthrie, *idiopathic* or *constitutional cataract* generally affects both eyes; and the *local* or *accidental* form of the disease is more frequently confined to the organ that has been injured either by external violence or active inflammation.—(*Op. cit. p.* 190.) However, from my being acquainted with several cases in which a cataract arose in one eye, without any previous injury or inflammation, and continued many years single, in one case twenty years, I conclude that the exceptions to a part of the foregoing statement are by no means unfrequent.

Among the *locally complicated* cases is the *adherent cataract.* The preternatural cohesion may be one of the anterior layer of the capsule with the uvea, produced by effused lymph; it may consist in a very firm connexion of the posterior layer of the capsule with the membrana hyaloidea; or it may be an unusually close cohesion of the whole of the capsule with the lens; or, says Beer, all the three species of adhesion may exist together.—(*P.* 318.)

The adhesion of the capsule of the lens to the uvea (synechia posterior) is generally obvious enough: for, as Beer has observed, the pupillary margin of the iris is not completely circular, and is more angular the stronger the light is. The cataract lies close to the

uvea, and is very white. The motions of the iris are more or less obstructed, and when the adhesion is extensive, are quite prevented. The perception of light is indistinct, often very faint, and sometimes entirely lost, for the preternatural adhesion is always the consequence of previous internal ophthalmy, which, besides occasioning opacity of the lens and its capsule, readily produces other serious effects upon the retina, the choroid coat, and vitreous humour, quite adequate to account for the loss of sight, and the incapacity of distinguishing the rays of light. When the anterior layer of the capsule is adherent only at a single point to the uvea, the extent of the adhesion may be readily ascertained by artificially dilating the pupil with hyosciamus or belladonna; and the information thus obtained will have great weight in the selection of a method of operating.—(*Beer, loco cit.*)

Some other local complications of cataract are so obvious that they cannot fail to be understood; as, for instance, its combination with an adhesion of the iris to the cornea (*synechia anterior*); with closure of the pupil, unattended by any adhesion of the uvea to the anterior capsule of the lens (*synechia posterior*); as in watchmakers, and hysterical and hypochondriacal subjects, the complications with atrophy, hydrophthalmia, cirsophthalmia, specks and scars upon the cornea, pterygium, and various forms of ophthalmy.

According to Beer, the combination of cataract with glaucoma is also readily made out by any body who has once seen the case; for the cataract always presents a greenish, and sometimes quite a sea-green colour; it is of prodigious size, so as to project through the pupil towards the cornea; the colour of the iris is more or less changed nearly in the same manner as after iritis; the iris is perfectly motionless; the pupil very much expanded and drawn into angles, for the most part towards the canthi; the lesser circle of the iris is nowhere visible, because it lies concealed under the far-projecting soft cataract; the light cannot be perceived, though the blinded patient is frequently conscious of false luminous appearances within the eye (*photopsia*); and, lastly, the case is invariably accompanied with more or less of a varicose state of the blood-vessels of the eye. The origin of this sort of cataract is constantly attended with severe obstinate headache.

There are, says Beer, two other local complications which are much more difficult to learn before an operation. The first is a cataract combined with a dissolution of the vitreous humour (*synchysis*), the diagnosis of which, indeed, when the affection prevails in a considerable degree, is tolerably easy, as the cataract trembles, and the iris always swings backwards and forwards upon the slightest motion of the eyeball; the globe itself is somewhat affected with atrophy; the eye is quite spoiled, and feels flaccid and unresisting; the sclerotica immediately around the cornea is bluish, as in infants; and the perception of light is uncertain. On the other hand, when the synchysis is not far advanced, the only symptoms are a suspicious softness of the eyeball, and a swinging of the iris when the eye is suddenly or violently moved.

The other complication of cataract, sometimes very difficult to detect previously to an operation, is amaurosis. When, indeed, the pupil is extraordinarily large, the iris nearly or quite motionless, and the patient cannot distinguish day from night, and of course not the least glimmer of light, no great powers of divination are required to predict with certainty that no operation will restore the eyesight, which is abolished, not by the cataract, but by the existing amaurosis. On the other hand, when the motions of the iris are nearly as free as in the natural state, the pupil as small as it usually is in a given degree of light, the patient capable of judging accurately of the strength of the light, and yet the cataract conjoined with amaurosis, which, with the exception of the faculty of perceiving the light, completely impedes vision, it is then only by a careful inquiry into the history of the disease, that certain circumstances attending the origin of the cataract, and indicating in some measure the prevalence of amaurosis, can be traced: sometimes in consequence of one eye being affected with amaurosis, and not with cataract, a reasonable suspicion may be deduced, that the eye with cataract is also amaurotic; yet, says Beer, in such a case nothing certain can be known before an operation is done.

He considers the general complications of cataract to be as numerous as the diseases of the constitution itself, or as the affections of other organs besides the eye; but the most common are scrofula, gout, syphilis, psora, old ulcers of the leg, and an unhealthy constitution.

CAUSES, PROGNOSIS, &c.

Persons much exposed to strong fires, as blacksmiths, locksmiths, glassmen, and persons above the age of forty, have been reckoned more liable to cataracts than other subjects.—(*Wenzel.*) In young persons the disease is by no means unfrequent: even children are often affected, and some are born with it. Beer assents to the general correctness of the opinion that old age is conducive to cataracts, since the disease is most frequently observed in old persons. Yet, says he, that age, nay, a very great age, cannot be deemed a regular cause of cataract, is clear from the circumstance of many very old and even decrepit individuals being able, with the aid of spectacles, to read the smallest print: and it would seem that other causes, besides old age, are essential to the production of cataracts; as for instance immoderate exertion of the eye during youth, particularly in such employments as expose the organ to a strong reflected light.—(*Lehre von den Augenkr. b.* 2, *p.* 325.)

Among the circumstances which promote the formation of cataracts, Beer enumerates rooms illuminated only by reflected light; and all kinds of work in which the eyes are employed upon shining, small, microscopic objects, especially when, during such labour, a determination of blood to the head and eyes is kept up by the compressed state of the abdomen, the cataract often seeming to come on more or less quickly with inflammation of the capsule and lens. And, according to the manifold experience of the same author, one of the most important though least noticed causes promoting the formation of cataract, is allowing very strong light suddenly to enter the eyes of a new-born or very young, delicate infant, the consequence of which is, that the cataracts form more or less quickly, with inflammation of the capsule and lens, or remain for life incomplete, as is the case in the central capsulolenticular cataract. The habitual examination of minute objects in a depending position of the head, by which an undue proportion of blood is thrown upon the organ, is said frequently to bring on cataracts.—(See *Med. Chir. Trans. vol.* 4, *p.* 279.) In the majority of instances, true cataracts arise spontaneously, without any assignable cause. Sometimes, however, the opacity of the lens is the consequence of external violence; a case which more frequently than any other gets well without an operation.

Frequently (says a modern writer) the cataract "proceeds from an hereditary disposition which has existed for several successive generations; while in other cases it attacks several members of the same family without any disposition of this kind being recognisable in their progenitors. Among others, Janin mentions a whole family of six persons who laboured under this disease."—(*Obs. sur l'Œil, p.* 149.) Richter extracted the cataract from a patient whose father and grandfather had been affected with the same malady, and in whose son, at that period, it had begun to manifest itself. He adds, that he had seen three children, all born of the same parents, who acquired cataracts at the age of three years.—(*On the different Kinds of Cataract, p.* 3.) "During my apprenticeship with the late Mr. Hill, of Barnstable, I was present when he operated on two brothers and a sister, all of whom were adults, and who stated that three of four others of their family were affected with symptoms not unlike those which they had experienced at the commencement of the complaint. I myself recently operated on two gentlemen advanced in years, who informed me that they had a brother on his return from India, who was similarly affected."—(See *Adams's Pract. Observations on Ectropium, Artificial Pupil, and Cataract, p.* 101, *London*, 1812.) Beer speaks of families in which the children all became afflicted with cataracts at a certain age; cases, says he, where an operation, though done by the most skilful practitioner, hardly ever succeeds.—(*Lehre von den Augenkr. b.* 2, *p.* 331.)

Long exposure of the head and eyes to the rays of the sun, together with a bent position of the body, as in some kinds of field labour, is reckoned by Beer a

cause promoting the formation of cataracts on the approach of age; also hard labour near strong fires, as near ovens and forges, in glass-houses, &c. In England, little credit is given to these opinions.

Beer says, that he has also learned from repeated observation, that exposing the eye to the vapour of concentrated acids, naphtha, and alcohol, will sometimes bring on a cataract; a statement which will be received in this country with some hesitation, where the vapour of ether has been occasionally recommended for the dispersion of opacities of the lens and its capsule. The dust of lime is also supposed to be conducive to the disease, cataracts being said to be frequent among the workmen in lime-pits and kilns. In such cases, I conceive that the cataract has mostly been the result of inflammation.

Wounds of the eye, where the weapon has pierced the capsule and the lens, and especially violent concussions of the forepart of the globe of the eye, though no wound may exist, are in general followed by a cataract as an immediate consequence. This is the case, says Beer, even when no inflammation arises from the injury, the cataract often occurring in a few hours, and in so considerable a degree as not to admit of being mistaken.

The cause of cataract thus rapidly produced must depend, in Beer's opinion, upon the complete separation of the lens from its connexions with the capsule, and not unfrequently in part upon the detachment of the capsule itself from the neighbouring textures; for in such cases this membrane also gradually becomes opaque.

According to Beer, cataracts frequently arise from a slow, insidious inflammation of the lens and its capsule.

With respect to the prognosis, it must be evident from what has been premised, that there are many cataracts in which the cure is highly problematical, and others in which the impossibility of restoring vision, even in the slightest degree, may be predicted with absolute certainty.

With the little positive information which surgeons possess concerning the causes of cataracts, scarcely any expectation can ever be entertained of curing opacities of the lens and its capsule, by means of medicine, so as to supersede all occasion for an operation. A possibility of success, as Beer remarks, can exist only when the cause of the cataract is ascertained, admits of complete removal, and the disease is in an early stage. And he has learned from manifold and repeated trials, that the attempt to cure an incipient cataract will never succeed, except when some determinate and obvious general or local affection of a curable nature has had a chief share in the production of the disease of the eye; as, for instance, scrofula in a mildish form, syphilis, (!) and the sudden cure of eruptions, or old ulcers of the legs, (!) or a slow insidious inflammation of the iris and capsule of the lens. In some examples of this kind, Beer could only check the farther progress of the cataract, and even when the eyesight was improved, it was never rendered perfectly clear. And when the cataract was so far advanced and quite developed, with the exception of the general melioration of the health, and an improved state of eye, whereby it was put in a better condition for the operation, not the slightest benefit was derived from medicine.—(*Lehre, &c. b.* 2, *p.* 333.)

In this country no faith is put in these notions respecting the constitutional influence of rheumatism, gout, scrofula, syphilis, &c. in the production of cataracts, except where such general disorders directly excite inflammation of the eye, and opacity of the lens or its capsule is brought on as a consequence of such inflammation. Indeed, Mr. Guthrie maintains that scrofulous inflammation is rarely propagated to the interior of the eye, and that strumous subjects are not more subject to cataract than other individuals; an opinion in which I perfectly coincide. He also remarks, that there is no evidence of syphilitic patients being particularly liable to cataracts, and this even when they have suffered severely and frequently. In short, he absolutely denies the power of this and other constitutional diseases to promote the formation of an opacity of the lens and its capsule, unless inflammation of the eye be excited by them (see *Operative Surgery of the Eye*, *p.* 191); a sentiment which I think is consonant to every fact revealed to us by daily experience.

The principal external remedies that have been tried for the cure of the cataract are, bleeding, cupping, scarifications, setons, issues, blisters, and fumigations; and the chief internal remedies are aperients, emetics, cathartics, sudorifics, cephalics, and sternutatories. Formerly, preparations of eyebright, millepedes, wild poppy, henbane, and hemlock were credulously extolled as specifics for the disorder.

Scultetus asserts that he checked the progress of a cataract by applying to the eye the gall of a pike, mixed with sugar; and Spigelius boasted of having successfully used for this purpose the oil of the eelpout (*mustela fluviatilis*).

Cataracts are said to have been cured in venereal patients while under a course of mercury. Probably, however, many such cases might have been mere opacities of the cornea, or, at most, only transient opacities of the capsule, or depositions of lymph in the posterior chamber, the consequence of existing or previous inflammation. Wenzel placed no reliance whatever on the power of any remedies to dissipate a cataract, and as he had remarked their inefficacy in numerous instances, he felt authorized in declaring that internal remedies, either of the mercurial or any other kind, are inadequate to the cure of this disorder; and equally so, whether the opacity be in the crystalline or in the capsule, whether incipient or advanced.

Although the late Mr. Ware coincided with Wenzel and Beer in regard to the uncertainty of all known medicines to dissipate an opacity, either in the lens or its capsule, or even to prevent the progress of such opacity when once begun, yet, according to his observations, many cases prove that the powers of nature are often sufficient to accomplish these purposes. The opacities, in particular, which are produced by external violence, Mr. Ware had repeatedly seen dissipated in a short space of time, when no other parts of the eye had been hurt. In such cases the crystalline lens is generally absorbed, as is proved by the benefit which is afterward derived from very convex glasses. In some of these cases, though the crystalline had been dissolved, the greater part of the capsule remained opaque, and the light was transmitted to the retina only through a small aperture which had become transparent in its centre. Instances are also recorded, in which cataracts, formed without any violence, have been suddenly dissipated in consequence of an accidental blow on the eye. The remedies which Mr. Ware found more effectual than others, were the application to the eye itself of one or two drops of ether once or twice in the course of the day, and occasionally rubbing the eye over the lid with the point of the finger, first moistened with a weak volatile or mercurial liniment. While Mr. Guthrie admits that opacities perceptible behind the iris have been cured under a course of medicine, he considers such events very rare, and to have been accomplished only when the opacity arose from slight depositions in the capsule, the result of simple inflammation rather than from any affection of the crystalline itself. A haziness of the capsule, caused by the extension of inflammation of the iris to it, he says, may almost always be relieved under the treatment proper for the cure of iritis; but he does not believe that an opacity of the lens, distinctly discerned to be such, has ever been removed by medicine. He expresses his decided opinion, that if any lenticular cataracts have really been cured, they were caused by external violence, and disappeared in consequence of their dissolution in the aqueous humour, and the action of the absorbents, the opacity of the lens having been the result of a rupture of its capsule. Mr. Ware, who at one time supposed that incipient cataracts might be cured by spirituous applications, and particularly the sulphuric ether, latterly abandoned the opinion; and it would seem from a note in the third edition of his book on the cataract, that the cases he published in the first and second, and as proceeding from an external injury, were of the latter description.—(*Operative Surgery of the Eye*, *p.* 250.) In short, the operation is now regarded as the only means affording any rational hope of restoring the eyesight of patients afflicted with cataracts.

Notwithstanding also the perfection to which the operation, with all its different modifications, is really brought, its performance will not always re-establish vision; nay, says Beer, it is frequently counterindicated; and even in favourable cases the result of the

operation is exposed to so many contingencies, that it is rather a matter of surprise that, on the whole, so much success should attend it as is found to happen.

When an operation for a cataract is done apparently under favourable circumstances, and its event is unexpectedly very incomplete or quite unsuccessful, surgeons in vain ascribe the failure to the particular method of operating which they have hitherto adopted, and uselessly abandon it for another; because none of these methods, including that which is preferred, brought to the highest state of perfection possible, can be applicable to all cataracts. But, says Beer, the reason of the ill success is generally rather owing to the operation not having been indicated, or to a mode of operating not well calculated for the particular case having been selected. He ridicules the idea of adhering exclusively to any one plan of operating; and whenever the question was put to him, "what is your plan?" he answered, that his custom was to operate in the manner which appeared to him the best adapted to each particular case about which he was consulted. A surgeon should be able to distinguish, first, the cases of cataract in which an operation may be done with the best chance of success; secondly, the examples in which the prognosis is more or less doubtful; and, lastly, the cases in which there is a great probability or an absolute certainty of the operation failing, in which last circumstance the practice is prohibited.

According to Beer, the result of an operation will probably be favourable, 1. When the cataract is a genuine local complaint, perfectly free from every species of complication. 2. When the conformation of the eye and surrounding parts is such, as to allow whatever method of operating may be most advantageous for the particular case, to be done without difficulty. 3. When the patient is intelligent enough to behave himself in a manner which will not disturb the precision and safety of the requisite proceedings in the operation or the subsequent treatment. 4. When the operator not only possesses all requisite medical and surgical knowledge in general, but is capable of judging correctly what method of operating suits the particular case; and when besides he has derived from nature and acquirement such mental and corporeal qualities as are essential to a skilful operator on the eye; viz. an acute eyesight, a steady, but light, skilful hand, excellently qualified for mechanical artifice in general; long, pliant fingers; a delicate touch; a certain tenderness in the scientific treatment of this particular organ; complete fearlessness; invincible presence of mind; and proper circumspection. 5. When the requisite instruments are not too complicated; but well adapted to the purpose, and in right order. 6. When the domestic condition of the patient is such as not to occasion any particular disadvantages during or after the operation. Yet, says Beer, even with this fortunate combination of circumstances, uniform success must not be expected; for a patient whose sight is quite prevented by this disease, and who, previously to its origin was already far-sighted, will be still more so after the removal of the diseased lens, and, in order to see distinctly the most common objects which are near, he will be obliged constantly to employ suitable glasses. An individual of this description, though the operation be done with great success, is apt not to be satisfied. But such patients as were short-sighted previously to the formation of their cataracts, are more pleased with the restoration of vision; as before the operation their eyesight was much less than what it is now, and in general they can lay aside the glasses which they formerly made use of, without having occasion for any others. Lastly, as Beer remarks, although patients, who before the origin of their cataracts were neither far nor short sighted, are sensible of the important benefit of an operation, inasmuch as they now plainly discern all objects again, yet they are usually obliged to employ spectacles in reading, writing, or doing any kind of fine work.

On the other hand, the result of an operation Beer considers always more or less doubtful, 1. When the cataract is only locally complicated, as, for instance, with pterygium, which may not form any absolute reason against the experiment. 2. When the conformation of the eye and surrounding parts causes several hindrances to the operator; as is the case when the eye is small, and deep in the orbit, and the fissure of the eyelids very narrow. 3. When the patient is either very stupid and obstinate, rough-mannered, particularly timid, or badly fed. 4. When the surgeon knows how to operate only in one way, in which perhaps he has also not had sufficient experience, and when possibly he is also deficient in the qualities specified above as essential to a good operator on the eyes. 5. When the instruments are bad. 6. When in the patient's domestic affairs there are any circumstances which cannot be removed, and are likely to have a bad effect upon the operation, as an unwholesome, damp room, great uncleanliness, &c. 7. When the origin of the cataract was attended with repeated or tedious headache, though this may have subsided a long while. 8. When the patient is particularly subject to catarrhal and rheumatic complaints, especially affecting the eyes. 9. When the patient has often had, or still labours under, an attack of erysipelas, notwithstanding the parts inflamed be remote from the eye. 10. When the patient's skin is peculiarly irritable. 11. When in his childhood or youth he has been frequently afflicted with convulsions or epileptic fits, though these complaints may have ceased many years. 12. When there is the least tendency to certain constitutional diseases, scrofula, gout, syphilis, &c. Gout, however, does not always make an operation fail, as we learn from Mr. Travers, who, in three cases, extracted the cataract from gouty subjects, and, though a smart attack of the disease followed the operation, the eyes were unaffected, and the sight was well recovered.—(*Synopsis of the Diseases of the Eye, p.* 297.) 13. When the patient's habit is bad, though not affected with any definite disorder. 14. When the patient in his youth has often been troubled with attacks of ophthalmy. 15. When he cannot perceive the different degrees of light, and correctly describe them, while nothing to account for this state can be detected in the eye itself. 16. The result of an operation is always very doubtful, when there is the slightest tendency to hysteria or hypochondriasis. 17. When the patient is subject to violent mental emotions, mania, &c. 18. When the eye to be operated upon can still discern things, however feebly; a state which generally produces an involuntary resistance to the necessary measures in the operation. 19. When the cataract is the consequence of a wound, though free from complication. 20. When the patient is in the state of pregnancy. 21. When one eye has been already destroyed by suppuration. 22. And lastly, when one eye has already been operated upon without success by a man whose professional judgment, skill, and caution are unquestionable.

According to Beer, the result of the operation will be more or less unfavourable, 1. When the patient is affected with gutta or acne rosacea, not the effect of hard drinking, but rather of scurvy. 2. When evident traces of some general disease of the constitution are present. 3. When the patient has been ill, and is only yet convalescent. 4. When any other disease, though not constitutional, is present. 5. When the cataract is adherent for a considerable extent to the uvea, or an incurable, though not very severe, chronic inflammatory affection of the eyelids or eyeball prevails, as, for instance, an habitual inflammation of the Meibomian glands; ectropium of the lower eyelid; the remains of a pannus; or a strong aversion to light.

Lastly, as Beer observes, every operation must fail when the cataract is manifestly joined with complete amaurosis, a dissolution of the vitreous humour, dropsy, or atrophy of the eye, some species of ophthalmy, glaucoma, or a general varicose affection of the blood-vessels of the eye.

The capacity of distinguishing light from darkness, and in a shady place, where the pupil is not too much contracted, of perceiving bright colours and the shadows of objects, is, as Scarpa has particularly noticed, a very important desideratum in every case selected for operation.

The power of distinguishing light from darkness is even more satisfactory than motion of the iris. I saw, many years ago, in St. Bartholomew's and the York Hospitals, several cases of complete gutta serena in both eyes, in which there was the freest contraction and dilatation of the pupils. Had such patients been also afflicted with cataract (a complication by no means unfrequent), and a surgeon, induced by the moveable state of the iris, had undertaken an operation, it must of course have proved unavailing, since the rays of light could only have been transmitted to an insensible

retina. Richter and Wenzel make mention of these peculiarities, and the latter refers the phenomenon to the iris deriving its nerves wholly from the lenticular ganglion, while the immediate organ of sight is constituted entirely by another distinct nerve. Hence, motion of the iris is not an infallible criterion, as authors have stated (*Wathen*), that the retina is endued with sensibility. Relating to this subject, Mr. Lucas has made a curious remark: he attended, in conjunction with Hey and Jones, five children of a clergyman at Leaven, near Beverley, who were all born blind. He writes, "None of them can distinguish light from darkness, and although the pupil is, in common, neither too much dilated nor contracted, and has motions, yet these do not seem to depend upon the usual causes, but are irregular."—(*Med. Obs. and Inq. vol.* 6.)

The reciprocal sympathy between the two organs of sight is so active, that no one, solicitous to acquire either physiological or pathological knowledge respecting them, ought, for a moment, to forget it. Hence, in the examination of cataracts, it is of the highest importance to keep one eye entirely secluded from the light, while the surgeon is investigating the state of the iris in the other; for the impression of the rays of light upon one eye, sensible to this stimulus, is known to be often sufficient to produce corresponding motions of the iris in the opposite one, although in the state of perfect amaurosis. In other examples of cataract, the pupil may be quite motionless, and yet sight shall be restored after the performance of an operation.—(*Wenzel.*) There are two circumstances, however, which may prevent us from ascertaining whether the retina is sensible to light or not: the first is, a circular adhesion of the crystalline capsule to the iris. Here Richter thought that some opinion might be formed of the nature of this case by observing the distance between the cataract and pupil: inferring that when the space between the pupil and opaque lens was inconsiderable, such an adhesion had happened; and when the cataract did not seem particularly close to the pupil, and yet the patient could not discern light from darkness, that it was complicated with amaurosis. The second circumstance, sometimes utterly preventing the ingress of any light to the healthy retina, is the round, bulky form of the cataract.

But although the power of distinguishing light from darkness is more satisfactory than motion of the iris, it is not an unequivocal test of the retina being perfectly free from disease. While the gutta serena is incomplete, the patient can yet distinguish light and the shadows of objects. Dilatation of the pupil is also a deceitful criterion of the complication of gutta serena with the cataract When the cataract is large, or adherent to the iris, the pupil is frequently much dilated, though the optic nerve may be natural and sound: the pupil often continues quite undilated in a perfect gutta serena.—(*Richter.*)

From all this it must be manifest, 1st, That the irregularity and inconstancy of the symptoms of gutta serena, together with the possibility of particular states of the cataract rendering the patient utterly unconscious of the stimulus of light, make it necessary for the surgeon to be particularly attentive to the appearance and to the history of the origin and progress of the disease, in order to understand the real condition of certain causes. 2dly, That when the patient can distinguish light from darkness, though the iris may be motionless, there is good ground for trying an operation. Possibly in this circumstance an incipient *amaurosis* may exist; but the *chance* of the defect of the iris arising from other causes; the *certainty* that the opaque body *must* be removed from the axis of sight (even if the disease of the retina be cured), ere sight can be restored; and the *improbability* that an operation to cure the cataract will render the other complaint at all less remediable, fully justify the attempt. Frequently, the patient has a fully-formed cataract in one eye, which presents the signs of amaurosis, while an incipient cataract, or one as much advanced, exists in the other, which at present is free from these symptoms: in this case (says Mr. Travers), the cataract of the latter should be removed without delay.—(*Synopsis, &c. p.* 314.)

The concurrent testimony of almost all writers upon the subject tends to prove, that the restoration of sight has sometimes been effected in the most hopeless cases; and I am therefore of opinion with Mr. Lucas, that in all doubtful cases an operation should be tried as a remedy by no means violent or hazardous.—(*Med. Obs. and Inquiries, vol.* 6, *p.* 257.)

I shall conclude this part of the subject with annexing the sentiment of Mr. Travers, viz. that it would be incorrect to say that the operation is unadvisable in all cases of cataract in which the patient has no sense of light; for it is possible that the density of the lens may be such as absolutely to exclude the light, and that the motions of the iris may be therefore suspended; or from some degree of pressure of the lens or adhesion of the uvea to the capsule, that the pupil may be undilated, and the circumference of the lens permanently covered. But undoubtedly, says Mr. Travers, a case of this description is unpromising. "A strong sense of light by which at least to know the direction in which it enters the apartment, to be sensible of its falling on the eye, and of a shade, as the hand for example, intercepting it, with a corresponding freedom of motion of the pupil, is the most favourable state for the operation."—(*Synopsis of the Diseases of the Eye, p.* 315.)

As it not unfrequently happens that cataracts produced by external violence spontaneously disappear (*Pott, Hey, &c.*), the operation should never be too hastily recommended for them.

Respecting the question, whether an operation ought to be done when only one eye is affected with cataract, and the other is sound, some difference of opinion prevails.

One reason assigned by the condemners of this practice, viz. that one eye is sufficient for the necessities of life, is but of a frivolous description; and another, that the patient would never be able to see distinctly after the operation, by reason of the difference of the focus in the eyes, is (I have grounds for believing) only a gratuitous supposition, inconsiderately transmitted from one writer to another. In support of what I have here advanced, and to prove that success does sometimes, probably in general (if no other causes of failure exist), attend the practice of couching and extraction, when only one eye is affected with a cataract, I refer to a case reported by Maître-Jan.—(*Traité des Maladies de l'Œil, édit. Paris*, 1741. 12*mo. Obs. sur une Cataracte laiteuse, p.* 196.)

Baron Wenzel was in the habit of extracting cataracts with the most successful result, when only one eye was affected with the disease, as may be learned by referring to the cases here specified.—(*Cases*, 6, 13, 16, 19, 22, 25, 29, 30, 31, 34, &c. *Treatise on the Cataract.*)

Richter was formerly convinced, that the advice not to operate when there is a cataract only in one eye, ought, for several reasons, to be disregarded: he reminds us of the wonderful consent between the eyes, so that one is seldom diseased without the other, sooner or later, falling into the same state; and hence he questions whether it may not be possible to prevent the loss of the sound eye by a timely operation? *An non caveri possit jactura integri oculi tempestive extrahendo cataractam prioris?*—(*Obs. Chir. fascic.* 1.) He adverts to the remarkable case related by St. Ives, where a man was wounded in the right eye by a small shot, and shortly afterward had a cataract in it; he then gradually became blind in the left, but soon recovered his sight in it, after the cataract had been extracted from the right one. Here let us notice, that St. Ives, (*Maladies des Yeux, chap.* 15, *art.* 3) makes no mention of any confusion in vision, in consequence of the different refracting powers of the two eyes in question. From some modern publications, indeed, it would appear, that, in a few instances, an incipient cataract in one eye has actually disappeared of itself, after the operation had been performed for a complete one in the other.—(*Carmichael, in Med. and Physical Journ. vol.* 19; *and Stevenson, in Edin. Med. and Surg. Journ. No.* 77, *p.* 521.) This is a circumstance which is urged by the latter gentleman, not only as a strong reason for disregarding the common opinion, that a cataract should never be operated upon while the other eye enjoys useful vision, but as a powerful motive for doing the operation even at an early period so; that if there be no cataract in the other eye, the operation may be the means of preventing its formation, or if it be already beginning, the chance of its dispersal by the effect of the removal of the other cataract may be taken. In the *Medical and Physical Journ.* for May,

1808, is also an ingenious paper, defending the practice of operating when only one eye is affected. Another reason, judiciously assigned by Richter (*Obs. Chirurg. fascic.* 1), for disregarding the above precept, is, that in waiting until a cataract forms in the other eye, the existing one, which is at this moment, perhaps, in the most favourable state for the operation, may soon change so much for the worse (for instance, it may contract such adhesions to the iris), as either to destroy all prospect of relief, or, at most, afford but a very precarious and discouraging one. The length of time necessary to wait is also uncertain and tedious. I once saw a man in St. Bartholomew's Hospital, who had had a cataract in one eye fifteen years, during all which time the other continued quite sound; and another case of twenty years' standing has lately been communicated to me. It is right to state, that Richter latterly inculcated a contrary opinion to what he formerly espoused, yet without specifying the particular facts which induced him to revoke his former sentiments. The principal reason stated by him is, that the patient not only does not see much more acutely with the two eyes after the operation, than with one before it, but he frequently sees more confusedly, because the eye that has been operated on cannot see well without the aid of a glass, which perhaps the sound one does not require.—(*Anfangsgründe der Wundarzn. Dritter. b.* 3, *p.* 199.)

When I remember that no cases are adduced by this author to contradict the rationality of his former sentiments; when I also reflect upon the facts recorded by Maitre-Jan, St. Ives, and Wenzel; when I contemplate that Callisen mentions, as the feeble ground of his adopting the common opinion, that in one single instance of this description he was unsuccessful, without particularizing from what immediate cause the failure arose; there appears to my mind strong cause to believe that the advice not to operate when there is only one cataract, and the other eye is perfect, is at least a subject which merits farther investigation. Warner's objection is similar to that specified by Richter: he writes, "the eye from which the crystalline lens is removed cannot be restored to a degree of perfection at all equal to that of the sound eye, without *the assistance of a convex glas*" (*Description of the Human Eye, and its Diseases*, *p.* 85); but is not the power of using both eyes at the same time, even with the inconvenience of being necessitated to employ a glass for the purpose, preferable to being blind of one? The cases quoted, at all events, prove, that confusion in vision is not always the result of the practice: whether the fact is concordant with the modern theory of vision is entirely another consideration; if it should be found incompatible with it, we must infer that our knowledge of optics still continues imperfect; not that such well-attested examples, as some alluded to, are unworthy of belief.

When there is a fully formed cataract in one eye, and vision is retained in the other, Mr. Travers thinks the postponement of the operation wrong. "I am satisfied (says he) that the cataractous eye, if it becomes the subject of an accidental inflammation, is strongly disposed to go into amaurosis; and, farther, that the retina loses its vigour by the permanent exclusion of light. I speak from repeated observation of the fact. The objection to the operation on the ground of inconvenience, arising from the difference of focus of the two eyes, when one only is the subject of disease, is trivial, and a consideration altogether subordinate: such a defect may always be remedied by glasses properly adjusted. In several cases of amaurosis ensuing upon cataract, I have been disposed to regard the change in consistence and volume of the lens, as productive of a destroying inflammation; in others, of a partial absorption of the vitreous humour."—(*Synopsis of Diseases of the Eye*, *p.* 313.)

For some decided information on the foregoing interesting question, I have referred to Beer; but he seems not to have entered into its consideration at all. The only instance in which he approaches the subject is, when he notices the custom of covering the eye, which yet possesses more or less vision, when the other alone has a cataract in a fit state for an operation.—(*Lehre von den Augenkr. b.* 2, *p.* 351.)

The reason which has induced me to allot so much space for the consideration of the question, whether an operation should be undertaken when only one eye is affected, is a conviction of the importance of the decision made about it. Were I to judge only from what has been said by writers, I should be confident that a determination in the negative must be erroneous; but when I know that my experienced and judicious friend Mr. Lawrence joins in the belief that the practice is not productive of advantage, the only inference which I venture to make is, that the subject deserves farther experiment.

Mr. Guthrie even declares, that he has met with several "cases in which great inconvenience was sustained from the confusion of vision caused by a successful operation;" and in one instance, the patient actually wished him to destroy the sight gained by the operation. He therefore joins in the opinion that the operation should not be attempted on one eye while the other is sound.—(*Operative Surgery of the Eye*, *p.* 258.)

On the other hand, however, we have the evidence of Dr. Andrew Smith, a gentleman whose observations appear to be deduced from considerable experience in the ophthalmic hospital at Chatham. He admits that a slight degree of double vision does occur for a short time after the lens has been extracted. In cases where the lens was broken up, however, this casual imperfection did not occur, as, before the lens was absorbed, the eye became accustomed to its privation. "The following (says he) were the remarks I made on the cases in which extraction was performed. Three saw objects double when the bandage was first removed, and for nearly twenty-four hours; and then singly. Two saw double for about three hours; and one of them, two days afterward, upon being surprised, and opening his eyelids suddenly, experienced for a few seconds the same imperfection. A sixth saw constantly double for four days, and after that as distinctly as ever he did; and the other three cases, as above remarked, always single."—(*Edin. Med. and Surgical Journ. No.* 74, *p.* 14.) On the whole, I consider this question, which is a very important one in practice, by no means decidedly settled; and as far as the evidence of various writers upon it extends, I think those who are in favour of operating upon a cataract, though the other eye is sound, have the best of the argument.

When there are cataracts in both eyes, most authors are of opinion that there is no reason why one should not be operated upon immediately after the other. As, however, the ophthalmy is likely to be more severe, *cæteris paribus*, when both eyes are operated upon at the same time, Scarpa, who gives the preference to the needle, disapproves of this mode of proceeding, and assures us, that in patients with cataracts in both eyes, his experience has taught him, that it is by no means advantageous to operate upon one immediately after the other; but that it is better to wait till one eye is well, before any attempt is made upon the other.—(*Saggio di Osservazioni, &c. p.* 255.)

On this point, the following is Beer's sentiment:—When cataracts are completely formed in both eyes, the patient willing, and every thing promises a favourable result, both eyes may be operated upon at the same time. On the contrary, when any circumstances are present which render the event of the operation very doubtful, it is most advisable to make the attempt only on one eye, even though the patient absolutely wish more to be done, so that if the first operation should fail, but the complication of this cataract afterward change considerably to the advantage of the patient, one eye would still be left for a second more favourable attempt.—(*Lehre von den Augenkr. b.* 2, *p.* 350.)

With regard to this question, I should say, with Mr. Guthrie, that if I were the patient myself, I should always prefer to have the operation done only on one eye in the first instance.

Some years ago, it was the common doctrine, that no operation should be undertaken for a cataract before the patient had attained the age of docility and reason, and in a point of view abstractedly surgical, there can be no doubt of the rectitude of such advice; but when it is farther considered how essential sight is to the acquirement of education; that youth is the condition best adapted for this indispensable pursuit: that when the child's head is steadily fixed, the needle admits of being employed; that with the aid of an assistant, this object can most effectually be accomplished; that when the operation is delayed, the cataract may acquire adhe-

sions; that persons have not only had cataracts successfully depressed or broken, at a very early age, but with the assistance of a *speculum oculi*, have even had them extracted (see *Ware's note, p. 90, of Wenzel's treatise*), which is universally acknowledged to be a far more difficult process; and that the pupil of the eye in a young subject, is nearly as large as in an adult (*Warner's Description of the Human Eye, and its Diseases, p.* 34); I cannot help thinking, with Mr. Lucas, that after a child is old enough to bear an operation, the attempt to cure a cataract with the needle *may be proper* at any age. Surgeons do not refuse to operate for the hare-lip as early as two years of age, or even earlier; they do not wait for docility and reason in the patient, to make him manageable, and sensible of the propriety of submitting quietly to the performance of the operation; they render him tractable by force, and thus they wisely succeed in making, perhaps with more certainty than reliance upon the fortitude of any human being would afford, a very precise incision, such as the nature of the operation demands: and why should they refuse to attempt the cure of cataracts in children, when the motives are more urgent, and it is equally in the power of art to substitute means quite as effectual as docility and reason in surgical patients? What experienced operator would trust to these qualities, when he undertakes any grand operation, even on the most rational and firm adult?—(*Critical Reflections on the Cataract*, 1805.)

Of late years, the attention of surgeons has been much drawn to the subect of operating on the cataracts of children, and the propriety of the practice seems to be now firmly fixed on the basis of experience. It is even ascertained that the needle may be successfully employed on children of the most tender age. The late Mr. Saunders, surgeon to the London Infirmary for curing diseases of the eye, may be said to have had the principal share in promoting the adoption of this important improvement. His practice confirmed what reason had long ago made probable, and the judgment, tenderness, and skill with which he operated on the eyes of infants, as well as those of adults, were followed by a degree of success which had never been previously witnessed, and which infused quite a new spirit into this most interesting branch of surgery. Subjects from eighteen months to four years old received most benefit from Mr. Saunders's operations; and, if any intermediate time be selected, Dr. Farre (the editor of this gentleman's publication) is inclined to recommend the age of two years. "The parts have then attained a degree of resistance which enables the surgeon to operate with greater precision than at an earlier period; yet the capsule has not become so tough and flexible as it does at a later period, after the lens has been more completely absorbed.

But this is not the greatest, although a considerable advantage of an early operation; for, in cases in which the patient has no perception of external objects, the muscles acquire such an inveterate habit of rolling the eye, that, for a very long time after the pupil has been cleared by an operation, no voluntary effort can control this irregular motion, nor direct the eye to objects with sufficient precision for the purpose of distinct and useful vision. The retina, too, by a law common to all the structures of an animal body, for want of being exercised, fades in power. Its sensibility, in many of the cases cured at the ages of four years and under, could not be surpassed in children who had enjoyed vision from birth; but at eight years, or even earlier, the sense was evidently less active; at twelve it was still more dull; and from the age of fifteen and upwards, it was generally very imperfect, and sometimes the mere perception of light remained. But these observations do not apply to those congenital cataracts in which only the centre of the lens and capsule is opaque, the circumference being transparent; for in those the retina is exercised by a perception, although an imperfect one, of external objects, the motions of the muscles which direct the globe are associated, and an absorption of the lens does not take place: therefore, in this variety of the disease, the argument in favour of an early operation is not so much a medical as a moral one—it is preferable for the purposes of education and enjoyment."—(*Saunders on the Diseases of the Eye, p.* 153. 155.)

Besides Mr. Saunders, several other surgeons of the present day have become zealous advocates for operating upon the cataracts of children. Even Mr. Ware, before his death, strongly recommended the use of the needle in the congenital cataract of infants and children. His mode of operating I shall hereafter notice. The late Mr. Gibson, of Manchester, likewise urged the propriety of couching young subjects, and fixed on the age of six months as preferable to that of two years. "Whatever objections (says he) have been urged against the safe and effectual use of the couching-needle in infants, have always appeared to me so slight, and so easily surmountable, that without inquiring particularly into the real state of the question, I have long concluded that the same motives which would induce an operator to couch a cataract at any period of adult life, would equally lead him to perform that operation at any earlier period when a cataract existed. Acting upon this presumption, *I have operated upon children of all ages for ten years past.*"—(See *Edin. Med. and Surgical Journal, vol.* 7, *p.* 394.)

Mr. Gibson's paper being dated June, 1811, we are of course given to understand, that he pursued this practice from the year 1801, and he asserts that his experience had embraced a considerable number of cases.

"In performing the operation of couching infants, it has always appeared to me (says this gentleman), that the advantages to be gained by restoring vision at so early a period, are so important as to bear down any obstacles which may occasionally be opposed to the safe use of the needle. Even the risk of deranging the figure of the pupil forms no solid objection to its use; and may always be avoided by steadiness and good management. Should even a slight change in its figure be produced, it is seldom in the least detrimental to distinct vision, and can scarcely be considered a blemish in the eye of any one; except perhaps in that of a geometrician, who may easily reconcile to himself the presence of an oval opening, where one of a circular form should exist. It may farther be observed, that if an operator cannot depend upon his management of the eye, so as to render it steady by the introduction of the couching-needle, he can avail himself of the assistance of a speculum to restrain its motions.

The following observations will apply principally to infants under twenty months old. The advantages which an operator possesses in operating upon a child of this age, as compared with a child of three years old or upwards, are important. An infant is not conscious of the operation intended: it is free from the fears created by imagination, and can oppose very feeble resistance to the means employed to secure it with steadiness. At an early age it has not acquired the power of retracting the eye deep in the socket, so that the operator has always a good prospect of introducing the couching-needle with ease by watching a proper opportunity. The eye has not at this time acquired the unsteady rolling motion which, after a few years, is so common and remarkable in children born blind, or reduced to that state soon after birth. So that this impediment to the easy introduction of the needle does not exist in infants a few months old. The operator also has it in his power to administer a dose of opium, sufficient to render the steps necessary to expose the eye almost entirely disregarded by his patient. With respect to the state of the eye itself, but particularly that of the cataract, this is more favourable for the operation than at any future period of life. *In infants, the cataract is generally fluid*, and merely requires the free rupture of its containing capsule, which is in that case generally opaque. The capsule, however, is tender and easily removed by the needle, so as to leave an aperture sufficiently large for the admission of light. The milky fluid which escapes from the capsule is soon removed by absorption. If, on the other hand (says Mr. Gibson), the cataract should be soft, it is generally of so pulpy a softness that the free laceration of the anterior part of its capsule, and the consequent admission of the aqueous humour, ensure its speedy dissolution, and disappearance, without the necessity of a second operation Should the cataract happen to be hard, there will be no more difficulty in depressing it than in an adult.

The advantages (says Mr. Gibson) which an operator will possess, when he attempts the removal of a cataract in a child of a few months old, are peculiar to that period. In proportion as the age of the patient advances until he arrives at the age of discretion, and can estimate, in some measure, the value of sight by feeling its loss, the difficulties opposed to the use of the couching-needle increase. His fears of the operation, the unstea-

diness of the eye, and his power of retracting it within the orbit, present considerable, but not insuperable obstacles; such, however, as every surgeon would willingly dispense with, if he had it in his power.

Before an operation at an early age is recommended, the practitioner ought (as at any other age) to ascertain that the cataract is not complicated with a defective state of the retina, or with a complete amaurosis. Such cases are by no means uncommon. Some years ago, I recollect to have seen five or six children, the families of two sisters, who were all totally blind, and in an idiotic state, with cataracts accompanied by amaurosis."—(*Gibson, op. et loco cit.*)

I find also in this gentleman's paper some arguments which have been repeated in Mr. Saunders's work. "Few practitioners, at all conversant with cases of blindness from birth, will deny that it is highly probable that the eye may lose a considerable part of its original powers, from the mere circumstance of its having so long remained a passive organ. Hence, probably, it happens, that in some cases of congenital cataract, the only benefit conferred on the patient by an operation is that of enabling him to find his way in an awkward manner, and to discriminate the more vivid colours. Such patients have never been able to discern small objects, or to judge, in any useful degree, of figure or magnitude: I am well aware, however," says Mr. Gibson, "that in some rare instances, such a defective state of the eye exists from birth.

Another circumstance which must have attracted the attention of oculists is, that in a few years, the eye of a patient born blind acquires a restless and rolling motion, which is at length so firmly established by habit, that he has little control over it. This motion unfortunately continues for a considerable time after sight has been restored to such a person, and is a very material obstacle to the early attainment of a knowledge of the objects of vision. He cannot fix his eye steadily upon one point for a moment, and the inconvenience which arises from this unsteadiness is, to such a person, occasionally as great a bar to the distinct view of an object, as the unsteady motion of the same object would be to one whose vision is perfect. This inconvenience any one can appreciate, and, as far as I know, it is completely avoided by restoring sight at an early age."

As a motive for operating on infants, Mr. Gibson also comments on the loss of those years which ought to be spent in education.—(See *Edin. Med. and Surgical Journal, vol. 7, p.* 394. 400.)

Mr. Guthrie also joins in recommending the cure of cataracts in children: he considers the period of dentition an unseasonable one for the operation; but excepting the time of this process, if the child be healthy, he thinks it qualified for the attempt at any age, reckoning from that of six months; and that "even if the operation be delayed until the end of the third or fourth year, little or no inconvenience is found to arise from it."—(*Operative Surgery of the Eye, p.* 362.)

When once it is decided to operate upon a cataract, the sooner the operation is generally done the better, because the anxiety of the patient increases, as Beer says, with every day, nay, with every hour. Just before the operation, care must be taken not to let the patient eat a great deal, nor load his stomach with substances difficult of digestion; and if the stomach and bowels should already be disordered by what they contain, their contents ought to be carefully removed previously to the operation. In the same manner, if the surgeon wish to keep off much inflammation, and the patient should be coustipated, this state must be obviated by suitable medicines. And, lastly, when, at the request of the patient himself, the operation is deferred for a few days, the greatest caution must be used not to let him expose himself to any causes likely to bring on catarrhal or rheumatic complaints.—(*Beer, b.* 2, *p.* 344.) The following advice, delivered by Scarpa, with respect to the preparation of patients for operations on the eye with the needle is valuable: In ordinary cases, there is not the least occasion for any preparatory treatment previous to the operation; all that prudence requires is, that the patient should abstain from animal food and fermented liquors for a few days before submitting to it, and should take one dose of a gentle purgative. But this, like every other general observation, is liable to particular exceptions. Hypochondriacal men, hysterical women, and patients subject to affections of the stomach and nervous system, should take, for two or three weeks before the operation, tonic bitter medicines, particularly the infusion of quassia, either with or without a few drops of sulphuric ether to each dose; or, in other cases, ℥j. of Peruvian bark, with ℈j. of valerian, may be administered two or three times a day with particular benefit. It is observed by the most accurate writers upon this subject, that in such persons the symptoms consequent to operations upon the eyes are often much more violent than in common cases; and it therefore seems proper to endeavour previously to meliorate their constitutions. When the patient is timid, it is advisable to give him, half an hour before the time of operating, about fifteen drops of the tinctura opii, with a little wine.

Some patients, besides being afflicted with cataracts, have the edges of the eyelids swollen and gummy, with relaxation and chronic redness of the conjunctiva. In this case, before undertaking to couch, it is advisable to apply a blister to the nape of the neck, and to keep it open for two or three weeks, by means of the savin cerate, and to insinuate, every morning and evening, between the palpebræ and globe of the eye, a small quantity of the following ointment, the strength of which is to be gradually increased: ℞. Unguenti hydrargyri nitratis ʒiv. Adipis suillæ ʒviij. Olei olivæ ℥ij. When this ointment does not produce the desired effect, an ointment recommended by Janin (*Mémoires sur l'Œil*) should be substituted: it consists of ʒss. of hog's lard, ℥ij. of prepared tutty, ℥ij. of Armenian bole, and ℥j. of the white precipitate of mercury. At first, care should be taken to use it lowered with twice or thrice its quantity of lard. In the daytime, a collyrium, composed of ʒiv. of rose-water, ʒss. of the mucilage of quince seeds, and gr v. of the sulphate of zinc, may also be frequently used with considerable advantage. By such means, the morbid secretion from the Meibomian glands, and membranous lining of the eyelids, will be checked, and the due action of the vessels and natural flexibility of the eyelids restored.—(*Saggio di Osservazioni, &c. sulle principali malattie degli occhi; Venez.* 1802.)

There are three different operations practised for the cure of cataracts, viz. one termed *couching*, or *depression*, of which the method called *reclination* is a modification, as will be hereafter explained; another named *extraction*; and a third denominated *keratonyxis*, which consists in puncturing the cornea with a needle, the point of which is to be conveyed through the pupil, so as to reach the cataract, which is to be gently broken into fragments. As Beer observes, each of these modes has, in particular cases, manifest advantages over the other two; but no single method will ever be exclusively preferred, and invariably followed, by any man of experience or judgment. In every operation for a cataract, the position of the patient, assistants, and surgeon is of great importance. In order to enable the assistant, who stands behind the patient, to be conveniently near the head of the latter, Beer prefers letting the patient sit on a stool which has no back. However, as I shall presently notice, some eminent surgeons have urged good reasons in favour of employing a chair which is completely perpendicular. When the left eye is to be operated upon, the same assistant is to apply his right hand under the patient's chin, and press the head of the latter against his breast, at the same time that he inclines it and himself more or less forwards towards the operator, who sits upon rather a high stool, in front of the patient. In this country, a music-stool is commonly preferred, the height of which can be regulated in a moment, by simply turning the seat round to the right or left, whereby the screw, with which it is connected, is made to rise or descend, as may be found most desirable. The same assistant then places his left hand flat upon the left side of the patient's forehead, with the points of the fore and middle fingers somewhat under the edge of the upper eyelid; and, with the fore-finger, he is now to raise the edge of this eyelid as much as possible, following that finger immediately with the middle one, so as to fix the eyelid with greater certainty. The ends of these fingers, however, must be so applied as not to touch the globe of the eye in the slightest manner, much less make any pressure upon it, yet so that the upper part of the eyeball and cornea may be gently resisted by them, when the eye rolls upwards away from the instrument about to be intro-

duced, whereby this position, which is extremely inconvenient to the operator, may be immediately rectified. The patient should also sit obliquely opposite a clear window, so that a sufficient light may fall obliquely upon the eyes, without any rays being reflected to the cornea, and becoming a hindrance to the operator. Nor should light from any other quarter be ever allowed to fall upon the eyes. The surgeon should sit in front of the patient, whose head ought to be directly opposite the operator's breast, whereby the latter will be enabled to see from above, with the greatest correctness, every thing in the eye during the operation, and will not be under the necessity of raising his arms too considerably. Supposing it to be the left eye which is to be operated upon, he next effectually draws down the lower eyelid with the left fore-finger, the end of which must be placed over the edge of the eyelid, towards the globe of the eye. The middle finger is then to be applied in a similar way over the caruncula lachrymalis. The operator now takes in his right hand the requisite instrument for the operation, viz. the needle or knife, which is to be held like a pen, between the thumb and the fore and middle fingers. By this particular arrangement of the fingers of the assistant and operator, which, indeed, is partly ineffectual where the fissure of the eyelids is very narrow, and the eyeball is diminutive and sunk in the orbit, the restless eye of the timid patient is fixed; for a point of the finger is disposed on every side to which the eye can possibly turn away from the instrument about to be introduced, and when the cornea is gently touched with the extremity of the finger, the wrong position which the eye is about to take is immediately prevented. This method of fixing the eye, says Beer, is not merely indispensable for young operators, but is the only perfectly unobjectionable one which can be employed on this delicate organ, since all mechanical inventions for this purpose, like the speculum oculi, which keeps the eye steady by considerable pressure, or other contrivances, like Rumpelt's instrument, which does the same thing by means of a short pointed instrument *attached* to a kind of thimble, and with which the sclerotica is pierced and held motionless, are found by experience to be worse than useless. And, as a proof of this fact, Beer adverts to the numerous patients who come out of the hands of such operators as employ these instruments, with a more or less hurtful loss of the vitreous humour, and other ill consequences; a statement which nearly agrees with the observations of Wenzel and Ware.

While the late Mr. Ware coincided with Wenzel and Beer, respecting the general objections to specula, he remarks, that in some instances of children born with cataracts, he had been obliged to fix the eye with a speculum; without the aid of which, he found it totally impracticable to make the incision through the cornea with any degree of precision or safety. His speculum was an oval ring, the longest diameter of which is about twice as long as the diameter of the cornea, and the shortest about half as long again as this tunic. Annexed to the upper rim of the speculum is a rest or shoulder, to support the upper eyelid, and by its lower rim it is fixed to a suitable handle. Beer entertained no higher opinion of other inventions, made for the purpose of enabling surgeons to operate on both eyes with the right hand; for, says he, the right eye should always be operated upon with the left hand, and the left with the right, and he who cannot learn to be equally skilful with both his hands, must always remain a bungler.—(*Lehre von den Augenkr. b.* 2, *p.* 347—350.)

Mr. Alexander, whose great skill in operations on the eye is universally acknowledged, employs no assistant for raising the upper eyelid, or fixing the eye, which objects he accomplishes himself; and in Germany, this independent mode of proceeding has been particularly commended by Barth.—(*Etwas über die Ausziehung des grauen Staare, für den geübten Operateur*, 8vo. *Wien*, 1797.)

The preceding directions, respecting the position of the assistant, the seats for the patient and surgeon, and the mode of fixing the eye, are chiefly those of Professor Beer. Whether these instructions are in every respect better than the following, which combine the sentiments of some other writers of experience, the impartial reader must judge for himself.

The patient should be seated rather low, opposite a window where the light is not vivid, and in such a manner, that the rays may fall laterally upon the eye about to be couched. The other eye, whether in a healthy or diseased state, ought always to be closed, and covered with a handkerchief, or any thing convenient for the purpose; for, so strong is the sympathy between the two organs, that the motions of the one constantly produce a disturbance of the other. The surgeon should sit upon a seat rather higher than that upon which the patient is placed; and, in order to give his hand a greater degree of steadiness in the various manœuvres of the operation, he will find it useful to place his elbow upon his knee, which must be sufficiently raised for this purpose, by a stool placed under the foot. The chair on which the patient sits ought to have a high back, against which his head may be so firmly supported, that he cannot draw it backwards during the operation. The back of the chair must not slope backwards, as that of a common one, but be quite perpendicular, in order that the patient's head may not be too distant from the surgeon's breast.—(*Richter's Anfangsgr. der Wundarzn. p.* 207, *b.* 3.)

The propriety of supporting the patient's head rather upon the back of the chair on which he sits, than upon an assistant's breast, as Bischoff has observed, is founded upon a consideration, that the least motion of the assistant, even that necessarily occasioned by respiration, causes also a synchronous motion of the part supported on his breast, which cannot fail to be disadvantageous, both in the operation of extraction and of couching. However, as this is not at present the common practice, the inconvenience of having the back of the chair between the assistant and the patient may more than counterbalance the circumstance in which it seems to be advantageous.

In certain cases, where the muscles of the eye and eyelids are incessantly affected with spasm; or where the eye is peculiarly diminutive, and sunk, as it were, in the orbit, the elevator for the upper eyelid, invented by Pellier, and approved by Scarpa, may possibly prove serviceable: in young subjects, it materially facilitates the operation.

The particular sentiments of Wenzel and Ware, concerning the mode of fixing the eye, will be farther explained in the description of the extraction of the cataract.

OF COUCHING, OR DEPRESSION OF THE CATARACT, AND RECLINATION.

The operation of couching was once supposed to consist altogether in removing the opaque lens out of the axis of vision, by means of a needle, constructed for the purpose; but it is well known to be frequently effectual on another principle, even when the nature and consistence of the cataract do not admit of the depression of the opaque body. Experience fully proves, that the diseased lens, when broken and disturbed, with the needle, and especially when freely exposed to the contact of the aqueous humour by a proper laceration of its capsule, is gradually dissolved and removed by the action of the absorbents.

Indeed, couching now means a variety of operations; for it comprehends not merely the *depression* of the cataract, not simply its *displacement* in any direction whatsoever, not only the *breaking of it piecemeal* and the *pushing of the fragments into the aqueous humour*, but likewise the *mere disturbance of the opaque body*, whereby its absorption is sometimes affected, without any kind of depression or displacement of it at all with the needle. When, therefore, the merits of couching are investigated, it is necessary to define precisely what modification of it is meant, and for what particular kind of case its application is designed; for no surgeon of the present day would confine himself exclusively to one method of operating; and, as Mr Guthrie has remarked, "In considering the advantages or disadvantages from any or all of the different operations for cataract, it is absolutely necessary to recollect, that no individual operation is applicable to every species of the disease; that each kind requires an operation for its relief or cure, sometimes of a particular nature, and differing essentially from that which is found most advantageous in another. To collect then all the objections which can be urged against any of the operations, from a consideration of every case of cataract to which it is and is not applicable, is

merely to confuse the subject, and has generally been done for the purpose of recommending some particular mode of proceeding, rather than to regulate these operations by the general principles of surgery."—(*Operative Surgery of the Eye*, p. 365.) In this respect, the doctrines of Pott, Callisen, Hey, and Scarpa are undoubtedly wrong, though their sentiments are blended with many valuable and important truths. Beer, who is by no means a great advocate for depression, admits its utility in particular cases. It is easily comprehensible, says he, that in this way a firm and large cataract either cannot be removed without injuring the reting, and the attachment of the corpus ciliare to the vitreous humour, or not far enough to prevent the opaque body from rising again at the first opportunity. Hence the former complaints about the frequent return of the cataract, and other ill consequences, unappeaseable vomiting, suddenly produced amaurosis, and severe inflammation, &c. But while Beer acknowledges the frequency of these ill effects of depression, he condemns the universal rejection of it, attempted at the present day, and the unlimited substitution for it of *reclination*, which consists in applying the needle in a certain manner to the anterior surface of the cataract, and depressing the opaque body into the vitreous humour, in such a way, that the front surface of the cataract is now the upper one, its back surface the lower one, its upper edge backwards, and its lower edge forwards; a change which, Beer says, cannot be made without an extensive destruction of the cells of the vitreous humour. Hence, with few exceptions, this author thinks the common mode of depression should be preferred.—(*Lehre von den Augenkr. b.* 2, *p.* 352.) And in this sentiment he is joined by Mr. Travers, who remarks, that the real objection to couching is the breaking up of the fine texture of the globe of the eye, by the forcible depression of the lens. "Whether it be depressed edgeways or breadthways, makes no difference in the result; it must still occupy a breach in the cells of the vitreous humour, and must derange and disorder that delicate texture and those connected with it. A slow, insidious inflammation, marked by a gradual developement of the symptoms of disorganization, viz. congestion of vessels, turbid humours, flaccid tunica, and palsied iris, is too often the consequence. The sight, instead of improving when the immediate effects of the injury are passed away, remains habitually weak and dim, or declines and fades altogether. The advocates for *reclination* seem to forget, that the principle, which is the same in both operations, is the real ground of objection. As to the position of the lens, I suspect less mischief is done by the old method of depression, as less force is required to break a space for the vertical than the horizontal lens, provided the depression be carried to no greater extent than is necessary to clear the inferior border of the pupil."—(*Synopsis of the Diseases of the Eye*, *p.* 318.)

The form of couching-needles should vary according to the object designed to be effected by the operation. The needle used by the late Mr. Hey, that recommended by Scarpa, and another employed by Beer, are the principal ones.

The length of Mr. Hey's needle is somewhat less than an inch. It would be sufficiently long if it did not exceed seven-eighths of an inch. It is round, except near the point, where it is made flat, by grinding two opposite sides. The flat part is ground gradually thinner to the extremity of the needle, which is semicircular, and ought to be made as sharp as a lancet. The flat part extends in length about an eighth of an inch, and its sides are parallel. From the part where the needle ceases to be flat, its diameter gradually increases towards the handle. The flat part is one-fortieth of an inch in diameter. The part which is nearest the handle, is one-twentieth of an inch. The handle, which is three inches and a half in length, is made of light wood, stained black. It is octagonal, and has a little ivory inlaid in the two sides which correspond with the edge of the needle.

Mr. Hey describes the recommendations of this instrument in the following terms:

1. "It is only half the length of the common needle; and this gives the operator a greater command over the motions of its point, in removing the crystalline from its bed, and tearing its capsule. It is also of some consequence that the operator should know how far the point of the needle has penetrated the globe of the eye, before he has an opportunity of seeing it through the pupil; as it ought to be brought forwards when it has reached the axis of the pupil. Now he may undoubtedly form a better judgment respecting this circumstance, when the length of his needle does not much exceed the diameter of the eye, than when he uses one of the ordinary length, which is nearly two inches. The shortness of the needle is peculiarly useful when the capsule is so opaque that the point cannot be seen through the pupil.

2. As this needle becomes gradually thicker towards the handle, it will remain fixed in that part of the sclerotis, to which the operator has pushed it, while he employs its point in depressing and removing the cataract. But the spear-shaped needle, by making a wound larger in diameter than that part of the instrument which remains in the sclerotis, becomes unsteady, and is with difficulty prevented from sliding forwards against the ciliary processes, while the operator is giving it those motions which are necessary for depressing the cataract.

On the same account the common spear-shaped needle may suffer some of the vitreous humour to escape during the operation, whereby the iris and ciliary processes would be somewhat displaced and rendered flaccid; whereas the needle which I use, making but a small aperture in the sclerotis, and filling up that aperture completely during the operation, no portion of the vitreous humour can flow out so as to render the iris and ciliary processes flaccid.

3. This needle has no projecting edges; but the spear-shaped needle, having two sharp edges, which grow gradually broader to a certain distance from its point, will be liable to wound the iris, if it be introduced too near the ciliary ligament, with its edges in a horizontal position. Besides, in whatever manner the needle be introduced, one of its sharp edges must be turned towards the iris in the act of depressing the cataract; and in the various motions which are often necessary in this operation, the ciliary processes are certainly exposed to more danger than when a needle is used which has no projecting edge.

4. It has no projecting point. In the use of the spear-shaped needle, the operator's intention is to bring its broadest part over the centre of the crystalline. In attempting to do this, there is great danger of carrying the point beyond the circumference of the crystalline, and catching hold of the ciliary processes or their investing membrane, the *membrana nigra*."

Mr. Hey asserts, that his needle will pass through the sclerotis with ease; depress a firm cataract readily, and break down the texture of one that is soft. "If the operator finds it of use to bring the point of the needle into the anterior chamber of the eye (which is often the case), he may do this with the greatest safety, for the edges of the needle will not wound the iris. In short, if the operator in the use of this needle does but attend properly to the motion of its point, he will do no avoidable injury to the eye, and this caution becomes the less embarrassing, as the point does not project beyond that part of the needle by which the depression is made, the extreme part of the needle being used for this purpose."—(*Hey.*)

Scarpa employs a very slender needle, possessing sufficient firmness to enter the eye without hazard of breaking, and having a point which is slightly curved. The curved extremity of the needle is flat upon its dorsum or convexity, sharp at its edges, and has a concavity, constructed with two oblique surfaces, forming in the middle a gentle eminence, that is continued along to the very point of the instrument; there is a mark on that side of the handle which corresponds to the convexity of the point. The surgeons of the Leeds Infirmary have had one advantage in the needle, which they have used in imitation of Baron Hilmer; I mean, having it made of no greater length than the purposes of the operation demand. A couching-needle is sufficiently long when it does not exceed, at most, an inch in length: this affords the operator a greater command over the motions of the point, and enables him to judge more accurately how far it has penetrated the globe of the eye, before he has an opportunity of seeing it through the pupil. When Scarpa's needle is preferred, it should therefore be of no greater length than the operation requires. The needle here described will penetrate the sclerotic coat as readily as any straight one of the same diameter, and by reason of its slender-

ness, will impair the internal structure of the eye less in its movements than common couching-needles. When cautiously pushed in a transverse direction, till its point has reached the upper part of the opaque lens, it becomes situated with its convexity towards the iris and its point in the opposite direction; and, upon the least pressure being made with its convex surface, it removes the cataract a little downwards, by which a space is afforded at the upper part of the pupil, between the cataract and ciliary processes, through which the instrument may be safely conveyed in front of the opaque body and its capsule, which it is prudent to lacerate in the operation. In cases of caseous, milky, and membranous cataracts, the soft pulp of the crystalline may be most readily divided and broken piecemeal by the edges of its curved extremity; and the front layer of the capsule lacerated into numerous membranous flakes, which, by turning the point of the instrument towards the pupil, may be as easily pushed through this aperture into the anterior chamber, where Scarpa finds absorption takes place more quickly than behind the pupil.

Beer, and many other skilful operators, give the preference to a straight spear-pointed needle. Scarpa's needle made quite straight is a very eligible instrument, and Beer's small spear-pointed needle, which is sold at almost every shop for surgical instruments, deserves all the reputation which it possesses.

As Mr. Travers has observed, in all cases of operation with the needle, the employment of a solution of the extract of belladonna in an equal part of distilled water, is a point of the first importance. "The space included between the eyebrow and lash should be thickly painted with the solution once, or oftener, in the twenty-four hours, and this varnish should be preserved moist for a period of half an hour, in order to admit of its absorption. The frequency of the application must be determined by its effect upon the pupil. The preternatural dilatation should not be permanently maintained; for if it be, the pupil will in all probability be misshapen," when the use of the belladonna is suspended, and the iris recovers its power.—(*Synopsis of the Diseases of the Eye*, *p.* 322.)

The couching-needle (if the curved one be used) is to be held with its convexity forwards, its point backwards, and its handle parallel to the patient's temple. The surgeon, having directed the patient to turn the eye towards the nose, is to introduce the instrument boldly through the sclerotic coat, at the distance of at least one line and a half from the margin of the cornea, for fear of injuring the ciliary processes. Most authors advise the puncture to be made at about one line, and some even at the minute distance of 1-16th of an inch (*Hey*) from the union of the cornea with the sclerotica; but as the ciliary processes ought invariably to be avoided, and there is no real cause to dread wounding the aponeurosis of the abductor muscle, as some have conceived, the propriety of puncturing the globe of the eye, at the distance of one line and a half, or two, from the margin of the cornea, as advised by Petit, Platner, Bertrandi, Beer, &c., must be sufficiently manifest.

Nor is it a matter of indifference at what height the needle is introduced, if it be desirable to avoid, as much as possible, effusion of blood in the operation. Anatomy reveals to us, that the long ciliary artery pursues its course to the iris, along the middle of the external convexity of the eyeball, between the sclerotic and choroid coats; and hence, in order to avoid this vessel, it is prudent to introduce the instrument a full line below the transverse diameter of the pupil, as Dudell, Guntz, Bertrandi, Beer, Scarpa, &c. have directed. If the couching-needle were introduced higher than the track of the long ciliary artery, it would be inconvenient for the depression of the cataract.

The exact place where the point of the needle should next be guided is, no doubt, between the cataract and ciliary processes, in front of the opaque lens and its capsule: but as I conceive the attempt to hit this delicate invisible mark borders upon impossibility, and, perhaps, in the common manner of bringing the needle from the posterior chamber to the upper edge of the lens, is never effected without injuring those processes, as Mr. Guthrie positively asserts (*Operative Surgery of the Eye*, *p.* 270), I cannot refrain from expressing my dissent to the common method of passing a couching-needle at once in front of the cataract. On the contrary, it seems safer to direct the extremity of the instrument immediately over the opaque lens, and in the first instance to depress it a little downwards, by means of the flat surface of the needle, in order to make room for the safe conveyance of the instrument between the cataract and corpus ciliare, in front of the diseased crystalline and its capsule; taking care in this latter step of the operation to keep the marked side of the handle forwards, by which means the point of the needle will be in an opposite direction to the iris, and will come into contact with the diseased body, and the membrane binding it down in the fossula of the vitreous humour. When this has been done, and the case is a firm cataract, the instrument will be visible through the pupil. Scarpa now pushes its point transversely, as near as possible the margin of the lens, on the side next the internal angle of the eye, taking strict care to keep it continually turned backwards. He then inclines the handle of the instrument towards himself, whereby its point is directed through the capsule into the substance of the opaque lens; and on making a movement of the needle, describing the segment of a circle, at the same instant inclining it downwards and backwards, he lacerates the former and conveys it in the generality of cases with the latter, deeply into the vitreous humour. Perhaps the greatest inconvenience of Scarpa's method is that likely to arise from passing the point of the needle into a firm cataract, whereby the opaque body may become fixed on the end of the instrument, and follow it when it is withdrawn, instead of remaining below the pupil. Indeed, Mr. Guthrie considers it a point of great importance in this operation never to pierce the lens, and that this rule should even be followed, "*if necessary*, at the expense of the ciliary processes," of which, he thinks, the principal utility terminates with the removal of the lens.—(*Operative Surgery of the Eye*, *p.* 271.) To me, who prefer Scarpa's manner of depressing the cataract a little in the first instance, so as to make room for the passage of the needle between it and the ciliary processes into the posterior chamber, the necessity of ever wounding those processes, for the purpose of avoiding to pierce the lens, seems hardly conceivable. At the same time, I believe, with Mr. Guthrie, that in the common practice of moving the needle from the posterior chamber to the upper part of the cataract, the ciliary processes must suffer more or less injury.

Beer, as I have explained, gives the preference to a spear-pointed straight needle, one flat surface of which, at the period of its first introduction into the eye, is turned upwards, the other downwards, one edge directed towards the nasal, the other towards the temporal canthus, and the point towards the centre of the eyeball. Beer prefers this mode of proceeding, in order to avoid moving the lens too soon out of its natural situation, whereby the subsequent manœuvres of depression or reclination, he thinks, would be rendered very uncertain and incomplete. He also recommends the surgeon to support his hand in some measure on the patient's cheek by means of the little finger, so as to have it in his power to check the too sudden and deep entrance of the instrument into the eye, liable to happen when the broadest part of the spear-point has passed through the sclerotica.—(*Lehre*, *&c. b.* 2, *p.* 354.)

It happened, unfortunately for the credit of the operation of depression, that Petit admonished surgeons to beware of wounding the anterior layer of the crystalline capsule: he had an idea, that when this caution was observed, the vitreous humour would afterward fill up the space previously occupied by the lens, and that thus the refracting powers of the eye might become as strong as in the natural state, and the necessity for using spectacles be considerably obviated. But we are now apprized, that leaving this very membrane, from which Petit anticipated such great utility, even were it practicable to leave it constantly uninjured in its natural situation, would be one of the worst inculcations that could possibly be established: for, in many cases where extraction proves fruitless, in some where depression fails, the want of success is owing to a subsequent opacity of the crystalline capsule; in short, blindness is reproduced by the secondary membranous cataract. It seems more than probable, that in some of the instances where the opaque lens has been said to have risen again, nothing more has happened than the disease in question. Therefore, notwithstanding the whole capsule in the majority of cases may be depressed with the lens out of the axis of vision, as it is not a

constant occurrence, I cannot too strongly enforce the propriety of extirpating, as it were, every source and seat of the cataract in the same operation; and in imitation of the celebrated Scarpa, who is entitled to the honour of having first pointed out the great importance of this practice, I shall presume to recommend, as a general rule in couching, always to lacerate the front layer of the capsule, whether in an opaque or transparent state.

The capsule of the lens may retain its usual transparency, while the lens itself is in an opaque state. In this case, an inexperienced operator might, from the blackness of the pupil, suppose, not only that he had removed the lens, but also the capsule from the axis of sight, and having depressed the cataract, he might unintentionally leave this membrane entire in its natural situation. Therefore, if there should be any reason for suspecting that the anterior layer of the capsule has escaped laceration; if, in other words, the resistance made to moving the convexity of the instrument forwards, towards the pupil, should give rise to such a suspicion; for the sake of removing all doubt, it is proper to communicate to the needle a gentle rotatory motion, by which its point will be turned forwards and disengaged through the transparent capsule opposite the pupil: then, by repeating a few movements downwards and backwards, it will be so freely rent with the needle, as to occasion no future trouble.

Beer divides both the operations of couching and reclination into three stages: the first is that in which the needle is introduced into the eye; the second that in which it is passed into the posterior chamber and placed across the anterior surface of the cataract; and the third that in which the depression or reclination of the cataract is accomplished.

If a straight, slender, spear-pointed needle be used, and the second stage of the operation be completed by the introduction of the extremity of the instrument into the posterior chamber (which I particularly recommended to be done in the manner directed by Scarpa), then according to the directions given by Professor Beer, when depression is indicated, the needle is to be immediately carried to the uppermost part of the cataract, with its point directed somewhat obliquely downwards; and with that surface, which, in the first instance, was applied to the front of the lens, now placed upon its superior edge; then the opaque body is to be pushed rather obliquely downwards and outwards, so far below the pupil that it can no longer be distinguished. After this has been done, the needle is to be gently raised, in order to see whether the cataract will continue depressed, and if it be found to do so, the needle is to be withdrawn in the same direction in which it was introduced.

On the other hand, says Beer, when reclination is to be practised, the needle, after being applied to the front surface of the cataract, is not to be moved farther out of the position of the second stage of the operation, but its handle is merely to be raised diagonally forwards, whereby the cataract will be pressed downwards and outwards towards the bottom of the vitreous humour, and turned in the manner already specified. Beer has delivered what appears to me one valuable piece of advice for operators on the eye with the needle: whether depression or reclination is to be done, says he, a surgeon can only use this instrument without injurious consequences on the principle of a lever; and every attempt to press with the whole length of the instrument is not only ineffectual, with respect to the progress of the operation, but so hurtful to the eye that bad effects must follow, as may be readily conceived, when it is recollected how violently the ciliary nerves must be stretched.

As for the modifications of the manœuvres rendered necessary by the varieties of cataracts, they are (says Beer) so unimportant in all cases of depression, that a young operator will easily understand them himself. But things are far otherwise in the practice of reclination; for when the case is a completely formed *capsulo-lenticular cataract*, and the opaque capsule is so thin as to be torn during the turning of the lens, the latter body will indeed be placed in the intended position at the bottom of the eye, but the capsule itself, which has merely been lacerated, must form a secondary cataract, unless the surgeon, with a sharp double-edged needle, immediately divide it in every direction, and remove it as far as possible from the pupil. When, during reclination, a *softish lens*, or one which is *pulpy* to its very nucleus, breaks into several pieces, it is necessary, in order not to have afterward a considerable secondary lenticular cataract, to put the larger fragments separately in a state of reclination, while the smaller ones may either be depressed, or (if the pupil be not too much contracted) they may be pushed into the anterior chamber, where they will soon be absorbed. *When the cataract is partially adherent to the uvea*, Beer recommends an endeavour to be first made with the edge of the needle (which is to be introduced flat between the cataract and the uvea, above or below the adhesion) to separate the adherent parts before the attempt at reclination is made. Should it be a cataract which always rises again as soon as the needle is taken from it, though the instrument has not pierced it at all, the case is termed the *elastic cataract*, in which the lens is not only firmly adherent to its own capsule, but this also to the membrana hyaloidea. Here Beer thinks that the best plan is first to carry the needle to the uppermost point of the posterior surface of the lens, and, by means of perpendicular movements of the cutting part of the instrument, to endeavour completely to loosen this preternatural adhesion of the cataract to the vitreous humour, when reclination may be tried again, and will perhaps succeed. But, says Beer, when the continual rising of the cataract is caused by the operator's running the needle into it, the instrument must either be withdrawn far enough out of the eye to let it be again properly brought into the posterior chamber, when reclination may be effectually repeated; or, if the cataract be firmly fixed on the needle at the bottom of the eye, the instrument should not be raised again, but previously to being withdrawn, it should be rotated a couple of times on its axis, whereby the pierced lens will be more easily disengaged from the needle, and at last continue depressed.—(*Lehre von den Augenkr. b.* 2, *p.* 356 358.)

In addition to Beer's directions for couching and reclination, the following observations seem to me to merit attention.

When the case is a *fluid* or *milky* cataract, the operator frequently finds, that on passing the point of the couching-needle through the anterior layer of the capsule, its white milky contents instantly flow out, and, spreading like a cloud over the two chambers of the aqueous humour, completely conceal the pupil, the iris, and the instrument from his view; who, however, ought never to be discouraged at this event. Although it seems to me most prudent to postpone the completion of operations with the needle, in the example of blood concealing the pupil, in the first step of couching, and not to renew any attempt before the aqueous humour has recovered its transparency; I am inclined to adopt this sentiment, chiefly because the species of cataract is, in this circumstance, generally unknown to the operator; consequently, he must be absolutely incapable of employing that method of couching which the peculiarities of the case may demand. Speaking of this case, however, Beer says, "the surgeon must hasten the completion of extraction or reclination, though possibly the operation may not always admit of being continued, or, if gone on with, it must be done, as it were, blindfold."—(*Lehre, &c. b.* 2, *p.* 361.) When a milky fluid blends itself with the aqueous humour, and prevents the surgeon from seeing the iris and pupil: this event is itself a source of information to him, inasmuch as it gives him a perfect insight into the nature of the cataract which he is treating; and instructs him what method of operating it is his duty to adopt. The surgeon, guided by his anatomical knowledge of the eye, should make the curved point of the needle describe the segment of a circle, from the inner towards the outer canthus, and in a direction backwards, as if he had to depress a firm cataract.—(*Scarpa.*) Thus he will succeed in lacerating, as much as is necessary, the anterior layer of the capsule, upon which, in a great measure, the perfect success of the operation depends; and, not only in the milky, but almost every other species of cataract.

The extravasation of the milky fluid in the chambers of the aqueous humour spontaneously disappears very soon after the operation, and leaves the pupil of its accustomed transparency. "In twelve cases of a dissolved lens, on which I have operated," says Latta, "the dissolution was so complete, that on entering the needle into the capsule of the lens, the whole was mixed with the aqueous humour, and all that could be done was to destroy the capsule as comptelely as possible, that all the milky matter might be evacuated. In ten of these cases, vision was almost completely re-

stored in four weeks from the operation." Mr. Pott, in treating of this circumstance, viz. the effusion of the fluid contents of the capsule into the aqueous humour, observes, that so far from being an unlucky one, and preventive of success, it proves, on the contrary, productive of all the benefit which can be derived from the most successful depression or extraction, as he has often and often seen.

When the cataract is of a *soft* or *caseous* description, the particles of which it is composed will frequently elude all efforts made with the needle to depress them, and will continue behind the pupil in the axis of vision. This has been adduced as one instance that baffles the efficacy of couching, and may really seem to the inexperienced an unfortunate circumstance. It often happens in the operation of extraction, that fragments of opaque matter are unavoidably overlooked and left behind; yet Richter confesses that such matter is frequently removed by the absorbents. Supposing a caseous cataract were not sufficiently broken and disturbed in the first operation, and that consequently the absorbents did not completely remove it, such a state might possibly require a reapplication of the instrument; but this does not generally occur, and is the worst that can happen. It is quite impossible to determine, *à priori*, what effect will result from the most trivial disturbance of a cataract; its entire absorption may, in some instances, follow, while, in others, a repetition of the operation becomes necessary for the restoration of sight. Even where the whole firm lens has reascended behind the pupil, as Latta and Hey confirm, the absorbents have superseded the necessity for couching again. The disappearance of the opaque particles of cataracts was, in all times and in all ages, a fact of such conspicuousness, that, as appears from the authority of Barbette and others, it was recorded even previously to the discovery of the system of lymphatic vessels in the body. Indeed, the modern observations of Scarpa and others so strongly corroborate the account which I have given of the vigorous action of the absorbents in the two chambers of the aqueous humour, and particularly in the anterior one, that from the moment the case is discovered to be a soft or caseous cataract, it seems quite unnecessary to make any farther attempt to depress it into the vitreous humour. Mr. Pott sometimes in this circumstance made no attempt of this kind, but contented himself with a free laceration of the capsule, and after turning the needle round and round between his finger and thumb within the body of the crystalline, left all the parts in their natural situation, where he hardly ever knew them fail of dissolving so entirely as not to leave the smallest vestige of a cataract. This eminent surgeon even practised occasionally what Beer sanctions and Scarpa so strongly recommends at this day; for he sometimes pushed the firm part of such cataracts through the pupil into the anterior chamber, where it always disappeared, without producing the least inconvenience; we must at the same time add, that he thought this method wrong, not on account of its inefficacy, but an apprehension that it would be apt to produce an irregularity of the pupil, one of the worst inconveniences attending the operation of extraction. But the deformity of the pupil after extraction seems to proceed either from an actual laceration of the iris, or a forcible distention of the pupil, by the passage of large cataracts through it, a kind of cause that would not be present in pushing the broken portions of a caseous lens into the anterior chamber. Hence, it does not seem warrantable to reject this very efficacious plan of treatment. It is well deserving of notice that Mr. Hey, who has several times seen the whole opaque nucleus and very frequently small opaque portions fall into the anterior chamber, makes this remark: "Indeed, if the cataract could, in all cases, be brought into the anterior chamber of the eye without injury to the iris, *it would be the best method of performing the operation.*" What the same author also observes, in a subsequent part of his work, is strikingly corroborative of the efficacy of Scarpa's practice. The practice of the Italian professor consists in lacerating the anterior portion of the crystalline capsule to the extent of the diameter of the pupil, in a moderately dilated state; in breaking the pappy substance of the diseased lens piecemeal; and in pushing the fragments through the pupil into the anterior chamber, where they are gradually absorbed.

One great advantage of couching insisted upon by Scarpa depends upon its generally removing the capsule at the same time with the lens, from the passage of the rays of light to the retina. Sometimes, however, this desirable event, by which the patient is extricated from the danger of a *secondary membranous cataract*, does not take place. What most frequently constitutes the secondary membranous cataract is the anterior half of the capsule, which, not having been removed, or sufficiently broken in a previous operation, continues more or less entire in its natural situation, afterward becomes opaque, and thus impedes the free transmission of the rays of light to the seat of vision. Sometimes the secondary membranous cataract presents itself beyond the pupil, in the form of membranous flakes, apparently floating in the aqueous humour and shutting up the pupil; at other times, it appears in the form of triangular membranes, with their bases affixed to the *membrana hyaloidea*, and their points directed towards the centre of the pupil. When there is only a minute membranous flake suspended in the posterior chamber, Scarpa thinks it by no means necessary for the patient to submit to another operation; vision is tolerably perfect, and in time the small particle of opaque matter will spontaneously disappear. But when the secondary membranous cataract consists of a collection of opaque fragments of the capsule, accumulated so as either in a great degree or entirely to close the pupil; or when the disease consists of the whole anterior half of the opaque capsule, neglected in a prior operation, and continuing adherent in its natural situation, it is indispensable to operate again; for although, in the first case, there may be good reason to hope that the collection of membranous fragments might in time disappear, yet it would be unjustifiable to detain the patient for weeks and months in a state of anxiety and blindness, when a safe and simple operation would restore him, in a very short space of time, to the enjoyment of this most useful of the senses. In the second case, says Scarpa, it is absolutely indispensable; for while the capsule remains adherent to its natural connexions, the opacity seldom disappears, and may even expand over a larger portion of the pupil. He advises the operation to be performed as follows: when the aperture in the iris is obstructed by a collection of membranous flakes detached from the membrana hyaloidea, the curved needle should be introduced with the usual precaution of keeping its convexity forwards, its point backwards, until arrived behind the mass of opaque matter; the surgeon is then to turn the point of the needle towards the pupil, and is to push through this opening regularly, one after another, all the opaque particles into the anterior chamber, where, as we have before noticed, absorption seems to be carried on more vigorously than behind the pupil. All endeavours to depress them into the vitreous humour Scarpa has found to be in vain; for scarcely is the couching-needle withdrawn when they all reappear at the pupil, as if (to use his own phrase) carried thither by a current: but when forced into the anterior chamber, besides being incapable of blocking up the pupil, they lie without inconvenience at the bottom of that cavity, and in a few weeks are entirely absorbed.

When the *secondary membranous cataract* consists of the whole anterior layer of the crystalline capsule, or of several portions of it connected with the membrana hyaloidea, Scarpa, after cautiously turning the point of the needle towards the pupil, pierces the opaque capsule: or, if there be any interspace, he passes the point of the instrument through it; then, having turned it again backwards, he conveys it as near as possible to the attachment of the membranous cataract, and after piercing the capsule, or each portion of it successively, and sometimes carefully rolling the handle of the instrument between his finger and thumb, so as to twist the capsule round its extremity, he thus breaks the cataract, as far as it is practicable, at every point of its circumference. The portions of membrane by this means separated from their adhesions, are next cautiously pushed, with the point of the couching-needle turned forwards, through the pupil into the anterior chamber. In these manœuvres the operator must use the utmost caution not to injure the iris and ciliary processes, for upon this circumstance depends the avoidance of bad symptoms after the operation, notwithstanding its duration may be long, and the neces-

sary movements of the needle frequently repeated. If a part of the membranous cataract be found adherent to the iris (a complication that will be indicated when, upon moving it backwards or downwards with the needle, the pupil alters its shape, and, from being circular, becomes of an oval or irregular figure), even more caution is required than in the foregoing case, so as to make repeated but delicate movements of the needle, to separate the membranous opacity without injuring the iris. Beer's mode of proceeding in such a case I have already described.

Scarpa does not deem it necessary to vary the plan of operating above explained, if occasionally the cataract be formed of the posterior layer of the capsule. And, according to this author, the same plan also succeeds in those rare instances where the substance itself of the crystalline wastes, and is almost completely absorbed, leaving the capsule opaque, and including, at most, only a small nucleus not larger than a pin's head. Scarpa terms it the *primary membranous cataract*, and describes it as being met with in children or young people under the age of twenty; as being characterized by a certain transparency and similitude to a cobweb; by a whitish opaque point either at its centre or circumference; and by a streaked and reticulated appearance: he adds, that whosoever attempts to depress such a cataract is baffled, as it reappears behind the pupil soon after the operation: he recommends breaking it freely with the curved extremity of the couching-needle, and pushing its fragments into the anterior chamber, where they are gradually absorbed in the course of about three weeks.

No other topical application is generally requisite after the operation, but a small compress of fine linen upon each eye; and the patient ought to be kept in a quiet, moderately darkened room. On the following morning a dose of some mild purgative salt, such as the sulphate of soda or magnesia, may usually be administered with advantage. I shall not enlarge upon the method of treatment when the inflammation subsequent to couching exceeds the ordinary bounds; in hypochondriacal, hysterical, and irritable constitutions this is more frequently met with, and I have already touched upon the propriety of some preparatory measures before operating upon these unfavourable subjects.

Beer remarks, that although after extraction very cautious trials of the sight are indispensable, they are by no means proper after depression or reclination; for the action of the muscles of the eye, in the inspection of objects at various distances, is very liable to make the opaque body rise again. Hence, as soon as the pupil is clear, Beer recommends covering both eyes (even when one only has been operated upon) with a plaster, and simple linen compress, which last is to be fastened on the forehead with a common bandage. The same experienced operator also enjoins perfect quietude of the body and head for some days. The patient, he says, may either lie in bed, or sit in an arm-chair, as may be most agreeable, care being taken to avoid all sudden motions. The most proper food for the patient is such as is easily digested, not too nutritious, and does not require much mastication. Every thing must be avoided which has a tendency to excite inflammation in the eye. On the third or fourth day, the eye should be opened, and afterward be merely protected by a green silk eye-screen, which should also be gradually dispensed with. The patient should be careful to do whatever is agreeable to the eye which has been operated upon, and as carefully avoid every thing which irritates it, or causes a disagreeable sensation in it, a difficulty of opening the eyelids, or keeping them open, a discharge of tears, or a redness of the white of the eye, &c.

Of the thrombus under the conjunctiva, sometimes caused by the prick of the needle, and of the readily bleeding granulations which occasionally shoot up at the puncture, I need not here particularly speak. For relieving the obstinate vomiting sometimes excited by injury of the ciliary nerves, or that of the retina, Beer recommends castor, musk, and opium, except when the eye is in a state of inflammation, in which circumstance the antiphlogistic treatment is preferable. Such vomiting, Beer joins other writers in believing, is often produced by a firm lens being depressed too far, so as to injure the retina; a case, however, which is usually combined with a suddenly produced complete or incomplete amaurosis. Here, unless the position of the lens can be changed by a sudden movement of the head, the above class of medicines will be of no use. This kind of amaurosis may also take place without any vomiting, and, as Beer has had opportunitiesof remarking, it will not always subside, even though the cataract be made to rise again. The same amaurotic affection may also result from the surgeon hurting the retina by pushing the needle too deeply against this membrane. According to Beer, the ophthalmy liable to happen in these cases, as well as after extraction and keratonyxis, is always most severe in the iris and neighbouring textures.—(*Von den Augenkr. b.* 2, *p.* 361—363.)

I cannot help remarking how judicious it is never to attempt too much at one time in any mode of couching. It happens in this, as in most other branches of operative surgery, that celerity is too often mistaken for skill: the operator should not only be slow and deliberate in achieving his purpose; he should be taught to consider, that the repetition of couching may, like the puncture of a vein, be safely and advantageously put in practice again and again; and with far greater security, than if, for the sake of appearing expeditious, or avoiding the temporary semblance of failure, a bolder use of the couching-needle should be made than the delicate structure of the eye warrants. We read, in Mr. Hey's *Practical Observations on Surgery*, that he couched one eye seven times, before perfect success was obtained: had he been less patient, and endeavoured to effect by one or two rough applications of the instrument what he achieved by seven efforts of a gentler description, it is highly probable that the structure of the eye would have been so impaired, as well as the consequent ophthalmy so violent, as to have utterly prevented the restoration of sight.

All the various methods of couching having now been described, I subjoin the sentiments of Beer, respecting the circumstances by which the choice of depression or reclination ought to be regulated. According to this author, when the cataract is very firm, or moderately so, with a scabrous surface, or the case is what has been already described under the name of *encysted cataract*, or when the cataract consists of any tough membrane, both depression and reclination can only be a palliative remedy; for, says he, none of these cataracts after the operation can be dissolved and absorbed, but must remain in the eye, as a foreign unorganized body, ready at every opportunity to rise again, and partially or completely blind the patient anew. Beer assures us, that he has carefully examined the eyes of persons after death, on whom depression or reclination had been practised, in some instances, twenty or more years previously; but in almost all the examples, the lens was found firm and undissolved, or at most only diminished, with or without its capsule. Membranous cataracts were very trivially lessened; though they had quite lost their rough consistence, and were changed into a firmish white mass. In a living person, Beer says, he saw an instance, in which a cataract rose again after it had been depressed by Hilmer thirty years previously: it was small, angular, and when the pupil was dilated, it floated from one chamber of the eye into the other. When extracted, which was done with complete success, it was found to be almost ossified. In 1805, Beer extracted from a woman, forty years of age, a very large, hard, yellowish-white lenticular cataract, which had been in the anterior chamber twenty-six years. The lens had been thus displaced by a blow received on the eye from the branch of a tree. Nor has Beer ever yet seen a case in which a cataract of a semi-firm consistence was dissolved and absorbed. —(*Von den Augenkr. b.* 2, *p.* 363.) Had Beer confined his statements to what happens to certain cataracts, on which depression or reclination, strictly so called, had been practised, I should have been disposed to accede to the general assertion, respecting the great length of time which a firm or tough capsular cataract remains in the vitreous humour undissolved and unabsorbed. But if he mean that the same thing is generally the case with cataracts broken piecemeal, and placed in the aqueous humour, we know that such a representation is contradicted by the experience of an infinite number of the highest authorities in surgery. Nay, notwithstanding the case adduced of a bony lens having remained in the aqueous humour twenty-six years, I am disposed to think that Beer himself does not intend to question the absorption of the fragments of cataracts in the aqueous humour, particularly as at *p.* 357, *b.* 2, he

sanctions pushing the fragments of semi-firm cataracts through the pupil into the anterior chamber, where, he confesses, that *they are soon absorbed.*

Beer thinks that, in general, depression and reclination are indicated only in cases in which extraction is absolutely impracticable, or attended with too great difficulty, as will be better understood when this operation is considered. As examples of this kind, Beer specifies an extensive adhesion of the iris to the cornea; a very flat cornea, and, of course, so small an anterior chamber, that an incision of proper size in the cornea cannot be made; a broad arcus senilis; an habitually contracted pupil (incapable of being artificially dilated); an eye much sunk in the orbit, with a small fissure between the eyelids; eyes affected with incessant convulsive motions; a partial adhesion of the cataract to the uvea; unappeasable timidity in the patient; and an impossibility of managing him during and after the operation, in consequence of his childhood or stupidity.

With regard to the question whether depression or reclination should be preferred, Beer is of opinion that the first method is indicated only when the dimensions of the cataract are small, and, consequently, when there is room enough for it to be placed below the pupil, without the ciliary processes being torn from the annulus ciliaris. Such cases are the *dry siliquose cataract* (the *primary membranous cataract* of Scarpa), when perfectly free from adhesions to the uvea; the true *lenticular secondary cataract*, produced by the small but firm fragments of the lens having been left, or risen again; and the genuine *secondary membranous* or *capsular cataract*. On the other hand, reclination is to be preferred, when, together with the above objections to extraction, the surgeon has to deal with a fully formed, very *hard lenticular*, or *capsulo-lenticular cataract*; or with a case of the latter kind, complicated with partial adhesions to the uvea; or when the case is a *secondary capsular cataract*, similarly circumstanced; a *secondary cataract of lymph*; a *gypsum cataract*; or there is reason to apprehend a considerable tendency in the blood-vessels of the interior of the eye to become varicose.—(*Lehre von den Augenkr. b.* 2, *p.* 365.)

The manner of operating with the needle upon the congenital cataracts of children will be hereafter explained.

EXTRACTION OF THE CATARACT.

From some passages in the works of Rhazes, Haly, and Avicenna, specified by Mr. Guthrie, it is sufficiently clear, that the practice of opening the cornea for the removal of cataracts was not unknown to the ancients. Rhazes says, that about the end of the first century, Antyllus opened the cornea, and drew the cataract out of the eye with a fine needle, in which practice he was followed by Lathyrion. However, while doubts were entertained respecting the true seat of the cataract, it is hardly to be supposed, that this mode of treatment could have been frequently adopted; but as soon as it was fully proved that the true cataract was an opacity of the crystalline lens; that the loss of sight would not be occasioned by the removal of this body; that the cornea might be divided without danger; and that the aqueous humour would be quickly regenerated; the mode of cure by extracting the cataract out of the eye would naturally present itself.—(*Wenzel.*)

Freytag is perhaps the first in modern times who made an attempt to extract the cataract: this was about the close of the 17th century. After him, Lotterius, of Turin, performed the operation. But nobody has so strong a claim as M. Daviel to the honour of bringing the merits of the practice before the public; and he not only adopted it himself, but published the first good description of it.—(*Sur une Nouvelle Méthode de guérir la Cataracte par l'Extraction du Cristallin*, 1747. *Also, Mémoires de l'Acad. Royale de Chirurgie, t.* 2, *4to.* 1753.) Two cases in which the cataract had accidentally slipped through the pupil into the anterior chamber, whence they were extracted in the years 1707 and 1708 by MM. Mery and Petit, as related by St. Ives, seem to have had considerable influence in bringing about the regular performance of this method of removing the cataract; for they served as an encouragement to Daviel, by whom the practice was completely established. The operation was afterward brought considerably nearer to perfection by the ingenuity and industry of Wenzel. —(*Brambilla, Instrumentarium Chir. Austriacum*, 1782, *p.* 71.)

Indeed, with the valuable instructions which Ware and Beer have still more recently furnished, the extraction of the cataract may now be regarded as brought to the highest state of improvement. According to Beer, it admits of division into three stages, the first of which, as in depression and reclination, is the most important, because, unless it be performed exactly as it ought to be, the operation will be very liable to fail, and it is exceedingly difficult to make amends for any fault committed in this early part of the proceedings. The first stage consists in making an effectual opening in the cornea with a suitable knife. The second, in dividing the anterior layer of the capsule, which, says Beer, should not be merely punctured, or torn with a bluntish instrument, but cut with a sharp two-edged lance-pointed needle; and, as much as possible, annihilated. In the third stage, the expulsion of the cataract from the eye is effected either by the well-regulated action of the eyeball itself, or by the assistance of art. But, as Beer remarks, they who have learned the manner of effectually and skilfully cutting the cornea, will frequently have the pleasure to find the last two stages beneficially converted into one, and the operation in general soon and expeditiously completed.—(*Von den Augenkr. b.* 2, *p.* 366.)

The knives used by Richter, Wenzel, Ware, and Beer are all of them more or less different; but they agree in the common quality of completely filling up the wound, as it is extended, so that none of the vitreous humour can escape before the division of the cornea is finished.

Wenzel's knife resembles the common lancet employed in bleeding, excepting that its blade is a little longer, and not quite so broad. Its edges are straight, and the blade is an inch and a half (eighteen lines) long, and a quarter of an inch (three lines) broad, in the widest part of it, which is at the base. From this part it gradually becomes narrower towards the point; so that this breadth of a quarter of an inch extends only to the space of about one-third of an inch from the base; and for the space of half an inch from the point, it is no more than one-eighth of an inch broad.

The knife employed by the late Mr. Ware is, in regard to its dimensions, not unlike that employed by Wenzel. The principal difference is, that Mr. Ware's knife is less spear-pointed; in consequence of which when this latter instrument has transfixed the cornea, its lower or cutting edge will sooner pass below the inferior margin of the pupil, than the knife used by Wenzel. On this account, Mr. Ware believed that the iris would be less likely to be entangled under the knife which he recommended, than under Wenzel's, when the instrument begins to cut its way downwards, and the aqueous humour is discharged. Mr. Ware particularly advises great care to be taken to let the knife increase gradually in thickness from the point to the handle; by which means, if it be conducted steadily through the cornea, it will be next to an impossibility, that any part of the aqueous humour can escape, before the section is begun downwards: and, consequently, during this time, the cornea will preserve its due convexity. But if the blade should not increase in thickness from the point; or if it be incurvated much in its back or edge, the aqueous humour will unavoidably escape before the puncture is completed; and the iris, being brought under the edge of the knife, will be in great danger of being wounded by it. But a better knife than any other which has yet been proposed, is that employed by Beer. A very ingenious double cataract-knife is used by Jaeger. "The instrument is composed of a Beer's blade affixed to a handle; a smaller blade of the same form, having its flat side in contact with the other knife; and a button screw. When not in use, the second blade is situated within the outline of the first, with which the cornea is transfixed. It is introduced in the same way as Beer's knife, not parallel, but nearly perpendicular to the cornea, and afterward carried across the eye, exactly like the single knife, with the posterior surface of the fixed blade parallel to the iris, at the usual distance from the junction of the cornea with the sclerotica. When the point of the greater knife has transfixed the cornea at the inner side, pressure is made on the button head of the smaller blade, which slides in a groove in the upper part of the handle with the thumb, with which it it pushed steadily forwards, while the greater blade keeps the ball firmly fixed, and thus the

section of the cornea is completed," &c.—(See *Loudon's Short Inquiry into the Principal Causes of the Unsuccessful Termination of Extraction*, &c. 1826.) Among the advantages imputed to Jaeger's knife are those of not injuring parts at the inner angle; of not making the incision too small for the extraction of the lens; and of less of the aqueous humour being discharged previously to the iris being out of danger. The sentiments of Richter, Scarpa, Beer, and others, about the position of the patient in the operation, and the mode of fixing the eye, have been already noticed in a foregoing section.

The operator is to sit in front of the patient, but upon a considerably higher stool or chair than the latter, as already explained, and his legs are to be placed on each side of the patient, and his right foot sufficiently raised by a stool for his elbow to rest upon his knee, while the knife is on a level with the patient's eye.—(See *Guthrie's Operative Surgery of the Eye, p.* 295.)

When the right eye is to be operated upon, and the operation is to be done according to the preceding directions, the surgeon must of course use his left hand; but if he be not an ambidexter, "the patient must be placed on his back on a table, or on a mattress, or a firm bedstead with a head, so that the operator can stand behind without inconvenience. The head being supported on a cushion, the operator raises the upper eyelid himself and fixes the eyeball, while an assistant depresses the lower lid, if necessary. The incision is then to be made with the same precaution as in the other method, the knife being held with its edges towards the thumb, and the little finger towards the temple instead of the cheek. The division of the cornea upwards in this manner is the operation generally preferred by Mr. Alexander for both eyes, when not specially contra-indicated."—(*Guthrie, p.* 318.)

Baron Wenzel, fearful of the bad consequences of undue pressure, made no endeavour to fix the eye at all at the period of cutting the cornea.

The late Mr. Ware did not approve of this plan of leaving the eye unfixed. The danger likely to arise from undue pressure, he observes, can only take place after the instrument has made an opening into the eye; but the pressure which he recommended is to be removed the instant the knife is carried through the cornea, and before any attempt is made to divide this tunic downwards. To understand this subject better, however, the reader should know, that Mr. Ware divided the incision of the cornea into two distinct processes; the first of which may be called *punctuation*, and the second *section*. So long, says Mr. Ware, as the knife fills up the aperture in which it is inserted, that is, until it has passed through both sides of the cornea, and its extremity has advanced some way beyond this tunic, the aqueous humour cannot be discharged, and pressure may be continued with safety. The punctuation of the cornea being completed, the purpose of pressure is fully answered; and if such pressure be continued when the section of the cornea begins, instead of being useful, it will be hurtful. To avoid all bad defects, Mr. Ware recommends the cornea to be cut in the following way.

The operator is to place the fore and middle fingers of the left hand upon the tunica conjunctiva, just below and a little on the inside of the cornea. At the same time, the assistant who supports the head is to apply one or, if the eye projects sufficiently, two of his fingers upon the conjunctiva, a little on the inside, above the cornea. The fingers of the operator and assistant thus opposed to each other, will fix the eye, and prevent the lids from closing. The point of the knife is to enter the outside of the cornea a little above its transverse diameter, and just before its connexion with the sclerotica. Thus introduced, it is to be pushed on slowly, but steadily, without the least intermission, and in a straight direction, with its blade parallel to the iris, so as to pierce the cornea towards the inner angle of the eye on the side opposite to that which it first entered, and till about one-third part of it is seen to emerge beyond the inner margin of the cornea. When the knife has reached so far, the punctuation is completed. The broad part of the blade is now between the cornea and the iris, and its cutting edge below the pupil, which of course is out of all danger of being wounded. As every degree of pressure must now be taken off the eyeball, the fingers both of the operator and his assistant are instantly to be removed from this part and shifted to the eyelids. These are to be kept asunder by gently pressing them against the edges of the orbit; and the eye is to be left entirely to the guidance of the knife, by which, says Mr. Ware, it may be raised, depressed, or drawn to either side, as may be found necessary. The aqueous humour being now partly, if not entirely, evacuated, and the cornea of course rendered flaccid, the edge of the blade is to be pressed slowly downwards, till it has cut its way out, and separated a little more than half the cornea from the sclerotica, following the semicircular direction marked out by the attachment of the one to the other. —(*Ware.*)

In the eyes of some persons, the iris is so convex, that it almost impossible to complete the section of the cornea without entangling the iris under the edge of the knife, unless the cornea be gently rubbed downwards with the finger; one of the most important directions, according to Mr. Ware, in Wenzel's whole book.

If the edge of the knife should incline too much forwards, and its direction be not altered, the incision in the cornea will be too small, and terminate almost opposite the pupil. In this case, there will be great difficulty in extracting the cataract, and the cicatrix afterward may obstruct sight. If, on the contrary, the edge of the instrument be inclined too much backwards, and its direction be not changed, the incision will approach too near the part where the iris and sclerotica unite, and there will be great danger of wounding them. These accidents may be prevented by gently rolling the instrument between the fingers, until the blade takes the proper direction.—(*Wenzel.*)

The late Mr. Ware had seen operators, through a fear of wounding the iris, introduce and bring out the instrument at a considerable distance before the union of the cornea and sclerotica; in consequence of which the incision from one side of the cornea to the other was made too small for the easy extraction of the cartaract, although from above downwards it was fully large enough for this purpose. Mr. Ware also sometimes observed, that though the punctuation of the cornea from side to side had been properly conducted, and its section afterward, to all appearance, effectually completed, yet, on account of the frictions employed to disengage the iris from the edge of the instrument, the knife, in cutting downwards, was carried between the layers of the cornea, and, consequently, though the incision appeared externally to be of its proper size, internally it was much too small for the cataract to be easily extracted. In this case, the incision must be enlarged by means of a pair of curved blunt-pointed scissors, which should be introduced at the part where the knife first entered the cornea.—(*Ware.*)

Beer subdivides the first stage of this operation into four, each of which, he says, claims the utmost attention, if it be wished to make the incision in the cornea in every respect proper: the first is the introduction of the knife through the cornea into the anterior chamber; the second is directing the knife towards the place where its point is to be brought out again; the third is bringing out the point and guiding the knife in continuing the incision in the cornea; and the fourth is the finishing of that incision. As Beer states, a completely well-made incision in the cornea must, in the first place, be of sufficient size to let the cataract escape from the eye without the slightest impediment; and it will be large enough, if care be taken to open one-half of the cornea near its edge. Secondly, it must be of a proper shape, its margin not being triangular, nor notched, but evenly rounded. In general, says Beer, no greater disadvantage can happen, than that of having too small an incision in the cornea; for, even when the cataract is pressed out of such an opening, portions of it are always left behind which afterward cannot be extracted without trouble; and though the sight may be at the moment restored, it will be fortunate if the eye be not afterward spoiled by the effects of inflammation. When the incision is triangular or notched, its edges cannot be put smoothly together so as to be healed by the first intention, which, however, is highly necessary, and the consequence is a white ugly scar, which is slowly produced with inflammation, and forms a greater or less permanent impediment to vision downwards, though the patient be capable of

seeing the smallest objects which are straight before him.

According to Beer, when the knife is to be introduced, its point should enter the cornea, about one-eighth of a line from its edge, and one-fourth of a line above its transverse diameter, directed obliquely towards the iris, with its edge turned downwards, by which means the point will pass immediately into the anterior chamber. As soon as it has arrived there, which is indicated partly by its bright extremity being seen within the space in question, and partly by the *tactus eruditus*, such a direction is to be given to it, that its point may project from the place of its entrance nearly in a direct line towards the intended place of its exit out of the cornea, but a little higher; while the posterior surface of the blade is to be conveyed across the anterior chamber exactly parallel to the iris. The knife is to be cautiously pushed on, neither too quickly nor too slowly, with its point continually directed somewhat upwards above the part, where it is to pass out again, until the point arrives near the inner edge of the cornea; but in the transverse passage of the knife, its edge should not be suffered either to go nearer to or farther from the iris, as every turn of the blade backwards or forwards opens the upper angle of the wound, when the aqueous humour immediately escapes, and the iris not only falls close against the posterior surface of the blade, but sometimes even under the edge, so as to throw the young operator into the greatest embarrassment. If the point of the knife has now been favourably brought out, the surgeon is to continue to push it on without pressing it downwards, or making a sawing motion with it, until the last stage of the operation, viz. that in which the incision is finished. However, as soon as the point of the knife has passed out of the cornea and reached the inner canthus, attention must be paid, first, to that part of the blade which is yet in the anterior chamber, so that the iris may not fall under its edge, and the knife may not take an erroneous direction; secondly, to the point of the knife, which continually projects more and more, so that the inner canthus may not be wounded, which accident, though trivial in itself, would make the unprepared patient suddenly and involuntarily draw back his head. The only way of preventing this injury, says Beer, is regularly to incline the handle more backwards and downwards, in proportion as the point passes farther out of the anterior chamber. Thirdly, at the period when the last piece of the cornea is to be cut, the knife should be pushed on very slowly, for otherwise the lens, and with it a part of the vitreous humour, may be discharged, as now the muscles of the eye are acting and compressing this organ with the greatest force, and, in old persons especially, the loose conjunctiva, after the cornea is cut through, comes against the knife, and is apt to be wounded. At the time when the operator finishes the incision in the cornea, the assistant is to let the upper eyelid cover the eye, and a few seconds are to be allowed for the patient to recoverfrom his fright.

In the second stage of the operation, Beer directs the assistant again steadily to hold the patient's head in the same manner as during the cutting of the cornea; but the upper eyelid, he says, must be carefully and effectually raised, without touching the eyeball in the least, or letting the ends of the fingers project beyond the edge of the tarsus. The operator is to depress the lower eyelid with his fore-finger, which is not to be removed away from the eye, but gently applied to the lower part of it with the intervention of the eyelid, by which means the cataract-lance or capsule-needle may be more readily and easily introduced under the flap of the cornea into the pupil, while the gentle pressure and the projection of the cataract thereby produced considerably enlarge the pupil, and facilitate the proper division of the capsule. In order to complete the latter object, the surgeon introduces one of the sharp edges of the capsule-needle, with the point directed towards the inner canthus, between the cornea and the iris, the wound in the former of these membranes being opened as little as possible, lest the atmospheric air enter the eye; a circumstance of which Beer entertains great apprehension. After the capsule-needle has been cautiously passed to the inferior margin of the pupil, its lower sharp edge is to be applied to the capsule of the lens with its point directly upwards, and one of its flat surfaces towards the inner, and the other towards the outer canthus. The operator is now strictly to cut through the capsule, by making, at small distances from one another, repeated perpendicular strokes with the edge of the needle. Then the handle of the instrument is to be half turned round on its axis, and similar strokes are to be made with its edge in a somewhat oblique direction, by which means the anterior layer of the capsule will be cut into many squarish fragments, some of which, in the third stage of the operation, are taken out of the eye together with the cataract, and the risk of a secondary cataract of the anterior layer of the capsule is in a great measure removed. When the capsule-needle has done its business, it is to be withdrawn from the eye in the same position in which it was introduced, and the second stage of the operation is thus finished.—(*Beer, b. 2, p. 369.*)

I believe no better instructions than the foregoing can be delivered, respectir g the most advantageous method of dividing the capsule. They are infinitely better than those given by Wenzel and Ware. As soon as the point of the cornea-knife had arrived opposite the pupil, Wenzel used to incline it gently backwards, and thus puncture the capsule; but Mr. Ware very properly objected to this plan, which, however it might serve to exhibit the dexterity of the operator, was attended with no advantage to the patient, and could not be so efficient and safe as the mode of making the division of the capsule a distinct part of the operation.

Indeed, Wenzel himself did not recommend opening the capsule of the crystalline in this way when the pupil was much contracted, and the muscles of the eye and eyelids easily thrown into convulsions, or when the posterior chamber was large.

For dividing the capsule after the division of the cornea, Wenzel and his father used to employ a flat needle, one line, that is, one-twelfth part of an inch, in diameter, having its cutting extremity a little incurvated. This needle, which they advised to be made of nealed gold, in order that its pliability may allow the operator to bend it in different directions as occasion requires, is fixed in a handle two inches and a half in length, and similar to that of the cornea-knife. At the other extremity of the same handle a small curette or scoop is fixed, made also of nealed gold, which is of use for extracting the cataract.

The late Mr. Ware's method of opening the capsule will be hereafter noticed.

When the incision in the cornea has been completed, and the capsule effectually divided, the cataract, as Beer observes, advances into the pupil immediately behind the capsule-needle, and if there be the least action in the eye itself, it is generally at once discharged. Under these very favourable circumstances, however, it sometimes happens that a portion of the gelatinous or scabrous surface of the cataract is detached at the margin of the pupil, as the opaque body is passing out, and therefore in the second stage of the operation, Beer recommends having Daviel's scoop always ready, which is to be substituted for the capsule-needle, and employed for preventing the loose fragments from falling back into the posterior chamber, in the following manner: as soon as the operator remarks that in the passage of the cataract out of the pupil, a portion of it will be scraped off by the edge of that opening, he should introduce the scoop at the lower and outer edge of the cataract upwards, between the cornea and the iris, so as to be able to keep the part of the cataract which is ready to break off, close up behind the rest of it, and bring the whole out of the eye.

But, says Beer, when the third stage of the operation, viz. the removal of the cataract from the eye, cannot be so readily accomplished; a circumstance not always owing to an imperfection in the incision in the cornea or in the division of the capsule, but sometimes proceeding from a want of proper action in the eye itself; the operator, if he feels convinced that the fault does not lie in the first or second stage of the operation (in which case it would be necessary to endeavour to rectify what is wrong), should assist in promoting the discharge of the cataract. There are two manners of doing this, and it is not a matter of indifference which is selected; for the second should be adopted only when the first will not answer. Hence, says Beer, the operator, like a skilful accoucheur, must first trust to the action of the organ itself, which he should in a certain degree excite, and not proceed immediately

to the use of a scoop, hook, or forceps. The eye is to be suffered to turn quickly a few times upwards, and in general, during these movements, the surgeon will perceive that the lower edge of the cataract advances farther through the pupil, and at length slips out of the eye without the aid of instruments. If at this period a portion of the cataract were found to be likely to break off, the employment of Daviel's scoop in the way already explained would be proper. On the other hand, if, during the protracted movements of the eye upwards, this organ evince little energy of its own, the cataract will not enter the pupil, or scarcely do so, much less pass out of the eye, and the operator is under the necessity of resorting to manual assistance, and with the end of the finger, used for keeping the lower eyelid depressed, he is gently to press the lid against the lower part of the eyeball. Such pressure should be gradually increased until the greatest diameter of the cataract has passed into the pupil, at which moment the pressure must not be discontinued before the cataract is completely out of the eye, which object may be promoted by supporting the lower part of the lens with Daviel's scoop, and then the pressure is to be diminished in the same gradual way in which it has been previously augmented. Immediately the cataract is completely out of the eye, and the surgeon has paid due attention to the removal of any fragments left behind, the assistant is to let the upper eyelid descend, the patient is to be desired to keep both his eyes shut and perfectly still, and his head and eyes are to be covered with a clean white piece of linen, so that the effect of the light may be moderated.

When the patient has recovered from the alarm, which, according to Beer, the passage of the cataract outwards, especially when it is large and firm, always produces in a greater or less degree, he is to be placed with his back towards the window, and the linen is to be raised a little from the eye, which is to be very slowly opened, while the other eye, which has not been operated upon, is to be kept well covered. Beer says that the patient should then be shown some objects, not of a shining or very bright description, at different distances; and if he is able to see them plainly, the surgeon may proceed to apply the dressings without delay.

Beer confesses, that if possible it would be better to dispense altogether with making any trials of the power of the eye which has just been operated upon, because such attempts must tend to increase the subsequent inflammation in the organ; yet he is of opinion that these trials of the eyesight are necessary after extraction of the cataract. First, because the capability of seeing immediately is a thing always expected by the patient and his friends, and leaving them in ignorance on this point would keep up an anxiety likely to have a bad effect in rendering ophthalmy more severe. Secondly, Beer urges as a stronger motive for the custom, the circumstance of the patient seeing, when his eye is first opened, all, even the smallest objects, though he suddenly loses the faculty of distinguishing them at all, or sees them very obscurely; and now, if he be half turned with his face towards the window, one will find in the pupil, which directly after the passage of the cataract was perfectly clear, some soft or firm fragments of the lens, which are first dislodged from within the capsule by the variations in the eye, produced by the inspection of different objects at different distances, and which, without these trials of vision, would be long in being loosened by the aqueous humour, and might form a secondary lenticular cataract: which will not now be the case, as the surgeon can and ought at once to remove them.—(*Lehre von den Augenkr. b.* 2, *p.* 373.)

The preceding mode of operating, as Beer observes, will not answer for every case of cataract adapted to extraction; but the plan sometimes requires to be modified according to circumstances. Thus, according to the same writer, when the eye is very prominent, and particularly when at the same time the fissure of the eyelids is extremely narrow, the incision in the cornea must not be made horizontally, but obliquely outwards; for otherwise the edge of the lower eyelid will retard the healing of the wound, and an ugly cicatrix, more or less injurious to the eyesight, be the consequence.

When the cataract is of middling consistence, neither very hard nor soft, Beer assures us that the attempt ought to be made to extract the cataract and the capsule together.—(*Methode den grauen Staar Sammt der Kapsel auszuziehen, &c. Wien*, 1799.) In such a case, he says, the experiment will mostly succeed if properly conducted, and if it should not, it causes not the slightest detriment to the eye, nor the least obstacle to the effectual completion of the operation. The capsule-needle is to be introduced into the pupil, as in the second stage of the operation, and its point is then to be slowly pushed, as far as its greatest diameter, into the centre of the lens, so that one surface of the needle may be upwards, the other downwards; one of its cutting edges turned towards the inner canthus, the other towards the outer one. And now the needle, with the impaled cataract, is to have sudden but short perpendicular jerks communicated to it, by which means the upper and lower connexions of the capsule with the neighbouring textures will be in part loosened. The needle is next to be suddenly rotated without withdrawing it from the cataract, so that one of its flat surfaces may face the inner canthus, the other the outer one; and one of its edges may be turned upwards, the other downwards; and then the short sudden jerks of the needle in the horizontal direction may be repeated, for the purpose of breaking, as much as possible, the lateral connexions of the capsule. Lastly, the capsule-needle is to be quickly withdrawn from the eye, when it is mostly followed by the lens and the capsule, or the cataract comes away fixed on the point of the instrument, at which moment the pupil becomes perfectly clear and black. When the cataract does not follow the withdrawing of the needle, the surgeon is to proceed with the usual cautions to the third stage of the operation. Great as the advantage would always be of extracting the cataract, together with its capsule, it is plain that the attempt is not practicable when the case is a very hard lenticular cataract, because the capsule-needle cannot be effectually introduced into the body of such a lens, situated upon the yielding vitreous humour. Nor would the plan answer if the cataract were very soft, as the movements of the needle in it could have no effect in breaking the connexions of the capsule. Mr. Lawrence has often expressed to me his decided opinion that the foregoing method will rarely succeed, and ought not to be attempted; which is also Mr. Guthrie's judgment.—(*Operative Surgery of the Eye*, *p.* 308.)

In the case described by Beer under the name of *encysted cataract*, the capsule must not be opened; but after properly opening the cornea, if the cataract does not escape of itself at this moment from the eye, the operator must immediately introduce the small cataract-tenaculum, with its point turned downwards, between the cornea and the iris, into the pupil. The cataract should then be firmly taken hold of with the hook, and slowly and steadily drawn out of the eye with its thick, tough capsule. Beer says, that extraction should be performed in the same way in the dry siliquose capsulo-lenticular cataract of children and adults, except that in all these cases a fine, elastic, sharp, silver or golden spatula, fixed at the lower part of Daviel's curette or scoop, should be ready at hand to assist in separating the cataract from the vitreous humour, immediately the opaque substance is disposed to pass out of the eye. Also in the completely fluid cataract, when the capsule is partially opaque and thickened, a circumstance easily known by appearances, the same mode of extraction must be attempted. But if the hook should tear its way out, and the capsule empty itself, the extraction must be performed altogether with the forceps. The latter instrument is to be cautiously introduced, in the same manner as the capsule-needle, into the pupil; one of the largest and thickest portions of the capsule is then to be taken hold of, and suddenly drawn out towards the opposite side, by which means generally the whole anterior layer, and sometimes also the posterior layer, of the capsule will be detached, and the pupil immediately cleared. On the contrary, in what Beer has called the *bar-cataract*, which, he says, is seldom fit for an operation as soon as the cornea has been opened, the bar must first be separated by means of the capsule-needle from the uvea, in whatever way is found most practicable and then it is to be extracted with the small cataract-tenaculum, or teeth-forceps: when this has been done, the cataract itself must be taken out of the eye in the same manner as the enoysted cataract.—(*B.* 2, *p.* 377.)

When extraction has been completed, the next object is to dress the eye: while the patient turns this upwards the lower eyelid is to be drawn downwards with the fore-finger, and steadily held so until the patient has shut his eye as much as possible.

Mr. Ware found that a dossil of lint, steeped in plain water, or brandy and water, and covered with the spermaceti or saturnine cerate, and removed once every day, is the most easy and convenient dressing that can be applied after the operation. The cerate over the lint prevents the latter, when impregnated with the discharge, from becoming stiff and irritating the lids. Mr. Ware thought the mode of applying the compress and bandage over the eye, a circumstance of no small importance, because if too loose the dressings are very apt to slip off, and consequently to press unequally and injuriously on the eye; and if too tight, the undue pressure will excite pain and inflammation, and even force out some of the vitreous humour. Mr. Ware's compress is made of soft linen folded two or three times, wide enough to cover both eyes, and sufficiently long to extend from the upper part of the forehead to the lower part of the nose. This he pins at the top of the patient's nightcap; and its lower part, which is divided in the middle, to allow the nose to come through it, he lays loosely over the eyes. The bandage, also made of old linen, and as broad as six fingers, he carries round the head over the compress, and pins to the side of the nightcap moderately tight. A slip of linen is afterward carried under the chin, and pinned at each end to the side of the bandage, so as to prevent it from slipping upwards.—(*Ware.*) Mr. Guthrie recommends an elastic net-work nightcap which fits the head closely to be put on, and a piece of roller to be fastened by its middle to the centre of the cap behind. "A small piece of lint, on which some ung. cetacei has been spread, is to be applied over the closed eyelids, a compress of fine linen is to be placed over it, and another over the opposite eye, when each end of the roller is to be brought forwards, made to secure the compress of its own side, and then passed over to the other."—(*Operative Surgery of the Eye*, p. 314.)

Beer recommends the patient to lie upon his back, with his head not too low, and in a chamber which is not too light, and to remain in this way at least until the wound in the cornea is closed. As during the first two days after the operation, the doubled piece of linen, which Beer places over the eye, is repeatedly wet through with the discharged aqueous humour, it is to be changed several times a day. He also enjoins the observance of every thing which has been already pointed out as proper after depression and reclination; and in particular while the wound in the cornea is not firmly healed, and the eye cannot be kept open, the patient must refrain from taking snuff and smoking tobacco. According to the same author, no thoughts should be entertained of opening the eye again till two or three days after the discharge of the aqueous humour has completely ceased; a circumstance indicated by slight prickings in the eye itself, by a burning, though not very severe pain attending the escape of that fluid from the inner canthus, and in irritable, nervous, debilitated subjects, even by the sensation of transient luminous appearances. Therefore, Beer says, the eye should seldom be opened before the fifth or sixth day. When this is first done, the light should be very moderate, and the patient placed with his back towards it, all unnecessary lateral light being kept from the eye by the linen attached to the forehead while the daily trials of the newly recovered powers of the eye should be made with the utmost caution. On the 8th, 9th, or, at latest, on the 10th day, Beer recommends leaving the eye open, but screened above by a green eye-shade, in a half-darkened chamber, and the patient is afterward to be treated, until his eye is perfectly well, according to the rules already laid down as proper to be observed after couching. And especially when the patient has had cataracts in both eyes, Beer thinks it as well to apprize him, in order to prevent unnecessary alarm, that, upon first going out into the open air, particularly in the evening, he will be for some moments almost blinded, and then begin to see again, but every object will now appear covered with a white, shining circle, which at length goes off; though, in the open air, it will sometimes continue for several days.—(*B.* 2, *p.* 380.)

A few hours after the operation, Mr. Guthrie always bleeds the patient, whether pain come on or not; and if it continue, or afterward take place, he repeats the evacuation. In another few hours, if no amendment occur, he has recourse even to a third bleeding. For the first twenty-four hours he does not wish the patient to be disturbed with purgative medicines, so as to produce any risk of the edges of the cornea being displaced; but after this period he exhibits saline aperients, and when much inflammation is expected, he prescribes calomel, combined with opiate confection; and if the inflammation continue, he gives two grains of calomel with $\frac{1}{4}$ or $\frac{1}{2}$ of a grain of opium, three or four times in the course of twenty-four hours, so as to affect the system, and prevent the bad consequences of the inflammation of the iris and internal parts of the eye.—(See *Guthrie's Operative Surgery of the Eye*, p. 315, 316.)

The late Mr. Ware published an inquiry into the causes preventing the success of extraction of the cataract.

The first which he considers is making the incision through the cornea too small. In this circumstance, a degree of violence will be required to bring the cataract through the wound; and if the cataract be not altered in its figure, the wound will be forcibly dilated, and the edge of the iris compressed between the cornea and the cataract. In this way either some of its fibres may be ruptured, or it may be otherwise so much injured as to excite a considerable degree of inflammation, and even induce in the end a closure of the pupil.

This accident may arise from the operator's cutting the cornea, without being able to see exactly the position of this membrane, in consequence of the eye having turned inwards, owing to its not being properly fixed. The fault may also proceed from the incision having been begun below the transverse diameter of the cornea. In this manner nine-sixteenths, or rather more than half, of the circumference of this membrane will not be divided; which extent the incision ought always to occupy, in order to allow the cataract to be extracted with facility.

When, however, the cornea is remarkably flat, and the iris projects unusually forwards in the anterior chamber, Mr. Ware recommends including only one-third of the cornea in the first incision, and afterward enlarging the aperture on the outer side by means of curved scissors.

Taking care to fix the eye in Mr. Ware's way is represented by this author as being of great consequence in hindering the wound in the cornea from being made too small.

Whenever the wound in the cornea is made too small, it should always be enlarged before proceeding farther in the operation; and, according to Mr. Ware, this can be best accomplished with a pair of curved blunt-pointed scissors, on the outer side of the cornea, where the knife first made its entrance.

For doing this Beer recommends the use of Daviel's scissors, which are to be introduced with their concavity towards the operator, and their point directed towards the pupil. Beer also introduces the point of the inner blade into the middle of the wound of the cornea, under the flap already made, and passes it somewhat higher than the place to which it is necessary to enlarge the incision. Then he first conveys the instrument to the inner or outer angle of the wound, where the dilatation is to be made, keeping the blade, which is within the cornea, not parallel to the iris, but in an oblique position with respect to it, for otherwise the best scissors will fail to make a clear division. The scissors also must not be opened more than is absolutely necessary, and they should be very quickly shut, and in such a manner that the outer blade ought only to move towards that within the cornea, lest the eye suffer injury. Beer says, that it is hardly ever necessary to enlarge the incision in the cornea at both its angles: and in these cases he confesses that all idea of shaping the wound altogether as it ought to be, must be renounced.—(*Lehre von den Augenkr. b.* 2, *p.* 382.) As already explained, Jaeger uses a double knife, with which it is alleged the incision in the cornea may always be made of due size.—(See *Loudon's Short Inquiry, &c.* 1826.)

Wounding the iris with the cornea-knife is the second accident which Mr. Ware considers. The principal cause seems to him to be a discharge of the aqueous humour before the knife has passed through the cornea low enough to hinder the lower part of the iris, which

forms the inferior rim of the pupil, from getting beneath the edge of the instrument. According to Mr. Ware, the escape of the aqueous humour may be owing to some inaccuracy in the shape of the knife, or unsteadiness in introducing it. The falling of the lower part of the iris under the edge of the knife, Mr. Ware believes, cannot always be prevented by the utmost skill or precaution of the operator. Happily, however, says he, we have been taught that the iris may be reinstated after it has been thus displaced, and without suffering any injury, by making gentle frictions on the cornea with the point of the finger.

By unsteadiness in passing the knife, Mr. Ware means, that the knife may not only be suffered to make a punctuation through this tunic, but that its edge may at the same time be unintentionally pressed downwards, so as to make an incision likewise; in consequence of which downward motion of the knife, an aperture must unavoidably be left in the cornea, through which the aqueous humour will escape. If the cornea-knife increase through its whole length, both in width and thickness, and if it be merely pushed through the cornea, no space will be left through which any fluid can escape.

According to Beer, the escape of the aqueous humour, as the knife passes across the anterior chamber, may happen with or without any fault on the part of the operator, and the iris fall not merely against the posterior surface of the knife, but even project under its edge and over its back. When this happens, Beer joins Ware in recommending the end of the middle finger, situated at the inner canthus, to be gently pressed without delay upon that part of the cornea which is in front of the knife, and, at the moment when this is done, the iris will recede from the edge of the instrument, and the operator, by being very quick, may proceed again without any risk of injuring that part of the eye. But if the iris should be found to project again above and below the knife immediately the point of the finger is removed from the cornea, such removal should not be made, and the knife be boldly pushed on until its point pierces the other side of the cornea; or, if the point has already passed some way out of the cornea towards the inner canthus, the blade is to be pushed on so far that no protrusion of the iris is possible. For, says Beer, while the finger continues to make gentle pressure upon the cornea, the iris will not fall under the knife. Should the eye chance to withdraw itself from the knife, after this has penetrated the anterior chamber, a circumstance which may easily happen in restless, timid patients, the greater part or the whole of the aqueous humour is immediately discharged, and the iris comes in contact with the empty cornea. In this case, Beer says, that the operator should find out the wound with another knife, and with a wriggling motion of the instrument, conduct it between the iris and the cornea, twisting and turning the point about until it has successfully passed beyond the external, then beyond the inner pupillary margin of the iris, and has finally come out of the cornea again. Now the incision in the cornea may be properly finished, in doing which it is always necessary to keep the middle finger applied to this membrane, in consequence of the disposition of the iris to fall against the knife. Beer mentions it as a curious fact, that most of the patients who are restless and unmanageable at the first introduction of the knife, and who themselves cause that disagreeable occurrence now spoken of, are, on the contrary, very quiet during the foregoing manœuvres.—(*Lehre von den Augenkr. b.* 2, *p.* 381.)

The third accident noticed by Mr. Ware is the escape of the vitreous humour. The common cause of this occurrence is the undue application of pressure. It may take place, either when the incision is made through the cornea, or at the time of extracting the cataract. Some eyes are subject to spasm, which renders them much more liable to this accident. To prevent it, Mr. Ware recommends every kind and degree of pressure to be taken from the eye, before the knife has completely cut its way through the cornea. And as soon as the knife has proceeded sufficiently low to secure the iris from being wounded the operator should not only take heed, that his own fingers do not touch the eye, but should also direct the assistant, who supports the upper lid, to remove his fingers entirely from this part. The assistant seldom need make any pressure on the globe of the eye; however, when there is room for one of his fingers to be placed on the inner and upper part of the globe, without interfering with those of the operator, the method may be followed in order to make the eye still more fixed. But immediately the *punctuation* of the cornea is completed, the assistant's finger should always be entirely removed both from the eyelids and eye itself.

Notwithstanding the upper lid is left thus free, there will be sufficient space between it and the lower lid to allow the progress of the knife to be seen; and, in finishing the wound, the operator should depress the lower lid with great gentleness.

With Jaeger's double knife, the risks arising from a very early escape of the aqueous humour are said to be avoided.

The vitreous humour may also be lost in consequence of opening the capsule of the lens nearer the circumference than the centre of the pupil. As the crystalline is both thinner and softer at that part, the instrument will be liable to pass through both sides of the capsule, and enter the vitreous humour. This humour, having no longer any barrier to its escape, is liable to be forced out by the action of the eyelids alone; and when pressure is afterward made, to bring the cataract through, a much greater quantity will be lost, and the cataract, instead of coming forwards, will recede from the pupil. The only way to extract it now is, by letting the upper lid be gently raised by an assistant (a rare instance, in which this is necessary after cutting the cornea), while the operator, either with the fore-finger of the left hand, or with the blunt end of the curette, applied beneath the incision in the cornea, prevents the cataract from sinking farther. Then with his right hand let him introduce a hook under the flap of the cornea, and with its point carefully entangle the cataract and bring it away.

To prevent, however, such difficulties, Mr. Ware never attempted to puncture the capsule, until the whole pupil was in view. He was in the habit of opening the capsule with a gold-pointed needle, arched towards its extremity. Wenzel's needle for this purpose was flat in its extremity; Mr. Ware's pointed; and this is their only difference. The latter introduced his instrument under the flap of the cornea, with its arched part uppermost, until its point was on a level with the centre of the pupil. The end of the instrument was then turned inwards, and gently rubbed on the capsule of the crystalline until it pierced it. In a few instances Mr. Ware found the capsule so tough, that the point of the gold needle would not enter it, and he was obliged to use a sharp steel instrument of the same shape as that with a gold point. As already explained, Beer was much bolder with the capsule than Ware, and there can be little doubt, that both his capsule-needle and mode of using it are better than those of Wenzel and Ware.

The vitreous humour may also be lost at the time of extracting the cataract, and the usual cause is an undue application of pressure. All violent pressure is quite unnecessary for forcing out the cataract, when the wound in the cornea is sufficiently large. When the wound is too small, it should be enlarged as above directed. If pressure be continued at all after the cataract is extracted, the capsule of the vitreous humour will certainly be ruptured, and some of this part of the eye protrude. Pressure may even rupture the capsule of the vitreous humour, before the cataract is brought through the incision in the cornea; the same consequences will ensue, and the same practice be necessary, as in the case in which the operator has unskilfully opened the capsule of the vitreous humour with the needle in attempting to open that of the lens.

In taking away fragments of opaque matter from the pupil by means of the curette, great care is requisite to avoid wounding the posterior part of the capsule of the crystalline with the end of the instrument, so as to open a way for the escape of the vitreous humour.

The vitreous humour may, indeed, be forced out, after the extraction of the cataract, merely by a spasmodic action of the eyelids. On this subject, Mr. Ware, after hinting his suspicion, that in a case of this kind, which he saw, the assistant's keeping up the lid contributed to the event, repeats his advice, "that after the cornea has been cut, the upper eyelid should be raised solely by the fingers of the left hand of the operator."

Mr. Ware seems to think, that more evil has resulted from the operator's being deterred, by the readiness with which the vitreous humour continues to start out, from ascertaining that all the fragments of the cataract are

removed, and that the whole of the iris has resumed its position, than from the mere loss of the vitreous humour which is quickly regenerated.

When a portion of the vitreous humour protrudes, Beer thinks that the safest practice is not to meddle with it, though he owns that in this circumstance the wound heals slowly, and is always followed by a more or less perceptible whitish scar, the pupil being generally drawn towards it, and deformed, while the iris and the partly-emptied membrana hyaloidea become adherent to the edges of the incision in the cornea. But, says Beer, the eyesight will be but little or not at all impaired, notwithstanding one-eighth or one-fourth of the vitreous humour may be lost. However, he observes, that when one-third or half of it has escaped, a good degree of vision afterward cannot be expected; and when more than half has been lost, the operation will have a still less successful result. He states also, that when two-thirds have been lost, though the eye may recover its natural form, the pupillary edge of the iris will remain contracted round the empty, light-gray membrana hyaloidea, which projects into the anterior chamber, consequently, the pupil will be closed, and that state of the iris ensue, which is aptly termed a *sinking of the pupil*, *subsidentia pupillæ*, or *synizesis*.

Mr. Ware notices the accident of extracting only a part of the cataract, and leaving the remainder behind. He is an advocate for removing all opaque substances from the pupil, except an extreme degree of irritability, to which some eyes are subject, should render the introduction of every sort of instrument, after the cataract is extracted, difficult and dangerous. Mr. Ware usually removed opaque portions of the cataract by means of a curette; and occasionally, when the opaque substance was large, and adherent to the capsule, he was obliged to extract it with small forceps. Before finishing the operation, Mr. Ware approves of always rubbing the end of the finger gently on the forepart of the eye over the eyelids; which proceeding tends to bring into view any opaque matter, which may previously lie behind the iris. Mr. Ware relates a case, proving that such opacities as cannot be removed in the operation are capable of being absorbed.

When, notwithstanding the observance of the directions laid down by Beer, as explained in the previous columns, some of the pultaceous or scabrous surface of the cataract is detached, and continues behind in the posterior chamber, Beer says, that it ought to be immediately removed, lest the patient be left with a secondary lenticular cataract, which, he observes, is not always so certain of being dissolved and absorbed as some imagine. The fragments may be removed in two ways; and first, the experiment of rubbing the upper eyelid over the eye should be made, because it not unfrequently brings the remains, especially when they are gelatinous, completely through the pupil, and out of the incision in the cornea. But if such manœuvre should not be effectual, Beer recommends cautiously introducing Daviel's curette to the outer pupillary edge of the iris, with its concavity towards the inner surface of the flap of the cornea, without raising this flap unnecessarily high, and then the operator is to endeavour to scoop out at once as much of the opaque matter as he can, and bring it to the inner surface of the cornea. He says, that it will rarely be necessary frequently to repeat the introduction of the curette.—(*B.* 2, *p.* 387.)

According to Mr. Ware, an opacity of the capsule can be the only reason for removing it. The anterior part, he says, can alone become the object of the operator's attention; its posterior part is necessarily hidden, while the cataract remains in the eye, and afterward, if discovered to be opaque, it is so closely connected with the capsule of the vitreous humour, that Mr. Ware believes it cannot be removed by any instrument, without hazarding a destructive effusion of this humour.

When, however, the opaque lens is accompanied with an opacity in the front part of the capsule, the late Mr. Ware recommended the following plan. After cutting the cornea, as usual, a fine-pointed instrument, somewhat smaller in size than a round couching-needle, and a little bent towards the point, should be introduced under the flap of the cornea, with its bent part upwards, until its point is parallel with the aperture of the pupil. The point should then be turned towards the opaque capsule, which is to be punctured by it in a circular direction, as near to the rim of the pupil as the instrument can be applied without hurting the iris. Sometimes the part included within the punctures may be extracted on the point of the instrument; and if this cannot be done, it should be removed with a small pair of forceps. The lens, whether opaque or transparent, should next be extracted, by making a slight pressure with the curette, either above or below the circumference of the cornea.

On the preceding subject Beer remarks, that when none of the lens itself is left behind, but there is a slight degree of opacity in the anterior layer of the capsule, easily distinguishable from the cut flakes, and producing the least obstacle to vision, the opaque membrane should be taken away with the forceps, in the manner described in the preceding pages; for, otherwise, a secondary capsular cataract will follow, which will become of a snow-white colour, and if only a trivial degree of iritis takes place after the operation, it will become adherent to the iris, and the pupil become contracted and disfigured.—(*B.* 2, *p.* 388.)

Beer does not agree with Ware in condemning all attempts to remove the posterior layer of the capsule, when found opaque, after the extraction of the lens. The case, he says, is indicated by the light-gray speckled appearance of the whole pupil, and by the patient seeing nothing at all, or objects only indistinctly in a thick mist. Beer advises a cataract-tenaculum to be passed into the pupil, in the same way as the capsule-needle is introduced in the second stage of extraction, directing its point downwards as it enters, and upwards when it is brought out again. After it has entered the pupil, it is to be made to divide and annihilate, by repeated turns of the tenaculum, the back layer of the capsule, and also the membrana hyaloidea directly behind it, which, in such a case, is always adherent and opaque. Of these membranes a considerable part, closely wound round the hook, may be taken out of the eye, though never without some slight loss of the vitreous humour. In cases of this kind, the patient ought to be informed, that though his sight will be restored, a part of the cataract must be left, and will be visible behind the pupil, particularly when it is dilated; for otherwise suspicions may arise, that the operation has been badly done, and a relapse apprehended.—(*B.* 2, *p.* 388.)

The late Mr. Ware published some remarks on the bad consequences of allowing foreign bodies of any kind, after the operation, to press unequally on the globe of the eye; comprehending under this head, the intervention of the edge of the lower eyelid between the sides of the divided cornea; the inversion of the edge of the lower eyelid; and the lodgement of one or more loose eyelashes on the globe of the eye.

To prevent the first accident, every operator, before applying the dressings, should carefully depress the lower eyelid; and before he suffers it to rise again, should take care that the flap of the cornea be accurately adjusted in its proper position; and that the upper lid be dropped, so as completely to cover it. After this, the eyelids should not be opened again for three or four days, that is, until there is a good reason to suppose the wound in the cornea closed.

The inversion of the lower eyelid is hurtful, in consequence of its making the eye-lashes rub against the eye. These should be extracted the day before the operation. For the mode of effecting a permanent cure, see *Trichiasis*.

Besides the danger to which the eye is exposed from the inversion of the edge of the lid, the eye may receive injury from the improper position of the eye-lashes alone; one or more of which, during the operation, may happen to bend inwards, or, becoming loose, may afterward insinuate themselves between the inside of the lid and the eye. An eyelash bent inwards should be rectified; if broken off and loose, it should be removed.

Lastly, Mr. Ware considers prematurely exposing the eye to a strong light. He censures the plan of opening the eyelids within the first two or three days after the operation, because the stimulus of the light increases the ophthalmy, and the method is apt to disturb the wound in the cornea before it is closed. Mr. Ware, however, wishes it not to be inferred, that he is an advocate for long confinement after the operation. His mode is to keep the patient wholly in bed, and to direct him to move his head as little as possible, for the first three days after the operation. During this time, a dossil of wet lint is kept on his eyes, covered

with a saturnine plaster, compress, and bandage, as already described. The dressing is renewed once every day, and the outsides of the eyelids washed with warm water in winter and cold in summer. At each time of dressing, the skin of the lower lid is drawn gently down, to prevent any tendency to an inversion. Animal food is prohibited, and the patient enjoined not to talk much. On the fourth day he is permitted to sit up for two or three hours, and if he has had no stool since the operation, a mild opening medicine is now administered. On the fifth, the time of his getting up is lengthened, and presuming that the wound in the cornea is now closed, Mr. Ware usually examines the state of the eye. After this, no dressing need be applied in the daytime, care being taken to defend it from a strong light by a pasteboard hood or shade, and by darkening the room, so that no inconvenience is felt. The patient may now also look for a short time at large objects. The following part of the treatment need interfere very little with the wishes of the patient, unless unexpected accidents occur.—(*Ware.*)

As Beer observes, if the patient be very restless, make frequent attempts to open his eyes in the least, and partly lie upon the eye, or if in changing the compresses the greatest caution be not used, the eye will perhaps be roughly pressed upon, and the iris protrude between the displaced and half-opened edges of the incision in the cornea, to which it will become adherent during a slow and seldom very violent inflammation. From the moment when the iris thus interposes itself between the sides of the wound, the aqueous humour begins to collect, and at length pushes the iris considerably forwards. In this case, Beer recommends carefully opening the eye in a very moderate light, and adopting the expedients formerly mentioned, for the purpose of making the iris recede. The dressings should be reapplied, and the eye kept closed and very quiet for at least eight or ten days, so as to hinder a recurrence of this disagreeable accident. But if the iris should be already adherent to the edges of the wound in the cornea, the eye incapable of bearing light, and the aqueous humour more or less accumulated in the anterior chamber, Beer says, every thing must be left to time, while the eye is kept lightly covered for about a fortnight, and the existing inflammation properly treated. Then, if the protrusion, or staphyloma of the iris should not be diminished by the means calculated for lessening the inflammation, caustic or the knife must be employed.—(*Beer, b.* 2, *p.* 391.) The same causes which have been above specified, as conducive to a protrusion of the iris, may also produce a discharge of the vitreous humour.

The following observations by Beer are interesting: when the dressings have been unskilfully applied; when the incision in the cornea has been made horizontally upon a large prominent eye; when the fissure of the eyelids is exceedingly narrow; or the patient is restless; a proper cicatrization of the wound in the cornea may not follow. Though the aqueous humour may collect in the anterior chamber, the partially united lamellæ of the cornea may be incapable of duly resisting the distention of that fluid, and consequently protrude in the form of a light-gray, semi-transparent, oval vesicle, extending nearly the whole length of the wound in the cornea, and being most prominent in the centre. The patient complains of an annoying sense of pressure in the eye, as in cases of protrusion of the iris; but the discharge of the aqueous humour has completely stopped, and therefore the anterior chamber presents its natural appearance, and the pupil its regular round shape, though the edges of the wound in the cornea are whitish and swollen. This case was formerly regarded as a prolapsus of the membrane of the aqueous humour; but Beer considers it as a sort of hernia of the cornea, termed *ceratocele*. Merely puncturing or cutting away the cyst is of no service; for though the aqueous humour immediately flows out, the wound soon closes again and the tumour reappears, attended also with some risk of the iris falling into the cyst, and becoming adherent to it. Effectual relief cannot be obtained, unless the tumour be removed, with Daviel's scissors, as close as possible to the wound; the dressings skilfully arranged; and the eye kept closed and quiet for eight days or a fortnight. In such a case, a whitish scar is always permanently left.—(*Beer, b.* 2, *p.* 393.)

Beer observes, that when the pupil contracts very considerably after the incision in the cornea is made, and the cataract at the same time remains at some distance from the uvea, too small an opening has generally been made, and it ought to be enlarged. But if the cataract cannot be forced though the pupil without making pressure on the lower part of the eyeball, and the closure of the pupil should still continue, the circumstance proceeds from the loss of the aqueous humour, and the second stage of extraction must be deferred a little while, until the pupil dilates again, and the operation must then be finished in a very moderate light.—(Also *Guthrie's Operative Surgery of the Eye, p.* 305.)

When, in the second stage of the operation, the anterior layer of the capsule has been properly divided, and yet the cataract will not pass into the pupil, though the eye itself acts with energy, Beer says, that it is indispensably necessary to make pressure upon the lower part of the eyeball, as already advised, and to continue it either until the cataract with its lowermost edge effectually projects through the pupil and out of the eye, or until it is moved so far directly upwards (without entering the pupil) that its lower margin is brought into view, and quite a black semilunar interspace is seen between it and the inferior pupillary edge of the iris. At this moment the operator, without increasing the pressure of the finger on the eyeball, lest the vitreous humour burst, and a great part of it be lost, and without lessening the pressure, lest the cataract sink back into the eye, should introduce Daviel's curette into the above interspace, with its hollow surface applied against the back surface of the cataract, which is to be gently pushed out of the eye. In doing this, Beer owns that a small part of the vitreous humour is almost always lost, but the quantity is not at all comparable to what is lost when the hyaloid membrane gives way before Daviel's curette is introduced, which can then only be passed into the eye through the protruded vitreous humour for the purpose of pushing out the cataract.

Beer notices the occasional protrusion of the iris, in the third stage of the operation, more or less between the edges of the incision in the cornea, immediately after the exit of the cataract. Here, says Beer, the iris should be reduced without the least delay, and the pupil, which is completely oval, made round again; a thing which the operator may easily perform, by applying his hand flat upon the patient's forehead, letting the latter shut his eye, rubbing the upper eyelid quickly yet gently with the thumb, and then suddenly opening the eye, by which means a moderate light will at once strike it, and produce an expansion of the iris.

In all patients who have been operated upon for cataracts, the edges of the eyelids become glued together with mucus on the first night after the operation; yet, according to Beer, in individuals particularly subject to copious secretions of mucus, it is not unusual for the puncta lachrymalia and lachrymal ducts to be blocked up with thickened mucus, whereby the tears are prevented from duly passing down into the nose, so that from time to time they are discharged from the inner angle of the eye, and collect under the eyelids. In this case, the patient soon begins to complain of a violent, continual, and increasing sense of pressure on the eye, and the upper eyelid swells, unattended with any redness. Irritable persons also experience a stupifying dull headache. These inconveniences may be immediately removed by clearing away the mucus with a little lukewarm milk from the inner canthus, and letting a stream of clean water fall over the cheek. Care must also be taken to hinder a recurrence of the circumstance, and to remove it if it should happen.

The inflammation consequent to extraction chiefly affects the iris and neighbouring textures. Beer refers its origin principally to the entrance of air into the interior of the eye; which, owing to the size of the wound, he says, is not entirely to be prevented. But another cause is the introduction of different instruments into the eye; and hence the inflammation is generally severe when it has been necessary to remove fragments of the cataract with Daviel's curette, or to take away the capsule with forceps, or destroy it with the tenaculum-needle. However, Beer is of opinion, that a surgeon who knows how to operate well in every mode, will not find the inflammation, under these circumstances, more violent after extraction than other methods; and therefore he thinks that when no con-

siderable impediment exists, it should be preferred. Beer, who considers extraction as a radical mode of removing a cataract, thinks, that when there are no great and insurmountable obstacles to its performance, and the operator can execute it as well as all other methods, and with the requisite skill, it ought to be preferred. But when he is deficient in skill, he is himself the greatest impediment to the success of the operation. The particular cases in which the methods of depression and reclination are indicated, have been already specified, and in these, of course, extraction is not advantageous. There are also some examples, as Beer remarks, in which the latter operation must be hazardous for a beginner, and therefore, in respect to such an operator, by no means eligible, as in cases of *bar-cataract* and *capsulo-lenticular cataracts with a cyst of purulent matter*.—(*Beer, b.* 2, *p.* 396.)

OF KERATONYXIS.

Gleize, having commenced an operation by extraction, was prevented from completing it by a sudden movement of the patient's head: instead of enlarging the opening in the cornea with scissors, he introduced a needle through it, and depressed the lens. This case led to the invention of the new method of operating by *keratonyxis*, as it is now termed, a description of which Gleize published in 1786. Gleize's method was simplified by Conradi, who merely opened the cornea and capsule of the lens with a lance-shaped knife, and left the removal of the cataract to be effected by the absorbents. Several improvements were subsequently made in this method by Dr. H. Buchhorn, who first gave it the name of *Keratonyxis* (see *this word*), and adopted the practice of dividing the lens, as well as the capsule, and of bringing the fragments forwards into the anterior chamber. About the same time Mr. Saunders, in England, perfected a similar operation, and applied it particularly to congenital cataracts.—(See *Guthrie's Operative Surgery of the Eye*, *p.* 331, 332.)

This operation requires the pupil to be first artificially dilated. The belladonna (says Mr. Guthrie) should be applied the day before, and on the morning of the operation, in order that the pupil may be completely dilated, and a few drops of a solution, in the proportion of five grains of the extract to a drachm of water, should be dropped into the eye half an hour before its commencement, so as to prevent a contraction of the pupil during the operation.—(*Op. cit. p.* 333.) Keratonyxis admits of being divided into two stages; first the introduction of the needle through the cornea and pupil as far as the cataract; and secondly, the breaking of the lens to pieces, and the division and laceration of its capsule. For these purposes Beer prefers a common, straight, spear-shaped, sharp-edged couching-needle to any curved one, however fine it may be made; first, because it pierces the cornea with greater facility; secondly, because both a soft cataract and the capsule can be more effectually cut with it, a larger opening being made, through which the aqueous humour may flow over the fragments of the lens, and the dissolution of the cataract be thus rendered more certain; whereas, with a curved needle, Beer says, the lens can only be disturbed and the capsule torn, under which circumstances inflammation and a secondary capsular cataract are likely to be produced. He directs the instrument to be introduced either at the lower or at the external part of the cornea, one line and a half from its margin, the point being directed obliquely towards the pupil, and the capsule is to be effectually cut by moving the extremity of the needle laterally in various ways; and, above all things, it is necessary at the time of breaking the lens piecemeal, not to let the instrument continue always within this body, but at every stroke to lift it completely out of the lens and capsule, and then introduce it into them again in different directions.

Dr. Jacob prefers, for the performance of this operation, a fine sewing-needle curved at the point. He says, that it rarely or never leaves the slightest mark in the cornea. "The capsule can be opened to any extent; a soft or friable lens can be actually broken up into a pulp, by pushing the curved extremity of the needle into its centre, and revolving the handle between the fingers; large fragments can be taken up on the point of the needle from the anterior chamber, and forced back out of the way of the iris; or, if sufficiently soft, may be divided by pressing them against the back of the cornea with the convexity of the needle," &c.—(See *Dublin Hospital Reports*, *vol.* 4, *p.* 224.)

As Beer observes, keratonyxis must soon have been found as little adapted to all cataracts as any other mode; for otherwise the suggestion would not have been made to practise *reclination* through the cornea. To this form of reclination, however, Beer adduces great objections; for he says that in this manner either the cataract cannot be properly turned if the iris be duly spared, but it will continue to lie obliquely, being always quite evident below the pupil, and very apt to rise again from the slightest cause; or it is indeed depressed far enough towards the bottom of the eye, but however much the pupil may be artificially dilated, the pupillary edge of the iris is more or less injured, especially at the convexity of the curved needle. In addition to these considerations, Beer urges against this method all the objections which apply to the practice of reclination through the sclerotica.

After the lens and capsule have been effectually cut in pieces, the same light mode of dressing and the same after-treatment are proper, which are adopted in cases of depression and reclination. Beer also particularly objects to any trials being immediately made of the eyesight. At the same time he assures us, that he has not met with any of the instances so frequently mentioned in books, of persons on whom keratonyxis has been done, seeing perfectly well, and having quite a clear pupil in a few days: under the most favourable circumstances, several weeks, and sometimes as many months elapsed before the pupil became quite transparent.

According to Beer, keratonyxis is not liable to many accidents. Sometimes, says he, the artificially dilated pupil contracts as soon as the needle has pierced the cornea and reached the cataract: in this circumstance the operator must wait quietly, until the pupil gradually expands again, a change which may be promoted by screening the eye with the hand. If the operation were to be continued without delay, either the pupillary edge of the iris would be seriously and dangerously hurt by the needle, or the cataract could not be effectually divided. When, contrary to expectation, the nucleus of the cataract is too hard to be broken piecemeal, reclination and depression should be done through the cornea, as well as circumstances will allow, and these objects can be more easily effected with a part than with the whole of the lens. When the lens is found completely fluid, but the capsule opaque only at some points, Beer, with the view of preventing a secondary capsular cataract, recommends cutting the membrane in all directions, and annihilating it as much as possible. Keratonyxis may be followed by the same evils which occasionally take place after depression and reclination, and which will require similar treatment. But, according to Beer's experience, one of the most frequent consequences is a secondary capsular cataract, which often ensues even though the pupil was quite clear at the time of the operation; and though it may not quite blind the patient, it considerably lessens his power of vision, and renders the operation very incomplete.

When the sole object of keratonyxis is to break and cut the cataract and its capsule piecemeal, and the fragments are to be left to dissolve and be absorbed, the operation can be indicated only where this division, breaking, dissolution, and absorption of the cataract can be successfully wrought. Hence Beer sets down the method as not calculated for firm, hard, lenticular cataracts; nor for those which are softish and scabrous only upon their surface; and he says that it is not suited for capsulo-lenticular cataracts, nor for any cases termed false cataracts, which are of a membranous nature. Keratonyxis, he observes, may be expected to answer only in fluid or gelatinous cataracts, when the capsule is either little or not at all opaque and thickened, and of course can be easily opened and cut to pieces, as in the case described under the name of encysted cataract. For the above reasons, the method is well adapted for children and young subjects, in whom the origin and general complications of a cataract involve the case in suspicious circumstances.

After keratonyxis, the dilatation of the pupil should be kept up by means of belladonna until all symptoms of inflammation have subsided.—(See *Guthrie's Operative Surgery of the Eye*, *p.* 336.)

Langenbeck, who has practised keratonyxis to a con-

siderable extent, and uses the curved, two-edged, lancet-shaped needle, thinks extraction preferable to it only when the whole cataract can be brought out at once by means of gentle pressure on the eye, and with the aid of Daviel's curette, as in the case of a firm cataract; while he represents keratonyxis as most advantageous where, by the manœuvre of opening the capsule, the mass of the cataract would be so divided by the instrument as not to admit of being extracted altogether; but would require the use of a scoop, forceps, or hook for bringing out the fragments, as in examples of soft, milky, and capsular cataracts. Langenbeck also urges, as a reason against extracting soft cataracts, their greater size, whereby in their passage through the pupil in an entire state, they may injure the iris.—(*Neue Bibliothek für die Chir. b.* 1, *p.* 461.) Valuable information on keratonyxis has been published by the same author in the 4th vol. of his first *Bibliothek*; in the 1st vol. of his new *Bibl. p.* 1, *&c.* 1815; and in a tract entitled, "*Prüfung der Keratonyxis, einer Methode den grauen Staar durch die Hornhaut zu recliniren, oder zuzurstuckeln nebst erläuternden Operations geschichten, Göttingen*, 1811. See also *Conradi, in Arnemann's Magazin, b.* 1, *p.* 95, 1791. *Gleize, Nouvelles Obs. Pratiques sur les Maladies de l'Œil, p.* 118, 1812. *G. H. Buchhorn's Diss. de Keratonyxide, Halæ*, 1806. *Die Keratonyxis, &c.* 1811.

[The several operations enumerated by Mr. Cooper for the removal of this disease have all found strenuous advocates in this country. That no one operation is adapted to every kind of cataract is admitted by all experienced oculists; and the refinement of the art consists in distinguishing each from the other. I have known very many erroneous decisions made by gentlemen of great skill and experience, in their diagnosis of cataract; and after the operation was commenced, the true character of the cataract was ascertained to be very different from what had before been supposed. This liability to error arises from the very imperfect descriptions given of the characteristics of each kind of cataract, and yet, imperfect as they are, they are too often presented as infallible.

It will not be found easy to decide in all cases with absolute certainty whether the cataract be hard, soft, caseous, or fluid, nor to assert positively whether the opacity is in the capsule or the body of the crystalline lens, by merely looking into the eye; nor should any decision be made in any case until the pupil is fully dilated by the belladonna, stramonium, or some similar agent; for this will be found greatly to facilitate the diagnosis.

The operation most frequently performed in this country, is that of passing the needle of Adams, Scarpa, Saunders, or Hey through the sclerotic, immediately behind the iris, and then lacerating the capsule or the lens itself, and permitting the aqueous humour to act upon it, either by pressing the fragments of the lens through the pupil into the anterior chamber, or, where this is impracticable, by suffering the lacerated membrane or fragments to remain *in situ*, which will often be found sufficient.

One of the most successful operators in this country is Doct. John Harper, of Baltimore, and he seldom adopts any other operation than this, which he repeats as often as necessary on the same eye. When the opacity is in the anterior portion of the capsule, which is frequently the case, a single operation of this kind will succeed. I have often witnessed the satisfactory results of this method in his practice and in my own. Inone instance I performed it on both eyes at once, on the person of a young lady, and to promote absorption kept her on the use of the blue pill; and in three weeks her vision was restored, although she had been blind twelve years.

The operation of keratonyxis is now very often performed, and is well spoken of by many surgeons, who think it adapted to more kinds of cataract than any other. Some, however, after passing the needle through the cornea, have the tactus eruditus to bring forward the lens into the anterior chamber, and thus accomplish the same object as by the posterior operation.

Couching or depression has now but few advocates among us, although, from its simplicity and the facility of its performance, it was formerly very generally practised in America. The frequent instances of amaurosis by injury of the retina, and the return of the lens to the axis of the eye after its depression, have brought it into disrepute.

The operation of extraction is not often preferred, even for hard cataract, whether from any real or supposed difficulty in its performance, as insinuated by its advocates, I am not prepared to decide. If, however, the lens be first brought into the anterior chamber, the difficulty will be annihilated, and very often absorption will render the latter operation unnecessary if the former be premised. I know this fact from my own experience, as well as from the observation of other surgeons.

When the cataract exists only in one eye, the propriety of an operation is not only questionable, but should never be admitted. I have a valuable friend, a clergyman, in this city, who has had an entire opacity, situated in the capsule of one lens, for many years, while the other eye has always possessed an uncommon acuteness of vision. And I once knew the operation of extraction attempted by an European surgeon, in the city of Baltimore, on a man who had one sound eye, and by some mishap iritis came on, and this attempt to cure one eye has resulted in the loss of both, and he is totally blind to this day. One such occurrence in a century should prevent the repetition of so hazardous an experiment.

When, however there is a well-formed cataract on one eye, and another begins to form on the other eye, then the operation should not be delayed on the eye first diseased; and in very many cases the cataract in its forming state will be removed by the operation on its fellow. This I have seen in several instances, and is one of the most satisfactory results which can follow in this department of operative surgery.—*Reese.*]

OF THE CONGENITAL CATARACT, AND OPERATING UPON CHILDREN.

I shall not stop here to inquire whether the expression *congenital cataract* is generally used with strict propriety; but it is worth noticing, that the term is reprobated by Beer as being in general incorrectly applied.

So much has been already said in a preceding section of this article, concerning the propriety and striking advantages of operating for the cataracts of children, that to expatiate farther upon this point would be a mere waste of time.

We have noticed the case which Scarpa terms the *primary membranous cataract*, and which is mentioned by that distinguished professor as being met with in children, or young people under the age of twenty, the substance of the crystalline itself being almost entirely absorbed, while the capsule is left in an opaque state, including at most only a small nucleus, not larger than a pin's head. This disease is described by Scarpa as exceedingly rare, and characterized by a certain transparency, and similitude to a cobweb: by a whitish opaque point, either at its centre or circumference; and by a streaked and reticulated appearance. Now this example, which is represented by Scarpa as being rare, appears, from the experience of Mr. Saunders, to be by no means uncommon, since, at the London Infirmary for diseases of the eye, it was found that the majority of congenital cataracts were capsular or membranous. This last statement is also at variance with that of the late Mr. Gibson, who has asserted, that in infants the cataract is generally fluid.—(*Edin. Med. and Surgical Journal, vol.* 7, *p.* 397.) Mr. Ware also asserts, that in children born with cataracts the crystalline humour has generally, if not always, been found either in a soft or fluid state.—(*Obs. on the Cataract and Gutta Serena, vol.* 2, *p.* 380.) We learn from Mr. Saunders's publication, that in the congenital cataract, after the crystalline lens is converted into an opaque substance, it is gradually absorbed; and in proportion to the progress of absorption the anterior lamella of the capsule approaches the posterior, until they form one membrane, which is white, opaque, and very elastic. This process is commonly completed long before the eighth year, and the operator will now find a substance which he will in vain endeavour either to extract or depress. But there is one form of the congenital cataract in which the absorption of the lens does not proceed, viz. when the centre of the crystalline is opaque, and its circumference is perfectly transparent. Should the capsule and lens be penetrated, however, with any instrument, the opacity soon be-

comes complete, and from this moment the substance of the lens begins to be absorbed.

The experience of Mr. Saunders proves, that in the congenital cataract, the lens may be either solid, soft, or fluid, but that more frequently it is partially or completely absorbed, and the cataract is capsular.

The circumstance of Mr. Gibson's never having met with a simple membranous cataract in an infant, a fact so much at variance with Mr. Saunders's account, is conceived by Mr. Guthrie to admit of satisfactory explanation by the inference, that Mr. Gibson, in Manchester, probably saw all the children there with congenital cataract soon after they were born, and before the absorption of the lens had proceeded far; while a great number of Mr. Saunders's congenital cases were brought to him in London from distant places, and not seen by him till the children were older, and the disease had made greater progress.—(*Operative Surgery of the Eye*, p. 359.) Indeed, Mr. Gibson states himself, that simple membranous cataracts are by no means uncommon at the age of eight or ten, as well as in adults who have been born blind.—(See *Edin. Med. and Surg. Jour. vol.* 8, *p.* 399.)

The following table of forty-four cases is given in Mr. Saunders's work, for the purpose of showing in what proportion each species of cataract has been found to prevail in congenital cases.

Solid opaque lens, with or without opacity of the capsule. Three single, two double cataracts....	5
Solid lens, opaque in the centre, transparent in the circumference, with capsule in the same state. Five double.....	5
Soft opaque lens, with or without opacity of the capsule. Two single, two double.....	4
Soft opaque lens, with solid nucleus. One single, two double.....	3
Soft opaque lens, with dotted capsule, the spots white, the spaces transparent. Two double.....	2
Fluid cataract, with opacity of the capsule. Two single	2
Fluid cataract, with opacity of the capsule, and closed pupil. Two double.....	2
Opaque and thickened capsule, the lens being completely absorbed, or the remains of it being thin and squamose. Six single, twelve double.....	18
Opaque and thickened capsule, with only a very small nucleus of the lens unabsorbed in the centre. Two single.....	2
Opaque and thickened capsule in the centre, remains of the lens in the circumference. One double...	1

Here the corresponding character of congenital cataracts in the eyes of each individual is exhibited by the number of double cases, and we are informed that the same character was preserved in the cataracts of several children of the same family.—(*Saunders on Diseases of the Eye, edit. by Dr. Farre, p.* 135, 136.)

The congenital cataract appears frequently to afflict several children of the same parents. In the course of the present article, I have already had occasion to advert to two striking examples of this fact. The first is related by Mr. Lucas, who attended five children of a clergyman at Leaven, near Beverley, all born with cataracts.—(See *Med. Obs. and Inquiries, vol.* 6.) The second is mentioned by Mr. Gibson, who, some years ago, saw five or six children, the families of two sisters, who were all totally blind, and in an idiotic state, having cataracts accompanied with amaurosis.—(*Edin. Med. and Surgical Journal, vol.* 8, *p.* 398.) Several instances occurred to the late Mr. Saunders. In one family, two brothers were thus afflicted. In a second family, two brothers, twins, became blind with cataracts at the age of twenty-one months, each within a few days of the other. It is remarkable, that the four cataracts had precisely the same character. In a third family, a brother and two sisters were born with this disease. The eldest sister was affected with it only in one eye, the brother and youngest sister in both eyes. In a fourth family, three brothers and a sister had all congenital cataracts.—(*Saunders on the Diseases of the Eye, p.* 134, 135.)

Children with congenital cataracts possess various degrees of vision; but when they are totally blind, their eyes not being attracted by external objects, volition is not exercised over the muscles of these organs, which roll about with an irregular, rapid, and trembling motion.

I shall now proceed to speak of the manner of operating upon children. Until the time of Mr. Pott, the intention of surgeons, in couching or depressing the cataract (as indeed the expression itself implies), was to push the opaque crystalline downwards, away from the pupil. Mr. Pott, conscious that the cataract often existed in a fluid or soft state, was aware that it could not then be depressed; and therefore, in such cases, he recommended using the couching-needle for the express purpose of breaking down the cataract, and of making a large aperture in the capsule, so that the aqueous humour, which he believed to be a solvent for the opaque crystalline, might come into immediate contact with this body. This operation, subsequently to Mr. Pott, has been strongly and ably recommended by Mr. Hey, of Leeds, and Professor Scarpa, of Pavia. In the cases of children, it even received the approbation of the late Mr. Ware.—(*On the Operation of Puncturing the Capsule of the Crystalline Humour, p.* 9.)

But, notwithstanding the utility and efficacy of lacerating the front layer of the crystalline capsule had been so much insisted upon by Scarpa and others, their observations were confined to the cataract in the adult subject, and, before the example set by the late Mr. Saunders, no one (excepting, perhaps, Mr. Gibson of Manchester) ventured to apply, as a regular and successful practice, such an operation to the eyes of infants and children. Indeed, it seems highly probable that even Mr. Gibson himself would have remained silent upon the subject, had not his attention been roused by the reports of the London Institution for curing diseases of the eye, which reports, he says, were dispersed and exhibited in the public news-rooms of Manchester. For the creation and perfection of this beneficial practice, therefore, I am disposed to give the memory of Mr. Saunders great honour. The propriety of operating for the cataracts of children had long ago been insisted upon by a few writers, and the attempt even now and then made; but the method never gained any ground, until Mr. Saunders led the way.

It only remains for me to describe the plans of operating, as executed by Mr. Saunders, Mr. Gibson, and Mr. Ware.

The principle on which Mr. Saunders proceeded in his operations on the congenital cataract, was founded on the opinion, that the only obstacle to the absorption of the opaque lens is the capsule; and that, as the latter also is most generally opaque, "the business of art is to effect a permanent aperture in the centre of this membrane. This applies to every case of congenital cataract which can occur." Mr. Saunders used to overcome the difficulty of operating upon children, by fixing the eyeball with Pellier's elevator, having the patient held by four or five assistants, dilating the pupil with belladonna, and employing a very slender needle, armed with a cutting edge from its shoulders to its point, and furnished with a very sharp point, calculated to penetrate with the utmost facility.

Before the operation, the extract of belladonna, diluted with water to the consistence of cream, is to be dropped into the eye, or, to avoid irritation, the extract itself may be smeared in considerable quantity over the eyelid and brow. In less than an hour, if there be no adhesions, it produces a full dilatation of the pupil, exposing to view nearly the whole anterior surface of the cataract. The application should then be washed from the appendages of the eye.

In using the needle, Mr. Saunders most carefully abstained from doing any injury to the vitreous humour, or its capsule, and it was an essential point with him to avoid displacing the lens. In directing the extremity of the instrument to the centre of the capsule, he passed it either through the cornea, near the edge of this membrane (the operation now called *keratonyxis*), or through the sclerotica, a little way behind the iris. By the first, which is called the *anterior* operation, Mr. Saunders conceived that less injury would be inflicted, and less irritation excited, than by introducing the needle behind the iris, through all the tunics of the eye. In every case, the first thing aimed at was the permanent destruction of the central portion of the capsule to an extent equal to that of the natural size of the pupil. If the capsule contained an opaque lens, Mr. Saunders used next to sink the needle gently into the body of the crystalline, and moderately open its texture; cautiously observing not to move the lens at all out of its natural situation.

When the case was a fluid cataract, Mr. Saunders was content in the first operation with simply lacerating the centre of the capsule, being desirous of avoiding to increase the irritation following the diffusion of the matter of the cataract in the aqueous humour.

When the cataract was entirely capsular, Mr. Saunders acted with rather more freedom, as he entertained in this case less fear of inflammation: but in other respects, he proceeded with the same objects in view which have been already related, and of which the principal consisted in effecting a permanent aperture in the centre of the capsule, without detaching this membrane at its circumference; for then the pupil would have been more or less covered by it, and the operation imperfect, "because this thickened capsule is never absorbed, and the pendulous flap is incapable of presenting a sufficient resistance to the needle to admit of being removed by a second operation."—(*P.* 145.)

I have already explained, that Mr. Saunders found that the greatest success attended the operation between the ages of eighteen months and four years. One operation frequently accomplished a cure; as many as five were seldom requisite.

The only particularity in Mr. Saunders's treatment of the eye after the operation, was that of applying the belladonna externally, for the purpose of making the pupil remain dilated, till the inflammation had ceased, so as to keep the edge of the iris from contracting adhesions with the margin of the torn capsule. This last practice is found to be so important, that it is never neglected by any good operator of the present day. In leaving this part of the subject, I must advise every surgeon to read the interesting account of Mr. Saunders's practice, published by his friend and colleague, Dr. Farre. Many minute particulars will be found in this work, highly worthy of the practitioner's attention and imitation.

Mr. Gibson appears to have been unacquainted with the usefulness of the extract of belladonna in preparing the eye for the operation. A few hours before operating, he was in the habit of ordering an opiate, sufficient to produce a considerable degree of drowsiness, so that the infant generally allowed its eyelids to be opened and properly secured without resistance, and was little inclined to offer any impediment to the introduction of the couching-needle; but, on the contrary, presented the sclerotica to view, naturally turning up the white of its eye. If the infant was more than a year old, and whenever it was necessary, Mr. Gibson used to introduce its body and arms into a kind of sack, open at both ends, and furnished with strings to draw round the neck, and tie sufficiently tight round the legs, so that its hands were effectually secured, and the assistants had only to steady its body, and fix its head, while the child was laid on a table, upon a pillow. Mr. Gibson never found it necessary to use a speculum, having uniformly experienced that, after the couching-needle was introduced, he had no difficulty in commanding the eye, aided by a slight degree of pressure upon the eyeball with the index and middle fingers of his left hand, which were employed in depressing the lower eyelid. He admits, however, that the speculum can easily be applied, if an operator prefer it. He generally used Scarpa's needle, because, in infants, the free rupture of the capsule of the lens ought commonly to be aimed at, in order that the milky cataract may escape, and mix with the aqueous humour; or, if the cataract be soft, that the aqueous humour may be freely admitted to its pulpy substance which has been previously broken down with the needle. He thinks that no peculiarity is necessary in depressing the hard cataract of infants. Before Scarpa's needle was known in this country, Mr. Gibson used Mr. Hey's, which was generally effectual, and, as he conceives, possesses the recommendation of being less liable to have its points entangled in the iris. He says, that when a milky cataract has been thus evacuated, it renders the aqueous humour turbid; but that within the space of two days, the eye generally acquires its natural transparency, and vision commences. When the capsule and substance of the soft cataract have been broken down, and the aqueous humour has come into contact with the lens, the solution and disappearance of the cataract, in all the cases upon which Mr. Gibson has operated have uniformly taken place in a short time. —(See *Edin. Med. and Surgical Journal*, *vol.* 8, *p.* 398, 399.)

For the purpose of fixing the eye, Mr. Ware considered Pellier's elevator requisite in operating upon infants. When the patient, however, had advanced beyond the age of infancy, Mr. Ware sometimes fixed the eye by means of the fingers alone. For the purpose of puncturing the capsule, and breaking down the cataract, this gentleman gave the preference to an instrument which resembles one recommended by Cheselden, for the purpose of making an artificial pupil; but it is somewhat narrower. Its blade, indeed, is so narrow, that it nearly resembles a needle. Its extremity is pointed, and it cuts on one side for the space of about the eighth of an inch, the other side being blunt. It is perfectly straight, is an inch long in the blade, and forms a complete wedge through its whole length. Upon one side of the handle is a coloured spot; by attending to which, the operator may always ascertain the position of the instrument in the eye.

Mr. Ware dilated the pupil with the extractum belladonnæ, softened with a little water, and applied about half an hour before the time of operating. He believed that, in operating upon infants, the surgeon might perform the operation with more composure, if the patient were laid upon a table, with the head properly raised on a pillow. The bent end of Pellier's elevator should be introduced under the upper eyelid, and the instrument committed to the care of an assistant. If the right eye is to undergo the operation, and the surgeon operate with his right hand, he must of course sit or stand behind the patient; and, in this case, he will himself manage the speculum with his left hand. The eye being thus fixed, Mr. Ware passed the point of the narrow-bladed knife above mentioned through the sclerotica, on the side next to the temple, about the eighth of an inch from the union of that membrane to the cornea, the blunt edge being turned downwards. The instrument was pushed forwards in the same direction, until its point had nearly reached the centre of the crystalline. The point was then brought forwards, until it had passed through the opaque crystalline and its capsule, and was plainly visible in the anterior chamber. If the cataract was fluid, and the anterior chamber became immediately filled with the opaque matter, Mr. Ware deemed it advisable to withdraw the instrument, and defer farther measures until the matter was absorbed, which absorption usually took place in the course of a few days, and sometimes of a few hours. If no visible change were produced in the pupil, the point and cutting edge of the instrument were applied in different directions, so as to divide both the opaque crystalline and its capsule into small portions, and, if possible, bring them forwards into the anterior chamber. This may require the instrument to be kept in the eye for a minute or two; but if the operator preserve his steadiness, he may continue it there a much longer time, without doing the least injury to the iris, or to any other part. If the cataract be found of a firm consistence (though this rarely happens in young persons), it may be advisable to depress it below the pupil; and in such a case, particular care should be taken to perforate largely the posterior part of the capsule, and to withdraw the instrument immediately after the cataract has been depressed, in order to hinder it from rising again. If the opacity be in the capsule, the instrument will not act so easily upon it as it does on the opaque crystalline; but, notwithstanding this, the capsule, as well as the crystalline, may be divided by it into larger or smaller portions, which, when thus divided, will be softened by the action of the aqueous humour; and though in the first operation on such a case, says Mr. Ware, it may not be possible to remove the opacity, yet, on the second or third attempt, the divided portions may be brought forwards into the anterior chamber, in which place they will then be gradually absorbed, and soon disappear. After the operation, Mr. Ware seldom found it necessary to take away blood from children or persons under the age of twenty. He continued a cooling antiphlogistic treatment a few days. After this, if any opaque matter remained, he expedited its absorption by dropping a small portion of powdered sugar into the eye once or twice a day. When, at the end of a week or ten days, the inflammation was over, and the pupil obstructed with opaque matter, Mr. Ware advised a repetition of the operation. After a similar interval, the operation, he says, may be requisite again. In most cases, Mr. Ware was obliged to operate twice; in a few instances, once proved suffi-

cient; and only in three, out of the last twenty, did he find it necessary to operate a fourth time.—(*On the Operation of puncturing the Capsule of the Crystalline Humour.*)

I think any impartial man, who considers the practice of the three preceding operators, will find great cause to admire the superior gentleness and skill which predominate in the operations of the late Mr. Saunders. For my own part, I am so fully convinced of the mischief which has been done to the eyes by the rash boldness, awkwardness, and unsteadiness of numerous operators, that it appears to me the inculcation of gentleness and forbearance, in all operations for the cataract, is the bounden duty of every man who has occasion to write upon the subject. Great manual skill and invariable gentleness, indeed, seem to me to have had more share in rendering Mr. Saunders's operations successful, than any particularity either in his method or his instrument. I have no hesitation in declaring my own partiality to the principles on which his practice was founded, and my belief that they are well calculated to improve most materially this interesting branch of surgery. In conclusion, I shall mention Mr. Guthrie's general opinion respecting the kinds of operation suited for the three classes of cataracts, into which he arranges them for the consideration of this important point. The *hard* admit only of extraction or displacement; the *soft* seldom of displacement or of extraction, but usually of division; the *capsular* neither of displacement, extraction, nor division, purely considered as such, but by laceration, and removal of the opaque body from the axis of vision by different operations, which, although they may partake of the nature of all, are yet not precisely either. All intermediate states of disease, such, for instance, as the caseous and fluid cataracts, admit of some slight deviations from these rules, but are still regulated by the same principles.—(*Operative Surgery of the Eye*, p. 365.)

With respect to extraction, also, it deserves careful recollection, that it is a method, which, though the cataract may be of a hard consistency, is often prohibited by various unfavourable circumstances, which I have taken notice of in the foregoing pages. Consult *P. Brisseau, Nouvelles Obs. sur la Cataracte, proposées à l'Acad. des Sciences*, 1705. *Tournay*, 1706. *Ant. Maitre-Jan, Traité des Maladies de l'Œil*, 4to. *Paris*, 1707. *Charles de St. Ives, Nouveau Traité des Maladies des Yeux*, 12mo. *Paris*, 1722. *J. H. Freytag, De Cataracta, Argent.* 1721. *A. Petit, Lettre, dans laquelle il démontre que le Crystallin est fort près de l'Uvée, et rapporte de nouvelles Preuves, qui concernent l'Operation de la Cataracte.*—(*Haller, Disp. Chir.* 5, 570.) *L. Heister, De Cataracta, &c. tract. Alt.* 1713; *Vindiciæ de Cataracta, &c. Alt.* 1713; *and Apologia et uberior Illustratio Systematis sui de Cataracta, Glaucomate, et Amaurosi*, 12mo. *Altorf.* 1717. *Pott's Remarks on the Cataract, vol.* 3 *of his Chirurgical Works. Daviel, Sur une Nouvelle Méthode de Guérir la Cataracte par l'Extraction du Crystallin*, 1747; *and in Mém. de l'Acad. de Chirurgie, t.* 5, *p.* 369, *édit.* 12mo. *A. Bischoff, A Treatise on the Extraction of the Cataract*, 8vo. *Lond.* 1793. *Wenzel's Treatise on the Cataract, by Ware*, 8vo. *Lond.* 1791. *W. H. J. Buchhorn, Die Keratonyxis, Eine neue gefahrlosere Methode den grauen Staar zu operiren, &c.* 8vo. *Halæ Magd.* 1811. *Richter's Treatise on the Extraction of the Cataract, transl.* 8vo. *Lond.* 1791; *and Anfangsgr. der Wundarzneykunst, b.* 3. *Jon. Wathen, A Diss. on the Theory and Cure of the Cataract, in which the Practice of Extraction is supported, &c.* 8vo. 1785. *Ph. F. Walther, Abhandlungen, &c. Landshut*, 1810. *Also in Quarterly Journ. of Foreign Med. 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CATHETER. (From καθίημι, to thrust into.) A tube which is introduced through the urethra into the bladder, for the purpose of drawing off the urine.—(See *Urine, Retention of.*) Of course there are two kinds of catheters; one intended for the male, the other for the female urethra. With respect to catheters, three things are to be considered: 1st, the instrument itself; 2d, the manner of introducing it; and 3d, the conduct to be pursued after its introduction.

Catheters were anciently composed of copper; Celsus knew of no other kind. As these, however, had the inconvenience of becoming incrusted with verdigris, they at length fell into disuse, and others, made of silver, were substituted for them. This change, which was made as early as the time of the Arabian practitioners, still receives the approbation of the best modern surgeons. The common catheter is a silver tube, of such a diameter as will allow it to be introduced with ease into the urethra, and of various figures and lengths, according as it is intended for the young or adult, the male or female subject. For an adult female subject it should be about six inches long, and for young girls, four or five. For men, the length ought to be from ten inches and a half to eleven inches. But as the instrument need not enter far into the bladder, Mr. John Bell's advice to avoid too great a length merits observance.—(*Principles of Surgery, vol.* 2, *p.* 193.) As the urethra in some instances is narrow, and in others wide, surgeons should be furnished with catheters of different diameters. The choice of the instrument, with respect to its width, is likewise determined very much by the nature of the disease of the urethra.—(*Langenbeck, Bibl. b.* 1, *p.* 1177.) For a woman, the diameter ought to be at least two lines; and for girls, a line and a half. For male adult subjects, Desault recommends the thickness of two lines and one-third; and for boys, that of a line and a half. In general, whenever the urethra is pervious, it is better to follow the advice of Desault, and employ a largish catheter, which will enter the passage more easily, and not be entangled in the folds of the membranous lining of the canal, while it will afford a more ready outlet for the urine. On the other hand, a small catheter

should be preferred when there are obstructions in the passage. Catheters also differ in shape: those which Desault used for male subjects had only a slight curvature of one-third of their length: a curvature which began insensibly from their straight part, and was continued to the very end of their beaks. The curvature was also regular, so as to form the segment of a circle of six French inches in diameter. Amussat recommends the use of straight catheters, which are passed as far as the pubes, while the penis is drawn upwards, which is then brought down between the thighs, so as to lessen the bend of the urethra. One advantage imputed to a straight catheter is, that it may be rotated between the surgeon's fingers, whereby the chance of its surmounting any obstacle will be increased.—(*Archives Gén. de Méd. t.* 4. *Also, P. Ecot, Diss. du Catherisme exercée avec la Sonde droite, Strasb.* 1825, 4*to.*) As the course of the healthy urethra in the male subject is regular, the caprice evinced by surgeons in the different curvatures of their catheters, cannot be founded on any correct anatomical principles, and the bend of the instrument (at least for subjects of the same age and stature) should generally not vary at all, but be strictly adapted, as Langenbeck remarks, to the natural track of the urethra.—(*Bibl.* 1, *p.* 1177.) The female catheter, however, has only a slight curvature towards its beak; a shape adapted to the direction of the meatus urinarius. Desault also improved silver catheters, by causing them to be made with elliptical openings, or eyes, at the sides of the beak, with rounded edges, instead of the longitudinal slits previously in use, in which the lining of the urethra was frequently entangled, pinched, and lacerated, so that acute pain and profuse hemorrhage were the consequences. With the view of preventing these evils, he also filled up the openings with lard.—(See *Œuvres Chir. de Desault, t.* 3, *p.* 118.)

Besides silver or inflexible catheters, surgeons now frequently employ flexible ones made of elastic gum. These last, indeed, are of so much importance, that they may be said to constitute one of the greatest improvements in modern surgery. I shall not here inquire whether they were first invented by Theden, Pickel of Wurzburg, or Bernard of Paris: this is a point which the Germans and French must settle themselves. Imperfect attempts had been made by others at earlier periods to invent catheters possessing the property of flexibility. Van Helmont proposed the use of catheters made of horn; but this substance was found to be too stiff, and to be very quickly coated with depositions from the urine. Fabricius ab Aquapendente employed leather catheters, which were objectionable, inasmuch as they were soon softened by the urine and mucus of the urethra, when they shrivelled and became impervious. Other flexible catheters were also formerly tried, composed of spiral springs of silver wire, covered with the skins of particular animals. These last, however, were very quickly spoiled by putrefaction; and when left in the urethra any considerable time, the beak sometimes entirely separated from the rest of the instrument, and was left behind in the bladder.

The elastic-gum catheters now in use are liable to none of the preceding inconveniences; they are formed of silk tubes, woven for the purpose, and covered with a coat of elastic gum; they are sufficiently flexible to accommodate themselves to the different curvatures of the urethra; they are not softened by the urine; and they constantly remain with their cavity unobliterated. Their smooth and polished surface makes them continue a long while free from incrustations deposited from the urine. Sometimes they are introduced with a stilet or wire, which is passed into their canal, in order to give them a certain curvature, and a greater degree of firmness: but in general it is withdrawn as soon as the tube is in the bladder.

Elastic catheters are less irritating to the urethra, and less apt to become covered with calculous incrustations than silver tubes: they can also be frequently introduced when a metallic one will not pass.

The selection of good bougies and catheters, especially in operations upon the male subject, is a business of the first-rate importance, for by employing such as are disposed to break, "many a practitioner has doomed his patient to years of dreadful and perhaps hopeless suffering, and brought down irreparable disgrace upon his own head."—(*Med. Chir. Journ. vol.* 5, *p.* 75.) M. Nicod, in performing the operation of lithotomy upon a male, found the stone, which was very brittle, one inch and a half long, and eight or nine lines thick, traversed in the direction of its greater diameter, by a piece of elastic gum catheter, which had acted as a nucleus for the deposition of calcareous matter.—(See *Obs. sur le danger d'employer de mauvaises sondes de gomme élastique; Journ. de Médecine, par Leroux, Oct.* 1816.)

Formerly, the best elastic catheters used to be fabricated at Paris; but such as are now made in London are in some respects better than French, being generally much smoother and more regular, though I believe our smallest size is not yet so small as theirs. The gum catheters made at Paris are of twelve different sizes, which correspond to twelve holes in a plate of brass. "Each catheter, therefore (says a late intelligent visiter to that capital), has its size designated by its number, which greatly facilitates the ascertaining of the progress of the case towards a cure. Numbers 1 and 2 are smaller than can be procured in England, and are so slender that I thought there might be danger of their breaking until I was convinced, by seeing the method of making them, that there is no reason for fearing any such thing. A firm tissue of silk is woven upon a brass stilet, of the size of the cavity of the instrument to be made. In weaving this tissue, the orifice or eye is left, and the whole therefore consists of one entire thread. The successive layers of varnish are deposited on the outer surface of the silken tissue, their number depending on the size of the instrument; and each coating of varnishing undergoes a long process of scouring before the next is put on, for which purpose women are employed by Feburier."—(See *Sketches of the Medical Schools of Paris, by J. Cross,* 1815, *p.* 122, 123.)

According to this gentleman, however, the English gum catheters possess advantages: "they retain their curve better without the stilet, are less liable to crack, and have eyes more smooth and better formed."—(*P.* 124.)

When the object of passing a catheter is merely to empty the bladder, without any design of leaving the instrument afterward in its passage, Langenbeck always prefers an inflexible one made of silver.—(*Bibl. für die Chir. b.* 1, *p.* 1176.)

Sometimes spasm about the perinæum renders the introduction of a catheter difficult. In this case, a dose of opium should be administered before a second attempt is made. When inflammation prevails in the passage, the introduction may often be facilitated by a previous bleeding.

The operation of introducing the catheter may be performed either when the patient is standing up, sitting, or lying down, which last posture is the most favourable. In order to pass a catheter with ease and dexterity, the following circumstances must be observed: the instrument must be of suitable shape and size: a just idea of the perinæum and curvature of the urethra must be entertained; the catheter must be introduced with the greatest care and delicacy; and the relaxation of the abdominal muscles has been insisted upon (*Langenbeck, Bibl.* 1, *p.* 1177), though I confess that it does not appear to me how this circumstance is of importance.

One of the most important maxims is, never to force forward the instrument when it is stopped by any obstacle. If there are no strictures, the stoppage of the catheter is always owing to one of the following circumstances. Its beak may be pushed against the os pubis. This chiefly occurs when the handle of the instrument is prematurely depressed. Here the employment of force can obviously do no good, and may be productive of serious mischief. The beak of the catheter may take a wrong direction, and push against the side of the urethra, especially at its membranous part, which it may dilate into a kind of pouch. In this circumstance, if force were exerted, it would certainly lacerate the urethra, and occasion a false passage. The end of the catheter may be entangled in a fold of the lining of the urethra, and here force would be equally wrong. Lastly, the point of the instrument may be stopped by the prostate gland, in which case force can be of no service, and may do great harm. Hence it is always proper to withdraw the instrument a little, and then push it on gently in a different position.

There are two methods of introducing a male cathe-

ter, viz., with the concavity turned towards the abdomen, or with the concavity directed downwards, in the first stage of the operation. Of course, the latter plan requires the instrument to be turned so as to place its concavity upwards, as soon as the beak has arrived in the perinæum; and hence the French surgeons call this method the "tour de maître." This method is disapproved of by some practitioners, who prefer beginning the operation in corpulent persons with the handle of the catheter placed towards the left groin.—(See *Chelius, Handb. der Chir. b.* 2, *p.* 158, *Heidelb.* 1827.)

The operation may be divided into three stages. In the first, the catheter passes, in the male subject, that portion of the urethra which is surrounded by the corpus spongiosum; in the second, it passes the membranous part of the canal, situated between the bulb and the prostate gland; and in the third, it enters the gland and the neck of the bladder.

In the first stage, little trouble is usually experienced; for the canal is here so supported by the surrounding corpus spongiosum, that it cannot easily be pushed into the form of a pouch, in which the end of the instrument can be entangled.

When the catheter is to be introduced with its concavity towards the abdomen, and the patient is in the recumbent posture, the thighs are to be separated, and the legs moderately bent. The surgeon is to draw back the prepuce, and to hold the penis between the thumb and fore-finger of his left hand, which are to be applied on each side of the corona glandis, and not at all to the under surface of the penis, so as to avoid pressing upon the commencement of the urethra. After the catheter has been well oiled, its handle is to be held between the thumb and fore-finger of the right hand, and to rest with the back of the little finger upon the patient's abdomen, in the vicinity of the navel. Now, while the handle is parallel to the axis of the body, the beak is to be introduced into the urethra; the penis being extended and drawn forwards, as it were, over the instrument, while the latter is gently pushed on until its beak has reached the arch of the pubes. When the penis cannot be drawn farther over the catheter, the beak has arrived in this situation, where it stops in front of the arch, and is pressing against the posterior side of the urethra. At this particular moment, the handle is to be depressed towards the patient's thighs, and the manœuvre well managed generally directs the end of the catheter at once through the prostatic portion of the urethra into the cavity of the bladder. In short, as soon as the beak of the instrument has passed under the arch of the pubes, and the surgeon very slowly brings the handle forwards or downwards, the beak is elevated and glides into the bladder. In this stage of the operation, the penis must be allowed to sink down, and not be kept tense, as this would only render the passage of the instrument more difficult.

The operation, however, is not always successfully accomplished in this manner. The beak of the catheter may be stopped by the os pubis; it may take a wrong direction, so as to push the membranous part of the urethra to one side or the other; or it may be stopped by a fold of the lining of the passage.

The first kind of impediment is best avoided by not depressing the handle of the catheter too soon; that is, before the point has passed beyond the arch of the pubes. When the membranous part of the urethra is pushed to one side or the other, the instrument ought to be withdrawn a little, and then pushed gently on in a different direction; but if this expedient is unavailing, the index finger of the left hand may be introduced into the rectum, for the purpose of supporting the membranous part of the urethra, and guiding the extremity of the catheter. The passage of the catheter through the membranous part of the urethra, and especially the attempt to hit the entrance of the prostate, are the most difficult things in the operation, and also the only ones attended with risk of mischief, which is frequently produced by rough, unskilful surgeons when they use violence, and rupture this yielding, weak portion of the canal.

When the prostate gland is enlarged, the urethra, just as it approaches the bladder, makes a more sudden turn upwards than is natural. The end of the catheter, therefore, should be more bent upwards than in other cases.

In the third stage of the operation, the beak of the instrument has to pass the prostate gland and neck of the bladder. The principal obstacles to its passage in this situation arise from spasm of the neck of the bladder and muscles in the perinæum, and from the instrument being pushed against the prostate gland, instead of into the continuation of the urethra through it. The first impediment may generally be obviated by waiting a few moments, and gently rubbing the perinæum, before attempting to push the catheter farther into the passage. The hinderance caused by the prostate is best eluded by using an instrument the point of which is more curved than its other part. Sometimes the surgeon himself presses the prostate towards the os pubis, by means of his finger in the rectum, and thus prevents the passage of the catheter, by increasing the sudden curvature at this part of the urethra. Hence, as Richter observes, it is a very important maxim, never to introduce the finger so far into the rectum as to press on the prostate gland itself.

When the catheter has turned round the pubes, and is just about to enter the neck of the bladder, is the critical moment at which may be seen whether a surgeon can or cannot manage the operation with skill; for if he knows how to pass the instrument, he suddenly, but not violently, changes its direction. He depresses the handle with a particular kind of address, and raises the point, which, as if it had suddenly surmounted some obstacle, starts into the neck of the bladder, and the urine bursts out in a jet from the mouth of the catheter.

They who are unskilful press the tube forwards, and persist, as they first began, in drawing up the penis, on the supposition that by stretching this part, they lengthen the urethra and make it straight, whereas they elongate only that part of the canal into which the catheter has already passed.—(*John Bell's Principles of Surgery, vol.* 2, *p.* 213.)

When the catheter is to be introduced with its concavity downwards, or by the "tour de maître," the beak is to be passed into the urethra, and the penis drawn over it, as it were, as in the foregoing method. In other words, the instrument, well oiled, is to be introduced, with its convexity uppermost, as far as it can be without using force. As soon, however, as the end of the catheter has reached the point at which the canal begins to form a curve under the pubes, the surgeon is to make the penis and the instrument perform a simicircular movement, by inclining them towards the right groin, and then towards the abdomen. In the execution of this manœuvre, care is to be taken to keep the beak of the catheter stationary, so that it may be the centre of the movement, and simply revolve upon itself. This part of the operation, the object of which is to turn the concavity of the catheter upwards, ought to be done very slowly, a large sweep being made with the handle, while particular care is taken not to retract nor move the beak from its position. The handle is then to be depressed, and the operation finished exactly in the same manner as when the first plan is pursued. As Desault properly observes, the only circumstance in which the two methods differ is, that in one the same thing is performed by two movements, which is done in the other by one; so that the operation is rendered more difficult and painful. Hence, many judicious modern surgeons never practice the "tour de maître," except when their patients are very corpulent, or placed in the position usually chosen for lithotomy, when other modes of introducing the catheter would be less convenient.

The depth to which the catheter has entered, the cessation of any feeling of resistance to the motions of the beak when revolved upon its axis, and the issue of the urine, are the circumstances by which the surgeon knows that the instrument has passed into the bladder.

According to the experience of Desault, the practice of gradually letting out a part of the urine, after the catheter has been introduced, is by no means advantageous. He also disapproves of running into the opposite extreme, that is to say, of letting the urine flow out of the catheter as fast as it is secreted; for then the bladder is kept constantly relaxed, and the detrusor muscle will not be likely to recover its tone. When the bladder is continually empty, it is liable to come into contact with the end of the catheter; a circumstance which has sometimes caused considerable irritation, pain, and even ulceration of that viscus. Be-

sides these inconveniences there are some others; the catheter is sooner obstructed with mucus, and covered with incrustations, than when it is closed with the stilet. The patients are likewise obliged to remain in bed, where they are either wet with their urine, or compelled to have incessantly a pot for its reception. The best practice, therefore, seems to be that of letting out all the urine as soon as the catheter is introduced, and then closing the instrument until the bladder has become moderately distended again; for experience proves, that such moderate distention and relaxation of the muscular fibres of the bladder, alternately kept up, have the same good effects upon that organ as moderate exercise has upon other parts of the body. When a catheter is to be left in the urethra, it should always be properly fixed with a narrow piece of tape, or else it is apt to slip out, or even pass too far into the passage. For this purpose, some surgeons use cotton thread, which they fasten to the rings, or round the external end of the catheter. The two extremities of the thread are then carried some way along the dorsum of the penis, when they are tied together, and afterward conveyed in opposite directions round the part till they meet underneath it, where they are tied in a bow. When a silver catheter is employed, a tape or narrow riband is passed through each of the rings, and conveyed to each side of the pelvis, where it is fastened to a circular bandage. Mr. Hunter remarks, that the common bag-truss for the scrotum answers extremely well, when two or three rings are fixed on each side of it along the side of the scrotum, and the ring of the cannula is fastened to any of them with a piece of tape.—(*On the Venereal Disease, ed.* 2, *p.* 159.) He also notices another method: when the catheter (says he) is fairly in the bladder, the outer end is rather inclined downwards nearly in a line with the body. To keep it in this position, we may take the common strap or belt part of a bag-truss with two thigh straps, either fixed to it or hooked to it, and coming round each thigh forwards by the side of the scrotum, to be fastened to the belt, where the ears of the bag are usually fixed. A small ring or two may be fixed to each strap just where it passes the scrotum or root of the penis; and with a piece of small tape the ends of the catheter may be fixed to those rings, which will keep it in the bladder. It seems Mr. Hunter did not, like Desault, disapprove of leaving the catheter unclothed, and he adds, therefore, "a bit of rag about four or five inches long, with a hole at the end of it, passed over the exterior end of the catheter, and the loose end allowed to hang in a basin placed between the thighs, will catch the water, which cannot disengage itself from the catheter, and keep the patient dry; or if another pipe is introduced into the catheter, it will answer the same purpose."—(*Op. cit. p.* 191.) The following, which is the French method of retaining the catheter in the bladder, is the most convenient with which I am acquainted: "A metallic ring, the circumference of which should be more than sufficient to encircle the penis, is to be covered with cloth, and four long pieces of tape, with the same number of short ones, attached to it. This ring, enclosing the penis, is fixed against the pubes by the long pieces of tape, which, surrounding the pelvis in different directions, meet and are tied posteriorly. One of the short pieces is carried through the ring or round the groove of the catheter, on each side, and being tied to its fellow, fixes the instrument securely in the bladder."—(See *Averill's Operative Surgery*, *p.* 195.) But there are numerous modes of fixing a catheter which need not be specified; for although they are of importance, the principles which should be observed in adopting them are the main things to be understood. These are, first, never to fix a catheter in such a way, that too much of the instrument projects into the cavity of the bladder (*Lallemand, Perforation de la Vessie par les Sondes fixés; Revue Méd. Nov.* 1822, *p.* 299); and secondly, to be careful that the thread or tape which is applied will not chafe and irritate the parts.

Mr. Hey has offered some good practical remarks on the introduction of the catheter. If, says he, the point of the catheter be less turned up than the urethra, the point will be pushed against the posterior part of the passage, instead of following the course of the canal. The posterior part of the urethra has nothing contiguous to it which can support it; and no considerable degree of force will push the point of the catheter through that part between the bladder and the rectum. If this accident is avoided, still the point will be pushed against the prostate, and cannot enter the bladder. Mr. Hey tells us, that the truth of this is illustrated by the assistance which is derived, whenever the catheter stops at the prostate, from elevating the point of the instrument with a finger introduced into the rectum.

Mr. Hey takes notice of the impropriety of pushing forwards the point of the catheter before its handle is sufficiently depressed, as the point would move in a horizontal direction, and be likely to rupture the posterior side of the urethra.

The difficulty arising from the inflamed and dry state of the passage (which difficulty I should conceive can never be great), Mr. Hey says, may be obviated by the previous introduction of a bougie well covered with lard.

In order to pass the catheter, Hr. Hey places his patient on a bed, in a recumbent posture, his breech advancing to, or projecting a little beyond, the edge of the bed. If the patient's feet cannot rest upon the floor, Mr. Hey supports the right leg by a stool or by the hand of an assistant. The patient's head and shoulders are elevated by pillows; but the lower part of the abdomen is left in a horizontal position. Mr. Hey commonly introduces the catheter with its convexity towards the abdomen, and having gently pushed down the point of the instrument, till it becomes stopped by the curvature of the urethra, under the symphysis pubis, he turns the handle towards the navel, pressing at the same time its point. In making the turn he sometimes keeps the handle at the same distance from the patient's abdomen, and sometimes makes it gradually recede; but in either method, he avoids pushing forwards the point of the catheter any farther than is necessary to carry it just beyond the angle of the symphysis pubis. When he feels that the point is beyond that part, he pulls the catheter gently towards him, hooking, as it were, the point of the instrument upon the pubes. He then depresses the handle, making it describe a portion of a circle, the centre of which is the angle of the pubis. When the handle of the catheter is brought into a horizontal position, with the concave side of the instrument upwards, he pushes forwards the point, keeping it close to the interior surface of the symphysis pubis; for when passing in this direction it will not hitch upon the prostate gland, nor injure the membranous part of the urethra.

If the surgeon uses a flexible catheter, covered with elastic gum, it is of great consequence to have the stilet made of some firm metallic substance, and of a proper thickness. Mr. Hey always makes use of brass wire for the purpose. If the stilet is too slender, the catheter will not preserve the same curvature during the operation; and it will be difficult to make the point pass upwards behind the symphysis pubis in a proper direction. If the stilet is too thick, it is withdrawn with difficulty.

When the stilet is of a proper thickness, this instrument has one advantage over the silver catheter, which is, that its curvature may be increased while it is in the urethra, which is often of great use when the point approaches the prostate gland. In all cases where an elastic gum catheter is preferred, care must be taken that it does not pass unnecessarily far into the bladder; and, if it be too long, a part of it ought to be cut off, or a shorter one employed.

In many cases elastic catheters, formed with a permanent curvature, so as to admit of being introduced without a stilet, are advantageous.—(*M. J. Chelius, Handb. der Chirurgie, b.* 2, *p.* 157, *Heidelb.* 1827.)

When the proper manœuvres with a silver catheter do not succeed, the surgeon must change it, taking a bigger or more slender one, with a greater or less curve, according to such observations as he may have made in his first attempt. But if the catheter has been of a good form or commodious size, yet has not passed easily, he should, instead of choosing a rigid catheter of another size or form, take a flexible one for his second attempt. The flexible catheter is generally slender, and of sufficient length, and its shape may be accommodated to all occasions, and to all forms of the urethra; for, having a stiff wire, we can give that wire, either before or after it has passed into the catheter, whatever shape we please; and what is of still greater importance, we can introduce the instrument without or

with the wire, as circumstances may require; or what is more advantageous, we can introduce the wire particularly so as not quite to reach the point of the catheter, but only to within two inches or a little more of this part, by which contrivance the point, if previously warmed and wrought in the hand, has so much elasticity, that it follows the precise curve of the urethra, and yet has sufficient rigidity to surmount any slight resistance. If this too fail, and especially if there be the slightest reason to suspect that the resistance is not merely spasmodic, but arises from stricture near the neck of the bladder in a young man, or swelling of the prostate in an old one, we may take a small bougie, turn up the extremity of it with the finger and thumb, so as to make it incline towards the pubes, and allowing no time for the wax to be softened, pass it quickly down to the obstruction, turn it with a vertical or twisting motion, and make it enter the constricted part. On withdrawing it in about ten minutes or a quarter of an hour, the urine generally escapes, or the catheter may now be introduced.—(*John Bell's Principles of Surgery*, *vol.* 2, *p.* 215.)

Mr. Hey found, that in withdrawing the stilet of an elastic gum catheter, the instrument becomes more curved; and he availed himself of this information by withdrawing the stilet, as he introduced the catheter beyond the arch of the pubes, by which artifice the point was raised in the due direction. He says, you may sometimes, though not always, succeed in introducing an elastic gum catheter, by using one which has acquired a considerable degree of curvature and firmness by having had a curved stilet kept in it a long while. Introduce this without the stilet, with its concavity towards the abdomen, taking care not to push on the point of the instrument, after it has reached the symphysis pubis, until its handle is depressed into a horizontal position.

When it is necessary to draw off the urine frequently, and the surgeon cannot attend often enough for this purpose, a catheter must be left in the urethra till an attendant or the patient himself has learned the mode of introducing the instrument.

Mr. Hey imputes the formation of a false passage, or the rupture of the membranous part of the urethra, generally to the method of pushing forwards the catheter before its handle has been depressed. In this manner, the course of the instrument crosses that of the urethra, and the point of the catheter, pressing against the posterior side of the membranous part of the urethra, is easily forced through the coats of that canal. The want of due curvature in the catheter, and of sufficient bluntness in its point, greatly contributes to facilitate the injury. When it has once happened, the point of the instrument passes more readily into the wound, than along the urethra against the symphysis pubis; and a great deal of skill is requisite to prevent this disadvantageous occurrence from repeatedly taking place, and rendering the case more and more serious.

Mr. Hey surmounted a difficulty of this kind, by bending upwards the point of a silver catheter, so as to keep it more closely in contact with the anterior part of the urethra, and thereby pass over the wound made in the posterior side of the canal. In the instance alluded to, as it was necessary to leave an elastic gum catheter in the urethra, Mr. Hey procured some brass wire of a proper thickness, with which he made a stilet, and having given it the same curvature as that of the silver catheter, he introduced it about four hours after the preceding operation, and fixed it by tying it to a bag-truss. Mr. Hey sometimes succeeded by partly withdrawing the stilet at the moment when he wished to increase the curvature of the catheter.

In an instance in which the urethra had suffered a violent contusion, Mr. Hey drew off the urine with a silver catheter of unusual thickness, after he had failed with instruments of a smaller bore. He suspected that the urethra was ruptured, and was obliged to raise the point of the catheter by a finger introduced into the rectum, and to use bleeding, purgatives, the warm bath, and opium before it could be made to pass. The elastic gum catheter was afterward employed. It is an unsettled point, whether it is best to leave the catheter in the urethra until the power of expelling the urine is regained, or to draw off the urine twice a day, and withdraw the catheter after each operation. Mr. Hey thinks that no general rule can be laid down; some patients cannot bear the catheter to remain introduced; others seem to suffer no inconvenience from it. On the whole, however, Mr. Hey commonly prefers removing the catheter. In this manner, he is of opinion, that the power of expelling the urine again is soonest acquired.

The preceding question is often determined by the nature of the disease, and, as Mr. Hunter observes, in cases of debility of the bladder, and where a catheter passes with difficulty, or with great uncertainty, as well as in other instances in which it must be used frequently and for a length of time, it will be necessary to keep it introduced, so as to allow the water to pass freely through it.—(*On the Venereal Disease*, *edit.* 2, *p.* 191.)

In France, a conical silver catheter (*sonde conique*) is frequently employed in difficult cases by Boyer, Roux, &c. This instrument has a very slight curvature, and an extremity almost pointed. By force, regularly applied, it is introduced into the bladder in spite of all opposition. Care is taken to keep it in the centre of the passage, and the direction of its point is judged of by the position of the lateral rings. The rule mentioned by Roux, for commencing the great depression of the outer extremity of the instrument, is when, by the finger in the rectum, the point can be felt to have reached the apex of the prostate.—(See *Sketches of the Medical Schools of Paris*, *by J. Cross*, *p.* 112.) In bad cases the conical catheter is usually allowed to remain introduced three or four days, and on being withdrawn, a small flexible gum catheter generally admits of being used.

The forcible manner in which the French surgeons employ the conical silver catheter must often do great and dangerous mischief. Thus, in two examples, which were witnessed and examined by Roux himself after the decease of the patients, a false passage had been made, no flexible gum catheter could be passed, the urine was effused in the cellular membrane, and the parts were gangrenous.—(See *p.* 116 *of the above work.*) According to the observation of Mr. Cross, the French surgeons employ the conical silver catheter with too little discrimination, and "in their practice they seem to make no nice distinctions between impediments to the flow of urine from spasm, irritable and inflamed state of the canal, disease of the prostate gland, and cartilaginous stricture of long duration. If the conical catheter be admissible at all, it is in the last of these cases, particularly when combined with fistula in perinæo; and here all surgeons who are familiar with the treatment of diseases of the urethra, occasionally use means which approach very closely to the *forcing* method of the French. I have heard of instances, in which John Hunter employed great force with the silver catheter, and overcame the obstruction. I have seen Mr. Pearson (who generally treats strictures as mildly, and, I need hardly say, as successfully as any man) take a steel sound, and pass it gradually and forcibly on into the bladder, at the same time feeling his way, as it were, by keeping one finger in the rectum: the relief of the patient, and the ultimate cure of the disease, were the results of this practice."—(*P.* 118.) It appears farther, that the conical silver catheter has been used by Sir A. Cooper. Without altogether condemning the occasional employment of this instrument, I perfectly coincide with Mr. Cross, that it is one with which young men, of little caution and no experience, may do more harm in the first few cases they meet with, than the rest of their life will afford them opportunities of doing good.

Mr. Hunter refers to instances in which the common catheter had been pushed through the projecting part of the prostate gland into the bladder, and the water then drawn off; but, "in one patient, the blood from the wound passed into the bladder, and increased the quantity of matter in it. The use of the catheter was attempted a second time; but not succeeding, I was sent for. I passed the catheter till it came to a stop, and then suspecting that this part of the prostate projected forwards, I introduced my finger into the anus, and found that gland very much enlarged. By depressing the handle of the catheter, which of course raised the point, it passed over the projection; but unfortunately the blood had coagulated in the bladder, which filled up the holes in the catheter, so that I was obliged to withdraw it, and clear it repeatedly. This I practised several days; but suspecting that the coagulum must in the end kill, I proposed cutting him

(the patient) for the stone; but he died before it could be conveniently done, and the dissection after death explained the case," &c.—(*On the Venereal Disease, ed.* 2, *p.* 172.)

To a surgeon duly acquainted with anatomy, the introduction of the female catheter is exceedingly simple. From motives of delicacy, the instrument should be passed without any exposure. The surgeon should hold the catheter in his right hand, while he introduces the fore-finger of his left hand between the nymphæ, so as to feel upon the upper surface of the passage the little papilla, which surrounds, and denotes to the touch the precise situation of the orifice of the meatus urinarius. Holding the concavity of the catheter forwards, the surgeon, guided by the fore-finger of his left hand, is then to introduce the instrument upwards into the bladder. A female catheter should always be furnished with some contrivance for preventing its slipping completely into the bladder: the following case, mentioned in a respectable periodical work, fully proves the truth of this remark:

Some years ago, a surgeon, practising in the country, was required to introduce the catheter for a lady labouring under retention of urine. During the operation he was observed to exhibit signs of confusion, and to quit his patient in considerable embarrassment. The same day he abruptly left his home, and was never seen afterward. The lady passed several years of dreadful suffering, attributed by herself and the professional gentleman on whom the treatment of the case devolved, to aggravation of the original complaint. At length an abscess presented itself in the sacral region, and the surgeon punctured it, when his instrument came in contact with some unusually hard substance imbedded in the centre of the abscess. With a pair of forceps he now extracted, to his utter astonishment, a blackened female catheter. From this period the lady's sufferings all terminated. A similar accident nearly happened in the practice of another gentleman.—(See *Urine, Retention of.*) See *Medico-Chir. Journ. vol.* 5, *p.* 75, *Lond.* 1818. *J. Hunter, Treatise on the Venereal Disease, ed.* 2, *in various places. Hey's Practical Obs. in Surgery, ed.* 3. *John Bell's Principles, vol.* 2. *Sketches of the Medical Schools of Paris, by J. Cross, p.* 111, *&c. Jos. M'Sweeny, Observations on the Catheter, Edin. Med. and Surgical Journ. No.* 58, *p.* 52. *Richter's Anfangsgr. der Wundarzneykunst. Lallemand, Perforation de la Vessie par les Sondes fixés, Revue Méd. Nov.* 1822. *Langenbeck, Bibl. für die Chir. b.* 1, *p.* 175, 12*mo. Gött.* 1806. *Desault, Œuvres Chir. t.* 3. *Amussat, Archives Gén. de Méd. t.* 4. *Berton, op. cit. Mai*, 1826. *The Observations on the Catheter, by Desault, Richter, J. Hunter, and Hey are the best with which I am acquainted.*

CATLING, often spelled in surgical books *catlin*, is a long, narrow, double-edged, sharp-pointed, straight knife, which is chiefly used in amputations of the leg and forearm, for dividing the interosseous ligaments and the muscles, &c. situated between the two bones. It is frequently made too wide and large, so that it cannot execute its office with the right degree of ease.

CAUSTICS. (From καίω, to burn.) Medicines, which destroy parts by burning or chemically decomposing them. The potassa fusa, the potassa cum calce, the antimonium muriatum, the argenti nitras, the hydrargyri nitrico-oxydum, the acidum sulphuricum, and the cupri sulphas, are the caustics in most frequent use.

CAUTERY. (From καίω, to burn.) Cauteries are of two kinds, viz. *actual* and *potential*. By the first term is implied a heated iron; by the second, surgeons understand any caustic application.

The high opinion which the ancients entertained of the efficacy of the actual cautery, may be well conceived from the following passage. "Quoscumque morbos medicamenta non sanant, ferrum sanat; quos ferrum non sanat, ignis sanat; quos vero ignis non sanat, insanabiles existimare oportet."—(*Hipp. sect.* 8, *aph.* 6.) The actual cautery has been employed for the stoppage of bleeding, where the vessels could neither be tied nor compressed. It has been also employed for the destruction of carcinomatous tumours and ulcers, fistulæ, polypi, and a variety of fungous diseases. Whoever looks over the writings of Hippocrates will discover, that the actual cautery was a principal means of relief in several chronic affections, as dropsies, diseased joints, &c.

In modern times, the actual cautery has been more and more relinquished, in proportion as surgery has attained a higher state of improvement. On the continent, however, it still retains advocates. In France, all the professors recommend and employ it in particular cases. Hospital gangrene, a peculiar disorder, much more frequently seen in foreign and military hospitals than in the charitable institutions for the reception of the sick poor in England, is said to be little affected by any internal remedies. "Vegetable and diluted mineral acids are the local means employed with effect in mild cases. I have (says Mr. Cross) already alluded to a case of Pelletan's, where carbon was applied, and the progress of the disease impeded. But the actual cautery is the only means that has been found effectual in stopping the fatal progress of bad cases of hospital ulcer, and the iron is applied red-hot, so as to produce an eschar on every point of the surface of the sore."—(See *Sketches of the Medical Schools of Paris, p.* 84, and the article *Hospital Gangrene.*)

Desault often employed the actual cautery to destroy fungous tumours of the antrum.—(See *Antrum.*) The same practice is still followed by Pelletan and other eminent surgeons in France. Mr. Cross saw it adopted in one such case with good effect.—(*P.* 86.) That part of the fungus which can be cut away is to be so removed, and the deeper portion, out of the reach of the knife, is to be cauterized. If there be any case in surgery justifying the use of a red-hot iron, it is a fungus of the antrum. But even in this instance, I should prefer any other certain mode of destroying the root of the disease, and stopping the profuse bleeding.

[The actual cautery has been found exceedingly useful in the treatment of the hip-joint disease, though it is seldom employed in this country for any other purpose. It is not easy to perceive, however, in what respects it is to be preferred for the formation of an eschar, which is its chief design, to the potassa fusa, or other caustics. Even in the hip-joint disease, as deep and extensive a destruction of the integument can be effected by some of these, as by the red-hot iron; without exciting that mental horror which the latter often produces, both in the patient and friends. And although the sloughing is not so early, yet ultimately the effect is the same.

In fungus of the antrum, which, according to Mr. Cooper, is the only case in surgery "justifying the use of the red-hot iron," I have known the caustic potash fully adequate for the destruction of this disease, after the operation with the knife; and it always arrests the hemorrhage as suddenly and effectually.

The use of fire in surgery as an agent for the purposes to which it has been applied from time immemorial, has gradually fallen into disrepute. But in cases of *suspended animation*, or sudden injury to the powers of life from casualty, poison, or hemorrhage, in which other means fail, and yet a faint hope is indulged of resuscitation, I apprehend we are perfectly justifiable in resorting to this potential agent.

I have employed boiling water to the extremities in cases in which there was no sign of life, after *hanging*, and *hemorrhage from a wound in the throat*, and *poisoning with opium*, and in each of these have met with entire success, although other means offered no hope whatever. The actual cautery applied to the extremities in like manner, had this been convenient, would doubtless have produced the same result.

In these and other cases of suspended animation, in which the signs of death, although present, are equivocal, it may often be advisable to try this means, for if any portion of vitality remain, fire will find it, and other appropriate means may be then superadded. I believe resuscitation might often be effected by this agent, when other remedial agents are unsuccessful. See article *Moxa* in this Dictionary, for the farther use of fire. Dr. Cogswell, of Hartford, recommends the use of boiling water instead of cantharides, where vesication is important, and where an immediate effect is desirable.—*Reese.*]

CERATOTOME. (From κέρας, a horn, and τέμνω, to cut.) The name given by Wenzel to the knife with which he divided the cornea, or horny coat of the eye.

CERATUM CALAMINÆ. (L.) A good simple dressing.

CERATUM CANTHARIDIS, (L.) lately called the cerate of lyttæ, was once much used for stimulating

blistered surfaces, in order to maintain a discharge. The ceratum sabinæ, however, which answers much better, and is not attended with danger of bringing on strangury, inflammation of the bladder, &c., has almost superseded the ceratum cantharidis.

CERATUM CETACEI. (L.) The spermaceti cerate. A mild, unirritating salve for common purposes.

CERATUM CONII. ℞. *Unguenti conii* lbj.—(See *Unguentum.*) *Cetacei* ℥ ij. *Ceræ albæ* ℥ iij. M. One of the formulæ at St. Bartholomew's Hospital, occasionally applied to cancerous, scrofulous, and phagedænic sores.

CERATUM HYDRARGYRI SUBMURIATIS. ℞. *Hydrarg. submuriatis* ℥ i. *Cerati lapid. calamin.* ℥ ss. M. Some practitioners are partial to this as a dressing for chancres.

CERATUM PLUMBI ACETATIS. (L.) A mild, astringent, unirritating salve.

CERATUM PLUMBI COMPOSITUM. (L.) An excellent gently astringent salve for common purposes.

CERATUM SABINÆ. ℞. *Sabinæ foliorum recentium contusorum* lbj. *Ceræ flavæ* lbss. *Adipis præparatæ*, lbij. Mix the savin with the melted wax and hog's lard, and strain the composition.

The common application for keeping open blisters, on the plan recommended by Mr. Crowther.—(See *Blisters.*)

CERATUM SAPONIS. ℞. *Plumbi oxydi semivitrei lib.* j. *Aceti cong.* j. *Saponis unc.* viij. *Olei olivæ, ceræ flavæ, sing. lib.* j.

The *soap cerate* of St. Bartholomew's Hospital. In preparing it, the utmost caution must be used. The first three ingredients are to be mixed together and boiled gently till all the moisture is evaporated; after which the wax and oil, previously melted together, must be added. The whole composition, from first to last, must be incessantly and effectually stirred, without which the whole will be spoiled. This formula was introduced into practice by Mr. Pott, and is found to be a very convenient application for fractures and sometimes a good dressing for ulcers; being of a convenient degree of adhesiveness, and at the same time possessing the usual properties of a saturnine remedy.

In applying this cerate, spread on linen, to fractures of the leg or arm, one caution is necessary to be observed, namely, that it be in two distinct pieces; for if, in one piece, the limb be encircled by it, and the ends overlap each other, it will form a very inconvenient and partial constriction of the fractured part, in consequence of the subsequent tumefaction.—(*Pharm. Chirurg.*)

CERU'MEN AURIS. A degree of deafness is frequently produced by the lodgement of hard dry pellets of this substance in the meatus auditorius. The best plan, in such cases, is to syringe the ear with warm water, which should be injected with moderate force.

In some instances, deafness seems to depend on a defective secretion of the cerumen, and a consequent dryness of the meatus. Here, a drop or two of sweet oil may now and then be introduced into the ear, and fomentations applied.

CERUSSA ACETATA. Sugar of lead. Superacetate of lead. This preparation is well known as an ingredient in a variety of lotions and collyria. It has the qualities of preparations of lead in general, being highly useful in diminishing inflammation.

CHALAZIUM. (From *χάλαζα*, a hailstone.) A little tubercle on the eyelid, which has been whimsically supposed to resemble a hailstone. When the hordeolum or stye does not suppurate, but changes into a hard fleshy tumour, it receives this appellation.—(See *Hordeolum.*)

CHAMOMILE. The flowers, which are bitter and aromatic, are used in surgery for making fomentations.

CHANCRE. (From *καρκῖνος, cancer venereus.*) A sore which arises from the direct application of the venereal poison to any part of the body. Of course it almost always occurs on the genitals. Such venereal sores as break out from a general contamination of the system, in consequence of absorption, never have the term *chancre* applied to them. (For an account of the nature and treatment of chancres, see *Venereal Disease.*)

CHEMOSIS. (From *χαίνω*, to gape.) When ophthalmy or inflammation of the eye is exceedingly violent, it frequently happens, that lymph or blood is effused in the cellular membrane, which connects the conjunctiva with the anterior hemisphere of the eye. Hence, the latter membrane is gradually elevated upon the eyeball, and projects towards the eyelids, so as to conceal within it the cornea, which appears as if it were depressed. In this way the middle of the eye assumes the appearance of a gap or aperture.

It is observed by Mr. R. Welbank, that inflammatory chemosis is generally dependent on the fungous swelling of the mucous tissue, but that it may also partly arise from effusion. He notices a very firm, but pale chemosis, as occasionally produced by effusion, and resembling a solid œdema, or fat. In one case of this sort which fell under his own observation, there were numerous white aphthæ on the mucous surface.—(See *Frick on Diseases of the Eye, note, p.* 15.)

The time has expired when surgeons had faith in the application of the vapour of ether, or of an inspissated decoction of the lactuca sissilis, to an inflamed eye, for the relief of chemosis, as recommended by the late Mr. Ware. In this kind of case, more benefit will result from general treatment than from any local measures. I here particularly refer to the inflammatory chemosis; for, in certain chronic cases, like that spoken of by Mr. Welbank, topical remedies may undoubtedly promote the cure.

Acute ophthalmy, attended with chemosis, demands the most rigorous employment of the antiphlogistic treatment. Both general and topical bleeding should be speedily and copiously put in practice, with due regard, however, to the age and strength of the patient. Leeches should be applied to the vicinity of the eyelids; or, what is preferable, the temporal artery should be opened. When chemosis is very considerable, Scarpa approves of making an incision in the conjunctiva, near its junction with the cornea, for the discharge of the lymph or blood lodged under the distended membrane.—(See *Ophthalmy.*)

CHEVASTER, or CHEVA'STRE. A double-headed roller, the middle of which was applied to the chin; the bandage then crossed at the top of the head, and passed on each side to the nape of the neck, where it crossed again. It was next carried up to the top of the head, and so on, till all the roller was exhausted.

CHIA'STRE. A bandage for stopping hemorrhage from the temporal artery. It is double-headed, about an inch and a half wide, and four ells long. Its middle is applied to the opposite side of the head: the bandage is carried round to the bleeding temple, and there made to cross over a compress on the wound. The roller is then continued over the coronal suture, and under the chin, care being taken to make the bandage cross upon the compress. In this way, the rest of it is applied round the head.

CHILBLAINS are the effect of inflammation arising from cold. A chilblain, in its mildest form, is attended with a moderate redness of the skin, a sensation of heat and itching, and more or less swelling, which symptoms, after a time, spontaneously disappear. The intolerable itching and sense of tingling, accompanying the inflammation of the milder description of chilblains, are observed to be seriously aggravated by exposure to heat. In a more violent degree, the swelling is larger, redder, and sometimes of a dark-blue colour; and the heat, itching, and pain are so excessive, that the patient cannot use the part. In the third degree, small vesicles arise upon the tumour, which burst and leave excoriations. These often change into ill-conditioned sores, which sometimes penetrate even as deeply as the bone, discharge a thin ichorous matter, and generally prove very obstinate. As Dr. John Thomson has remarked, "when the serum contained in the vesications is let out by a small opening, a portion of new cuticle is usually formed to supply the place of that which has been separated; but when the inflammation is severe, and the affection neglected, or improperly treated, the parts which are the seat of vesication are liable to pass into the state of vitiated ulcers. In this state, they yield a thin ichorous or sanious discharge, and are in general brought, only after a long time, and with much difficulty, to a healthy suppuration. In neglected cases, these ulcers not unfrequently become covered with foul sloughs. Ulceration often supervenes, and the soft parts covering the bones are destroyed."—(*On Inflammation, p.* 638.) The worst stage of chilblains is attended with sloughing.

Chilblains are particularly apt to occur in persons who are in the habit of going immediately to the fire, when they come home in winter, with their fingers and toes very cold; they are also frequent in persons who often go suddenly into the cold, while very warm. Hence the disease most commonly affects parts of the body which are peculiarly exposed to these sudden transitions; for instance, the nose, ears, lips, toes, heels, and fingers. Richter remarks that they are still more frequently occasioned when the part, suddenly exposed to cold, is in a moist, perspiring state, as well as warm. Young subjects are much more liable to this troublesome complaint than adults; and females brought up in a delicate manner are generally more afflicted than the other sex.

The most likely plan of preventing chilblains is to accustom the skin to moderate friction; to avoid hot rooms and making the parts too warm; to adapt the quantity and kind of clothing to the state of the constitution, so as to avoid extremes, both in summer and winter; to wash the parts frequently with cold water; to take regular exercise in the open air in all weathers; and to take particular care not to go suddenly into a warm room, or very near the fire, out of the cold air.

Although chilblains of the milder kinds are only local inflammations, yet they have some peculiarity in them; for they are not most benefited by the same antiphlogistic applications which are most effectual in the relief of inflammation in general.

One of the best modes of curing chilblains of the milder kind is to rub them with snow, or ice-cold water, or to bathe them in the latter several times a day, keeping them immersed each time till the pain and itching abate. After the parts have been rubbed or bathed in this way, they should be well dried with a towel, and covered with flannel or leather socks.

This plan is perhaps as good a one as any; but it is not that which is always congenial to the feelings and caprice of patients; and with the constitutions of some it may even disagree. In such cases, the parts agitated may be rubbed with spirits of wine, linimentum saponis, a mixture of tincture of opium and hartshorn, tinctura myrrhæ, or a strong solution of alum or vinegar. A mixture of oleum terebinthinæ and balsamum copaibæ, in equal parts, is a celebrated application. A mixture of two parts of camphorated spirit of wine, and one of the liquor plumbi subacetatis, has also been praised. Mr. Wardrop speaks highly of one part of the tincture of cantharides, with six of the soap liniment.—(*Medico-Chir. Trans. vol.* 5, *p.* 142.)

With respect to vesications, "their occurrence is always hastened, and the inflammation upon which they depend greatly aggravated, by the action of external heat; and hence the propriety of continuing cold applications to frost-bitten parts, so long as their temperature continues above the natural standard, or the inflammation excited seems to retain an acute character. From the tendency which the inflammation excited has to pass into gangrene, the more stimulating applications, such as spirit of wine, diluted ammonia, or oil of turpentine, may be required. But should these applications prove too stimulating, their strength may be weakened by additions of greater or less portions of the linimentum ex aqua calcis.—(*Thomson on Inflammation, p.* 648.)

When chilblains suppurate and ulcerate, they require stimulating dressings, such as lint dipped in a mixture of the liquor plumbi subacetatis dilutus, and liquor calcis; tinctura myrrhæ, or warm vinegar. If a salve be employed, one which contains the hydrargyri nitrico-oxydum, or the unguentum zinci with myrrh, camphor, opium, or the Peruvian balsam, will be found most beneficial. Ulcers of this kind frequently require to be touched with the nitrate of silver, or dressed with a solution of it.

Chilblains, attended with sloughing, should be poulticed till the dead parts are detached. The sores should then be first dressed with some mildly stimulating ointment, such as the unguentum resinæ flavæ, or unguentum zinci. With the first of these, in a day or two, a little of the hydrargyri nitrico-oxydum may be mixed; but the surgeon should not venture on the employment of very irritating applications, till he sees what the parts will bear, and whether such will be requisite at all; for were he too bold, immediately he leaves off the poultices, he might bring on sloughing again.

Rees's Cyclopædia, art. Chilblains. Richter's Anfangsgr. der Wundarzn. b. 1. *Thomson's Lectures on Inflammation, p.* 637, *&c. Lassus, Pathologie Chirurg. t.* 2, *p.* 388, *&c. Léveillé, Nouvelle Doctrine Chir. t.* 4, *p.* 352, *&c. Callisen's Systema Chirurgiæ Hodiernæ, vol.* 1, *p.* 304, *&c. ed.* 1798. *Pearson's Principles of Surgery, p.* 153, *&c. ed.* 1808. *M. J. Chelius, Handb. der Chir. b.* 1, *p.* 72. *Heidelb.* 1826.

CHIMNEY-SWEEPER'S CANCER. See *Scrotum.*

CHORDEE. (French, from χορδὴ, a cord.) When inflammation is not confined merely to the surface of the urethra, but affects the corpus spongiosum, it produces in it an extravasation of coagulable lymph, as in the adhesive inflammation, which, uniting the cells together, destroys the power of distention of the corpus spongiosum urethræ, and makes it unequal in this respect to the corpora cavernosa penis, and therefore a curvature takes place at the time of an erection, which is called a *chordee.* The curvature is generally in the lower part of the penis. When the chordee is violent, the inner membrane of the urethra is so much upon the stretch, that it may be torn, and a profuse bleeding from the urethra excited, that often relieves the patient, and even sometimes proves a cure.

This is the *inflammatory* chordee: there is another kind, which has been named *spasmodic.*

In the beginning of the inflammatory chordee, bleeding from the arm is often of service; but it is more immediately useful to take blood from the part itself by leeches; for we often find that when a vessel gives way, and bleeds a good deal, the patient is greatly relieved. Exposing the penis to the steam of hot water frequently gives great relief. Poultices have also beneficial effects; and both fomentations and poultices will often do most good when they contain camphor. Opium, given internally, is of singular service; and if it be joined with camphor, the effect will be still greater.

When the chordee continues after all inflammation has terminated, no evacuations are required; for the consequences of the inflammation will gradually cease on the absorption of the extravasated coagulating lymph. Mercurial ointment, rubbed on the part, will considerably promote this event. When the common methods of cure are unavailing, hemlock is sometimes very useful. Electricity may be of service. A chordee is often longer in going off than any other consequence of a gonorrhœa, but in the end it disappears.

For bringing about the removal of the extravasated lymph, camphorated mercurial ointment is better than the simple unguentum hydrargyri. According to Mr. Hunter, the *spasmodic chordee* is much benefited by bark.—(*See his Treatise on the Venereal Disease, ed.* 2.) The recent leaves of belladonna, powdered and made into an ointment with an equal weight of lard, and rubbed over the penis, are stated to hinder priapism, and relieve chordee more effectually than any other application hitherto proposed.—(*J. A. Paris, in Pharmacologia, vol.* 2, *p.* 110, *ed.* 5.)

Last summer (1828) I attended, with Dr. Langmore, of King Street, Finsbury, and Mr. Holt, of Compton Street, Brunswick Square, a gentleman attacked with gonorrhœa, whose case was remarkable on account of the situation and quantity of the effused lymph; for it occupied the portion of the corpus spongiosum towards the glans, and produced so considerable a swelling and pressure on the corresponding portion of the urethra, that the patient required the use of a catheter for nearly a fortnight, as well as the most active antiphlogistic treatment. The irritability of the bladder, without the power of emptying it; the suffering from tenesmus; and the high degree of fever, made this really a very severe case, demanding the utmost attention. I have never seen any other instance in which the effused lymph was half so copious.

CICATRIX. A scar: the mark left after the healing of a wound or ulcer.

CICATRIZATION. The process by which wounds and sores heal. Granulations having been formed, the next object of nature is to cover them with skin. The parts which had receded by their natural elasticity, in consequence of the breach made in them, now begin to be brought together by the contraction of the granulations. The contraction takes place at every point, but principally from edge to edge, bringing the circumference towards the centre of the sore, which thus becomes smaller and smaller, even although little or no new skin be formed.

The contracting tendency is in some degree proportioned to the general healing disposition of the sore, and

looseness of the parts. When granulations are formed upon a fixed surface, their contraction is mechanically impeded; as for instance on the skull, the shin, &c. Hence, in all operations on such parts, as much skin should be saved as possible.

The shape of a sore, as well as its situation, makes also a considerable difference in its readiness to heal: thus, as Sir Astley Cooper has remarked, a sore of a circular form, *cæteris paribus*, will be longer in cicatrizing than another of much greater length but less diameter. —(*Lancet*, *vol.* 1, *p.* 225.)

When there has been a loss of substance, making a hollow sore, and the contraction of the granulations has begun, and made a good deal of progress, before they have had time to rise as high as the skin, then the edges of the skin are generally drawn down, and tucked in by it, in the hollow direction of the surface of the sore.

The contraction of the granulations continues till the healing is complete; but it is greatest at first. That there is a mechanical resistance to such contraction, is proved by the assistance which may be given to the process by the application of a bandage.

Besides the contractile power of the granulations, there is also a similar power in the surrounding edge of the cicatrizing skin, which assists the contraction of the granulations, and is generally more considerable than that of the granulations themselves, drawing the mouth of the wound together like a purse. The contractile power of the skin is confined principally to the very edge where it is cicatrizing, and, as Hunter believed, to those very granulations which have already cicatrized; for the natural or original skin surrounding this edge does not contract, or at least not nearly so much, as appears by its having been thrown into folds and plaits, while the new skin is smooth and shining.

The uses of the contraction of granulations are various. It facilitates the healing of a sore, as there are two operations going on at the same time, viz. contraction and skinning.

It avoids the formation of much new skin, the advantage of which is evident; for it is with the skin as with all other parts of the body, viz. that such as are originally formed are much fitter for the purposes of life than those which are newly formed, and not nearly so liable to ulceration.

When the whole surface of a sore has skinned over, the substance, the remains of the granulations on which the new skin is formed, still continues to contract, till hardly any thing more is left than what the new skin stands upon. This is a very small part, in comparison with the first formed granulations, and it in time loses most of its apparent vessels, becoming white and ligamentous. All newly healed sores are at first redder than the common skin, but in time they become much whiter.

As the granulations contract, the surrounding old skin is stretched to cover the part which is deprived of skin.

When a sore begins to heal, the surrounding old skin, close to the granulations, becomes smooth, and rounded with a whitish cast, as if covered with something white. This, Mr. Hunter supposed to be a beginning cuticle, and it is as early and sure a symptom of healing as any. While the sore retains its red edge all round, for perhaps a quarter or half an inch in breadth, we may be certain that it is not in a healing state.

Skin is a very different substance, with respect to texture, from the granulations upon which it is formed; but it is not known whether it is a new substance formed by the granulations or a change in the surface of the granulations themselves.

The new skin most commonly takes its rise from the surrounding old skin, as if elongated from it; but, according to Mr. Hunter, not always. In very large sores, but principally old ulcers, in which the edges of the surrounding skin have but little tendency to contract, and the cellular membrane underneath to yield, or the old skin to become drawn over the ulcerated surface, the nearest granulations do not acquire a cicatrizing disposition. In such cases, new skin forms in different parts of the ulcer, standing on the surface of the granulations like little islands.

This power of the centre of a sore to form new skin, however, is not universally admitted; and while Sir Astley Cooper acknowledges the fact of insulated portions of skin being sometimes seen in the middle of sores, he maintains, that such appearance is produced in consequence of the whole of the skin not having been destroyed by ulceration, and granulations having arisen from the part of the skin which was left. This, he says, only happens in irregularly formed sores, where, after the healing process has gone on to the centre, the sore breaks out again at the circumference.—(See *Lancet*, *vol.* 1, *p.* 225.)

Whatever change the granulations undergo to form new skin, they are generally guided to it by the surrounding skin, which gives this disposition to the surface of the adjoining granulations.

The new-formed skin is never so large as the sore was on which it is formed, owing to the contraction of the granulations, and the yielding of the surrounding old skin. If the sore is situated where the adjoining skin is loose, as in the scrotum, then the contractile power of the granulations being quite free from obstruction, a very little new skin is formed; but if the sore is situated where the skin is fixed or tense, the new skin is nearly as large as the sore.

The new skin is at first commonly on the same level with the old. This, however, is not the case with scalds and burns, which frequently heal with a cicatrix higher than the skin, although the granulations may have been kept from rising higher than this part.

The new-formed cutis is neither so yielding nor so elastic as the original is; it is also less moveable. It gradually becomes, however, more flexible and loose. At first it is very thin and tender, but it afterward becomes firmer and thicker. It is a smooth continued skin, not formed with those insensible indentations which are observed in the natural or original skin, and by which the latter admits of any distention which the cellular membrane itself will allow of.

This new cutis, and indeed all the substance which had formerly been granulations, is not nearly so strong, nor endowed with such lasting and proper actions, as the originally formed parts. The living principle itself is less active; for when an old sore breaks out, it continues to yield, till almost the whole of the new-formed matter has been absorbed, or has mortified.

The young cutis is extremely full of vessels; but they afterward disappear, and the part becomes white. Hence the white appearance of the cicatrices or marks of small-pox.

The surrounding old skin being drawn towards the centre by the contraction of the granulations, is thrown into loose folds, while the new skin itself seems to be upon the stretch, having a smooth shining appearance.

The new cuticle is more easily formed from the cutis, than the cutis itself from granulations. Every point of the surface of the cutis is concerned in forming cuticle, so that this is forming equally every where at once; but the formation of the cutis is principally, if not entirely, progressive from the adjoining skin.

The new cuticle is at first very thin, and rather pulpy than horny. As it becomes stronger, it looks smooth and shining, and is more transparent than the old cuticle.

The rete mucosum is later in forming than the cuticle, and in some cases never forms at all. In blacks, who have been wounded or blistered, the cicatrix is a considerable time before it becomes dark; and in one black whom Mr. Hunter saw, the scar of a sore, which had been upon his leg when young, remained white when he was old. This case, however, must have been an unusual one; for it is now ascertained that the new skin of a negro does not become white, but is at first red, and after a little time turns blacker than the original skin.—(*Sir A. Cooper*, *Lancet*, *vol.* 1, *p.* 227.) According to this gentleman's observations, muscle and cartilage are the only two parts of the body incapable of being reproduced in the processes of cicatrization: when a muscle is divided, it unites by means of a tendinous substance; and, except in very young subjects, the cartilages of the ribs invariably unite with the intervention of bone.—(*Hunter*, *On the Blood*, *Inflammation*, *&c.* *Thomson's Lectures on Inflammation*, *p.* 399, *&c.*)

CICUTA. See *Conium Maculatum*.

CINCHONA. As one of the designs of this Dictionary is to embrace the subjects of a surgical pharmacopœia, Peruvian bark, which is administered in a very great number of surgical cases, cannot be passed over in silence.

Its great repute for its virtues in stopping mortifica-

tions, and accelerating the separation of the sloughs, every person, whether of the medical profession or not, has frequently heard of. Indeed, so high is the character of the medicine, that many practitioners order it in some stage or another of almost every distemper, often prescribe it when it is totally useless, give it when it actually does harm, and make their patients swallow such quantities as operate perniciously, when smaller doses would effect striking benefit. Some men are credulous enough to think, that from the Peruvian bark vigour and strength are directly extricated and infused into the constitution, in exact proportion to the quantity of the medicine which the stomach will keep down and digest.

While a doctrine of this sort prevails, we must expect to see indiscriminate and erroneous practice. The generality of diseases will always be attended with an appearance of languor and weakness, and certainly, while there exists a supposition that a drug is at hand, possessing the quality of evolving and communicating strength, it would be absurd to fancy that so important an article will not be largely exhibited in a multiplicity of surgical cases. I shall not presume to hazard an idea of the powers of the Peruvian bark in the practice of physic; but I have not the least doubt that they have been unwarrantably exaggerated in surgery, so as to blind and prejudice many a practitioner of good abilities, and lead him to adopt injudicious and hurtful methods of treatment.

Under particular circumstances, bark has undoubtedly the quality of increasing the tone of the digestive organs; and, of course, whenever the indication is to strengthen the system by nourishing food, and the appetite fails, this medicine may prove of the highest utility, provided it be given in moderate doses, and it be found to agree with the stomach and bowels. But the plan of making the patient swallow as much of it as can be got into his stomach, must, in my opinion, be invariably followed by bad instead of good effects. How can it be reasonably expected that the stomach, which is already out of order, can be set right by having an immoderate quantity of any drug whatever forced into it? In fact, if the alimentary canal were in a healthy state, must not such practice be likely to throw it into a disordered condition?

Bark is an excellent medicine when judiciously administered; but, like every other good medicine in bad hands, it may be the means of producing the worst consequences. How much good does mercury effect in an infinite number of surgical diseases, when prescribed by a surgeon of understanding; what a poison it becomes under the direction of an ignorant practitioner! With respect to cases of mortification, bark is often most strongly indicated when the sloughing is not surrounded with active inflammation, when the patient is debilitated, and his stomach cannot take nutritious food. I have always regarded the notion of giving bark as a specific for gangrene as totally unfounded and absurd. I have watched its effects in these cases, and could never dis ern that it had the least peculiar power of operating directly upon the parts which are distempered. Whatever good it does is by its improving the tone of the digestive organs, and making them more capable of conveying nourishment, and of course strength into the constitution.

I should feel myself guilty of a degree of presumption in speaking thus freely upon this subject, were not my sentiments in some measure supported by those of certain surgical writers, the remembrance of whom will always be hailed with unfeigned veneration and esteem. Mr. Samuel Sharp was not bigoted to bark, and while he allowed it to possess a share of efficacy, he would not admit that it was capable of miraculously accomplishing every thing which the ignorant or prejudiced alleged. "I know," says he, "it will be looked upon by many as a kind of skepticism, to doubt the efficacy of a remedy so well attested by such an infinity of cases; and yet I shall frankly own I have never clearly to my satisfaction met with any evident proofs of its preference to the cordial medicines usually prescribed; though I have a long a time made experiment of it with a view to search into the truth.

Perhaps it may seem strange thus to dispute a doctrine established on what is called matter of fact; but I shall here observe, that in the practice of physic and surgery it is often exceedingly difficult to ascertain a fact. Prejudice or want of abilities sometimes misleads us in our judgment, where there is evidently a right and a wrong; but in certain cases to distinguish how far the remedy and how far nature operate, is probably above our discernment. In gangrenes particularly, there is frequently such a complication of unknown circumstances as cannot but tend to deceive an unwary observer. Mortifications arising from mere cold, compression, or stricture, generally cease upon removing the cause, and are, therefore, seldom proper cases for proving the power of the bark. However, there are two kinds of gangrene where internals have a fairer trial; those are a spreading gangrene from an internal cause, and a spreading gangrene from violent external accidents, such as gun-shot wounds, compound fractures, &c. Yet even here we cannot judge of their effect with absolute certainty; for sometimes a mortification from internal causes is a kind of critical disorder. There seems to be a certain portion of the body destined to perish, and no more; of this we have an infinity of examples brought into our hospitals, where the gangrene stops at a particular point without the least assistance from art. The same thing happens in the other species of gangrene from violent accidents, where the injury appears to be communicated to a certain distance and no farther; though, by-the-way, I shall remark in this place, contrary to the received opinion, that gangrenes from these accidents (where there has been no previous straitness of bandage) are as often fatal as those from internal causes.

As I have here stated the fact, we see how difficult it is to ascertain the real efficacy of this medicine; but had bark in any degree those wonderful effects in gangrenes which it has in periodical complaints, its preeminence would no more be doubted in the one case than in the other. What, in my judgment, seems to have raised its character so high, are the great numbers of single observations published on this subject, the authors of which, not having frequent opportunities of seeing the issue of this disorder under the use of cordials, &c., and some of them, perhaps, prejudiced with the common supposition, that every gangrene is of itself mortal, have therefore ascribed a marvellous influence to the bark, when the event has proved successful."—(*Sharp's Crit. Inq. chap.* 8, *on Amputation.*)

Some farther remarks on this subject will be reserved for the article *Mortification*.

According to Mr. Bromfield, bark is a specific for old ulcers, where the inflammation seems circumscribed at the distance of an inch round the sore, the surface of the ulcer looks glossy, and the discharge is extremely thin and very offensive, with little or no sleep from the violence of the pain. He farther observes, that the addition of opium, as circumstances may require, will often be found necessary.—(*Chirurgical Observations and Cases, vol.* 1, *p.* 132.)

Bark is given so extensively in the practice of surgery, that there are few important cases in which, in certain circumstances, and at some period or another, it is not indicated. When persons have been weakened by a course of mercury, or by the effects of any disease whatsoever, moderate doses of bark will frequently be found of great service. But it only becomes so on the principles above suggested, and, as far as my judgment extends, this medicine should never be prescribed in any surgical cases in excessive and unreasonable quantities.

[The use of charcoal, in combination with one-fourth part of pulverized myrrh, is found of essential service as a tonic in the debility and constitutional irritation which are induced in some habits by the excessive use of mercury, and I learn from my friend Dr. Francis, that he has recently tested its efficacy to his entire satisfaction. In the mercurial sore-throat of long standing, it has proved an effective remedy, and its use may be alternated or combined with bark and other corroborants in fulfilling the indications required in the eczema mercuriale.—*Reese.*]

The yellow bark, or the cortex cinchonæ cordifoliæ of the new pharmacopœia, is said to possess more efficacy than the other kinds. One desirable result of the complete establishment of the modern doctrine, that the virtues of the various kinds of cinchona reside in two salifiable bases, or alkaline elements, termed *cinchonine*, and *quinine*, is that of being able to prescribe preparations which will concentrate all the efficacy of the medicine in formulæ of moderate bulk, not likely at least to disorder the alimentary canal by the mechanical effects of quantity.

The sulphate of quinine, or quina, as Dr. Paris terms it, "appears to be the most efficient of all the salts of bark. We must be careful not to combine it with substances that form insoluble compounds with it. The infusum rosæ comp. is objectionable as a vehicle, on account of the astringent matter which it contains, and which therefore precipitates the quina from its solution." The form in which Dr. Paris prefers to prescribe it is that of solution, with a minim of sulphuric acid to every grain of the salt.—(*Pharmacologia, vol.* 2, *p.* 163.) It is frequently made into pills, with the conserve of roses, or joined with hyosciamus, squills, opium, and other medicines. Professor Brande does not agree with Dr. Paris, respecting the compound infusion of roses being an unfit vehicle for sulphate of quinine, and recommends the subjoined formula: ℞. Quiniæ sulphatis gr. ij. Infus. rosæ comp. ℥ xi. Tinct. cort. aurant. syrupi ejusdem ā ā ℥ ss. M. ft. haustus bis in die sumendus.

CINNABAR, ARTIFICIAL. (*Hydrargyri sulphuretum rubrum*), is chiefly employed by surgeons for fumigating venereal ulcers. An apparatus is sold in the shops for this purpose. The powder is thrown upon a heated iron, and the smoke is conducted by means of a tube to the part affected.

CIRCUMCISION. (From *circumcido*, to cut round.) The operation of cutting off a circular piece of the prepuce, sometimes practised in cases of phymosis.—(See *Phymosis.*)

CIRSOCELE. (From κιρσὸς, a varix, and κήλη, a tumour.) Cirsocele is a varicose distention and enlargement of the spermatic vein; and whether considered on account of the pain which it sometimes occasions, or on account of a wasting of the testicle, which now and then follows, it may truly be called a disease. It is frequently mistaken for a descent of a small portion of omentum. The uneasiness which it occasions is a dull kind of pain in the back, generally relieved by suspension of the scrotum. It has been fancied to resemble a collection of earth-worms; but whoever has an idea of a varicose vessel, will not stand in need of an illustration by comparison. It is most frequently confined to that part of the spermatic process, which is below the opening in the abdominal tendon; and the vessels generally become rather larger as they approach the testis. Mr. Pott never knew good effects arise from external applications of any kind.

In general the testicle is perfectly unconcerned in, and unaffected by, this disease; but it sometimes happens, that it makes its appearance very suddenly, and with acute pain, requiring rest and ease; and sometimes after such symptoms have been removed, Mr. Pott has seen the testicle so wasted as hardly to be discernible. He has also observed the same effect from the injudicious application of a truss to a true cirsocele; the vessels, by means of the pressure, became enlarged to a prodigious size, but the testicle shrunk to almost nothing.—(*Pott's Works, vol.* 2.)

Morgagni has remarked, that the disease is more frequent in the left than in the right spermatic cord; a circumstance which he refers to the left spermatic vein terminating in the renal.—(*De Sedibus et Caus. Morb. Epist.* 43, *art.* 34.)

Cirsocele is, more frequently than any other disorder, mistaken for an omental hernia. As Sir Astley Cooper remarks, when large it dilates upon coughing; and it swells in an erect, and retires in a recumbent posture of the body. There is only one sure method of distinguishing the two complaints: place the patient in a horizontal posture, and empty the swelling by pressure upon the scrotum; then put the fingers firmly upon the upper part of the abdominal ring, and desire the patient to rise: if it is a hernia, the tumour cannot reappear, as long as the pressure is continued at the ring; but if a cirsocele, the swelling returns with increased size, on account of the return of blood into the abdomen being prevented by the pressure.—(*A. Cooper on Inguinal Hernia.*)

Cirsocele can, for the most part, only be palliated, and seldom radically cured. When the complaint is attended with pain, cold saturnine and alum lotions may be applied to the testicle and spermatic cord. At the same time, blood should be repeatedly taken away by means of leeches; the bowels should be kept gently open; the patient should be placed in a horizontal posture, and the testicle should be supported in a bag-truss.

In general, the patient only finds it necessary to keep up the testicle with this kind of suspensory bandage.

[I learn from Dr. H. G. Jameson, of Baltimore, that he has been favoured with singular success in treating cirsocele, by tying the spermatic artery. He has thus proved that this painful and disagreeable disease may be radically cured by this simple operation. The first public account I can find of this operation, is that performed by Dr. J. in 1821, and published in the *Am. Med. Recorder* for 1825. He reports, that in neither of the cases in which this operation was performed, did the patient suffer in the integrity of the testis, nor, so far as could be ascertained, did the ligature interfere with the important functions of that organ, although both these effects had been feared, and even predicted.

Dr. Stephen Brown, of New-York, has succeeded in curing varicocele by a similar operation, viz. tying the spermatic vein. Although no evil consequences resulted in this case from the ligature, yet, after the facts before the profession, of the dangerous and fatal results of tying the veins, the propriety of performing this operation for the cure of varicocele may be justly questioned, unless in cases of so much suffering and danger as to warrant this hazard.—(See *N. Y. Med. and Phys. Journal for* 1824.)—*Reese.*]

Gooch and other writers have related cases of cirsocele, in which the pain was so intolerable and incurable, that nothing but castration could afford the patient any relief.—(*J. A. Murray de Cirsocele, Upsal*, 1784. *Pott on Hydrocele, &c. Richter in Nov. Comment, Goett. No.* 4, *and in Obs. Chir. Fasc.* 2, *p.* 22. *Gooch, Chir. Works. Most, Diss. de Cirsocele, Halæ*, 1796.)

CIRSOPHTHALMIA. (From κιρσὸς, a varix, and ὀφθαλμὸς, the eye.) A general varicose affection of the blood-vessels of the eye.

CLAP. See *Gonorrhœa.*

CLOACA. The openings leading through the new bony shell, in cases of necrosis, down to the enclosed dead bone are termed *cloacæ.*

COLLYRIUM ACIDI ACETICI. ℞. Aceti distillati, ℥j. Spiritus vini tenuioris, ℥ss. Aq rosæ, ℥viij. Misce.

COLLYRIUM ALUMINIS. ℞. Aluminis purif. ℈j. Aq. rosæ, ℥vj. Misce.

COLLYRIUM AMMONIÆ ACETATÆ. ℞. Liq. ammon. acet., aq. rosæ sing. ℥j. M.

COLLYRIUM AMMONIÆ ACETATÆ CAMPHORATUM. ℞. Collyrii ammon. acet. misturæ camphoratæ sing. ℥ij. M.

COLLYRIUM AMMONIÆ ACETATÆ OPIATUM. ℞. Collyrii ammon. acet. ℥iv. Tinct. opii gutt. xl. M.

COLLYRIUM CUPRI SULPHATIS CAMPHORATUM. ℞. Aq. cupri sulphatis camphoratæ, ℥ij. Aq. distillatæ, ℥iv. M. Recommended by the late Mr. Ware, for the purulent ophthalmy of children.

COLLYRIUM HYDRARGYRI OXYMURIATIS. ℞. Hydrarg. oxymuriatis, gr. ss. Aq. distillat. ℥iv. M. This collyrium is fit to be employed after the acute stage of ophthalmy has subsided, and it will disperse many superficial opacities of the cornea.

COLLYRIUM OPIATUM. ℞. Opii extracti gr. x. Camphoræ gr. vj. Aquæ distillatæ ferventis, ℥xii. Beat the first two ingredients together in a mortar, and mix the hot water gradually, and strain the fluid.

This collyrium is recommended in some ophthalmies attended with great pain and swelling.—(See *Wilson's Pharm. Chir. p.* 70.)

COLLYRIUM PLUMBI ACETATIS. ℞. Aquæ rosæ, ℥vj. Plumbi acetatis, ℥ss. Misce: or, ℞. Aq. distillatæ, ℥iv. Liq. plumbi acetatis gutt. x. M. This is a good application to the eyes, when one of a gently astringent, cooling quality is indicated.

COLLYRIUM ZINCI SULPHATIS. Zinci sulphatis, gr. v. Aq. distillatæ, ℥iv. M. This is the most common collyrium of all: it may be made gradually stronger.

COLLYRIUM ZINCI SULPHATIS CUM MUCILAGINE SEMINIS CIDONII MALI. ℞. Aq. plantaginis, ℥iv. zinci sulphatis, gr. v. et mucil. sem. cydon. mal. ℥ss. M. In order to check the morbid secretion from the eyelids, in cases of fistula lachrymalis, or what Scarpa calls [illegible]*usso palpebrale puriforme*, this celebrated Professor recommends a few drops of the above collyrium to be insinuated between the eyelid and the eye.

COLPOCELE. (From κόλπος, the vagina, and κήλη, a tumour.) A tumour or hernia situated in the vagina.

COLPOPTOSIS. (From κόλπος, the vagina, and πίπτω, to fall down.) A bearing or falling down of the vagina.—(See *Vagina, Prolapsus of.*)

COMMINUTED. (From *comminuo*, to break in pieces.) A fracture is termed *comminuted* when the bone is broken into several pieces.

COMPRESS. (From *comprimo* to press upon.) Folded linen, lint, or other materials, making a sort of pad, which surgeons place over those parts of the body on which they wish to make particular pressure; and for this purpose a bandage is usually applied over the compress. Compresses are also frequently applied to prevent the ill effects which the pressure of hard bodies or tight bandages would otherwise occasion.

COMPRESSION OF THE BRAIN. See *Head, Injuries of.*

CONCUSSION OF THE BRAIN. See *Head, Injuries of.*

CONDYLOMA. (From κόνδυλος, a tubercle or knot.) A small, very hard tumour. The term is generally applied to excrescences of this description about the anus. The practitioner may either destroy them with caustic, tie their base with a ligature, or remove them at once with a knife; the first is generally the worst, the last the best and most speedy method.

CONIUM MACULATUM. Hemlock. *Cicuta.* This is a medicine to which my observations in practice incline me to impute considerable efficacy in several surgical diseases. However, there is no doubt, that when it is represented as a certain cure for cancer and scrofula, exaggeration is employed. It is an excellent remedy for irritable painful sores of the scrofulous kind, and it will complete the cure of many ulcers in which the venereal action has been destroyed by mercury, though the healing does not proceed in a favourable way. Hemlock is likewise beneficial to several inveterate malignant sores, particularly some which are every now and then met with upon the tongue. It is an eligible alterative in cases of noli me tangere, porrigo, and various herpetic affections. I have seen several enlargements of the female breast give way to hemlock conjoined with calomel. Some swellings of the testes also yield to the same medicines. Hemlock certainly has not the power of curing cancer; but its narcotic anodyne qualities tend to lessen the pain of that distemper, so as to render it by no means a contemptible remedy in that intractable kind of case.

Respecting hemlock, Mr. Pearson observes, that the extract and powder may be sometimes given with evidently good effect in spreading irritable sores; whether they are connected with the active state of the venereal virus, or whether they remain after the completion of the mercurial course; and it would seem, that the benefit conferred by this drug ought not to be ascribed solely to its anodyne qualities, since the same advantages cannot always be obtained by the liberal exhibition of opium, even where it does not disagree with the stomach. He states that cicuta is almost a specific for the venereal ulcers which attack the toes at their line of junction with the foot, and which frequently become gangrenous. Also, in spreading sores which are accompanied with great pain, and no appearance of remarkable debility, hemlock will often do more than bark, vitriol, or cordials. The common mode of exhibiting hemlock is in the form of pills, made of the extractum conii, five grains to each. However, I have always thought three grains sufficient to begin with, the dose being afterward gradually augmented. It is curious how large a quantity may at last be taken in this manner. Mr. J. Wilson, in his Pharmacopœia Chirurgica, informs us of a remarkable case of cancerous ulcer, for which the patient took a hundred and twenty pills, each consisting of five grains of the extractum conii, in twenty-four hours, and this without any benefit being produced, or any inconvenience to the patient.

The stomach being a little disordered, and the head somewhat giddy, is a sign of the dose being sufficiently strong.

"According to some writers, but more particularly Dr. Withering, there are several ways in which the views of a medical practitioner, in prescribing this remedy, may be frustrated. The plant chosen for preparing the extract may not be the true *conium maculatum*, which is distinguished by red spots along the stalk. It may not be gathered when in perfection, namely, when beginning to flower. The inspissation of the juice may not have been performed in a water-bath, but, for the sake of despatch, over a common fire. The leaves, of which the powder is made, may not have been cautiously dried and preserved in a well-stopped bottle; or, if so, may still not have been guarded from the ill effects of exposure to light. Or lastly, the whole medicine may have suffered from the mere effects of long keeping. From any of these causes, it is evident, the powers of cicuta may have suffered; and it happens, no doubt, very frequently, that the failure of it ought, in fact, to be attributed to one or other of them."—(*Pharmacopœia Chirurgica, published in* 1802, *p.* 174.)

The activity of hemlock is now found to reside in a resinous element, obtained separately, by evaporating an ethereal tincture of the leaves on the surface of water. A dose of half a grain will produce vertigo and headache. The watery extract of this plant has been proved by Orfila to have but little power.—(*J. A. Paris, in Pharmacologia, vol.* 2, *p.* 180, *ed.* 6.)

I have sometimes prescribed as an alterative, with manifest benefit in several surgical diseases, a pill containing three grains of extractum conii, or, what is preferable, the dried leaves, one of hydrargyri submurias (calomel), and one of antimonii sulphuretum præcipitatum. In various cases of scrofulous diseases, and also in several very painful irritable ulcers and swellings, it is occasionally employed in the form of fomentations and poultices. The latter are generally made by mixing the powder with the common bread and water cataplasm. *F. Hoffman, Of Hemlock*, 8vo. *Lond.* 1763. *A. Storck, Libellus, quo demonstratur cicutam non solum usu interno tutissimè exhiberi, sed et esse simul remedium valdè utile, &c.; editio altera*, 8vo. *Vindob.* 1761. *Also, Supplementum Necessarium de Cicuta*, 8vo. *Vindob.* 1761. *J. Pearson, On Various Articles of the Materia Medica, &c.* 2*d edit.* 8vo. *London*, 1807. *J. A. Paris, Pharmacologia, ed.* 6.

CONJUNCTIVA, GRANULAR. The following account of this subject is given by Dr. Frick. This disease is mostly the sequel of purulent ophthalmy. It is characterized by a rough, scabrous, or granulated state of the palpebral conjunctiva, with a gleety or puriform discharge from its surface. The constant friction of the eyelids upon the globe brings on a varicose state of the sclerotic conjunctiva, and a dusky appearance of the cornea. The patient complains of a sensation similar to that produced by sand, or other extraneous matter, under the eyelids; the eye cannot endure the light, and there is a troublesome epiphora. In the recent stage, a cure is easily accomplished by the application of a few leeches to the eyebrows, and pencilling the part once or twice a day with the vinous tincture of opium, or the ung. hydrarg. nitrat. When these means fail, the sulphate of copper or nitrate of silver may be used, though not so freely as to produce a slough, but only to change the diseased condition of the part.—(See *Frick, On Dis. of the Eye, p.* 240, *ed.* 2.) Mr. R. Welbank recommends the use of these means to be followed by ablution with tepid water, and the application of a few leeches. He also recommends counter-irritation and active aperients. The upper eyelid, he says, should be completely everted in examination, as there is sometimes, at the angle where the conjunctiva passes from the globe to the lid, a crescentic fringed fold, not unlike a cock's comb, apt to keep up a tedious inflammation of the cornea. Dr. Frick considers excision of the granular surface proper only when it is hard, insensible, and prominent, or the excrescences hang like peduncles from the surface of the eyelids. In this state, Dr. Vetch recommends the application of a little burnt alum, or verdigris, and then washing it off with a syringe.—(See the article *Cornea*, and *Frick, Vetch, and Travers on Diseases of the Eye.*)

CONTUSED WOUNDS. See *Wounds.*

CONTUSION. (From *contundo*, to bruise.) A bruise.

Slight bruises seldom meet with much attention; but when they are severe, very bad consequences may ensue; and these are the more likely to occur, when such cases are not taken proper care of.

In all severe bruises, besides the inflammation which the violence necessarily occasions, there is an instantaneous extravasation, in consequence of the rupture of many of the small vessels of the part. In no other way can we account for those very considerable tumours, which often rise immediately after injuries of this nature. The black and blue appearance instantly following many bruises can only be explained by there being

an actual effusion of blood from the small arteries and veins which have been ruptured. Even largish vessels are frequently burst in this manner, and considerable collections of blood are the consequence. Blows on the head very often cause a large effusion of blood under the scalp. I have seen many ounces thus extravasated.

Besides the rupture of an infinite number of small vessels, and an extravasation of blood, which attend all bruises in a greater or less degree, the tone of the fibres and vessels which have suffered contusion is considerably disordered. Nay, the violence may have been so great, that the parts are from the first deprived of vitality, and must slough.

Parts at some distance from such as are actually struck may suffer greatly from the violence of the contusion. This effect is what the Fench have named a *contrecoup*.

The bad consequences of bruises are not invariably proportioned to the force which has operated; much depends on the nature and situation of the part. When a contusion takes place on a bone which is thinly covered with soft parts, the latter always suffer very severely, in consequence of being pressed, at the time of the accident, between two hard bodies. Hence, bruises of the shin so frequently cause sloughing and troublesome sores. Contusions affecting the large joints are always serious cases; the inflammation occasioned is generally obstinate; and abscesses and other diseases, which may follow, are proper grounds for serious alarm.

In the treatment of bruises, the practitioner has three indications, which ought successively to claim his attention.

The first is to prevent and diminish the inflammation which, from the violence done, must be expected to arise. The bruised parts should be kept perfectly at rest, and be covered with linen, constantly wet with the liquor plumbi acetatis dilutus, or the lotio ammon. acetatis. When muscles are bruised, they are to be kept in a relaxed position, and as quiet as possible.

If the bruise be very violent, it will be proper to apply leeches, and this repeatedly; and even in some cases, particularly when the joints are contused, to take blood from the arm. In every instance, the bowels should be kept well open with saline purgatives.

A second object in the cure of contusions is to promote the absorption of the extravasated fluid by discutient applications. These may at once be employed in all ordinary contusions, not attended with too much violence: for then nothing is so beneficial as maintaining a continual evaporation from the bruised part, by means of the cold saturnine lotion, and at the same time repeatedly applying leeches. In common bruises, however, the *lotio ammoniæ muriatæ* (see *this article*) is an excellent discutient application; but most surgeons are in the habit of ordering liniments for all ordinary contusions; and certainly they do so much good in accelerating the absorption of the extravasated blood, that the practice is highly praiseworthy. The linimentum saponis or the linimentum camphoræ are as good as any that can be employed.—(See *Linimentum.*)

In many cases unattended with any threatening appearances of inflammation, but in which there is a good deal of blood and fluid extravasated, bandages act very beneficially, by the remarkable power which they have of exciting the action of the lymphatics, by means of the pressure which they produce.

A third object in the treatment of contusions is to restore the tone of the parts. Rubbing the parts with liniments has a good deal of effect in this way. But notwithstanding such applications, it is often observed, that bruised parts continue for a long while weak, and even swell and become œdematous, when the patient takes exercise, or allows them to hang down, as their functions in life may require. Pumping cold water two or three times a day on a part thus circumstanced, is the very best measure which can be adopted. A bandage should also be worn, if the situation of the part will permit. These steps, together with perseverance in the use of liniments, and in exercise gradually increased, will soon bring every thing into its natural state again.

COPPER. The subacetate and sulphate are used in surgery. The first, often called ærugo, or prepared verdigris, is employed as an escharotic. Mixed with an equal quantity of powdered cantharides, it is sometimes applied for the removal of warts and other excrescences. At present, the old practice of destroying the surface of chancres with it, with the view of hindering the absorption of venereal matter, and rendering the exhibition of mercury needless, may be said to be completely abandoned.

CORNEA. (From *cornu*, a horn.) The anterior transparent convex part of the eye, which in texture is tough, like horn. It has a structure peculiar to itself, being composed of a number of concentric cellular lamellæ, in the cells of which is deposited a particular sort of fluid. It is covered externally by a continuation of the conjunctiva, which belongs to the class of mucous membranes: and it is lined by a membrane, the tunica humoris aquei, which seems to belong to the serous class.

FLESHY EXCRESCENCES OF THE CORNEA.

Mr. Wardrop, in his *Essays on the Morbid Anatomy of the Human Eye*, has published an excellent chapter on this subject. Besides pterygia, which are treated of in another part of this Dictionary, Mr. Wardrop states that the cornea is subject to two kinds of caruncles, or fleshy excrescences. One appears at birth, or soon after it, and resembles the nævi materni, so frequent on the skin of various parts of the body. The second is described as having a greater analogy to the fungi which grow from mucous surfaces, and being in general preceded by ulceration.

Of the congenital excrescence of the cornea, Mr. Wardrop has seen two remarkable instances. The first was in a girl eight or ten years of age, on whose left eye there was a conical mass; the base of which grew from about two-thirds of the cornea, and a small portion of the adjoining sclerotic coat.

The second example occurred in a patient upwards of fifty years old. The tumour had been observed from birth, was about as large as a horse-bean, and only a small portion of it seemed to grow from the cornea. The other part was situated on the white of the eye, next the temporal angle of the orbit. From the middle of the excrescence, upwards of twelve long firm hairs grew, and hung over the cheek.

Mr. Wardrop acquaints us, that a similar tumour, with two hairs growing out of it, was seen at Lisbon by Dr. Barron, of St. Andrew's. Mr. Crampton also mentions, that he once saw a "tuft of very strong hairs proceeding from the sclerotica."—(*Essay on the Entropeon*, *p.* 7.) And De Gazelles met with an instance, in which a single hair grew from the cornea.—(*Journ. de Médecine*, *tom.* 24.) According to Mr. Wardrop, this species of excrescence of the cornea greatly resembles the spots covered with hair, which are frequent on various parts of the surface of the body.

With regard to the second kind of tumour growing from the cornea, a fungus, proceeding from an ulcer of this part of the eye, is stated to be very uncommon. However, it is said that when a portion of the iris protrudes through an ulcer of the cornea, the growth of a large excrescence from the projecting part is not so unusual. Of such a disease, Mr. Wardrop has cited examples from *Maître-Jean's Traité des Maladies des Yeux*, *Voigtel*, *Beer*, *and Plaichner*. Excrescences growing from the cornea are also quoted from the following works: *Handbuch der Pathologischen Anatomie*, *von F. G. Voigtel*, *Halle*, 1804. *Praktische Beobachtungen uber den grauen Staar und die Krankheiten der Hornhaut*, *von Joseph Beer*, *Wien*, 1791. *Plaichner's Dissertatio de Fungo Oculi.*—(See *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, *vol.* 1, *chap.* 4.) Others are likewise described by *Mery*, *in Mem. de l'Acad. des Sciences*, 1703; *by Dupré*, *in Phil. Trans. vol.* 19; and *Home*, *in the same work*, *vol.* 81.

The only treatment which excrescences of the cornea admit of, is that of removing them with a scalpel and a pair of forceps, or destroying them with caustic.

ABSCESSES OF THE CORNEA.

When the matter is collected between the lamellæ of the cornea, it first appears like a small spot; and instead of resembling a speck in colour, it is of the yellow hue of common pus. As the quantity of the matter increases, this spot becomes broader, and it does not alter its situation from the position of the

head. If it be situated among the external layers of the cornea, or immediately below the corneal conjunctiva, a tumour is formed anteriorly, and if touched with the point of a probe, the contained fluid can be felt fluctuating within, or if the eye be looked at sideways, an alteration in the form of the cornea may be readily perceived.

When the matter collects between the interior lamellæ, it does not produce any evident alteration in the external form of the cornea; but if it be touched with the point of a probe, a fluctuation can be more or less distinctly perceived, and the spot alters its form, and becomes somewhat broader.

Such collections of matter appear on every part of the cornea. Sometimes they alter their situation by degrees, and sink downwards; and sometimes they change both their situation and form. They very seldom cover more than one-fourth or one-third of the cornea.

When the quantity of matter is small, it is often completely absorbed during the abatement of the inflammatory symptoms, and it generally leaves no vestige behind it. In other cases, the cornea is eroded externally, producing an ulcer and subsequent opacity. In some few instances, the internal lamellæ of the cornea give way, and the matter escapes into the anterior chamber. When an artificial opening is made, the matter often does not readily flow out; and it is sometimes so tenacious, and contained in a cavity so irregular, that it neither escapes spontaneously, nor can it be evacuated by art.

It is particularly to the cases in which matter collects between the layers of the cornea, that the terms *unguis* and *onyx* are applied.—(See *Wardrop's Essays on the Morbid Anatomy of the Human Eye, vol.* 1, *chap.* 6.) According to a late writer, these words should be restricted to what he names "crescentic interlamellar depositions."—(*Travers's Synopsis of the Diseases of the Eye, p.* 115.) Where the cornea is affected with onyx, this gentleman commends antiphlogistic treatment.—(*P.* 278.) And with respect to a large collection of matter in the cornea, whether the puriform onyx or central abscess, he observes, that it requires "a supporting constitutional treatment, mild cathartics, and the application of blisters: calomel should be avoided, and the cornea can seldom be punctured with advantage."—(*P.* 280.)

OPACITIES OF THE CORNEA.

Opacity of the cornea is one of the worst consequences of obstinate chronic ophthalmy. The term *opacity* is used when the loss of transparency extends over the whole or the greater part of the cornea; while other cases of a more limited kind are named *specks*. The distinction, as Beer observes, is chiefly important in respect to the prognosis.—(*Lehre von den Augenkr. b.* 2, *p.* 77.)

Scarpa distinguishes the superficial and recent species of opacity from the *albugo* and *leucoma* (see *these words*), which are not in general attended with inflammation, assume a clear and pearl colour, affect the very substance of the cornea, and form a dense speck upon this coat of the eye. The *nebula*, or slight opacity, here to be treated of, is preceded and accompanied by chronic ophthalmy; it allows the iris and pupil to be discerned through a kind of cloudiness, and consequently does not entirely bereave the patient of vision, but permits him to distinguish objects, as it were, through a mist. The nebula is an effect of protracted or ill-treated chronic ophthalmy. The veins of the conjunctiva, much relaxed by the long continuance of the inflammation, become preternaturally turgid and prominent; afterward they begin to appear irregular and knotty, first in their trunks, then in their ramifications, near the union of the cornea with the sclerotica, and lastly in their most minute ramifications, returning from the delicate layer of the conjunctiva, spread over the cornea. It is only, however, in extreme relaxation of the veins of the conjunctiva, that these very small branches of the cornea become enlarged.

When this happens, some reddish streaks begin to be perceptible, in the interspaces of which, very soon afterward, a thin, milky, albuminous fluid is effused, which dims the diaphanous state of the cornea. The whitish, delicate, superficial speck thence resulting forms precisely what is termed *nebula*, or the kind of opacity here to be considered. And since this extravasation may happen only at one point of the cornea, or in more places, the opacity may be in one speck or in several distinct ones, but which altogether diminish more or less the transparency of this membrane.

The cloudiness of the cornea, which sometimes takes place in the inflammatory stage of violent acute ophthalmy, especially differs from the species of opacity expressed by the term *nebula*. The first is a deep extravasation of coagulating lymph in the internal cellular texture of the cornea, or else the opacity proceeds from an abscess between the layers of this membrane about to end in ulceration. On the other hand, the nebula forms slowly upon the superfices of the cornea, in long-protracted chronic ophthalmy; is preceded first by a varicose enlargement of the veins in the conjunctiva, next of those in the delicate lamina of this tunic, continued over the front of the cornea; and finally it is followed by an effusion of albuminous lymph in the texture of this thin layer, expanded over the transparent part of the eye. This effusion never elevates itself in the shape of a pustule. Wherever the cornea is affected with *nebula*, the part of the conjunctiva corresponding to it is constantly occupied by net-work of varicose veins, more knotty and prominent than other vessels of the same description; and though the cornea be clouded at more points than one, there are distinct corresponding fasciculi of varicose veins in the white of the eye. Scarpa injected an eye affected with chronic ophthalmy and *nebula*, and he found that the wax easily passed, both into the enlarged veins of the conjunctiva, and those of that part of the surface of the cornea where the opacity existed; the inosculations all round the margin of the cornea were beautifully variegated, without trespassing that line which bounds the sclerotica, except on that side where the cornea was affected with the species of opacity.

Mr. Travers does not adopt precisely the same definition of nebula as Scarpa; for he describes it as a thickening of the conjunctiva, and an effusion of adhesive matter between it and the cornea, or *between the lamellæ of the latter*, commonly the product of acute strumous ophthalmy.—(*Synopsis, &c. p.* 118.)

According to Scarpa, the superficial opacity, which alone he calls nebula, demands, from its very origin, active treatment; for though at first it may only occupy a small portion of the cornea, when left to itself it advances towards the centre of this membrane, and the ramifications of the dilated veins upon this coat growing still larger, at length convert the delicate continuation of the conjunctiva upon the surface of the cornea, into a dense opaque membrane, obstructing vision.

The curative indication in this disease is to make the varicose vessels resume their natural diameters, or if that be impracticable, to cut off all communication between the trunk of the most prominent varicose veins of the conjunctiva, and the ramifications coming from the surface of the cornea, the seat of the opacity. The first mode of treatment is executed by means of topical astringents and corroborants, especially Janin's ophthalmic ointment, and *success attends it when the opacity is in an early state, and not extensive. But when advanced to the centre of the cornea, the most infallible treatment is the excision of the fasciculus of varicose veins near their ramifications, that is, near the seat of the opacity.* By means of this excision, the blood retarded in the dilated veins of the cornea is voided; the varicose veins of the conjunctiva have an opportunity to contract and regain their tone, no longer having blood impelled into them; and the turbid secretion effused in the texture of the layer of the conjunctiva continued over the cornea, or in the cellular substance connecting these two membranes, becomes absorbed. The celerity with which the nebula disappears after this operation is surprising, commonly in twenty-four hours. The extent to which the excision of the varicose veins of the conjunctiva must be performed depends upon the extent of the opacity of the cornea. Thus, should there be only one set of varicose vessels, corresponding to an opacity of moderate extent, it is sufficient to cut a portion of them away. Should there appear several dim specks upon the cornea, with as many distinct sets of varicose vessels, arranged round upon the white of the eye, the surgeon must make a circular incision into the conjunctiva, near the margin of the cornea, by which he will certainly divide every plexus of varicose vessels. But let

it be observed, that a simple incision through the varicose vessels is not permanently effectual in destroying all direct communication between the trunks and ramifications of these vessels upon the cornea, after such an incision made, for instance, with a lancet; though it be true that a separation of the mouths of the divided vessels follows in opposite directions, it is no less true, that in the course of a few days after the incision, the mouths of the same vessels approximate each other, and inosculate, so as to resume their former continuity. Hence, to derive from this operation all possible advantage, it is essential to extirpate with the knife a small portion of the varicose plexus, together with the adherent particle of the tunica conjunctiva.

The eyelids are to be separated from the affected eye by a skilful assistant, who is, at the same moment, to support the patient's head upon his breast. The surgeon is then to take hold of the varicose vessels with a pair of small forceps, near the edge of the cornea, and to lift them a little up, which the lax state of the conjunctiva renders easy; then, with a pair of small, curved scissors, he is to cut away the plexus of varicose vessels, together with a small piece of the conjunctiva, making the wound of a semilunar form, and as near as possible to the cornea. If it should be necessary to operate upon more than one plexus of varicose vessels, situated at some distance apart, the surgeon must elevate them one after the other with the forceps, and remove them. But when they are very close together, and occupy every side of the eye, he must make an uninterrupted circular incision in the conjunctiva, guiding it closely to the margin of the cornea all around, so as to divide with the conjunctiva all the varicose vessels.

This being done, he may allow the cut vessels to bleed freely, even promoting the hemorrhage by fomenting the eyelids until the blood discontinues to flow. Scarpa then covers the eye with an oval piece of the emplastrum saponis and a retentive bandage. The eye ought not to be opened till twenty-four hours after the operation, when, usually, the opacity of the cornea will be found completely dispersed; and, during the ensuing days, the patient is to be enjoined to keep the eye shut, and covered with a bit of fine rag. A collyrium of milk and rose-water, warm, may be applied two or three times a day. When the inflammation of the conjunctiva happens, about the second or third day after the operation, particularly in cases in which the incision is made all round, while the greater part of the sphere of the eye reddens, a whitish circle, in the place of the incision, forms a line of boundary to the redness which does not extend farther upon the cornea. This inflammation of the conjunctiva, with the aid of internal antiphlogistic remedies and topical emollients, abates in a few days, and then pus is secreted along the track of the incision in the conjunctiva. The wound contracts, and, growing smaller and smaller, soon cicatrizes. Bathing the eye with warm milk and rose-water is the only local treatment necessary in this stage of the complaint.

Thus, not only the transparency of the cornea is revived, but also the preternatural laxity of the conjunctiva is diminished, or even removed. When the conjunctiva subsequently appears yellowish and wrinkled, the use of topical astringents and corroborants, and of Janin's ophthalmic ointment, may be highly beneficial in preventing the recurrence of the varicose state of the vessels.—(*Scarpa sulle Malattie degli Occhi*, c. 8.)

According to the experience of Dr. Vetch, Scarpa's plan of removing the plexus of varicose vessels, together with a portion of the conjunctiva, produces no good effect, "except in cases of great relaxation of the membrane covering the eye." He asserts, that new vessels immediately appear in the room of those removed, and the good derived from the bleeding does not compensate for the irritation produced by the operation.—(*A Practical Treatise on the Diseases of the Eye*, p. 86.) However, when it is reflected, that Scarpa advises this practice only for advanced cases, and particularly recommends topical astringents for the more recent stages of the disease, he nearly agrees with Dr. Vetch, as far as this point is concerned. But Scarpa's account of the disease and its treatment is left imperfect by the omission of any notice of the connexion frequently existing between opacity of the cornea, and a rough, scabrous, granulated state of the lining of the eyelids. Yet, perhaps, Scarpa was not to be expected to treat of this combination in his chapter on nebula, because his definition of this superficial opacity will not altogether suit the affection of the same membrane referred to in the following observations. It is remarked by Dr. Vetch, that after the complete cessation of conjunctival ophthalmia, as far as regards that portion of the membrane which covers the eye, the villous elongation of the vessels of the lining of the eyelids, instead of recovering their natural state, acquire a farther increase of size, so as to produce a rough, scabrous, or granulated surface, with a secretion of puriform matter. The irritation of this unequal surface gradually induces an inflammatory state of the sclerotic vessels, and, consequently, a greater flow of blood towards the cornea: the superficial vessels become varicose; the conjunctiva assumes a dusky and loaded appearance; and the cornea becomes opaque, not partially, but throughout the whole extent of its structure. This affection, says Dr. Vetch, is essentially different from those nebulous or partial opacities which take place in primary sclerotic inflammation, and which consist in slight extravasations, accompanied by intolerance of light, and in which any affection of the palpebral linings is a secondary instead of a primary circumstance. The cornea is of the green colour presented by a broken gun-flint; and while it is sufficiently diaphanous to permit the perception of light, it is yet too opaque to allow the patient to discern external objects, except by their shades. Nor can the colour of the iris and limits of the pupil be seen. Dr. Vetch also describes the conjunctiva as being sometimes so much relaxed, and its vessels so generally loaded, as to give it a dusky appearance similar to that of the cornea; and, in other instances, without much alteration of its thickness or transparency, it is said to lose for a considerable extent its close attachment to the subjacent lamina of the cornea. Along with the opaque state of the cornea, there is more generally an enlargement of individual vessels, which penetrate almost to its centre, increase as they come outwards, and terminate in trunks, which run to the duplicature of the conjunctiva. Dr. Vetch represents this disease of the palpebræ as consisting at first in a highly villous state of their membranous lining. This state, if not rectified by proper treatment, gives birth to granulations, which in time become more deeply sulcated, hard, or warty, accompanied by an oozing of purulent matter. Dr. Vetch has explained, that the use of the actual cautery, excision, and friction, for the purpose of curing the diseased state of the eyelids, may be traced back to Hippocrates, who prefers escharotics. Dr. Vetch ascribes their first employment in these cases to St. Ives. Mr. Saunders, he observes, took an early and a just view of the relations existing between the diseased conditions of the palpebral linings, and the opaque state of the cornea; and he succeeded in establishing the cure of the latter by the removal of the former. In short, Dr. Vetch admits, that in the case which more especially formed the claim of Mr. Saunders to the discovery of the nature of the disease, the practice of excision was attended with complete success. Dr. Vetch contends, however, that this method is for the most part inadequate to the cure of the disease; and that there are very few cases, in which the more certain and consistent process of gradually repressing the diseased surface by escharotic substances will not produce a more complete and permanent cure. After giving a fair trial to a great variety of escharotics made into ointments, and applied to the inside of the upper eyelid, Dr. Vetch found the direct application of the escharotic substances themselves was preferable. When there is too much increased action of the vessels of the sclerotic coat, Dr. Vetch recommends the use of escharotics to be preceded by cupping the temples; or, when there is any risk of a slough, the application of a leech to the inside of the lower eyelid. Whatever will bring on a determination of blood to the head is to be avoided, and a low regimen observed.

The escharotics preferred by Dr. Vetch, are the sulphate of copper and nitrate of silver, scraped in the form of a pencil and fixed in a porte-crayon. In this way, Dr. Vetch says, they should be applied, not, as some have conceived, with the view of producing a slough over the whole surface, but with great delicacy, and in so many points only as will produce a gradual change in the condition and disposition of the part. As long as there is any

secretion of pus, the above application may be materially assisted by the daily use of the undiluted liquor plumbi acetatis. When the disease resists these remedies, and its surface is hard and warty, Dr. Vetch applies to the everted surface powder of verdigris or burnt alum, finely levigated; or even lightly touches the diseased surface with the kali purum. In employing these remedies, he enjoins confining their operation to the point of contact, so as to prevent them from hurting the eye. Hence, they are to be applied in very minute quantities with a fine camel's hair pencil, and to be washed off with an elastic gum syringe, before the eyelid is returned. Of the employment of astringent collyria in conjunction with escharotics, Dr. Vetch disapproves.—(See *A Practical Treatise on the Diseases of the Eye*, p. 67, &c.) With respect to the treatment by excision, as first practised by Mr. Saunders with scissors, and afterward by Sir W. Adams with a knife, the principle of cure does not appear to me different from that aimed at with escharotics, unless these latter be supposed not always to destroy, but sometimes to cause an absorption of the fungous granulations. At present, the last method is considered most effectual, and during the operation the eyelids should be everted over a probe.

For the form of disease termed by Mr. Travers "strumous nebula, with vessels overshooting the cornea," this gentleman recommends ptyalism. He says, that "the hydrargyrus cum creta or oxymuriate, in small but frequent doses, will sometimes succeed better in this case, than the other forms of mercury, and the combination of calomel with antimony, better than that with opium." When the internal exhibition of mercury either disorders the bowels or has no effect on the constitution, frictions are to be preferred.—(*Synopsis of the Diseases of the Eye*, p. 282.) In the particular form of opacity, to which he alludes, he disapproves of dividing the vessels of the conjunctiva before the inflammation has declined.—(*P.* 285.)

From some observations published by Mr. Wardrop, it would appear, that certain opacities of the cornea are produced by an increase in the quantity of the contents of the eyeball, and not by the deposition of an albuminous fluid in the texture of the cornea, as takes place in the common speck. He considers this fact proved, by cases in which the cornea regained its transparency the instant the aqueous humour was evacuated. Some cases are detailed by this gentleman, with the view of recommending the practice of puncturing the cornea, and discharging the aqueous humour, for the relief of the kind of opacity to which we have here alluded.—(See *Med. Chir. Trans. vol.* 4, p. 180, &c.)

For other opacities of the cornea, refer to *Albugo*, *Leucoma*, and *Staphyloma*.

ULCERS OF THE CORNEA.

An ulcer is a common consequence of the bursting of a small abscess, which not unfrequently forms beneath the delicate layer of the conjunctiva continued over the cornea, or in the very substance of the cornea itself, after violent ophthalmy. At other times, the ulcer is produced by the contact of corroding matter, or sharp pointed bodies insinuated into the eyes, such as quicklime, pieces of glass or iron, thorns, &c. As Dr. Vetch has observed, ulceration of the cornea is a very frequent consequence of purulent ophthalmy. The little abscess of the cornea is attended with the same symptoms as the severe acute ophthalmy; especially with a troublesome sensation of tension in the eye, eyebrow, and nape of the neck; with ardent heat; copious secretion of tears; aversion to light; intense redness of the conjunctiva, particularly near the point of suppuration. The inflammatory pustule, compared with similar ones in any other part of the body, is slow in bursting after matter is formed. Scarpa deems it improper, however, to puncture the small abscess; for, though it assumes the appearance of being perfectly maturated, the matter contained in it is so tenacious and adherent to the substance of the cornea, that not a particle issues out of the artificial aperture, and the wound exasperates the disease, increases the opacity of the cornea, and often occasions another small abscess to form in the vicinity of the first. Indeed, if the observations of Mr. Travers be correct, "the ulcer of the cornea begins not in abscess, but in a circumscribed deposite of lymph, or in pure ulcerative absorption without pus."—(*Synopsis of the Diseases of the Eye*, p. 106.) And Dr. Vetch takes notice, that the observation with respect to fluid matter never forming in the cornea, he invariably found true in several cases, where the whole of the eyeball had been destroyed by inflammation.—(*Practical Treatise on the Diseases of the Eye*, p. 52.) This author differs from Scarpa, however, respecting the question of opening pustules or abscesses of the cornea; for he remarks, that whenever the matter or slough is removed, the ulcer, however deep and extensive, will fill up without leucoma being the consequence. By a little address, he says, it may in most instances be removed in a mass upon the point of a lancet or couching-needle.—(*Op. cit. p.* 50.) This remark applies both to cases where lymph or tenacious matter more or less protrudes, and to instances in which it is quite confined between the lamellæ of the cornea. Scarpa thinks that the safest plan is to temporize, until the pustule spontaneously bursts, promoting it by means of frequent fomentations, bathing the eye with warm milk and water, and applying emollient poultices. The spontaneous bursting of the little abscess is usually denoted by a sudden increase of all the symptoms of ophthalmy; particularly by an intolerable burning pain at the point of the cornea, where the abscess first began, greatly increased by motion of the eye or eyelid. The event is confirmed by ocular inspection, and at the spot where the white pustule existed a cavity appears, as may best be seen when the eye is viewed in the profile. Extraneous bodies in the eye, which have simply divided a part of the cornea, or lodged in it, when soon extracted do not in general cause ulceration, as the injured part heals by the first intention. Those which destroy or burn the surface of this membrane, or which, when lodged, are not soon extracted, excite acute ophthalmy, suppuration at the injured part, and at length ulceration.

As Dr. Vetch has observed, the appearance of ulceration varies according to the degree of apostemation, or tendency towards it in the surrounding cornea: when this part is clear, the case is doing well, but when opacity comes on, the ulcer is increasing. The soft middle lamina, he says, is destroyed with great rapidity when the inflammation is violent, but as soon as the ulcer reaches the internal coat, it often proceeds no farther.—(*Practical Treatise on Diseases of the Eye*, p. 52.)

The ulcer of the cornea, as Scarpa remarks, has this in common with all solutions of continuity in the skin, where this is delicate, tense, and endowed with exquisite sensibility, that at its first appearance, it is of a pale ash colour; has its edges high and irregular; creates sharp pain; discharges, instead of pus, an acrid serum, and tends to spread widely and deeply. Such is the precise character of ulcers upon the cornea, and such is the nature of those upon the nipples of the mammæ, the glans penis, lips, apex of the tongue, the tarsi, the entrance of the meatus auditorius externus; nostrils, &c. Ulcers of this description, neglected or ill-treated, speedily enlarge, make their way deeply, and destroy the parts in which they are situated. If they spread superficially upon the cornea, the transparency of this membrane is destroyed; if they proceed deeply and penetrate the anterior chamber of the aqueous humour, this fluid escapes, and a fistula of the cornea may ensue; and if it should form a larger opening in it, besides the exit of the aqueous humour it occasions another more grievous malady than the ulcer itself, namely, a prolapsus of a portion of the iris; an escape of the crystalline lens and vitreous humour; in short, a total destruction of the whole organ of sight. It is therefore of the highest importance, as soon as an ulcer appears upon the cornea, to impede its growing larger as much as the nature of it will permit; the morbid process should be converted into a healing one, and the surgeon must exert his skill with more attention, the more extensively and deeply the ulceration has proceeded. According to Scarpa, the cicatrix of a larger ulcer impairs the texture of the cornea so much, that the injury is irreparable. Yet Dr. Vetch assures us, that when a slough covers an ulcer of considerable extent, and is taken off with great caution, so as not to wound the inner tunic of the cornea; or when it cannot be removed, if it be slightly scarified and divided, the cornea may recover its transparency after two-thirds of it have been in this state.—(*Practical Treatise on Diseases of the Eye*, p. 51.)

They who inculcate that no external application can be adopted with benefit for the cure of this disease, before the acute ophthalmy has been subdued, or at least diminished, are, in Scarpa's opinion, deceived. Experience teaches that local remedies ought, in the very first instance, to be applied to the ulcer; such as are appropriate to lessen the increased morbid irritability and stop the destructive process going on: afterward such means should be taken as will cure the ophthalmy if it does not subside gradually, as the ulcer heals. It is a fact, confirmed by repeated observation, that it is the ulcer which keeps up the ophthhalmy, not the ophthalmy the ulcer. The case, however, is to be excepted in which the ulcer makes its appearance in the height of a severe ophthalmy. Here the first indication is to abate inflammation before attempting to heal the sore.

It is true, that when the little abscess of the cornea breaks, the symptoms of acute ophthalmy are aggravated; the redness of the conjunctiva is increased, as well as the turgid state of its vessels; but it is equally certain, that it happens from no other cause than an increased inflammation in the part, in consequence of the augmented sensibility in the ulcerated spot of the cornea. As soon as this increase of sensibility in the ulcer of the cornea ceases or abates in violence, the ophthalmy retreats with equal speed; and finally, when the ulcer heals, the inflammation disappears gradually, or, at most, requires only the use of an astringent and corroborant collyrium for a few days. Analogous examples every day occur in practice, in ulcers of other parts besides the cornea; particularly in little foul ulcers on the inside of the lips, on the apex of the tongue, on the nipples, on the glans penis, which, as was described above, at their first appearance assume an ash-coloured surface, excite inflammation of the part in which they are seated, and cause a very troublesome itching and ardent heat in the part affected. To subdue this inflammation we do nothing more, and the vulgar do the same, than repel the excessive irritability in these ulcers, and convert the ulcerative process into cicatrization: this done, the surrounding inflammation immediately disappears of itself.

Such speedy and good effects may be obtained by caustic. It immediately destroys the naked extremities of the nerves in the ulcerated part, and soon removes the diseased irritability in the part affected; it converts the ash-coloured surface of the ulcer, and the serous discharge upon it, into an eschar and scab, which, as a kind of epidermis, moderate the contact of the neighbouring parts upon the ulcer, and at length convert the process of ulceration into that of granulation and cicatrization.

For cauterizing the ulcer of the cornea, the caustic to which Scarpa gives the preference is the argentum nitratum. It must be scraped to a point, like a crayon pencil, and the eyelids being opened perfectly, and the upper eyelid suspended, by means of Pellier's elevator, the ulcer of the cornea is to be touched with the apex sufficiently to form an eschar. Should any of the caustic dissolve in the tears, the eye must be copiously bathed with warm milk. At the instant the caustic is applied, the patient complains of a most acute pain; but this aggravation is amply compensated by the ease experienced a few minutes after the operation: the burning heat in the eye ceases, as it were by a charm; the eye and eyelids become capable of motion without pain; the flux of tears and the turgidity of the vessels of the conjunctiva decrease; the patient can bear a moderate light, and enjoys repose. These advantages last while the eschar adheres to the cornea.

On the separation of the eschar, sometimes at the end of two, three, or four days after the application of the caustic, the primary symptoms of the disease recur, especially the smarting and burning pain at the ulcerated part of the cornea; the effusion of tears; the restraint in moving the eye and eyelids; and the aversion to light; but all these inconveniences are less in degree than before. At their recurrence the surgeon, without delay, must renew the application of the argentum nitratum, making a good eschar, as at first, upon the whole surface of the ulcer, which will, as before, be followed by perfect ease in the eye. The application of the caustic is, if required, to be repeated a third time; that is, if, upon the separation of the eschar, the extreme irritability in the ulcer is not exhausted, and its progressive mischief checked. When the case goes on favourably, it is a constant phenomenon in the cure of this disease, that at every separation of the eschar, the diseased sensibility of the eye is decreased; the ulcer also, abandoning its pale ash-colour, assumes a delicate, fleshy tint, a certain sign that the destructive process which prevailed is turned into a healing one. The turgid state of the vessels of the conjunctiva, and the degree of ophthalmy, disappear in proportion as the ulcer draws near to a cure. At this epoch, when the formation of granulations has begun, the surgeon would act very wrongly were he to continue the use of the argentum nitratum; it would now reproduce pain, effusion of tears, and inflammation of the eye; and the ulcer would take on that foul, ash-coloured aspect, with swelled and irregular edges, which it had in the beginning. Platner has noticed this fact. *Necesse est, ut hoc temperatâ manu, nec crebrius fiat, ne nova inflammatio, novaque lachrymatio hic acrioribus concitetur.*--(*Inst. Chirurg.* §314.) As soon as ease is felt in the eye, and granulations begin to rise, whether after the first, second, or third application of the caustic, the surgeon must refrain from the use of every strong caustic, and use only the following collyrium: ℞. *Zinci sulphatis gr.* iv. *Aq. rosæ*, ℥iv. *Mucil. sem. cydon mali* ℥ss. M. This is to be used every two hours, the eye in the intervals being defended from the air and light by means of a gentle compress and retentive bandage. When, besides the ulcer of the cornea, a slight relaxation of the conjunctiva remains, Janin's ointment, towards the end of the treatment, introduced between the eye and eyelids, morning and evening, proved serviceable. It must be adapted in strength and quantity to the particular sensibility of the patient.

To cure those superficial excoriations of the cornea which make no excavation in the substance of this membrane, and which, in reality, are only a detachment of the cuticle, covering the layer of the conjunctiva continued over the cornea, the use of caustic is not requisite. The same collyrium, combined with mucilage, is sufficient. The symptoms which accompany these slight excoriations or detachments of the cuticle are unimportant, and when the patient takes care to bathe his eye every two or three hours with the solution of sulphate of zinc, and to avoid too much light and exposure to the air, they soon get well.

According to Dr. Vetch, when the ulcerative process is likely to destroy the membrane which lines the cornea, it can only be checked by measures calculated to subdue the inflammation upon which it depends. "As long, therefore, as there is an appearance of activity in the disease, or recurrence of pain, local blood-letting by cupping or leeches must be steadily adhered to. The indication of the ulcer healing is easily seen in the diminished activity of the inflammation, relief from pain, and the clean aspect of the ulcerated part. The injection of vegetable, tepid, astringent infusions may be used, or milk and water only. When called upon in extreme cases, where the immediate perforation of the inner membrane is threatened, we may, with great propriety, resort to the operation of puncturing the cornea at a place as remote as possible from the ulcer. Next in importance to a diminution of the action on which the ulcer depends, is the removal by scarification of any slough thrown out from its surface, or imbedded in the adjoining part of the cornea. Sometimes, but always subordinate to these indications, we may add some topical applications to the ulcer; a solution of nitrate of silver, the infusion of tobacco or calomel in powder, applied with a camel's hair pencil."—(*Practical Treatise on Diseases of the Eye, p.* 57.) In incipient protrusions of the inner membrane of the cornea, this author decidedly condemns the use of the argentum nitratum in the free manner proposed by Scarpa; observing that, "if the caustic touches by accident the edge of the ulcer, or any part but the apex of the projecting vesicle, it will often produce much mischief."

Thus far of ulcers of the cornea, and the best method of curing them in ordinary cases. However, sometimes, says Scarpa, in consequence of ill-treatment, the ulcer, already very extensive, assumes the form of a fungous excrescence upon the cornea, appearing to derive its nourishment from a band of blood-vessels of the conjunctiva; and on this account it occasions, not unfrequently, a serious mistake in being taken for a real pterygium. Left to itself, or treated with slight astringents, it produces, in general, a loss of the whole eye. It requires the speedy adop-

tion of some active and efficacious plan to destroy all the fungus upon the cornea, to annihilate the vessels of the conjunctiva tending to it, and to impede the progress of ulceration. This consists first in cutting away the fungus with a pair of small scissors to a level with the cornea, continuing the incision far enough upon the conjunctiva to remove with the excrescence that string of blood-vessels from which it seems to derive its supply. Having effected this, and allowed the blood to flow freely, Scarpa applies the argentum nitratum to all the space of the cornea which appears to have been the seat of the fungus, so as to make a complete eschar; and if, upon its separation, the whole morbid surface should not be destroyed, he repeats the caustic until the ulcerative process changes into a healing one. To execute commodiously such a full application of the caustic, it is not in general enough to have the upper eyelid raised by an assistant, and the lower one depressed; it is also farther requisite, that the operator should evert the upper eyelid completely, and keep it so, while a deep eschar is made with the caustic.

The action of the caustic cannot always be calculated with precision, and therefore a portion of the whole thickness of the cornea may be destroyed with the fungus, which never fails to be followed by a prolapsus of the part of the iris through the aperture made in the cornea. This accident may seem grievous, yet it is not irreparable, as will be shown in the article *Iris, Prolapsus of*; and when the surgeon can produce a firm cicatrix at the point where the excrescence was situated, which prevents a reproduction of the fungus and a total destruction of the eye, he has fulfilled the indications required.—(*Scarpa, sulle Malattie degli Occhi.*)

In a late publication, two cases of ulcer of the cornea are recorded, which were benefited by Mr. Wardrop's operation of puncturing the cornea and discharging the aqueous humour. In the first example, there was an ulcer on the central part of the cornea, and a cluster of blood-vessels passing towards it. The whole eyeball was also much inflamed. The puncture was made at the place where the vessels passed. The patient's severe headache was relieved, and under the use of fomentations and the vinous tincture of opium, all the other symptoms rapidly subsided. In the second case, there were two or three erosions, with a good deal of muddiness of the cornea, headache, &c. The obscurity of this membrane instantly disappeared, and the headache subsided, upon the aqueous humour being discharged. With the help of bleeding and fomentations, the symptoms abated, the ulcer healed in a few days, and the eye recovered.—(See *Med. Chir. Trans. vol.* 4, *p.* 186, 187.)

In superficial ulcers of the cornea, attended with much inflammation of the conjunctiva, Mr. Travers recommends opium, combined so as to operate upon the skin, and keeping the bowels well open. Here he differs from Scarpa, in specifying the use of the nitrate of silver as the best local treatment. Warm fomentations, he says, afford temporary relief; and when the inflammation of the sclerotica is intense, he advises the exhibition of mercury.—(*Synopsis of the Diseases of the Eye, p.* 278.)

With regard to the treatment of indolent and deep sloughing ulcers of the cornea, Mr. Travers praises, in addition to the employment of the nitrate of silver, the occasional use of leeches, and the administration of tonics and sedatives.

The same author has also noticed chronic interstitial ulcers, where the cornea is transparent, "but indented like a bonce when stuck upon a marble hearth, or pitted, according as the ulcers are diffused or circumscribed." These are said to succeed acute inflammation, when large quantities of blood have been lost, and to occur frequently in children imperfectly nourished, or in adults who are very debilitated. With the aid of good diet, tonics, and moderate topical stimulants, like vinum opii, or the zinc collyrium, they become hazy, which denotes the commencement of the adhesive inflammation.—(*Op. cit. p.* 117.)

OSSIFICATION OF THE CORNEA.

Mr. Wardrop has seen only one instance of ossification of the cornea; and in that case the whole eye was changed in its form, and the cornea had become opaque. On macerating the latter part, a piece of bone, weighing two grains, oval-shaped, hard, and with a smooth surface, was found between its lamellæ. A piece of bone was also found between the choroid coat and retina.

The same gentleman informs us, that Walter had, in his museum, a piece of cornea, taken from a man sixty years of age, containing a bony mass, which was three lines long, two broad, and weighed two grains.

In Mr. Wardrop's publication there is also recorded a curious case, in which a portion of bone was formed, either in the substance of the cornea, or immediately behind it, and which was extracted from the eye by Mr. Anderson, surgeon at Inverary. The patient was a woman thirty-one years of age, and the formation of the bony substance, which was about half as large as a sixpence, is said to have been occasioned by a fall against the root of a tree, fifteen years before the operation, by which accident the eye was struck, though not cut.—(See *Wardrop's Essays on the Morbid Anatomy of the Human Eye, vol.* 1, *chap.* 10.)

ALTERATION IN THE FORM OF THE CORNEA.

This is the last subject which I shall take notice of in the present article. It is well known that the convexity of the cornea varies in different persons, and in the same individual at different periods of life, this part of the eye being naturally most convex in young subjects. It appears also from the experiments of the late Mr. Ramsden, and those of Sir E. Home, that the sphericity of the cornea is altered according to the distance at which objects are viewed.

Sometimes the cornea projects or collapses so considerably, without its transparency being affected, that sight is much impaired or quite destroyed. The first case has been called by some authors the *Staphyloma pellucidum*; the second, *Rhytidosis*.

Leveillé, the French translator of Scarpa's book on the diseases of the eye, has described a case in which the cornea of both eyes became of a conical form. Mr. Wardrop met with two examples of a similar disease; but only one eye was affected in each of them. In both cases, the conical figure of the cornea was very remarkable, and the apex in the cone was in the centre of the cornea. When the eye was viewed laterally, the apex resembled a piece of solid crystal; and when looked at directly opposite, it had a transparent sparkling appearance, which prevented the pupil and iris from being distinctly seen.

One of these cases occurred in a lady upwards of thirty years of age, and the changes produced in her vision were very remarkable. At the distance of an inch, or an inch and a half, she could plainly distinguish small objects when held towards the temporal angle of the eye, although it required considerable exertion; but the sphere of vision was very limited.

On looking through a small hole in a card, she could distinguish objects held very close to the eye, and could even read a book.

At any distance greater than two inches, vision was very indistinct; and at a few feet she could neither judge of the distance nor the form of the object.

When she looked at a distant luminous body, such as a candle, it was multiplied five or six times, and all the images were more or less indistinct. She could never find any glass sufficiently concave to assist her vision. She did not remark this complaint in her eye until she was about sixteen years of age, and she does not think it has undergone any change since that time.

In Mr. Wardrop's publication may be read a letter from Dr. Brewster, giving an explanation of the phenomena of the foregoing case.

It appears that Mr. Phipps had opportunities of watching the progress of several cases in which the cornea had become conical, and that he never saw the disease in persons under the age of fourteen or sixteen. The same gentleman also observed, that when the cone is once complete, the disease seldom makes any farther progress, except that the apex sometimes becomes opaque.

Burgman saw a remarkable case where the cornea of both the eyes of a person, who had been hanged, were so prodigiously extended, that they reached down to the mouth like two horns.—(*Haller, Disputationes Chirurg. tom.* 2.) The chapter of Mr. Wardrop on the preceding subject will be found highly interesting to such as are desirous of farther information concerning this curious disease of the eye.—(See *Wardrop's Essays on the Morbid Anatomy of the Eye, vol.* 1, *chap.* 13.) For information relative to diseases of the cornea,

see *M. Geiger, De Fistula Corneæ, Tub.* 1742. *C. F. Giffiheil, De Ulceribus Corneæ, Tub.* 1744. *J. W. Baury, De Maculis Corneæ, &c. Tub.* 1743. *G. H. Volger, De Maculis Corneæ, 4to. Gött.* 1778. *A. G. Richter, Anfangsgr. der Wundarzn. b.* 3, *kap.* 4. *8vo. Gött.* 1795. *Ant. Scarpa, Trattato delle Malattie degli Occhi, ed.* 2, *8vo. Pavia,* 1816, *chap.* 8. 10. *J. Beer, Praktische Beobacht. über den grauen Staar, und die Krankheiten der Hornhaut, Wien,* 1799, *und Lehre von den Augenkr. b.* 2, *Wien,* 1817. *M. J. Chelius, Ueber die durchsichtige Hornhaut des Auges, ihre Function, und ihre Krankhaften Veränderungen, 8vo. Karlsruhe,* 1818. *A. Clemens, Diss. sistens Tunicæ Corneæ et Humoris Aquei Monographiam Physiologico-pathologicam, 4to. Gött.* 1816. *J. Wardrop's Essays on the Morbid Anatomy of the Human Eye, vol.* 1, *8vo. edit.* 1808. *B. Travers, Synopsis of the Diseases of the Eye, 8vo. Lond.* 1820. *J. Vetch, A Practical Treatise on the Diseases of the Eye, 8vo. Lond.* 1820. The sections of this work on opaque cornea and ulceration of the cornea are highly interesting.

CORNS. (*Clavi, Spinæ Pedum, Calli, Condylomata, &c.*) A corn, technically called *clavus*, from its fancied resemblance to the head of a nail, is a brawn-like hardness of the skin, with a kind of root sometimes extending deeply into the subjacent cellular substance. When this is the case, the indurated part is fixed; but while the hardness is more superficial, it is quite moveable. Some corns rise up above the level of the skin in the manner of a flat wart. They are hard, dry, and insensible, just like the thickened cuticle which forms on the soles of the feet, or on the hands of labouring people.

Corns are entirely owing to repeated and long-continued pressure. Hence they are most frequent in such situations as are most exposed to pressure, and where the skin is near bones, as on the toes, soles of the feet, &c. However, corns have occasionally been seen over the crista of the ileum from the pressure of stays, and even on the ears from the pressure of heavy earrings.

Corns of the feet are usually owing to tight shoes, and consequently they are more common in the higher classes, and in women, than other subjects. In females, indeed, the ridiculous fashion of wearing high-heeled shoes was very conducive to this affliction; for certainly it merits the appellation. In shoes thus made the whole weight of the body falls principally on the toes, which become quite wedged, and dreadfully compressed in the end of the shoe.

Though some persons who have corns suffer very little, others occasionally endure such torture from them, that they are quite incapable of standing or walking. Doubtless the great pain proceeds from the irritation of the hard corn on the tender cutis beneath, which is frequently very much inflamed in consequence of the pressure. It is observed that every thing which accelerates the motion of the blood, which heats the feet, which increases the pressure of the corn on the subjacent parts, or the determination of blood to the feet, or which promotes its accumulation in them, exasperates the pain. Hence, the bad effects of warm stockings, tight shoes, exercise, long standing, drinking, &c. The pain in warm weather is always much more annoying than in winter.

If a person merely seeks temporary relief, it may be obtained by pulling off his tight shoes, sitting down, placing his feet in a horizontal posture, and becoming a little cool: the prominent portion of the corn should be cut off, as far as it can be done without exciting pain or bleeding, and the feet should be bathed in warm water.

The radical cure essentially requires the avoidance of all the above causes, and particularly of much walking or standing. Wide, soft shoes should be worn. Such means are not only requisite for a radical cure, but they alone very often effect it. How many women become spontaneously free from corns in childbed and other confinements! Though the radical cure is so easy, few obtain it, because their perseverance ceases as soon as they experience the wished-for relief.

When business or other circumstances prevent the patient from adopting this plan, and oblige him to walk or stand a good deal, still it is possible to remove all pressure from the corn. For this purpose, from eight to twelve pieces of linen, smeared with an emollient ointment, and having an aperture cut in the middle, exactly adapted to the size of the corn, are to be laid over each other, and so applied to the foot, that the corn is to lie in the opening in such a manner that it cannot be touched by the shoe or stocking. When the plaster has been applied some weeks, the corn commonly disappears without any other means. Should the corn be in the sole of the foot, it is only necessary to put in the shoe a felt-sole, wherein a hole has been cut, corresponding to the situation, size, and figure of the induration.

A corn may also be certainly, permanently, and speedily eradicated by the following method, especially when the plaster and felt-sole with a hole in it are employed at the same time. The corn is to be rubbed twice a day with an emollient ointment, such as that of marshmallows, or with the volatile liniment, which is still better; and in the interim is to be covered with a softening plaster. Every morning and evening the foot is to be put for half an hour in warm water, and while there the corn is to be well rubbed with soap. Afterward all the soft, white, pulpy outside of the corn is to be scraped off with a blunt knife; but the scraping is to be left off the moment the patient begins to complain of pain from it. The same treatment is be persisted in without interruption until the corn is totally extirpated, which is generally effected in eight or twelve days. If left off sooner, the corn grows again.

A multitude of other remedies for curing corns are recommended. They all possess, more or less, an emollient and discutient property. The principal are green wax, soap, mercurial and hemlock plasters, a piece of green oil-skin, &c. They are to be applied to the corn, and renewed as often as necessary. A very successful composition consists of two ounces of gum ammoniacum, the same quantity of yellow wax, and six drachms of verdigris. In a fortnight, if the corn yet remain, a fresh plaster is to be applied.

It is frequently difficult and hazardous to cut out a corn. The whole must be completely taken away, or else it grows again; and the more frequently it is partially cut away, the quicker is its growth rendered. When the skin is moveable, and consequently the corn not adherent to the subjacent parts, its excision may be performed with facility and safety, but not without pain. But, in the opposite case, either leaving a piece of the corn behind, or wounding the parts beneath, can seldom be avoided. The latter circumstance may excite serious mischief.

A person entirely cured of corns is sure to be affected with them again, unless the above-mentioned causes be carefully avoided. Some subjects are indeed particularly disposed to have the complaint. There are persons who for life wear tight shoes, and take no care of their feet, and yet are never incommoded with corns. On the contrary, others are constantly troubled with them, though they pay attention to themselves. Many are for a time vexed with corns, and then become quite free from them, though they continue to wear the same kind of shoes and stockings.

Mr. Wardrop recommends cutting or tearing away as much of the corn as can be done with safety; then keeping the toe for some time in warm water; and after the adjacent skin has been well dried, rubbing the exposed surface of the corn with the argentum nitratum, or wetting it, by the means of a camel-hair pencil, with a solution of the oxymuriate of mercury in spirit of wine. Either of these applications, two or three times repeated, he says, will mostly effect a cure.—(See *Med. Chir. Trans. vol.* 5, *p.* 140.) However, the use of caustic for the cure of corns is not a new proposal.—(See *Callisen's Syst. Chir. Hodiernæ, part* 2, *p.* 200.)

The above account is partly taken from *Richter's Anfangsgründe der Wundarzneykunst, b.* 1.

COUCHING. The depression of a cataract out of the axis of sight, or the displacement, breaking, and disturbance of the opaque lens in various ways with a kind of needle for these purposes, so as to bring about the dispersion and absorption of the cataract.—(See *Cataract.*)

COUVRE CHEF. The name of a bandage.—(See *Bandage.*)

CRANIUM. For an account of its fractures, see *Head, Injuries of.*

CREMOR LITHARGYRI ACETATI. R. Cremoris lactis ℥j. Liq. plumbi. acet. ℥j. M. Employed by Kirkland in ophthalmies, and other inflammations.

CREPITUS. The grating sensation or noise occasioned by the ends of a fracture, when they are moved and rubbed against each other; one of the most positive symptoms of the existence of such an accident.

CUPRI SULPHAS (*Sulphate of Copper*) is an escharotic, and an ingredient in several astringent fluid applications, lotions for ulcers, collyria for the eyes, and injections for the urethra.

CURETTE. (French.) An instrument shaped like a minute spoon or scoop, invented by Daviel, and used in the extraction of the cataract, for taking away any opaque matter, which may remain behind the pupil, immediately after the lens has been taken out.

CURVATURE OF THE SPINE. See *Vertebræ, Disease of.*

CUPPING. See *Bleeding.*

CYSTITOME. (From κύστις, and τέμνω, to cut.) An instrument made on the same principle as the pharyngotomus, and invented by M. de la Faye, for opening the capsule of the crystalline lens.

CYSTOCELE. (From κύστις, the bladder, and κήλη, a tumour.) A hernia formed by a protrusion of the bladder.—(See *Hernia.*)

CYSTOTOMIA. (From κύστις, the bladder, and τέμνω, to cut.) The operation of opening the bladder, for the extraction of a stone or calculus.—(See *Lithotomy.*)

D

DACRYOMA. (From δακρύω, to weep.) An impervious state of one or both the puncta lachrymalia, preventing the tears from passing into the lachrymal sac.

DAUCUS. See *Cataplasma Dauci.*

DECOCTUM CHAMŒMELI. ℞. Florum chamœmeli, ℥ ss. Aquæ distillatæ, ℔j. Boil ten minutes, and strain the liquor. A common decoction for fomentations.—(See *Fomentum.*)

DECOCTUM DULCAMARÆ. ℞. Dulcamaræ caulis concisæ unciam, aquæ octarium cum semisse. Decoque ad octarium, et cola.

The decoction of bittersweet, or woody nightshade, is recommended for some cutaneous diseases, proceeding from scrofula, lepra, and lues venerea. The dose is one or two table spoonfuls, three times a day. An aromatic tincture should be added.

DECOCTUM HELLEBORI ALBI. (Now the *Decoctum Veratri.*) ℞. Pulveris radicis hellebori albi, ℥ j. Aquæ distillatæ, ℔j. Spiritus vinosi rectificati, ℥ ij. Boil the water and powder till only one-half the fluid remains, and when cold add the spirit.

This is used as a lotion for curing psora, porrigo, and some herpetic affections.

DECOCTUM LOBELIÆ. (*Blue Cardinal Flower of Virginia.*) ℞. Radicis lobeliæ syphiliticæ siccæ manip. j. Aquæ distillatæ, ℔xij. This is to be boiled till only four quarts remain. The lobelia once gained repute as an antivenereal, though little reliance is now put in it. The patient is at first to take half a pint twice, and afterward four times a day. It operates, however, as a purgative, and the doses must be regulated according as the bowels appear to bear them.

DECOCTUM MEZEREI. ℞. Corticis radicis mezerei recentis, ℥ ij. Radicis glycirrhizæ contusæ, ℥ j. Aquæ distillatæ, ℔iij. Boil the mezereon in the water till only two pints remain; and when the boiling is nearly finished, add the liquorice root.

The decoction of mezereon has been much prescribed for venereal nodes and nocturnal pains in the bones, in doses of from four to eight ounces, three times a day.

DECOCTUM PAPAVERIS. ℞. Papaveris somniferi capsularum concisarum, ℥ iv. Aquæ, ℔iv. Boil for a quarter of an hour, and strain. In cases attended with great pain and inflammation, this decoction is used as a fomenting fluid.

DECOCTUM QUERCUS. ℞. Quercûs corticis, ℥ j. Aquæ, ℔ij. Boil down to a pint, and strain the fluid.

This decoction forms a very astringent injection, which is sometimes used for stopping gleets from the vagina. It also makes a lotion which is of considerable use in cases of prolapsus ani. It may be applied to some slight rheumatic white swellings, which it will sometimes cure, particularly when a little alum is put into it.

DECOCTUM SARSAPARILLÆ. ℞. Sarsaparillæ radicis concisæ, ℥ iv. Aquæ ferventis, ℔iv. The sarsaparilla is to be macerated for four hours, near the fire, in a vessel lightly closed. The root is then to be taken out, bruised, and put into the fluid again. The maceration is to be continued two hours longer, after which the liquor is to be boiled till only two pints remain. Lastly it is to be strained.

DECOCTUM SARSAPARILLÆ COMPOSITUM. ℞. Decocti sarsaparillæ ferventis, ℔iv. Sassafras radicis concisæ, guaiaci ligni rasi, glycirrhizæ radicis contusæ, singulorum ℥ j. Mezerei radicis corticis, ℥ iij.

These are to be boiled together for a quarter of an hour, and then strained.

This and the preceding decoction of sarsaparilla are much prescribed in cases of venereal nodes and pains; but while some surgeons hold them in high repute in such cases, others entertain an opposite opinion of them. They are also commonly given in several cutaneous diseases, and in scrofula.

The simple decoction is frequently directed for the restoration of the constitution after a course of mercury, sometimes mixed with an equal quantity of milk.

The common dose of both the decoctions is from four to eight ounces, three times a day.

The compound one possesses similar qualities to those of the famous Lisbon diet drink, for which it is now a common substitute.

DECOCTUM ULMI. ℞. Ulmi corticis recentis contus. ℥ iv. Aquæ, ℔iv. Boil to two pints, and then strain the liquor.

The decoction of elm bark is often prescribed in cutaneous diseases. Its operation is frequently promoted by giving with it the hydrargyri submurias.

DECOCTUM VERATRI. See *Decoctum Hellebori Albi.*

DEPRESSION OF THE SKULL. See *Head, Injuries of.*

DEPRESSION OF THE CATARACT. See *Cataract.*

DETERMINATION. When the blood flows into a part more rapidly and copiously than is natural, it is said, in the language of surgery, that there is a *determination* of blood to it.

DIÆRESIS. (From διαιρέω, to divide.) A division of substance; a solution of continuity. This was formerly a sort of generic term applied to every part of surgery, by which the continuity of parts was divided.

DIGESTION. (From *digero*, to dissolve.) By the *digestion* of a wound, or ulcer, the old surgeons meant bringing it into a state in which it formed healthy pus.

DIGESTIVES. Applications which promote this object.

DIORTHOSIS. (From διορθόω, to direct.) One of the ancient divisions of surgery: it signifies the restoration of parts to their proper situations.

DIPLOPIA. (From διπλοῦς, double, and ὤψ, the eye, or ὄπτομαι, to see.) *Visus duplicatus* is of two kinds. For instance, the patient either sees an object double, treble, &c. only when he is looking at it with both his eyes, and no sooner is one eye shut than the object is seen single and right; or else he sees every object double, whether he surveys it with one or both his eyes. The disorder is observed to affect persons in different degrees. Patients seldom see the two appearances which objects present with equal distinctness; but generally discern one much more plainly and perfectly than the other. The first distinct shape which strikes the eye is commonly that of the real object, while the second is indistinct, false, and visionary. Therefore patients labouring under this affection seldom make a mistake, but almost always know which is the true and real object. However, there are cases in which the patient sees, with equal clearness, the two appearances which things assume, so that he is incapable of distinguishing the real object from what is false and only imaginary.

The disorder is sometimes transitory and of short duration, and may be brought on in a healthy eye by some accidental cause, generally an irritation affecting the organ. Sometimes the complaint is continual, sometimes periodical. In particular instances the patient only sees objects double, when he has been straining his sight for a considerable time, as, for example, when he has been reading a small print for a long while by can-

dle-light. In this case, the disorder becomes lessened by shutting the eyes for a few moments. There are also instances in which the objects have a double appearance only at a particular distance, and not either when they are nearer or farther off. Sometimes the patient sees objects double only upon one side; as, for example, when he turns his eyes to the right-hand, while nothing of this sort is experienced in looking in any other direction. In certain cases, objects appear double, in whatever way the eyes are turned and directed.

The causes of double vision may be divided into four classes. Namely, the object which the patient looks at may be represented double upon the retina; which is the effect of the first class of causes. Or, the object may be depicted in one eye differently from what it is in the other, in regard to size, position, distance, clearness, &c. This is the effect of the second class of causes. Or, the object may appear to one eye to be in a different place from that which it seems to the other to occupy: the effect of the third class of causes. Or, lastly, the sensibility of the optic nerves is defective, so that the image of an object, though it may appear single to one eye as well as the other, yet in one identical situation will seem double to both of them. When the complaint originates from causes of the first and fourth class, the patient sees things double, whether he is using only one or both eyes; but when it proceeds from the second and third class of causes, the patient sees objects double only when he is looking at them with both eyes, and no sooner does he shut one than objects put on their natural single appearance.

The following are the chief causes of the first class of a single object being depicted upon the retina as if double. 1. An unevenness of the cornea, which is divided into two or more convex surfaces. There are cases, which show that such an uneven shape may actually be the cause of double vision.—(*Haller, Element. Physiol. t.* 5, *p.* 85.) According to Beer, this conformation of the cornea is mostly a result of several preceding ulcers of that membrane; in which circumstance, the patient sees with the affected eye not merely double, but treble, and quadruple, of which facts Beer has met with some examples.—(*Lehre von den Augenkr. b.* 2, *p.* 31.) However, it must not be dissembled that in a far greater number of instances, such unevenness of the cornea, though equally considerable, does not occasion this defect of sight. We have principally an opportunity of observing cases of this sort after the operation of extracting the cataract. Hence, it would seem that the inequalities must be of very particular shape to produce double vision. The diagnosis of this cause is easy enough, but the removal of it is impracticable; for how is it possible to restore the original shape of the cornea? On this case, however, Beer delivers a more favourable prognosis than Richter; for he states, that when the patient is not decrepit, the double vision, from altered shape of the cornea, will gradually disappear of itself, when proper care is taken of the constitution, and in particular of the eye.—(*B.* 2, *p.* 32.) 2. An inequality of the anterior surface of the crystalline lens, whereby the same is divided into several distinct surfaces, it is suggested, may also be the occasion of diplopia. Such an inequality may possibly produce the disorder; but it is exceedingly doubtful, whether any case of this sort has ever been met with, and, as Richter properly remarks, the investigation is not worth undertaking, as the diagnosis and cure would be equally impracticable. The only possible method of cure would be the extraction or depression of the crystalline lens; yet with the uncertainty respecting the nature of the cause, what man would be justified in performing an operation, in which the patient is not wholly exempt from the danger of losing his sight altogether? A double aperture in the iris, or, as the case is termed, a double pupil, and a deviation of the pupil from its natural position, have been enumerated as causes of diplopia.—(*Baumer, in Act. Soc. Hassiac. t.* 1, *No.* 27.) However, Richter deems the reality of the first of these causes doubtful; for cases have been noticed, where double vision was not the effect of there being two openings in the iris.—(*Janin, Mém. sur l'Œil.*) But were the disorder actually to originate in this way, the experiment might be made of converting the two apertures into one.

The causes of the second class, by the effect of which the object is represented, in regard to its size, position, distance, &c., differently in one eye from what it is in the other, are for the most part rather possible, than such as have been actually observed. The causes which make objects assume an appearance contrary to the real one, may sometimes be confined to one eye, to which things are depicted diversely from what they are to the other healthy eye, so that the patient sees, as it were, double. Thus, for example, there may be a stronger refraction of the rays of light in one eye than the other; the patient may be a *myops* with one eye, and a *presbyops* with the other; and then the object will seem to one eye large, to the other small; to one eye distant, to the other plainly near. This state of the sight, indeed, is said to have occurred after operating upon a cataract in one eye.—(*Heuermann.*) However, that this is not a common consequence of operating upon a cataract in one eye, while the other is perfect, is sufficiently clear from what has been said upon this subject in a foregoing part of this work.—(See *Cataract.*) In particular examples, objects which are perpendicular seem to the patient to have a sloping posture. When it is considered that only one eye is thus affected, and that to it things will appear sloping, and to the other straight, double vision must be the effect. A few remarks connected with this subject will be introduced hereafter.—(See *Sight, Defects of.*)

When both eyes are so directed to an object, that it becomes situated in the axis of vision of each of these organs, such object is represented in both at the same place, that is, it is depicted upon that part of the retina on which the axis of sight falls. Thus the object seems to both eyes to be in the same place; and though the two organs discern the thing, it only communicates a single appearance. But when one eye is turned to any object in a different direction from that of the other; that is to say, when one eye is turned to an object in such a way that the object is situated in the axis of vision of this eye, while the opposite eye is so turned that the same object is placed on one side of its axis of vision; in other words, when a person squints, the object is depicted in one eye upon a different part of the retina from what it is in the other; consequently, the object appears to the two respective organs to be differently situated, and the patient is affected with diplopia. This is the third species of this disorder, which arises from strabismus, as a third kind of occasional cause. Such patients naturally see objects double only when they behold them with both eyes. A lady, whom I frequently see, is much annoyed with diplopia, the effect of deep-seated disease in the orbit, whereby the eye is forced out of its natural position.

A person who squints usually has one eye stronger than the other, and the weakness of one of those organs is the common cause of the strabismus. Such a person does not see objects double, because he only sees with one eye well, and with the other so faintly and imperfectly, that scarcely any impression is made. Hence, every case of strabismus is not necessarily combined with diplopia; indeed, the common kind of squinting is not joined with it. A person affected with strabismus only sees double when the sight of each eye is equally strong, and when the squinting does not depend upon any weakness of one of the eyes, but upon some other occasional causes. The principal causes of the latter sort are of a spasmodic nature, viz. an irritation affects some muscle of the eye in such a manner, that the patient is incapacitated from moving both his eyes according to his will, and from directing them to any object, so that such object may be at once in the axis of vision of both. On this case, the observations of Sir E. Home are interesting, who has made many accurate reflections on the effect of an irregular action of the straight muscles of the eye in producing double vision.—(*Phil. Trans.* 1797.)

Richter states that in the majority of cases, the irritation alluded to is seated in the gastric organs, though he thinks that any other species of irritation may operate upon the eyes in a similar manner. This kind of diplopia is frequently attendant on other spasmodic diseases as a symptom. It often accompanies hypochondriasis. Sometimes it is the consequence of violent pain. Richter informs us of a man who saw double, and squinted, during a severe headache. He states that another was affected in the same way during a toothache. Sometimes the diplopia is owing to a paralysis of one of the muscles of the eye (*Morgagni de Sedibus et Causis Morborum, epist.* 13, *art.* 20, *a paralysis of the abductor muscle*); sometimes to a tumour in

the orbit. The diagnosis of this kind of diplopia is free from difficulty; the patient having been affected with squinting ever since things appeared double to him.

The views which Sir E. Home took of diplopia from irregular action, spasm, or weakness of any particular muscle of the eye, led him to propose a plan of treatment, the principle of which is to keep the muscle affected for a time perfectly at rest, which is easily done by covering the eye with a bandage, and not allowing the organ to be at all employed.

The fourth class of causes are such irritations as act upon the optic nerves, changing their sensibility in such a way that objects do not make that sort of impression upon them which they ought to do. Thus things sometimes have the appearance of being coloured, when they are really not so; immoveable objects seem in motion, straight objects appear oblique, and in the cases which we are now treating of, single things seem to the eye double, treble, &c. This faulty kind of sensibility may also be produced by irritation in eyes which are perfectly sound; but it is most readily occasioned in eyes which are preternaturally weak and irritable. In these, very trivial and inconsiderable irritations will often excite it. In the treatment, the common indication is to discover and remove whatever irritation conduces to this effect; but the attempt frequently fails. In irritable eyes, the disorder is often brought on by very slight irritations, which cannot always be diminished or removed. Here the grand indication is to cure the weakness and irritability of the organs.

According to Richter, the fourth class of causes of diplopia is the most frequent. The irritations are of various kinds, and generally seated in the abdominal viscera. Diplopia is sometimes the consequence of inebriety, foulness of the stomach, intermitting fevers, hypochondriasis, worms, &c. However, the complaint is occasionally excited by other sorts of irritation. It has frequently followed a violent fright. It may be connected with spasmodic and painful diseases of several kinds. Severe headaches and toothaches are sometimes joined with this affection of the sight. Richter mentions a boy, who, being in the woods, was struck by the bough of a tree over the eye, and in consequence of the accident became affected with diplopia. He informs us of a man, who rode a journey on horseback along a snowy road on a very sunshiny day, and was affected in the same manner. This affection of the eyes is sometimes the effect of injuries of the head. —(See *Hill's Cases in Surgery*, p. 108. *Schmucker, Med. Chir. Bemerk. b.* 1, *No.* 26. *Hennen's Principles of Military Surgery*, p. 345, *ed.* 2.) Persons who have weak eyes, are apt to become double-sighted, whenever they look attentively for a long while at any light shining objects. Patients in fevers are also sometimes double-sighted.—(*Gooch's Cases, &c. vol.* 2.)

The irritation, productive of diplopia, may lead to other serious complaints of the eye, when it operates with great violence. Indeed, it frequently happens that diplopia terminates in some other disorder of the eyes, and is often the forerunner of the worst diseases of these organs, particularly the gutta serena. The difficulty or ease of the cure partly depends upon the nature of the remote cause, and partly upon the condition of the eye. Some of the causes are easy, others difficult of removal. When the eye is very weak and irritable, the disorder frequently continues, notwithstanding the irritation has been removed. Also, when the complaint is relieved, it is exceedingly difficult to prevent a relapse, for on very irritable eyes, slight irritations, which cannot be hindered, are apt to produce a return of the affection. Therefore, the indication is to remove the existing defect of sight, and take means for the prevention of its return, or the commencement of any other. The weakness and preternatural irritability of the eye should be removed, as well as every sort of irritation, things which are often difficult of accomplishment.

The chief business of the surgeon in the treatment of this kind of diplopia, consists in endeavouring to find out and remove the irritation occasioning the disorder. The majority of such irritations are of the same nature as those which give rise to the gutta serena.—(See *Amaurosis.*) Indeed, both the complaints are often only different effects of the same cause, and of course require a similar mode of treatment. The boy whom Richter has mentioned as having become double-sighted in consequence of being struck over the eye with the bough of a tree, was cured by the external use of the infusum radicis valerianæ and spiritus vini crocatus, with which the eyelids and adjacent parts were rubbed several times a day. A diplopia, which followed a violent fright, was cured by valerian, preceded by a few doses of cream of tartar. The case recorded by Dr. Hennen, as proceeding from a gun-shot wound of the soft parts, covering the root of the nose and right eyebrow, yielded to abstinence, occasional emetics, and cold collyria.—(*Principles of Mil. Surgery, ed.* 2, *p.* 345.) A hypochondriacal patient got rid of the disorder by means of the warm bath. A diplopia, supposed to arise from disorder of the biliary secretion was cured by means of pills made of gum galbanum, guaiacum, rhubarb, and Venice soap, assisted with emetics and purgatives.

When the irritation exciting the disorder is only of temporary duration, as, for instance, looking at shining objects; when the disorder continues after the removal of the irritation; or, lastly, when the irritation cannot be well detected; the surgeon is to endeavour, by means of nervous and soothing medicines, either to remove the impression which the irritation has left upon the nerves, or to render the nerves insensible to the continuing irritation. According to Richter, the following remedies have proved useful in cases of diplopia: hartshorn, dropped into the hand, and held before the eyes; the external use of the spiritus vini crocatus; warm bathing of the eye, particularly in a decoction of white poppy heads; bathing the eye in cold collyria; the internal administration of bark, valerian, small doses of ipecacuanha, flowers of zinc, and oleum cajeput. In one instance, in which it was impossible to detect the cause, Richter states, that soluble tartar with ox's gall, and castoreum was found of service; that, in another similar case, rhubarb, ox's gall, and asafœtida; and, in a third, liquor ammoniæ acetatæ with ox's gall proved useful. This author farther observes, that in all cases in which the particular cause of the disorder cannot be precisely determined, we may conjecture, that such cause has its seat in the abdominal viscera; and that much benefit may often be derived from mild resolvents, evacuants, and anodyne medicines.—(*Richter's Anfangsgr. der Wundarzn. b.* 3, *kap.* 15.)

According to Beer, the diplopia which is not an effect of the continuance of another disease after inflammation of the eye, but probably depends upon injury of the retina caused by such inflammation, usually diminishes without the assistance of art, if the eye be not abused.—(*Lehre von den Augenkr. b.* 2, *p.* 32.) *For the foregoing account of diplopia, I am chiefly indebted to Richter. See also A. Vater et J. C. Heinicker, Visus Vitia duo rarissima; alterum duplicati, alterum dimidiati, &c. Wittemb.* 1723. (*Haller, Diss. ad Morb. t.* 1, *p.* 305.) *J. J. Klauhold de Visu duplicato, 4to. Argent.* 1746. *Buchner de Visione simplici et duplici, 4to. Argent.* 1753. *Euler, Recherches Physiques sur la diverse réfrangibilité des rayons de lumière; Mem. de l'Acad. des Sciences, &c. Berlin, p.* 200, 1754. *Klinke de Diplopia, 4to. Goett.* 1774. *Sir E. Home's Obs. on the Straight Muscles of the Eye, and the structure of the Cornea, in Phil. Trans. for* 1797; *B. Gooch, Chir. Cases, &c. vol.* 2, *p.* 42, *&c. 8vo. Lond.* 1792. *Keghellini, Lettera sopra l'offera della cista in una Donna, &c. 8vo. Venet.* 1749; *an instance of Diplopia from double pupil. Dict. des Sciences Méd. t.* 9, *p* 497. *J. Wardrop, Essays on the Morbid Anatomy of the Human Eye, vol.* 2, *p.* 216, *&c. 8vo. Lond.* 1818.)

DIRECTOR. (From *dirigo*, to direct.) One of the most common instruments of surgery; it is long, narrow, grooved, and made of silver, in order that it may be bent into any desirable shape. Its use is to direct the knife, and protect the parts underneath from the edge or point of the latter instrument. The surgeon introduces the director under the parts which he means to divide, and then either cuts down, along the groove of the instrument, with a common bistoury, or cuts upwards with a narrow, curved, pointed bistoury, the point of which is turned upwards, which he carefully introduces along the groove. This instrument and the crooked bistoury are commonly employed for opening sinuses, for cutting fistulæ in ano, and fistulæ in other situations, and for dilating the stricture in cases of hernia.

DISLOCATION. (From *disloco*, to put out of place.) *A Luxation.* When the articular surfaces of the bones are forced out of their proper situation, the accident is termed a *dislocation* or *luxation.*

Sir Astley Cooper has justly remarked, that of the various accidents which happen to the body, there are

few which require more prompt assistance, or in which the reputation of the surgeon is more at stake, than cases of luxation; for if much time be lost prior to the attempt at reduction, there is great additional difficulty in accomplishing it, and it is often entirely incapable of being effected. If it remains unknown, and consequently unreduced, the patient becomes a living memorial of the surgeon's ignorance or inattention. Hence this experienced surgeon forcibly inculcates the careful study of anatomy; the want of an accurate knowledge of the structure of the joints being the chief cause of the many errors which happen in the diagnosis and treatment of dislocated bones. The following passage cannot be too deeply impressed upon the surgeon's mind: "A considerable share of anatomical knowledge is required to detect the nature of these accidents, as well as to suggest the best means of reduction; and it is much to be lamented, that our students neglect to inform themselves sufficiently of the structure of the joints. They often dissect the muscles of a limb with great neatness and minuteness, and then throw it away, without any examination of the ligaments, the knowledge of which, in a surgical point of view, is of infinitely greater importance; and from hence arise the numerous errors of which they are guilty, when they embark in the practice of their profession; for the injuries of the hip, elbow, and shoulder are scarcely to be detected but by those who possess accurate anatomical information. Even our hospital surgeons, who have neglected anatomy, mistake these accidents; for I have known the pulleys applied to an hospital patient in a case of a fracture of the neck of the thigh-bone, which had been mistaken for a dislocation, and the patient cruelly exposed, through the surgeon's ignorance, to a violent and protracted extension. It is therefore proper, that the form of the ends of the bones, their mode of articulation, the ligaments by which they are connected, and the direction in which the larger muscles act, should be well understood."—(*Surgical Essays, part* 1, *p.* 2.)

The most important differences of luxations are: 1. With respect to the articulation in which these accidents take place; 2. The extent of the dislocation; 3. The direction in which the bone is displaced; 4. The length of time the displacement has continued; 5. The circumstances which accompany it, and which make the injury simple or compound; 6. And lastly, with respect to the causes of the accident.

1. Every kind of joint is not equally liable to dislocations. Experience proves, indeed, that in the greater part of the vertebral column, luxations are absolutely impossible, the pieces of bone being articulated by extensive numerous surfaces, varying in their form and direction, and so tied together by many powerful elastic means, that very little motion is allowed. Experience proves, also, that the strength of the articulations of the pelvic bones can scarcely be affected by enormous efforts, unless these bones be simultaneously fractured. Boyer has therefore set down luxations of joints with continuous surfaces as impossible.—(*Traité des Maladies Chirurg. t.* 4, *p.* 17.) And Sir A. Cooper observes, that in the spine, the motion between any two bones is so small, that dislocations hardly ever occur, except between the first and second vertebræ, although the bones are often displaced by fracture.—(*Surgical Essays, p.* 14.)

In the articulations with contiguous surfaces, the facility with which dislocations happen, depends upon the extent and variety of motion in such joints. Thus in the short bones of the carpus, and particularly of the tarsus, and at the carpal and tarsal extremities of the metacarpal and metatarsal bones, where flat broad surfaces are held together by ligaments, strong, numerous, and partly interarticular, and where only an obscure degree of motion can take place, dislocations are very unfrequent, and can only be produced by uncommon violence.

The loose joints, which admit of motion in every direction, are those in which dislocations most frequently occur; such is that of the humerus with the scapula. On the contrary, the ginglymoid joints, which allow motion only in two directions, are, comparatively speaking, seldom dislocated. The articular surfaces of the latter are of great extent, and consequently the heads of the bones must be pushed a great way in order to be completely dislocated; and the ligaments are numerous and strong.

2. With respect to the extent of the dislocation, luxations are either *complete* or *incomplete*. The latter term is applied, when the articular surfaces still remain partially in contact. Incomplete dislocations only occur in ginglymoid articulations, as those of the foot, knee, and elbow. In these, the luxation is almost always incomplete; and very great violence must have operated, when the bones are completely dislocated. In the elbow, the dislocation is partial, with respect both to the ulna and radius. In the orbicular articulations, the luxations are almost invariably complete. However, "the os humeri sometimes rests upon the edge of the glenoid cavity, and readily returns into its socket."—(*A. Cooper, Essays, part* 1, *p.* 14.) The lower jaw is sometimes partially dislocated in a manner different from what is commonly meant by this expression, viz. one of its condyles is luxated, while the other remains in its natural situation.

As Sir A. Cooper has explained, a partial dislocation sometimes occurs at the ankle-joint. "An ankle (says he) was dissected at Guy's, and given to the collection of St. Thomas's, which was partially dislocated: the end of the tibia rested still in part upon the astragalus, but a large portion of its surface was seated on the os naviculare, and the tibia, altered by this change of place, had formed two new articular surfaces, with their faces turned in opposite directions towards the two bones. The dislocation had not been reduced."

3. In the orbicular joints, the head of the bone may be dislocated at any point of their circumference; and the luxations are named accordingly *upwards, downwards, forwards*, and *backwards*. In the ginglymoid articulations, the bones may be dislocated either laterally, or forwards, or backwards.

4. The length of time a dislocation has existed makes a material difference. In general, recent dislocations may be easily reduced; but when the head of a bone has been out of its place several days, the reduction becomes exceedingly difficult, and in older cases very often impossible. The soft parts and the bone itself have acquired a certain position; the muscles have adapted themselves in length to the altered situation of the bone to which they are attached, and sometimes cannot be lengthened sufficiently for it to be reduced. Indeed, I believe that Sir Astley Cooper's statement is quite correct, that the difficulty in the reduction, arising from the muscles, is proportioned to the length of time that has elapsed from the period of the accident.—(*Treatise on Dislocations, p.* 26.)

Desault and Boyer believe, that frequently the opening in the capsular ligament soon becomes closed, and hinders the return of the head of the bone into its original situation. However, with regard to the doctrine of the reduction being prevented by the capsular ligaments, it is considered by Sir Astley Cooper as destitute of foundation.—(*Surgical Essays, part* 1, *p.* 18; *and Treatise, &c. p.* 25.) Lastly, the head of the bone may become adherent to the parts on which it has been forced.

5. The difference is immense, in regard to the danger of the case, arising from the circumstance of a dislocation being attended or unattended with a wound, communicating internally with the joint, and externally with the air. When there is no wound of this kind, the danger is generally trivial, and the dislocation is termed a *simple one;* when there is such a wound, together with the dislocation, the case is denominated *compound*, and is frequently accompanied with the most imminent peril. Indeed, the latter kind of accident sometimes renders amputation necessary, and in too many instances has a fatal termination.

6. The causes of dislocations are external and internal. A predisposition to such accidents may depend on circumstances natural or accidental. The great latitude of motion which the joint admits of; the little extent of the articular surfaces; the looseness and fewness of the ligaments; the lowness of one side of the articular cavity, as at the anterior and inferior part of the acetabulum; and the shallowness of the cavity, as of that of the scapula; are natural predisposing causes of luxations.

A paralytic affection of the muscles of a joint, and a looseness of its ligaments, are also predisposing causes. When the deltoid muscle has been paralytic, the mere weight of the arm has been known to cause such a lengthening of the capsular ligament of the shoulder-

joint, that the head of the os brachii descended two or three inches from the glenoid cavity.

Two cases strikingly illustrative of the tendency to dislocation from a weakened or paralytic state of the muscles, are recorded by Sir A. Cooper. The first is that of a junior officer of an India ship, who, for some trifling offence, had been placed with his foot upon a small projection on the deck, while his arm was kept forcibly drawn up to the yard-arm for an hour. "When he returned to England, he had the power of readily throwing that arm from its socket, merely by raising it towards his head; but a very slight extension reduced it. The muscles were wasted, also, as in the case of paralysis." The other example happened in a young gentleman, troubled with a paralytic affection of his right side from dentition. "The muscles of the shoulder were wasted, and he had the power of throwing his os humeri over the posterior edge of the glenoid cavity of the scapula, from whence it became easily reduced." In these cases, no laceration of the ligaments could have occurred, and the influence of the muscles in preventing dislocation and in impeding reduction is exemplified.—(*Surgical Essays, part* 1, *p.* 10.) Mr. Brindley, of Wink Hill, communicated to Sir A. Cooper an account of a dislocation of the os femoris, which the patient, a man of 50, is able to produce and reduce whenever he chooses.—(*Treatise on Dislocations, Preface.*)

The looseness of the ligaments sometimes makes the occurrence of dislocations so easy, that the slightest causes produce them. Some persons cannot yawn or laugh without running the risk of having their lower jaw luxated. On this account, collections of fluid within the knee, causing a relaxation of the ligament of the patella, are often followed by a dislocation of that bone. And whenever a bone has been once dislocated, it ever afterward has a tendency to be displaced again, by a slighter cause than what was first necessary to produce the accident. This tendency, indeed, increases with every new displacement.

Diseases which destroy the cartilages, ligaments, and articular cavities of the bones, may give rise to a dislocation. The knee is sometimes, but not frequently, partially luxated, in consequence of a white swelling; the thigh is often dislocated, in consequence of the acetabulum and ligaments being destroyed by disease. Such dislocations are termed *spontaneous.*

In the anatomical collection at St. Thomas's Hospital, there is a preparation of a knee dislocated in consequence of ulceration, and in the state of anchylosis; the leg forming a right angle with the femur directly forwards.—(See *Sir A. Cooper's Surg. Essays, part* 1, *p.* 11.)

An enarthrosis joint can only be dislocated by external violence, a blow, a fall, or the action of the muscles, when the axis of the bone is in a direction more or less oblique with respect to the surface with which it is articulated.

Any external force may occasion a dislocation of ginglymoid joints, which case is generally incomplete; but in the ball and socket articulations the action of the muscles constantly has a share in producing the accident. So, when a person falls on his elbow, while his arm is raised outwards from his side, the force thus applied will undoubtedly contribute very much to push the head of the os brachii out of the glenoid cavity, at the lower and internal part. Still, the sudden action of the pectoralis major, latissimus dorsi, and teres major, which always takes place from the alarm, will also aid in pulling downwards and inwards the head of the bone. Under certain circumstances, the violent action of the muscles alone may produce a dislocation, without the conjoint operation of any outward force. But when the patient is aware in time of the violence which is about to operate, and his muscles are prepared for resistance, a dislocation cannot be produced without the greatest difficulty (*Sir A. Cooper, op. cit. p.* 15), unless the posture of the member at the moment be such as to render the action of the strongest muscles conducive to the displacement instead of preventive of it, as is frequently the case in luxations of the shoulder.

Dislocations are constantly attended with more or less laceration or elongation of the ligaments; and in the shoulder and hip, the capsules are always torn, when the accident has been produced by violence. Some instances, in which the ligaments are only lengthened and relaxed, I have already quoted. Sometimes a dislocation is attended with a fracture. The ancle is seldom luxated, without the fibula being broken; and in dislocation at the hip, the acetabulum is also occasionally fractured.—(*Sir A. Cooper's Treatise on Dislocations, &c. p.* 15.)

SYMPTOMS OF DISLOCATIONS.

As Boyer justly observes, every dislocation produces pain and incapacity in the limb; but these are only equivocal symptoms, and cannot distinguish the case from a fracture, nor even from a simple contusion. A severe but obtuse pain arises from the pressure of the head of the bone upon the muscles; sometimes the pain is rendered more acute by the pressure being made upon a large nerve.—(*Sir A. Cooper's Treatise, p.* 5.)

In order that a dislocation may happen, there must be a particular attitude of the limb during the action of the external violence. Indeed, the displacement can hardly occur from the direct action of the cause on the articulation itself. The action of the luxating cause is the more efficient the farther it is from the joint, and the longer the lever is which it affects. Thus, in a fall on the side, when the arm, raised considerably from the trunk, has had to sustain all the weight of the body on a point at its inner side, the probability of a dislocation is evident, and even that the head of the bone has been forced through the lower portion of the capsular ligament.

But the symptoms which Boyer terms positive, or actually present, are numerous and clear.

1. In dislocations of orbicular joints and complete luxations of ginglymoid joints, the articular surfaces are not at all in contact, and the point where the dislocated bone is lodged cannot be upon the same level with the centre of the cavity, from which it has been forced. Hence, a change in the length of the limb. In the ginglymoid joints, such alteration can only be a shortening proportioned to the extent of the displacement, for there is then an overlapping of the bones, similar to that of the fragments of a fracture longitudinally displaced. But in the orbicular joints, the bone may be displaced, and carried above or below the articular cavity; so that, in the first event, a shortening, in the second, an elongation, of the limb will be produced. But as the direction of the member is at the same time altered, it is not always practicable to place the limbs parallel together, nor to bring them near the trunk, for the purpose of judging whether they are lengthened or shortened. A comparison, however, made without this advantage, will generally enable the surgeon to form a correct opinion. The proper length of a dislocated limb cannot be restored, except by putting the bone back into the cavity from which it has slipped. In general, this cannot be accomplished without considerable efforts, while a slight exertion is usually sufficient to obtain the same effect in cases where the shortening of the limb depends upon a fracture. It is also particularly worthy of notice, that when once the natural length of the limb has been restored in dislocations, it remains; while there are a great many fractures, in which the shortening of the member recurs after it has been made to disappear. The surgeon must also recollect, that an elongation of the limb can never happen in cases of fracture as it does in certain dislocations.

2. In almost all complete luxations, the direction of the axis of the limb is unavoidably altered. This circumstance arises from the resistance of that portion of the articular ligaments which has not been ruptured, as well as from the action of the muscles. In complete lateral dislocations of ginglymoid joints, the direction of the axis of the limb is not altered, on account of the total rupture of the ligaments, and even of a part of the surrounding muscles. Neither is this observable in incomplete dislocations of such articulations, on account of the extent of the articular surfaces. But it is strongly marked in complete luxations of these joints, where the displacement has happened in the direction of the articular movements, although, in cases of this description, the ligaments must be totally ruptured. The muscles, which have suffered less, are in a state of extreme tension, and must necessarily alter the axis of the limb. The tension of certain muscles, and the preservation of some of the ligaments, especially in the orbicular joints, are also a cause of a rotatory movement of the dislocated limb at the moment of the displace-

ment, and which it afterward retains. Thus, in luxations of the thigh, the toes and knee are turned outwards or inwards, according as the head of the thigh-bone happens to be situated at the inside or outside of the joint. These two kinds of alteration in the direction of the limb are permanent, when they depend upon a dislocation; a circumstance quite different from what is observable in fractures, where the same changes occur, but can be made to cease at once, without any particular effort.

3. The absolute immobility of a limb, or, at least, the inability of performing certain motions, is among the most characteristic symptoms of a dislocation. In some complete luxations of particular ginglymoid joints, the dislocated limb is absolutely, or very nearly, incapable of any motion. Thus, in the dislocation of the forearm backwards, the particular disposition of the bones, and the extreme tension of the extensor and flexor muscles, confine the limb in the half-bent state, and at the same time resist every spontaneous motion, and likewise almost every motion which is communicated. In the orbicular joints, the painful tension of the muscles which surround the luxated bone nearly impedes all spontaneous movements; but, in general, analogous motions to that by which the displacement was produced can be communicated to the limb, though not without exciting pain. Thus, in the dislocation of the humerus downwards, the elbow hardly admits of being put near the side, nor of being carried forwards and backwards; but it can be raised up with ease. In the dislocation of the acromial end of the clavicle, the patient can bring the arm towards the trunk, separate it a little from the side, or carry it forwards or backwards; but he cannot raise it in a direct way. Lastly, in complete lateral dislocations of such joints as have alternate motions, the patient has the power of performing no motion of the part; but the complete destruction of all the means of union allows the limb to obey every species of extraneous impulse; and this symptom, which is besides never single, makes the nature of the case sufficiently manifest.

Sometimes, as Sir A. Cooper has remarked, a considerable degree of motion continues for a short time after a dislocation: thus, in a man, brought into Guy's Hospital, whose thigh-bone had just been dislocated into the foramen ovale, a great mobility of the femur still remained; but, "in less than three hours, it became firmly fixed in its new situation, by the contraction of the muscles.—(*Surgical Essays, part* 1, *p.* 3.)

4. In dislocations attended with elongation of the limb, the general and uniform tension of all the muscles arranged along it, gives to these organs an appearance as if they lay nearer the circumference of the bone, and the limb were smaller than its fellow. The muscles, however, which belong to the side, from which the dislocated bone has become more distant, appear more tense than the others, and form externally a prominent line. This is very manifestly the case with the deltoid muscle, when the arm is luxated downwards. On the contrary, in dislocations where the limb is shortened, the muscles are relaxed; but, being irritated, they contract and accommodate themselves to the shortened state of the limb. Hence the extraordinary swelling of their fleshy part, and the manifestly increased diameter of the portion of the member to which they belong. We have a striking example of this in the dislocation of the thigh upwards and outwards, where the muscles at the inside of the limb form a distinct oblong tumour.

The parts which surround the affected joint also experience alterations in their form, whenever muscles connected with the dislocated bone occupy that situation. Thus, in dislocations of the thigh, the buttock on the same side is flattened, if the bone is carried inwards; but it is more prominent, when the thigh-bone is carried outwards; and its lower edge is situated higher or lower than in the natural state, according as the luxation may have taken place upwards or downwards. In the complete luxation of the forearm backwards, the triceps is tense, and forms a cylindrical prominence, owing to the displacement of the olecranon backwards, in which displacement it is obliged to participate.

5. The circumference of the joint itself presents alterations of shape well deserving attention, and in order to judge rightly of this symptom, correct anatomical knowledge is of high importance.

The form of the joints principally depends upon the shape of the heads of the bones. Hence, the natural relation of the bones to each other cannot be altered without a change being immediately produced in the external form of the joint. The changes which the muscles passing over the luxated joint at the same time undergo in their situation and direction, contribute likewise to the difference of shape, by destroying the harmony of what may be called the outlines of the limb.

When the head of a bone articulated by enarthrosis, has slipped out of the cavity, instead of the plumpness which previously indicated the natural relation of parts, the head of the dislocated bone may be distinguished at some surrounding point of the articulation, while at the articulation itself may be remarked a flatness, caused by one of the neighbouring muscles stretched over the articular cavity, and more deeply may be perceived the outline and depression produced by this cavity itself. The bony eminences situated near the joint, and whose outlines were gradually effaced in the general form of the member, are rendered much more apparent by the displacement, and project in a stronger degree than in the natural state. On this part of the subject Sir A. Cooper is particularly correct, when he observes, that the head of the bone can generally be felt in its new situation, excepting in some of the dislocations of the hip, and its rotation is often the best criterion of the accident. *The natural prominences of bone near the joint either disappear or become less conspicuous, as the trochanter at the hip-joint. Sometimes the reverse occurs; for in dislocations of the shoulder, the acromion projects more than usual.*—(*Surg. Essays, part* 1, *p.* 4.)

The lines made by the contour of the limb and the natural relation of the bones, are so manifestly broken in dislocations of ginglymoid joints, that when there is no inflammatory swelling the case is at once manifest. More certain knowledge, however, and more correct information respecting the kind of displacement, are to be obtained, by attentively examining the changes of position which the bony prominences forming the termination of the bones articulated together have undergone, and which are the more obvious in these joints, inasmuch as they give attachment to the principal muscles. The natural relations of these processes being known, the least error of situation ought to strike the well-informed practitioner. Thus, in the elbow-joint, a considerable difference in the respective height, and in the distances between the olecranon and internal and external condyles, can be easily distinguished. But the thing is less easy when the surrounding parts are so swelled and tense as to make the bony projections deeper from the surface and less obvious to examination. Even then, however, a good surgeon will at least find something to make him suspect the dislocation, and the suspicion will be confirmed when he again examines the part after the swelling has begun to subside. It is of the utmost consequence to make out what the case is as early as possible; for the unnatural state in which the soft parts are placed keeps up the swelling a long while; and if the surgeon wait till this has entirely subsided before he ascertains that the bones are luxated, he will have waited till it is too late to think of reducing them, and the patient must remain for ever afterward deprived of the free use of his limb.—(*Boyer, Traité des Maladies Chir. t.* 5, *p.* 45, *&c.*) It is not only the inflammatory swelling which may tend to conceal the state of the ends of the bone; sometimes a quicker tumour arises from the effusion of blood in the cellular membrane, and causes an equal difficulty of feeling the exact position of the heads of the bones.—(See *Treatise on Dislocation, by Sir A. Cooper, p.* 5.)

Dislocations are also sometimes attended with particular symptoms, arising altogether from the pressure caused by the head of the luxated bone on certain parts. The sternal end of the clavicle has been known to compress the trachea and impede respiration: the head of the humerus may press upon the axillary plexus of nerves, and produce a paralytic affection of the whole arm. In one instance cited by Sir A. Cooper, a dislocated clavicle pressed upon the œsophagus and endangered life.—(*Surg. Essays, part* 1, *p.* 4.)

As Kirkland has observed, there are some luxations which are far worse injuries than fractures; of this description are dislocations of the vertebræ, cases, which, indeed, can hardly happen without fracture,

and are almost always fatal; dislocations of the long bones, with protrusion of their ends through the muscles and skin, and severe inflammation, extensive abscesses, attended with great risk of being followed by large and tedious exfoliations, and not unfrequently gangrene.

According to Sir A. Cooper, young persons are rarely subjects of dislocations from violence; but he admits that they do sometimes experience them, and relates an instance which happened in a child seven years of age. In general, their bones break, or their epiphyses give way, much more frequently than the articular surfaces are displaced.—(*Surg. Essays, part.* 1, *p.* 16; *and Treatise, &c. p.* 23.) Suspected luxations of the hip in children commonly turn out to be disease of the joint, one instance of which is given by the preceding author, and an example of which I was lately consulted about myself. Also, when a dislocation of the elbow is suspected in a child, because the bone appears readily to return into its place, but directly to slip out of it again, the case, according to Sir A. Cooper, is an oblique fracture of the condyles of the humerus. Old persons are also much less liable to dislocations than individuals of middle age; a fact which is accounted for by the extremities of bones in old subjects being so softened that the violence sooner breaks than luxates them.—(*Sir Astley Cooper, Treatise, &c. p.* 23.)

PROGNOSIS.

In general, every unreduced dislocation must deprive the patient more or less completely of the use of the limb; for nature cannot re-establish the natural relations which are lost. There is indeed an effort made to restore some of the motions and the use of the limb in a certain degree; but it is always very imperfectly accomplished, and in the best cases, only a confined degree of motion is recovered. Nature cannot in any way alter the lengthened or shortened state of the limb; and she can only correct in a very imperfect manner its faulty direction. There are even some cases in which no amendment whatsoever can be effected; as in complete dislocations of ginglymoid joints.

There are, however, a few exceptions to this general rule. The arthrodia joints are seldom extensively displaced; and as, in the natural state, their motions are very limited, the loss of these motions in consequence of the natural relations not having been restored, is of less importance. Thus, the bones of the carpus, those of the tarsus, and the acromial end of the clavicle, may be dislocated, and be reduced either imperfectly or not at all, without the functions of the limb to which they belong being materially impaired.—(*Boyer, Traité des Maladies Chir. t.* 4, *p.* 54.)

Dislocations of enarthrosis joints are generally much less dangerous than those of ginglymoid ones; for the action of the muscles has a great share in producing the former; the violence done to the external parts is less; and the laceration of the soft parts is not so considerable. Even in the same kind of joints, the seriousness of the case depends on the largeness of the articular surfaces, and the number and strength of the muscles and ligaments.

Dislocations of ginglymoid joints, however, are more easily reduced than those of enarthrosis ones, the muscles of which are frequently very powerful, and capable of making great resistance to the efforts of the surgeon. This is frequently seen in luxations of the shoulder and thigh.

It may be said, however, of the luxations of enarthrosis joints, that if they happen the most easily, they are attended with less injury; and that although their reduction may require considerable efforts, yet it can be accomplished, and the accident leaves no ill effects. On the contrary, in dislocations of ginglymoid joints, the same reason which renders them more unfrequent, makes them also more serious. The solidity of these joints prevents the uniting means from being destroyed except by great violence; and the extent of the articular surfaces does not permit a considerable displacement, especially a complete one, without extensive injury of the ligaments and surrounding soft parts. It is for these reasons, no doubt, that compound luxations and protrusions of the heads of the bones are most commonly seen in the ginglymoid articulations.

The more recent a luxation is, the more easy it is to reduce, and, therefore, *cæteris paribus*, the less grave is the injury. In this point of view, dislocations of ginglymoid joints are the most serious, because they soon become irreducible.

Simple dislocations are much less dangerous than those which are complicated with contusion, the injury of a large nerve or blood-vessel, inflammatory swelling, fracture, wound, and, especially, a protrusion of one of the articular surfaces.—(*Boyer, Traité des Maladies, Chir. t.* 4, *p.* 55, 56.)

Dislocations from ulceration and suppuration in joints, termed *spontaneous luxations*, cannot admit of reduction: when they arise from the hip-disease, it is not merely in consequence of the ligaments being destroyed, the brim of the acetabulum itself is often annihilated. However, there are other *spontaneous* dislocations from preternatural looseness of the ligaments, where reduction may be accomplished with the greatest facility; though the displacement generally recurs from the slightest causes.

TREATMENT OF DISLOCATIONS IN GENERAL.

Mr. Pott observes:—By what our forefathers have said on the subject of luxations, and by the descriptions and figures which they have left us of the means they used, of what they call their organs and machinemata, it is plain, that force was their object, and that whatever purposes were aimed at or executed by these instruments or machines, were aimed at and executed principally by violence. Many or most of them are much more calculated to pull a man's joints asunder than to set them to rights. Hardly any of them are so contrived as to execute the purpose for which they should be used, in a manner most adapted to the nature or mechanism of the parts on which they are to operate. The force or power of some of the instruments is not always determinable, as to degree, by the operator, and consequently may do too little or too much, according to different circumstances in the case, or more or less caution or rashness in the surgeon. If, in the diagnosis of these accidents, an exact knowledge of the ligaments is of the highest importance, a familiar acquaintance with the muscles is not less essential in the treatment.

In dislocations, as in fractures, says Pott, our great attention ought to be paid to the muscles belonging to the part affected. These are the moving powers, and by these the joints, as well as other moveable parts, are put into action: while the parts to be moved are in right order and disposition, their actions will be regular and just, and generally determinable by the will of the agent (at least in what are called voluntary motions); but when the said parts are disturbed from that order and disposition, the action or power of the muscles does not therefore cease; far from it; they still continue to exert themselves occasionally, but instead of producing regular motions at the will of the agent, they pull and distort the parts they are attached to, and which, by being displaced, cannot perform the functions for which they were designed.

"Hence principally arise the trouble and difficulty which attend the reduction of luxated joints. The mere bones composing the articulations, or the mere connecting ligaments, would in general afford very little opposition; and the replacing the dislocation would require very little trouble or force, was it not for the resistance of the muscles and tendons attached to and connected with them: for by examining the fresh joints of the human body, we shall find, that they not only are all moved by muscles and tendons, but also, that although what are called the ligaments of the joints do really connect and hold them together, in such manner as could not well be executed without them, yet in many instances they are, when stripped of all connexion, so very weak and lax, and so dilatable and distractile, that they do little more than connect the bones and retain the synovia; and that the strength as well as the motion of the joints, depends in great measure on the muscles and tendons connected with and passing over them; and this in those articulations which are designed for the greatest quantity, as well as for celerity of motion. Hence it must follow, that as the figure, mobility, action, and strength of the principal joints depend so much more on the muscles and tendons in connexion with them than on their mere ligaments, that the former are the parts which require our first and greatest regard, these being the

parts which will necessarily oppose us in our attempts for reduction, and whose resistance must be either eluded or overcome; terms of very different import, and which every practitioner ought to be well apprized of."—(See *Pott's Chir. Works, vol.* 1.)

That the muscles are the chief cause of resistance is strongly evinced by cases in which the dislocation is accompanied with injury of a vital organ; for then the bone may be reduced by a very slight force. Thus, in a man who had an injury of his jejunum, and a dislocation of his hip, the bone was most easily replaced.—(*Sir A. Cooper, Surgical Essays, part* 1, *p.* 20.) In short, any thing which produces faintness or weakness facilitates the reduction, as intoxication, nausea and sickness, paralysis, &c.

The following, which are some of the principles laid down by Mr. Pott, merit attention.

1. Although a joint may have been luxated by means of considerable violence, it does by no means follow that the same degree of violence is necessary for its reduction.

2. When a joint has been luxated, at least one of the bones of which it is composed is detained in that unnatural situation by the action of some of the muscular parts in connexion with it; which action, by the immobility of the joint, becomes as it were tonic, and is not under the direction of the will of the patient.

3. That all the force used in reducing a luxated bone, be it more or less, be it by hands, towels, ligatures, or machines, ought always to be applied to the other extremity of the said bone, and as much as possible to that only. Mr. Pott argues, that if the extending force were applied to a distant part of the limb, or to the bone below or adjoining, it would necessarily be lost in the articulation which is not luxated, owing to the yielding nature of the ligaments, and be of little or no service in that which is dislocated. This remark, though made by Pott and generally received as true, is very incorrect; for it tends to state that if you pull at the ankle or wrist, the force does not operate on the hip or shoulder.

4. That in the reduction of such joints as are composed of a round head, received into a socket, such as those of the shoulder and hip, the whole body should be kept as steady as possible.

5. That in order to make use of an extending force with all possible advantage, and to excite thereby the least pain and inconvenience, it is necessary that all parts serving to the motion of the dislocated joint, or in any degree connected with it, be put into such a state as to give the smallest possible degree of resistance.

6. That in the reduction of such joints as consist of a round head, moving in an acetabulum or socket, no attempt ought to be made for replacing the said head, until it has by extension been brought forth from the place where it is, and nearly to a level with the said socket. This will show us, says Mr. Pott, a fault in the common ambi, and why that kind of ambi which Mr. Freke called his commander, is a much better instrument than any of them, or indeed than all; because it is a lever joined to an extensor; and that capable of being used with the arm in such position as to require the least extension and to admit the most; besides which it is graduated, and therefore perfectly under the dominion of the operator. It will show us why the old method by the door or ladder sometimes produced a fracture of the neck of the scapula; as Mr. Pott saw it do himself. Why, if a sufficient degree of extension be not made, the towel over the surgeon's shoulder, and under the patient's axilla, must prove an impediment rather than an assistance, by thrusting the head of the humerus under the neck of the scapula, instead of directing it into its socket. Why the bar, or rolling-pin, under the axilla produces the same effect. Why the common method of bending the arm (that is, the os humeri) downwards, before sufficient extension has been made, prevents the very thing aimed at, by pushing the head of the bone under the scapula, which the continuation of the extension for a few seconds only would have carried into its proper place. To the observation that mere extension only draws the head of the bone out from the axilla in which it is lodged, but does not replace it in the acetabulum scapulæ, Mr. Pott replies, that when the head of the os humeri is drawn forth from the axilla, and brought to a level with the cup of the scapula, it must be a very great and very unnecessary addition of external force, that will or can keep it from going into it. All that the surgeon has to do is to bring it to such level; the muscles attached to the bone will do the rest for him, and that whether he will or not.

7. Another of Pott's principles is, that whatever kind or degree of force may be found necessary for the reduction of a luxated joint, that such force be employed gradually; that the lesser degree be always first tried, and that it be increased gradatim.—(See *Pott's Chir. Works, vol.* 1.)

The supposition of the reduction being sometimes prevented by the capsular ligaments, Sir A. Cooper considers erroneous: he assures us, that in dislocations from violence, those ligaments are always extensively lacerated; and that the idea of the neck of the bone being girt or confined by them, is altogether untrue.—(*Surg. Essays, part* 1, *p.* 18.) But, in addition to the resistance of the muscles, there are, in old dislocations, three circumstances pointed out by him as causes of the difficulty of reduction. 1. The extremity of the bone contracts adhesion to the surrounding parts, so that in dissection, even when the muscles are removed, the bone cannot be reduced. In this state, he found the head of a radius, which had been long dislocated upon the external condyle, and which is preserved in the collection of St. Thomas's Hospital. In a similar state he has also seen the dislocated head of the humerus.—(*On Dislocations, p.* 28.) 2. The socket is sometimes filled up with adhesive matter. 3. A new bony socket is sometimes formed, in which the head of the bone is so completely confined that it could not be extricated without breaking its new lodgement. —(*Surgical Essays, part* 1, *p.* 21; *and Treatise, &c. p.* 10.)

Dislocations in general cannot be reduced without trouble; but after the reduction is accomplished, it is easily maintained. On the contrary, fractures are for the most part easy of reduction; but cannot be kept in this desirable state without difficulty. The moment extension is remitted, the muscles act, the ends of the broken bone slip out of their proper situation wtih respect to each other, and the distortion of the limb recurs. As a modern writer has observed, the reduction is only a small part of the treatment of fractures: the most essential point of it is the almost daily care which a fracture demands during the whole time requisite for its consolidation. The contrary is the case in luxations. Here, in fact, the reduction is every thing, if we put out of consideration the less frequent cases in which the dislocation is complicated, and attended with such grave circumstances as render it indispensably necessary to continue for a length of time the utmost surgical care. But even then the protracted treatment is less for the dislocation itself than for the extraordinary circumstances with which it is accompanied.—(See *Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 207.)

All the ancient writers recommend the extending force to be applied to the luxated bone; for instance, above the knee in dislocations of the thigh-bone, and above the elbow in those of the humerus. We have stated that Pott advised this plan, and the same practice, which is approved by J. L. Petit, Duverney, and Callisen, is almost generally adopted in this country.

However, many of the best modern surgeons in France, for instance, Fabre, D'Apouy, Desault, Boyer, Richerand, and Leveillé, advise the extending force not to be applied on the luxated bone, but on that with which it is articulated, and as far as possible from it. It is said that this plan has two most important advantages: first, the muscles which surround the dislocated bone are not compressed, nor stimulated to spasmodic contractions, which would resist the reduction; secondly, the extending force is much more considerable than in the other mode; for, by using a long lever, we obtain a greater degree of power.

In Pott's remarks, we find even him influenced by the prevailing prejudice against the above practice, that part of the extending force is lost on the joint intervening between the dislocation and the part at which the extension is made. This notion is quite unfounded, as every man, who reflects for one moment, must soon perceive. When extension is made at the wrist, the ligaments, muscles, &c. which connect the bones of the forearm with the os brachii, have the whole of the

extending force operating on them, and they must obviously transmit the same degree of extension which they receive to the bone above, to which they are attached. Indeed, this matter seems so plain, that I think it would be an insult to the reader's understanding to say any more about it, than that such eminent surgeons as have contrary sentiments can never have taken the trouble to reflect for themselves on this particular subject. Whether the force necessary to be exerted in some instances would have a bad effect on the intervening joint, may yet be a question; but as Desault's practice was very extensive, and he did not find any objection of this kind, perhaps we have no right to conclude that such would exist.

If, however, the common objection to Desault's plan of applying the extending force be unfounded, the question still remains to be settled, whether this practice is most advantageous on the grounds above specified? This is a point which, perhaps, cannot be at once peremptorily decided altogether in the negative or the affirmative, since what may be best in one kind of dislocation may not be so in another. Thus, Sir A. Cooper states, that as far as he has had opportunity of observing, it is generally best to apply the extension to the bone which is dislocated: but that dislocations of the shoulder are exceptions in which he mostly prefers to reduce the head of the bone, by placing his heel in the axilla, and drawing the arm at the wrist in a line with the side of the body, whereby the pectoralis major and latissimus dorsi are kept in a relaxed state.—(*Surgical Essays, part* 1, *p.* 25.)

Extension may either be made by means of assistants, who are to take hold of napkins or sheets put round the part at which it is judged proper to make the extension; or else a multiplied pulley may be used. In cases of difficulty, Sir A. Cooper thinks the pulley should always be preferred. "When assistants are employed, their exertions are sudden, violent, and often ill-directed, and the force is more likely to produce laceration of parts, than to restore the bone to its situation. Their efforts are also often uncombined, and their muscles are necessarily fatigued, as those of the patient, whose resistance they are employed to overcome." In dislocations of the hip-joint, and in those of the shoulder which have been long unreduced, pulleys should always be employed.—(*Surgical Essays, part* 1, *p.* 24.) But whether pulleys be used or not, nothing more need be added to what Mr. Pott has stated, concerning the propriety of using moderate force in the first instance, and increasing the extending power very gradually.

The extension should always be first made in the same direction in which the dislocated bone is thrown; but in proportion as the muscles yield, the bone is to be gradually brought back into its natural position. Thus the head of the bone becomes disengaged from the parts among which it has been placed, and is brought back to the articular cavity again by being made to follow the same course which it took in escaping from it.

Extension will prove quite unavailing, unless the bone, with which the dislocated head is naturally articulated, be kept motionless by counter-extension, or a force at least equal to the other, but made in a contrary direction.

The mode of fixing the scapula and pelvis, in luxations of the shoulder and thigh, will be hereafter described.

In dislocations of ginglymoid joints, extension and counter-extension are only made for the purpose of diminishing the friction of the surfaces of the joints, so that the reduction may be rendered more easy.

When the attempts at reduction fail, the want of success is sometimes owing to the extension not being powerful enough, and the great muscular strength of the patient, which counteracts all efforts to replace the bone.

In the latter case, the patient may be freely bled, and put into a warm bath, so as to make him faint. The opening in the vein should be made large, because a sudden evacuation of blood is more likely to produce weakness and swooning, than a gradual discharge of it; and the patient, for the same reason, may be bled as he stands up. In very difficult cases, the expedient of intoxication has been recommended, as, when the patient is in this state, his muscles are incapable of making great resistance to reduction. Under these circumstances, opium is also frequently administered with advantage.

"The means to be employed for the reduction of dislocations (says Sir Astley Cooper) are both constitutional and mechanical. It is generally wrong to employ force only, as it becomes necessary to use it in such a degree as to occasion violence and injury; and it will be shown in the sequel, that the most powerful mechanical means fail, when unaided by constitutional remedies. The power of the muscles, in the first instance, is to be duly appreciated; as this forms the principal cause of resistance. The constitutional means to be employed for the purpose of reduction are those which produce a tendency to syncope, and this necessary st te may be best induced by one or other of the following means, viz. by bleeding, warm bath, and nausea. Of these remedies, I consider bleeding the most powerful; and that the effect may be produced as quickly as possible, the blood should be drawn from a large orifice, and the patient kept in the erect position; for by this mode of depletion, syncope is produced before so large a quantity of blood as might injure the patient is lost. However the activity of this practice must be regulated by the constitution of the person; for as the accident happens to all the varieties of constitution, it must not be laid down as a general rule; but when the patient is young, athletic, and muscular, the quantity removed should be considerable, and the method of taking it away that which I have described.

Secondly, in those cases where the warm bath may be thought preferable, or where it may be considered improper to carry bleeding any further, the bath should be employed at the temperature of 100° or 110°; and as the object is the same as in the application of the last remedy, the person should be kept in the bath at the same heat till the fainting effect is produced, when he should be immediately placed in a chair, wrapped in a blanket, and the mechanical means employed.

Of late years, I have practised a third mode of lowering the action of the muscles, by exhibiting nauseating doses of tatarized antimony; but as its action is uncertain, frequently producing vomiting, which is unnecessary, I rather recommend its application, merely to keep up the state of syncope, already produced by the two preceding means, which its nauseating effects will most readily do, and so powerfully overcome the tone of the muscles, that dislocations may be reduced with much less effort, and at a much more distant period from the accident than can be effected in any other way."—(*Sir A. Cooper on Dislocations, &c. p.* 29, 30. Also, *Surgical Essays, part* 1, *p.* 22.) In cases of unusual difficulty, the use of antimonium tartar., together with the warm bath and bleeding, seems rational and judicious; but except in cases of that description, I should prefer long-continued, unremitting, not too violent, extension, which will at last overcome the muscles of the most athletic man. Sometimes the resistance made to reduction by muscles, acting in obedience to the will, may be eluded by the patient's attention being suddenly taken from the injured part, at which moment the action of those muscles is suspended, and a very little effort on the part of the surgeon will reduce the bone. A case, illustrating this circumstance, is recorded by Sir A. Cooper, (*Surgical Essays, part* 1, *p.* 25; and *Treatise, &c. p.* 34.)

Dislocations of orbicular joints can seldom be reduced after a month, though by means of great violence Desault used to succeed at the end of three or four. Dislocations of ginglymoid articulations generally become irreducible in twenty or twenty-four days, in consequence of anchylosis.

The reduction of a dislocation is known by the limb recovering its natural length, shape, and direction, and being able to perform certain motions, not possible while the bone was out of its place. The patient experiences a great and sudden diminution of pain; and very often the head of the bone makes a noise at the moment when it turns into the cavity of the joint.

Sir Astley Cooper believes, that much mischief is produced by attempts to reduce dislocations of long standing in very muscular persons. He has seen great contusion of the integuments, laceration, and bruises of the muscles, and stretching of the nerves, leading to an insensibility and paralysis of the hand, follow an abortive attempt to reduce a dislocation of the shoulder. He is of opinion that three months for the shoulder, and eight weeks for the hip, may be set down as the period from the accident when it would be imprudent to make the attempt, except in persons of very re-

laxed fibre, or advanced age.—(See *Treatise on Dislocations, &c. p.* 35.) I have seen two cases, in which very great force was exerted with pulleys, to reduce the thigh-bone at the end of three or four weeks; but the attempts completely failed. However, the assistance to be derived from properly lowering the strength of the muscles previously, by means of nauseating doses of antimony, the warm bath, &c., was not here taken advantage of. A dislocation of the upper head of the radius, of about a fortnight's standing, I have known resist all the efforts of two of the most eminent surgeons in London.

[The mischiefs resulting from violence done to the structure of the neighbouring parts in attempts at dislocation, are often much greater than those to which Mr. Cooper alludes in the preceding paragraph. The following extract is taken from the last edition of the 'First Lines,' and may be found in a note by the Philadelphia editor, vol. 2, p. 469.

"In the third volume of the *Repertoire d'Anatomie*, several cases of long-continued luxation of the humerus, in which severe mischief arose from the attempt to reduce the parts, are reported by M. Flaubert, M.D.; in one case, one of the axillary nerves was torn from the spinal marrow; and in others, paralysis of the arm was the result. After having succeeded completely in several previous instances, Professor Gibson has within a few years met with two instances in which the axillary artery, having formed unnatural adhesions, was torn across, and the death of the patients consequently resulted from the attempts at reduction.

One of these cases is reported in the third number of the *Am. Journal of the Med. Sciences*. The patient, a strout, muscular, athletic man, about six feet high, applied to Professor Gibson on account of a luxation of the left os humeri at the shoulder-joint, of nine weeks' standing. He was admitted into the Alms-House Infirmary on the 6th of March; the antiphlogistic system was pursued until the 15th, when attempts at reduction were made, in the presence of the surgeons and students of the house, which was not accomplished until after the lapse of an hour and three-quarters from the commencement of the operation.

On the 16th, there was a general swelling over the deltoid and pectoral muscles, with a distinct pulsation of an aneurismal character. On the morning of the 17th, it had increased considerably, and in consultation it was decided that the subclavian artery should be tied without delay. This was accordingly done by Professor G."

This patient died on the tenth day after the ligature of the subclavian. The details of the case, and the dissection, which was highly interesting, may be found in the 3d No. of the *Am. Journal of the Med. Sciences*. The writer then adds, "Those who are acquainted with the professional skill of Professor G. must attribute the failure in this case to the proper cause, the 'firm adhesion of the artery to the head of the bone;' and a like result must necessarily have followed its reduction in the hands of any other surgeon. As the result of his experience, Professor G. has drawn some conclusions of immense practical value, and to which we think too much attention cannot be paid. 'If,' says Professor G., 'the patient is young, not very muscular, the luxation not complicated with fracture—if no attempts have previously been made to accomplish the reduction, and the head of the bone has not been out of its natural situation beyond five or six weeks, I should advise the attempt to *replace* it. But, on the contrary, if the patient is very robust and vigorous, advanced in years, accustomed to labour and to the free use of ardent spirits, and the head of the bone has been long out, I should discountenance any attempt at reduction.'" —*Reese.*]

In order to keep the bone from slipping out of its place again, we have only to hinder the limb from moving. When splints will act powerfully in supporting the joint, they are very often used, as in dislocations of the ankle, wrist, &c. As the humerus cannot be luxated, except when at some distance from the body, a return of its dislocation will be prevented by confining the arm close to the side in a sling. The spica bandage, applied after such an accident, is more satisfactory to the patient, than really efficacious. Whatever bandage is used to keep the arm from moving, should be put on the lower end of the bone, as far as possible from the centre of motion. According to Sir Astley Cooper, the hip is rarely dislocated a second time; but the humerus and the lower jaw very frequently slip again from their sockets, which are shallow. Bandages for the prevention of this return of displacement are, therefore, in such cases, particularly necessary. Rest is required for some time after the reduction, in order that the ruptured ligaments may unite. The strength of the muscles, &c. will also be greatly promoted by friction, and pouring cold water over the limb.—(*On Dislocations, p.* 35.)

When a bone is broken and dislocated, an endeavour should be made to reduce the dislocation without loss of time, and then pay attention to the fracture. Also, if there be a compound fracture of the leg, and a dislocation of the shoulder, the fracture is to be secured in splints, and the dislocation then reduced.—(*Sir A. Cooper on Dislocations, p.* 16.) The case of a bone, dislocated and fractured at the same time, might be attended with considerable difficulty of reduction: fortunately, it is a very uncommon accident.

COMPOUND DISLOCATIONS.

Compound Dislocations are those which are attended with a wound communicating with the cavities of the injured joints. Some joints are much more disposed than others to compound dislocations. The accident scarcely ever takes place at the hip. Sir Astley Cooper has known one instance of it at the shoulder, and he has seen one of the knee; but the case isvery frequent in the ankle, elbow, and wrist.—(*On Dislocations, p.* 19.) In most instances, the opening in the skin is caused by the protrusion of the bone, but sometimes by the part having struck against a hard or an irregular body. Cases of this description are frequently attended with great danger; and the same nicety of judgment is requisite in determining, whether amputation ought to be immediately performed, or an effort made to preserve the limb, as in compound fractures, and bad gun-shot injuries; and many of the observations which I shall have to offer upon the latter subjects, will, for the most part, be applicable to the present.

When the luxation of a large joint is conjoined with an external wound, leading into the capsular ligament, it is a circumstance that has a particular tendency to increase the danger. In many cases, injuries of this description are followed by violent and extensive inflammation, abscesses, mortification, fever, delirium, and death. When the patient is advanced in years, much debilitated, or of an unhealthy irritable constitution, a compound luxation, especially if attended with much contusion and other injury of the sore parts, and wrongly treated, very often has a fatal termination. This, however, is not the general event of compound dislocations; and whatever may have happened in former times, we now know, that in the present improved state of surgery, these accidents mostly admit of cure. This statement may be made, without any censure being cast upon every instance of amputation performed in such cases. I know that this operation is sometimes indispensable directly after the accident, and I am equally aware, that it may become necessary in a future stage, when extensive abscesses or sloughing joined with threatening constitutional symptoms have taken place. My only design is to recommend the endeavour to cure the generality of compound luxations. But if a case were to present itself, attended with serious contusion and laceration of the soft parts, I should be as earnest an advocate for amputation as any surgeon.

Mr. Hammick, surgeon to the Royal Naval Hospital, Plymouth, in speaking of compound dislocations of the ankle, advises amputation, "where the lower heads of the tibia and fibula are very much shattered; where, together with the compound dislocations of these bones some of the tarsal bones are displaced and injured; where any large vessels are divided, and cannot be secured without extensive enlargement of the wound and disturbance of the soft parts; where the common integuments, with the neighbouring tendons and muscles, are considerably torn; where the protruded tibia cannot by any means be reduced; and where the constitution is enfeebled at the time of the accident, and not likely to endure pain, discharge, and length of confinement."—(*A. Cooper's Surgical Essays, part* 2, *p.* 146.) Perhaps, as general remarks, these may not

be inaccurate; but there are exceptions to them. Thus, we find in Sir A. Cooper's publication, several cases in which compound dislocations of the ankle terminated well, notwithstanding the displacement and removal of the astragalus,* other instances of which kind of success are to be found in the records of surgery.—(See *Laumonier, in Fourcroy, Méd. Eclairée; Percy, in Journ. de Méd. continué, Nov.* 1811, *p.* 348.) However, if the ends of the tibia and tarsal bones, especially the astragalus and os calcis are broken, the operation of amputation is recommended on high authority —(*Sir A. Cooper's Surg. Essays, part* 2, *p.* 181.) But with regard to the division of large blood-vessels, Sir A. Cooper states, that he would not at once proceed to amputation on that account. "The case from Mr. Sandford, of Worcester, sent me by Mr. Carden, clearly shows, that the division of the anterior tibial artery does not, if it be well secured, prevent the patient's recovery. I also once saw a compound fracture, close to the ankle-joint, accompanied by a division of that artery; and, although the patient was in the hospital, and a brewer's servant, who possessed the worst constitution to strugle against severe injuries, yet this man recovered without amputation." Nor, in Sir A. Cooper's opinion, would all hope be precluded, even if the posterior tibial artery were injured.—(*Vol. cit. p.* 186.) For the method of securing these vessels, see *Arteries.*

The following are the circumstances, which Sir A. Cooper has known give rise to the necessity for amputation in compound dislocations of the ankle. 1. The advanced age of the patient. 2. A very extensive lacerated wound. 3. Difficulty of reducing the ends of the bones he considers rather as a reason for sawing them off, than for amputation. 4. The extremely shattered state of the bones. 5. Dislocations of the tibia outwards cause greater injury of the bones and soft parts than those inwards, and more frequently require amputation. 6. Sometimes the bone cannot be kept reduced, owing to the tibia in the dislocation outwards being obliquely fractured. 7. Division of a large blood-vessel, attended with extensive wound of the soft parts. 8. Mortification. 9. Excessive contusion. 10. Extensive suppuration. 11. Necrosis, where the sequestra do not admit of removal. 12. Very great and permanent deformity of the foot. 13. When tetanus comes on, Sir A. Cooper does not approve of the operation. 14. A very irritable state of constitution, such as is often met with in very fat subjects, who take no exercise.—(*On Dislocations, &c. p.* 332, *&c.*)

The treatment of a compound dislocation requires the reduction to be effected without delay, and with as little violence and disturbance as possible. When the extremity of the bone protrudes, and is smeared with sand or dirt, as frequently happens from its having touched the ground, "it should be washed with warm water, as the least extraneous matter admitted into the joint will produce and support a suppurative process, and the utmost care should be taken to remove every portion of it adhering to the end of the bone. If the bone be shattered, the finger is to be passed into the joint, and the detached pieces are to be removed; but this is to be done in the most gentle manner possible, so as not to occasion unnecessary irritation; and if the wound be so small as to admit the finger with difficulty, and small loose pieces of bone even be felt, the integuments should be divided with a scalpel, to allow of such portions being removed without violence."—(*Sir A. Cooper, On Dislocations, p.* 254.) If any difficulty of reduction should arise from the bone being girt by the integuments, the opening in them should be dilated with a scalpel. The limb is then to be placed in splints, with the necessary pads, eighteen-tailed bandage, &c. Sir A. Cooper judiciously recommends the portions of this bandage not be sewed together, "but passed under the leg, so that one piece may be removed when it becomes stiff;" and by fixing another to its end, before it is withdrawn, the fresh piece may be applied without any disturbance of the limb.—(*Surg. Essays, part* 2, *p.* 120.) The wound is to be freed from any dirt, clots of blood, or other extraneous matter, and its lips are to be accurately brought together with strips of adhesive plaster. Sir A. Cooper considers lint dipped in the blood which oozes out the best kind of first dressing. The joint is to be covered with linen kept constantly wet with the liquor plumbi acetatis dilutus, or with, what is better, spirit of wine and water; the bandage is to be loosely laid down, and the splints fastened on the limb with their proper straps or pieces of tape, and the limb is to be kept perfectly at rest in an eligible posture. The patient, if strong and young, is to be bled. This last practice may be more freely adopted in the country than in London, or large hospitals. An anodyne the first night or two will be highly proper. Saline draughts, antimonials, and a low regimen are also indicated during the first few days of the symptomatic fever, which commonly follows so serious an accident.

According to Sir A. Cooper, purgatives should be used with the utmost caution; "for (says he), there cannot be a worse practice, when a limb has been placed in a good position, and adhesion is proceeding, than to disturb the processes of nature by the frequent changes of position which purges produce; and I am quite sure, that in cases of compound fracture, I have seen patients destroyed by their frequent administration. That which is to be done by bleeding and emptying the bowels should be effected within an hour or two after the accident, before the adhesive inflammation arises."—(*Surgical Essays, part* 1, *p.* 121.) Here the fracture-bed, invented by Mr. Earle, would allow purgatives to be used without any disturbance of the limb.

If the case takes a favourable course, the constitutional fever will not be excessive, nor will the pain and inflammation of the limb be immoderate. Sometimes the wound unites more or less without suppuration; a circumstance particularly desirable, as tending more than any thing else to lessen the danger, by changing the case, as it were, from a compound into a simple one. In other cases the wound is not united, but the inflammation and suppuration are not violent nor extensive, the constitution is not dangerously disturbed, and hopes of ultimate success may be reasonably entertained. When the wound is disposed to heal favourably, adhesive plaster, with or without lint, or a pledget of soft soap cerate is the best dressing. In other instances, while the suppuration is copious, and the parts are tense and painful, emollient poultices are the most eligible.

When the symptomatic fever and first inflammatory symptoms are over, and much discharge prevails, attended with marks of approaching weakness, the patient is to be allowed more food, and directed to take bark, cordials, porter, wine, &c. If his nights are restless, he must have opiates; if he sweats profusely, sulphuric acid; and, in short, all such medicines as his particular complaints may require are to be prescribed.

When the inflammation of a compound dislocation is violent or extensive, general bleeding, the application of leeches, and the use of fomentations and poultices, are the most likely means of lessening the mischief. Yet it is only in strong habits that venesection to any extent can be prudently practised in large cities or crowded hospitals.

The following are the instructions delivered by Sir A. Cooper on the subject of dressings. "If the patient complain of considerable pain in the part, in four or five days the bandage may be raised to examine the wound; and if there be much inflammation, a corner of the lint (or other dressing) should be lifted from the wound, to give vent to any matter which may have formed; but this ought to be done with great circumspection, as there is danger of disturbing the adhesive process, if that be proceeding without suppuration. By this local treatment, it will every now and then happen, that the wound will be closed by adhesion; but if in a few days it be not and suppuration take place, the matter should have an opportunity of escaping; and the lint being removed, simple dressings should be applied. After a week or ten days, if there be suppuration with much surrounding inflammation, poultices should be applied upon the wound, leeches in its neighbourhood, and upon the limb at a distance the evaporating lotion should still be employed; but as soon as the inflammation is lessened, the poultices should be discontinued."—(*Surgical Essays, part* 2, *p.* 121.)

In certain examples, the most skilful treatment is unavailing. The joint and limb become affected with considerable pain and swelling, the fever runs high,

[* Professor Stevens, of New-York, removed the astragalus in a case of irreducible compound dislocation of the ankle-joint, and the case had an early and most happy termination.—*Reese.*]

delirium comes on, and the patient may even perish from the violence of the first symptoms, the limb being generally at the same time attacked by gangrene. If these first dangers are avoided, the wound may yet not heal favourably, the inflammation may be considerable, or of an erysipelatous nature, large abscesses under the fasciæ may be formed, the bones may be affected with necrosis, and the hectical symptoms and sinking state of the patient may make the only chance of recovery depend upon amputation. But even this operation is sometimes deferred till too late, and the patient must be left to his miserable fate.

Whoever gives the smallest reflection to the nature of compound luxations, will perceive that it is often a matter of the highest importance to make a right decision at the very beginning, whether amputation should be immediately done, or an attempt made to save the limb. In some instances, the patient's sole chance depends upon the operation being performed at once, without the least delay, and the opportunity of doing it never returns. The surgeon should take off the limb as soon as he has seen the nature of the injury, and not wait till a general tendency to swelling and gangrene has spread through the member, and every action in the system is disturbed. Amputation under these circumstances is undoubtedly done with a very diminished chance of success; and, until certain facts were adduced by Baron Larrey, Mr. Lawrence, Mr. A. C. Hutchison, and others, was of late years altogether prohibited.—(See *Amputation* and *Mortification*.)

But, besides this first critical period, the surgeon often has to exercise a nice degree of judgment in a future stage of the case; I mean when the suppuration is copious, the wound open, the bones carious, and the health impaired. Here the practitioner may sometimes err, in taking off a limb that might be saved; or he may commit a worse fault, and make the patient lose his life, in a fruitless attempt to save the member. No precepts can form the right practitioner in this delicate part of surgery; genius alone cannot do it; the opportunity of making observations, and the talent of profiting by them, are here the things which make the consummate surgeon.

It should ever be recollected, in regard to bad compound dislocations, that in young subjects, and in a salubrious air, many cases will do well, which in old persons, and in the polluted atmosphere of London, and crowded hospitals, would be fatal without amputation.

The constitutions of some individuals are so irritable, that whether an attempt be made to save the limb, or amputation be at once performed, the case has a rapid and fatal termination. According to Sir A. Cooper, persons who are much loaded with fat "are generally irritable, and bear important accidents very ill: indeed," says he, "they generally die, whichever plan of treatment be pursued."—However, he adds that such corpulent people as take a great deal of exercise, form exceptions to the foregoing remark.—(*Surgical Essays, part* 2, *p.* 195.)

There is a practice in regard to compound dislocations, which I think ought at all events to be adopted only in a very few cases; I mean the plan of sawing off the head of the luxated bone. According to Leveillé, this method is recommended by Hippocrates, as a means of accelerating and perfecting the cure.—(*Nouvelle Doctrine Chirurgicale, t.* 2, *p.* 44.) However, it seems not to have done sufficient good in ancient times to have obtained a lasting reputation. In fact, when it was mentioned by the late Mr. Gooch, it had sunk into such oblivion, that it was received as an entirely new proposal. "Compound luxations (says this author) are of a more dangerous nature than compound fractures, for very plain reasons; but if a surgeon should judge it advisable to attempt saving a limb under such threatening circumstances, *I am inclined to think, from what I have observed, he will be more likely to succeed by sawing off the head of the bone, especially if it has long been quite out, and exposed to the air.*"

Mr. Gooch afterward takes notice of a case in which Mr. Cooper, of Bungay, sawed off the heads of the tibia and fibula, and preserved the limb, the patient being able to walk and work for his bread for many years afterward. Other examples are also briefly mentioned, in which the lower head of the radius was sawn off, and the head of the second bone of the thumb.

The late Mr. Hey, of Leeds, was induced to make trial of this plan in a compound luxation of the ankle. The example, however, which he published, is decidedly unfavourable to the practice, as the following passage will show: "I was in hopes that this patient would have been able to walk stoutly; but in this I was disappointed. He walked indeed without a crutch; but his gait was slow, his leg remaining weak, and his toes turning outwards, which rather surprised me, as his leg was very straight when I ceased attending him."

Mr. Hey did not recite this case with the view of recommending a similar practice in all cases of this accident; for he had not always adopted it, nor was he of opinion, that the same mode of treatment, whether by replacing the bones, sawing off their extremities, or amputating the limb, ought to be universally practised. When the laceration of the capsular ligament and integuments is not greater than is sufficient to permit the head of the tibia to pass through them; and when, at the same time, the joint or contiguous parts have suffered no other injury; Mr. Hey recommends the replacing of the bone, and a union of the integuments by suture, with the treatment adapted to wounds of the joints.—(*Practical Obs. in Surgery, chap.* 11, *edit.* 2.)

That in a few cases recorded by Mr. Gooch and Mr. Hey the patients recovered with a new sort of joint, only proves to my mind the great resources and activity of nature, and her occasional triumph over the opposition she meets with from bad and injudicious surgery. A limb so treated must ever afterward be shorter than its fellow, and consequently the patient be more or less a cripple. We have seen, that in the only instance published by Mr. Hey, considerable deformity was the consequence of the practice. I cannot help adding my belief, that this gentleman would have experienced more success in the treatment of compound dislocations, had he relinquished the objectionable method of sewing up the wound. In such accidents every kind of irritation should be avoided as much as possible, and that the wound may be conveniently closed with sticking plaster, the observation of numerous cases in St. Bartholomew's Hospital has perfectly convinced me. In this munificent institution, under the disadvantage of the air of London, and an hospital, compound luxations used, at the period when I was an apprentice there, to be treated with marked success; and I feel warranted in ascribing the circumstance to the mode of treatment, which was conducted on the principles explained in this section of the Dictionary.

The most ingenious arguments which have yet been urged in behalf of the practice of sawing off the ends of the bones in compound dislocations of the ankle, are those recently published by Sir A. Cooper. However, he does not advise the plan without restrictions. If the dislocation (says he) can be easily reduced, without sawing off the end of the bone; if it be not too obliquely broken to remain firmly upon the astragalus after being reduced; if the end of the bone be not shattered, for then the small loose pieces of bone should be removed, and the surface of the bone be smoothed by the saw; if the patient be not excessively irritable, and the muscles affected with violent spasms, impeding reduction, and causing a displacement of the bones after they have been reduced; Sir Astley Cooper advises the immediate reduction of the parts, and uniting the wound by adhesion. In the opposite circumstances, rather than amputate the limb he would saw off the ends of the bones.—(*Surgical Essays, part* 1, *p.* 154. *Treatise, p.* 302.)

The only case in which the plan of sawing off the head of the bone can be at all proper, is when a compound dislocation cannot be reduced, notwithstanding the enlargement of the wound in the skin, and every other possible means. There is no other mode of preventing the formidable symptoms which would ensue were the bone left in a state of protrusion through the integuments; nor is there any better way of alleviating such symptoms after they have actually begun. M. Roux gives much praise to the English surgeons for the judicious boldness which they have evinced in cases of this description. Although Fabricius Hildanus, Ferrand, Desault, Laumonier, and several other French surgeons, have, like many British practitioners, ventured to remove the whole of the astragalus, when this bone was totally separated from the scaphoides, and protruded in compound luxations, yet M. Roux acknowledges that the bold practice of sawing off the

lower end of the humerus, the lower end of the radius, the lower end of the tibia, and also of the fibula, at the same time, originated with, and was first executed by, English surgeons.—(*Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, p. 208, 209.)

DISLOCATIONS OF THE LOWER JAW.

The lower jaw can only be luxated forwards, and either one or both of its condyles may become displaced in this direction. Every dislocation except that forwards is rendered impossible by the formation of the parts. The lower jaw cannot even be dislocated forwards, unless the mouth, just before the occurrence of the accident, be very much open. Whenever the chin is considerably depressed, the condyles slide from behind forwards under the transverse root of the zygomatic processes. The cartilaginous cap which envelopes the condyles, and follows them in all their motions, still affords them an articular cavity; but the depression of the bone continuing, the ligaments give way, the condyles glide before the *eminentiæ articulares*, and slip under the zygomatic arches. Hence a dislocation mostly happens while the patient is laughing, gaping, &c. A blow on the jaw, when the mouth is wide open, may easily cause the accident. The case has occasionally arisen from the exercise of great force in drawing out the teeth. Sir Astley Cooper has known a complete luxation, that is to say, of both condyles, produced by a boy suddenly putting an apple into his mouth to keep it from the reach of a play-fellow.—(*On Dislocations*, p. 389.) Whenever the jaw has once been dislocated, the same causes more easily reproduce the occurrence. In certain individuals the ligaments are so loose, and the muscles so weak, that a dislocation is produced by any slight attempt to yawn, laugh, or (as Lamotte has observed) to bite any substance which is rather large.—(*Leveillé, Nouvelle Doctrine Chirurgicale, tom.* 2, p. 54.) There have been persons who could scarcely ever laugh heartily without their lower jaws being luxated. But of all the causes of this occurrence, yawning alone, even without the combination of any external force, is by far the most common.

When the jaw is depressed, and its angles, to the external sides of which the masseters are attached, are carried upwards and backwards, if these muscles contract, the greater part of their force tends to bring the condyles into the zygomatic depression.—(*Boyer.*)

Dislocations of the lower jaw are attended with a great deal of pain, which Boyer imputes to the pressure produced by the condyles on the deep-seated temporal nerves, and those going to the masseters, which nerves pass before the roots of the zygomatic process. The mouth is wide open, and cannot be shut. It is more open in recent dislocations than in those which have continued for some time. An empty space is felt before the ear in the natural situation of the condyles. The coronal process forms under the cheek-bone a prominence, which may be felt through the cheek or from within the mouth. The cheeks and temples are flattened by the lengthening of the temporal, masseter, and buccinator muscles. The saliva flows in large quantities from the mouth, the secretion of which fluid is greatly increased by the irritation of the accident. The arch formed by the teeth of the lower jaw is situated more forward than that formed by the teeth of the upper jaw. During the first five days after the accident, the patient can neither speak nor swallow.—(*Boyer.*) When only one condyle is dislocated, the mouth is distorted, and turned towards the opposite side, while the fellow-teeth of he jaws do not correspond. However, Mr. Hey asserts, that frequently the position of the chin is not perceptibly altered.—(*Practical Observations*, p. 322.) The mouth cannot be shut; but it is not so widely open as in the complete luxation.—(*Sir A. Cooper on Dislocations*, p. 392.)

When a dislocated jaw has remained unreduced for several days or weeks, the symptoms are not so well marked. In such instances, the chin becomes gradually approximated to the upper jaw; the patient recovers by degrees the faculty of speaking and swallowing; but he stammers, and the saliva dribbles from his mouth. The sufferings induced by a dislocated jaw, it is said, may even prove fatal if the case continue unrectified; but we are not to believe Hippocrates when he positively declares the accident mortal if not reduced before the tenth day. Indeed, Sir Astley Cooper, in noticing the severity of the pain, assures us, that he has never seen any dangerous effect produced; on the contrary, that in time the jaw becomes more closed, and a considerable degree of its motion is restored.—(*On Dislocations*, p. 389.)

Monteggi attended a man, two months after such a luxation, which had not been understood, and Fabricius ab Aquapendente assures us, that he had never seen the prognostic of Hippocrates verified, though he had had many patients of this sort under his care.—(*Leveillé, Nouvelle Doctrine Chir. t.* 2, p. 58.)

Dislocations of the lower jaw may be reduced in the following manner: The surgeon is first to wrap some linen round his thumbs, to keep them from being hurt by the patient's teeth, and then introduce them into the mouth, as far as possible along the grinding teeth. At the same time he is to place his fingers under the chin and base of the jaw, and while he depresses the molares with his thumbs, he raises the chin with his fingers, by which means the condyles become disengaged from their situation under the zygomas; at which instant the muscles draw those parts so rapidly back into the articular cavities again, that the surgeon's thumbs might sometimes be hurt, did he not immediately move them outwards between the cheek and the jaw.

The reduction being accomplished, a fresh displacement is to be prevented by applying a four-tailed bandage, as recommended for the fractured jaw. For a few days the patient should avoid such food as requires much mastication.

The ancients used to place between the grinding teeth two pieces of stick, and while they used them as levers to depress the back part of the bone, they raised the chin by means of a bandage. The late Mr. Fox, the dentist, had a patient whose jaw was dislocated on both sides in the extraction of a tooth: the reduction was first effected on one side by placing a piece of wood a foot long upon the grinders, and then raising the part of it which was held in the hand. Mr. Fox next reduced the other condyle in the same manner. Sir Astley Cooper, in reducing a complete luxation of the lower jaw, prefers putting the patient in the recumbent posture, introducing two corks behind the molar teeth, and then elevating the chin.—(*On Dislocations*, p. 391.) When only one condyle is dislocated, whatever method of reduction be followed, it need only be applied to the side affected.

DISLOCATIONS OF THE VERTEBRÆ.

What have been called dislocations of the spine are considered by Sir Astley Cooper as really fractures of the vertebræ, with displacement of the bones but not of the intervertebral substance. The only true dislocations of the spine admitted by him, are those of the first and second cervical vertebræ.—(*On Dislocations, &c.* p. 17.)

The large surfaces with which the vertebræ support each other; the number and thickness of their ligaments; the strength of their muscles; the little degree of motion which each vertebra naturally has; and the vertical direction of the articular processes, are generally supposed to make dislocations of the dorsal and lumbar vertebræ impossible, unless there be also a fracture of the above-mentioned processes. Thus Sir Astley Cooper, in his very extensive experience, has never witnessed a separation of one vertebra from another, through the intervertebral substance, without fracture of the articular processes; or, if those processes remained unbroken, without a fracture through the bodies of the vertebræ. Of these cases, I shall merely remark, that they can only result from immense violence; that the symptoms would be an irregularity in the disposition of the spinous processes, retention or incontinence of the urine and feces, paralysis and a motionless state of the lower extremities, the effects of the pressure or other injury, to which the spinal marrow would be subjected. Similar symptoms may also arise when the spinal marrow has merely undergone a violent concussion, without any fracture or dislocation whatever; and it is certain, that most of the cases mentioned by authors as dislocations of the lumbar and dorsal vertebræ, have only been concussions of the spinal marrow, or fractures of those bones.

The cervical vertebræ, however, not having such extensive articular surfaces, and having more motion, are occasionally luxated. The dislocation of the head from the first vertebra, and of the first vertebra from

the second, particularly the last accident, is the most common; but luxations of the cervical vertebra lower down, though very rare, are possible. Indeed, according to Boyer, many examples have happened, in which one of the inferior oblique or articular processes of a cervical vertebra has been dislocated, so as to cause a permanent inclination of the neck towards the side opposite to that of the displacement.—(*Traité des Mal. Chir. t.* 4, *p.* 114.)

Whether the case published by Mr. C. Bell under the name of a subluxation of the spine, ought to be received as an uneqivocal specimen of a displacement of the last cervical from the first dorsal vertebra, I cannot presume to determine. This author speaks of an evident loosening between these two bones; of a considerable space between them; of the destruction of the intervertebral substance; and of an immense quantity of pus around the injured part of the spine, as circumstances seen in the dissection. "On the back part, the pus had extended under the scapulæ, and on the fore part was bounded by the œsophagus," and in the spinal canal it had ascended through the whole length of the sheath to the cauda equina.—(*C. Bell, Surg. Obs. vol.* 1, *p.* 148.)

Rust declares, however, that even the lumbar and dorsal vertebræ may be dislocated.—(*Arthrokakologie, p.* 71.) Mr. Bell also describes a case of complete dislocation of the last dorsal from the first lumbar vertebræ, with entire division of the spinal cord. A small portion of bone was broken off.—(*On Injuries of the Spine and Thigh-bone, p.* 25, *pl.* 2, *fig.* 2 *and* 3.) We learn from Mr. Lawrence, that in the museum of St. Bartholomew's Hospital, there are specimens of luxated cervical vertebræ. In one of these, the right inferior articular process of the fifth vertebra is dislocated forwards. The portion of the vertebral column above the seat of the injury is twisted to the left, and the body of the fifth, having been partially displaced, projects beyond that of the sixth vertebra. This displacement could not have been effected without considerable injury of the fibro-cartilage. The upper and anterior part of the body of the sixth and seventh vertebræ has been slightly fractured on the left side. In another case, the inferior articular processes of the fifth cervical vertebra are partially separated from those of the sixth. The bodies of the same bones are partially separated behind. A third specimen exhibits a dislocation of the sixth from the seventh cervical vertebra. The inferior articular processes of the sixth are completely dislocated forwards, and its body projects over that of the seventh. Mr. Lawrence has recorded one case, proving that complete dislocation both of the articular processes and body, without fracture, may occur in the cervical region of the spine.—(See *Med. Chir. Trans. vol.* 13, *p.* 391. 394.)

DISLOCATION OF THE HEAD FROM THE FIRST VERTEBRA, OR ATLAS.

The os occipitis and first cervical vertebra are so firmly connected by ligaments, that there is no instance of their being luxated from an external cause, and were the accident to happen, it would immediately prove fatal, by the unavoidable compression and injury of the spinal marrow.

Five examples of displacement of the atlas by disease are in the museum at Leyden, and are described by Sandifort. Boyer has seen one at La Charité; and a very interesting description of a similar case, illustrated by engravings, has been recently published by Schupke.—(*De Luxatione Spontanea Atlantis et Epistrophei*, 4*to. Berol.* 1816.) In this tract is collected, from the writings of J. P. Frank (*Delect. Opusc. vol.* 5), from those of Reil (*Feiberlehre, b.* 2, § 102), and of Rust, &c., an exact detail of the symptoms of the disease; an important topic, on which Boyer confesses his inability to give any information. The symptoms have been described from Rust, by Mr. Lawrence as follows: "Pain in the neck, becoming more severe at night, or in swallowing a large mouthful, or drawing a deep breath, is the first symptom. This pain affects one side of the neck, especially when the head is moved towards the shoulder; it extends from the larynx towards the nape, and often to the scapula of the pained side. No external alteration is perceptible; but firm pressure on the region of the first and second vertebræ produces considerable pain, and thus points out the seat of disease. The difficulty of swallowing and breathing, and hoarseness, increase, alternating with pain in the neck, which seems to fix about the back of the head, and becomes intolerable on moving that part. The head sinks towards one shoulder, the face being turned a little down; for, in general, the articulations are affected on one side only, and that was the left in seven out of nine examinations after death. If both sides are affected, the head will incline directly forwards. In this state things continue for several weeks or months; and before worse symptoms come on, there is often apparent improvement, freer motion, and more natural situation of the head. But the uneasiness in speaking and swallowing returns; the pain becomes more severe and extensive; the head falls a little backwards, and sinks towards the opposite side. The patient feels as if the head were too heavy, and he carefully supports it with his hands, when he moves from the sitting to the lying position, or *vice versâ*. This may be considered a pathognomonic symptom of the affection. Another symptom, which, at this period, shows the true nature of the disease, is a peculiar expression of pain in the countenance, which, combined with the position and stiffness of the head, constitutes so characteristic an assemblage of appearances, that it is enough to have seen it once, in order to recognise it again immediately. In the farther progress of the case, noise in the head, deafness, giddiness, cramps and convulsions, partial paralysis, particularly of the upper limbs, loss of voice, purulent expectorations, and hectic symptoms supervene. Generally, no external change is observable, either in the neck or in the nape; and Rust observed, in one case only, swelling of the affected side, which broke and left fistulous ulcers. But the slightest pressure in the region of the three upper vertebræ is acutely painful, and sometimes in the advanced period of the disease, a grating of rough surfaces is distinctly perceptible when the head is turned. The patient may continue for months in this helpless and painful state, and then dies, either from exhaustion and debility, or, which is more frequent, suddenly and unexpectedly."—(*Lawrence, in Med. Chir. Trans. vol.* 13, *p.* 406.) These spontaneous displacements of the atlas may depend upon caries and scrofulous disease of its articular surfaces, or upon an exostosis of its transverse process, or a similar tumour growing from the neighbouring portion of the os occipitis, or petrous portion of the temporal bone. By these causes, the anterior or posterior arch, or one of the sides of the atlas, has been made to intercept a third, the half, and even two-thirds of the diameter of the foramen magnum. Notwithstanding these changes, life may be carried on, and the nutritive functions performed sufficiently well to afford time enough either for the exostoses to attain a large size, or for the anchylosis, binding together the head and most of the cervical vertebræ, to acquire great solidity. The size of the foramen magnum, and the dimensions of the vertebral canal in the neck, are considerably beyond what would be necessary for simply containing the spinal marrow, so that the free lateral movements of the head and atlas can be executed without any risk of pressure on that important part. Hence spontaneous displacement can occur in these cases to a considerable degree, without impairing the functions of the spinal cord.—(*Lawrence, in Med. Chir. Trans. vol.* 13, *p.* 411.) According to Boyer, the atlas is never found free and distinct when thus displaced, but is confounded at least with the os occipitis, and mostly with five or six of the subjacent vertebræ. And another interesting fact is, that in cases of this description, the joint between the atlas and occiput is never the only one which is displaced and deformed, unless the disease be very slightly advanced; for the articulation of the processus dentatus with the atlas, and sometimes that of the point of the same process with the occiput, are considerably affected. Sometimes the processus dentatus and the occiput retain their natural position with respect to each other, and the atlas alone seems to be displaced between them. Sometimes the second vertebra is out of its place with respect to the os occipitis, in the same direction as the atlas, but not in quite so great a degree. Lastly, in some other instances, the two vertebræ are twisted in opposite directions, as, for instance, one to the left, the other to the right; or *vice versâ*. In one of the cases recorded by Sandifort, this kind of lateral displacement in opposite directions was so extensive, that an interspace, only six lines in breadth, was left between their ap-

proximated annular margins. An instance was seen by Duverney, where the displacement of the two vertebræ was from before backward, and where the processus dentatus was approximated to the posterior arch of the atlas to the extent of two-thirds of the annular opening in this vertebra. In these cases, nothing can be more obvious, than that there must be a destruction, or at all events a thoroughly diseased state of the ligaments between the atlas and dentatus, and of those connecting the dental process to the occiput.—(*Boyer, vol. cit. p.* 105.)

As for the treatment of the preceding forms of disease, experience has hitherto furnished little satisfactory knowledge. But as an analogy is seen between these cases and the scrofulous and carious affections of other joints, blisters, setons, and issues have been proposed and tried. Rust found these remedies only capable of retarding the progress of the disease, and of producing an abatement of the symptoms. The pain, often reaching from the back of the head to the forehead, was rendered less severe; and the difficulty of swallowing was considerably lessened. But, the means here specified were not found adequate to arrest the morbid change in the bones. However, Rust thinks, that greater benefit might be expected, if a case were to present itself arising altogether from a local cause, without its origin being connected with constitutional disease.—(*Salzburger Med. Chir. Zeitung, jahrgang* 1813, *b.* 3, *p.* 108.) In a later work he adverts to some examples, in which a cure was effected by nature. Indeed the occasional termination of the disease by anchylosis is a full proof.—(*Arthrokakologie*, § 118.)

DISLOCATIONS OF THE FIRST CERVICAL VERTEBRA FROM THE SECOND.

The rotatory motion of the head is chiefly performed by the first vertebra moving on the second. When this motion is forced beyond its proper limits, the ligaments which tie the processus dentatus to the edge of the foramen magnum are torn, and supposing the head to be forced from the left to the right, the left side of the body of the vertebra is carried before its corresponding articulating surface, while the right side falls behind its corresponding surface. Sometimes the processus dentatus, whose ligaments are ruptured, quits the foramen formed for it by the transverse ligament and the anterior arch of the first vertebra, and presses on the medulla oblongata. But, according to Boyer, the processus dentatus may be displaced in two ways: 1st, It may be carried directly backwards, the transverse and other ligaments being broken. This mode of displacement Boyer considers as the most difficult and uncommon, as it can hardly take place, except from a fall from a great height upon the back of the head, while the spine is bent forwards.—(*Traité des Mal. Chir. t.* 4, *p.* 109.) However, the accident may happen in another manner, as in Mr. C. Bell's instance where it occurred from the chin striking against a curb stone.—(*Surg. Obs. vol.* 1, *p.* 150.) 2dly, In a violent rotation in which the face is carried sideways beyond the proper limits, the lateral and accessory ligaments of the processus dentatus may be stretched and twisted spirally round this process. The force operates entirely upon them, and not at all upon the transverse ligament. Now when the lateral and accessory ligaments of the processus dentatus have given way, and an effort to incline the head to one side is kept up, one of the sides of the space, bounded by the transverse ligament, may present itself near the point of the processus dentatus, which may then pass below the transverse ligament without rupturing it.

In children, where the processus dentatus is not fully developed, and the ligaments are weaker than in the adult, a perpendicular impulse may break the lateral and accessory ligaments, and then force the processus dentatus under the transverse ligament, without rupturing this latter part; as Boyer conceives must have been the case in the child, which J. L. Petit mentions as having been instantaneously killed by being lifted up by the head.

Lastly, when the transverse lateral and other ligaments are capable of making very great resistance a force tending to rupture them all, and to throw the processus dentatus directly backwards, this process, if more slender than common, may be broken near its base, and this portion of it forced back upon the spinal marrow.

A case exemplifying the occurrence, used to be related by Mr. Else in his lectures, and is recorded by Sir Astley Cooper.—(*On Dislocations, p.* 348. *Boyer, vol. cit. p.* 110.)

Patients can hardly be expected to survive mischief of this kind in so high a situation; when the transverse ligament is broken, and the processus dentatus is thrown directly backwards against the medulla oblongata, the effect must be instant death, as happened in the case recorded by Mr. C. Bell, (*Surg. Obs. vol.* 1, *p.* 150.) and in that mentioned by Mr. Else.

According to surgical writers, the causes which may produce this formidable accident are various: a fall on the head from a high place; the fall of a heavy body against the back of the neck; a violent blow; a forcible twist of the neck; tumbling; standing upon the head; the rash custom of lifting children up by the head, &c. Louis found that the first vertebra was dislocated from the second in the malefactors hanged at Lyons; at which place, the executioner used *to give a sudden twist* to the body, at the moment of its suspension, and then bear with all his weight upon it. Under such circumstances, Boyer conceives, that the processus dentatus might pass under the transverse ligament, without any rupture of the latter.

Dislocations of the cervical vertebræ are said not to be always fatal, as when they occur at the third, fourth, fifth, or sixth of these bones, and only one articular process is luxated. In these instances, the vertebral canal is not so much lessened as to compress the spinal marrow, and occasion immediate death.

With regard to the prognosis and treatment of all luxations in which the processus dentatus is displaced suddenly by violence, and not gradually by disease, the reader need only hear that such cases are immediately fatal. Mistaken notions have been entertained upon this point, in consequence of particular dislocations of the neck having been successfully treated.

A child was brought to Desault, with its neck bent, and its chin turned towards the right shoulder. The accident had been a consequence of the head having been fixed on the ground, while the feet were up in the air. A surgeon happened to be with Desault at the time, and they agreed to make an attempt to reduce the luxation, and to apprize the mother, that though the child might be cured, there was a possibility of its perishing under their hands. Being permitted to do what they judged proper, they fixed the shoulders, and the head was gently raised, and gradually turned into its natural position. The child could now move freely, the pain ceased, and a considerable swelling in the situation of the luxation yet left, was dispersed by the application of emollient poultices.—(*Leveillé, Nouvelle Doctrine Chir. t.* 2, *p.* 62.)

Another alleged instance of the reduction of a dislocation of the neck is also recorded by Dr. Settin.—(*Schmucker's Vermischte Chirurgische Schriften, b.* 1.) However, both in this case and that related by Desault, there can now be little or no doubt, that the accident was not a dislocation of the dentata from the atlas, but only a luxation of one of the oblique processes of a cervical vertebra lower down. Whenever the processus dentatus is suddenly displaced, or fractured, the effects on the medulla spinalis are inevitably fatal. A case, indeed, was attended by Mr. Cline, in which the processus dentatus had lost a part of its natural support, in consequence of a transverse fracture of the first vertebra, and in which the child survived the accident a year.—(See *A. Cooper, On Dislocations, p.* 549. *T. E. Schmidt, De Luxatione Nuchæ. Haller, Disp. Chir. t.* 2, *p.* 351. *Tub.* 1747. *S. T. Soemmering, Bemerkungen über Verrunkung und Bruch des Rückgrats*, 8vo. *Berlin*, 1793. *Boyer, Traité des Mal. Chir. t.*4, *p.* 100, *&c.* 8vo. *Paris*, 1814. *A. E. Schupke, De Luxatione Spontaneâ Atlantis et Epistrophei*, 4to. *Berol*, 1816. *C. Bell, Surgical Obs. vol.* 1, *p.* 145, 149, *&c.* 8vo. *Lond.* 1816. *Observations on Injuries of the Spine, &c.* 4to. *Lond.* 1824. *Sir A Cooper, Treatise on Dislocations, &c. p.* 548—551, *&c.* 4to. *Lond.* 1822. *Lawrence, in Med. Chir. Trans. vol.* 13.)

DISLOCATIONS OF THE CLAVICLE.

These are much less common than fractures, which are said to occur six times more frequently. In fact, as Sir Astley Cooper has truly remarked, the clavicle is so strongly articulated both with the sternum and scapula, that its dislocations are rare in comparison

with those of many other joints.—(*On Dislocations*, *p.* 395.)

The clavicle may be luxated at its sternal extremity, forwards, backwards, and upwards, but never downwards, on account of the situation of the cartilage of the first rib. The luxation forwards is the most frequent; dislocations backwards and upwards are very unusual; and one directly backwards is still more rare. This last case Sir Astley Cooper has never known arise from violence; but he conceives that it might happen from a blow on the fore part of the bone, rupturing the capsular ligament and that between the clavicle and rib. The only instance of the dislocation backwards, with which this experienced surgeon is acquainted, proceeded from great deformity of the spine. In this extraordinary case, the bone gradually slipped behind the sternum, and produced so much inconvenience by its pressure on the œsophagus, that the late Mr. Davie, of Bungay, in Suffolk, was obliged to remove its sternal extremity.—(*A. Cooper on Dislocations*, *p.* 401.)

If the dislocation be forwards, a hard, circumscribed tumour is felt, or even seen, on the front and upper part of the sternum. According to Boyer, when the shoulder is carried forwards and outwards, the tumour disappears; but in Sir Astley Cooper's account, it is said, that the projection on the sternum will subside, if the shoulder be drawn backwards. The shoulder being elevated, the projection descends; if it be drawn downwards, the dislocated extremity of the bone becomes elevated to the neck. The motions of the clavicle are painful, and the patient moves the shoulder with difficulty. The point of the injured shoulder is less distant from the central line of the sternum than usual. According to the same authority, the dislocation forwards is sometimes incomplete, only the front of the capsular ligament being torn. The dislocation forwards is generally produced by a fall upon the point of the shoulder, when the force pushes the clavicle inwards and forwards; but it also frequently happens from falls upon the elbow, when this is separated from the side, and thus the clavicle is propelled violently inwards and forwards against the anterior portion of the capsular ligament.—(*A. Cooper on Dislocations*, *p.* 399.)

When the luxation is upwards, the distance between the sternal ends of the clavicles is diminished.

When the dislocation is backwards, there is a depression where the end of the clavicle ought to be, and the head of the bone forms a projection at the front and lower part of the neck, which, as J. L. Petit remarks, may compress the trachea, œsophagus, jugular vein, carotid artery, and nerves. The head is inclined towards the side on which the accident itself is situated.

In reducing dislocations of the sternal end of the clavicle, we are to make a lever of the arm, by means of which the shoulder is brought outwards; and when thus brought outwards, it is to be pushed forwards, if the dislocation be in that direction; backwards, if the dislocation be behind; and upwards, if the dislocation be above.

The same position of the arm, and the same apparatus as in fractures of the clavicle, are to be employed. The wedge-like pad, with its thick part towards the axilla, for the purpose of inclining the shoulder outwards, a sling for the support of the weight of the arm, and a bandage judiciously applied, are especially necessary. In consequence of the obliquity and smoothness of the articular surfaces, the reduction is easy, but great attention is requisite to prevent a return of the displacement.

Dislocation of the scapular end of the clavicle from the acromion. The luxation upwards is almost the only one that ever occurs. It is possible, however, for the accident to take place downwards, and for the end of the clavicle to glide under the acromion. The rarity of dislocations of the scapular end of the clavicle is owing to the strength of the ligaments tying the clavicle and acromion together. While Desault and Boyer, however, represent these cases as much less common than displacements of the sternal end of the bone, Sir Astley Cooper's experience pronounces them to be more frequent.—(*On Dislocations*, *p.* 405.)

A fall on the top of the shoulder may cause the dislocation upwards. The scapular end of the clavicle then slides upwards on the acromion, and the shoulder is drawn inwards by the muscles which approximate the arm to the body. It has been asserted, that the violent action of the trapezius muscle, in pulling the clavicle upwards, may tend to produce the accident; but, as Sir Astley Cooper has remarked, the mere action of this muscle, without the simultaneous operation of great violence, could never tear both the ligaments of the coracoid process, which must be broken ere this dislocation can happen. When the projection is but slight, as Sir Astley Cooper has sometimes noticed, the circumstance indicates that the internal ligament is not ruptured.—(*On Dislocations*, *p.* 406.) Pain at the top of the shoulder, a projection of the end of the clavicle under the skin covering the acromion, and a depression of the shoulder, are symptoms indicating what has happened. The patient also inclines his head to the affected side, and avoids moving his arm or shoulder.

This dislocation is reduced by carrying the shoulder outwards, putting a thick cushion in the axilla, and applying Desault's bandage for fractures of the clavicle (see *Fractures*), making the turns ascend from the elbow to the shoulder, so as to press the luxated end of the bone downwards and keep it in its due situation, at the same time that the elbow is confined close to the side, and supported in a sling; by which means, the shoulder will be kept raised and inclined outwards. This plan, which is advised by Boyer, is more efficient than the common practice, which consists in applying a compress, the figure of 8 bandage, and supporting the arm in a sling. However, the exact maintenance of the reduction, by any apparatus whatever, is found to be a matter of the greatest difficulty, and some slight deformity will remain; though it is agreeable to know that, notwithstanding this disadvantage, the use of the limb returns very well. In the course of my time, I have seen several cases in proof of this statement, and one example was shown me by my friend, Mr. Vincent, in St. Bartholomew's Hospital. The same observations are applicable to luxations of the sternal end of the bone.

[Dr. James Cocke, of Baltimore, has reported in vol. 1, of the *New-York Med. and Phil. Journ.* the successful reduction of a dislocation of the clavicle at its scapular articulation.—*Reese.*]

DISLOCATIONS OF THE OS BRACHII.

Nature, which varies according to the necessities of different animals, the number of their joints, has also been provident enough to vary the structure of these parts, according to the use of the different portions of their economy. To great moveableness, some unite considerable solidity; for instance, the vertebral column. Others are very strong, but only admit of a slight yielding motion, as we observe in the carpus, tarsus, &c. Lastly, other joints admit of a great latitude of motion; but their strength is easily overpowered by the action of external bodies. Such are in man the shoulder-joint, and that between the sternum and clavicle.

The last kinds of articulation are particularly subject to dislocation, and, of all, not one is so often luxated as the shoulder-joint. Bichat mentions, that it appears from a comparative table, that in some years, this accident at the Hôtel-Dieu has been as frequent, and even more so, than dislocations of all the other bones taken collectively.

Here every thing seems to facilitate the escape of the bone from its natural cavity. An oval shallow cavity, surrounded by a margin of little thickness, receives a semi-spherical head, which is twice as broad as the cavity in the perpendicular direction, and three times as extensive from before backward. With respect to the ligaments, the joint is only strengthened by a mere capsule, which is thin below, where nothing opposes a dislocation; but thicker above, where the acromion, coracoid process, and triangular ligament form an almost insurmountable obstacle to such an accident. With regard to the muscles and motions of this joint, strong and numerous fasciculi surround the articular surfaces, make them easily move in all directions, and, pushing the head of the os brachii against the different points of the capsule, distend this ligamentous bag; and when their power exceeds the resistance, actually lacerate it. As for external bodies, what bone is more exposed than the os brachii to the effect of their force?

Thus subjected to the influence of these predisposing causes, the os brachii would be in continual danger of being dislocated, if the scapula, which is as moveable as itself, did not furnish a point of support for it, by

accompanying all its motions. This point of support accommodates itself to the variations in the position of the head of the os brachii, so that to the moveableness of the articular surfaces their strength is in a great measure owing.

The shoulder-joint, which is very liable to luxations in a general sense, is not equally so at all points. There are some, where a dislocation cannot occur; there are others, where, though possible, such an accident has never been observed.

Desault divided dislocations of the humerus into *primitive*, which are the sudden effect of external violence, and into *consecutive*, which follow the first by the influence of causes presently to be explained. In order to simplify the comprehension of the various directions in which the head of the humerus is luxated, he supposed the genoid cavity to be bounded by four lines: one representing its upper edge; another its lower; a third its inner; and a fourth its external one.

The head of the humerus cannot be displaced towards the upper edge. Here are situated the acromion and coracoid process, the triangular ligament stretched between them, the tendons of the triceps, supraspinatus, and the fleshy portion of the deltoid, insurmountable obstacles to the luxation of the head of the bone, propelled by any force upwards. Besides, what power could this be? Supposing there were such a force, the head of the bone must necessarily be driven outwards as well as upwards, ere its head would be displaced. This is impossible, because the trunk prevents the lower part of the arm from being directed sufficiently inwards to produce this effect.

On the contrary, at the other margins there is little resistance. At the inferior one, the long portion of the triceps; at the internal one, the tendon of the subscapularis; and at the external edge, those of the infraspinatus and teres minor, will readily yield to any power directed against them, and allow primitive luxations to take place downwards, inwards, or outwards. Downwards, between the tendon of the long portion of the triceps and the tendon of the subscapularis, which last, in a case dissected by Sir A. Cooper, was ruptured (*Surg. Essays, part* 1, *p.* 7; *and on Dislocations*, 421, 422); inwards, between the fossa subscapularis and muscles of this name; outwards, between the fossa infraspinata and infraspinatus muscle.

According to Sir Astley Cooper, the os humeri is liable to be thrown from the glenoid cavity of the scapula in four directions: three of these luxations are complete; the other is only partial. The first is *downwards and inwards*, the dislocation *into the axilla*, as it is usually called, in which case the head of the bone rests upon the inner side of the inferior costa of the scapula. The second is *forwards under the pectoral muscle*, the head of the bone being placed below the middle of the clavicle, and on the sternal side of the coracoid process. The third is the dislocation *backwards*, in which the head of the bone can be plainly felt and seen, as a protuberance at the back and outer part of the inferior costa of the scapula, upon the dorsum of this bone. The fourth, which is only partial, is when the front of the capsular ligament is torn, and the head of the bone rests against the outer side of the coracoid process. "Of the dislocation in the axilla (says Sir Astley Cooper), I have seen a multitude of instances; of that forwards on the inner side of the coracoid process, several; although it is much less frequent than that in the axilla: of the dislocation backwards, I have seen only two instances during the practice of my profession for 38 years."—(*On Dislocations, &c. p.* 416.)

Sometimes, after the head of the bone has escaped from the internal or inferior part of the capsule, it is carried behind the clavicle, forming a case of consecutive dislocation upwards; a specimen of which was preserved in Desault's museum. But here the secondary displacement only takes place slowly, and when it occurs a reduction can rarely be effected, on account of the strong adhesions contracted by the surfaces of the bone. Thus, in the specimen referred to, a new cavity was formed behind the clavicle, and the humerus adhered by new ligaments to the surrounding parts.

The action of external bodies directed against the arm, but particularly falls, in which this part is forced against a resisting body, gives rise to primitive dislocations, and then the different species of the accident are determined by the particular position of the humerus at the instant when the injury takes place.

Should this bone be raised from the side without being carried either forwards or backwards; should the elbow be elevated and the fall take place on the side, then the weight of the trunk, almost entirely supported by this bone, forces downwards its upper part, which stretches and lacerates the lower part of the capsular ligament. Thus a luxation downwards is produced and its occurrence may also be facilitated by the combined action of the latissimus dorsi, pectoralis major, and teres major muscles, as Fabre has judiciously remarked; for being at this period involuntarily contracted to support the trunk, they act with the power of a considerable lever; the resistance being the head of the bone, which they draw downwards, while the fixed point is the lower end of the bone, resting against the ground. Some authors also consider, as the immediate cause of a dislocation downwards, the strong action of the deltoid, which is supposed to depress the head of the bone, and push it downwards through the capsular ligament. In support of this opinion, Bichat mentions the well-known case of a notary who luxated his arm downwards in lifting up a register.

The rationale of the primitive luxation inwards differs very little from that of the preceding case. The elbow is both separated from the side and carried backwards: in falling, the weight of the body acts on the humerus, the front part of the capsule is lacerated, and a luxation takes place in this direction.

The dislocation outwards (or, as Sir Astley Cooper calls it, backwards) is produced in the same sort of way. The elbow is carried forwards towards the opposite shoulder; the capsule is stretched outwards, and if a sufficient force act on the limb, it is lacerated. But how could such a force arise? In a fall, the arm being pushed against the trunk and kept there, cannot move extensively enough to cause such a laceration. Hence a luxation outwards, or rather backwards, under the spine of the scapula, must necessarily be exceedingly rare, and Desault, in all his experience, never saw such an accident. Besides, when in a fall the arm is raised from the side and inclined forwards or backwards, the weight of the body only operates upon it obliquely, and the limb is very little exposed to the action of the latissimus dorsi, pectoralis major, and teres major muscles. However, a few instances of a dislocation of the head of the humerus in this direction have been recorded. Sir Astley Cooper, in the course of 38 years, has met with two examples. In a dead subject, Boyer remarked a singular inclination of the glenoid cavity backwards, its articular surface also presenting on this side an extraordinary elongation, and the humerus readily slipping under the spine of the scapula.—(*Traité des Mal. Chir. t.* 4, *p.* 176.)

In the patient whose history was published by M. Fizeau, and in whom a dislocation of the humerus outwards and backwards was seen both by that gentleman and Boyer, there was also the particularity that the luxation was readily reproduced.—(*Journ. de Méd. par Corvisart, &c. t.* 10, *p.* 386.) Hence Boyer suspects that this very rare kind of displacement must have been facilitated by some preternatural disposition of the articular surfaces, especially that of the glenoid cavity. No dislocation must occur more frequently than that downwards, in which the influence of the weight of the body, and of the action of the muscles, is direct. However, the luxation inwards, or, as Sir Astley Cooper and others call it, forwards, is common.

In all primitive dislocations from violence, and not from paralysis of the deltoid, and a gradual yielding of the capsule, I believe the latter part is always extensively lacerated. In general authors have paid too little attention to this circumstance, which dissections have repeatedly demonstrated. Desault had two specimens made of wax; one of a dislocation inwards; the other of one downwards; both of which were met with in subjects who died at the Hôtel-Dieu. Bell also makes mention of similar facts, and another English surgeon, says Bichat, has observed the same occurrence. I suppose Bichat here alludes to Mr. Thompson, who long ago noticed the laceration of the capsule, and particularly called the attention of surgeons to the subject.—(See *Med. Obs. and Inquiries.*)

Desault conceives that the capsule may be sufficiently torn to let the head of the bone escape; but

that the opening may afterward form a kind of constriction round the neck of the humerus, so as to prevent the return of the head of the bone into the place which it originally occupied. The correctness of this statement, however, is positively denied by Sir A. Cooper, who remarks, that they who entertain this belief must forget the inelastic structure of the capsular ligament, and never witnessed by dissection the extensive laceration which it suffers in dislocations from violence.—(*Surgical Essays, part* 1, *p.* 18.)

Several causes may lead to a *consecutive* luxation. If a fresh fall happen while the arm is separated from the trunk, the head of the humerus, which nothing confines, obeys, with the utmost facility, the power displacing it in this manner, and is again pushed out of the situation which it accidentally occupies.

A man, going down stairs, meets with a fall, and dislocates the humerus downwards; he immediately sends for Desault, who defers the reduction till the evening. In the mean time, the patient, in getting upon a chair, slips and falls again. The pain was more acute than when the first accident occurred, and Desault, on his return, instead of finding the head of the humerus as it was in the morning, in the hollow of the axilla, finds it behind the pectoralis major muscle.

The action of muscles is a permanent cause of a new dislocation. When the humerus is luxated downwards, the pectoralis major and the deltoid draw the upper part of this bone upwards and inwards, which, only making a weak resistance to their action, changes its position, and takes one in the above double direction.

The various motions imparted to the arm may also produce the same effect, according to their direction. Thus, in consequence of unskilful efforts to reduce the bone, a luxation inwards frequently follows one downwards. By the French surgeons, a great deal of importance has been attached to the division of dislocations of the humerus into primary and consecutive; and perhaps some of their statements on the secondary change in the position of the head of the bone may be exaggerated. That a subsequent alteration in the situation of the bone may happen, from the causes specified by Desault, can hardly be questioned. The observations of Petit, Hey, and others, confirm the fact; and I have myself seen a dislocation in the axilla change into one forwards, under the pectoral muscle. However, Sir Astley Cooper believes that, excepting from violence and the effect of absorption, the nature and direction of a dislocation are never changed after the muscles have once contracted.—(*On Dislocations*, *p.* 416.) Perhaps, with the latter qualification, no great difference prevails between him and other writers.

SYMPTOMS.

In general, the diagnosis of dislocations of the humerus is attended with no difficulties.

Whatever may be the mode and situation of the dislocation, there always exists, as Hippocrates has remarked, a manifest depression under the acromion, which forms a more evident projection than in the natural state. Almost all the motions of the arm are painful; some cannot be performed in any degree; and they are all very limited. The arm cannot move without the shoulder moving also, because the articulation being no longer able to execute its functions, both it and the shoulder form, as it were, one body. When the limb is moved, a slight crepitus may sometimes be felt, probably in consequence of the synovia having escaped through the laceration of the capsule. —(*A. Cooper on Dislocations*, *p.* 418.)

To these symptoms, generally characteristic of every sort of dislocation of the humerus, are to be added such as are peculiar to each particular case. When the luxation is downwards, the arm is a little longer than in the natural state; the natural roundness of the shoulder is lost in consequence of the deltoid muscle being drawn down with the head of the bone; and the patient cannot use the arm. The elbow is more or less removed from the axis of the body by the action of the deltoid, the long head of the biceps and supraspinatus muscle being also stretched, and tending to draw the bone outwards. The pain which arises from this position compels the patient to lean towards the dislocated limb, to keep the forearm half bent, and the elbow supported on his hip, in such a way that the arm, having a resting-place, may be sheltered from all painful motion, especially that of the elbow inwards. By this posture alone Desault often recognised the accident. The head of the humerus may be felt in the axilla; but "only when the elbow is considerably removed from the side."—(*Sir A. Cooper on Dislocations*, *p.* 417.) This last circumstance is worthy of particular notice, as the inability to feel the head of the bone has led to mistakes.

With the general symptoms of dislocations of the humerus, a luxation inwards has the following: the elbow, separated from the axis of the body, is inclined a little backwards; the humerus seems to be directed towards the middle of the clavicle; motion backwards is not very painful, but that forwards is infinitely so; a manifest prominence under the great pectoral muscle; the arm is said by Desault to be a very little longer than in the natural state: by Sir Astley Cooper it is described as being somewhat shortened (*On Dislocations*, *p.* 435), and the posture is the same as in the foregoing case. The coracoid process is on the outer side of the head of the bone.

Were a dislocation outwards to present itself, it would be particularly characterized by a hard tumour under the spine of the scapula; by the direction of the elbow forwards; and by the somewhat increased length of the arm. The motions of the arm would be impaired, but not in so great a degree as in the foregoing cases. In one example, related by Mr. Toulmin, of Hackney, the arm could be moved considerably either upwards or downwards; but motion forwards or backwards was very limited. And from the observations of Mr. Coley, of Bridgenorth, it would seem that this dislocation may be attended with the peculiarity of the arm lying close to the side.—(*A. Cooper on Dislocations*, *p.* 441—443.)

Many authors, particularly B. Bell, speak of an œdematous swelling of the whole upper extremity as a frequent consequence of a dislocation inwards. In the time of Desault and Bichat, this occurrence was not often noticed at the Hôtel-Dieu, except in very old luxations; and when it was, very beneficial effects were obtained, in certain instances, by applying, for a few days, a moderately tight bandage from the fingers up to the axilla. Bichat relates a case in which the œdema did not disappear with the cause, but even rather increased; but the day after a bandage had been applied, the swelling was found diminished by one-half. Considerable swelling, which sometimes takes place very rapidly, may render the nature of the accident too obscure for a practitioner imperfectly acquainted with all its signs to detect it with certainty; and hence the patient may not have the benefit of right treatment in due time; the bone at length cannot be reduced; a permanently crippled state of the arm is the consequence; the surgeon is sued for heavy damages; and his reputation and prospects are ruined.

There is another consequence, to which authors have paid but little attention; though it was known to Avicenna, and was several times observed by Desault. This is a palsy of the upper extremity, arising from the pressure made by the head of the bone, when dislocated inwards, upon the axillary plexus of nerves, and sometimes resisting every means of relief.

Indeed, when the nerves have been long compressed, the affection is very difficult of cure. Desault several times applied the moxa above the clavicle. The success which he at first experienced in some patients did not invariably follow in others. But when the head of the humerus has only made, as it were, a momentary pressure on the nerves, and the reduction has been effected soon after the appearance of the symptoms, the paralytic affection often goes off of itself, and its dispersion may always be powerfully promoted by the use of volatile liniments.

OF THE REDUCTION.

We may refer to two general classes the infinitely various number of means proposed for the reduction of a dislocated humerus. The first are designed to push back, by some kind of mechanical force, the head of the bone into the cavity from which it is displaced, either with or without making previous extension. The others are merely intended to disengage the head of the bone from the place which it accidentally occupies, leaving it to be put into its natural situation by the action of the muscles.

By the first means art effects every thing; by the second, it limits its interference to the suitable direc-

tion of the powers of nature. In the first method, the force externally applied always operates on the bone in the diagonal of two powers, which resist each other at a more or less acute angle; in the last the power is only in one direction.

All the means intended to operate in the first way, act nearly in the following manner. Something placed under the axilla serves as a fulcrum, on which the arm is moved as a lever, the resistance being produced by the dislocated head of the humerus, while the power is applied either to the lower part of this bone, or the wrist. The condyles of the humerus being pushed downwards and inwards, the head of the bone is necessarily moved in the opposite direction, towards the glenoid cavity, into which it slips with more or less facility.

Thus operated the machine so celebrated among the ancients and moderns, under the name of the ambi of Hippocrates; whether used exactly in the form described by him, or with the numerous corrections devised by Paul of Ægina, Ambrose Paré, Duverney, Freke, &c. By this machine a double motion is communicated to the head of the humerus, as above explained.

The extension usually moves the bone from its unnatural situation, and is executed in different ways. Sometimes the weight of the body on one side, and the dragging of the end of the dislocated bone on the other, tend to produce this effect. Such was the action of the ladder, door, &c. described in Hippocrates's Treatise on Fractures, and repeated in modern works. Sometimes the trunk is fixed in an unchangeable manner, while the arm is powerfully extended, as is practised in employing the machine of Oribasius, one of the methods formerly adopted in the public places where wrestlers combated.

Sometimes no extension is sensibly executed, and while the end of the humerus is pushed outwards by a body placed under the axilla, the surgeon pushes it upwards into the glenoid cavity.

The following are the objections common to all these contrivances.

However well covered the body placed under the axilla may be to serve as a fulcrum, there is always a more or less inconvenient chafing, frequently dreadful stretching and laceration of parts in consequence of its application when the trunk is suspended upon it, as in the instance of the door, &c. In this way Petit saw a fracture of the neck of the humerus produced, and even a laceration and aneurism of the axillary artery.

Few surgeons have the different kinds of apparatus at hand. Hence trouble and loss of time in getting them; time, which is of so much moment, as the reduction is always more easy the sooner it is accomplished.

When the luxation is consecutive, how can mechanical means bring back the head of the bone through the track it has taken? For instance, if to a dislocation downwards one inwards has succeeded, the head of the bone ought to be brought down before it can be replaced. The above means often do not co-operate with the muscles, which are the chief and essential agents in the reduction.

Perhaps, however, they might be advantageously employed, when a primitive luxation downwards is quite recent, and when the head of the bone is very near the cavity. Then the inferior costa of the scapula presents an inclined plane, along which the end of the bone can easily glide, when propelled by any kind of external force.

Desault very often employed the following method with great success. While the patient was seated upon a chair of moderate height, he took hold of the hand on the affected side, placed it between his knees, which he moved downwards and backwards, in order to make the extension and disengage the head of the bone, while an assistant held back the trunk to effect the counter-extension. This was sometimes executed by the weight of the body and effort of the patient. At the same time the surgeon's hands, being applied to the arm in such a way that the four fingers of each were put in the hollow of the axilla, and the thumbs on the outer part of the arm, pushed upwards, and a little outwards, the head of the humerus, which usually returned with ease into its natural cavity.

Petit describes this plan, but complicated with the use of a napkin, passed under the patient's axilla, and over the surgeon's neck, who contributes to raise the dislocated end of the bone, by lifting up his head.

When the luxation downwards was very recent, Desault occasionally reduced it by a still more simple process. Marie-Louise Favert fell in going down stairs, dislocated her arm downwards, and was conveyed immediately after the accident to the Hôtel-Dieu. Desault having recognised the disorder, placed his left hand under the axilla, to serve as a fulcrum, while with the right, applied to the lower and outer part of the arm, he depressed the humerus towards the trunk, and at the same time raised the upper part of the bone. The head of the humerus, directed upwards and outwards by this double motion, returned into the glenoid cavity without the least resistance.

Reduction by means of the surgeon's heel in the patient's axilla is a well-known method, which is commended by Sir Astley Cooper as the best in three-fourths of recent dislocations. The patient (he observes) should be placed in the recumbent posture, upon a table or a sofa, and near its edge. "The surgeon then binds a wetted roller round the arm, immediately above the elbow, upon which he ties a handkerchief. Then, with one foot resting upon the floor, he separates the patient's elbow from his side, and places the heel of his other foot in the axilla." The arm is then steadily drawn with the handkerchief for three or four minutes, at the end of which the bone in common cases is easily replaced. If more force be required, a long towel can be used, with which several persons may pull. Sir Astley Cooper generally bends the forearm nearly to a right angle with the os humeri, because this position relaxes the biceps, and lessens its resistance: in many cases, however, he makes the extension at the wrist; a plan in which he finds more force requisite, but the bandage is less apt to slip.

Another simple mode of reduction, which Sir Astley Cooper considers proper for recent dislocations, delicate females, and very old, relaxed, emaciated persons, is that by means of the surgeon's knee, as a fulcrum, in the patient's axilla. The patient is placed on a low chair, on the side of which the surgeon rests his foot, while he takes hold of the os humeri just above the condyles, and applies his other hand to the acromion. The arm is then drawn down over the knee, and the head of the bone returns into its place.—(*On Dislocations*, *p.* 432.)

In some cases the preceding methods are inadequate, and greater extension must be made. The following was the practice of Desault.

The patient is laid upon a table covered with a mattress; a thick linen compress is applied to the axilla, on the side affected, and upon this compress the middle of the first extending bandage is placed, the two heads of which ascend obliquely before and behind the chest, meet each other at the top of the sound shoulder, and are held there by an assistant, so as to fix the trunk and make the counter-extension. The action of this bandage does not affect the margin of the pectoralis major and latissimus dorsi, in consequence of the pad projecting over them. If this were not attended to, these muscles, being drawn upwards, would pull the humerus in this direction, and thus destroy the effect of the extension, which is to be made in the following manner.

Two assistants take hold of the forearm, above the wrist; or else the towel, doubled several times, is to be applied to this part. The two ends are to be twisted together, and held by one or two assistants, who are to begin pulling in the same direction in which the humerus is thrown. After this first proceeding, which is designed to disengage the head of the bone from its accidental situation, another motion is to be employed, which differs according to the kind of luxation. If this should be downwards, the arm is to be gradually brought near the trunk, at the same time that it is gently pushed upwards. Thus the head of the bone being separated from the trunk, and brought near the glenoid cavity, usually glides into this situation with very little resistance.

When the luxation is inwards, after the extension has been made in the direction of the humerus, the end of this bone should be inclined upwards and forwards, in order that its head may be guided backwards; and *vice versâ*, when the luxation is outwards.

When the head of the bone has been disengaged by the first extension, the motion imparted to it by the rest of the extension, should in general be exactly contrary to the course which the head of the bone has taken after quitting the glenoid cavity. When there is difficulty experienced in replacing the head of the bone, we should, after making the extension, move the bone about in various manners, according to the different

direction of the dislocation, and the principle just noticed. This plan often accomplishes what extension alone cannot; and the head of the bone, brought by such movements towards its cavity, returns into it during their execution.

When the dislocation is consecutive, it is the first extension made in the direction of the displaced bone, which brings back its head to the situation where it was primitively lodged, and the case is then to be managed just as if it were a primitive dislocation.

Thus we see that, except in a few cases, where the beneficial operation of the muscles had been prevented by the oldness of the dislocation or by adhesions, and where it was necessary to employ means to force, as it were, the head of the bone into its cavity, to which the muscles could not bring it, Desault only employed extension variously diversified, till he had put the muscles in a state favourable for accomplishing reduction.

When the muscles are very powerful, or the displacement has continued several days, Sir Astley Cooper, instead of the treatment by the heel in the axilla, recommends the patient to be put upon a chair, and the scapula to be fixed by means of a bandage which allows the arm to pass through it, and is buckled on the top of the acromion, so that it cannot slip downwards. A wetted roller is next applied round the arm just above the elbow, and over the roller a strong worsted tape, fixed with what the sailors term the *clove-hitch* knot. The arm should now be raised to a right angle with the body, and, if much difficulty be experienced, even above the horizontal line, in order to relax more completely the deltoid and supraspinatus muscles. Two persons are then to pull the worsted tape, and two the scapula bandage, in opposite directions, with a steady, equal, and combined force. After the extension has been kept up a few minutes, the surgeon is to place his knee in the axilla, with his foot resting upon the patient's chair; he now raises his knee, while he pushes the acromion downwards and inwards, and the head of the bone usually slips into the glenoid cavity. Sometimes Sir Astley Cooper has seen a gentle rotatory motion of the limb, made during the extension, bring about the reduction.

In old cases, and others attended with great difficulty from the powerful contraction of the muscles, Sir Astley prefers making the extension with pulleys, because with them, when the resistance is likely to be long, jerks and unequal force are more likely to be avoided than in the preceding method of reduction; and the assistants less apt to be fatigued. The patient sits between two staples, which are screwed into the sides of the room; the bandages are then applied precisely in the same way as when the extension is made without pulleys; and the force is applied in the same direction. The surgeon is to pull the cord of the pulley gently and steadily until pain is complained of, when he is to maintain the extension already made, but not increase it. During this stop, he should converse with the patient, and direct his mind to other subjects. In two or three minutes, more force should be applied, and very gently increased, until pain be again complained of, when another stop should be made. The surgeon should proceed in this way for a quarter of an hour, at intervals slightly rotating the limb. When the extension seems great enough, an assistant should hold the cord of the pulley, and keep up the degree of extension, while the surgeon puts his knee into the axilla, and resting his foot upon the chair, gently raises and pushes back the head of the bone towards the glenoid cavity, into which it generally returns without the snap usually heard when the reduction is effected by other means. Sir Astley Cooper precedes the use of the pulleys with venesection, the warm bath, and a grain of tartarized antimony every ten minutes, until faintness is produced, as already noticed in our general remarks.—(*On Dislocations*, p. 429.)

When the head of the humerus is dislocated forwards, or under the middle of the clavicle, Sir Astley Cooper recommends the biceps to be relaxed, and the extension to be made obliquely downwards and a little backwards. In most instances of this kind, he says, the plan of reduction by means of the heel in the axilla will succeed, care being taken to apply the foot rather more forwards than in a dislocation into the axilla, so that it may press on the head of the bone. However, when the dislocation has continued several days, he considers gradual extension with pulleys necessary. As soon as the head of the bone has been drawn below the level of the coracoid process, it is to be pressed backwards with the surgeon's heel or knee, and the elbow at the same moment pulled forwards.—(*Op. cit.* p. 439.)

The dislocation on the dorsum of the scapula appears, from some cases in Sir Astley Cooper's work, to be reducible by nearly the same mode of extension as that employed for the reduction of the dislocation in the axilla. Mr. Coley, of Bridgenorth, who has met with two cases of luxation backwards, advises the reduction to be effected by elevating the arm and rotating it outwards, so as to roll the head of the humerus towards the axilla, when it is to be kept in this position, while the arm is brought down into a horizontal direction: on the extending force being now applied, the bone is easily reduced.—(*Op. cit.* p. 444.)

In the partial dislocation forwards, or that where the head of the bone lies at the scapular side of the coracoid process, the mode of reduction, according to Sir Astley Cooper, is the same as that employed in the complete dislocation forwards; but it is necessary to draw the shoulders backwards, and as soon as the reduction is accomplished, the bone is to be kept from slipping forwards again by maintaining the shoulders in that position with a bandage.—(*Op. cit.* p. 449.) The elbow and forearm should also be supported as much forwards as possible in a sling.

In the museum of St. Thomas's Hospital is a preparation, exhibiting a dislocation of the humerus into the axilla, complicated with a separation of the greater tubercle by fracture. In Sir Astley Cooper's valuable work on this subject is also recorded a case of compound dislocation of the shoulder, which was under the care of Messrs. Saumarez and Dixon, of Newington, and was cured by anchylosis.—(*P.* 450.) Such an accident must be treated on the same principles as other severe compound dislocations.

For the purpose of preventing the head of the bone from slipping out of its place again, the arm should be kept for some days quiet, the elbow bandaged close to the side, and supported in a sling. Sir Astley Cooper recommends a cushion to be put in the axilla, and a stellate bandage and sling to be applied.—(*On Dislocations*, p. 432.) After the reduction of a dislocation which has happened downwards, the facility of a fresh displacement is said to depend very much upon the extent to which the tendon of the subscapularis muscle has been lacerated.—(*A. Cooper's Surgical Essays*, *part* 1, *p.* 7.)

OF SOME CIRCUMSTANCES RENDERING THE REDUCTION DIFFICULT.

1. *Narrowness of the Opening of the Capsule.*

While Desault considers this circumstance as one of the chief impediments to the return of the head of the humerus into the glenoid cavity, Pott and Sir Astley Cooper are of opinion that the capsular ligament can never create any such difficulty. According to Desault, the obvious indication is to enlarge such an opening by lacerating its edges. This is fulfilled by moving the bone about freely in every direction, particularly in that in which the dislocation has taken place. Now by pushing the head of the bone against the capsule already torn, the latter becomes lacerated still more, in consequence of being pressed between two hard bodies. The reduction, which is frequently impracticable before this proceeding, often spontaneously follows immediately after it has been adopted. In the *Journal de Chirurgie* are two cases, by Anthaume and Faucheron, establishing this doctrine.

Mr. C. White, of Manchester, also believed that the reduction was sometimes prevented by the head of the bone not being able to get through the laceration in the capsule again. He succeeded in reducing some cases which he supposed to be of this nature, in the following manner: having screwed an iron ring into a beam at the top of the patient's room, he fixed one end of the pulleys to it, and fastened the other to the dislocated arm by ligatures attached to the wrist, placing the arm in an erect position. In this way, he drew up the patient till his whole body was suspended; but that too much force might not be sustained by the wrist, Mr. White at the same time directed two other persons to support the arm above the elbow. He now used to try with his hands to conduct the arm into its place, if the reduction had not already happened, as was some-

times the case. Occasionally, a snap might be heard as soon as the patient was drawn up; but the reduction could not be completed till he was let down again, and a trial made with the heel in the armpit. When no iron ring was at hand, Mr. White used to have the patient raised from the ground by three or four men who stood upon a table.—(*Cases in Surgery, p.* 95.)

2. *Oldness of the Dislocation.*

When the head of the bone has lodged a long while in its accidental situation, it contracts adhesions to it. The surrounding cellular substance becomes condensed, and forms, as it were, a new capsule, which resists reduction, and which, when such reduction cannot be accomplished, supplies in a certain degree the office of the original joint by allowing a considerable degree of motion.

In such cases, the common advice used to be that no attempt at reduction should be made, as it would be useless in regard to the dislocation, and might be injurious to the patient from the excessive stretching of parts. This was for some time the doctrine of Desault; but in his latter years experience led him to be bolder.

Complete success obtained in dislocations which had existed from fifteen to twenty days, encouraged him to attempt reduction at the end of thirty and thirty-five days; and in the two years preceding his death he succeeded three or four times in reducing dislocations which had existed two months and a half, and even three months, both when the head of the bone was situated at the lower and at the internal part of the scapula.

In these cases it is necessary, before making the extension, to move the bone about extensively in all directions for the purpose of first breaking its adhesions, lacerating the condensed cellular substance which forms an accidental capsule, and of producing, as it were, a second dislocation, in order to remove the first. Extension is then to be made in the ordinary way, but with an additional number of assistants.

The first attempts frequently fail, and the dislocated head of the bone continues unmoved notwithstanding the most violent efforts. In this case, after leaving off the extension, the arm is to be again moved about very extensively. The humerus is to be carried upwards, downwards, forwards, and backwards; and every resistance overcome. Let the arm describe a large segment of a circle in the place where it is situated. Let it be once more rotated on its axis; then let the extension be repeated, and directed in every way. Thus the head of the bone will first be disengaged by the free motion, and afterward reduced.

In these cases, when the dislocation, in consequence of being very old, presents great obstacles to reduction, even though the attempts made for this purpose should fail, they are not entirely useless. By forcing the head of the bone to approach the glenoid cavity, and even placing it before the cavity, and making it form new adhesions after the destruction of the old ones, the motions of the arm are rendered freer. Indeed, they are always the less obstructed, the nearer the head of the bone is to its natural situation. Notwithstanding the encouragement given by Desault to making attempts to reduce old dislocations of the humerus, experience proves that when the bone has been out of its place more than a month, success is rarely obtained. And as for the danger which may arise from long-protracted, immoderate force, a case which I have elsewhere cited proves that caution is here a virtue which cannot be too highly commended.—(See *First Lines of Surgery, vol.* 2, *p.* 465.) Another instance, in which a woman died from the violence used in the extension, is reported by Sir Astley Cooper.—(*On Dislocations, p.* 422.)

[The late Dr. Colin Mackenzie, of Baltimore, several years since reduced a dislocation of the humerus, of nearly six months' duration, in the Maryland Hospital, with entire success; and Dr. James Cocke, also of Baltimore, reduced a luxated humerus after it had been displaced 120 days.—*Reese.*]

3. *Contractions of the Muscles.*

A third impediment to the reduction of every kind of dislocation is the power of the muscles, which is augmented beyond the natural degree, in consequence of their being on the stretch. Sometimes this power is so considerable, that it renders the head of the bone immoveable, though the most violent efforts are made. Here the means to be adopted are such as weaken the patient; bleeding, the warm bath, nauseating doses of tartarized antimony, as advised by Loder, Sir Astley Cooper, &c.; opium, &c. Should the patient happen to be intoxicated at the time of his being first seen by the surgeon, the opportunity would be very favourable to reduction, as the muscles would then be capable of less resistance. Extension unremittingly, but not violently, continued for a length of time, will ultimately fatigue the resisting muscles, and overcome them with more safety and efficacy, than could be accomplished by any sudden exertion of force. In all cases of difficulty, pulleys should be preferred.

The swelling about the joint, brought on by the accident, usually disappears without trouble.

Another consequence, which seldom occurs in practice, but which Desault saw twice, is a considerable emphysema, sudenly originating at the time of reduction. In the middle of such violent extension, as the long standing of the dislocation requires, a tumour suddenly makes its appearance under the great pectoral muscle. Rapidly increasing, it spreads towards the armpit, the whole extent of which it soon occupies. It reaches backwards, and in a few minutes sometimes becomes as large as a child's head. A practitioner unacquainted with this accident, might take it for an aneurism, occasioned by the sudden rupture of the axillary artery, by the violent extension. But if attention be paid to the elasticity of the tumour, its fluctuation, the situation where it first appears, commonly under the great pectoral muscle, and not in the axilla; the continuance of the pulse; and the unchanged colour of the skin; the case may easily be discriminated from a rupture of the artery.—(*Œuvres Chir. de Desault, par Bichat, t.* 1.)

For dispersing the above kind of swelling, the lotio plumbi acetatis, and gentle compression with a bandage, are recommended.

I shall conclude the subject of luxations of the shoulder with the following singular observation, recorded by Baron Larrey.

"Among the curious anatomical preparations (says he) which I saw in the cabinet of the university of Vienna, there was a dissected thorax, shown to me by Professor Prokaska, in which the whole orbicular mass of the head of the right humerus, engaged between the second and third true ribs, projected into the cavity of the chest. This singular displacement was the result of an accidental luxation, occasioned by a fall on the elbow, while the arm was extended and lifted from the side. The head of the humerus, after tearing the capsular ligament, had been violently driven into the hollow of the axilla, under the pectoral muscles, so as to separate the two corresponding ribs, and pass between them. The diameter of the head of the bone surmounted this obstacle, and penetrated entirely into the cavity of the thorax, pushing before it the adjacent portion of the pleura. Every possible effort was made in vain to reduce this extraordinary dislocation. The urgent symptoms which arose were dissipated by bleeding, warm bathing, and antiphlogistic remedies. The arm, however, remained at a distance from the side, to which condition the patient became gradually habituated, and after several years of suffering and oppression, he at length experienced no inconvenience. The patient was about sixteen or seventeen, when he met with the accident; and he lived to the age of thirty-one, when he died of some disease, which had no concern with the dislocation. His physicians were anxious to ascertain the nature of this curious case, of which they had been able to form only an imperfect judgment. They were much surprised to find, upon opening the body, the head of the humerus lodged in the chest, surrounded by the pleura, and its neck closely embraced by the two ribs above specified. They were still more astonished to find, instead of a hard spherical body covered with cartilage, only a very soft membranous ball, which yielded to the slightest pressure of the finger. The cartilage and osseous texture of the whole portion of the humerus, contained within the cavity of the chest, had entirely disappeared. *Les absorbans s'en étaient emparés* (says Mr. Larrey), *et comme autant de gardiens fidèles, ils avaient cherché à détruire par portions, n'ayant pu l'expulser en masse, un ennemi qui s'était furtivement introduit dans un domicile où sa présence devait être importune et nuisible.* Of the humerus, there only remained some membranous rudiments of its head, and a great part of these seemed to

belong to the pleura costalis."—(*Mémoires de Chirurgie Militaire, t. 2, p. 405—407.*)

DISLOCATIONS OF THE FOREARM FROM THE HUMERUS.

Notwithstanding the extent of the articular surfaces of the radius and ulna, the strength of the muscles and ligaments surrounding the joint, and the mutual reception of the bony eminences, rendering the articulation a perfect angular ginglymus, a dislocation of both the radius and ulna from the humerus, is an accident for which a surgeon is sometimes consulted. The radius and ulna are most frequently luxated backwards; sometimes laterally, but very rarely forwards: the latter luxation cannot occur without a fracture of the olecranon. Indeed, it is so uncommon, that neither Petit nor Desault ever met with it. The luxation backwards is facilitated by the small size of the coronoid process, which, when the humerus is forcibly pushed downwards and forwards, may slip behind it, and ascend as high as the cavity which receives the olecranon in the extended state of the forearm.

Sir Astley Cooper's experience has made him acquainted with five different luxations of the elbow: 1. That of the radius and ulna backwards. 2. That of both these bones laterally. 3. That of the ulna alone. 4. That of the radius alone forwards. 5. That of the radius backwards.—(*On Dislocations, p. 467.*)

In the luxation backwards, the radius and ulna may ascend more or less behind the humerus; but the coronoid process of the ulna is always carried above the articular pulley, and is found lodged in the cavity destined to receive the olecranon. The head of the radius is placed behind and above the external condyle of the humerus. The annular ligament, which confines the superior extremity of the radius to the ulna, may be lacerated: in which case, even when the bones are reduced, it is difficult to keep them in their proper places, as the radius tends constantly to quit the ulna.

This accident always takes place from a fall on the hand; for when we are falling, we are led by a mechanical instinct to bring our hands forwards to protect the body. If, in this case, the superior extremity, instead of resting vertically on the ground, be placed obliquely with the hand nearly in a state of supination, the repulsion which it receives from the ground will cause the two bones of the forearm to ascend behind the humerus, while the weight of the body pressing on the humerus, directed obliquely downwards, forces its extremity to pass down before the coronoid process of the ulna.

The forearm is in a state of half flexion, and every attempt to extend it produces acute pain. The situation of the olecranon, with respect to the condyles of the humerus, is changed. The olecranon, which, in the natural state, is placed on a level with the external condyle, which is itself situated lower than the internal, is even higher than the latter. Posteriorly a considerable projection is formed by the ulna and radius. On each side of the olecranon, a hollow appears. A considerable hard swelling is felt on the fore part of the joint, arising from the projection of the lower end of the humerus. The hand and forearm are supine, and the power of bending the joint is in a great measure lost.—(*Sir Astley Cooper on Dislocations, p. 468.*)

The swelling, which supervenes in twenty-four hours after the accident, renders the diagnosis more difficult; but, notwithstanding the assertion of Boyer, I believe the olecranon and internal condyle are never so obscured that the distance between them cannot be felt to be increased. It is true that the rubbing of the coronoid process and olecranon against the humerus may cause a grating noise, similar to that of a fracture; and some attention is certainly requisite to establish a diagnosis between a fracture of the head of the radius and a dislocation of the forearm backwards. "This dislocation (says Sir Astley Cooper) is at first sometimes undiscovered, in consequence of the great tumefaction, which immediately succeeds the injury; but this circumstance does not prevent the reduction, even at the period of several weeks after the accident; for I have known it thus reduced by bending the limb over the knee, even without great violence being employed."—(*On Dislocations, &c. p. 470.*)

A luxation backwards must be attended with serious injury of the surrounding soft parts. The lateral ligaments are constantly ruptured, and sometimes the annular ligament of the radius. In a case dissected by Sir Astley Cooper the annular ligament was entire. The biceps muscle was only slightly put upon the stretch; but the brachialis was excessively so. Probably the lower insertions of the biceps and brachialis internus would likewise be more frequently lacerated, by the violent protrusion of the head of the humerus forwards, were it not that their attachments are at some distance from the joint. This mischief, however, occasionally takes place, and then the forearm is observed to be readily placed in any position, and not to retain one attitude, as is generally the case in dislocations. The lower end of the humerus, indeed, has been known not only to lacerate these muscles, but to burst the integuments and present itself externally; an instance of which is recorded by Petit, and two such cases I saw myself, during my apprenticeship at St. Bartholomew's. Boyer justly remarks, that it is difficult to conceive how, under these circumstances, the brachial artery and median nerve can escape. In fact, this vessel has sometimes been ruptured, and mortification of the limb been the consequence; but this injury of the artery, and the laceration of the muscles and skin, are rare occurrences.—(*Traité des Mal. Chir. t. 4, p. 215.*) Nor if the artery were wounded, would gangrene be invariably the result; for if my memory is correct, an instance in which the limb was saved, notwithstanding such a complication, is mentioned by Mr. Abernethy in his lectures, though no doubt the risk would be great.

The following method of reducing the case is advised by Boyer:—The patient being seated, an assistant is to take hold of the middle of the humerus, and make counter-extension, while another assistant makes extension at the wrist. The surgeon, seated on the outside, grasps the elbow with his two hands, by applying the fore-fingers of each to the anterior part of the humerus, and the thumbs to the posterior, with which he presses on the olecranon, in a direction downwards and forwards. This method will generally be successful. If the strength of the patient, or the long continuance of the luxation, render it necessary to employ a greater force, extension is to be made with a towel applied on the wrist, and a cushion is to be placed in the axilla, and the arm and trunk fixed as is done in cases of luxation of the humerus.

In Sir Astley Cooper's method, the patient sits in a chair. The surgeon places his knee on the inner side of the elbow-joint, in the bend of the arm, and taking hold of the patient's wrist, bends the arm. At the same time he presses on the radius and ulna with his knee, so as to separate them from the os humeri. Thus the coronoid process is pushed out of the posterior fossa of the humerus; and while the pressure is kept up with the knee, the arm is to be forcibly but slowly bent, and the reduction is soon effected. According to the same authority, the bones may also be reduced by bending the arm over a bedpost, or by bending it while it is engaged in the opening of the back of the elbow-chair in which the patient sits.—(*On Dislocations, p. 469.*)

A bandage may afterward be applied in the form of a figure of 8, evaporating lotions used, and the arm kept in a sling. The swelling which follows is to be combated by antiphlogistic means.

At the end of seven or eight days, when the inflammation has subsided, the articulation is to be gently moved, and the motion is to be increased every day, in order to prevent an anchylosis, to which there is a great tendency.

In this luxation, the annular ligament which confines the head of the radius to the extremity of the ulna is sometimes torn, and the radius passes in front of the ulna. In such cases, pronation and supination are difficult and painful; though the principal luxation has been reduced, the head may be easily replaced by pressing it from before backwards, and it is to be kept in its place by a compress, applied to the superior and external part of the forearm. The bandage and compress are to be taken off every two or three days, and the joint gently bent and extended, in order to prevent anchylosis.

In a modern publication, an instance of a dislocation of the heads of the radius and ulna backwards is related, where the lower end of the humerus protruded through the integuments, and, as it could not be reduced, it was sawed off. The patient, a boy, recovered the full use of his arm.—(*Evans, Pract. Obs. on Cataract, Compound Dislocations, &c. p. 101.*

A luxation forwards should be treated as a fracture of the olecranon, with which it would be inevitably accompanied. Here, on account of the great injury done to the soft parts, it would also be right to bleed the patient copiously, and put him on the antiphlogistic regimen.

With respect to lateral luxations, either inwards or outwards, they are always incomplete and easily discovered. In the case outwards, the coronoid process is situated on the back part of the external condyle. The projection of the ulna backwards is even greater than in the dislocation of both bones directly backwards, and the radius forms a protuberance behind and on the outer side of the os humeri. By moving the hand, the rotation of the head of the humerus can be distinctly felt In the lateral dislocation inwards, the ulna may be thrown upon the internal condyle, so as to produce an apparent hollow above it, and the rotation of the head of the radius can be distinctly felt. Sometimes when the ulna is thrown upon the internal condyle, it still projects backwards, as in the external lateral dislocation, in which circumstance the head of the radius is in the posterior fossa of the humerus, and the outer condyle forms a considerable projection. —(*A. Cooper, op. cit. p.* 471.) Boyer advises the reduction of lateral dislocations to be effected by extending the humerus and forearm, and at the same time pushing the extremity of the humerus and the heads of the ulna and radius in opposite directions.

According to Sir Astley Cooper, in each of the lateral dislocations, the reduction may be performed by bending the arm over the knee; but in a recent case, as one which he relates proves, he considers that the business may be most readily accomplished by forcibly extending the arm; for when this is done, the biceps and brachialis draw the heads of the radius and ulna into their right places again.—(*P.* 472.)

These luxations cannot be produced without considerable violence; but when the bones are reduced, they are easily kept in their place. It will be sufficient to pass a roller round the part, to put the forearm in a middle state, neither much bent nor extended, and to support it in a sling. But much inflammation is to be expected from the injury done to the soft parts. In order to prevent, or at least mitigate it, the patient is to be bled two or three times and put on a low diet, and the articulation is to be covered with the lotio plumbi acet. or an emollient poultice. It is scarcely necessary to repeat that the arm is to be moved as soon as the state of the soft parts will admit of it.—(*Boyer, sur les Maladies des Os, t.* 2.)

A dislocation of the forearm backwards is said to occur ten times as frequently as lateral luxations; and those forwards are so rare, that no comparison whatever can be drawn.—(*Œuvres Chir. de Desault, t.* 1.)

All recent dislocations of the elbow are easily reduced and as easily maintained so; for a displacement is prevented by the reciprocal manner in which the articular surfaces receive each other, and by their mutual eminences and cavities. This consideration, however, should not lead us to omit the application of a bandage in the form of a figure of 8, and supporting the arm in a sling.

DISLOCATION OF THE RADIUS FROM THE ULNA.

The majority of writers on dislocations of the forearm have not separately considered those of the radius. The subject was first well treated of by Duverney. However, dislocations of its lower end remained unnoticed, until Desault favoured the profession with a particular account of them.

The radius, the moveable agent of pronation and supination, rolls round the ulna, which forms its immoveable support, by means of two articular surfaces; one above, slightly convex, broad internally, narrow outwardly, and corresponding to the little sigmoid cavity of the ulna, in which it is lodged; the other below, concave, semicircular, and adapted to receive the convex edge of the ulna. Hence, there are two joints, differing in their motions, articular surfaces, and ligaments.

Above, the radius in pronation and supination only moves on its own axis: below, it rolls round the axis of the ulna. Here, being more distant from the centre, its motions must be both more extensive and powerful than they are above. The head of the radius, turning on its own axis in the annular or coronary ligament, cannot distend it in any direction. On the contrary, below, the radius, in performing pronation, stretches the posterior part of the capsule, and presses it against the immoveable head of the ulna, which is apt to be pushed through, if the motion be forced. A similar event, in a contrary direction, takes place in supination. The front part of the capsule being rendered tense, may now be lacerated.

Add to this disposition the difference of strength between the ligaments of the two joints. Delicate and yielding below; thick and firm above; their difference is very great. The upper head of the radius, supported on the smaller immoveable articular surface of the ulna, is protected from dislocation in most of its motions. On the contrary, its lower end, carrying along with it in its motions the bones of the carpus, which it supports, cannot itself derive any solid stability from them.

From what has been said, the following conclusions may be drawn: 1. That with more causes of luxation, the lower articulation of the radius has less means of resistance: and that under the triple consideration of motions, ligaments tying the articular surfaces together, and the relations of these surfaces to each other, this joint must be very subject to dislocation. 2. That, for opposite reasons, the upper joint must, according to Desault, be rarely exposed to such an accident. He here excludes from consideration cases in which the annular ligament of the radius is lacerated in a luxation of both heads of the radius and ulna backwards; and particularly confines his reasoning to a dislocation of the upper head of the radius from the lesser sigmoid cavity of the ulna, as a single and uncomplicated injury, suddenly produced by an external cause, and, therefore, neither to be confounded with the cases above specified, nor with other examples in which the displacement happens slowly, especially in children, in consequence of a diseased or relaxed state of the ligaments.

However, some instances of dislocation of the upper head of the radius, suddenly produced by external causes, are recorded by Duverney; the particulars of another case were transmitted to the French Academy of Surgery; and I have been informed of four examples which were met with in this country.

Two of these cases occurred in the practice of Mr. Dunn, of Scarborough; one in that of Mr. Lawrence; and the other was attended by Mr. Earle. Sir Astley Cooper has himself seen six examples of the dislocation of the head of the radius forwards. Baron Boyer says, that many instances are now known in which the upper head of the radius was dislocated backwards; indeed, in opposition to what Desault has stated, he asserts, that dislocations of the lower joint between the radius and ulna are more rare than those of the upper joint between the same bones. The latter accident he has twice seen himself.—(*Mal. Chir. t.* 4, *p.* 248.)

The displacement backwards is described by this author, as occurring more readily and frequently in children than in adults or old subjects. The reason of this circumstance is ascribed to the less firmness both of the ligaments and of the tendinous fibres of the exterior muscles, which fibres, in a more advanced age, contribute greatly to strengthen the external lateral ligament. In a child, also, the little sigmoid cavity of the ulna is smaller, and the annular ligament, extending farther round the head of the radius, is longer, and more apt to give way. Hence, in a subject of this description, efforts, which may not at first produce a dislocation, if frequently repeated, cause a gradual elongation of the ligaments, a change in the natural position of the bones, and at length, a degree of displacement as great as in a case of luxation suddenly and immediately effected.—(*Traité des Mal. Chir. t.* 4, *p.* 239.)

Another fact mentioned by Boyer is, that the dislocation of the upper head of the radius backwards is always complete, its articular surfaces being perfectly separated both from the lower end of the humerus, and from the little sigmoid cavity of the ulna. The usual cause of the accident is a pronation of the forearm, carried with great violence beyond the natural limits.

In a dislocation of the head of the radius backwards, the forearm is bent, and the hand fixed in the state of pronation. Supination can neither be performed by the action of the muscles, nor by external force; and

every attempt to execute this movement produces a considerable increase of pain. The hand and fingers are moderately bent, and the upper head of the radius may be observed forming a considerable projection behind the lesser head of the humerus. In the case which was mentioned to me by my friend Mr. Lawrence, the head of the radius lay upon the outside of the external condyle.

Sir Astley Cooper has never seen a dislocation of the upper head of the radius backwards in the living subject; but a man was brought for dissection into the theatre of St. Thomas's Hospital, who had such a dislocation which had never been reduced. The head of the radius was thrown behind the external condyle, and rather to the outer side of the lower extremity of the humerus. The fore part of the coronary ligament was torn through, as well as the oblique one, and the capsular was partially lacerated.

In the kind of case described by Sir Astley Cooper, where it seems the limb was extended, this experienced surgeon conceives, that the bone would be easily reduced by bending the arm.

The reduction is to be accomplished by extending the forearm, and endeavouring to bring it into the supine posture at the same time that the surgeon tries to press with his thumb the head of the radius forwards towards the lesser tubercle of the humerus, and into the little sigmoid cavity of the ulna again. Success is indicated by the patient being now able to perform the supine motion of the hand, and to bend and extend the elbow with freedom

For the purpose of preventing a return of the displacement, and giving nature an opportunity of repairing the torn ligaments, measures must be taken to hinder the pronation of the hand. Boyer recommends with this view a roller, compresses, and a sling; but it appears to me, that a splint, extending nearly to the extremity of the fingers, and laid along the inside of the forearm with a pad of sufficient thickness to keep the hand duly supine, would be right, in addition to the sling, roller, &c.

In the dislocation of the head of the radius forwards, this part is thrown into the hollow above the external condyle, and upon the coronoid process of the ulna. According to Sir Astley Cooper, the forearm is slightly bent, but cannot be bent to a right angle, nor completely extended. When it is suddenly bent, the head of the radius strikes against the fore part of the os humeri. The hand is in the prone position, and if rotated, the corresponding motion of the head of the radius can be felt at the upper and front part of the elbow-joint. The coronary or annular, the oblique ligament, the front of the capsular, and a portion of the interosseous ligament, are torn.

Sir Astley says, that the cause of this accident is a fall upon the hand when the arm is extended; in which event, the radius receives the weight of the body, and is forced up by the side of the ulna, and thrown over the external condyle upon the coronoid process. In two of the cases recorded by him, the reduction could not be accomplished: in the third it was affected during a syncope by extending the forearm, while the olecranion rested on Sir Astley's foot. In the fourth, the patient was placed on a sofa, and his arm bent over the back of it, in which state extension was made from the hand, *without including the ulna*. The sofa fixed the os humeri, and the reduction was accomplished in a few minutes. The chief things to be observed are, to let the extension act upon the radius alone, without the ulna, and during the extension to let the hand be supine.—(*Dislocations*, *p.* 474—477.) In the latter posture the forearm should also be kept by means of a splint, pad, and bandage, until the torn parts are healed.

DISLOCATION OF THE LOWER END OF THE RADIUS.

The causes are, 1. Violent action of the pronator and supinator muscles. Thus, Desault has published the case of a laundress, who dislocated the lower end of the radius forwards, by a powerful pronation of her hand in twisting a wet sheet.—(*Boyer, Traité des Mal. Chir. t.* 4, *p.* 249.)

2. External force, moving the radius violently into a state of pronation, and rupturing the back part of the capsule; or into a state of supination, and breaking its fore part.

Hence there are two kinds of dislocation: one of the radius forwards; the other backwards. The first is very frequent; the second is much less so. The latter case is not mentioned by Sir Astley Cooper, and never presented itself to Desault but once in the dead body of a man, both of whose arms were dislocated, and of whom no particulars could be learned. The head of the ulna was placed in front of the sigmoid cavity of the radius, and in contact with the os pisiforme, to which it was connected by a capsular ligament.—(*Boyer, Traité des Mal. Chir. t.* 4, *p.* 249.) The latter writer has also recorded one instance of this rare accident.—(*Vol. cit. p.* 253.)

In the dislocation of the lower head of the radius forwards, described by Sir Astley Cooper, this part is thrown upon the front of the carpus, and lies upon the os scaphoides and the os trapezium.

The luxations of the lower head of the radius, described by Desault, are the same as those named by Sir Astley Cooper dislocations of the lower end of the ulna from the radius, and differ from the case called by him a luxation of the radius only at the wrist, inasmuch as the hand is not thrown in the opposite direction to that of the radius; but this bone is merely displaced from the convex articular surface of the ulna, the hand going along with it. This circumstance makes a material difference in the mode of reduction, with reference to the direction in which the hand is to be pushed. In the luxation of the lower head of the radius forwards, described by Desault, the symptoms are, constant pronation of the forearm; an inability to perform supination, and great pain on its being attempted; an unusual projection at the back of the joint, in consequence of the protrusion of the little head of the ulna through the capsule; the position of the radius is more forward than natural; constant adduction of the thumb, which is almost always extended; a half bent state of the forearm, and very often of the fingers, which posture cannot be changed without considerable pain. The outer side of the hand is twisted backwards, and the inner forwards. The protuberance made on the fore part of the wrist by the head of the radius is very evident, and, as Sir Astley Cooper observes, the styloid process of the radius is no longer situated opposite to the os trapezium. This case, he says, usually happens from a fall while the hand is bent back.—(*On Dislocations*, *p.* 503.)

Sometimes the lower head of the radius is driven through the skin at the inside of the wrist, between the radial artery, and the mass formed of the flexor tendons of the wrist and fingers. Cases of this description, when well managed, generally have a favourable termination, as we see in the case reported by M. Thomassin.—(*Journ. de Méd. t.* 39.)

If the smallness of the opening in the skin cause an impediment to reduction, the integuments should be divided with a knife.

A luxation of the radius backwards is characterized by symptoms the reverse of those above mentioned. They are, a violent supination of the limb; inability to put it prone; pain on making the attempt; a tumour in front of the forearm formed by the head of the ulna; a projection backwards of the large head of the radius; and adduction of the thumb.

When he dislocation is forwards, an assistant is to take hold of the elbow, and raise the arm a little from the body; while another is to support the hand and fingers.

The surgeon is to take hold of the end of the forearm with both his hands; one applied to the inside, the other to the outside, in such a manner that the two thumbs meet each other in front of the limb, between the ulna and radius, while the fingers are applied to the back of the wrist. He is then to endeavour to separate the two bones from each other, pushing the radius backwards and outwards, while the ulna is held in its proper place. At the same time, the assistant holding the hand should try to bring it into a state of supination, and consequently the radius, which is its support. Thus pushed, in the direction contrary to that of the dislocation, by two powers, the radius is moved outwards, and the ulna returns into the opening of the capsule, and into the sigmoid cavity.

Sir A. Cooper, who describes this case under the name of a dislocation of the lower end of the ulna backwards, reduces it by pressing the bone forwards, and maintains the reduction with splints well padded, and a compress of leather over the end of the ulna.—(*On Dislocations*, *p.* 505.)

If chance should present a dislocation of the lower head of the radius backwards, or, in other words, of the lower head of the ulna forwards, the same kind of proceeding, executed in the opposite direction, would serve to accomplish the reduction.—(See *Œuvres Chir. de Desault*, *t.* 1.)

In the luxation of the lower head of the radius forwards, upon the carpus, Sir Astley Cooper effects the reduction by extending the hand, while the forearm is fixed.—(*On Dislocations*, *p.* 504.)

DISLOCATIONS OF THE WRIST.

The carpal bones may be luxated from the lower ends of the radius and ulna forwards or backwards: The case backwards is the most frequent. It is facilitated by the direction of the convex articular surfaces of the scaphoid, lunar, and cuneiform bones, which slope more backwards than forwards. According to Sir Astley Cooper, the direction of the force determines the direction in which the carpal bones are thrown: thus if a person in falling put out his hand to save himself, and fall upon the palm, a dislocation is produced, the radius and ulna are forced forwards upon the annular ligament, and the carpal bones are thrown backwards. A considerable swelling is produced by the radius and ulna on the fore part of the wrist, and a similar protuberance upon the back of the wrist by the carpus, with a depression above it, and the hand is bent back.

When the carpal bones are dislocated forwards under the flexor tendons, and the radius and ulna backwards upon the posterior part of the carpus, the accident has been caused by a fall on the back of the hand.

In each of these cases, two swellings are produced; one by the radius and ulna; the other by the bones of the carpus. Sprains will often cause a great swelling over the flexor tendons, and give rise to the suspicion of a luxation, from which they may always be known by the swelling being single, and its not having made its appearance directly after the injury.

Dislocations inwards or outwards are never complete. The projection of the carpal bones at the inner or outer side of the joint, and the distortion of the hand, make such cases sufficiently evident.

Recent dislocations of the wrist, particularly such as are incomplete, are easy of reduction: but when the displacement has been suffered to continue some time more difficulty is experienced, and in a few days all attempts are generally unavailing. This observation applies to all dislocations of ginglymoid joints; and I cannot, therefore, too strongly condemn the waste of time in trials to disperse the swellings of the soft parts ere the bones are replaced; an absurd plan, which, I am sorry to say, is sanctioned by Boyer.—(*Mal. Chir.* *t.* 4, *p.* 260.)

For the purpose of reducing the dislocated bones, gentle extension must be made, while the two surfaces of the joint are made to slide on each other in a direction contrary to what they took when the accident occurred.

In dislocations of the wrist, numerous tendons are always seriously sprained, and many ligaments lacerated; consequently, a good deal of swelling generally follows, and the patient is a long time in regaining the perfect use of the joint. Hence the propriety of bleeding, low diet, and opening, cooling medicines; while the hand and wrist should be continually covered with linen wet with the lotio plumbi acetatis, or spirit of wine and water, and the forearm and hand kept in splints, which ought to extend nearly to the end of the fingers, so as to prevent a return of the displacement. The limb must also remain quiet in a sling.

When the ruptured ligaments have united, liniments will tend to dispel the remaining stiffness and weakness of the joint.

DISLOCATION OF THE CARPUS, METACARPUS, FINGERS, AND THUMB.

A simple dislocation of the carpal bones from each other seems almost impossible. The os magnum, however, has been known to be partially luxated from the deep cavity formed for it in the os scaphoides and os lunare. This displacement is produced by too great a flexion of the bones of the first phalanx on those of the second, and the os magnum forms a tumour on the back of the hand.—(*Chopart; Boyer; Richerand.*)

Chopart once met with a partial luxation of the os magnum in a butcher. Baron Boyer has seen several examples of the accident, which, he says, is more common in women than men; a circumstance which he imputes to the ligaments being looser in females, and to the bones of the carpus in them having naturally a greater degree of motion. The tumour increases when the hand is bent, and diminishes when it is extended. The case does not produce any serious inconvenience. If the wrist be extended, and pressure be made on the head of the os magnum, the reduction is easily accomplished; though a renewal of the displacement cannot be prevented, unless the extension and compression be kept up by means of a suitable apparatus, during the whole time requisite for the healing of the torn ligaments. As the inconveniences of the accident are slight, few patients will submit to any tedious, irksome treatment; and sometimes the surgeon is never consulted, till it is too late to think of replacing the bone. In general, therefore, he is obliged to be content with treating the case as a sprain or contusion.

Sir Astley Cooper has seen two cases of displacement of the os magnum in females: the accidents produced a weakened state of the limb, and arose from relaxation of the ligaments. One example is also given of a dislocation of the os scaphoides, which was thrown backwards upon the carpus, with the lower portion of the broken radius.—(*On Dislocations*, *p.* 514, 515.) Compound dislocations of the carpal bones are not uncommon, and generally arise from gun-shot violence, or other great mechanical injury. In these cases, it is sometimes necessary to take away the displaced bones altogether; and too frequently the accident is such as to require amputation.

The connexion of the metacarpal bones with one another, and with those of the carpus, is so close, and the degree of motion so slight, that a dislocation can hardly take place. Thus, Sir Astley Cooper, in his vast experience, has never seen them dislocated, except by the bursting of guns, or by the passage of heavy carriages over the hand; cases frequently demanding amputation.—(*On Dislocations*, *p.* 519.) The first metacarpal bone, which is articulated with the os trapezium, and admits of the movements of flexion, extension, abduction, and adduction, is capable of being luxated; but the accident is uncommon, for reasons explained in my other work.

Although from the nature of the joint, between the first metacarpal bone and the trapezium, one might infer that a dislocation is possible in the four directions, backwards, forwards, inwards, and outwards, yet if we are to believe Boyer, the first case is the only one which has been observed. The accident is produced by the application of external force to the back of the metacarpal bone, which is suddenly and violently thrown into a state of flexion, the case usually arising from a fall on the outer edge of the hand. In this circumstance, the upper head of the bone is forcibly driven backwards, the capsular ligament is lacerated, the extensor tendons of the thumb are pushed up, and the head of the bone slips behind the trapezium.

For an account of the symptoms and treatment of this accident, I must refer to the fifth edition of the *First Lines of the Practice of Surgery*.

The first phalanges of the fingers may be dislocated backwards off the heads of the metacarpal bones. A luxation forwards would be very difficult, if not impossible, because the articular surfaces of the metacarpal bones extend a good way forwards, and the palm of the hand makes resistance to such an accident. The first phalanx of the thumb, in particular, is often dislocated backwards behind the head of the first metacarpal bone, in which case it remains extended, while the second phalanx is bent.

These dislocations should be speedily reduced; for after eight or ten days they become irreducible. In a luxation of the first bone of the thumb which was too old to be easily reduced, and where the part was thrown behind the head of the metacarpal bone, Desault proposed cutting down to the dislocation, and pushing the head of the bone into its place with a spatula. Even in cases which are quite recent, this kind of dislocation frequently cannot be reduced without the utmost difficulty, and the different proposals which have been made respecting this particular accident, by Mr. Evans, the late Mr. Hey, Mr. C. Bell, and Boyer, deserve the notice of the surgical practitioner, who will find them explained in my other work. On this sub-

ject, however, Sir Astley Cooper remarks, that he has seen too much mischief arise from injury to the tendons and ligaments, ever to recommend their division, in order to facilitate their reduction, when extension will not succeed.—(*On Dislocation*, *p.* 523.) Dislocations of the thumb and little finger inwards, and that of the thumb outwards (which are possible cases), and luxations of the first phalanges of the other fingers backwards, and of their second phalanges forwards, are all reduced by making extension on the lower end of the affected thumb or finger, and at the same time pressing the head of the bone towards its natural situation.

After the reduction, the thumb or finger should be rolled with tape, and surrounded and supported with pasteboard, till the lacerated ligaments have united; care being taken to keep the hand and forearm in a sling. The luxation of the first phalanx of the thumb behind the metacarpal bone, requires peculiar treatment, as I have elsewhere explained.

DISLOCATIONS OF THE BONES OF THE PELVIS.

Experience proves, that the bones of the pelvis, notwithstanding the vast strength of their ligaments, may be dislocated by violence: thus the os sacrum may be driven forwards towards the interior of the pelvis; the ossa ileum may be displaced forwards and upwards; and the bones of the pubes may be totally separated at the sympyhsis, and an evident degree of moveableness occur between them. For the production of these accidents the operation of enormous force is requisite; and, in fact, their usual causes are falls from a great height; the fall of a very heavy body against the sacrum, at a period when the body is fixed; and the pressure of the pelvis between a wall or post and the wheel of a carriage or wagon. Hence, the dislocation is generally the least part of the mischief occasioned by such kinds of violence, and the case is commmonly attended with concussion of the spinal marrow, injury of the sacral nerves, extravasation of blood in the cellular substance of the pelvis or cavity of the peritoneum, injury of the kidneys, and fracture of one or more of the bones of the pelvis. As Sir A. Cooper has remarked, some of these cases complicated with fracture, are liable to be mistaken for dislocations of the thigh:—"When," says this gentleman, "a fracture of the os innominatum happens through the acetabulum, the head of the femur is drawn upwards, and the trochanter somewhat forwards, so that the leg is shortened, and the knee and foot are turned inwards. Such a case, therefore, may be readily mistaken. If the os innominatum is disjointed from the sacrum, and the pubes and ischium are broken, the limb is slightly shorter than the other; but the knee and foot are not turned inwards. These accidents may generally be detected by a crepitus perceived in the motion of the thigh, when the surgeon applies his hand to the crista of the ileum, and there is greater motion than in a dislocation of the thigh."—(*Surgical Essays*, *part* 1, *p.* 49.)

In addition to the complications which may attend a dislocation of the bones of the pelvis, and arise immediately from the external violence, the case is always followed by inflammation, which may be very serious, not only on account of the extent of the articular surfaces affected, but because such inflammation may extend to the peritoneum and viscera of the abdomen and pelvis, as I have myself seen in two or three instances.

Louis relates a case in which the os ileum of the right side was found separated from the sacrum so as to project nearly three inches behind it. This accident was caused by a heavy sack of wheat falling on a labourer.—(*Mém. de l'Acad. de Chir. t.* 4, 4*to.*)

In a case recorded by Sir A. Cooper, the posterior part of the acetabulum was broken off, and the head of the thigh-bone had slipped from its socket; the fracture extended across the os innominatum to the pubes, the bones of which were separated at the symphysis nearly an inch asunder. The ilia were separated on each side, and the left os pubis, ischium, and ileum broken.—(*Surgical Essays*, *part* 1, *p.* 50.) In the same work may also be perused another case of fracture of the body of the os pubis and ramus of the ischium, combined with a luxation of the right os innominatum from the sacrum and laceration of the ligaments of the symphysis of the pubes.

When these cases do not prove fatal from the direct effect of the great violence committed on many parts, or from peritonitis, the same unpleasant event sometimes follows rather later from suppuration of the articular surfaces taking place, and abscesses forming in the cellular membrane of the pelvis.—(*Boyer*, *Traité des Mal. Chir. t.* 4, *p.* 147.)

A case in which a dislocation of the left os innominatum upwards had a successful termination, was attended by Enaux, Hoin, and Chaussier, and is published in a modern work.—(*Mém. de l'Acad. des Sciences de Dijon.*) As the reduction could not be accomplished at first, antiphlogistic treatment was followed for some days, when new attempts to replace the bone were made, but could not be continued, as they caused a recurrence of pain and other bad symptoms. A third trial, made at a later period, was not more effectual; and all thoughts of reduction were then abandoned. After the patient had been kept quiet some time, though not so long as was wished, he quitted his bed and began to walk about on crutches. I do not understand, however, as is asserted, how the weight of the body could now bring about the reduction which had been previously attempted in vain. Be this as it may, the result was the patient's recovery. The fact clearly proves, as Boyer observes, that in cases of this description the most important object is not to aim at the reduction, but rather to oppose, by every means in our power, inflammation and its consequences. Frequently the use of the catheter is necessary, and sometimes an incontinence of urine, or the involuntary discharge of the feces, demands the strictest attention to cleanliness. In these cases, if the patient live any time, there is also another source of danger, consisting in a tendency to sloughing in the soft parts, on which the patient lies, and which, when they have been bruised, require still greater vigilance.

The os coccygis is not so easily dislocated as fractured. Boyer has seen it displaced in a man who was greatly emaciated by disease. This subject had considerable ulcerations about the coccyx, and the bone itself was bare. There was an interspace of nearly two inches between the sacrum and base of the os coccygis. In proportion as the man regained his strength, the bone recovered its right position, and at length united to the os sacrum, notwithstanding the action of the levatores ani, which are inserted into it. This case, however, was not an accidental luxation; and it clearly arose from the destruction of the ligaments by disease.

Authors mention two kinds of dislocation to which the os coccygis is liable; one inwards, the other outwards. The first is always occasioned by external violence; the second by the pressure of the child's head in difficult labours. Pain, difficulty of voiding the feces and urine, tenesmus, and inflammation, sometimes ending in abscesses which interest the rectum, are symptoms said to attend and follow dislocations of the os coccygis.

The best authors now regard all schemes for the reduction useless, as the bone will spontaneously return into its place as soon as the cause of displacement ceases: and the introduction of the finger within the rectum, and handling of the painful and injured parts, are more likely to increase the subsequent inflammation, and produce abscesses, than have any beneficial effect. In short, the wisest plan is to be content with enjoining quietude, and adopting antiphlogistic measures.

DISLOCATION OF THE RIBS.

J. L. Petit was silent on this subject, as he thought such cases never occurred. Since his death, a French surgeon, Buttet, has related an instance which he supposed to be a dislocation of the posterior extremity of the rib from the vertebræ; but Boyer clearly proves, that there were no true reasons for this opinion, and that the case was only a fracture of the neck or end of the bone near the spine.—(*Traité de Mal. Chir. t.* 4, *p.* 123.)

Ambrose Paré, Barbette, Juncker, Platner, and Heister not only admit the occurrence of luxations of the ribs, but describe different species of them. Lieutaud also extended the term luxations to cases in which the head of the rib is separated by disease, the pressure of aneurisms, &c.

In a modern work may be read the particulars of a case where all the ribs are said to have been dislocated from their cartilages. The accident arose from the chest being violently compressed between the beam of

a mill and the wall. In such a case there is no means of reduction except the effect produced by forcible inspirations; nor are there any modes of relief but bleeding, and the application of a roller round the chest. —(See *C. Bell's Surg. Obs. p.* 171.)

DISLOCATIONS OF THE THIGH-BONE.

The head of the thigh-bone may be dislocated upwards on the dorsum of the ileum; upwards and forwards on the body of the os pubis; downwards and forwards on the foramen ovale; and backwards on the ischiatic notch.

The dislocation upwards, and that downwards and forwards, are the most frequent.

The dislocation of the thigh-bone upwards on the dorsum of the ileum is attended with the following symptoms. The limb is from one inch and a half to two inches and a half shorter than its fellow, the thigh a little bent and carried inwards. The knee inclines more forwards and inwards than the opposite one; the leg and thigh are turned inwards, and the foot points in this direction; the toe resting, as Sir A. Cooper remarks, against the tarsus of the other foot.—(*Surgical Essays, part* 4, *p.* 27.) There is an approximation of the trochanter major to the anterior superior spinous process of the ileum, and at the same time it is elevated and carried a little forwards. It is also less prominent than that on the opposite side, and the natural roundness of the hip has disappeared. The natural length of the limb cannot be restored without reducing the luxation: the foot cannot be turned outwards, and any attempt to do so causes pain; but the inclination of the foot inwards may be increased.—(*Boyer.*)

When an attempt is made to draw the leg away from the other, it cannot be accomplished: but the thigh may be slightly bent across its fellow.

A dislocation on the dorsum of the ileum is generally at once readily discriminated from a fracture of the neck of the thigh-bone within the capsular ligament, by *the rotation of the limb inwards;* a position which is unusual in a fracture of any part of the os femoris. "In a fracture of the neck of the thigh-bone (says Sir A. Cooper), the knee and foot are generally turned outwards; the trochanter is drawn backwards: the limb can be readily bent towards the abdomen, although with some pain; but, above all, the limb which is shortened from one to two inches by the contraction of the muscles, can be made of the length of the other by a slight extension, and when the extension is abandoned the leg is again shortened. If, when extended, the limb is rotated, a crepitus can often be felt, which ceases when rotation is performed under a shortened state of the limb. The fractured neck of the thigh-bone, within the capsular ligament, rarely occurs but in advanced age, and it is the effect of the most trifling accidents, owing to the absorption which this part of the bone undergoes at advanced periods of life. Fractures external to the capsular ligament occur at any age, but generally in the middle periods of life; and these are easily distinguished by the crepitus which attends them, if the limb is rotated and the trochanter is compressed with the hand. The position is the same as in fractures within the ligament. The proportion of fractures of the neck of the thigh-bone which I have seen, is at least four cases to one of dislocation."—(*A. Cooper, Surg. Essays, part* 1, *p.* 28.)

The rotation of the limb inwards, in cases of fracture of the neck of the thigh-bone, is uncommon, though sometimes met with. Sir A. Cooper saw one example of it, under the care of Mr. Langstaff.—(*On Dislocations, Preface.*) To reduce this dislocation, the patient should be placed on his opposite side upon a table firmly fixed, or a large four-posted bedstead. A sheet folded longitudinally is first to be placed under the perinæum; and one end being carried behind the patient, the other before him, they are to be fastened to one of the legs or posts of the bed. Thus the pelvis will be fixed, so as to allow the necessary extension of the thigh-bone to be made. Great care must be taken during the extension to keep the scrotum and testicles, or the pudenda in women, from being hurt by the sheet passed under the perinæum. The patient must be farther fixed by the assistants.

The best practitioners of the present day in France advise the extending force to be applied to the inferior part of the leg, in order that it may be as far as possible from the parts which resist the return of the head of the bone into its natural situation. In this country, surgeons generally prefer making the extension by means of a sheet, or the strap of a pulley, fastened round the limb, just above the condyles of the os femoris. The direction in which Sir A. Cooper makes the extension is in the line made by the limb, when it is brought across the other thigh a little above the knee. As soon as the head of the bone has been brought on a level with the acetabulum by the assistants who are making the extension, the surgeon is to force it into this cavity by pressing on the great trochanter, or by rotating the knee and foot gently outwards, as practised by Sir A. Cooper.

The extension should always be made in a gradual and unremitting manner; at first gently, but afterward more strongly; never violently. The difficulty of reduction arises from the great power and resistance of the muscles, especially the glutei and triceps, which will at length be fatigued, so as to yield to the extending force, if care be taken that it be maintained the necessary time, without the least intermission. Sometimes, when there is difficulty in bringing the head of the bone over the lip of the acetabulum, Sir A. Cooper raises it by placing his arm under it near the joint.

The disappearance of all the symptoms, and the noise made by the head of the bone when it slips into the acetabulum, denote that the reduction is effected. This noise, however, is not always made when pulleys are used. The bone is afterward to be kept from slipping out again, by tying the patient's thighs together with a bandage placed a little above the knees. The patient should be kept in bed at least three weeks, live low, and rub the joint with a camphorated liniment. Due time must be given for the lacerated ligaments to unite, and the sprained parts to recover. Premature exercise may bring on irremediable disease in the joint.

Mr. Hey gives the following description of the way in which he reduced a case of this kind.

"The extension of the limb must be made in a right line with the trunk of the body; and, during the extension, the head of the bone must be directed outwards as well as downwards. A rotatory motion of the os femoris on its own axis, towards the spine (the patient lying prone), seems likely to elevate the great trochanter, bring it nearer to its natural position, and direct the head of the bone towards the acetabulum. These circumstances led to the following method: a folded blanket was wrapped round one of the bed-posts, so that the patient, lying in a prone position, and astride of the bed-post, might have the affected limb on the outside of the bed. The bed was rendered immoveable by placing it against a small iron pillar, which had been fixed for the purpose of supporting the curtain-rods. The leg was bent to a right angle with the thigh, and was supported in that position by Mr. Lucas, who, when the extension should be brought to a proper degree, was to give the thigh its rotatory motion, by pushing the leg inwards; that is, towards the other inferior extremity. Mr. Jones sat before the patient's knee, and was to assist in giving the rotatory motion, by pushing the knee outwards at the same moment. I sat by the side of the patient, to press the head of the bone downwards and outwards during the extension. Two long towels were wrapped round the thigh, just above the condyles; one towel passing on the inside of the knee, the other on the outside. Three persons made the extension; but when we attempted to give the thigh its rotatory motion, we found it confined by the towel, which passed on the inside of the knee and leg. We therefore placed both the towels on the outside; and in this position, the extending force concurred in giving the rotatory motion. The first effort that was made, after the towels were thus placed, had the desired effect; and the head of the bone moved downwards and outwards into the acetabulum."—(*Hey's Practical Observations, p.* 313.)

For the purpose of facilitating the reduction, many surgeons endeavour to produce a temporary faintness by a copious venesection, immediately before the extension is begun; a practice which, when the patient's state of health does not forbid it, is advisable, as lessening very materially the resistance of the muscles. Sir A. Cooper gives it his general approbation, as well as the warm bath, and nauseating doses of tartarized antimony. After taking away from twelve to twenty ounces of blood, this gentleman places the patient in a

bath heated to 100 degrees, and gradually raised to 110 degrees, until faintness is induced. While in the bath, the patient is also to take a grain of tartarized antimony every ten minutes, until nausea is excited; when he is to be removed from the bath, put in blankets, and placed between two strong posts, in each of which a staple is fixed; or he may be placed on the floor, into which two rings may be screwed. The manner in which Sir A. Cooper performs the reduction with pulleys, and by making the extension with the thigh slightly bent, having been detailed in the last edition of the *First Lines of Surgery*, I shall not here repeat it. Of Mr. Hey's plan, especially the direction of the limb in it, he entertains an unfavourable opinion, as little calculated to answer where the reduction has been at all delayed.—(*On Dislocations*, *p.* 45.) In this sentiment I fully concur. In all cases of difficulty, the above-mentioned debilitating means, the intoxicating effect of a liberal dose of opium, and the use of pulleys, for the reduction, appear to me to deserve recommendation.

An instance of dislocation of the thigh-bone on the dorsum of the ileum, with fracture of the same bone, is recorded by Sir Astley Cooper: the dislocation was not at first detected, and afterward no attempt to reduce the bone was considered prudent. "The probability is, that dislocations, thus complicated with fracture, will generally not admit of reduction, as an extension cannot be made until three or four months have elapsed from the accident, and then only with strong splints upon the thigh, to prevent the risk of disuniting the fracture."—(*On Dislocations*, *&c. p.* 62.)

Luxations of the thigh-bone, downwards and forwards, upon the obturator foramen, are the next in frequency to those upon the dorsum of the ileum. The accident is facilitated by the great extent to which the abduction of the thigh can be carried; by the notch at the inferior and internal part of the acetabulum; by the weakness of the orbicular ligament, which on this side is torn through; and by the ligamentum teres not opposing, or being necessarily ruptured by it; that is to say, it is only broken when the head of the femur has been carried with great violence a certain distance from the acetabulum. On this point, however, I mention with great respect the statement of Sir Astley Cooper: "The dislocation in the foramen ovale happens while the thighs are widely separated, during which the ligamentum teres is upon the stretch; and when the head of the bone is thrown from the acetabulum, *the ligament is torn through* before it entirely quits the cavity."—(*On Dislocations*, *&c. p.* 65.) That the ligamentum teres is frequently ruptured admits of no doubt. It seems also that the pectinalis and adductor brevis muscles are sometimes lacerated.—(See *Case*, *vol. cit. p.* 66.) The head of the bone is thrown between the obturator ligament and obturator externus muscle.

The symptoms are as follows: the injured limb is two inches longer than its fellow, the head of the femur being lower than the acetabulum; the trochanter major, which is less prominent than natural, is removed to a greater distance from the anterior superior spinous process of the ileum, and the thigh is flattened in consequence of the elongation of the muscles. A hard, round tumour, formed by the head of the femur, is felt at the inner and superior part of the thigh, towards the perinæum. The leg is slightly bent; and, according to Sir A. Cooper's experience, the foot, though widely separated from the other, is generally turned neither outwards nor inwards; but he has seen a little variation in this respect in different instances. Hence, he prefers as the diagnostic symptoms, the bent position of the body, caused by the psoas and iliacus muscles being on the stretch; the separated knees; and the increased length of the limb.—(*Essays*, *part* 1, *p.* 37.) The latter symptom alone is a sufficient indication of the case not being a fracture.

Dislocations on the obturator foramen are very easy of reduction. The pelvis having been fixed, the extension is to be made downwards and outwards, so as just to dislodge the head of the bone. The muscles then generally draw it into the acetabulum, on the extending force being gradually relaxed, if the upper part of the bone be pulled outwards with a bandage, and the ankle be at the same instant inclined inwards. Thus the limb is used as a lever, with very considerable power.

Mr. Hey says, that "in this species of dislocation (downwards and forwards), as the head of the bone is situated lower than the acetabulum, it is evident, that an extension made in a right line with the trunk of the body must remove the head of the bone farther from its proper place, and thereby prevent, instead of assisting, reduction. The extension ought to be made with the thigh at a right angle, or inclined somewhat less than a right angle to the trunk of the body. When the extension has removed the head of the bone from the external obturator muscle, which covers the great foramen of the os innominatum, the upper part of the os femoris must then be pushed or drawn outwards; which motion will be greatly assisted by moving the lower part of the os femoris, at the same moment, in a contrary direction; and, by a rotatory motion of the bone upon its own axis, turning the head of the bone towards the acetabulum."—(*Hey*, *p.* 316.)

The ensuing case illustrates Mr. Hey's practice. "The lower bed-post, on the right side of the bed on which the patient lay, was placed in contact with a small immoveable iron pillar (about an inch square in thickness), such as in our wards are used for supporting the curtain-rods of the beds. A folded blanket being wrapped round the bed-post and pillar, the patient was placed astride of them, with his left thigh close to the post, and his right thigh on the outside of the bed. A large piece of flannel was put between the blanket and the scrotum, that the latter might not be hurt during the extension.

The patient sat upright with his abdomen in contact with the folded blanket which covered the bed-post. He supported himself by putting his arms round the post, and an assistant sat behind him to prevent him from receding backwards. He was also supported on each side.

Two long towels were put round the lower part of the thigh, after the part had been well defended from excoriation by the application of a flannel roller. The knot which the towels form was made upon the anterior part of the thigh, that the motion intended to be given to the leg might not be impeded by the towels.

The thigh being placed in a horizontal position, or rather a little elevated, with the leg hanging down at right angles to the thigh, I sat down upon a chair directly fronting the patient, and directed a gentle extension to be made by the assistants standing at my left side. This was done with the view of drawing the head of the bone a little nearer to the middle of the thigh, and the extension had this effect. I then placed the two assistants who held the towels at my right side, by which means the extension would be made in a direction a little inclined to the sound limb. Mr. Logan stood on the right side of the patient, with his hands placed on the upper and inner side of the thigh, for the purpose of drawing the head of the bone towards the acetabulum, when the extension should have removed it sufficiently from the place in which it now lay.

I desired the assistants to make the extension slowly and gradually, and to give a signal when it arrived at its greatest degree. At that moment Mr. Logan drew the upper part of the bone outwards, while I pushed the knee inwards, and also gave the os femoris a considerable rotatory motion, by pushing the right leg towards the left. By these combined motions, the head of the os femoris was directed upwards and outwards, or, in other words, directly towards the acetabulum, into which it entered at our first attempt made in this manner.—(*Hey*, *p.* 318.)

The thigh-bone is sometimes luxated upwards and forwards on the pubes. The whole limb is turned outwards, and cannot be rotated inwards: it is shortened by one inch; the trochanter major is nearer the anterior superior spinous process of the ileum than natural; the head of the bone forms a tumour in the groin above the level of Poupart's ligament, on the outer side of the femoral artery and vein, where it can be perceived to move when the thigh-bone itself is moved. By the stretching of the anterior crural nerve, which lies over the neck of the bone (see *A. Cooper on Dislocations*, *p.* 95), great pain, numbness, and even paralysis, are liable to be produced. The knee is generally carried backwards.

In the account of the position of the limb, however, authors vary; and, in opposition to what Boyer has stated, Sir A. Cooper remarks, that there is a slight flexion forwards and outwards.—(*Surgical Essays*, *part* 1, *p.* 45.)

The head of the bone felt in the groin, and the im-

possibility of rotating the limb inwards, distinguish this case from a fracture of the neck of the bone.

In reducing this dislocation, Sir A. Cooper recommends the extension to be made in a line behind the axis of the body, so as to draw the thigh-bone backwards; and, when such extension has been continued some time, a napkin is to be put under the upper part of the bone, and its head lifted over the pubes and edge of the acetabulum.

The last dislocation of the thigh remaining to be spoken of, is that backwards.

In this case, according to the valuable description of it given by Sir A. Cooper, the head of the thigh-bone is placed on the pyriformis muscle, between the edge of the bone which forms the upper part of the ischiatic notch and the sacrosciatic ligament, being behind the acetabulum, and a little above the level of the middle of that cavity. The limb is generally not more than half an inch shorter than its fellow; and the knee and foot are turned inwards, but not nearly in so great a degree as in the dislocation on the dorsum of the ileum. The thigh inclines a little forwards, the knee is slightly bent, and the limb is so fixed that flexion and rotation are in a great measure prevented.

Sir A. Cooper considers this dislocation as the most difficult, both to detect and reduce: difficult to detect, because the length of the limb and the position of the knee and foot are but little changed; difficult to reduce, because the head of the bone is placed deeply behind the acetabulum, and requires to be drawn over the edge of the socket, as well as towards it. In thin subjects, a hard tumour is felt at the posterior and inferior part of the buttock, and the great trochanter is removed farther from the spine of the ileum.

The pelvis being fixed, the extension is to be made downwards and forwards across the middle of the other thigh, so as to dislodge the head of the bone, while the surgeon, with a napkin placed just below the trochanter minor, pulls the upper part of the femur towards the acetabulum. In this case, pulleys are preferable for making the extension.

[CONGENITAL DISLOCATION OF THE HIP-JOINT.

M. Dupuytren, of Paris, has divided dislocations into three kinds, viz. *primitive*, *consecutive*, and *congenital*. In the course of eighteen years he has met with twenty cases of the congenital kind, seventeen of which were females.

The following extract is made from his work, to which I must refer the reader for much valuable information.

"The signs which characterize it are, shortening of the limb; presence of the head of the femur on the dorsum ileum; prominence (saillie) of the trochanter major; retraction of almost all the muscles of the upper part of the thigh towards the crest of the ileum, where they form around the head of the femur a kind of cone, the base towards the os innominatum, the apex towards the trochanter; the almost entire denudation in consequence of the tuber ischii; the rotation of the limb inwards; the obliquity of the thigh, proportioned, of course, to the age and developement of the pelvis; the meagreness of the limb, out of all proportion to the trunk and upper extremities, which are really well developed; and the imperfect motions, particularly of abduction and rotation. The upper part of the trunk of the persons thus affected is thrown backwards, while the lumbar portion of the column projects as much forwards; the pelvis is placed almost horizontally on the femurs, and the ball of the foot alone touches the ground. In walking, we observe them incline the body strongly towards the limb which is to support the weight, at which moment the head of the femur of that side is seen distinctly to rise on the dorsum ilei, in consequence of the superincumbent weight and sinking of the pelvis, and then they drag painfully forwards the opposite limb, the head of the femur of which is perceived not to rise, but to sink, in consequence of its own weight drawing it down. This series of phenomena, then, is repeated each step the patient takes, and although locomotion to him is not so painful as it appears, still he is incapable of making any thing like a long journey.

In the recumbent posture, most of the symptoms of the dislocation in a great measure disappear, in consequence, no doubt, of the relaxation of the muscles, and removal of the weight of the trunk. In this position of the body, the surgeon can, by a slight effort, elongate the limb, and shorten it again; that is, he can pull the head of the femur downwards, or press it again upwards to the extent of two, or even three inches, according to circumstances.

Let us look to the history of this complaint. Even at birth, the prominence of the haunches, the obliquity of the femurs, &c., are perceptible, but in these cases, the attention of the parents is seldom much directed to the malformation, till the child begins to walk, and, indeed, even then its awkward efforts are attributed in general to weakness, &c., till the end of the third or fourth year, when the parent is at last convinced there must be something wrong. As the pelvis begins to be developed (for it is a curious fact that the growth of the pelvis is never affected in these patients), the symptoms which we have enumerated above become more marked, especially in females; and a person not acquainted with the true nature of the malady, would consider it the consequence of scrofulous disease of the joint. But the previous history, the absence of all pain, swelling, abscess, fistula, or cicatrix, and the simultaneous affection of both sides, are sufficient to correct this error. At the same time, it must be remarked, that these individuals are for the most part of a lymphatic and scrofulous habit.

As the age of the person increases, and the superincumbent weight becomes of course greater, the heads of the femurs rise on the dorsum ilei, till at last they almost touch the crista, the obliquity of the bones is increased, and the difficulty of motion proceeds at last so far, as to incapacitate the patient from all active exercise.

In the cases which he has examined, M. Dupuytren has found the acetabulum almost entirely obliterated, or even entirely wanting; the head of the femur a little flattened on its internal and anterior surface, and a sort of cotyloid cavity to lodge it, formed on the dorsum of the ileum, as happens in unreduced accidental dislocations. In one or two instances, he has seen the ligamentum teres elongated, and, in some places, worn apparently from the pressure and friction of the head of the femur.

On the treatment, which of course can be but palliative," says M. D., "as the weight of the trunk is the main agent in aggravating the displacement, repose is obviously indicated; but it is not necessary to confine patients to the recumbent posture; for, in the act of sitting, there is no stress on the femurs, the body resting entirely on the tuberosities of the ischia. Let these individuals, then, choose a profession which they can exercise when seated. Our author advises, likewise, the use of the cold bath, and the application of a bandage which encircles the pelvis, confines the trochanters, and keeps them of a uniform height, thus binding the ill-adapted parts together, and preventing that continual motion to which they are exposed. This practice, though it certainly will not cure the complaint, will give a great degree of support to the hip-joints, and prevent the progress of the displacement."—*Reese.*]

DISLOCATIONS OF THE PATELLA.

The patella may be luxated outwards, or even inwards, when violently pushed in this direction. It is also liable to a displacement upwards, in consequence of its ligament being sometimes ruptured by the action of the extensor muscles. The luxation outwards is the most frequent, because the bone more easily slips in this direction off the outer condyle of the femur than inwards. The assertion made by some authors, that the dislocation inwards is the most common, is quite erroneous, as I have elsewhere more particularly considered.—(See *First Lines of Surgery*, *5th ed.*) In confirmation of what is here observed, I may mention the opinion of Sir A. Cooper, who states, that the bone is most frequently thrown on the external condyle, where it produces a projection; and this circumstance, with an incapacity of bending the knee, is evidence of the nature of the injury.—(*Surgical Essays*, *part* 1, *p.* 66.) The accident is most common in persons whose knees incline inwards; a circumstance that accounts for the tendency of the patella to be drawn outwards by the action of the extensor muscles. The dislocation inwards, which is much less frequently met with, is produced either by a fall upon a projecting body, which strikes the outer edge of the patella, or by the foot being turned inwards at the time of the fall.

In each case, if there be no previous morbid relaxation of the parts, a portion of the capsular ligament will be torn.—(*A. Cooper, on Dislocations, &c. p.* 179.) The generality of cases are easily reduced by pressure when the extensors of the leg have been completely relaxed; but owing to a lax state of the ligament of the patella or other predisposing causes, the bone is sometimes difficultly kept in its proper situation, unless a roller be applied. The inflammatory affection of the joint is to be opposed by bleeding, purging, and the use of the lotio plumbi subacetatis. The joint must be kept quiet a few days, and then gently moved in order to prevent stiffness. When the relaxation of the ligaments is such that a relapse is likely to ensue from slight causes, a laced kneecap, with a strap and buckle above and below the patella, should be worn, as recommended by Sir Astley Cooper.—(*On Dislocations, p.* 181.) The luxation of the patella upwards, from a rupture of its ligament, is a case followed by a considerable degree of inflammation. Hence Sir Astley Cooper particularly recommends early depletion; the use of evaporating lotions from four to seven days, and then a roller to the foot and leg. The leg is to be kept extended by means of a splint behind the knee; a leather strap is to be buckled round the lower part of the thigh, and to it, on each side, another is buckled, which extends from the sole of the foot, and is carried up each side of the leg. Thus the patella is kept down, and an opportunity is afforded for the ligament to unite. In a month, the knee may be gently moved every day.—(*On Dislocations, p.* 182.)

DISLOCATIONS OF THE KNEE.

The tibia may be luxated forwards, backwards, or to either side. As Boyer observes, complete dislocations of the upper head of the tibia are exceedingly rare, because the articular surface of the condyles of the femur is so extensive that the tibia cannot be entirely removed from it without a prodigious laceration of the ligaments, tendons, and all the rest of the soft parts.

The condyles of the femur are disposed in such a manner, that, in the extreme flexion of the leg, the articular cavities of the upper head of the tibia are still in contact with those bony eminences; and this circumstance, together with the resistance made by the ligament of the patella, the patella itself, and the tendon of the extensor muscles of the leg, renders a sudden dislocation of the tibia backwards so difficult, that Boyer seems even to question the possibility of the accident, notwithstanding the case recited by Heister.—(*Traité des Mal. Chir. t.* 4, *p.* 366.) That this accident, however, sometimes really happens, no longer admits of dispute: the case is noticed by Sir A. Cooper as producing the following appearances: a shortened state of the limb; a projection of the condyles of the os femoris; a depression in the situation of the ligament of the patella; *and a bending of the leg forwards:* which last statement differs from that of Boyer, who declares that the leg is bent to a very acute angle, and cannot be extended again.—(*Mal. Chir. t.* 4, *p.* 369.) It appears farther, from the particulars of the example of this accident seen by Dr. Walshman, that the dislocation may even be complete, the head of the tibia being thrown behind the condyles of the femur into the ham. The tendinous connexion of the patella to the rectus muscle was ruptured; and, probably, without a laceration of that tendon, or of the ligament of the patella, such a degree of displacement could scarcely have happened.—(*Surgical Essays, part* 2, *p.* 74.)

But if a sudden dislocation of the tibia from the femur backwards is uncommon, the same remark cannot be made respecting a displacement in that direction, gradually produced by the effects of disease. Several cases of the latter kind have fallen under my own observation.

A dislocation of the head of the tibia forwards, from the condyles of the femur, cannot happen without the greatest difficulty; for the accident would be likely to be attended with a laceration of the lateral, crucial, and oblique, or posterior ligaments, all which tend to prevent the leg from being too far extended; and, in addition to all this injury, Boyer calculates that the head of the gastrocnemius, the popliteus, and the extensor tendons of the leg, would be immoderately stretched, and even torn. However, it deserves notice, that in one compound luxation of the knee, where the os femoris was thrown behind the outer side of the head of the tibia, the external condyle being dislocated backwards and outwards, and the internal one thrown forwards upon the head of the tibia, the dissection proved that "neither the sciatic nerve, the popliteal artery and vein, the lateral, nor the crucial ligaments were ruptured."—(*A. Cooper, on Dislocations, p.* 197.) Both heads of the gastrocnemius were lacerated, and the back portion of the capsular ligament extensively torn. In 1802, an instance of a luxation of the tibia forwards was seen in Guy's Hospital. According to Sir Astley Cooper, while the tibia projects forwards the thigh-bone is depressed, and thrown somewhat laterally as well as backwards. The os femoris makes such pressure on the popliteal artery as to prevent the pulsation of the anterior tibial artery on the instep; and the patella and tibia are drawn forwards by the rectus muscle.—(*Surgical Essays, part* 2, *p.* 73.)

Dislocations inwards or outwards, though more frequent than the foregoing cases, are still to be considered as rare, and are always incomplete. In the dislocation inwards, the condyle of the os femoris is thrown upon the external semilunar cartilage, and the tibia projects at the inner side of the joint, so as at once to disclose the nature of the accident; and a depression may be felt under the external condyle. In the luxation of the head of the tibia outwards, the condyle of the os femoris is thrown upon the inner semilunar cartilage, or, as Sir Astley Cooper says, rather behind it. In both these cases, this gentleman thinks that the tibia is rather twisted upon the os femoris, so that the condyle of the latter bone is thrown somewhat backwards as well as outwards or inwards.

I have stated that lateral luxations of the tibia from the femur are almost always incomplete: but the possibility of a complete dislocation inwards seems to be established by the 402d Obs. of Lamotte.

Whenever the tibia is dislocated from the femur, the accident has generally happened either while some force was operating upon that bone, at a period when the femur was fixed and immoveable, or else while the thigh-bone was propelled, or twisted with great violence, while the leg itself was firmly fixed.

These accidents are all most easily reduced by making gentle extension, and pushing the head of the tibia in the proper direction. The grand object, after the reduction, is to avert inflammation of the knee, and promote the union of the torn ligaments. The first demands the rigorous observance of the antiphlogistic plan—bleeding, leeches, low diet, opening medicines, and a cooling evaporating lotion; both require the limb to remain perfectly motionless. With respect to splints, I conceive that their pressure would be objectionable. As soon as the ligaments have grown together, and the danger of inflammation is over, which will be in about three weeks, the joint should be gently bent and extended every day, in order to prevent stiffness. Liniments will now also be of service.

In this section, we must notice the cases which were first described by the late Mr. Hey, and are named by Sir A. Cooper partial luxations of the thigh-bone from the semilunar cartilages. Mr. Hey observes, that the disorder may happen either with or without contusion. When no contusion has occurred, or the effects of it are removed, the joint, with respect to shape, appears uninjured. If there is any difference from its usual appearance, it is that the ligament of the patella seems rather more relaxed than that of the sound limb. The leg is readily bent, or extended by the hands of the surgeon, and without pain to the patient: at most, the degree of uneasiness caused by this flexion and extension is trifling. But the patient himself cannot freely bend, nor perfectly extend the limb in walking; and he is compelled to walk with an invariable and small degree of flexion. Yet though the leg is stiff in walking, it may be freely moved while the patient is sitting down.

Mr. Hey ascribes this complaint to any causes which had the effect of hindering the condyles of the os femoris from moving truly in the hollow formed by the semilunar cartilages, and articular depressions of the tibia; an unequal tension of the lateral or crucial ligaments; or some slight derangement of the semilunar cartilages.—(*Pract. Obs. p.* 333, *ed.* 2.) Sir A. Cooper says, the most frequent cause of the accident is the point of the foot, while averted, striking against any projection, when pain is immediately felt in the knee, and the patient becomes incapable of perfectly extend-

ing the leg. He has also known the case produced by a person suddenly turning in bed, and the clothes not suffering the foot to turn as quickly as the rest of the body. A sudden twist of the knee inwards may also displace the semilunar cartilages.

Sir A. Cooper gives the following explanation of the case. The semilunar cartilages are united to the tibia by ligaments, which, when relaxed, allow the cartilages to be easily pushed from their natural situation by the condyles of the femur, which then come into contact with the head of the tibia; and now, upon an attempt being made to extend the leg, a complete movement of this kind is prevented by the edges of the semilunar cartilages.—(*Surgical Essays, part* 2, *p.* 76.) In several examples recorded by Mr. Hey, a cure was effected by placing the patient upon an elevated seat, extending the joint, while one hand was placed above the knee, and then suddenly moving the leg backwards so as to make as acute an angle with the thigh as possible.—(*Pract. Obs. p.* 337, &c.) This manœuvre seems to have the effect of restoring the semilunar cartilages to their natural position. Sometimes, however, it will not answer; and in one such case, mentioned by Sir A. Cooper, the patient used to accomplish the reduction by sitting upon the ground, and then bending the thigh inwards and pulling the foot outwards. A knee-cap, laced tightly, and furnished with a strong leather strap just below the patella, was requisite in this instance for preventing a return of the displacement. In another case, subject to frequent relapses, these were at length hindered by a bandage with four rollers attached to it, which were tightly applied above and below the patella.—(*A. Cooper, Surgical Essays, part* 2, *p.* 77.)

Compound dislocations of the knee generally demand immediate amputation.

DISLOCATIONS OF THE FIBULA.

According to Sir A. Cooper, luxations of the upper head of the fibula, from relaxation of the ligaments, are more frequent than those from violence. The head of the bone is thrown backwards. The bone is easily replaced, but immediately slips behind the tibia again. When the case is attended with disease, repeated blisters are recommended; and afterward a strap to confine the bone in its natural situation.—(*Surg. Essays, part* 2, *p.* 105.) In other instances, a roller, a compress applied over the head of the fibula, and a splint along this bone, would be proper.—(*Boyer, Mal. Chir. t.* 4, *p.* 374.) The latter author has seen a displacement of the whole fibula upwards, accompanying a dislocation of the foot outwards. This case must be exceedingly unfrequent, as it is resisted not only by the ligaments of the upper joint of the fibula, but also by those very strong ligamentous bands which bind the malleolus externus to the astragalus and os calcis. In all the cases which I have seen, the pressure of the astragalus, when driven outwards, has broken the fibula. In the instance mentioned by Boyer, the double luxation of the fibula was readily reduced, by rectifying the position of the foot, and bringing the astragalus into its proper place again with respect to the tibia.

DISLOCATION OF THE FOOT.

The tibia may be dislocated from the astragalus inwards or outwards, forwards or backwards; and either of these luxations may be complete or incomplete. The dislocation inwards is the most common; the foot being thrown outwards, and its inner edge resting upon the ground, while the fibula is broken about two or three inches above the ankle. Upon dissection, as Sir A. Cooper observes, the end of the tibia is found resting upon the inner side of the astragalus, and, if the accident has been produced by a jump from a considerable height, the lower end of the tibia, where it is connected to the fibula by ligament, is split off, and remains attached to the latter bone. The broken end of the fibula itself is carried down upon the astragalus, occupying the natural situation of the tibia. The malleolus externus remains in its natural situation, with two inches of the fibula, and the piece of the tibia which is split off. The capsular ligament attached to the fibula, and the three strong fibular tarsal ligaments are uninjured.—(*Surgical Essays, part* 2, *p.* 107.)

One thing very essential to be understood in this case is, that the fracture of the fibula is here the first mischief, without which the dislocation could not have happened. The fibula may easily be fractured without any luxation of the foot, but the above-described dislocation can never take place unpreceded by a fracture of the fibula; and grave and serious as the displacement of the joint is, it is always a secondary event.—(*Dupuytren, Annuaire, Méd. Chir.* 1819, *p.* 3.)

It was to this particular case, joined with the fracture of the fibula, that Mr. Pott drew the attention of surgeons as affording a striking example of the benefit derived from relaxing the muscles; the instance, in which "by leaping or jumping, the fibula breaks within two or three inches of the lower extremity. When this happens, the inferior fractured end of the fibula falls inwards towards the tibia, that extremity of the bone which forms the outer ancle is turned somewhat outwards and upwards, and the tibia having lost its proper support, and not being of itself capable of steadily preserving its true perpendicular bearing, is forced off from the astragalus inwards; by which means, the weak bursal or common ligament of the joint is violently stretched, if not torn, and the strong ones which fasten the tibia to the astragalus and os calcis, are always lacerated; thus producing, at the same time, a perfect fracture and a partial dislocation, to which is sometimes added, a wound in the integuments, made by the bone at the inner ankle. By this means, and indeed as a necessary consequence, all the tendons which pass behind or under, or are attached to the extremities of the tibia and fibula, or os calcis, have their natural direction and disposition so altered, that instead of performing their appointed actions, they all contribute to the distortion of the foot, and that by turning it outwards and upwards."

When this accident is accompanied, as it sometimes is, with a wound of the integuments of the inner ankle, and that made by the protrusion of the bone, the danger and difficulties of the case are seriously increased.

"By the fracture of the fibula, the dilatation of the bursal ligament of the joint, and the rupture of those which should tie the end of the tibia firmly to the astragalus and os calcis, the perpendicular bearing of the tibia on the astragalus is lost, and the foot becomes distorted; by this distortion, the direction and action of all the muscles already recited are so altered, that it becomes (in the usual way of treating this case) a difficult matter to reduce the joint; and the support of the fibula being gone, a more difficult one to keep it in its place after reduction. If it be attempted with compress and strict bandage, the consequence often is a very troublesome, as well as painful ulceration of the inner ankle, which very ulceration becomes itself a reason why such kind of pressure and bandage can be no longer continued; and if the bone be not kept in its place, the lameness and deformity are such as to be very fatiguing to the patient, and to oblige him to wear a shoe with an iron, or a laced buskin, or something of that sort, for a great while, or perhaps for life.

All this trouble, pain, difficulty, and inconvenience are occasioned by putting and keeping the limb in such position as necessarily puts the muscles into action, or into a state of resistance, which in this case is the same. This occasions the difficulty in reduction, and the difficulty in keeping it reduced; this distorts the foot, and, by pulling it outwards and upwards, makes that deformity which always accompanies such accident; but if the position of the limb be changed, if by laying it on its outside, with the knee moderately bent, the muscles forming the calf of the leg, and those which pass behind the fibula and under the os calcis, are all put into a state of relaxation and non-resistance, all this difficulty and trouble do in general vanish immediately; the foot may easily be placed right, the joint reduced, and by maintaining the same disposition of the limb, every thing will in general succeed very happily, as I have many times experienced.—(*Pott.*)

I think the profession are much indebted to Sir A. Cooper, for his application of terms to dislocations of the ankle, which are liable to no mistake or confusion. Thus, when he speaks of a dislocation of the tibia inwards or outwards, backwards or forwards, the case spoken of is immediately known. On the contrary, when authors write about dislocations of the ankle or foot, in any named direction, their meaning may be various and misinterpreted. We find this exemplified in Dupuytren's valuable memoir on fractures of the lower end of the fibula; for, instead of terming the

above case a dislocation of the foot *outwards*, as the generality of writers have done, he thinks it should be named a dislocation of the foot *inwards*, on account of the direction in which the astragalus is carried.—(*Annuaire, Méd. Chir. p.* 3, 1819.)

With respect to the treatment of the preceding case, Dupuytren admits, that Pott's method easily effects a reduction, though incapable of maintaining it; but, as I have endeavoured to explain in the last edition of the *First Lines of Surgery*, the practice recently proposed at the Hôtel-Dieu, it would be useless repetition to enter into the subject again. Sir A. Cooper appears to prefer the mode of treatment on Mr. Pott's principles; but gives one very essential piece of advice, which is, that the splint upon which the outer part of the limb rests may have a foot-piece, "to give support to the foot, prevent its eversion, and preserve it at right angles with the leg. If much inflammation succeeds, leeches are to be applied to the parts, and the constitution will require relief by taking blood from the arm."—(*Surgical Essays, part* 2, *p.* 108.)

When the tibia is dislocated outwards, the internal lateral ligaments are always ruptured, or pulled away from the bones, and the inner malleolus broken previously to the fracture of the fibula. On a part of this statement, however, Dupuytren and Sir A. Cooper differ, as the latter mentions that the deltoid ligament remains unbroken. In some cases, he says, the fracture is not confined to the malleolus, but passes obliquely through the articular surface of the tibia, which is thrown forwards and outwards upon the astragalus, in front of the malleolus externus. Sometimes the astragalus is fractured, and the lower extremity of the fibula broken into several splinters. He states also, that when the fibula is not broken, the external lateral ligaments are ruptured. The foot is thrown inwards, its outer edge resting upon the ground; while a considerable projection is made by the malleolus externus under the skin. The accident is generally caused by the passage of a wheel of a carriage over the leg, or a violent twist of the foot inwards in jumping or falling. —(*A. Cooper, vol. cit. p.* 113.)

The reduction is accomplished by relaxing the muscles of the calf, making extension in the axis of the leg, and pressing the lower head of the tibia inwards towards the astragalus. "The limb is to be laid upon its outer side, resting upon a splint with a foot-piece, and a pad is to be placed upon the fibula just above the outer angle, and extending a few inches upwards, so as in some measure to raise that portion of the leg, and prevent the tibia and fibula slipping from the astragalus, as well as lessen the pressure of the malleolus externus upon the integuments."—(*Surg. Essays, part* 2, *p.* 113.) Sir A. Cooper also enjoins paying the strictest attention to hindering the foot from being twisted inwards or pointed downwards.

Dupuytren's manner of treating this case is described in the last edition of the *First Lines of Surgery.*

A complete dislocation of the lower head of the tibia forwards cannot happen without the fibula being first broken, and either the base of the malleolus internus fractured, or its point torn away. The foot being then acted upon by the extensor and flexor muscles, and unretained by the malleoli and their ligaments, yields to the powerful operation of the muscles of the calf, the astragalus passing behind the tibia, while this projects forwards under the tendons and skin of the instep.—(*Dupuytren, Annuaire Méd. Chir. p.* 187, 4*to. Paris,* 1819.) The foot of course is much shortened, the heel lengthened, and firmly fixed, and the toes point downwards. Upon dissection, the tibia is found to rest upon the upper surface of the os naviculare, and os cuneiforme internum. The anterior part of the ca sular ligament is torn through; the deltoid ligament is only partially lacerated; and the three ligaments of the fibula remain unbroken.—(*A. Cooper, vol. cit. p.* 109.)

This case is much more difficult of reduction than the instance in which the foot is thrown inwards; and the cause is owing to the powerful manner in which the muscles resist the extension of the parts, and placing them in their natural position again. As Dupuytren observes, it is true that such resistance may be lessened by relaxing the muscles, and drawing the patient's attention from his limb; plans, which fully answer for the reduction of the other above-mentioned case; yet, in that now under consideration, they are insufficient, and here a greater effort is required to bring the foot from behind forwards, and to place the astragalus under the tibia. And a still greater difficulty is to keep the parts reduced during the time necessary for the fibula and torn ligaments to be firmly united. In fact, the upper surface of the astragalus, which is convex from behind forwards, is so slippery that it is hard to make the tibia rest securely on the articular pulley of that bone, which is itself incessantly acted upon by the extensor muscles of the leg, so as to have a tendency to slip behind the lower head of the tibia. In addition, therefore, to the bent posture, Dupuytren deems it necessary here to employ an apparatus, which propels the foot forwards, and the lower head of the tibia backwards.—(*Annuaire Méd. Chir. p.* 188.) As this apparatus has been described in the last edition of the *First Lines of Surgery*, I need not explain it again.

Sir A. Cooper prefers keeping the limb upon the heel, resting upon a pillow. A splint, with a suitable pad and a foot-piece, is to be applied to each side of the leg, care being taken to keep the foot well supported at a right angle with the leg.—(*Surgical Essays, part* 2, *p.* 110.)

Besides the complete dislocation of the tibia forwards, a partial case is sometimes met with, where one half of the articular surface of the bone rests upon the os naviculare, and the other on the astragalus. According to Sir A. Cooper, the fibula is broken; the foot appears but little shortened; nor is there any considerable projection of the heel. The foot points downwards, it cannot be put flat on the ground, and is nearly stiff, and the heel continues drawn up. The accident, if not detected and rectified in its early stage, afterward admits of no relief, the change in the state of the muscles, and the position in which the fibula has united, not suffering any reduction, even though great force be employed.

Dislocations of the tibia, forwards or backwards, are not common: during fifteen years, Dupuytren has scarcely met with two or three cases; though he has seen some hundreds of lateral dislocation. It must be obvious to every body, says he, that when the foot is violently bent, or extended, many powerful muscles resist the movement in question, and prevent the mischief with which the articulation is threatened.—(*Annuaire Méd. Chir. des H pitaux de Paris, p.* 34.) A luxation of the tibia from the astragalus backwards, Sir A. Cooper has never had an opportunity of observing; a proof of the rarity of the accident.

A luxation of the astragalus, either simple or complicated with a laceration of the integuments, as Mr. Hey has remarked, is an accident which does not often occur. Above, the astragalus is articulated with the tibia and fibula; below, it is united, by means of a capsular ligament, to the os calcis; while in front, it is connected to the os naviculare by a capsular and broad internal lateral ligament. Thus situated, it is evident that its displacement is not likely to happen with great frequency; and yet this observation must be received only as a comparative one; for the cases of dislocation of the astragalus, now upon record, are rather numerous.

When a dislocation of the lower head of the tibia is combined with one of the astragalus from the os calcis and os naviculare, and the ligaments which kept these bones together are nearly destroyed, while a considerable portion of the astragalus itself protrudes through the wound in the integuments, if it be judged prudent to attempt the preservation of the limb, it is best perhaps to imitate Desault, Ferrand, Trye, and Evans, and extract the astragalus altogether.

A luxation of the astragalus, unattended with a wound in the skin, is a serious and embarrassing accident; for, in general, the reduction is so difficult, that it is not many years since the case was deemed a ground for amputation.—(See *Gooch's Chir. Cases, &c.*) When the displacement in question happens, the astragalus is generally thrown forwards upon the os naviculare, forming a tumour on the instep and inclining a little either to the outer or inner side of the foot. In many cases of this description, the reduction is found to be impracticable. Here, as Boyer observes, the impediment does not depend upon the head of the bone being constricted in the narrow opening of the capsule; but rather upon the impossibility of making the extending force and the pressure of the surgeon's

hands operate with much effect upon the displaced bone. However, an example is recorded by Desault, where the reduction was accomplished by dividing the skin, and then extending the incision through a part of the ligaments. In the *Journ. de Chir.* another case is also related of a simple dislocation of the astragalus from the os calcis and os naviculare, where the reduction was easily performed by common means. Boyer conceives it probable, that in these cases, most of the ligaments uniting the astragalus to the os calcis and os naviculare were ruptured, and that the first of those bones was therefore sufficiently moveable to admit of being replaced by the pressure of the fingers. But the luxated astragalus may be so wedged between the tibia, os calcis, and os naviculare, that its reduction is impossible, as Boyer has actually seen. In the case here referred to, things were left to take their course, except that every possible means was employed to keep off inflammation. The result was, that the skin covering the projection of the astragalus at the inner and upper part of the foot sloughed, and amputation was at length deemed necessary.—(*Mal. Chir. t.* 4, *p.* 400.) A similar example is recorded by Sir Astley Cooper.—(*On Dislocations, p.* 360.) In another case, recorded by Mr. Hey, pressure was made with a tight bandage on the prominence of the astragalus, and the soft parts over it became gangrenous; yet a recovery followed without amputation, all the projecting portion of the astragalus having gradually come away in fragments.—(*Hey's Pract. Obs. p.* 384, *ed.* 2.) In an instance recently published by Dupuytren, a person dislocated the astragalus by alighting with great violence upon the heel, the bone being driven forwards by the pressure, which it had sustained between the tibia and os calcis, so as to form a protuberance under the skin of the instep. As the reduction was found impracticable, a cut was made down to the displaced bone with the intention of extracting; but Dupuytren found that he could not remove it so readily as he expected; nor could he replace it; and it was not till after a tedious operation that he succeeded in taking it away. The difficulty arose from the upper surface of the bone being turned downwards, while the back projection of what was naturally the lower part of it took hold of the tibia in the manner of a hook.—(*Annuaire Méd. Chir. des Hôpitaux de Paris*, 1819, *p.* 28.)

In another modern valuable publication, two cases of dislocation of the astragalus are related. One was a simple luxation of the astragalus inwards, the os calcis and rest of the foot being thrown outwards. The reduction was easily performed by fixing the knee, then extending the foot gently and directly from the leg, by laying hold of the heel with one hand and placing the other on the dorsum of the foot; and lastly, by pressing the foot inwards, while counter-pressure was made with the knee upon the opposite side of the lower extremity of the tibia. The other instance alluded to, was a compound luxation, in which the astragalus was displaced outwards, and the other tarsal bones thrown inwards. Reduction was accomplished, first by bending the leg so as to relax the muscles, and then by extending the foot, as above explained, and rotating it outwards.—(*A. Cooper, Surgical Essays, part* 2, *p.* 207.)

By heavy weights falling upon the foot, a dislocation is sometimes produced at the transverse joint between the astragalus and os calcis behind, and the os naviculare and os cuboides in front.

Sir A. Cooper has twice seen the os cuneiforme internum dislocated, and in both cases, the head of the bone naturally connected to the os naviculare projected inwards and somewhat upwards, being drawn in this direction by the action of the tibialis anticus muscle. In neither instance was the reduction accomplished; and, in one, the patient had so trivial a lameness that the functions of the foot were expected to be in time perfect again.—(*Surgical Essays, part* 2, *p.* 209.) With regard to the treatment, Sir A. Cooper recommends, first, confining the bone in its place with a roller, kept wet with spirits of wine and water, and when the inflammation is subdued, he directs a leather strap to be buckled round the foot, so as to maintain the bone in its right situation.—(*On Dislocations, p.* 384.)

The phalanges of the toes are sometimes dislocated, and the first bone of the great toe is frequently luxated from the first metatarsal bone; but I am not aware that these cases are attended with any particular difficulty in the reduction, like some dislocations of the thumb.

On the subject of Dislocations, consult *A. Flatch, de Luxatione Ossis Femoris rariore, frequentiore Colli fractura, Disp. Argent.* 1723. *H. Linguet, Quæstio, &c. An in Humeri Luxationi Ambi potius quam Scala, Janua, Polyspastusque iterato renovata? Paris*, 1732. *G. C. Reichel, Diss. de Epiphysium ab Ossium Diaphysi Diductione, Lips.* 1759. *J. L. Petit, Traité des Maladies des Os*, 1725; *et Traité des Mal. Chir.* 1783. *Duverney, Traité des Maladies des Os. Richerand, Nosographie Chir. t.* 3, *p.* 193, *&c. édit.* 4. *Œuvres Chir. de Desault, par Bichat, t.* 1. *Pott's Remarks on Fractures and Dislocations*, 1775. *Kirkland's Observations upon Mr. Pott's General Remarks on Fractures, &c. White's Cases in Surgery. Medical Observations and Inquiries, vol.* 2. *Bromfield's Chirurgical Cases and Observations*, 1773. *J. F. P. Castella, Sur les Fractures du Péroné, Landshut*, 1808. *C. Bell, A System of Operative Surgery*, 1809. *J. Howship, Pract. Obs. in Surgery and Morbid Anatomy*, 8vo. *Lond.* 1816. *Callisen, Systema Chirurgiæ Hodiernæ, t.* 2. *Desault, Journ. de Chirurgie. Boyer, Traité des Mal. Chir. t.* 4, *Paris*, 1814. *Trye's Illustrations of some of the Injuries to which the lower Limbs are exposed, &c. W. Hey, on Dislocations and internal Derangement of the Knee-joint, in Practical Obs. in Surgery, ed.* 2. *Dupuytren, sur la Fracture de l'Extremité inférieure du Péroné, les Luxasions, et les Accidens, qui en sont la Suite, in Annuaire Medico-Chir. des Hôpitaux de Paris, 4to. Paris*, 1809. *The observations in this Memoir are highly interesting, and afford new and instructive views of the subject. G. F. D. Evans, Practical Obs. on Cataract, Closed Pupil, Amp. at the Shoulder, &c., and Compound Dislocations*, 8vo. *Wellington*, 1815. *Astragalus removed; shattered end of the fibula sawed off; protruded lower end of the humerus similarly removed; a compound dislocation of the shoulder-joint, and head of the metacarpal bone of the thumb dislocated in two instances towards the palm, and on account of the difficulty of reduction, exposed by an incision and sawed off. Surgical Essays; also, a Treatise on Dislocations and Fractures of the joints, by Sir A. Cooper, Bart.: a work which abounds in practical information, and does infinite credit to the talents and industry of its experienced author.*

DISTICHIA, or DISTICHIASIS. (From δίς, twice, and στίχος, a row.) Gorrhæus, Heister, and St. Ives apply this term to an affection in which each tarsus has a double row of eyelashes, which, inclining inwards, irritate the eye, and keep up ophthalmy. Such authors speak of this as a very frequent complaint; but the author of the present article, in the *Encyclopédie Méthodique, partie Chirurgicale*, remarks, that he has never met with it at all, though in ulceration of the eyelids he has often seen a certain number of the eyelashes incline inwards, and cause a good deal of disturbance to the eye, already in a state of inflammation. This disorder cannot properly be called distichiasis. However it may be, all writers recommend plucking out such eyelashes as assume an unnatural direction. Some of the hairs are first to be taken out one after the other, and a few days are allowed to elapse before the operation is repeated. In order that the eyelashes may be more completely extirpated, and that others may not grow in the same situation, the places from which they grow are usually touched with the argentum nitratum. —(See *Trichiasis.*)

DURA MATER, FUNGOUS TUMOURS OF. The dura mater, the outer membrane of the brain, was so named by the ancients on account of its hardness, and its being formerly supposed to be the source of all the other membranes of the body.

Fungous tumours of the dura mater, the true nature of which was ascertained late in the last century, did not escape the notice of the ancient writers; but the disease is very imperfectly described by them, and under an erroneous denomination. They supposed that the swelling was of the encysted kind, or what they termed *matta, talpa, testudo*, and that it gradually altered and destroyed the cranium. They sometimes mistook the fungous or sarcomatous tumour of the dura mater for coagulated blood, or for ill-conditioned excrescences, like those which make their appearance on ulcers attended with caries. Such are the ideas which seem to be conveyed by some imperfectly de-

tailed cases in the writings of Lanfranc, Guido di Cauliaco, Theodoricus, and other authors of the thirteenth and fourteenth centuries. Amatus Lusitanus has given the appellation of lupus with caries to a fungous tumour of the dura mater. The swelling occurred in a child eight years old, who died in convulsions, two days after an opening had been made in it.—(*Centur.* 5, *obs.* 8.) Another similar case which happened in a child, and was noticed by Camerarius at Paris, is styled a singular bony excrescence.—(*Ephemer. curios. natur. decad.* 2, *ann.* 6, 1687, *obs.* 99.) Lastly, Cattier, a physician of Montpellier, has recorded the history of a lady who died from the consequences of a fungous tumour of the dura mater. The disease was so acutely painful, as to compel the patient to cry out. The swelling was opened with caustic. Pimprenelle, a Parisian surgeon, recommended the trepan to be employed; but his advice was overruled. After death a fungus of the dura mater, with a perforation in the skull, was detected, and it is described by the author as a hard, stony substance, accompanied with points and asperities.—(*Obs. Méd. obs.* 15, *p.* 48. See *Lassus, Pathologie Chirurgicale, tom.* 1, *p.* 498, *éd.* 1809.)

The old surgeons, ignorant of the real character of fungous tumours of the dura mater, used often to commit the most serious and fatal mistakes in the treatment. These diseases are of a chronic nature, and make their appearance gradually, in the form of a tumour, which makes its way through the bones of the cranium, rises up, and insensibly blends itself with the integuments, which seem, as it were, to make a part of it. Such fungous tumours of the dura mater may originate spontaneously at any part of this membrane; but they are particularly apt to grow on the surface, which is adherent to the upper part of the skull, or to its basis. They are firm, indolent, and chronic, seeming as if they were the consequence of slow inflammation, affecting the vessels which supply the dura mater, and inosculate with those of the diploe. It is very difficult, one might say impossible, to determine whether, in an affection of this kind, the disease begins in the dura mater or the substance of the bone itself. The general belief, however, is, that the bone is affected secondarily, and that the disorder originates in the dura mater. The patient, who is the subject of the first case, related in a memoir by M. Louis, had received no blow upon the head, and could only impute his complaint to a fall which he had met with four or five months previously, and in which the head itself had not received any violence; but from this time he experienced a stunning sensation, which continued till he died. The cranium and dura mater were found both equally diseased. Though this case may tend to prove that fungous tumours of the dura mater may form spontaneously, yet it is not the less confirmed by the examination of a vast number of cases, that this affection more frequently follows blows on the head, than any other cause. Hence a slow kind of thickening of the dura mater is produced, which ends in a sarcomatous excrescence, the formation of which always precedes the destruction of the bone. In the memoir published by M. Louis in the fifth volume, 4to. of those of the Royal Academy of Surgery, there is a very interesting case, illustrating the nature of the present disease.

The subject was a young man, aged twenty-one, who had a considerable tumour on the left side of the head, which was taken for a *hernia cerebri*.—(See *this article*.) The swelling had begun in the region of the temple, and had gradually acquired the magnitude of a second head. The external ear was displaced by it, and pushed down as low as the angle of the lower jaw. At the upper part of the circumference of the base of the tumour the inequalities of the perforated bone and the pulsations of the brain could be distinctly felt. Some parts of the mass were elastic and hard, others were soft and fluctuating. A plaster which had been applied brought on a suppuration at some points, from which an ichorous matter was discharged. Shiverings and febrile symptoms ensued, and the man died in less than four months, in the year 1764. On dissection a sarcomatous tumour of the dura mater was detected, together with a destruction of the whole portion of the skull corresponding to the extent of the disease.

When a tumour of this nature has decidedly formed, it makes its way outwards through all the parts soft or hard which are opposed to it. The swelling, in becoming circumscribed, is partly blended with the dura mater, and its pressure produces an absorption of such parts of the skull as oppose its enlargement. It unexpectedly elevates itself externally, confounding itself with the scalp, and presents itself outwardly in the form of a preternatural, soft, yielding swelling, which even sometimes betrays an appearance of a decided fluctuation or a pulsation which may make it be mistaken for an aneurismal tumour. When once the swelling has made its exit from the cavity of the cranium, it expands on every side under the integuments, which readily make way for its growth. The scalp becomes distended, smooth, and œdematous over the extent of the tumour, and lastly it ulcerates. The matter discharged from the ulcerations is thin and sanious; the outer part of the tumour is confounded with the integuments and edges of the skull on which it rests, so that in this state it is easy to mistake the tumour for one whose base is altogether external. While the swelling thus increases in size externally, it also enlarges internally. The latter change takes place in particular, while the opening in the cranium is not large enough to admit the whole mass of the tumour, which then depresses the brain, and lodges in an excavation which it forms for itself. But this cavity quickly diminishes, and becomes reduced almost to nothing, as soon as the tumour projects outwardly. The tables of the skull are absorbed to let the swelling arrive externally; but it is remarked, that the internal or vitreous table is always found much more extensively destroyed than the external one. Sometimes new bony matter is found deposited around the opening in the cranium.

It is asserted, that whatever may be the situation of a fungous tumour of the dura mater, the outer layer of this membrane, upon which the disease forms, is alone altered, the inner layer and the pia mater being always unchanged. (*Lassus, Pathologie Chirurgicale, tom.* 1, *p.* 501, *éd.* 1809.)

In one of these cases, detailed by Walther, the inner layer of the dura mater was quite natural, though one-half of the tumour, which was very large, was within the skull, where it had formed for itself a deep excavation in the posterior lobe of the brain. And, what is remarkable, notwithstanding this latter change, the patient, the day before her death, retained all her intellectual faculties, and the power of voluntary motion. —(*Journ. für Chirurgie von C. Graefe und Ph. v. Walther, b.* 1, *p.* 64, 65, 8*vo. Berlin*, 1820.)

According to surgical writers, fungous tumours of the dura mater have been caused by contusions on the skull, falls on the buttocks, concussions of the head or whole body, lues venerea, scrofula, inveterate rheumatism, &c. The three last of the alleged causes, however, seem to be little better than mere conjecture; and the same may be said of Walther's idea, that the disease is of a similar nature to white swelling of the joints (*Graefe's Journ. b.* 1, *p.* 104), beginning rather in the bone than in the dura mater.

Even children of the most tender years are liable to the disease. M. Louis has related, that a child, two years of age, died of a fungus of the dura mater, which had produced a swelling above the right ear, attended with a destruction of a portion of the parietal and temporal bones.—(*Mem. de l'Acad. de Chirurgie, tom.* 5, 4*to. p.* 31.)

Though the common opinion is, that these fungi grow entirely from the dura mater, Sandifort asserts that the vessels of the diploe have a considerable share in their production.—(*Descriptio Musei Anat. Acad. Lugd. t.* 1, *p.* 152.)

A similar belief was entertained by Heister and Kaufmann, and is espoused by Siebold and Walther, the latter imputing the disease to a simultaneous affection of the vessels of the dura mater and pericranium, attended with an absorption of the earthy part of the bone.—(*Journ. für Chir. von C. Graefe, &c. p.* 91—93.)

The existence of a fungous tumour of the dura mater cannot be ascertained, as long as there is no external change. The effects produced may originate from so many causes, that there would be great risk of a gross mistake in referring them to any particular ones. This is not the case when there is an opening in the skull. Then a hardness felt from the very first at the circumference of the tumour, denotes that it comes from within. When the swelling is carefully handled, such a crackling sensation is perceived, as would arise from

touching dry parchment stretched over the skin. On making much pressure pain is occasioned, and sometimes a numbness in all the limbs, stupefaction, and other more or less afflicting symptoms. The tumour in some measure returns inwards, *especially when not very large*, and gradually rises up and outwards again, when the pressure is discontinued. Sometimes there is pain; at other times there is none; which may be owing to the manner in which the tumour is affected by the edges of the bone through which it passes. The pain is often made to go off by compression, but returns as soon as this is taken off. The tumour has an alternate motion, derived from the pulsation of the brain, or of the large arteries at its base. This throbbing motion has led many practitioners to mistake the disease for an aneurism, as happened in the second case related in the memoir of M. Louis. When the tumour is pushed sideways, and the finger carried between it and the edge of the bone, through which the disease protrudes, the bony edge may be felt touching the base of the swelling, and more or less constricting it. This symptom, when distinguishable, added to a certain hardness and elasticity, and sometimes a facility of reduction, forms a pathognomonic mark, whereby fungous tumours of the dura mater may be discriminated from herniæ of the brain, external fleshy tumours, abscesses, exostosis, and other affections which at first resemble them.

Probably, however, some variety in the symptoms prevails in different instances; for in the cases recorded by Walther there was no pulsation, strictly so called, but merely an obscure movement, or an alternate distention and flaccidity, arising from the influx of blood into the vessels of the diseased mass; the tumours could not be pushed within the cranium, in the slightest degree; nor did the attempt cause any of the effects usually observed to proceed from pressure on the brain. No aperture could be felt in the skull, much less could the irregular edges of the bone around the tumour be distinguished.—(*Journ. für Chir. b.* 1, *p.* 57--61, *&c.* 8*vo. Berlin*, 1820.)

Whatever movements also were perceptible in the swellings, Walther is convinced could not be communicated to them by the pulsations of the subjacent brain; because they were wedged, as it were, in an aperture in the skull, and adherent to the dura mater beneath them, and to the superincumbent periosteum, so that even in the dead subject they did not admit of being pushed in the least more outwards without difficulty, and the employment of strong pressure.—(*Vol. cit. p.* 57.)

Indeed, this tight constriction of the tumour not only explains why stupor, paralysis, &c. were not brought on in these particular examples by external pressure, but also why the edges of the hole in the skull could not be felt; and the small size of the same opening, in relation to the magnitude of the swelling, fully accounts, in my opinion, for the swelling's not sinking inwards under pressure. But I am far from being convinced, with Walther, that fungi of the dura mater are in their nature always irreducible (see *vol. cit. p.* 82); a belief, which he grounds upon the connexion of the diseased mass with the vessels of the diploe; its constriction by the bone; and its expansion under as well as above the cranium. Here I think Walther is as wrong in saying that none of these fungi can possibly be reduced, as others would be in asserting that it is their invariable character to be reducible. These differences must chiefly depend upon the size of the swelling, in relation to that in the aperture in the skull.

Generally speaking, fungous tumours of the dura mater are very dangerous, as well on account of their nature as of the difficulty of curing them in any certain manner, and of the internal and external disorder which they may occasion. Such as have a pedicle, the base of which is not extensive; which are firm in their texture, without much disease in the surrounding bone, are moveable, not very painful, and in persons who are in other respects quite well, are in general reputed to be the least perilous. These are the cases in which a cure may be attempted with a hope of success, though the event is always exceedingly doubtful.

When the contrary of what has been just related occurs, when the disease is of long continuance, and the brain already affected, nothing favourable can be expected.

Compression is the most simple means of cure, and that which has naturally occurred to such practitioners as have mistaken the disease for an aneurism, or a hernia cerebri. The efficacy of this method has been further misconceived, because the tumour, when not very large, has sometimes been partly, or even wholly, reduced, without any bad consequences. This had no little share in leading to errors concerning the true character of the disease. But, as might be conceived, this reduction only being attended with temporary success, and having no effect whatever on the original cause of the affection, the symptoms returned, and the tumour rose up again the moment the compression was discontinued. There is a fact in the memoir of M. Louis, which seems to evince that good effects may sometimes be produced by compression judiciously employed. A woman brought to the brink of the grave by symptoms occasioned by a tumour of the above kind, having rested with her head for some time on the same side as the tumour, found the swelling so suddenly reduced, without any ill effects, that she thought herself cured by some miracle. Compression, artfully kept up by means of a piece of tin fastened to her cap, prevented the protrusion of the tumour again. The pressure, however, not having been always very exact, the symptoms every now and then recurred, while the tumour was in the act of being depressed again, and they afterward ceased, on the swelling having assumed a suitable position. The symptoms were doubtless occasioned by the irritation which the tumour suffered, in passing the inequalities around the opening through which it protruded. The patient lived in this state nine years, having every now and then fits of insensibility, in one of which, attended with hiccough and vomiting, she perished.

As compression cannot be depended upon, the following safer method may be tried. It consists in exposing the tumour with a knife, which is certainly preferable to caustics, the action of which is very tedious and painful, and can never be limited or extended with any degree of precision. A crucial incision may be made through the scalp covering the tumour, and the flaps dissected up, and reflected so as to bring all the bony circumference into view. Then with trephines repeatedly applied, or with what would be better, Mr. Hey's saws, all the margin of the bone should be carefully removed. Now, if it be true, that the vessels of the diploe are chiefly concerned in the supply of the diseased mass, we see that this source of its growth must be destroyed by the foregoing proceeding.

The tumour, thus disengaged on all sides, may he cut off with a scalpel; and such arteries as bleed much should be tied. Then instead of applying caustic, as sometimes advised, perhaps it would be better to remove every part of both layers of the dura mater immediately under the situation of the excrescence. By this means, and the removal of the surrounding bone and diploe, all chance of the regeneration of the tumour would be prevented. In attempting the excision of a fungus of the dura mater, it is certainly an interesting point to know whether the tumour has an intimate vascular connexion with the diploe and pericranium, as asserted by Siebold, Walther, and some other respectable authorities; though the importance of the information on this subject to the practitioner is somewhat lessened by his being aware that it is necessary always to begin with sawing away the bone in the immediate vicinity of the diseased mass. In the dissection of one case, Walther found the pericranium thickened for a considerable extent around the disease, and closely connected with the tumour by vessels.—(*Vol. cit. p.* 100.)

When the tumour is sarcomatous, and its pedicle small and narrow, as sometimes happens, one should not hesitate to cut it off.

This method is preferable to tying its base with a ligature: a plan which could not be executed without dragging and seriously injuring the dura mater; and the fatal effects of which I saw exemplified in one case that occurred many years ago in St. Bartholomew's Hospital, and was operated upon by the late Mr. Ramsden. Excision is also preferable to caustics, which cause great pain, and very often convulsions. In performing the extirpation, we should remove the whole extent of the tumour, and, if possible, its root, even though it may extend as deeply as the internal layer of the dura mater. This step must not be delayed, for the disease will continue to increase so as to affect the brain, become incurable, and even mortal. It is to such

decision that we must impute the success which attended the treatment of the Spaniard Avalos, of whom Marcus Aurelius Severinus makes mention. The above nobleman was afflicted with intolerable headaches, which no remedy could appease. It was proposed to him to trepan the cranium, an operation to which he consented. This proceeding brought into view, under the bone, a fungous excrescence, the destruction of which proved a permanent cure of the violent pains which the disease had occasioned. It is not mentioned in this case whether the internal layer of the dura mater was healthy or not; but there is foundation for believing that if the extirpation of these tumours be undertaken in time, and bold measures be pursued, as in the instance just cited, success would often be obtained. Indeed, reason would support this opinion; for when the disease is not extensive, it is necessary to expose a much smaller surface of the dura mater.

It appears to me, however, that trepanning can never be warrantable, unless the disease can be indicated by some external changes. I saw my late master, Mr. Ramsden, trepan a man for a mere fixed pain in one part of the head, on the supposition that there was a tumour under the bone; but no tumour was found, and the operation caused inflammation of the dura mater, and proved fatal.

No doubt, in some cases, the hemorrhage will be considerable, as was exemplified in the instance in which Walther made an incision at the base of one of these fungi, in order to ascertain its nature: two pints of blood being lost from several vessels of very large size ere they could be secured; and the farther use of the knife discontinued.

M. Louis has described other tumours, which grow from the surface of the dura mater, when this membrane has been denuded, as after the application of the trephine. They only seem to differ from the preceding in not existing before the opening was made in the skull. Tumour of the dura mater should not be confounded with hernia cerebri.—(See *this article.*) See, on the preceding subject, *Mém sur les Tumeurs fongueuses de la Dure-Mère, par M. Louis, in Mém. de l'Acad. de Chir. t.* 5, 4to. *Encyclopédie Méthodique, partie Chir. art. Dure-Mère. J. P. Kaufmann, de Tumore Capitis fungoso post Cariem Cranii exorto. Helmst.* 1743. *Lassus, Pathologie Chir. t.* 1, *p.* 497, *ed.* 1809. *J. and C. Wenzel, über die Schwammigen Auswuchse auf der aussern Hirnhaut. Fol. Mainz.* 1811 *In this work, the sentiments of M. Louis are espoused. Ph. v. Walther in Journ. für Chir. von C. Graefe, &c. b.* 1, *p.* 55, *&c.* 8vo. *Berlin*, 1820. *The latter writer criticises the opinions of the Wenzels, and of course differs considerably from Louis on several points, some of which I have noticed in the foregoing pages.*

For inflammation of the dura mater, see *Head, Injuries of.*

E

EAR, DISEASES OF.

AN organ so valuable and necessary to the perfection of our existence as the ear should have all the resources of surgery exerted for the preservation of its integrity, and the removal of the diseases with which it may be affected. What, indeed, would have been our lot, if nature had been less liberal, and not endued us with the sense of hearing? As Leschevin has observed, we should then have been ill qualified for the receipt of instruction; a principal inlet of divine and human knowledge would have been closed: and, there being no reciprocal communication of ideas, our feeble reason could never have approached perfection. Even our life itself, being as it were dependent upon all such bodies as surround us, would have been incessantly exposed to dangers. The eyesight serves to render us conscious of objects which present themselves before us, and when we judge them to be hurtful, we endeavour to avoid them. But to say nothing of our inability of looking on all sides at once, our eyes become of no service to us whenever we happen to be enveloped in darkness. The hearing is then the only sense that watches over our safety. It warns us not only of every thing which is moving about us, but likewise of noises which are more or less distant. Such are the inestimable advantages which we derive from this organ. Its importance when healthy makes it worthy of the utmost efforts of surgery when diseased.—(*Leschevin in Mém. sur les Sujets proposes pour le Prix de l'Acad. Royale de Chirurgie, t.* 9, *p.* 111, 112, *éd.* 12*mo.*)

It is not many years since the diseases of the ear were a subject on which the greatest ignorance and the most mistaken opinions prevailed; and indeed how could any correct pathological information be expected, while anatomists had not given a complete and accurate description of the organ itself? Also, notwithstanding what has now been made out respecting disorders of the ear, it is generally admitted that they still require farther investigation and renewed industry. Though Duverney, Valsalva, Morgagni, &c. dispelled some of the darkness which covered this branch of surgery, they left a great deal undone. Since their time, science has been enriched with the valuable discoveries of Cotunni, Meckel, Scarpa, and Comparetti; the first two of whom demonstrated that the labyrinth is filled with a limpid fluid, and not (as was pretended) with confined air; while the last two distinguished anatomists favoured the public with the first very accurate description of the parts composing the labyrinth, especially the semicircular canals.

In 1763, the French Academy of Surgery offered a prize for the best essay on diseases of the ear, and two years afterward the honour was adjudged to that of Leschevin, senior surgeon of the hospital at Rouen. This memoir is still of great value, few modern treatises being more complete. The most useful contributors to our stock of information on the pathology of the ear, subsequently to M. Leschevin, have been Britter and Lenten (*Ueber das schwere Gehoer. Leipz.* 1794); Trampel (*Arnemann's Magaz. b.* 2, 1798); Pfingsten (*Vieljahrige Erfahrung ueber die Gehoerfehler, Kiel*, 1802); Alard (*Sur le Catarrhe d' Oreille*, 8vo. *Paris*, 1807, *edit.* 2); Sir A. Cooper (*Phil. Trans.* 1802); Portal (*Anat. Méd.* 1803); J C. Saunders (*Anat. and Dis. of the Ear*, 1806); Baron Boyer (*Mal. Chir. t.* 6); Itard (*Traité des Mal. de l'Oreille*, 8vo. 2 *tomes*); Saissy, in an essay which received the approbation of the Medical Society of Bourdeaux; and Professor Rosenthal, in a short but sensible tract on the pathology of the ear.—(See *Journ. Complem. t.* 6, 1820.)

But notwithstanding the laudable endeavours of so many men of eminence, the pathology of the internal ear, and the treatment of its diseases, are far, I may say, very far, from a high state of improvement. To farther advances indeed some discouraging obstacles present themselves: the auditory apparatus is extremely complicated; the most important parts of it are entirely out of the reach of ocular inspection; the anatomy of the organ is perhaps not yet completely unravelled; the exact uses and action of several parts of it, anatomically known, are still involved in mystery; the opportunities of dissecting the ear in a state of disease are neither frequent nor duly watched; and even when they are taken, and when vestiges of disease or imperfection are traced to particular parts of the organ, the utmost difficulty is experienced in drawing any useful practical conclusion, because the natural uses of those parts, and the precise manner in which they contribute to the perfection of the ear, are not known to the most enlightened physiologists. We are here nearly in the same helpless dilemma as a watchmaker would be, were he, in examining the interior of a watch, to find parts broken and out of order, the exact uses of which, in the perfection of the instrument, he had not first studied and comprehended. In fact, the physiology of the ear is but very imperfectly understood; and, as Rosenthal remarks (*Journ. Complém. t.* 6, *p.* 17), if, notwithstanding the progress made in optics, and the complete knowledge of the structure of the eye, a perfect explanation has not yet been given of the phenomena of this organ as an instrument of vision, we cannot wonder that, with far more circumscribed information

about acoustics, and the greater difficulty of unravelling the structure of the ear, so little progress should have been made in the physiology of the latter organ. Were it practicable in acoustics to arrive at that precision and certainty which would enable us to establish laws in the theory of sound as fixed as those which relate to light, this void in physiological science might perhaps be obviated. But Rosenthal justly argues, that hitherto the approach to perfection has not been made, and this notwithstanding the learned and valuable labours of Chladni.—(*Akustik.* 4*to. Leipz.* 1802.) Some facts, however, are admitted to be well ascertained, and the researches of Autenrieth and Kerder (*Reil's Archiv. für die Physiol. t.* 9, *p.* 313—376) are honourably mentioned; for though they only elucidate the function of the conductor part of the ear, they are of unquestionable importance to the medical practitioner. It is clearly proved that the difference in the length and breadth of the meatus auditorius, form of the membrana tympani, and the make of the cavity of the tympanum modify sound; that is to say, that the differences of structure of the auricle and the meatus auditorius externus, which merely receive and concentrate the sonorous undulations, as these emanate from a vibrating body, can only influence the degree of force or weakness of the sound; while, on the contrary, the differences of structure in the membrane and cavity of the tympanum are not limited to this effect, but the greater or less tension of the one, and the more or less considerable capacity of the other appear to alter in a greater or less degree the particular character of the sound.—(*Journ. Complém. t.* 6, *p.* 20.)

1. *Wounds and Defects of the external Ear.*

The external ear, which is a sort of instrument calculated for concentrating the undulations or waves of sound, may be totally cut off without deafness being the consequence. For a few days after the loss, the hearing is rather hard; but the infirmity gradually diminishes, the increased sensibility of the auditory nerve compensating for the imperfection of the organic apparatus.—(*Richerand, Nosogr. Chir. t.* 2, *p.* 122, *ed.* 2.)

Dr. Hennen says, that he has met with a case where the external ear was completely removed by a cannon-shot, and yet the sense of hearing was as acute as ever. —(*Principles of Military Surgery, p.* 348, *ed.* 2.) Another case, recorded by Wepfer, also proves that a total loss of the auricle may not cause any material injury of hearing, for the patient of whom he speaks had had the whole of the external ear destroyed by ulceration, and yet could hear as well as before the loss.—(*Kriter und Lentin über das schwere Gehoer, p.* 19, *Leipz.* 1794.)

However, if we are to credit the statement of other writers, the recovery is generally far less complete. Thus Leschevin notices, that they who have lost the external ear, or have it naturally too flat or ill-shaped, have the hearing less fine. The defect can only be remedied by an artificial ear or an ear-trumpet, which, receiving a large quantity of the sonorous undulations, and directing them towards the meatus auditorius, thus does the office of the external ear.—(*Prix de l'Acad. Royale de Chir. t.* 9, *p.* 120, *édit.* 12*mo.*)

Wounds are not the only causes by which the external ear may be lost: its separation is sometimes the consequence of ulceration, and sometimes the effect of the bites of horses and other animals. In cold climates it is frequently frozen, and afterward attacked with inflammation and sloughing. When the external ear is not totally separated from the head, the surgeon should not despair of being able to accomplish the reunion of it. This attempt should always be made, however small a connexion the part may have with the skin; for in wounds of this kind, the efforts of surgery have occasionally succeeded beyond all expectation.

Wounds of the external ear, whatever may be their size and shape, do not require different treatment from that of the generality of other wounds. The reunion of the divided part is the only indication, and it may be in most instances easily fulfilled by means of methodical dressings. Such writers as have recommended sutures for wounds in the ear (says Leschevin), have founded this advice upon the difficulty of applying to the part a bandage that will keep the edges of the wound exactly together. The cranium, however, affords a firm and equal surface, against which the external ear may be conveniently fixed. Certainly, it is not more easy to secure dressings on the nose than the ear; and yet cases are recorded in which the cartilaginous part of the nose was wounded and almost entirely separated, and the union was effected without the aid of sutures.—(See *Mém. de M. Pibrac sur l'Abus des Sutures, in Mém. de l'Acad. de Chir. tom.* 3.)

In wounds of the ear, then, we may conclude that sutures are generally useless and unnecessary. As examples may occur, however, in which the wound may be so irregular and considerable as not to admit of being accurately united, except by this means, it should not be absolutely rejected. An enlightened surgeon will not abandon altogether any curative plans; he only points out their proper utility, and keeps them within the right limits. When sticking plaster, simple dressings, and a bandage that makes moderate pressure appear insufficient for keeping the edges of a wound of the ear in due contact, the judicious practitioner will not hesitate to employ sutures.

When a bandage is applied to the external ear, it should only be put on with moderate tightness, since much pressure gives considerable uneasiness, and may induce sloughing. In order to prevent these disagreeable effects, Leschevin advises us to fill the space behind the ear with soft wool or cotton, against which the part may be compressed without risk.—(*Op. cit. p.* 119.)

Baron Boyer remembers a medical student who was compelled by an ulcer on the sacrum to lie for a long time on his side, in which posture the pressure on the ear caused a slough of the antihelix, and after the separation of the dead part, an aperture, large enough to receive the end of the little finger, was left in the pinna or auricle.

In the application of sutures to the ear, the ancients caution us to avoid carefully the cartilage, and to sew only the skin. They were fearful that pricking the cartilage would make it mortify, "*ce qui est souventefois arrivé*," says Paré. But, notwithstanding so respectable an authority, as Leschevin has remarked, the moderns make no scruple about sewing cartilages. In wounds of the nose, Verduc expressly directs the skin and cartilage to be pierced at once, and the success of the plan is put out of all doubt by a multitude of facts. The same treatment may also be safely extended to the ear.

Celsus, *lib.* 3, *c.* 6, speaks of fractures of the cartilages of the ear; but such an accident seems hardly possible, unless the part be previously ossified. Leschevin and Boyer have never met with such a case, either in practice or in the works of surgical writers.

In this section, a few malformations of the external ear require notice. Sometimes the orifice of the meatus auditorius is diminished by the tragus, antitragus, and antihelix being depressed into it. Here the excision of these wrongly formed eminences has been recommended as a surer means of perfecting the sense of hearing than the use of any tube or dilating instruments. The tragus has been known to project considerably backwards, and to apply itself most closely over the orifice of the meatus, which was also a mere slit instead of a round opening. In one case of this description relief was obtained by the introduction of tubes, calculated to maintain the tragus in its proper position.—(*Dict. des Sciences Méd. t.* 38, *p.* 28.)

Sometimes the outer ear is entirely wanting. Thus Fritelli has given an account of a child in this condition, whose physiognomy at the same time strongly resembled that of an ape.—(*Orteschi Giorn. di Med. t.* 3, *p.* 80.) Oberteuffer has also recorded an example of a total deficiency of the auricles in an adult, who yet heard very well.—(*Stark's Neues Archiv. b.* 2, *p.* 638. *J. F. Meckel, Handbuch der Pathol. Anat. b.* 1, *p.* 400, *Leipz.* 1812.)

I remember a child which was exhibited many years ago in London as a curiosity; it was entirely destitute of external ears, and no vestiges of the meatus auditorii could be seen, these openings being completely covered by the common integuments. Yet the child could hear a great deal, though the sense was certainly dull and imperfect. I recollect that the circumstance of the patient hearing so well as he did, was what excited considerable surprise. I am sorry I do not more particularly recollect at the present time the degree in which this sense was enjoyed, and several other circumstances, such as the child's age, power of speech, &c. The example, however, is interesting, inasmuch as it

proves, that even a deficiency of the auricles, combined with an imperforate condition of both ears, may be unattended with complete deafness, provided the internal and more essential parts of these organs are sound and perfectly formed.

Baron Boyer attended a young man, the lobule of one of whose ears extended in a very inconvenient manner over the cheek; the redundant portion was removed with a pair of scissors, and the wound soon healed.

The auricle not being a very irritable part, is not often inflamed, and when it is so, the affection is generally of an erysipelatous character. Portal has seen the part nearly an inch thick; and he takes notice of the prodigious thickness which the lobe of the ear sometimes acquires in women who wear very heavy earrings, which keep up constant irritation. Small encysted and adipose swellings occasionally grow under the skin of the external ear, and demand the same treatment as swellings of the same nature in other situations.—(See *Tumours.*) Lastly, the external ear is frequently the seat of scrofulous and other ill-conditioned ulcers. These cases generally require cleanliness, alterative medicines, and to be dressed with the ung. hydrarg. nitrat. or a solution of the nitrate of silver; and sometimes, when the sores resist for a long time the effects of medicine and the usual dressings, they will soon heal up, if the treatment be assisted with a blister or seton, kept open on the nape of the neck.—(See *Dict. des Sciences Méd. t.* 38, *p.* 28, 29.)

2. *Of the Meatus Auditorius, and its Imperfections.*

This is the passage which leads from the cavity of the external ear called the concha, down to the membrane of the tympanum. It is partly cartilaginous, and partly bony, and has an oblique winding direction, so that its whole extent cannot be easily seen. There are circumstances, however, in which it is proper to look as far as possible into the passage. Such is the case, when the surgeon is to extract any foreign body, to remove an excrescence, or to detect any other occasion of deafness. Fabricius Hildanus gives a piece of advice upon this subject, not to be despised; namely, to expose the ear to the rays of the sun, in order to be enabled to see the very bottom of the passage.

Mr. Buchanan recommends the patient to be placed upon a low seat, with the ear exposed to the rays of the sun. The surgeon should then lay hold of the auricle with the left hand, by placing the thumb in the concha, and with the index and middle finger of the same hand placed behind the cartilage, take hold of the cavity, and pull it outwards and upwards, so as to elongate the cartilaginous part of the meatus. With the help of a slightly curved probe, by which the tragus is to be drawn a little outwards, and the diameter of the tube increased, the whole of the meatus and membrana tympani may then be distinctly seen.—(See *Buchanan's Illustrations of Acoustic Surgery, p.* 1.) When the assistance of sunshine cannot be obtained, and in the evening, Mr. Buchanan finds great advantage from the use of an ingenious kind of lantern, which he has invented for examining the ear, and which he terms an inspector auris. When it is used, the room is darkened, and the focus from the lantern directed into the meatus.

The surgical operations practised on the meatus auditorius are confined to opening it, when preternaturally closed, extracting foreign bodies, washing the passage out with injections, and removing excrescences.

The case which we shall next treat of, is the imperforation of the meatus auditorius externus, a defect with which some children are born.

When the malformation exists in both ears, it generally renders the subject dumb as well as deaf, for, as he is incapable of imitating sounds which he does not hear, he cannot of course learn to speak, although the organs of speech may be perfect, and in every respect rightly disposed. In this case the surgeon has to rectify the error of nature, and (to use the language of Leschevin) he has to give, by a double miracle, hearing and speech to an animated being, who, deprived of these two faculties, can scarcely be regarded in society as one of the human race. How highly must such an operation raise the utility and excellence of surgery in the estimation of the world!

When the meatus auditorius externus is merely closed by an external membrane, the nature of the case is evident, and the mode of relief equally easy. But when the membrane is more deeply situated in the passage, near the tympanum, the diagnosis is attended with increased difficulty, and the treatment with greater trouble.

If the preternatural membrane be external, or only a little way within the passage, it is to be divided with a bistoury; the small flaps are to be cut away; a tent of a suitable size is to be introduced into the opening; and the wound is to be healed *secundum artem*, care being taken to keep it constantly dilated, until the cicatrization is completed.

When the obstruction is deeply situated, we must first be sure of its existence, which is never ascertained, or even suspected, till after a long while. It is not till after children are past the age at which they usually begin to talk, that any defect is suspected in the organ of hearing, because until this period, little notice is taken whether they hear or not. As soon as it is clear that this sense is deficient, the ears should always be examined with great attention, in order to discover, if possible, the cause of deafness. Sometimes the infirmity depends upon a malformation of the internal ear, and the cause does not then admit of detection. The most convenient method of making the examination is to expose the ear which is about to be examined to the light of the sun. In this situation, the surgeon will be able to see beyond the middle of the bony part of the meatus, if he places his eye opposite the orifice of the passage, and takes care to efface the curvature of the cartilaginous portion of the canal, by drawing upwards the external ear. If the passage has been carefully cleansed before the examination, the skin forming the obstruction may now be seen, unless it be immediately adherent to the tympanum.

When the preternatural septum is not closely united to the tympanum, its destruction should be attempted; and hopes of effecting the object either suddenly or gradually may reasonably be entertained. According to Leschevin, the particular situation of the obstruction is the circumstance by which the surgeon ought to be guided in making a choice of the means for this operation. If the membranous partition is so far from the tympanum, that it can be pierced without danger of wounding the latter part, there can be no hesitation in choosing the plan to be adopted. In the contrary state of things, Leschevin is an advocate for the employment of caustic, not only on account of the risk of injuring the tympanum with a cutting instrument, but also because if the puncture were ever so well executed, a tent could not be introduced into it, so as to prevent it from closing again.

In the first case, a very narrow sharp-pointed bistoury should be used: after its blade has been wrapped round with a bit of tape to within a line of the point, it is to be passed perpendicularly down to the preternatural membrane, which is to be cut through its whole diameter. The instrument being then directed first towards one side, then the other, the crucial incision is to be completed. As the flaps, which are small and deeply situated, cannot be removed, the surgeon must be content with keeping them separated by means of a blunt tent. The wound will heal just as favourably as that occasioned by removing the imperforation of the concha, or outer part of the meatus auditorius.—(*Prix de l'Acad. de Chir. p.* 124—126, *t.* 9.) In the second case, that is to say, when the risk of wounding the tympanum leads us to prefer the employment of caustic, the safest and most commodious way of putting the plan in execution would be that of touching the obstruction, as often as circumstances may require, with the extremity of a bougie armed with the argentum nitratum. In the intervals of the applications, no dressings need be introduced, except a bit of clean soft cotton, for the purpose of absorbing any discharge which may take place within the passage.

It is manifest, that if the whole or a considerable part of the meatus auditorius externus were wanting, the foregoing measures would be insufficient. The following observations of Leschevin merit attention: "I do not here allude to cases, in which a malformation of the bone exists. I know not whether there are any examples of such an imperforation; but it is clear that it would be absolutely incurable. I speak of a temporal bone perfectly formed in all its parts, and the meatus auditorius of which, instead of being merely

lined by a membrane, as in the natural state, is blocked up by the cohesion of the parietes of this membrane, throughout a certain extent of the canal; just as the urethra, rectum, or vagina is sometimes observed to be not simply closed by a membrane, but by a true obliteration of its cavity.

Such a defect in the ear may be congenital, and it may also arise from a wound or ulceration of the whole circumference of the meatus auditorius externus, this canal having become closed by the adhesion of its parietes, on cicatrization taking place.

Such an imperforation, whether congenital or accidental, must certainly be more difficult to cure than the examples treated of above; but," says Leschevin, "I do not for this reason believe that the case ought to be entirely abandoned. Yet I would not have the cure attempted in all sorts of circumstances. For instance, if the defect only existed in one ear, and the other were sound, I would not undertake the operation, because as the patient can hear tolerably well on one side, the advantages which he might derive from having the enjoyment of the other ear, would not counterbalance the pain and bad symptoms occasioned by such an experiment, the success of which is extremely uncertain. I would not then run the risk of making a perforation, except in a case of complete deafness; and I propose this means only as a dubious one, upon the fundamental maxim, so often laid down, that it is preferable to employ a doubtful remedy, than none at all.

With respect to the mode of executing this operation," says Leschevin, "the trocar seems the most eligible instrument. I would employ one that is very short, and the point of which is bluntish, and only projects out of a cannula as little as possible. This construction would indeed make the instrument less adapted to pierce any thing; but still, as the parts to be perforated are firm, their division might be accomplished sufficiently well; and the inconvenience of a trivial difficulty in the introduction of the trocar is comparatively much less, than that which would attend the danger of wounding with a sharper point the membrane of the tympanum. I would plunge the point of the instrument into the place where the opening of the meatus auditorius externally ought naturally to be, and which would be denoted, either by a slight depression, or at all events by attending to the different parts of the ear, especially the tragus, which is situated directly over this passage. I would push in the trocar gently, in the direction of the canal formed in the bone, until the point of the instrument felt as if it had reached a vacant space. Then, withdrawing the trocar and leaving the cannula, I would try whether the patient could hear. I would then introduce into the cavity of the cannula itself a small, rather firm tent of the length of the passage, or a small bougie. By means of a probe I would push it to the end of the cannula, which I would now take out, observing to press upon the tent, which is to be left in. The rest of the treatment consists in keeping the canal pervious, making it suppurate, and healing it with common applications. One essential caution, however, would be that of keeping the part dilated long after it had healed: otherwise it might close again, and a repetition of the operation become necessary. This happened to Heister, as he himself apprizes us, and it occurred to Roonhuysen in treating imperforations of the vagina.

If the cohesion of the parietes of the meatus auditorius externus were to extend to the tympanum inclusively, the operation would be fruitless; but as it is impossible to ascertain this circumstance before the attempt is made, the surgeon would incur no disgrace by relinquishing the operation, and giving up the treatment of an incurable disease. If, then, after the trocar were introduced to about the depth of the tympanum, the situation of which must be judged of by our anatomical knowledge, no cavity were met with, the operation should be abandoned; and if, in these circumstances, any one were to impute the want of success to the inefficacy of surgery, or the unskilfulness of the surgeon, he would act very unfairly.

It is also plain, that such an operation could cure a congenital deafness, only inasmuch as it might depend upon the imperforation; for if there should exist, at the same time, in the internal ear any malformation, destructive of the power of the organ, the remedying of the external defect would be quite useless."—(*Leschevin, in Prix de l'Acad. de Chirurgie, tom. 9, p. 127. 132.*)

We find that this author entertains a great dread of wounding the tympanum, and certainly he is right in generally insisting upon the prudence of avoiding such an accident. It will appear, however, in the sequel of this article, that under certain circumstances puncturing the tympanum has been successfully practised, as a mode of remedying deafness. The operation, however, demands caution; for, if done so as to injure the connexion of the malleus with the membrana tympani, the hearing must ever afterward be very imperfect.

3. *Unusual Smallness of the Meatus Auditorius Externus.*

Imperforation is not the only congenital imperfection of the meatus auditorius; this passage is occasionally too narrow for the admission of a due quantity of the sonorous undulations, and the sense is of course weakened. Leschevin mentions that M. de la Metrie found this canal so narrow in a young person that it could hardly admit a probe. What has been observed concerning the imperforation is also applicable to this case. If it depends upon malformation of the bone it is manifestly incurable; but if it is owing to a thickening of the soft parts within the meatus, hopes may be indulged of doing good by gradually dilating the passage with tents, which should be increased in size from time to time, and lastly making the patient wear, for a considerable time, a tube adapted to the part in shape.—(*Leschevin in Prix de l'Acad. de Chirurgie, t. 9, p. 132.*)

Mr. Earle has published a case in which the diameter of the meatus auditorius was considerably lessened by a thickening of the surrounding parts, and especially of the cuticle, attended with a discharge from the passage, and great impairment of hearing. A cure was effected by injecting into the passage a very strong solution of the nitrate of silver, which in a few days was followed by a detachment of the thickened portions of cuticle. This evacuation was assisted by throwing warm water into the passage.—(See *Med. Chir. Trans. vol. 10, p. 411, &c.*) Boyer was consulted for a deafness, which arose from a malformation which consisted of a flattening of the meatus, its opposite sides being for some extent in contact. The patient was advised to wear in the ear a gold tube of suitable shape by which means he was enabled to hear perfectly well.

4. *Faulty Shape of the Meatus Auditorius Externus.*

Anatomy informs us that this passage is naturally oblique, and somewhat winding; and natural philosophy teaches us the necessity of such obliquity, which multiplies the reflections of the sonorous waves, and thereby strengthens the sense. This theory, says Leschevin is confirmed by experience; for there are persons in whom the meatus auditorius is almost straight, and they are found to be hard of hearing. If there is any means of correcting this defect, it must be that of substituting for the natural curvature of the passage a curved and conical tube, which must be placed at the outside of the organ, just like a hearing trumpet. The acoustic instrument invented by Deckers, which is much more convenient, might also prove useful.—(*Op. cit. p. 133.*)

5. *Extraneous Substances, Insects, &c. in the Meatus Auditorius Externus.*

Foreign bodies met with in this situation are inert substances which have been introduced by some external force; insects, which have insinuated themselves into the passage; or the cerumen itself, hardened in such a degree as to obstruct the transmission of the sonorous undulations. Worms which make their appearance in the meatus auditorius are always produced subsequently to ulcerations in the passage, or in the interior of the tympanum, and very often such insects are quite unsuspected causes of particular symptoms. In the cases of surgery published in 1778 by Acrel, there is an instance confirming the statement just offered. It is the case of a woman who, having been long afflicted with a hardness of hearing, was suddenly seized with violent convulsions without any apparent cause, and soon afterward complained of an acute pain in the ear. This affection was followed by a recurrence of convulsions, which were still more vehement. A small tent of fine linen moistened with a mixture of oil and laudanum, was introduced into the mea-

tus auditorius, and on removing it the next day several small round worms were observed upon it, and from that period all the symptoms disappeared. To this case we shall add another from Morgagni. A young woman consulted Valsalva, and told him that when she was a girl a worm had been discharged from her left ear; that another one about six months ago had also been discharged very much like a small silkworm in shape. This event took place after very acute pain in the same ear, the forehead, and temples. She added, that since this she had been tormented with the same pains at different intervals, and so severely that she often swooned away for two hours together. On recovering from this state, a small worm was discharged, of the same shape as, but much smaller than the preceding one, and she was now afflicted with deafness and insensibiltiy on the same side. After hearing this relation Valsalva no longer entertained any doubt of the membrane of the tympanum being ulcerated. He proposed the employment of an injection in order to destroy such worms as yet remained. For this purpose distilled water of St. John's wort, in which mercury had been agitated, was used. In order to prevent a recurrence of the inconvenience, Morgagni recommends the affected ear to be closed up when the patient goes to sleep, in autumn and summer. If this be not done, flies, attracted by the suppuration, enter the meatus auditorius, and while the patient is unconscious deposite their eggs in the ear. Acrel, in speaking of worms generated in the meatus auditorius, observes, that there is no better remedy for them than the decoction of ledum palustra injected into the ear several times a day. However, as this plant cannot always be procured, an infusion of tobacco in oil of almonds may be used, a few drops of which are to be introduced into the ear and retained there by means of a little bit of cotton. This application, which is not injurious to the lining of the passage, is fatal to insects, and especially to worms. When caterpillars, ants, earwigs, and other insects, have insinuated themselves into the meatus auditorius, they may be removed with a piece of lint smeared with honey; and when they cannot be extracted by this simple means, they may sometimes be taken out with a small pair of forceps. In general, however, the most safe and expeditious practice for the removal of small insects, peas, beads, and other extraneous bodies from the meatus auditorius, is to throw tepid water into the passage with a proper syringe, by which means they are forced out with the fluid. When the bead or globular substance is small (according to Mr. Buchanan), the best mode of extraction will be by means of a syringe and injection of tepid water. For this purpose the point of the syringe ought to be pressed gently against the edge of the meatus, so that it may occupy as little of the diameter of the tube as possible, and when the injection arrives at the membrana tympani, the regurgitation will force the bead or other substance outwards. If this be rather large, it may perhaps remain at the entrance of the meatus, whence it ought to be extracted by means of a pair of forceps.—(See *Buchanan's Illustrations of Acoustic Surgery*, *p.* 40.)

A few days ago (May, 1829) I was called to a child about two years and a half old, into one of whose ears a pebble, and into the other a French bean, had been pushed by another child, and remained there for ten months, causing complete deafness and extreme suffering. By throwing tepid water forcibly into the ear, I soon dislodged these foreign bodies, which lay close against the tympanum, entirely hidden by the swollen state of the lining of the ear, indurated wax and dried discharge. With a bent probe their extraction was then readily effected. Several surgeons, previously consulted, had failed in their endeavours to remove the substances by other methods.

The presence of foreign bodies in the ear often occasions the most extraordinary symptoms, as we may see in the fourth observation of Fabricius Hildanus, Cent. 13. After four surgeons, who had been successively consulted, had in vain exerted all their industry to extract a bit of glass from the left ear of a young girl, the patient found herself abandoned to the most excruciating pain, which soon extended to all the side of the head, and which, after a considerable time, was followed by a paralysis of the left side, a dry cough, suppression of the menses, epileptic convulsions, and at length an atrophy of the left arm. Hildanus cured her by extracting the piece of glass which had remained eight years in her ear, and had been the cause of all this disorder. Although the extraction must have been very difficult, it does not appear that Hildanus found it necessary to practise an incision behind the ear, as some authors have advised, and among them Duverney, who has quoted the foregoing case. We must agree with Leschevin that such an incision does not seem likely to facilitate the object very materially; for it must be on the outside of the extraneous substance, which is in the bony part of the canal. The incision enables us in some measure to avoid the obliquity of the passage, as Duverney has observed; but it is not such obliquity of the cartilaginous portion of the canal that can be a great impediment; for as it is flexible it may easily be made straight by drawing the external ear upwards. Hence Fabricius ab Aquapendente rejected this operation first proposed by Paulus Ægineta; and it is justly disapproved of by Leschevin.—(*Prix de l'Acad. de Chir. t.* 9, *p.* 147, *édit.* 12*mo.*)

Sabatier relates a case in which a paper ball, which had been pushed into the meatus auditorius, made its way by ulceration into the cavity of the tympanum, where an abscess formed, which communicated with the interior of the cranium.—(*Dict. des Sciences Méd. t.* 7, *p.* 8.)

6. *Meatus Auditorius obstructed with thickened or hardened Cerumen.*

The cerumen secreted in the meatus auditorius by the sebaceous glands frequently accumulates there in large quantities, and, becoming harder and harder, at length acquires so great a degree of solidity as entirely to deprive the patient of the power of hearing. Galen has remarked, *è numero eorum quæ meatum obstruunt, sordes esse quæ in auribus colligi solent.* This species of deafness is one of those kinds which are the most easy of cure, as is confirmed by observers, especially Duverney. Formerly, frequent injections either with simple olive oil or oil of almonds were recommended. The injection was retained by a piece of cotton, and when there was reason to believe that the matter was sufficiently softened, an attempt was made to extract it by means of a small scoop-like instrument. Various experiments were made by Haygarth, at Chester, in 1769, from which it appears that warm water is preferable to oil. The water dissolves the mucous matter which connects together the truly ceruminous particles, and which is the cause of their tenacity; other applications only succeeding by reason of the water which they contain.

The lodgementof hard pellets of wax, if neglected, may ultimately produce ulceration of the tympanum and other serious mischief. Thus, in one case, Ribes and Chaussier found the handle of the malleus separated from its head, partly destroyed and covered with the hardened cerumen that had made its way into the tympanum.—(See *Dict. des Sciences Méd. t.* 38, *p.* 30.)

"The symptoms (says Mr. Saunders) which are attached to the inspissation of the cerumen are pretty well known. The patient, besides his inability to hear, complains of noises, particularly a clash or confused sound in mastication, and of heavy sounds, like the ponderous strokes of a hammer.

The practitioner is led by the relation of such symptoms to suspect the existence of wax; but he may reduce it to a certainty by examination.

Any means capable of removing the inspissated wax may be adopted: but syringing the meatus with warm water is the most speedy and effectual, and the only means necessary. As the organ is sound, the patient is instantaneously restored."—(*Anatomy of the human Ear, with a Treatise on its Diseases, by J. C. Saunders*, 1806, *p.* 27, 28.)

In order to throw an injection into the ear with effect, a syringe capable of holding from four to six ounces, should be employed; and the fluid injected with a good deal of force, care being taken to let it enter in the natural direction, and not against one of the sides of the passage. The surgeon must also avoid pressing the pipe too deeply into the ear, so as to hurt the tympanum. As the fluid regurgitates with considerable rapidity, a small basin is to be held close up to the ear at the time of using the syringe, so as to catch the water and hinder it from wetting the patient's clothes; for the surer prevention of which a napkin is also to be laid over the shoulder. In general, it is necessary to throw

the water into the ear six or seven times, or more, ere the pellets of wax are loosened and entirely brought out; and sometimes the injections will not completely succeed the first day on which they are employed. The evening before the syringe is to be used, it may occasionally be best to drop a little sweet oil into the ear.

7. *Imperfect Secretion of Wax.*

When the wax is deficient in quantity, Mr. Buchanan recommends warmth and stimulant applications. He advises two drops of the following mixture to be introduced into the meatus auditorius, every night at bedtime. ℞. Acid. pyrolygn., spir. ætheris sulphur., Ol. terebinth. ā ā M. One tablespoonful of the following medicine is also to be taken at the same time. ℞. Tinct. colchici ℥ iij. Aq. distillat. ℥ vj. M. If costiveness prevail, the pilulæ rhei comp. are to be given. —(See *Buchanan's Acoustic Surgery, p.* 60.)

When the quality of the secretion requires improvement, the meatus is to be frequently washed out, and a little of the infusion of quassia with rhubarb and magnesia given once or twice a day. The warm bath is to be occasionally used at bedtime, and the following powder exhibited. ℞. Hydrarg. submur. gr. ij. Pulv. ipecac. comp. ℈j. ft. Pulv. Hora decubitus sumend. In cases where the ear is preternaturally dry, and the cuticle of the meatus peels off, the ensuing injection is to be used every second or third day. ℞. Acid. pyrolign. ℥ ij. Aquæ distillatæ ℥ vj. ft. lotio; or the vapour of a mixture of equal parts of distilled water and pyroligneous acid might be introduced three times a week into the meatus with the aid of a glass retort. A little cotton should afterward be put into the ear.—(See *Buchanan's Acoustic Surgery, p.* 62.)

8. *Discharges from the Meatus Auditorius.*

Purulent discharges from the ear either come from the meatus auditorius externus itself, or they originate from suppuration in the tympanum, in consequence of blows on the head, abscesses after malignant fevers, the small-pox, or the venereal disease. In such cases, the little bones of the ear are sometimes detached, and escape externally, and complete deafness is most frequently the consequence. However, in a few instances, total deafness does not always follow even this kind of mischief, as I myself have witnessed on one or two occasions. There is greater hope when the disorder is confined to the meatus; as judicious treatment may now avert the most serious consequences. In Acrel's surgical cases, there is a case relative to the circumstance of which we are speaking. Suppuration took place in the meatus auditorius externus, in consequence of acute rheumatism, which was followed by vertigo, restlessness, and a violent headache. The matter discharged was yellowish, of an aqueous consistence and acid smell. The meatus auditorius was filled with a spongy flesh. On introducing a probe, our author felt a piece of loose rough bone, which he immediately took hold of with a pair of forceps and extracted. From the time when this was accomplished the discharge diminished; and with the aid of proper treatment, the patient became perfectly well.

The meatus auditorius, like all other parts of the body, is subject to inflammation. This is frequently produced by exposure to cold. It is hardly necessary to say, that generally topical bleeding and antiphlogistic means are indicated. The meatus auditorius should also be protected from the cold air, particularly in the winter season, by means of a piece of cotton.

Mr. Saunders observes, "When the means employed to reduce the inflammation have not succeeded, and matter has formed, it is generally evacuated, as far as I have observed, between the auricle and mastoid process or into the meatus. If it has been evacuated into the meatus, the opening is most commonly small, and the spongy granulations, squeezed through a small aperture, assume the appearance of a polypus. Sometimes the small aperture by which the matter is evacuated is in this manner even closed, and the patient suffers the inconvenience of frequent returns of pain from the retention of the discharge. When the parts have fallen into this state, it will be expedient to hasten the cure by making an incision into the sinus, between the auricle and mastoid process.

It occasionally happens that the bone itself dies in consequence of the sinus being neglected, or the original extent of the suppuration. The exfoliating parts are the meatus externus of the os temporis, or the external lamina of the mastoid process."—(*P.* 24, 25.)

In some examples of purulent discharge from the ear, and particularly in scrofulous patients, Mr. Buchanan employs alterative medicines, as calomel, the tincture of iodine, and the compound rhubarb pills of the *Edinb. Pharmacopœia.* He also sometimes has recourse to the pyroligneous injection.—(See *Illustrations of Acoustic Surgery, p.* 93, &c.) Some additional cases in favour of the efficacy of iodine, in certain forms of deafness may be found in Dr. Manson's work.—(See *Medical Researches on the Effects of Iodine,* 8vo. *London,* 1825.)

9. *Excrescences in the Meatus Auditorius.*

Though the membrane lining the meatus auditorius is very delicate, it is not the less liable to become thickened, and to form polypous excrescences. This case, however, is not common. As such tumours are ordinarily firmer in their texture than polypi of the nose, they are sometimes not so easily extracted with forceps. When they are situated near the external orifice, and admit of being taken hold of with a small pair of forceps or a hook, and drawn outwards, they may easily be cut away. When the tumours are more deeply situated, Mr. B. Bell recommends the use of a ligature. Here the same plan may be pursued as will be explained in the article *Polypus.* But it sometimes happens, that the excrescences cannot be removed in this manner; as, instead of being adherent by a narrow neck, they have a broad base, which occupies a considerable extent of the passage. In such cases, the use of escharotics has been proposed; but they cannot be used without risk of injuring the tympanum. Mr. Buchanan prefers the practice of removing polypi of the meatus with forceps, and afterward touching the part from which they grew with the ung. hydrarg. nitrat., or tinct. ferri muriati.—(*Acoustic Surgery, p.* 74.) He also recommends washing out the passage every day with the injection, ℞. Acid. pyrolign. ℥ ij. Aq distillatæ ℥ vj. ft. lotio.

10. *Herpes of the Meatus Auditorius.*

An herpetic ulcerous eruption sometimes affects the meatus auditorius and auricle, producing considerable thickening of the skin, and so great an obstruction of the passage that a good deal of deafness is the consequence. Mr. Saunders remarks, that in this case, "the ichor which exudes from the pores of the ulcerated surface, inspissates in the meatus, and not only obstructs the entrance of sound, but is accompanied with a great degree of fetor. This disease is not unfrequent. I have never seen it resist the effect of alterative medicines," the use of injections containing the oxymuriate of quicksilver, and the application of the unguentum hydrargyri nitrati. Mr. Saunders exhibited calomel as the alterative, and in one instance, employed a solution of the argentum nitratum as an injection.—(*Page* 25, 26.) When the disease is obstinate, a seton should be made on the nape of the neck, or a blister be applied behind the ear. The tincture of iodine should also be tried.

11. *Affections of the Tympanum.*

The ear is sometimes affected with a puriform ichorous discharge, attended with a loss of hearing, proportionate to the degree of disorganization which the tympanum has sustained. Frequently, on blowing the nose, air is expelled at the meatus auditorius externus; and when this is the case, it is evident that the discharge is connected with an injury or destruction of the membrana tympani. However, when the Eustachian tube is obstructed with mucus or matter, or when it is rendered impervious, and permanently closed by inflammation, the membrana tympani may not be perfect, and yet it is clear, no air can in this state be forced out of the external ear in the above manner. An examination with a blunt probe or with the eye, while the rays of the sun fall into the passage, should therefore not be omitted. If the membrane have any aperture in it, the probe will pass into the cavity of the tympanum, and the surgeon feel that his instrument is in contact with the ossicula.

In this manner the affection may be discriminated from an herpetic ulceration of the meatus auditorius externus. The causes are various: In scarlatina maligna, the membrana tympani occasionally inflames, and sloughs; all the ossicula are discharged, and if the

patient live, he often continues quite deaf. An earache, in other words, acute inflammation of the tympanum, is the most common occasion of suppuration in this cavity, in which, and the cells of the mastoid process, a good deal of pus collects. At length the membrana tympani ulcerates, and a large quantity of matter is discharged; but as the secretion of pus still goes on, the discharge continues to ooze out of the external ear.

Instead of stimulating applications, inflammation of the tympanum demands the rigorous employment of antiphlogistic means. Unfortunately, it is a too common practice in this case to have recourse to acrid spirituous remedies. Above all things, the repeated application of leeches to the skin behind the external ear and over the mastoid process, should never be neglected. As soon as the inflammation ceases, the degree of deafness occasioned by it will also disappear. This, however, does not always happen.

When an abscess is situated in the cavity of the tympanum, Mr. Saunders thinks that the membrana tympani should not be allowed to burst by ulceration, but be opened by a small puncture.—(*P.* 31.) However, unless there were the strongest ground for believing that the Eustachian tube were impervious, this advice, I think, ought not to be followed, more especially as the symptoms are generally too vague to afford any degree of certainty in the diagnosis.

Sometimes the disease of which we are treating, is more insidious in its attack; slight paroxysms of pain occur, and are relieved by slight discharges. The case goes on in this way, until, at last, a continual discharge of matter from the ear takes place. The disorder is destructive in its tendency to the faculty of hearing, and it rarely stops until it has so much disorganized the tympanum and its contents, as to occasion total deafness. Hence, Mr. Saunders insists upon the propriety of making attempts to arrest its progress,—attempts which are free from danger; and he censures the foolish fear of interfering with the complaint, founded on the apprehension, that bad constitutional effects may originate from stopping the discharge.

If the case be neglected, the tympanum is very likely to become carious; before which change, the disease, says Mr. Saunders, is mostly curable.

Mr. Saunders divides the complaint into three stages: 1. A simple puriform discharge. 2. A puriform discharge complicated with fungi and polypi. 3. A puriform discharge with caries of the tympanum. As the disease is local, direct applications to the parts affected are chiefly entitled to confidence. Blisters and setons may also be advantageously employed. Mr. Saunders's practice consisted in administering laxative medicines and fomenting the ear, while inflammatory symptoms lasted, and afterward injecting a solution of the sulphate of zinc or cerussa acetata.

In the second stage, when there were fungi, he removed or destroyed them with forceps, afterward touched their roots with the argentum nitratum, or injected a solution of alum, sulphate of zinc, or argentum nitratum.

Writers describe a relaxed state of the membrana tympani as a cause of deafness. If, says a late author, after a discharge from the meatus auditorius externus, or cavity of the tympanum, or a dropsy of the latter cavity, the hearing remains hard, there is reason to suspect that the infirmity may depend upon relaxation of the membrane of the tympanum or paralysis of the internal muscle of the malleus. This suspicion will be strengthened if the deafness should increase in damp and lessen in dry weather; and particularly, if it be found that the hearing is benefited by introducing into the ear dry warm tonic applications, such as the smoke of burning juniper-berries or other astringent vegetable substances. The decoction of bark, used as an injection, is also said to have done good.

The relaxation of the tympanum, alleged to proceed from a rupture of the muscle of the malleus, is deemed incurable; but it is not so with the case which depends upon paralysis of this muscle. Here tonic injections into the tympanum, through the Eustachian tube, are recommended.—(*Dict. des Sciences Méd. t.* 38, *p.* 50.) Electricity, stimulating liniments, gargles, and a blister, might also be tried.

Imperfect hearing is supposed sometimes to arise from preternatural tension of the membrane of the tympanum, indicated by the patient hearing better in wet than dry weather, and by his hearing what is spoken in a low tone near his ear better than any thing said in a loud manner. The opinions delivered by writers on the causes of this affection are only uncertain conjectures. The local treatment recommended consists of injecting into the meatus auditorius emollient decoctions or warm milk, or introducing into the passage a dossil of soft cotton, dipped in oil of sweet almonds. Nothing certain is known respecting the proper constitutional treatment, as must be clear from our ignorance of the causes of this form of disease of the ear.

Hardness of hearing appears sometimes to be caused by a chronic thickening of the membrane of the tympanum; and it is alleged, that there are cases of this description which proceed from syphilis, and require mercury. An issue in the arm nearest the affected ear, the tincture of iodine, and emollient and slightly stimulant injections, are likewise commended. When the tympanum was so considerably thickened, that there was no chance of restoring it to a healthy state, Portal questioned whether it might not be advisable to make a small opening in it?—(*Précis de Chir. Pratique*, *t.* 2, *p.* 430.) This operation which is said to have been first suggested by Cheselden, will be considered in the ensuing section.

Morgagni found the cavity of the tympanum intersected by numerous membranes, which impeded the movements of the ossicula.—(*Epist. an.* 6, § 4.)

Meckel does not mention any example of a deficiency of all the ossicula.—(*Handb. des Pathol. Anat. b.* 1, *p.* 402.) Mersanni, however, found the incus wanting.—(*Bonet Sepulch. t.* 1, *sect.* 19, *obs.* 4, § 1.) Caldani, the malleus and incus.—(*Epist. ad Haller, t.* 6, *p.* 142.) The latter case was unattended with any bad effect on the hearing; the first with deafness. In a deaf child three years of age, Bailly found the ossicula of only one-third their proper size.—(*Bonet Sepulch. t.* 1, *sect.* 19, *obs.* 4, § 3.) In an example where the fenestra rotunda was obstructed, Cotunni found the ossicula twice as large as natural.—(*De Labyrinthi Auris contentis*, § 72, and *Meckel's Handb. des Pathol. Anat. b.* 1, *p.* 402.) A case in which all the ossiculi were wanting, is now on record.—(See *Dict. des Sciences Méd. t.* 38, *p.* 114.)

12. *Obstruction of the Eustachian Tube.*

This is often a cause of a considerable degree of deafness, because it is necessary for perfect hearing, that air should be conveyed from the mouth through this passage into the cavity of the tympanum, which now can no longer happen.

A degree of deafness generally attends a severe cold, which is accounted for by the Eustachian tube being obstructed with thickened mucus. Mr. Saunders tells us, that the obstruction most frequently arises from syphilitic ulcers in the throat, or sloughing in the cynanche maligna. The deafness comes on when such sores are healed; that is, when the obstruction is complete. The descent of a nasal polypus into the pharynx, and enlarged tonsils, have also been known to close the tube.—(*P.* 42.)

When the Eustachian tube is obstructed, the patient cannot feel the membrana tympani crackle, as it were, in his ear, on blowing forcibly with his nose and mouth stopped. Previous ulceration, or disease of the throat will sometimes facilitate the diagnosis.

When the Eustachian tube is obstructed with mucus, it has been proposed to employ injections, which are to be thrown by means of a syringe and catheter, into the guttural orifice of that canal. This operation, however, is alleged to be always attended with trouble; and, when the os spongiosum inferius happens to be situated near the floor of the orbit, the introduction of any instrument, like a female catheter, would be impracticable.—(*Richerand, Nosogr. Chir. t.* 2, *p.* 131, *id.* 2.)

Sir A. Cooper had noticed, that hearing was only impaired, not lost, when suppurations in the tympanum had injured and even destroyed the membrana tympani, and that the degree of deafness by no means equalled what resulted from an obstruction of the Eustachian tube. Hence, when the tube was permanently obliterated, he conceived that a small puncture of the membrana tympani might be the means of enabling the patient to hear. This gentleman reports four cases, in which the experiment was made with success.

The operation consists in introducing an instrument, resembling a hydrocele trocar, but curved, into the meatus auditorius externus, and pushing it through

the anterior and inferior part of the membrana tympani; a place rendered most eligible on account of the situation of the corda tympani and manubrium of the malleus, parts which should be left uninjured. The instrument must not be introduced far, lest it wound the vascular lining of the tympanum, and cause a temporary continuance of the deafness, by an effusion of blood. When the puncture is made in proper cases and in a judicious manner, hearing is immediately restored. A small hole in the membrana tympani now conveys the air into the cavity of the tympanum, answering the same purpose as the Eustachian tube.

The surgeon will be able to operate with more ease, if he take care to lessen the curvature of the meatus auditorius by drawing upwards the external ear.

There is some chance of a relapse in consequence of the opening closing up. This consideration led Richerand to propose making the aperture with caustic, so as to destroy a part of the membrane.—(*Nosogr. Chir. t.* 2, *p.* 132, *ed.* 2.) The suggestion is not likely to be adopted, on account of the inconveniences of applying caustic within the ear. Mr. Saunders is an advocate for making the opening large. However, perhaps the best method of doing the operation both effectually and safely is that lately described by Mr. Buchanan, of Hull, the chief peculiarity of whose mode consists in *drilling* the perforation. The quadrangular point of his perforator cuts the fibres of the membrana tympani across; they retract; the wound assumes an oval shape; and there is less danger of its closure again, than after the common plan of making a single puncture. "A room (says Mr. Buchanan), with a window fronting the south, should be chosen for the place of the operation; and the patient placed on a low seat, so that the rays of the sun may fall into the meatus. The manubrium or handle of the malleus, will then be distinctly seen, pointing downwards and inwards; occupying the superior half of the membrana tympani. The surgeon being seated on a high chair, should lay his left hand on the head of the patient, and with the right take hold of the instrument in the same manner as he would a pen when writing: he should then cautiously and steadily enter the point of the perforator into the membrana tympani, about half-way between the centre and its lower edge, and with the thumb and index finger, give the instrument half a turn one way and then half a turn the other, and in this manner gently push the point about a line through the membrane."—(See *Engraved Representation of the Anatomy of the Ear*, *p.* 33.) Mr. Saunders, by puncturing the tympanum, instantaneously restored the hearing of one patient, who had been deaf thirty years in consequence of a destruction of a part of his palate by syphilis.—(*P.* 45.) In an instance where a young man had been deaf for eight years, apparently from obstruction of the Eustachian tube by swellings and disease about the throat, Paroisse also restored the hearing directly, by perforating the anterior and inferior part of the tympanum.—(*Opuscules de Chir. p.* 309, 8*vo. Paris*, 1806.) The practice has also been successfully adopted by Michaelis in one case, and Hunold has tried it in a vast number of examples, two-thirds of which succeeded.—(*Dict. des Sciences Méd. t.* 38, *p.* 63.) Sir A. Cooper's cases are in the *Phil. Trans.* for 1802.

Puncturing the membrana tympani has been attended with some degree of success in France, where it has been tried by Itard, Celliez, and Maunoir, &c. It is not to be dissembled, however, that it is liable to failure. Dubois performed the operation in four instances, without success.—(*Richerand, Nosogr. Chir. t.* 2, *p.* 132.)

In most cases the patients benefited are said to have experienced pain just after the trocar was withdrawn The organ, not being accustomed to sound, had become so extremely sensible, that it could not bear the gentlest impression of the sonorous vibrations; and the patient's first request, after the perforation had been made, was, that persons near him might speak softly. This excessive tenderness of the sense gradually subsides.

The two principal objections made to the foregoing practice are, the risk of injuring that part of the tympanum which is connected with the malleus, and the tendency of the puncture to heal up again.—(See *Dict. des Sciences Méd. t.* 38, *p.* 57; *Maunoir in Journ. de Méd. t.* 13; *Sabatier, Traité d'Anatomie, t.* 2, *p.* 186.) The author of the article Oreille in the latter dictionary, who cannot, however, be deemed at all partial to the operation, delivers the following judgment concerning it:—1. It is the only operation which is likely to answer where the tympanum is cartilaginous or ossified, and the rest of the organ is sound. 2. It will be attended with some success where the Eustachian tube is closed, and this defect cannot be otherwise removed. 3. It will be useless where the cavity of the tympanum is filled with matter, which is too thick to escape through the puncture. 4. When deafness depends on paralysis of the auditory nerve. 5. When the infirmity arises from inflammation of the ear or nervous irritation. 6. From fevers, the Eustachian tube being pervious.

The limits of this work will not allow me to introduce the directions given by various authors for injecting fluids into the Eustachian tube. Wathen, Baron Boyer, Itard, Buchanan, and the latest surgeons who have considered this operation, seem to agree, that it is more easily performed by passing the tube through one of the nostrils than the mouth. Wathen's instruments are described in *Phil. Trans.* 1794; those of Baron Boyer in *Traité des Mal. Chir. t.* 6, *p.* 391; those of M. Itard, which deserve particular notice, in his *Traité des Mal. de l'Oreille;* and those of another modern advocate for this operation, in *Dict. des Sciences Méd. t.* 38, *p.* 108. The latter author, after stating how his tubes, which are four French inches in length, and shaped somewhat like an italic *S*, are introduced, enumerates the following as the advantages derived from their employment. 1. Fluid applications may be conveyed into the Eustachian tube, the cavity of the tympanum, and the mastoid cells, and deeply seated obstinate ulcerations within these parts cured. 2. The same parts can be cleared from any mucus by which they are obstructed. 3. Blood extravasated within the tympanum from blows on the head, can be washed out. 4. Chalky substances, which sometimes form in the tympanum, may be brought out in the same manner. 5. Through the tube a stilet can be passed into the Eustachian tube, so as to perforate a congenital septum, or any cicatrix, obstructing the entrance of that passage. 6. When the sensibility of the auditory nerve is dull, the effect of fluids thrown into the tympanum can be tried.—(See also *T. Buchanan's engraved Representation of the Anatomy of the Human Ear*, *p.* 28, *fol. Hull*, 1823.)

13. *Of perforating the Mastoid Process.*

Of all the cases of deafness for which Arnemann and others have recommended this operation, that attended with an abscess and caries of this process is the only one in which the practice is now at all sanctioned. An instance is related by Jasser, in which the carious surface of the right mastoid process was exposed by an incision, and an opening detected with a probe. An injection was thrown into the aperture with a syringe, when, to the astonishment of Jasser and his patient, the fluid gushed out of the right nostril. The plan was repeated for a few days, and at the end of three weeks, the part was healed, and the hearing greatly improved. This success induced Jasser to make a perforation in the left mastoid process, the ear on that side being deaf, and to employ the injection, which was also discharged from the left nostril. The hearing, however, was not so completely restored in this as it had been in the right ear; but the wound healed up without any exfoliations.—(*Journ. de Méd. Fev.* 1793.) The idea of perforating the mastoid process was suggested long before the time of Jasser. Riolan, in various parts of his works, suggests the propriety of making a small perforation in several cases of deafness, and tinnitus aurium, attended with obstruction of the Eustachian tube. Rolfincius also advised a similar opening to be made in the mastoid process with a trocar, in cases of dropsy of the cavity of the tympanum and of the mastoid cells. Jasser, however, was the first who actually made the experiment, and his example was followed by Hagstroem, whose attempt did not succeed, the completion of the operation having been interrupted by profuse hemorrhage, and no benefit done to the hearing. The injections also appear to have caused, in this instance, alarming symptoms, violent pain in the head, loss of vision, sense of suffocation, and syncope. The fluid entered the mastoid cells without any of it issuing either by the nostrils or mouth.—(*Op. cit.*)

The operation was successfully tried by Loffler. The injection did not pass into the mouth, yet the hearing

was restored, though it was lost again when the wound closed. Hence a new opening was made, and kept from healing by means of a piece of catgut. The patient was afterward able to hear when his mouth was open.

The perforation of the mastoid process was not approved of by Morgagni; indeed, it must often fail, as both Morgagni and Hagstroem have observed, on account of complete bony partitions preventing all communications between the mastoid cells; and sometimes the mastoid process, instead of being cellular, is perfectly solid; an instance of which is recorded by A. Murray.

14. *Diseases of the Labyrinth.*

These are much more diversified than might at first be supposed; and if we admit the two doubtful cases said to depend upon the state of the lymph of Cotunni, there are not less than seven different species of disease affecting the labyrinth:—1. Disease of the fenestra ovalis and fenestra rotunda, as ulceration, thickening, &c. 2. Malformation of these apertures. 3. Malformation of the labyrinth. 4. Inflammation of the nervous membrane which lines its cavities. 5. Alteration of the liquor of Cotunni. 6. Deficiency of the same fluid. 7. Affections of the nerve of hearing.

No doubt deafness (and that kind of it which so frequently foils the most skilful men) often arises from an insensible state of the portio mollis of the auditory nerve, or of the surfaces on which its filaments are spread. This affection is analogous to the amaurosis, or gutta serena, in which, though every part of the eye may seem to possess its natural structure, sight is lost, because the rays of light only strike against a paralytic or insensible retina. Mr. Saunders dissected the ears of two deaf patients with the greatest care, but could not discover the least deviation from the natural structure. In the commencement of deafness from a paralytic affection of the auditory nerve, Sir A. Cooper remarked, that the secretion of cerumen was diminished, and when the deafness became worse, was totally suppressed. And another particular symptom of paralysis of the auditory nerve, pointed out by the same author, is the patient's inability to hear the sound of a watch placed between the incisor teeth.

With respect to the causes of a paralytic affection of the auditory nerve, they are mostly buried in great obscurity, and some of them probably depend upon congenital imperfection of the nerve or brain itself. It seems, however, that a part of the causes to which we allude act mechanically, as an extravasation of blood, a steatoma, or an exostosis; while others operate on the ear by sympathy, as is the case when deafness is produced by the presence of worms in the bowels.

Mr. Saunders remarks, that all the diseases of the internal ear may be denominated nervous deafness; the term, in this sense, embracing every disease, the seat of which is in the nerve, or parts containing the nerve. Nervous deafness is attended with various complaints in different cases, noises in the head of sundry kinds, the murmuring of water, the hissing of a boiling kettle, rustling of leaves, blowing of wind, &c. Other patients speak of a beating noise, corresponding with the pulse, and increased by bodily exertion, in the same degree as the action of the heart.—(*Saunders, p.* 47.)

According to this author, there is a syphilitic species of nervous deafness, attended with a sensation of some of the above peculiar noises; and one case is related, in which the hearing was completely restored in five weeks, by a mercurial course.

Mr. Saunders relieved several cases of nervous deafness, by confining patients to low diet, giving them calomel freely, repeated doses of sulphate of soda, magnesia, sometimes twice, sometimes thrice a week, or according to circumstances, and applying blisters behind the ears, at intervals of a week. The plan requires perseverance.

Electricity has been highly recommended for the cure of nervous deafness, though the prospect of benefit from it must entirely depend upon the nature of the cause of the infirmity. It is allowed to be sometimes useful in cases of incomplete paralysis of the auditory nerve; but it cannot be of any service where the Eustachian tube, the cavity of the tympanum, or the mastoid cells are obstructed. It is set down as hurtful, when the patients are very irritable and subject to vertigo, bleeding from the nose, great determination of blood to the head, &c.—(*Dict. des Sciences Méd. t.* 38, *p.* 124.) The evidence in favour of the efficacy of galvanism is still more scanty and questionable.

Whether in certain cases of deafness from torpor of the auditory nerve the introduction of tonic injections into the cavity of the tympanum, through the Eustachian tube, will answer in the manner stated by a late writer, future experience must determine.—(*Dict. des Sciences Méd. t.* 38, *p.* 120, 121.) The effect of the tincture of iodine, in some of these cases, may also merit farther trial.

This article, I think, may be usefully concluded with a few general but sensible observations on the various kinds of deafness, made by a modern writer. According to Professor Rosenthal, all the disorders of the sense of hearing may be comprised under three principal forms.

1. Deafness (*Surditas, Cophosis*), in which the faculty of hearing articulated sounds is completely annihilated.

2. Hardness of hearing (*Dysæcia*), in which this faculty is so diminished, that articulated sounds cannot be heard, without the assistance of a particular apparatus.

3. Alteration, or diminution of hearing (*Paracusis*), in which the faculty of hearing articulated sounds in the natural way is imperfect for want of precision.

1. *Deafness* Rosenthal distinguishes into two degrees; the first of which is marked by an absolute impossibility of hearing at all; the second, by a power of still distinguishing certain sounds, as whistling, the vowels, &c. The first is usually congenital, and a cause of dumbness.

The discrimination of these two degrees Rosenthal considers of great importance in practice, and especially in institutions for the deaf and dumb; because the exceedingly fine sense of touch with which dumb persons are sometimes gifted, is apt to be mistaken for the faculty of hearing. This fact is illustrated by some interesting experiments made by Pfingsten on deaf and dumb persons.—(*Vieljahrige Erfahrung über die Gehoerfehler der Taubstummen, Kiel*, 1802, *p.* 32.) A deaf and dumb girl, who was at needle-work in a room near the house-door, regularly gave notice whenever it was opened or shut. As the door was furnished with a little bell, which rung loud enough whenever the door moved to be plainly heard in the neighbouring room, and, with the exception of this noise, no other impulse nor shock could be distinguished, Pfingsten was surprised at the circumstance. Desirous of ascertaining how the girl really knew about the movements of the door, he caused the bell to be rung with great force without the door being opened; the child was perfectly unconscious of the noise. The bell was afterward kept still, while a person opened and shut the door so softly, that Pfingsten himself could not hear it; yet the child instantly gave warning that somebody had entered. The inference was, that the chair on which she sat communicated to her legs and back a certain impulse, which made her conscious of the motion of the door.

The dissection of the ears of deaf and dumb persons has evinced some facts explanatory of the cause of the loss of hearing. Among other things, it appears, that complete deafness, whether congenital or acquired, more frequently depends upon morbid alterations of the soft parts, than upon any irregularity in the formation of the bones. Thus, in the body of a person who had been deaf and dumb while living, Hoffman found the auditory nerve diminished in size, while every other part of the organ was perfectly natural. Arnemann found the nerve harder than common. Dr. Haighton met with an instance, in which the vestibulum was filled with a caseous substance.—(*A case of original Deafness, in Mem. of the Med. Society, vol.* 3, *p.* 1—15.) Duverney and Sandifort found the auditory nerve strongly compressed by a steatoma. In one case, Itard found every part of the ear apparently so natural, that the deafness could not be ascribed to paralysis of the nerve. In another, the infirmity depended upon obstruction of the passages. In a third, the cavity of the tympanum and the vestibulum contained small portions of calcareous matter. He has also seen the tympanum filled with a thick, yellow lymph, or a thin fluid enclosed in membranous cells. In the dissection of the body of a deaf and dumb person, Rosenthal noticed,

among other remarkable circumstances, a greater hardness of the auditory than of the facial nerve, and preternatural firmness of the medulla oblongata; thickening of the membrane of the tympanum; the bony roof of the cavity of the tympanum not thicker than paper; and just over the junction of the malleus with the incus the bony substance was so absorbed, that an appearance like that of membrane alone remained. The mastoid cells, cavity of the tympanum, and the Eustachian tubes, contained a limpid yellow fluid. In the tympanum, the periosteum was thickened, forming small cells around the ossicula, which were of their natural structure. Nothing particular was remarked in the labyrinth.

In a small proportion of instances, the above degree of deafness has been traced to anomaly in the structure of the solid parts. Thus, Mundini found the cochlea composed of only one circle and a half.—(*Opusc. Acad. Bonon*, 1791, *t.* 7, *p.* 422.) Valsalva found the stapes adherent to the fenestra ovalis (*De Aure Humanâ, cap.* 11); and Reimarus relates a case in which the ossicula were entirely wanting.—(*Kunstribe der Thiere, p.* 57.)

In the first degree of deafness above described, which, when congenital, must excite suspicion of serious malformation of the organ and abolition of the nervous influence; and when acquired, indicates a complete injury of the functions of the nerve, the prognosis, as Rosenthal observes, must be unfavourable. Nor can it be otherwise in the second *congenital* degree of the disease, though only a partial imperfection of the organ and nerve can here be supposed. On the other hand, when the latter degree is *acquired*, there is more prospect of relief, because merely a partial alteration in the soft parts is to be suspected.

2. *Hardness of hearing.* Rosenthal also distinguishes several degrees of what is termed hardness of hearing. In the first, the patient cannot hear a distant noise, and especially high tones; but he can perceive, though, it is true, not in a very distinct manner, articulated sounds, when the voice is a good deal raised. In the second degree, he hears and distinguishes both high and low tones very well, and also words, but only when the voice is somewhat raised.

These two cases are better understood, inasmuch as it is tolerably well ascertained that the immediate cause of the infirmity is some alteration in that part of the organ which serves as a conductor for the vibrations of sound, or else an increased sensibility of the nerve, all the internal ear being in other respects right.

Among alterations of the conducting parts of the organ, Rosenthal comprehends:

1. A total obliteration of the meatus auditorius externus, its imperforation, or complete absence. These cases may almost always be detected by a superficial examination, the patient only hearing when some solid bodies are placed between his teeth, while his dull perception of sounds does not appear to be much lessened when the ear is covered.

2. Diseases of the cavity of the tympanum, as inflammation of its membranous lining, caries of its parietes, or collections of blood, pus, or other fluid, in its cavity. Rosenthal thinks there can be no doubt that inflammation and suppuration in the tympanum are much more frequent than is generally supposed; the former affection being often mistaken for a slight attack of rheumatism. In dissecting aged subjects, he has frequently found the membrane of the tympanum thickened and opaque, and he could only impute this appearance to previous inflammation.

After detailing a case illustrative of the symptoms of inflammation within the tympanum, and a few observations on caries and collections of fluid in that cavity, Rosenthal notices the *hardness of hearing connected with nervous irritability*, in the treatment of which case, he insists upon the advantage that would result from a knowledge of the particular species of morbid excitement prevailing in the patient. But as nothing very certain can be made out on this point, and only conjectures can arise from dissections of bodies, that the affection consists either in a determination of blood to the part, or in a partial paralysis of the auditory nerve, the exact nature and form of which are quite incomprehensible, it is absolutely necessary to attend solely to the diagnosis of the nervous affection in general. This diagnosis will be facilitated, 1st, If the patient has been previously very sensible to the impression of certain tones, or sound in general; 2dly, If the power of hearing has been lost all on a sudden, without any mark of inflammation; 3dly, If the affection coincides with other nervous disorders.

3. *Alteration or Diminution of Hearing.* Between the most perfect hearing, congenital or acquired, and this point of diminution of the faculty of hearing, Rosenthal observes there are a great many degrees, the cause of which is the more difficult to comprehend, as the circumstances of structure, which enable every part to perform its functions with freedom and perfection, are not yet made out. If, says he, it were in our power to determine what is truly the regular structure of each part, we should then be furnished with a means of judging correctly of the anomalies of function, the changes in which would be indicated quite as clearly as in the eye, by shades of organization, absolutely in the same way as we judge of the modifications which the image of objects must undergo at the bottom of the ocular mirror, by the greater or less convexity of the cornea or lens, or the consistence of the other humours.

In the present state of physiological and pathological knowledge of the ear, therefore, Rosenthal conceives that little can be attempted with respect to a scientific classification of these cases of altered or diminished hearing. As the cavity of the tympanum and its contents are the parts which have principal influence over the intensity of sound, and a great share in the propagation of articulated sounds, their faulty condition must here be chiefly the subject for consideration. And among their numerous defects, traced by dissection, and already specified in the foregoing columns, Rosenthal particularly calls the attention of the reader,

1. To alterations of the membrane of the tympanum, whether proceeding from congenital malformation or situation, or from thickening, ossification, perforation, or laceration of the same part.

2. The lodgement of some fluid in the cavity of the tympanum, more frequently produced than is commonly supposed by obstruction of the Eustachian tube. In most new-born infants, Rosenthal has also found the cavity of the tympanum filled with a thick, almost gelatinous fluid, which for some days is not absorbed, and is probably the cause of the indifference evinced by new-born children to sounds, which are even so intense as to be offensive to the ears of an adult.

3. Alterations of the membrane of the fenestra rotunda, such as its imperfect formation, or erroneous situation, its thickened state, &c.

But it is remarked by Rosenthal, that as the difference in the intensity of sound may occasion a modification in the sensations of the ear, the merely conducting parts of the auditory apparatus must not be forgotten, as the external ear and the meatus auditorius externus, which regulate the quantity of sonorous waves striking the auditory nerve. However, the malformations of the meatus and the state of the ceruminous secretion within it, are observed by Kritter and Lentin (*Ueber das schwere Gehoere, t.* 19, *Leipz.* 1794) to have more effect on the hearing than defects of the auricle itself, the whole of which, as we have stated, may be lost without any material deafness being produced. Lastly, Rosenthal calls our attention to the nervous action or influence, which, whether too much raised or depressed, may equally render the hearing dull; and some useful information may for the most part be derived from attending to the patient's general sensibility.—(See *Journ. Complém. t.* 6, *p.* 21, *&c. Duverney, de l'Organde de l'Ouie*, 12*mo.* 1683. *P. Kennedy, A Treatise on the Eye, and on some of the Diseases of the Ear*, 8*vo. Lond.* 1713. *A. D. Dienert, Quæstio, &c. an absque Membranæ Tympani Apertura topica injici in Concham possint, Paris*, 1748. *Mémoire sur la Théorie des Maladies de l'Oreille, et sur les Moyens que la Chirurgie peut employer pour leur Curation, in Prix de l'Acad. de Chir. t.* 9, *p.* 111, *&c. éd.* 12*mo. I. D. Arnemann, Bemerkungen über die Durchborung des Processus Mastoideus in gewissen Fallen der Taubheit*, 8*vo. Gött.* 1792. *G. R. Trampel von den Krankheiten des Ohres, in Arnemann's Magazin für die Wundarzneiwissenschaft, b.* 2, *p.* 17, *&c.* 8*vo. Gött.* 1798. *Richerand, Nosogr. Chir. t.* 2, *p.* 135, *&c. édit.* 4. *A. Cooper, in the Phil. Trans. for* 1802. *Saunders on the Anatomy and Diseases of the Ear*, 1806. *Desmonceaux, Traité des Maladies des Yeux et des Oreilles*, 2 *tom.* 8*vo, Paris*, 1806. *Lassus, Pathologie Chirurgicale, t.* 1, *p.* 84, *édit.* 1809. *W. Wright, An Essay on the Human Ear, its anatomical*

Structure, and incidental Complaints, 8vo. *Lond.* 1817. *Dict. des Sciences Méd. art. Oreille, t.* 38, 8vo. *Paris*, 1819. *Rosenthal, Essai d'une Pathologie de l'Organe de l'Ouie, in Journ. Complémentaire du Dict. des Sciences Méd. t.* 6, *p.* 17, 8vo. *Paris*, 1820. *J. M. G. Itard, Traité des Maladies de l'Oreille et de l'Audition*, 2 *tom.* 8vo. *Paris*, 1821. *T. Buchanan, An Engraved Representation of the Anatomy of the Human Ear, fol. Hull*, 1823. *Also, Illustrations of Acoustic Surgery*, 8vo. 1825. *And, Manson's Med. Researches on Iodine*, 8vo. *Lond.* 1825. *For an account of malformations of the organ, see Meckel's Handbuch der Pathol. Anat. b.* 1, *p.* 400, *&c.* 8vo. *Leipz.* 1812.) [*See also An Essay on Diseases of the Internal Ear, by J. R. Saissy, M.D. Translated by Professor Smith, of Maryland, with Additions on the External Ear.*]

ECCHYMOSIS. (From ἐκχύω, to *pour out.*) A superficial, soft swelling, attended with a livid or blue colour of the skin, produced by blood extravasated in the cellular substance.

The causes of ecchymosis are falls, blows, sprains, &c., which occasion a rupture of the small vessels on the surface of the body, and a consequent effusion of blood, even without any external breach of continuity. Ecchymosis is one of the symptoms of a contusion.—(See *Contusion.*) A considerable ecchymosis may originate from a very slight bruise, when the ruptured vessels are capable of pouring out a large quantity of blood, and particularly when the parts contain an abundance of loose cellular substance. In general, ecchymosis does not make its appearance immediately after the blow or sprain, and sometimes not till several hours after the application of the violence; at least, it is not till this time that the black, blue, and livid colour of the skin is most conspicuous. A black eye, which is only an ecchymosis, is always most disfigured six or eight hours after the receipt of the blow.

In the article *Bleeding*, we have noticed how an ecchymosis may arise from the blood getting out of the vein into the adjacent cellular substance.

Common cases of ecchymosis may generally be easily cured, by applying discutient lotions, and administering one or two doses of any mild purgative salt. The best topical applications are vinegar, the lotio muriatis ammoniæ, spirit. vin. camph. and the liquor ammon. acet.

The object is to avert inflammation, and to promote the absorption of the extravasated fluid.

In cases of ecchymosis, I have seen such success attend the practice of dispersing collections of extravasated blood, by means of absorption, that the plan of evacuating it by an incision seems to me to be seldom necessary. When an opening is made and air is admitted, the portion of blood which cannot be pressed out soon putrefies, and extensive inflammation and suppuration are the frequent consequences.

The quick and powerful action of the absorbent vessels in removing extravasations of blood can now be no longer called in question, when we daily see it proved in modern practice, that the largest aneurismal swellings are thus speedily diminished and removed, after the operation of tying the arteries, from which such tumours arise.

I wish, however, the preceding observations merely to convey a general condemnation of the practice of opening swellings containing extravasated blood; for no surgeon is more assured than I am, that there are particular exceptions, in which the plan is highly proper and necessary. Thus, whenever a case of extensive ecchymosis, or a large tumour of extravasated blood either excites suppuration or creates excessive pain from distention, it is better to practise a free opening. So it sometimes happens in cases of aneurism, that the skin breaks after the artery has been tied, and some of the blood escapes; but the remainder putrefies and soon becomes blended with purulent matter in the sac. Here the making of a free incision for the discharge of the irritating contents of the swelling, with due attention to every caution delivered in the article *Aneurism*, will often be followed by beneficial effects.

ECTROPIUM. (From ἐκτρέπω, to *turn.*) A turning out or an eversion of the eyelids.

According to Scarpa there are two species of this disease; one produced by an unnatural swelling of the lining of the eyelids, which not only pushes their edges from the eyeball, but also presses them so forcibly that they become everted; the other, arising from a contraction of the skin of the eyelid, or its vicinity, by which means the edge of the eyelid is first removed for some distance from the eye, and afterward turned completely out, together with the whole of the affected eyelid.

The morbid swelling of the lining of the eyelids, which causes the first species of ectropium (putting out of present consideration a similar affection incidental to old age), arises mostly from a congenital laxity of this membrane, afterward increased by obstinate chronic ophthalmies, particularly that of a scrofulous nature, in relaxed, unhealthy subjects; or else the disease originates from the small-pox affecting the eyes.

While the disease is confined to the lower eyelid, as it most commonly is, the lining of this part may be observed rising in the form of a semilunar fold, of a pale red colour, like the fungous granulations of wounds, and intervening between the eye and eyelid, which latter it in some measure everts. When the swelling is occasioned by the lining of both the eyelids, the disease assumes an annular shape, in the centre of which the eyeball seems sunk, while the circumference of the ring presses and everts the edges of the two eyelids so as to cause both great uneasiness and deformity. In each of the above cases, on pressing the skin of the eyelids with the point of the finger, it becomes manifest that they are very capable of being elongated, and would readily yield, so as entirely to cover the eyeball, were they not prevented by the intervening swelling of their membranous lining.

Besides the very considerable deformity which the disease produces, it occasions a continual discharge of tears over the cheek, and, what is worse, a dryness of the eyeball, frequent exasperated attacks of chronic ophthalmy, incapacity to bear the light, and, lastly, opacity and ulceration of the cornea.

The second species of ectropium, or that arising from a contraction of the integuments of the eyelids or neighbouring parts, is not unfrequently a consequence of puckered scars produced by the confluent small-pox; deep burns; or the excision of cancerous or encysted tumours, without saving a sufficient quantity of skin; or, lastly, the disorder is the effect of malignant carbuncles, or any kind of wound attended with much loss of substance. Each of these causes is quite enough to bring on such a contraction of the skin of the eyelids as to draw these parts towards the arches of the orbits, so as to remove them from the eyeball and turn their edges outwards. No sooner has this circumstance happened, than it is often followed by another one equally unpleasant, namely, a swelling of the internal membrane of the affected eyelids, which afterward has a great share in completing the eversion. The lining of the eyelids, though trivially everted, being continually exposed to the air and irritation of extraneous substances, soon swells, and rises up like a fungus. One side of this fungus-like tumour covers a part of the eyeball; the other pushes the eyelid so considerably outwards, that its edge is not unfrequently in contact with the margin of the orbit. The complaints induced by this second species of ectropium are the same as those brought on by the first; it being noticed, however, that in both cases whenever the disease is inveterate, the fungous swelling of the inside of the eyelids becomes hard, coriaceous, and, as it were, callous.

Although in both species of ectropium the lining of the eyelids seems equally swollen, yet the surgeon can easily distinguish to which of the two species the disease belongs. For in the first the skin of the eyelids and adjoining parts is not deformed with scars, and by pressing the everted eyelid with the point of the finger, the part would with ease cover the eye, were it not for the intervening fungous swelling. But in the second species of ectropium, besides the obvious cicatrix and contraction of the skin of the eyelids or adjacent parts, when an effort is made to cover the eye with the everted eyelid, by pressing upon the latter part with the point of the finger, it does not give way, so as completely to cover the globe, or only yields, as it ought to do, for a certain extent; or it does not move in the least from its unnatural position, by means of the integuments of the eyelids having been so extensively destroyed that their margin has become adherent to the arch of the orbit.

In addition to the forms of the disease mentioned by Scarpa, Mr. Guthrie enumerates a case depending on

chronic inflammation, accompanied with contraction of the integuments of the eyelid, but *without any manifest cicatrix*. It is described by him as usually taking place after a long continuance of *lippitudo*, and proceeding from the excoriation, contraction, and hardening of the skin, "the result of the passage of the vitiated secretions over it, and which, by dropping on it, increase the irritation."—(*On the Operative Surgery of the Eye, p.* 50—55.) This form of the disease, according to Mr. Guthrie, is rarely attended with such a thickening of the inner membrane of the eyelid, as to require removal with the knife or scissors; for it subsides with the removal of the complaint.—(*P.* 60.)

According to Scarpa, the cure of ectropium cannot be accomplished with equal perfection in both its forms, the second species being, in some cases, absolutely incurable. For, as in the first species of ectropium the disease only depends upon a morbid thickening of the internal membrane of the eyelids, and the treatment merely consists in removing the redundant portion, art possesses many efficacious means of accomplishing what is desired. But in the second species of ectropium, the chief cause of which arises from the loss of a portion of the skin of the eyelids or adjacent parts, which loss no known artifice can restore, surgery is not capable of effecting a perfect cure of the malady. The treatment is confined to remedying, as much as possible, such complaints as result from this kind of eversion, and this can be done in a more or less satisfactory manner, according as the loss of skin of the eyelid is little or great. Cases in which so much skin is deficient, that the edge of the eyelid is adherent to the margin of the orbit, Scarpa abandons as incurable. How far the case can be rectified, he thinks, may always be estimated by remarking to what point the eyelid admits of being replaced, on being gently pushed with the end of the finger towards the globe of the eye, both before and after the employment of such means as are calculated to effect an elongation of the skin of the eyelid; for it is to this point, and no farther, that art can reduce the everted part, and permanently keep it so replaced.

When the first species of ectropium is recent, the fungous swelling of the lining of the eyelid not considerable, and consequently the edge of the eyelid not much turned out, and in young subjects (for in old ones the eyelids are so flaccid, that the disease is irremediable), Scarpa prefers destroying the fungous surface of the internal membrane of the eyelid by the repeated application of the argentum nitratum. Mr. Guthrie touches the fungous portion of the conjunctiva every four days with a probe dipped in sulphuric acid, and gently applies every day, or every second day, the sulphate of copper, at the same time not omitting some minor remedies, which he also employs in cases proceeding from contraction of the skin independent of any cicatrix, and which I shall presently notice.—(*On the Operative Surgery of the Eye, p.* 70.) In recent cases, where the patient is weak and irritable (or a child), Beer commences the treatment with simply applying every day the tincture of opium, which after a time is to be strengthened by the addition of naphtha. To the relaxed conjunctiva he rfterward applies escharotic eyesalves, and last of all the nitrate of silver and muriate of antimony. When the part is hard and callous, the employment of caustic is preceded by scarifications.—(*Lehre, &c. b.* 2, *p.* 136.)

For remedying the considerable and inveterate form of the first species of the disease, Beer and Scarpa are advocates for cutting away the whole of the fungous swelling closely from the muscular substance, on the inside of the eyelid. The following is Scarpa's description of the operation.

The patient being seated with his head a little inclined backwards, the surgeon, with the index and middle finger of his left hand, is to keep the eyelid steadily everted, and holding a small pair of curved scissors with convex edges in his right, he is completely to cut off the whole fungosity of the internal membrane of the eyelid as near as possible to its base. The same operation is then to be repeated on the other eyelid, should that be affected with the same disorder. If the excrescence should be of such a shape that it cannot be exactly included within the scissors, it must be raised as much as possible with forceps, or a double-pointed hook, and dissected off at its base, by means of a small bistoury with a convex edge. This last mode is preferred by Beer to the use of scissors, and I confess that it has always appeared to me the most convenient. The bleeding, which seems at the beginning of the operation as if it would be copious, stops of itself, or as soon as the eye is bathed with cold water. The surgeon is then to apply the dressings, which are to consist of two small compresses, one put on the upper, the other on the lower arch of the orbit, and over these the uniting bandage, in the form of the monoculus, or so applied as to compress and replace the edges of the everted eyelids, in order to make them cover the eye. On the first removal of the dressings, which should take place about twenty-four or thirty hours after the operation, the surgeon will find the whole, or almost the whole, of the eyelid in its natural position. The treatment should afterward consist in washing the ulcer on the inside of the eyelid twice a day with simple water, or barley-water, and confect. rosæ, until it is completely well. If towards the end of the cure the wound should assume a fungous appearance, or the edge of the eyelid seem to be too distant from the eyeball, the wound on the inside of the eyelid must be rubbed several times with the argentum nitratum, for the purpose of destroying a little more of the membranous lining, so that when the cicatrization follows, a greater contraction of it may take place, and the edge of the eyelid be drawn still nearer the eye. Proper steps must be taken, however, for resisting the principal cause on which the ectropium depends, particularly chronic ophthalmy, a relaxed and varicose state of the conjunctiva, &c.—(See *Ophthalmy.*)

In England the excision of the fungous thickened portion of the conjunctiva, in cases of ectropium, has been very much relinquished for the employment of caustic. The difficulty and almost total impossibility of dissecting off every particle of the fungus render the practice of excision much less certain than the treatment with caustic. Thus we see that Scarpa confesses its occasional failure, and the necessity of then having recourse to the latter plan. Demours also lets the employment of caustic follow the use of the knife.—(*Mal. des Yeux, p.* 98.) In the ectropium from a relaxed fungous state of the conjunctiva, the consequence of purulent ophthalmia, Dr. Vetch begins with a light careful application of the argentum nitratum to the whole granulated villous surface. The everted part is then to be returned, and secured in its place with a compress, and straps of plaster and a bandage. Every time the eye is cleaned, the same things are to be repeated, and in the course of a few days the tendency to protrude will disappear.—(*On Diseases of the Eye, p.* 228.)

In the second species of ectropium, or that produced by an accidental contraction of the skin of the eyelids, or neighbouring parts, Scarpa observes, that if a contraction of the integuments has proved capable of everting the eyelid, the excision of a piece of the internal membrane of the part, and the cicatrix which will follow must also be capable, for the same reason, of bringing back the eyelid into its natural position. But since nothing can restore the lost skin, the shortened state of the whole eyelid, in whatever degree it exists, must always continue, even after any operation the most skilfully executed. Hence the treatment of the second species of ectropium, he says, will never succeed so perfectly as that of the first, and the replaced eyelid will always remain shorter than natural, in proportion to the quantity of integuments lost. It is true that, in many cases, the eversion seems greater than it actually is, in regard to the small quantity of skin lost or destroyed; for when the disease has once begun, though the contraction of the skin may be trivial in consequence of the little quantity of it deficient, still the swelling of the lining of the eyelid, which never fails to increase, at last brings on a complete eversion of the part. In these cases the cure may be accomplished with such success as is surprising to the inexperienced; for after the fungous swelling of the internal membrane of the eyelid has been cut off, and the edge of the part approximated to the eyeball, the shortening of the eyelid remaining after the operation is so trivial, that it may be considered as nothing in comparison with the deformity and inconvenience occasioned by the ectropium. Whenever, therefore, the retraction of the skin of the everted eyelid, and the consequent shortness of it, are such as not to prevent its rising again and covering the eye, if not entirely, at least moderately, Scarpa directs the surgeon to cut away the internal membrane of the everted eye-

lid, as already explained, so as to produce a loss of substance on the inside of the everted eyelid. In inveterate cases of ectropium, in which the lining of the eyelids has become hard and callous, Scarpa applies to the everted eyelid, for a few days before the operation, a soft bread-and-milk poultice, in order to render the part flexible, and more easily separated than it could be in its former rigid state.

The division of the cicatrices which have given rise to the shortening and eversion of the eyelid, as Scarpa observes, does not procure any permanent elongation of this part, and consequently it is of no avail in the cure of the present disease. We see the same circumstance occur after deep and extensive burns of the skin of the palm of the hand and fingers: whatever pains may have been taken, during the treatment, to keep the hand and fingers extended, no sooner is the cicatrization thus completed, than the fingers become irremediably bent. The same thing happens after extensive burns of the skin of the face and neck. Fabricius ab Aquapendente, who well knew the inutility of making a semilunar cut in the skin of the eyelids, for the purpose of remedying their shortness and eversion, proposes, as the best expedient, to stretch them with adhesive plasters, applied to them and the eyebrow, and tied closely together. Whatever advantage may result from this practice, the same degree of benefit may be derived from using, for a few days, a bread-and-milk poultice, afterward oily embrocations, and lastly, the uniting bandage, so put on as to stretch the shortened eyelid in an opposite direction to that produced by the cicatrix; a practice which Scarpa thinks should always be carefully tried before the operation is determined upon.

The surgeon, with a small convex-edged bistoury, is to make an incision of sufficient depth into the internal membrane of the eyelid, along the tarsus, carefully avoiding the situation of the puncta lachrymalia. Then with a pair of forceps he should raise the flap of the divided fungous membrane, and continue to detach it with the bistoury from the subjacent parts all over the inner surface of the eyelid, as far as where the membrane quits this part, to be reflected over the front of the eye, under the name of *conjunctiva*. The separation being thus far accomplished, the membrane is to be raised still more with the forceps, and cut off with one or two strokes of the scissors, at the lowest part of the eyelid. The compresses and bandage, to keep the eyelid replaced, are to be applied as above directed. On changing the dressings, a day or two after the operation, the eyelid will be found, in a great measure, replaced, and the disfigurement which the disease caused greatly amended. The operation is rarely followed by bad symptoms, such as vomiting, violent pain, and inflammation. However, should they occur, the vomiting may be relieved by means of an opiate clyster; and as for the pain and inflammation, attended with a great tumefaction of the eyelid operated upon, these complaints may be cured by applying a poultice, or bags filled with emollient herbs, at the same time applying internal antiphlogistics, until the inflammation and swelling have subsided, and suppuration has commenced on the inside of the eyelid on which the operation has been done. After this the treatment is to consist in washing the part twice a day with barley-water and confect. rosæ, and lastly, in touching the wound a few times with the argentum nitratum, in order to keep the granulations within certain limits, and to form a permanent cicatrix, proper for maintaining the eyelid replaced.—(*Scarpa sulle Mallattie degli Occhi.*)

In cases in which the eversion is considerable, Sir W. Adams has never found the simple incision of the fungus, as practised by Scarpa, sufficient to effect a radical cure, and he therefore tried a new mode of operating. In his first attempts, he employed a very small curved bistoury, the point of which he carried along the inside of the eyelid, at its outer angle, downwards and outwards, as far as the point of reflection of the conjunctiva would admit. He then pushed it through the whole substance of the everted eyelid and its integuments, and cut upwards through the tarsus, making an incision nearly half an inch in length. With a curved pair of scissors, he next snipped off a piece of the edge of the tarsus, about one-third of an inch in width, and he afterward removed with the same instrument the whole of the diseased conjunctiva. When the bleeding had ceased, Sir W. Adams passed a needle and ligature through the whole substance of the two divided portions, and brought them as accurately into contact as possible. Finding, however, that too much integument had been left at the lower part of the incision, he employed in future operations, instead of the scalpel, a pair of straight scissors, with which he cut out an angular piece of the lid, resembling the letter V. Latterly Sir W. Adams has found it advantageous to leave about a quarter of an inch of the lid adjoining its external angle, and after shortening the part as much as necessary he brings the edges of the incision together with a suture.—(See *Practical Observations on the Ectropium, &c. p. 4 and 5, Lond.* 1812.)

On the subject of the foregoing proposal, M. Roux observes, "What Sir W. Adams says, with a view of enhancing the value of his own method, about the frequent recurrence of ectropium, when the conjunctiva is simply cut out, is a gratuitous assertion, contradicted by experience. I have already in a very great number of cases undertaken the cure of ectropium in the common way: the operation always succeeded as much as the degree or other circumstances of the disease allowed; and I have not yet observed an instance of a relapse."—(*Voyage fait à Londres en* 1814, *ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 291.) If this new operation, however, will cure the ectropium, caused by the contraction of cicatrices, as its inventor describes, or produce great improvement, as the experience of Mr. Travers confirms (*Synopsis of the Diseases of the Eye, p.* 235), it is clear that though it may not be necessary in ordinary cases, its usefulness will not be entirely lost. Mr. Guthrie acknowledges that it may be highly useful in the ectropium from the contraction of a cicatrix.—(*On the Operative Surgery of the Eye, p.* 71.) The contracted scar must of course be divided, in addition to the other proceedings.

In the form of ectropium described by Mr. Guthrie as arising from a hardened and contracted state of the integuments of the eye, but without any cicatrix, he observes that the indications are, 1st, to relieve the contraction of the skin externally; 2dly, to restore and retain the eyelid in its proper situation, until the unnatural curvature of the cartilage has been overcome, and the chronic inflammation removed. For fulfilling the first indication he recommends washing the external parts with warm water, so as to leave the skin as clean as possible. It is then to be carefully dried, and repeatedly anointed with the ung. zinci, for three or four days. Being thus protected from the irritation, it becomes softer, and in a favourable state to yield to mild extension. For accomplishing the second indication, Mr. Guthrie applies the sulphuric acid: the eyelid having been cleansed so as to prevent its slipping, the conjunctiva is to be gently wiped dry and everted as much as possible, so that the part where it begins to be reflected over the eyeball may be seen. An assistant is to raise the upper eyelid a little, and the patient to look upwards. The blunt end of a common silver probe is then to be dipped in the sulphuric acid and rubbed over the conjunctiva, so that every part of it may be touched with the acid. The round point of the probe is to be carried as far as where the membrane begins to be reflected over the eyeball, but no farther. The punctum lachrymale, caruncle, and semilunar fold are to be avoided; but the external angle, as well as every other part, except what is reflected over the eye, is to be carefully rubbed. The acid will turn the touched portion of the conjunctiva white; and in order to prevent the acid from affecting the eyeball, a stream of water is now to be directed over the eyelid with an elastic gum syringe. If the conjunctiva should not be turned sufficiently white, its application may be repeated. The use of the acid is to be repeated every fourth day; "and when applied in the manner directed it does not cause a slough, but a general contraction of the part, which is, however, only perceptible after two or three applications, by its effect in inverting the lid, which gradually begins to take place. After six or eight applications, the cure will be more than half accomplished, and in most cases of this species of eversion, the thickening of the conjunctiva will have subsided." The ung. zinci is to be constantly applied to the skin, and the ung. hydrarg. nitr. in the proportion of one part to four or six of the ung. cetacei, to the edge of the eyelid. After the eyelid has returned two-thirds of the way towards its natural position, the intervals between the applications of the acid must be longer, lest the contraction within the eyelid be carried too far, and an inversion of it pro-

duced. After the eversion is cured, the lippitudo may yet partly remain, and demand the use of the ung. hydrarg. nitr. or other gentle stimulants.—(See *Scarpa's Osservazioni sulle Malattie degli Occhi; ed.* 5, *cap.* 6. *Richter's Anfangsgr. der Wundarzneykunst, b.* 2, *p.* 473, *&c. Wenzel's Manuel de l'Oculiste. Pellier, Recueil d'Obs. sur les Maladies des Yeux. Sir W. Adams, Pract. Observ. on Ectropium, or Eversion of the Eyelids, with a Description of a new Operation for the Cure of that Disease; on the modes of forming an artificial Pupil; and on Cataract,* 8vo. *Lond.* 1812. *M. Bordenave, Mémoire dans lequel on propose un nouveau Procédé pour traiter le Renversement des Paupières, in Mém. de l'Acad. Royale de Chirurgie, t.* 13, *p.* 156, *et seq. édit.* 12*mo. It was in this memoir, that the proposal of removing a portion of the inside of the eyelid for the cure of ectropium was first made. Here may also be found the best historical account of the different methods of treatment, which have prevailed from the earliest periods of surgery. Consult also Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, par P. J. Roux, p.* 289—292, *Paris,* 1815. *G. J. Beer, Lehre von den Augenkrankheiten, b.* 2, *p.* 133, *&c.* 8vo. *Wien,* 1817. *Benj. Travers, Synopsis of the Diseases of the Eye, p.* 234. 356, *&c.* 8vo. *Lond.* 1820. *Demours, Traité des Mal. des Yeux, p.* 98. *G. J. Guthrie, Lectures on the Operative Surgery of the Eye,* 8vo. *Lond.* 1823.)

ECZEMA, or ECZE'SMA (from *ἐκζέω, to boil out*), is characterized by an eruption of small vesicles on various parts of the skin, usually close or crowded together, with little or no inflammation round their bases, and unattended by fever. It is not contagious. —(*Bateman's Synopsis, p.* 250, *ed.* 3.) There are several varieties of this disease, the most remarkable of which is the *eczema rubrum* from the irritation of mercury. This form is attended with quickened pulse and a white tongue; but the stomach and sensorium are not materially disturbed.—(See *Mercury.*)

EFFUSION, in surgery, means the escape of any fluid out of the vessel or viscus naturally containing it, and its lodgement in another cavity in the cellular substance, or in the substance of parts. Thus, when the chest is wounded, blood is sometimes effused from the vessels into the cavity of the pleura; in cases of false aneurisms, the blood passes out of the artery into the interstices of the cellular substance; in cases of fistulæ in perinæo, the urine flows from the bladder and urethra into the cellular membrane of the perinæum and scrotum; and when great violence is applied to the skull, blood is often effused even in the very substance of the brain.

Effusion also sometimes signifies the natural secretion of fluids from the vessels; thus surgeons frequently speak of the coagulable lymph being effused on different surfaces.—(See *Extravasation.*)

ELECTRICITY. Among the aids of surgery, electricity once held a conspicuous and important situation. It has, however, met with a fate not unusual with remedies too much cried up and too indiscriminately employed; that of having fallen into an undeserved degree of neglect.

Whatever its effects may be on the system, it certainly possesses this advantage over other topical remedies, that it may be made to act on parts very remote from the surface.

Electricity, as a topical remedy for surgical diseases, is chiefly used in amaurosis, deafness, some chronic tumours and abscesses, weakness from sprains, or contusions, paralysis, &c.

In cases of suspended animation, electricity is sometimes an important auxiliary for the restoration of the vital functions.—(See *J. Curry's Obs. on Apparent Death, &c. ed.* 2, 1815.)

ELEVATOR. An instrument for raising depressed portions of the skull.

Besides the common elevator, now generally preferred by all the best operators, several others have been invented; as, for instance, the tripod elevator, and another which was first devised by M. J. L. Petit, and afterward improved by M. Louis.

EMBROCATIO ALUMINIS. ℞. Aluminis ʒij. Aceti, spiritûs vinosi tenuioris, sing. lbss. For chilblains and diseased joints.

EMBROCATIO AMMONIÆ. ℞. Liq. ammon. ʒi. Ætheris sulphurici ʒ ss. Spir. lavandulæ ʒij. M. For sprains and bruises.

EMBROCATIO AMMONIÆ ACETATÆ CAMPHORATA. ℞. Linim. camph., liq. ammon. acet sing. ʒvj. Liq. ammon. ʒss. M. For sprains, bruises and chilblains, not in a state of suppuration.

EMBROCATIO AMMONIÆ ACETATÆ. ℞. Liq ammon. acet., lin. sapon. sing. ʒj. M. For bruises with inflammation.

EMBROCATIO CANTHARIDIS CUM CAMPHORA. ℞. Tinct. canth., spirit. camph. sing. ʒj. M. This may be used in any case in which the object is to stimulate the skin. It should be remembered, however, that the absorption of cantharides will sometimes bring on strangury.

EMBRYOTOMIA. (From *ἔμβρυον, a fœtus,* and *τέμνω, to cut.*) The operation of cutting into the womb, in order to extract the fœtus.—(See *Cæsarean Operation.*)

EMPHYSEMA. (Ἐμφύσημα, from *φυσάω,* to inflate.) A swelling produced by air in the cellular substance. The common cause is a fractured rib, by which the vesicles of the lungs are wounded, so that the air escapes from them into the cavity of the thorax. But as the rib at the moment of its being fractured is pushed inwards and wounds the pleura, which lines the ribs and intercostal muscles, part of the air most commonly passes through the pleura and the lacerated muscles into the cellular membrane on the outside of the chest, and thence is diffused through the same membrane over the whole body, so as to inflate it sometimes in an extraordinary degree. This inflation of the cellular membrane has been commonly looked upon as the most dangerous part of the disease; but very erroneously, as will appear in the sequel.—(*Hewson, Med. Obs. and Inquiries, vol.* 3.)

Emphysema is most frequent after a fractured rib, because there is a wide laceration of the lungs, and no exit for the air; it is less frequent in large wounds with a knife or broadsword, because the air has an open and unimpeded issue; it is again more frequent in deep stabs with bayonets or small swords; but it is not so peculiarly frequent in gun-shot wounds as the late Mr. John Bell supposed (*On Wounds of the Breast, p.* 265, *ed.* 3), and, in fact, is not nearly so common in them as in cases of stabs, particularly where the ribs are not splintered.

Emphysema has also been known to arise from a rupture of the larynx and trachea, produced by a blow or kick, as we find exemplified in the case reported by Dr. L. O'Brien.—(See *Edin. Med. and Surg. Journ. No.* 72.)

The symptoms attending emphysema are generally of the following kind. The patient at first complains of a considerable tightness of the chest, with pain, chiefly in the situation of the injury, and great difficulty of breathing. This obstruction of respiration gradually increases, and becomes more and more insupportable. The patient soon finds himself unable to lie down in bed, and cannot breathe, unless when his body is in an upright posture, or he is sitting a little inclined forwards. The countenance becomes red and swollen. The pulse, at first weak and contracted, becomes afterward irregular. The extremities grow cold, and, if the patient continue unrelieved, he soon dies, to every appearance suffocated.

The emphysematous swelling, wheresoever situated, is easily distinguished from œdema or anasarca, by the crepitation which occurs on handling it, or a noise like that which takes place on compressing a dry bladder half filled with air.

The tumour is colourless and free from pain. It does not of itself descend into depending parts, though by pressure it may be made to change its situation. It is elastic, that is to say, it may be pressed down, but it rises up again as soon as the pressure is discontinued. The swelling never retains the impression of the end of the finger, or, in the language of surgery, never *pits.* The part affected is not heavy. The tumour first makes its appearance in one particular place; but it soon extends over the whole body, and causes an extraordinary distention of the skin.—(*Richter's Anfangsgr. der Wundarzn. b.* 1, *p.* 451.)

The wound of the pleura and intercostals may sometimes be too small to suffer the air to get readily into the cellular membrane, and inflate it, but may confine a part of it in the cavity of the thorax, so as to compress the lungs, prevent their expansion, and cause the same symptoms of tightness of the chest, quick breathing,

and sense of suffocation, which water does in the hydrops pectoris, or matter in empyema.—(*Hewson.*)

To understand why the air passes at all out of the wound of the lungs, we must advert to the manner in which inspiration and expiration are naturally carried on. It is well known, that in the perfect state, the surface of the lungs always lies in close contact with the membrane lining the chest, both in inspiration and expiration. The lungs themselves are only passive organs, and are quite incapable by any action of their own of expanding and contracting, so as to maintain their external surface always in contact with the inside of the thorax, which is continually undergoing an alternate change of dimensions. Every muscle that has any share in enlarging and diminishing the capacity of the chest, must contribute to the effect of adapting the volume of the lungs to the cavity in which they are contained, as long as there is no communication between the cavity of the pleura and the external air. In inspiration the thorax is enlarged in every direction, the lungs are expanded in the same way, and the air, entering through the windpipe into the air-cells of these organs, prevents the occurrence of a vacuum.

But in cases of wounds, when there is a free communication between the atmosphere and inside of the chest, no sooner is this cavity expanded, than the air naturally enters it at the same time, and for the same reasons, that the air enters the lungs through the trachea, and the lung itself remains proportionally collapsed. When the thorax is next contracted in expiration the air is compressed out of the lung, and also out of the bag of the pleura through the external wound, if there be a direct one; in which circumstance the emphysematous swelling is never extensive.

But in the case of a fractured rib, attended with a breach in the pleura costalis, pleura pulmonalis, and air-cells of the lungs, there is no direct communication between the cavity of the chest and the external air; in other words, there is no outward wound in the parietes of the thorax. There is, however, a preternatural opening formed between the air-cells of the lungs and the cavity of the chest, and also another one between the latter space and the general cellular substance of the body, through the breach in the pleura costalis. The consequence is, that when the chest is expanded in inspiration, air rushes from the wound in the surface of the lungs, and insinuates itself between them and the pleura costalis. The lungs collapse in proportion, and the place which they naturally occupied when distended, is now occupied by the air. When in expiration the dimensions of the chest are every where diminished, the air now lodged in the bag of the pleura cannot get back into the aperture in the collapsed lung, because this is already full of air, and is equally compressed on every side, by that which is confined in the thorax. Were there no breach in the pleura costalis, this air could not now become diffused; the muscles of inspiration would next enlarge the chest, remove the pressure from the surface of the wounded lung, more air would be sucked out of it, as it were, into the space between the pleura costalis and pleura pulmonalis, and this process would go on till the lungs of the wounded side were completely collapsed. But in the case of a fractured rib or narrow stab, in which there is also a breach in the pleura costalis, without any free vent outwards for the air which gets out of the lung into the cavity of the pleura, as soon as the expiratory powers lessen the capacity of the chest, this air, not being able to pass back through the breach in the collapsed lung, is forced through the laceration or wound in the pleura costalis into the common cellular substance.

It is through the communicating cells of this structure that the air becomes most extensively diffused over the whole body, in proportion as the expiratory muscles continue in their turn to lessen the capacity of the chest, and pump the air, as it were, through the breach in the pleura costalis, immediately after it has been drawn out of the wound of the lung in inspiration. —(See *John Bell, On Wounds of the Breast, and Halliday, On Emphysema*, 1807.)

To prove that the confinement of air in the chest is the cause of the dangerous symptoms attending emphysema, Hewson adverts to the histories of some remarkable cases, published by Littre, Mery, W. Hunter, and Cheston.—(See *Mém. de l'Acad. Royale des Sciences, for* 1713; *Med. Obs. and Inquiries, vol.* 2; *and Pathological Inquiries.*)

In Littre's case, the patient, who had been wounded in the side with a sword, could not breathe without making the most violent efforts, especially during the latter part of his disease; he died on the fifth day.

In Mery's instance, the fourth and fifth true ribs were broken by a coach passing over the chest; the patient's respiration was much impeded from the first, and became more and more difficult till he died, which was on the fourth day after the accident.

In Dr. Hunter's case, the patient had received a considerable hurt on his side by a fall from his horse. He had a difficulty of breathing, which increased in proportion as the skin became elevated and tense; it was laborious as well as frequent. His inspiration was short and almost instantaneous, and ended with a catch in the throat, which was produced by the shutting of the glottis; after this he strained to expire for a moment without any noise, then suddenly opening the glottis, forced out his breath with a sort of groan, and in a hurry, and then quickly inspired again; so that his endeavours seemed to be to keep his lungs always full; inspiration succeeded expiration as fast as possible. He said, his difficulty of breathing was owing to an oppression or tightness across his breast, near the pit of the stomach. He had a little cough, which exasperated his pain, and he brought up blood and phlegm from his lungs. He was relieved by scarifications, and recovered.

In Mr. Cheston's case, the man had received a blow on the chest. He had a constant cough, bringing up, after many ineffectual efforts, a frothy discharge, lightly tinctured with blood; he seemed to be in the greatest agonies, and constantly threatened with suffocation. His pulse was irregular, and sometimes scarcely to be felt, his face livid, and when he was sensible, which was only now and then, he complained of a pain in his head. On passing a bandage round his chest, with a proper compress to prevent the discharge of air into the cellular membrane, and to confine the motion of the thorax, the patient cried out that he could not suffer it. A strong compression by the hand alone affected him in the same way. Notwithstanding bleeding, repeated scarifications, and other means, his sense of suffocation and difficulty of breathing increased. On the fourth day, the air no longer passed into the cellular membrane, when on a sudden inclining his head backwards, as it were, for the admission of more air than usual, his breathing became more difficult and interrupted, he turned wholly insensible, and soon afterward died.

Littre, Mery, and Cheston opened their patients after death.

Besides a wound of the lungs and fractured rib, Littre found a considerable quantity of blood in the cavity of the thorax, and was sensible of some fetid air escaping on his first puncturing the intercostals and pleura. The wounded lobe was hard and black, and the other two of the same side were inflamed.

In Mery's patient no blood was extravasated, nor was there any thing preternatural, except the fractured ribs, the wound of the pleura, and that of the lungs.

Cheston found a fracture of the tenth and eleventh ribs, and a wound of the lungs. The lungs below the wound were livid, and more compact than usual; but every thing else was natural, no extravasation, no inflammation, no internal emphysema.

Hewson made several experiments on animals, tending to prove, that air in their chests produced great difficulty in breathing, such as occurs in cases of emphysema; and in one case which he examined after death, air was actually discharged on puncturing the thorax.

The object of Mr. Hewson's paper is to recommend making an opening in the chest, for the purpose of giving vent to the air confined in that cavity, just as is done for the discharge of pus in cases of empyema or of water in those of hydrops pectoris.

In wounds of the lungs, says this author, whether occasioned by fractured ribs or other causes, when symptoms of tightness and suffocation come on, so far should we be from dreading the emphysematous swelling of the cellular membrane, that we should rather consider it as a favourable symptom, showing that the air is not likely to be confined in the thorax; and so far should we be from compressing the wound to prevent the inflation or emphysema, that we should rather dilate it (if not large enough already) or perform the paracentesis thoracis. We may judge of the necessity of this operation from the violence of the symptoms,

such as the oppressed breathing, &c. For when these are not considerable, and the air passes out of the chest with sufficient freedom, the operation is then unnecessary.

If the disease is on the right side, the best place for performing the operation, says Mr. Hewson, will be on the fore part of the chest, between the fifth and sixth ribs; for there the integuments are thin, and in the case of air no depending drain is required. But if the disease is on the left side, it will be more advisable to make the opening between the seventh and eighth, or eighth and ninth ribs, in order that we may be sure of avoiding the pericardium. As large penetrating wounds are inconvenient on account of the air entering by the aperture in such a quantity *as to prevent the expansion of the lungs*, a small wound will be eligible, especially as air does not require a large one for its escape. Mr. Hewson recommends dissecting cautiously with a knife, in preference to the coarse and hazardous method of thrusting in a trocar.

There is one error prevailing in Mr. Hewson's paper, for which he has been justly criticised by Mr. John Bell; viz. the idea that it is possible and proper to make the collapsed lung expand by making an opening in the chest. Bromfield and B. Bell have both imbibed the same erroneous opinions, and proposed plans for exhausting the air and expanding the lung. It is very certain that it is impracticable to make the collapsed viscus expand, until the breach in it is closed, and this closure is greatly promoted by the quiet state in which the collapsed lung remains; a state also the most favourable for the stoppage of any bleeding from the pulmonary vessels.

The true object then of making an opening in the thorax, when the symptoms of suffocation are violent, is not to obtain an expansion of the lung on the affected side, nor to take the pressure of the air from it; but to remove the pressure caused on the opposite lung by the distention of the mediastinum, and at the same time to diminish the pressure of the air on the diaphragm. The lung on the affected side must continue collapsed, and it is most advantageous that it should do so. The opposite lung is that which for a time must of itself carry on respiration, and it is known to be fully adequate to this function, provided the quantity of air on the other side of the chest does not produce too much pressure on the mediastinum and diaphragm.

Mr. John Bell concludes his remarks on this subject with advising the following practice:

1st. When the crackling tumour begins to form over a fractured rib, small punctures should be made with the point of a lancet, as in bleeding; and if the point be struck deep enough, the air will rush out audibly. But as (supposing the lung is not adherent to the inside of the chest) this air was in the thorax before it came into the cellular substance, it is plain that the thorax is still full, and that the lung of that side is already collapsed and useless, and must continue so. The purpose, therefore, of making these scarifications, and especially of making them so near the fractured part, is not to relieve the lungs, but merely to prevent the air spreading more widely beneath the skin.

2d. If the air should have spread to very remote parts of the body, as to the scrotum and down the thighs, it will be easier to make small punctures in those parts to let out the air directly, than to press it along the whole body till it is brought up to the punctures made on the chest over the wounded part.

3d. If, notwithstanding free punctures and pressing out the air in this way, you should find by the oppression that either air or blood is accumulating within the cavity of the thorax, so as to oppress not the wounded lung only, which was of course collapsed and useless from the first, but the diaphragm, and through the diaphragm to affect also the sound lung; then a freer incision must be made through the skin and muscles, and a small puncture should be cautiously made through the pleura, in order to let out the air or blood confined in the thorax.—(*John Bell, op. cit. p.* 278.)

In all these cases copious and frequently repeated venesection is generally proper.

After a few days the wound in the collapsed lung is closed by the adhesive inflammation, so that the air no longer passes out of it into the cavity of the chest, and the outer wound may therefore be healed. What air is already there is ultimately absorbed, and the lung, expanding in proportion, resumes its original functions.

The application of a bandage round the chest is sometimes practised in cases of emphysema; and its utility when the ribs are broken has been highly spoken of by Mr. Abernethy.—"Pressure by bandage (says he) not only hinders the air from diffusing itself through the cellular substance, but serves to prevent it from escaping out of the wounded lung, and of course facilitates the healing of the wound, which would be prevented by the constant transmission of air. Its early application, therefore, will often prevent a very troublesome symptom, while, at the same time, by keeping the fractured bones from motion it greatly lessens the sufferings of the patient."—(*Abernethy's Surgical Works, vol.* 2, *p.* 179.) Where emphysema is complicated with a fractured rib, the latter injury is unquestionably a reason in favour of a bandage. But whether the pressure of the roller will be useful or hurtful with respect to the emphysema itself, or the state of the lungs and respiration, may be questionable. As for its tendency to resist the diffusion of air in the common cellular membrane, this circumstance does not appear to me important, because the air thus diffused, much as it disfigures the patient, is nearly harmless, at least as long as the interlobular texture of the lungs remains uninflated; a danger also which no bandaging, as far as I can judge, has any tendency to prevent. Neither will a bandage have so much effect in hindering the diffusion of air as scarifications, with this important additional consideration, that punctures or small incisions, made over the broken rib, prevent the spreading of the air by letting it escape, while a bandage can only do so by more or less resisting its escape from the cavity of the pleura; which mode of operation in some cases would dangerously interfere with the continuation of respiration by the lung of the opposite side. At the same time, I believe, that when the air extravasated within the injured side of the chest is not in such quantity as to oppress the sound lung, and a rib is broken, a bandage will generally afford great relief. Indeed, it is but justice to Mr. Abernethy to state, that he does not recommend the employment of a bandage in all cases of emphysema. "Patients (says he) will not always be able to wear a bandage when one lung is collapsed, particularly if any previous disease has existed in the other, as it equally confines the motions of the ribs on both sides, and as every possible enlargement of the chest becomes necessary for the due admission of the air into the lung which still executes its functions. Under these circumstances, if the emphysema continues (and its continuance must always denote that the wound in the lung is not closed), I should esteem it the best practice to make a small opening into the chest, so that the external air might have a free communication with that cavity; and then the injured lung must remain motionless till its wound is healed, and the mediastinum will, in every state of the thorax, preserve its natural situation."—(*Abernethy, vol. cit. p.* 183.)

The utility of a free incision and scarifications is well illustrated in a case recorded by Larrey. The emphysema arose from a wound of the lungs by a lance. The whole body was prodigiously swelled, the integuments so distended that the limbs were inflexible, the eyes buried, and the lips so enlarged that nothing could be introduced into the mouth. The pulse and respiration were scarcely perceptible, and the voice feeble and interrupted. The lance had entered obliquely under the lower angle of the scapula, and though the external and internal orifices of the wound were not parallel, the surgeon had applied adhesive straps, and closed the external one. Hence the air, as it escaped from the lungs, distended the cellular texture. Larrey immediately removed the dressings, and with a bistoury made the openings in the pleura and skin parallel. Cupping-glasses were then applied over the wound, and quickly filled with air and blood. The lips of the wound were now brought together, and kept so with a suitable bandage. Cupping-glasses and scarificators were applied to various parts of the body, and in others incisions were made with a scalpel. The patient recovered.—(See *Mém. de Chir. Militaire, t.* 4.)

Emphysema has been known to arise from the bursting of a vomica, and ulceration of the surface of the lungs; but the air which escapes in this instance cannot find its way into the cavity of the thorax, because the inflammation which precedes the abscess and ulceration of the air-cells closes those which are adja-

cent, and produces an adhesion of the edges of the vomica or ulcer to the inner surface of the chest, so as entirely to separate the two cavities. We are not acquainted with any instance of the symptoms imputed to the confinement of air in the chest originating from suppuration and ulceration of the surface of the lungs; but Palfyn, Dr. Hunter, and the author of the article *Emphysema* in the *Encyclopédie Méthodique, partie Chirurgicale*, have seen cases in which emphysema originated from abscesses of the lungs, attended with adhesion to the pleura, and ulcerations in the situation of such adhesion. In these instances, the pus having made its way through the pleura and intercostal muscles, the air escapes also through the same track, so as to pass into the cellular membrane on the outside of the chest.

A violent effort of respiration has sometimes produced a certain degree of emphysema, which first makes its appearance about the clavicles, and afterward spreads over the neck and adjacent parts. The efforts of labour have been known to occasion a similar symptom; but no bad consequences followed.—(*Medical Communications, vol.* 1, *p.* 176; *Blackden, in Med. Facts and Experiments, vol.* 2; *and Wilmer's Obs. in Surgery p.* 143.)

Louis has described an emphysema of this sort, which, on account of its cause, and the indication furnished by it to the practitioner, is highly important. It took place in a young girl, who died suffocated from a bean falling into her windpipe, and he considers it as a pathognomonic symptom of such an accident, concerning the existence of which it is so essential not to commit any mistake.—(See *Bronchotomy.*) It made its appearance on both sides of the neck above the clavicles, and came on suddenly on the third day after the accident. The inspection of the body proved that the lungs and mediastinum were also in an emphysematous state. The retention of the air, confined by the foreign body, produced, says Louis, at each attempt to expire, and especially when the violent fits of coughing occurred, a strong propulsion of this fluid towards the surface of the lung into the spongy substance of this viscus. Thence the air passed into the cellular texture which unites the surface of the lung to the pleura pulmonaris; and by communications from cells to cells it caused a prodigious swelling of the cellular substance between the two layers of the mediastinum. The emphysema increasing, at length made its appearance above the clavicles. This tumefaction of the lung and surrounding parts, in consequence of air getting into their spongy and cellular texture, is an evident cause of suffocation, and the swelling seems so natural an effect of the presence of a foreign body in the trachea, that one can hardly fail to think it an essential symptom, though no author has made mention of it.—(*Mém. de l'Acad. de Chir. t.* 4, *in* 4*to.*) The emphysematous swelling, sometimes formed in the axilla in the reduction of a dislocated shoulder (see *Dislocation*), was accounted for by Desault and Bichat on the same principle as the foregoing case, viz. a rupture of one of the air-cells by the patient's efforts to hold his breath during the reduction of the bone. How far the explanation of the cause may be true has been questioned (see *Dict. des Sciences Méd. t.* 12, *p.* 15); the fact itself admits of no doubt, and is both curious and interesting.

The example lately recorded by Dr. Ireland as one of idiopathic emphysema following pneumonia, bears so strong a resemblance to the case above cited from M. Louis, that I cannot refrain from suspecting that it may have been one of the same nature.—(See *Trans. of the King's and Queen's College of Physicians, vol.* 3, *art.* 4.)

An emphysematous swelling of the head, neck, and chest has also been noticed in typhoid fevers. Dr. Huxam relates an instance of this sort in a sailor of a scorbutic habit.—(*Medical Observations and Inquiries, vol.* 3, *art.* 4.) Another example in a case of bilious fever is recorded in a periodical work —(See *London Med. Repository, No.* 73.) A case of spontaneous emphysema is likewise described by Dr. Baillie.—(See *Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 1, *p.* 202.)

A curious example of what has been called a spontaneous emphysema is recorded by Mr. Allan Burns: "The patient was a strong, athletic man, who, about six years previous to his application at the Royal Infirmary, had received a smart blow on the neck from the keel of a boat. This injury was soon followed by the formation of a firm, tense tumour on the place which had been hurt. The swelling increased very slowly during the five years immediately succeeding its commencement; but during the sixth it received a very rapid addition to its bulk. At this time it measured nearly six inches in diameter, seemed to be confined by a firm and dense covering, and the morbid parts had an obscure fluctuation. From the first to the last the tumour had been productive of very little pain.

Judging from the apparent fluctuation that the tumour was encysted, it was resolved at a consultation to puncture the swelling, draw off its contents, and then pass a seton through it. By plunging a lancet into it, only a very small quantity of blood, partly coagulated, and partly fluid, was discharged—a quantity so trifling that after its evacuation, the size of the tumour was not perceptibly reduced. A seton was passed through the swelling. At this time the man was in perfect health.

About ten hours after the operation, the patient was seized with extremely violent rigors, followed by heat, thirst, pain in the back, excessive pain in the tumour, and oppressive sickness.

An emetic was prescribed, but instead of producing vomiting it operated as a cathartic. To remove the irritation the seton was withdrawn. The pain in the tumour, however, and the general uneasiness continued to increase, and thirty hours subsequent to making the puncture, air began to issue from the track of the seton; and afterward the cellular membrane of the neck, and of the other parts of the body in succession, became distended with a gaseous fluid. In the course of a few hours after the commencement of the general emphysema the man died.

Twelve hours after death, when the body was free from putrefaction, it was inspected. The emphysema was neither increased nor diminished since death, and some idea may be formed of its extent, when the scrotum was distended to the size of the head of an adult. Even the cavities of the heart, and the canals of the blood-vessels, contained a considerable quantity of air. We could discover no direct communication between the tumour and the trachea or lungs, although such was carefully sought for."—(*A. Burns on the Surgical Anatomy of the Head and Neck, p.* 51—53.)

From such cases we may infer, with the preceding writer, that from the mere rupture of a few of the bronchial cells, occasioned by irregular action of the lungs, or by some other internal cause, a spontaneous diffusion of air may take place in the cellular texture of the body. Such examples are dependent on the same cause as the emphysema from injury of the lungs; only the rupture of the bronchial cells in the former cases is less obvious.

A partial emphysema is sometimes seen in cases of gangrene. Here, however, it is hardly necessary to observe, the air is the product of putrefaction, and the disorder has not the smallest connexion with any injury, or disease of the air-cells of the lungs.

[That very extensive emphysema does occur during the parturient process, without fractured rib, or punctured wounds of the lung, is a fact familiar with every obstetric practitioner whose opportunities are considerable; and it is equally well known, that this kind of emphysema is not attended with any dangerous consequences. It doubtless arises from a rupture of one or more of the air-cells by the efforts of the patient to hold her breath.

In the Maryland Medical Recorder for January, 1830, a case of spontaneous emphysema is reported by Dr. Yeates, occurring in a child of 4 years old, which proved fatal in a few days. It is to be regretted that punctures and scarifications were not resorted to, reliance being placed on ipecacuanha and squills, which failed to produce any impression on the stomach or the disease. Dr. Jameson suggests that probably the disease arose from an accidental opening of the bronchia and investing membrane of the lungs, by which the air escaped and thus found its way throughout the body.—*Reese.*]

C. C. Pruysch, De Emphysemate. Haller, Disp. Chir. 2, 567. *Halæ*, 1733. *H. A. Nies, De Miro Emphysemate,* 4*to. Duisb. ad Rhen.* 1751. *Hewson's Paper, in Med. Observations and Inquiries, vol.* 3. *Mém. de l'Acad. Royale des Sciences, for* 1713. *Dr. Hunter, in Med. Obs. and Inquiries, vol.* 2. *Cheston, in Pathological*

Inquiries. Abernethy's Surgical Works, vol. 2. *Richter, von der Windgeschwulst, in Anfangsgr. der Wundarzneykunst, b.* 1, *p.* 451, *&c. John Bell on Wounds, edit.* 3, *Edin.* 1812. *Halliday on Emphysema*, 1807. *Allan Burns on the Surgical Anatomy of the Head and Neck, p.* 52, *&c. Trans. of a Society for the Improvement of Medical and Chir. Knowledge, vol.* 1, *p.* 262. *Wilmer's Observations in Surgery, p.* 143. *F. C. Waitz, De Emphysemate, 4to. Lips.* 1803. *Richerand, Nosographie Chir. t.* 4, *p.* 164, *edit.* 2. *Lassus, Pathologie Chir. t.* 2, *p.* 321, *&c. edit.* 1809. *Dict. des Sciences Méd. t.* 12, *p.* 1, *&c. J. Hennen, Principles of Military Surgery, p.* 376, *edit.* 2, *8vo. Edin.* 1820. *C. Bell, Surgical Obs. vol.* 1, *p.* 161, *&c.*

EMPLASTRUM AMMONIACI CUM ACETO. R. Ammoniaci purif. ℥ij. Acidi acetici, ℥iij. Ammoniacum in aceto liquefactum vapora in vase ferreo ad emplastri crassitudinem.

EMPLASTRUM AMMONIACI SCILLITICUM. R. Gumm. ammoniaci, ℥j. Aceti scillitici, q. s. ut fiant emplastrum, quo pars affecta tegatur.

Mr. Ford found this last plaster useful in some scrofulous affections. It may be rendered more stimulating by sprinkling it with squills.—(*Ford on the Hip-joint, p.* 59.) It was recommended by Swediaur.—(*London Medical Journal, vol.* 1, *p.* 198.)

EMPLASTRUM AMMONIACI CUM HYDRARGYRO. Discutient.

EMPLASTRUM AMMONIACI CUM CICUTA. R. Gum. ammon. ℥iij. Extracti conii, ℥ij. Liq. plumb. acet. ℥j.

Dissolve the ammoniacum in a little vinegar of squills, then add the other ingredients, and boil them all slowly to the consistence of a plaster. Discutient.

EMPLASTRUM AMMONIÆ. R. Sapon. ℥ij. Emplastr. plumbi ℥ss. Ammon. mur. ℥j.

The first two articles are to be melted together, and when nearly cold, the muriated ammonia, finely powdered, is to be added. This plaster stimulates the skin, excites the action of the absorbents, and disperses many chronic swellings and indurations.

EMPLASTRUM CANTHARIDIS. See *Blister.*

EMPLASTRUM GALBANI COMPOSITUM. L. P. (*Olim emplastrum lithargyri comp.*) Properties discutient.

EMPLASTRUM HYDRARGYRI. L. P. (*Olim emplastrum litharg. cum hydrargyro.*) Properties discutient.

EMPLASTRUM PLUMBI. L. P. (*Olim emplastrum lithargyri cum resina.*) The common adhesive or sticking plaster.

EMPLASTRUM SAPONIS. The plaster commonly used for fractures. It is also frequently applied to bruised parts, and to many indurations of a chronic nature.

EMPYEMA. (From ἐν, *within*, and πυον, *pus*, or *matter.*) A collection of purulent matter in the cavity of the chest.

The ancients made use of the word "empyema" to express every kind of internal suppuration. It was Ætius who first restricted the term to collections of matter in the cavity of the pleura, or membrane lining the chest; and all the best modern surgeons invariably attach this meaning alone to the expression.

The operation for empyema properly means the making of an opening into the thorax, for the purpose of giving vent to the matter collected in the cavity of the pleura, though the phrase with several writers denotes making an incision into the chest, in order to let out any effused or confined fluid, whether matter, blood, an aqueous fluid, or even air. The necessity of having recourse to such an operation, however, does not often present itself. I would not wish to be supposed to assert, that inflammation of the lungs, pleura, mediastinum, diaphragm, and even of the liver, does not sometimes terminate in suppuration. Certainly, the latter event is occasionally produced; but when it does happen, the matter does not always make its way into the cavity of the chest: frequently external abscesses form, or the pus is either coughed up, or discharged with the stools.

Acute and chronic abscesses not unfrequently form in the cellular substance between the pleura and the ribs and intercostal muscles. A swelling occurs between two of those bones; the skin does not undergo any change of colour; a fluctuation is distinguishable, and sometimes an extensive œdema is observable.

With respect to abscesses formed in the cellular substance connecting the pleura costalis to the intercostal muscles, they rarely burst into the chest, the pleura always being considered thickened. However, in order to keep them from spreading extensively, as well as to obviate any possibility of their breaking inwards, the best rule is to make an early and, if possible, a depending opening. The motions of respiration then both promote the exit of the matter, as well as the contraction of the cavity in which it was lodged; and the disease, if unattended with caries, generally terminates favourably.

It often happens, however, that the ribs are carious, and then the cure is more tedious and difficult. A modern writer, indeed, informs us, that when the inside of the rib is extensively carious, or when the caries is near the junction of the bone to the spine, the fistula is incurable.—(*Lassus, Pathologie Chirurgicale, t.* 1, *p.* 128, *édit.* 1809.) On the other hand, another surgeon of vast experience recommends us to endeavour to separate the diseased bone, either by cutting it away or employing the trepan.—(*Pelletan, Clinique Chir. t.* 3, *p.* 253.) Were a part of a diseased rib to admit of being sawed away, Mr. Hey's convex saw would be a more proper instrument for the purpose than a trepan.

An abscess of the preceding kind may be so situated, and attended with such a pulsation, as greatly to resemble an aneurism of the origin of the aorta. An interesting case of this description is detailed by Pelletan (*Clinique Chir. t.* 3, *p.* 254); and another was seen by Baron Boyer (*Traité des Mal. Chir. t.* 7, *p.* 333).

When the surface of the lungs and that of the pleura costalis have become adherent to each other, in the situation of the abscess, so as to constitute what is termed *encysted empyema*, the pus, disposed by a law of nature to make its way to the surface of the body, generally occasions ulceration of the intercostal muscles, and collects on the outside of them. An abscess of this kind comes on with a deep-seated pain in the part affected; an œdematous swelling, which retains the impression of the finger; and a fluctuation, which is at first not very distinct, but from day to day becomes more and more palpable; and at length leads the surgeon to make an opening.

If this be not done when the fluctuation becomes perceptible, the abscess may possibly insinuate itself into the cavity of the pleura, in consequence of the adhesion being in part destroyed by ulceration. Sabatier affirms that the case may take this course, even when the abscess has been punctured, and while a free external opening exists; and this experienced surgeon has adduced a fact in confirmation of such an occurrence.—(See *Médecine Opératoire, tom.* 2, *p.* 249.)

In a few instances, the surface of the lung ulcerates, and the matter is voided from the trachea. But in the majority of examples, the pus makes its way outwards through the pleura costalis. If inflammation occurs in the anterior mediastinum, and ends in suppuration, the abscess may possibly burst into neither of the cavities of the chest, but make its way outwards, after rendering the sternum carious, as happened in the example recorded by Van Swieten.—(*Comment on Boerhaave's* 895*th Aphorism.*)

But though collections of matter in the anterior mediastinum are influenced by the general law, whereby abscesses in general tend to the surface of the body, and though it be true that they rarely burst inwardly into the cavity of the pleura, the contrary may happen, as is proved by the 9th case in La Martinières's memoir on the operation of trepanning the sternum. Here the event was the more extraordinary, as there was already an external opening in the abscess.

External injuries, such as the perforation of the sternum with a sword (*Vanderwel, Obs.* 29, *Cent.* 1), a contusion, a fracture, or a caries of this bone may give rise to an abscess in the anterior mediastinum. Galen has recorded a memorable example, where the abscess was the consequence of a wound of the fore part of the chest. After the injury, which was in the region of the sternum, seemed quite well, an abscess formed in the same situation, and being opened healed up. The part, however, soon inflamed and suppurated again. The abscess could not now be cured. A consultation was held, at which Galen attended. As the sternum was obviously carious, and the pulsation of the heart was visible, every one was afraid of undertaking the treatment of the case, since it was conceived that it

would be necessary to open the thorax itself. Galen, however, engaged to manage the treatment, without making any such opening, and he expressed his opinion that he should be able to effect a cure. Not finding the bones so extensively diseased as was apprehended, he even indulged considerable hopes of success. After the removal of a portion of the bone, the heart was quite exposed (as is alleged), by reason of the pericardium having been destroyed by the previous disease. After the operation, the patient experienced a speedy recovery.

J. L. Petit met with an abscess in the anterior mediastinum, in consequence of a gun-shot wound in the situation of the sternum. The injury had been merely dressed with some digestive application; no dilatation, nor any particular examination of the wound had been made. The patient, after being to all appearance quite well, and joining his regiment again, was soon taken ill with irregular shiverings, and other febrile symptoms. Petit probed the wound, and found the bone affected. As there was a difficulty of breathing, he suspected an abscess either in the diploe or behind the sternum; and, consequently, he proposed laying the bone bare and applying the trepan. The operation gave vent to some sanious matter; and as soon as the inner part of the sternum was perforated, a quantity of pus was discharged. The patient was relieved, and afterward recovered.—(*Petit, Traité des Mal. Chir. t.* 1, *p.* 80.)

Another instance, in which an abscess behind the sternum was cured by making a perforation in that bone opposite the lower part of the cavity in which the matter collected, is recorded by De la Martinière.—(*Mém. de l'Acad. de Chir. t.* 12, *édit.* 12*mo.*)

When, in consequence of inflammation, an abscess forms deeply in the substance of the lungs, the pus more easily makes its way into the air-cells, and tends towards the bronchiæ, than towards the surface of the ungs. In this case the patient spits up purulent matter. When the opening by which the abscess has burst internally is large, and the pus escapes from it in considerable quantity at a time, the patient is in some danger of being suffocated. However, if the opening be not immoderately large, and the pus which is effused be not too copious, a recovery may ensue. Abscesses in the substance of the diaphragm, and collections of matter in the liver may also be discharged by the pus being coughed up from the trachea, when the parts affected become connected with the lungs by adhesions, and the abscesses of the liver are situated on its convex surface. When the collection of matter in the liver occupies any other situation, the abscess frequently makes its way into the colon, and the pus is discharged with the stools. Several cases of this kind are related by authors; Sabatier has recorded two in his *Médicine Operatoire*, Le Dran makes mention of others, and Pemberton, in his book on the *Diseases of the Abdominal Viscera*, p. 36, relates additional instances of a similar nature.

I shall now proceed to the consideration of empyema strictly so called. Sometimes it is a consequence of a penetrating wound of the chest; occasionally it proceeds from the bursting of one or more vomicæ; in a few examples it arises from the particular way in which abscesses of the liver burst (*Journ. de Méd. t.* 3, *p.* 47; *Morgagni, epist.* 30, *art.* 4;) but in the greater number of instances it originates from pleuritic inflammation, especially that of the chronic kind.—(*Boyer, Traité des Mal. Chir. t.* 7, *p.* 352.) Empyema very rarely takes place in both sides of the chest, but is almost always limited to one cavity of the pleura.

According to Baron Boyer, when empyema arises from thoracic inflammation, pleuritis, or pneumonia, the symptoms characterizing it are always preceded by those of the disease, of which the effusion of pus upon the diaphragm is the effect. Inquiry must, therefore, be made whether the patient has pleurisy or peripneumony, the symptoms of which have lasted longer than a fortnight; and whether, after a transient amendment, there have been frequent shiverings, followed by a low, continued fever, with nightly exacerbations. Now, these first circumstances justify the belief, that the inflammatory disorder has terminated in suppuration, and that the symptoms afterward experienced depend upon effusion of matter in the chest. Some of these arise from the mechanical action of the pus upon the lungs, heart, and parietes of the chest, and belong also to other effusions in the thorax; the rest may be said to be the effects of ulceration and suppuration of the parts on the animal economy, and, therefore, particularly belong to empyema.

First, of the common symptoms, respiration is difficult, short, and frequent; the patient suffers great oppression, and experiences a sense of suffocation, and of weight upon the diaphragm. He cannot move about, even for a short time, without being quite out of breath, and threatened with syncope. He has an almost incessant and very fatiguing cough, which is sometimes dry, sometimes attended with expectoration.—(*Boyer, Traité des Mal Chir. t.* 7, *p.* 356.)

No surgical writer with whom I am acquainted has treated with more discrimination than Mr. Samuel Sharp, of the symptoms produced by collections of matter in the chest. He remarks, that it has been almost universally taught, that when a fluid is extravasated in the thorax, the patient can only lie on the diseased side, the weight of the incumbent fluid on the mediastinum becoming troublesome, if he places himself on the sound side. For the same reason, when there is fluid in both cavities of the thorax, the patient finds it most easy to lie on his back, or to lean forwards, in order that the fluid may neither press upon the mediastinum nor the diaphragm. But it is noticed by Mr. Sharp, that however true this doctrine may prove in most instances, there are a few in which, notwithstanding the extravasation, the patient does not complain of more inconvenience in one posture than another, nor even of any great difficulty of breathing.—(See *Le Dran's Obs.* 217, and *Marchetti*, 65.)

On this account, observes Mr. Sharp, it is sometimes less easy to determine when the operation is requisite, than if we had so exact a criterion as we are generally supposed to have. But, says he, though this may be wanting, there are some other circumstances which will generally guide us with a reasonable certainty. He states, that the most infallible symptom of a large quantity of fluid in one of the cavities of the thorax, is a preternatural expansion of that side of the chest where it lies; for, in proportion as the fluid accumulates, it will necessarily elevate the ribs on that side, and prevent them from contracting so much in expiration as the ribs on the other side. This change is said to be most evident when the surgeon views the back of the chest.—(*Boyer, vol. cit. p.* 357.) Mr. Sharp also refers to *Le Dran's Obs.* 211, *vol.* 1, in order to prove that the pressure of the fluid on the lungs may sometimes be so great, as to make them collapse, and almost totally obstruct their function. When, therefore, says Mr. Sharp, the thorax becomes thus expanded after a previous pulmonary disorder, and the case is attended with the symptoms of a suppuration, it is probably owing to a collection of matter. The patient, he observes, will also labour under a continual low fever, and a particular anxiety from the load of fluid.

Besides this dilatation of the cavity by an accumulation of the fluid, the patient will be sensible of an undulation, which is sometimes so evident, that a bystander can plainly hear it in certain motions of the body. Mr. Sharp adds, that this was the case with a patient of his own, on whom he performed the operation; but the fluid in this instance, he says, was very thin, being a serous matter rather than pus. Sometimes, when the practitioner applies his ear close to the patient's chest, while this is agitated a noise can be heard like that produced by shaking a small cask not quite full of water.—(See *Dr. Archer's Case, in Trans. of the Fellows, &c. of the King's and Queen's College of Physicians in Ireland, vol.* 2, *p.* 2.) In this instance the fluid resembled whey.

According to the same author it will also frequently happen, that though the skin and intercostal muscles are not inflamed, they will become œdematous in certain parts of the thorax: or, if they are not œdematous, they will be a little thickened; or, as Boyer states, the intercostal spaces are widened, and, when the empyema is considerable, instead of being depressed, as they are in thin persons, they project beyond the level of the ribs.—(*Mal. Chir. t.* 7, *p.* 357.) These symptoms, joined with the enlargement of the thorax, and the preceding affection of the pleura or lungs, seem unquestionably to indicate the propriety of the operation. But, observes Mr. Sharp, among other motives to recommend it upon such an emergency, this is one, that if the operator should mistake the case, an incision of the intercostal muscles would neither be very painful nor dangerous.—(See

Critical Inquiry into the Present State of Surgery, sect. on Empyema.)

"The difficulty of lying on the side opposite to the collection of pus," says Le Dran, "is always accounted a sign of an empyema. This sign, indeed, is in the affirmative; but the want of it does not prove the negative; because, when there is adhesion of the lungs to the mediastinum, the patient may lie equally on both sides."—(*Le Dran's Obs. p.* 108, *edit.* 2.) The explanation of this circumstance offered by Le Dran is, that when the cyst, in which the matter is contained, is between the mediastinum and the lungs, the mediastinum gradually yields to the volume of the pus in proportion as it is formed, and the cyst in which it is contained becomes dilated; "whence habitude becomes a second nature." Whereas, in an empyemal person, in whom the lung is not adherent to the mediastinum, and who lies on the side opposite to that on which the collection of pus is situated, the mediastinum is on a sudden loaded with an unusual weight of fluid.—(*P.* 111.)

Richerand contends, that the difficulty of breathing which patients with extravasated fluid in the chest experience in lying upon the side opposite to that on which the disease is situated, never originates, as has been commonly taught and believed, from the fluid pressing upon the mediastinum and opposite lung. "I have (says he) produced artificial cases of hydrothorax, by injecting water into the thorax of several dead subjects, through a wound made in the side. This experiment can only be made on subjects in which the lungs are not adherent to the parietes of the chest. In this way from three to four pints of water were introduced. I then cautiously opened the opposite side of the chest; the ribs and lungs being removed, the mediastinum could be distinctly seen, reaching from the vertebræ to the sternum, and supporting, without yielding, the weight of the liquid, in whatever position the body was placed.

It is evident, then, that patients with thoracic extravasations lie on the diseased side, in order not to obstruct the dilatation of the sound side of the respiratory organs, one part of which is already in a state of inaction. It is for the same reason, and in order not to increase the pain by the tension of the inflamed pleura, that pleuritic patients lie on the diseased side. The same thing is observable in peripneumony; in a word, in all affections of the parietes of the chest.—(*Richerand, Nosogr. Chir. t.* 4, *p.* 168, 169, *édit.* 2.)

It appears to me, that there may be some truth in the foregoing statement; but the experiments are far from being conclusive with respect to the assertion, that in cases of empyema, hydrothorax, &c. the fluid on one side of the chest does not compress the opposite lung. In the first place the quantity of fluid is frequently much larger than that which Richerand injected. Secondly, although the mediastinum may not be apt to yield at once to the weight of a liquid suddenly injected into one side of the thorax, yet it may do so by the gradual effect of disease. Thirdly, many of the phenomena of empyema seem adverse to Richerand's inference.

Although surgeons should be aware, that patients with empyema can sometimes lie in any position, without particular aggravation of the difficulty of breathing, yet it ought to be distinctly understood, that the generality of patients with this disease cannot place themselves on the side opposite to that on which the collection of pus is situated, without their respiration being very materially obstructed. Another circumstance also which deserves to be mentioned while we are treating of the symptoms of empyema is, that the œdema of the integuments is sometimes not confined to the thorax, but extends to more remote parts, on the same side of the body as the collection of matter. Both the foregoing remarks are confirmed by an interesting case which was published by Mr. Hey.

Sept. 3, 1788, Mr. Hey was desired to visit John Wilkinson, who had been ill ten days of the influenza. The patient was found labouring under a fever, attended with cough, difficulty of breathing, and pain in the left side of the thorax. He was bled once, blisters were repeatedly applied to the chest, and he took nitre and antimonials, with a smooth linctus to allay his cough. "He was repeatedly relieved by these means, especially by the application of the blisters; but repeatedly relapsed. At last he became so ill, that he breathed with the utmost difficulty, and could not lie on the right side without danger of immediate suffocation."

Mr. Hey found the patient in the state just now described on the 17th of September. "His face, and especially his eyelids, were a little swollen on the left side." The left side of the thorax was larger than the right, and its integuments were œdematous. Upon pressing the intercostal muscles, they felt distended; they yielded a little to a strong pressure, but rebounded again. The abdomen, especially at its upper part, appeared to be fuller than in the natural state.—(See *Hey's Practical Obs. in Surgery, p.* 476.) This last symptom is also particularly noticed by Boyer.—(*Mal. Chir. t.* 7, *p.* 357.)

Another remarkable symptom which is occasionally produced by collections of matter in the chest, is an alteration in the position of the heart. I have seen a patient in St. Bartholomew's Hospital, who had so large a quantity of matter in the left bag of the pleura, that it completely displaced the heart, which pulsated against the inside of the chest at a considerable distance to the right of the sternum. This man's life might perhaps have been saved had paracentesis thoracis been performed in time. Some suspected an aneurism from the throbbing on the right of the sternum: and the case was not fully understood till after death, when the body was opened. A little attention to the symptoms, however, might have convinced any man of moderate understanding, that it was an empyema, and that making an opening for the discharge of the matter afforded the only rational chance of preserving life. There had been pain and inflammation in the chest, followed by shiverings; there was very great difficulty of breathing; the heart, which previously used to beat in the usual place, no longer did so; but now pulsated on the right side of the thorax.

That the heart should be displaced in this manner by any large collection of fluid in the right cavity of the thorax, one would naturally expect; but it is an occurrence that has not been much noticed by surgical writers. Baron Larrey, however, has related a highly interesting case, where the heart was not only pushed considerably to the right of the sternum, but its action was so much impeded by the derangement of its position, that the pulse in the large arteries was thereby rendered extremely feeble. In this instance, also, the diaphragm had descended so low down as to force some of the small intestines into the cavity of the pelvis.—(*Mémoires de Chirurgie Militaire, t.* 3, *p.* 447, *&c.*) Pelletan has also recorded an example in which a collection of fluid in the left cavity of the chest displaced the heart, the pulsations of which were perceptible between the third and fourth ribs of the right side, near the sternum.—(*Clinique Chir. t.* 3, *p.* 276.) Baron Boyer speaks of one case in which the displacement of the heart was so extensive that its pulsations were felt near the right axilla.—(*Traité des Mal. Chir. t.* 7, *p.* 357.) In the anatomical collection at Strasburg is also a preparation exhibiting the displacement of the heart into the right side of the chest, by matter in the left pleura, the left lung being nearly annihilated.—(*Lobstein, Compte de son Museum Anat. p.* 39, 8vo. 1820.) The heart is sometimes thrust downwards by collections of fluid in the chest, and its pulsation is distinguishable in the epigastrium.—(*Hodgson on the Diseases of Arteries and Veins, p.* 95.)

When the cavity of the pleura contains fluid, and the surgeon strikes the thorax repeatedly with the ends of his fingers, a dull sound is said to be produced, quite different from what would occur were the chest in its natural state. But, as Boyer remarks, this symptom, to which so much importance has of late been attached, being common to extravasations in the thorax and several other diseases, will not denote empyema, unless combined with other signs of this affection. Nor will any useful information be derived from the above percussions, except the practitioner has had a good deal of experience in them, and they are repeatedly practised with the patient in different positions.—(*Mal. Chir. t.* 7, *p.* 357.)

The symptoms of empyema are frequently very equivocal, and the existence of the disease is generally somewhat doubtful. Panarolius opened a man whose left lung was destroyed, at the same time that the thorax contained a considerable quantity of pus. Although the patient had been ill for two months, he had

suffered no difficulty of breathing, and had had only a slight cough. Le Dran met with a case of nearly the same kind. A patient who had been for three days affected with a considerable oppression and an acute pain on the left side of the chest, got somewhat better. He felt no material difficulty of breathing on whatever side he lay. The only thing which he complained of, was the sense of a fluctuation in his thorax, and a little obstruction of his respiration when he was in a sitting posture. These symptoms did not seem sufficiently decided to justify the operation, and it was delayed. The febrile symptoms continued, with cold sweats, and the patient died on the eighth day. Five pints of pus were found collected in the chest.—(See *Le Dran's Observations in Surgery*, *p.* 109, 110, *edit.* 2.)

The symptoms more particularly depending upon empyema itself, that is to say, upon the disease and suppuration within the chest, are nearly the same as those which accompany all large deep-seated abscesses. The fever attending the thoracic inflammation which ends in suppuration, gradually diminishes, but does not entirely cease. On the contrary, it soon changes into hectic, attended with flushings of the cheeks, heat of the palm of the hands, and exacerbations every evening and after meals. In the night, the upper parts of the body are covered with perspiration; the patient is tormented with insatiable thirst; his appetite quite fails; his debility becomes extreme; he is subject to frequent fainting fits; diarrhœa ensues; and the finger nails become curved, shining, and of the yellow tinge observable all over the body. At length the utmost emaciation and the facies Hippocratica come on, frequently attended with dilated pupils and enfeebled vision, and indicating the approach of death.

As the operation of empyema and some other particulars relating to this subject, are treated of in another part of this Dictionary (see *Paracentesis of the Thorax*), it will only be necessary for me here to subjoin a list of works, which may be advantageously consulted for information on empyema. *A. Vater, et J. E. Mutillet, Empyema, e vomica pulmonis, rupta in cavitatem pectoris dextram effusa, indeque pulmo hujus lateris compressus penitusque ab officio remotus, Wittemb*, 1731.—(*Haller, Disp. ad Morb.* 2, 4031.) *Gerardus le Maire, Diss. de Empyemate, 4to. Lugd.* 1735. *Sharp's Critical Inquiry into the Present State of Surgery, sect. on Empyema. Le Dran's Observations in Surgery. J. L. Petit, Traité des Maladies Chirurgicales, t.* 1, *chap.* 3. *Des Plaies de la Poitrine. Warner's Cases in Surgery, chap.* 6, *edit.* 4. *Mémoire sur l'Opération du Trépan au Sternum, par M. de la Martinière, in Mém. de l'Acad. Royale de Chirurgie, t.* 12, *p.* 342, *édit.* 12*mo. L. G. Van Malcote, De Empyemate, Teneramund.* 1783. *Sabatier, Médecine Opératoire, t.* 2, *p.* 247, *&c. édit.* 1. *A. O'Flaherty, De Empyemate, Montp.* 1774. *Andouard de l'Empyeme, Cure Radicale obtenue par l'Opération, &c.* 8*vo. Paris*, 1808. *Callisen, Systema Chirurgiæ Hodiernæ, vol.* 2, *p.* 363, *edit.* 1798. *Flajani, Collezione d'Osservazioni, &c. di Chirurgia, t.* 3, *p.* 185, *&c.* 8*vo. Roma*, 1802. *Richerand, Nosogr. Chir. t.* 4, *sect. des Maladies de l'Appareil respiratoire. Léveillé, Nouvelle Doctrine Chir. t.* 2, *p.* 575, *&c. Hey's Practical Obs. in Surgery, ed.* 3. *Lassus, Pathologie Chir. t.* 1, *p.* 122, *&c. Larrey, Mémoires de Chirurgie Militaire, t.* 3, *p.* 442; *et t.* 4, *p.* 356, *&c. Pelletan, Clinique Chir. t.* 3, *p.* 236, *&c. J. Hennen, Principles of Military Surgery, p.* 384, *&c. ed.* 2, 8*vo. Edinb.* 1820. *Boyer, Traité des Mal. Chir. t.* 7, *p.* 351, *&c.* 8*vo. Paris*, 1821.

[A most singular case of empyema occurred under my own observation, which was reported at length in the *Med. Recorder* for 1823. The patient had been treated by a number of physicians for abscess of the liver, from the circumstance of large quantities of pus passing off from the stomach and bowels at short intervals, and the pulmonic symptoms were attributed to the displacement of the diaphragm by the pressure of the enlarged hepar. On dissection, however, the case was found to be empyema, and an opening for the escape of the matter had taken place through the œsophagus near the cardiac orifice of the stomach, whereby the abscess emptied itself into that viscus, and the matter was thrown up from the stomach or passed off by the bowels.

I have now a patient in this city under medical treatment, who, I doubt not, is suffering under empyema, which somehow or other finds its way into the stomach, probably by a similar route. Large quantities of pus are passing periodically from the bowels or are ejected from the stomach, which I am satisfied does not come from the liver, and I have no doubt this is the case with many cases treated as hepatic abscess.—*Reese.*]

ENCANTHIS. (From ἐν, and κανθος, the angle of the eye.)

The encanthis, at its commencement, is nothing more, says Scarpa, than a small, soft, red, and sometimes rather livid excrescence, which grows from the caruncula lachrymalis, and, at the same time, from the neighbouring semilunar fold of the conjunctiva. The inveterate encanthis is ordinarily of considerable magnitude; its roots extend beyond the caruncula lachrymalis and semilunar fold, to the membranous lining of one or both eyelids. The patient experiences very serious inconvenience from its origin, and interposition between the commissure of the eyelids, which it necessarily keeps asunder, on the side towards the nose.

The encanthis keeps up a chronic ophthalmy, impedes the action of the eyelids, and, in particular, prevents the complete closure of the eye. Besides, partly by compressing and partly by displacing the orifices of the puncta lachrymalia, it obstructs the free passage of the tears into the nose.

According to Scarpa, this excrescence, on its first appearance, is commonly granulated like a mulberry, or is of a ragged and fringed structure. Afterward, when it has acquired a certain size, one part of it represents a granulated tumour, while the rest appears like a smooth, whitish, or ash-coloured substance, streaked with varicose vessels, sometimes advancing as far over the conjunctiva covering the side of the eye next to the nose, as where the cornea and sclerotica unite. In this advanced state, the encanthis constantly interests the caruncula lachrymalis, the valvula semilunaris, and the membranous lining of one or both eyelids. In addition to the roots, which in such circumstances connect the excrescence with the caruncula lachrymalis, the semilunar fold, and the conjunctiva of the globe of the eye, the encanthis emits an appendage, or prominent, firm elongation, along the inside of the upper or lower eyelid, in the direction of its edge. The middle or body of the encanthis divides near the cornea, as it were, like a swallow's tail, to form two appendages or elongations, one of which extends along the inner surface of the upper eyelid by the margin of which it is covered, while the other shoots in a direction from the internal towards the external angle, along the inside of the lower eyelid, which also conceals it beneath its edge.

The body of the encanthis, or that middle portion of the whole excrescence which reaches from the caruncula lachrymalis and semilunar fold, inclusively, over the conjunctiva almost to the junction of the sclerotica with the cornea, sometimes forms a prominence as large as a small nut or chestnut. At other times it is of considerable size, but depressed and broken down, as it were, at its centre. Still, however, the body of the encanthis preserves that granulated appearance which prevailed at first; while one or both the appendages on the inside of the eyelids appear rather like a fleshy than a granulated substance.

On turning out the inside of the eyelids, these appendages or elongations of the encanthis form a very manifest prominence. When both eyelids are equally affected, and turned inside out, the appendages conjointly represent, as it were, a ring, the back of which rests on the globe of the eye.

Sometimes the encanthis assumes a cancerous malignancy. This character is evinced by the dull red, leaden, or (as Beer says) the bluish red colour of the excrescence; by its excessive hardness, and the lancinating pains which occur in it, and extend to the forehead, the whole eyeball, and the temple, especially when the tumour has been slightly touched. It is also evinced by the propensity of the excrescence to bleed, by the partial ulcerations on its surface, which emit a fungous substance, and a thin and exceedingly acrid discharge. The disease is constantly attended with epiphora, and preceded by a scirrhous induration of the caruncle. The eyeball and neighbouring bones, which are of a spongy texture, are said to participate very soon in the disease, the lower eyelid also becoming everted.—(*Beer, Lehre von den Augenkr. b.* 2, *p.* 187, 188.) This form

of encanthis only admits of palliative treatment; unless, indeed, an effort be made to extirpate it entirely, together with the whole of what is contained in the orbit, and even then the event is dubious.

Beer joins Scarpa in the statement that the operation rarely proves successful, and adds, that it is always followed by an incurable weeping, and a considerable eversion of the lower eyelid.—(*Vol. cit. p.* 189.) Fortunately, the truly cancerous encanthis is uncommon; Mr. Guthrie has not seen it (*Operative Surgery of the Eye, p.* 117); and Mr. Travers, who was a surgeon to the London Eye Infirmary several years, never met with an instance of it.—(*Synopsis of Diseases of the Eye, p.* 103.)

The benign encanthis, how large soever it may be, is always curable by extirpation. Those instances which are small, incipient, and granulated, like a mulberry, or of a fringed structure, which originate either from the caruncula lachrymalis, or the semilunar fold of the conjunctiva, or from both these parts together, and even in part from the internal commissure of the eyelids, may be raised by means of a pair of forceps, and cut off from the whole of their origin closely to their base, with the curved scissors with convex edges. In the performance of this operation, it is unnecessary to introduce a needle and thread through this little excrescence, as some are wont to do, for the purpose of raising it, and destroying more accurately all its origins and adhesions. The same object is fulfilled by means of forceps, without inconveniencing the patient with a puncture of this kind, and drawing a thread through the part in order to make a noose. However, in cutting out an encanthis of this small size, care should be taken not to remove, together with that portion of the excrescence which originates from the caruncula lachrymalis, any more of this latter body than what is absolutely necessary for the precise eradication of the disease, in order that no irremediable weeping may be occasioned.

When the little excrescence has been detached from all its roots, says Scarpa, the eye must be washed several times with cold water, in order to cleanse it from the blood, and then it is to be covered with a piece of fine linen, and a retentive bandage. On the 5th, 6th, or 7th day, the inflammation arising from the operation entirely ceases, and the suppuration from the wound is accompanied with the mucous appearance already described. The little wounds are then to be touched with a piece of alum, scraped to a point like a crayon, and the vitriolic collyrium, containing the mucilage of quince seeds, is to be injected into the affected eye several times a day. If these means should not bring about the wished-for cicatrization, but, on the contrary, the small wounds situated on the caruncula and internal commissure of the eyelids should become stationary and covered with proud flesh, the argentum nitratum ought to be applied to them. The conjunctiva, however, should be avoided as much as possible, especially if at all wounded. When the fungous granulations have been destroyed, the cure may be perfected by the collyrium already mentioned, or rather by introducing thrice a day, between the eyeball and the internal angle of the eyelids, the powder of tutty and the Armenian bole. Bidloo recommends powdered chalk, either alone or in conjunction with burnt alum.—(*Exercit. Anat. Chir. decad.* 2.)

Excision is equally applicable to the inveterate encanthis, which is of considerable size, and broken down at its body, or which forms a prominence as large as a nut or chestnut, with two fleshy appendages extending along the inner surface of one or both eyelids. The application of a ligature to such an excrescence ought never to be regarded as a method of cure; for the large inveterate encanthis never has a sufficiently narrow neck to admit of being tied. On the contrary, when the tumour is voluminous, its roots invariably extend to the caruncula lachrymalis, the semilunar fold, and the conjunctiva covering the eyeball, oftentimes nearly as far as the cornea. In this state also, the encanthis has one or two fleshy appendages, which reach along the membranous lining of one or both eyelids. Hence, though the ligature were to produce a separation of the body of the encanthis, one or both the appendages would still remain to be extirpated. This second operation could only be accomplished with the knife. In this disease, there is no foundation for the fear of hemorrhage, to which the advocates for the ligature attach so much importance; for cases are recorded of considerable inveterate encanthes being removed, without the least untoward occurrence from loss of blood. To these, Scarpa observes, he could add a great number of his own, so that no doubt can now be entertained on this point.

Pellier relates a case, in which an encanthis was followed by a dangerous hemorrhage, though it had been cut out by an expert oculist. He enters, however, into no detail concerning the nature of the complaint, nor the way in which the operation was performed; circumstances from which one might deduce the reason of this unusual accident. Indeed, the same author adds, "I have often performed this operation for such excrescences, and have never met with a similar occurrence."—(*Recueil d'Observ. sur les Maladies de l'Œil. part* 2, *obs.* 118.)

When the encanthis is large and inveterate, with two extensive fleshy elongations, one on the inside of the upper eyelid, and the other on that of the lower one, we are to proceed in the following manner. The patient being seated, an assistant is to turn out the inside of the upper eyelid, so as to make one of the appendages of the encanthis project outwards. By means of a small bistoury, a deep incision is next to be made into the elongation, in the direction of the margin of the eyelid; and then having taken hold of and drawn it forwards with a pair of forceps, we are to separate it throughout its whole length, from the inside of the upper eyelid, proceeding from the external towards the internal angle of the eye, as far as the body or middle of the encanthis. We are then to do the same to the lippomatous appendage on the inside of the lower eyelid. Afterward the body of the encanthis is to be elevated, if possible, with a pair of forceps; but when this instrument will not answer the purpose, a double hook must be employed. This middle portion is now to be detached, partly with the bistoury, and partly with the curved scissors, from the subjacent conjunctiva, on the globe of the eye, from the semilunar fold, and from the caruncula lachrymalis; dividing the substance of this last part more or less deeply, according to the depth and hardness of the large inveterate encanthis. Here it is proper to state distinctly, that when we have to deal with an old large tumour of this nature, deeply rooted in the caruncula lachrymalis, it is not regularly in our power to preserve a sufficient quantity of the substance of this part, to prevent the tears from dropping over the cheek after the wound is healed.

The eye is to be repeatedly washed with cold water.

The rest of the treatment consequent to the extirpation of a large encanthis, is almost the same as what was explained in speaking of the small incipient case. Bathing the eye very frequently in the lotion of mallows, and employing anodyne, detergent collyria, are the best local means, until the mucous appearance, preceding suppuration, has taken place on the surface of the wound. Then we may have recourse to mild astringent ointments and collyria. The mildest topical applications are generally the best, both in the first stage of suppuration, as well as afterward, particularly when, together with the encanthis, we have removed a considerable piece of the conjunctiva which covered the eyeball towards the nose, and was intimately connected with the body of the excrescence.

Consult *Scarpa sulle Malattie degli Occhi, ed.* 5, *cap.* 12; *Richter, Anfangsgr. der Wundarzn. band* 2, *p.* 473, *&c. edit.* 1802. *G. J. Beer, Lehre von den Augenkr. b.* 2, *p.* 187, 8*vo. Wien*, 1817. *B. Travers, A Synopsis of the Diseases of the Eye, p.* 103, *&c. C. T. Guthrie, Lectures on the Operative Surgery of the Eye*, 8*vo. Lond.* 1823, *p.* 117, *&c.*

ENCEPHALOCELE. (From *ἐγκέφαλος*, the brain, and *κήλη*, a tumour.) A hernia of the brain.—(See *Hernia Cerebri.*)

ENCYSTED TUMOURS. See *Tumours, Encysted.*

ENEMA. The following are some of the most useful glysters employed in the practice of surgery.

Cathartic.

℞. Decocti hordei ℔j.
Sodæ muriatis ʒj.—Misce.

℞. Decocti avenæ ℔j.
Olei olivæ ʒij.
Magnesiæ Sulphatis ʒj.—Misce.

Anodyne.

℞. Mucilaginis amyli, aquæ distillatæ, sing. ℥ij. Tinctura opii guttas xl.—Misce.

℞. Olei olivæ ℥iv. Tinctura opii guttas xl.—Misce.

The two latter are particularly useful when great irritation exists about the rectum, bladder, or urethra. They have great effect in diminishing spasmodic affections of this canal and the neck of the bladder.

Tobacco.

Employed in cases of strangulated hernia.

℞. Nicotianæ ℥j. Aq. ferventis lbj. The plant is to be macerated ten minutes, and the liquor then strained for use. One half should be first injected, and soon afterwads the other, unless the glyster operate with dangerous violence, as it sometimes does in particular constitutions.

ENTEROCELE. (From ἔντερα, the bowels, and κήλη, a tumour.) A hernia, the contents of which are intestine.

ENTERO-EPIPLOCELE. (From ἔντερα, the bowels, ἐπίπλοον, the omentum, and κήλη, a tumour.) A hernia, the contents of which are both intestine and omentum.

[ENTEROTOMY. As Mr. Cooper has not introduced this operation into his Dictionary, it may be safely presumed that it has not been performed, at least with success, in Great Britain or on the continent.

To Professor White, senior, of Berkshire Medical Institution, belongs the honour of having first performed this operation, and with entire success, as early as the year 1806, for the extraction of a teaspoon from the intestine. This case, so novel and important, and standing as it does *alone* in this country as well as in Europe, will be found recorded in the *Med. Repos. of New-York, Hexade* 2, *vol.* 4, *p.* 367.—*Reese.*]

ENTROPIUM. (From ἐν, and τρέπω, to turn.) An inversion of the eyelids.—(See *Trichiasis.*)

EPIGLOTTIS SHOT AWAY. The practice of Baron Larrey furnishes a curious example, in which the epiglottis of a French soldier was shot off at the battle of Alexandria, on the 21st of March, 1801. The ball entered at the angle of the jaw, crossed the throat obliquely, and came out at the opposite side of the neck. The base of the tongue was grazed, and the epiglottis shot away; the patient spit it up after the accident, and showed it to the surgeon who first saw him.

The patient was not in much pain; but his voice was hoarse, feeble, and scarcely audible.

When he first attempted to swallow, he was seized with a convulsive suffocating cough, attended with vomiting. Annoyed by thirst, which the extreme heat of the weather, and the irritation of the wound excited, he incessantly repeated his attempts to drink; but always with the same result. Four days were passed in this deplorable condition. He already experienced violent complaints in his stomach, continual loss of sleep; he had a small accelerated pulse; and was beginning to look thin.

Such was the state of this wounded soldier, when Larrey saw him on the fifth day. After making a few inquiries about what had passed after the accident, attempting to make the patient drink, and examining the interior of the mouth, Larrey was convinced that the paroxysms of suffocation and the inability to swallow, depended upon the permanent opening of the glottis, the lid of which had been shot away. The prognosis of the injury was exceedingly unfavourable, and there can be no doubt, that if the patient had been abandoned to the resources of nature, he would have died in the course of a few days. The indications were equally difficult to fulfil: the most urgent was to appease the hunger and thirst with which this poor soldier was afflicted. Larrey fortunately was provided with an elastic gum tube, constructed for the œsophagus. This instrument was introduced, with the usual precautions, into the pharynx, and by means of it the patient was given some drink, which relieved him much, and afterward some rich broth. The patient was fed in this manner for six weeks, at the end of which time he was able, without the assistance of the tube, to swallow thick panado, and thickened rice made into little balls. The powers of speech and deglutition in time became much more perfect; in consequence, as Larrey imagines, of an enlargement of the artenoid cartilages, and an expansion of that part of the base of the tongue which lies next to the glottis, having formed a sort of substitute for the epiglottis.—(*Mémoires de Chirurgie Militaire, t.* 2, *p.* 145.—149.)

The foregoing case illustrates, in a convincing manner, the importance and utility of elastic gum tubes for conveying nourishment and medicines down the œsophagus in wounds about the throat. All practitioners, and especially military surgeons, should be duly impressed with the necessity of having such instruments always at hand. The patient, whose case is above recited, owed his preservation altogether to this means, without which he must have been starved to death.

In the 4th vol. of the above work, p. 247, is recorded another case, in which a gun-shot wound, that took away the epiglottis and broke the os hyoides, was successfully treated.

EPIPHORA. (From ἐπιφέρω, to carry with force.) By this term is meant an accumulation of tears on the anterior part of the eye; in consequence of which, the person affected is not only under the necessity of frequently wiping them away, but vision is injured by the morbid refraction which they produce of the rays of light that enter the pupil. *Stillicidium lachrymarum* is distinguished by modern writers from epiphora: the cause of stillicidium lies in some obstacle to the absorption and conveyance of the tears from the lacus lachrymarum into the sac. Epiphora, on the other hand, consists in a superabundant secretion of tears, and is a disease of the secreting, not of the excreting parts of the lachrymal organs.—(See *W. M'Kenzie's valuable Essay on the Diseases of the Lachrymal Organs, p.* 47, 8*vo. Lond.* 1819; *and Beer, Lehre von den Augenkr. b.* 2.)

EPIPLOCELE. (From ἐπίπλοον, the omentum, and κήλη, a tumour.) A hernia, formed by a protrusion of the omentum.—(See *Hernia.*)

EPULIS. (From ἐπι, upon, and οὖλα, the gums.) A small tubercle on the gums. It is said sometimes to become cancerous. The best plan of cure is to extirpate it with a knife.

ERETHISMUS. (From ἐρεθίζω, to irritate.) The state of irritation, attending the early stage of acute diseases. Mr. Pearson has described a state of the constitution produced by mercury acting on it as a poison. He calls it the *mercurial erethismus*, and mentions that it is characterized by great depression of strength, anxiety about the præcordia, irregular action of the heart, frequent sighing, trembling, a small, quick, sometimes intermitting pulse, occasional vomiting, a pale, contracted countenance, a sense of coldness; but the tongue is seldom furred, nor are the vital and natural functions much disturbed. In this state, any sudden exertion will sometimes prove fatal. Mr. Pearson advises, with a view of preventing the dangerous tendency of this affection, the immediate discontinuance of the use of mercury, and exposing the patient to a dry, cool air. The incipient erethismus may often be averted by the camphor mixture and large doses of ammonia, if mercury be also left off. Sarsaparilla is also beneficial, when the stomach will bear it.—(*Pearson on Lues Venerea, p.* 156, *&c. edit.* 2.)

ERYSIPELAS. (From ἐρύω, to draw, and πέλας, adjoining.) St. Anthony's fire; so called, from its tendency to draw the neighbouring parts into the same state, or, in other words, from its propensity to spread.

Erysipelas may be defined to be a cutaneous inflammation, attended with redness, which disappears, and leaves a white spot for a short time after being touched with the end of the finger; and the affection, which is irregularly circumscribed by a defined line, is characterized by a remarkable propensity to spread.

The part is generally of a bright red colour, clear, and shining. The disorder is not accompanied by throbbing; and a burning heat and tingling are felt rather than acute pain. If the skin alone be affected, there is hardly any perceptible swelling, and no tension; "yet some difference is perceived between the sound and the inflamed part by passing the finger over it." In many instances, vesications arise; a circumstance which led Dr. Willan to include the disease in the order *Bullæ*. However, if we mean this arrangement to extend to what is named *local* or *accidental erysipelas*, as well as to the *idiopathic* forms of the disorder, there cannot be a doubt of its inaccuracy; many examples of erysipelas from local irritation being characterized neither by fever nor vesications.

Desault preferred the division of erysipelas into *phlegmonous, bilious*, and *local*.—(*Chir. Journ. vol.* 2.)

Mr. Pearson divided the complaint into three forms, viz. *phlegmonous*, *œdematous*, and *gangrenous*.—(*Principles of Surgery, chap.* 10.) Burserius notices, 1. The *idiopathic*, or *primitive* erysipelas, or that which arises spontaneously from an internal cause, unpreceded by any other disease. 2. *Symptomatic*, or *secondary* erysipelas, depending on another affection, by which its progress is completely influenced. 3. *Accidental* erysipelas, or that which is casually excited by some external manifest cause.—(*Instit. Med. Prac. t.* 2, *c.* 2, 8*vo. Lips.* 1798.)

The division adopted by Mr. Lawrence is into *erythema*, *simple*, *œdematous*, and *phlegmonous erysipelas*. By erysipelas, he understands "inflammation of the skin, either alone, or in conjunction with that of the subjacent adipous and cellular tissues. Like other inflammations (he says), it varies in degree. When it affects the surface of the skin, which is red, not sensibly swelled, soft, and without vesication, it is called *erythema*. *Simple erysipelas* is a more violent cutaneous inflammation, attended with effusion into the cellular substance, and generally with vesication. *Phlegmonous erysipelas* is the highest degree of the affection, involving the cellular and adipous membrane, as well as the skin, and causing suppuration and mortification of the former."—(See *Med. Chir. Trans. vol.* 14, *p.* 2.) When erysipelas, however, is defined to be inflammation of the skin, a peculiar kind of inflammation must be implied; for the skin, like all other parts, is often the seat of common inflammation. My views of the subject lead me to consider erysipelas as a complaint of an inflammatory nature.

In the *phlegmonous erysipelas*, the skin is more raised than in the simple form of the complaint, the swelling is harder and deeper, and of a darker colour. The redness has often a brownish or dark livid tint; and the discoloration is sometimes irregular, giving to the part a marbled appearance. The tumefaction is more considerable than in simple erysipelas, the whole depth of the adipous and cellular textures being loaded with effusion, so that the arm or leg appears of twice the natural size. The sensation of heat and pain, at first sight, is aggravated to a very severe degree, and may be accompanied with throbbing. The swollen part at first yields slightly to the pressure of the finger, but subsequently becomes tense and firm. Vesications, often minute and miliary, form on the surface with purulent contents; but sloughing of the cellular membrane soon comes on, and the febrile symptoms are aggravated. According to Mr. Lawrence's late observations, these dangers are not attended with increased swelling, elevation, and pointing, as in phlegmon; on the contrary, there is rather a diminution of tension, a subsidence, and a feel of softness in the part. At first, the cellular texture contains a whey-like or whitish serum. The fluid gradually becomes yellow and purulent, and we often find it presenting all the characters of good pus, and very thick. The serum is diffused through the cells at an early period, and a mixture of serum and pus often fills a considerable portion of the cellular texture, without any distinct boundary. Frequently matter is deposited in small, separate portions, forming a kind of little abscesses, which often run irregularly in the cellular texture. The substance turns gray, yellowish, or tawny; and sometimes appears like a dirty, spongy substance, filled with a turbid fluid; thus losing its vitality altogether, it is converted into more or less considerable fibrous shreds, of various size and figure, which come away soaked with matter like a sponge. The integuments over a large slough of this kind being deprived of their vascular supply, become livid, and often lose their vitality. The suppurating and sloughing processes go on to a great extent when an entire limb is affected, sometimes completely detaching the skin, and often separating it through a large space; occasionally penetrating deeper, passing between the muscles, causing inflammation of them, suppuration between them, and often sloughing of the tendons. When the substance of a limb is thus generally inflamed, the joints do not escape; inflammation of the synovial membranes, effusion of matter into the joint, and ulceration of the cartilage take place.—(See *Hutchison's Practical Obs. p.* 115, *ed.* 2; *and Bibl. Med. Sept.* 1827, *p.* 331, *as cited by Lawrence.*) An inflammation of such extent and violence cannot fail to produce the most serious disturbance of the nervous system, typhoid symptoms, inflammation of the lungs, or pleura, of the intestinal mucous membrane, &c.; and the case is speedily fatal. If, however, says Mr. Lawrence, the patient should recover after tedious suppurations and discharge of slough, the parts which have been inflamed are so changed in structure, and the skin, fascia, muscles, tendons, and bones are so materially agglutinated and fixed after the extensive destruction of the connecting cellular texture, that the motions of the part are permanently and seriously injured.—(See *Lawrence, in Med. Chir. Trans. vol.* 14, *p.* 12.)

The following is Mr. Lawrence's description of *simple erysipelas*. The skin is preternaturally red and shining, having a light or rosy tint in the early stage and slighter cases of the affection; whence, in some languages, it has received the popular appellation of the *rose;* while, in other instances, it is of a bright scarlet, or even a deep and livid red. The colour disappears on pressure, returning as soon as the pressure is removed. If the skin alone be affected, there is hardly any perceptible swelling, and no tension; yet some difference is perceived between the sound and the inflamed part, by passing the finger over it. Erysipelas, however, is found by Mr. Lawrence to be seldom confined to the skin, except in the slightest cases; effusion soon takes place into the cellular texture, causing a soft swelling; and this may be considerable, together with much tension and a shining surface, when a large part of the body or an entire limb is involved. The inflamed part is hot and painful; at first, a stinging or itching is felt, which soon becomes a sharp, smarting, and burning sensation, with acute pain on pressure. The pain is not so intense and unremitting as in phlegmon, nor is it attended with throbbing. This kind of inflammation often ends by resolution; the redness and other symptoms disappearing, and the skin recovering its natural state, with or without desquamation of the cuticle. Frequently serous effusion takes place from the inflamed surface, elevating the cuticle into smaller or larger vesicles, or into bullæ, like those produced by blisters; or raising it by a soft, yellow, jelly-like deposite, which remains slightly adherent to both the cutis and cuticle. The contents of the vesicles or bullæ are transparent, sometimes nearly colourless, but more commonly yellowish; sometimes they consist of a thin pus, or they may exhibit a bloody or livid discoloration. The fluid loses its clearness, becoming thicker, opaque, and whitish or yellowish. The cuticle gives way; the fluid escapes, and incrustations form, which soon fall off, leaving the skin sound; or they may lead to superficial ulcerations. Erysipelas sometimes produces gangrene, but this is of comparatively rare occurrence. So long as this inflammation is confined to the skin, it does not produce suppuration; and the affection of the cellular structure is too slight for that termination in most cases of simple erysipelas. It may, however, become more severe at one point; and thus we occasionally see the formation of abscess under the skin towards the decline or after the disappearance of the general erysipelatous redness. This inflammation generally attacks a considerable surface of the skin, the inflamed part being irregularly circumscribed by a defined line. It spreads quickly to the neighbouring skin, declining and disappearing in the part first affected. Thus, we commonly see the various stages of erysipelas existing together at the same time in different parts of the skin. The portion last affected is red and swelled; another part is vesicated; while others exhibit incrustation and desquamation. Sometimes it leaves the part first affected, to appear in a distant situation. Its origin, developement, and complete termination seldom take place in one and the same spot. The neighbouring absorbent glands are frequently inflamed, and red streaks are sometimes seen leading to them.—(*Lawrence, in Med. Chir. Trans. vol.* 14.)

A little before the appearance of the redness, and sometimes during several previous days, the patient experiences considerable indisposition, loses his appetite, has shiverings and violent pains in his head, accompanied sometimes with vomiting, and always with weakness and dejection. Frequently bilious complaints occur, attended with a bitter taste in the mouth, and fetid eructations from the stomach. The tongue is moist, and covered with a yellow mucus. The patient afterward has a dry, parched skin, constipation, an accelerated pulse, thirst, and other common symptoms

of fever. Blood drawn from a vein exhibits in a greater or less degree the inflammatory character. "Often, particularly when the head is the seat of erysipelas, the sensorium is principally affected, and symptoms are of the kind called nervous, such as pain and oppression of the head, sleepiness, coma, or delirium. The tongue in such cases becomes dry and brown; but, according to Mr. Lawrence, this state of the organ is often owing principally to the circumstance of the patient breathing entirely through the mouth; the pulse is rapid and feeble, and there is great loss of muscular strength; in short, the symptoms at length are those called typhoid. In other cases, the circulation and the nervous system are not much affected; but there is pain in the epigastric region, foul tongue, with bad taste in the mouth, nausea, and constipation; that is, so many indications of disordered stomach and intestinal canal, to which, as its cause, the local affection must be referred."—(*Med. Chir. Trans. obs.* 14, *p.* 6.) This last form of the complaint has been termed by Desault and others *bilious erysipelas*.

The following is a description of phlegmonous erysipelas, as it sometimes appears when it attacks the head.

The attack is mostly preceded by shiverings, complaints about the region of the heart, and other symptoms very similar to those which indicate the approach of an intermittent fever. The heat is often accompanied with a little delirium, and almost always with drowsiness of a more or less evident kind. The swelling generally makes its appearance on the second night or third day of the fever, attacking the forehead, the cheeks, the nose, or eyelids. This swelling is elastic and smooth: but it is not distinctly circumscribed, and it gradually spreads over such parts of the face as were not at first affected. The skin becomes of a bright red colour; occasionally having a tendency to a livid hue; in other instances having a mixture of yellow. These colours disappear when pressure is made on the part affected, but very soon reappear when such pressure is discontinued. The patient experiences a burning heat and a disagreeable pricking in the part, rather than any acute pain; sometimes he complains of a very troublesome itching. The surface of the tumour is shining, and, as it were, semi-transparent; but without hardness, tension, or any sensation of throbbing. The eyelids are often so swollen that the patient cannot see, and the whole countenance is exceedingly disfigured. On more or less of the erysipelatous tumour vesications arise about the fourth or fifth day; they are filled with a transparent serous fluid, and bear a great resemblance to those which are occasioned by boiling water. They commonly burst, or subside, on the fifth or sixth; the fluid which is discharged sometimes excoriating the neighbouring parts. Frequently there is even a slight ulceration at their base, which ulceration, in the worst sort of cases, assumes a gangrenous appearance, and falls rapidly into a state of complete mortification. When the disease takes a more favourable course, the fever now begins to abate; the vesications dry up; and at the end of eight or twelve days the cuticle peels off, and the scabs situated in places which were occupied by the vesications fall off. The degree of danger depends materially on the delirium and other symptoms indicating an affection of the brain. When phlegmonous erysipelas attacks the face, the termination of the disorder in suppuration is very rare.—(*Bateman, vol. cit. p.* 127.) Mr. Lawrence represents phlegmonous as differing from simple erysipelas, merely in the higher degree and deeper extent of the inflammation, which not only occupies the whole thickness of the skin, and subjacent adipous and cellular tissues, but soon proceeds in the latter to suppuration and sloughing, the skin itself being often involved secondarily in the mortification. Other writers, however, regard as examples of phlegmonous erysipelas cases which perhaps would not be comprehended in the above view; and in fact, the exact line that should divide one form of erysipelas from another does not always admit of being drawn. The affected part, which is at first firm, becomes softer, when diffused suppuration and matter mixed with sloughs are under the skin. Experience proves that the seat of phlegmonous erysipelas is in the skin and cellular substance, and that the disease does not generally extend beneath the fascia. Mr. Lawrence differs from Mr. Hutchison, in having always found the aponeuroses unaffected in examination after death, and seen no symptoms referable to such an inflammation during life. "They may indeed become involved in the disease when it is violent, and they must suffer partially when it extends to the intermuscular cellular texture, but they are not primarily affected in these cases, while in the majority of instances they do not suffer at all."—(*Lawrence, Med. Chir. Trans. vol.* 14, *p.* 16.)

According to several writers, the seat of erysipelas in the greater number of cases is the very surface of the cutis: its most vascular and nervous part.—(*Dict. des Sciences Méd. t.* 13, *p.* 255.) Perhaps it may be true, that the disorder commences here, and is most intense; yet there can be no doubt that the affection generally extends more deeply, and affects the subjacent cellular membrane, particularly in cases of phlegmonous erysipelas. The researches of Mr. Lawrence have taught him, as already noticed, that erysipelas is seldom confined to the skin, except in the slightest cases; effusion soon takes place into the cellular texture, causing a soft swelling; and this may be considerable, together with much tension and a shining surface, when a large part of the body or an entire limb is involved.—(See *Med. Chir. Trans. vol.* 14, *p.* 3.) The affection of the cellular membrane, however, is very different from what happens in phlegmonous inflammation. In true erysipelas, healthy pus is rarely found enclosed in a circumscribed cavity; and when there is any secretion of purulent matter, a feel is communicated on compressing the part, almost like that which a sponge would give. In such cases, the cellular substance is frequently gangrenous.

It does not appear to me that any very exact information has yet been established respecting the causes of erysipelas. We absolutely know nothing about the *immediate* cause; the prevailing ideas concerning the *predisposing* causes are vague; and only those causes termed *exciting* appear entitled to much confidence.

Every surgeon is well aware, that one cause of erysipelatous inflammation is a fever of a determinate and peculiar nature, one feature of which is the invariable production of this kind of inflammation upon the surface of the body.

With respect to the causes of erysipelas, it is the opinion of Mr. Lawrence that no difference prevails on this point between erysipelas and other inflammations. "The habitual excitement of the vascular system, or the long-continued disturbance of the stomach, alimentary canal, and liver, consequent on intemperance and excess, lay the foundation of inflammation generally, and it depends on individual peculiarity, or on local causes, whether the skin or other parts shall be the seat of the disease. In most cases of erysipelas, the bilious and digestive systems are more or less actively disordered, such disorder appearing sometimes to produce the cutaneous affection, sometimes to be excited sympathetically by it. Hence Desault established the denomination of *bilious*, in contradistinction to *phlegmonous*, erysipelas; on which division it may be observed, that the symptoms called bilious are commonly found also in phlegmonous cases."—(*Med. Chir. Trans. vol.* 14, *p.* 36.) Erysipelas may arise from external irritants of all kinds; from heat or cold; blisters, issues, setons, caustics, or other acrid matters applied to the skin; from wounds, punctures, bruises, surgical operations, and all kinds of injury. The mechanical or chemical irritation of wounds, ulcers, or other local diseases will cause it. "Neglect of previous preparation, inattention to diet, injudicious modes of dressing, continued exercise of the affected part, and an imprudent degree of general exertion, are frequent causes of erysipelas after operations and wounds, and in the course of ulcers and other local affections. When these several points are properly attended to, we shall not be much troubled with traumatic and hospital erysipelas. Irritating plasters, a heating load of dressings, and tight bandaging, are common causes of erysipelas, whether in the case of wounds or operations. Light applications, and keeping the parts cool, are simple but effectual preventives. The most frequent source, however, of this affection, after accidents or operations, is improper diet, that is, indulgence in animal food or fermented liquors."—(*Lawrence, vol. cit. p.* 38.) As far as I have seen, another very common source of erysipelas after wounds, is the indiscriminate use of sutures.

According to Mr. Lawrence, simple erysipelas, and

the cases termed exanthematous, are mostly sympathetic, particularly from disorder of the primæ viæ or liver; and hence the epithets *bilious* and *gastric*. Phlegmonous erysipelas is most commonly produced by the wound of venesection, injuries of the superficial bursæ, as those of the patella and olecranon, incised and lacerated wounds, and compound fractures; inflamed ulcers of the legs, and a full diet to persons who have large wounds or ulcers rapidly healing; the wounds received in dissection, &c.

In most cases, erysipelas would seem to be intimately dependent on the state of the constitution. Thus, persons in the habit of drunkenness and other kinds of intemperance, and who in a state of intoxication meet with local injuries, often have erysipelatous inflammation in consequence of them. Other subjects, who lead more regular lives, experience, when they meet with similar injuries, healthy phlegmonous inflammation.

The opinion of Hippocrates and Galen, with respect to the origin of this disorder from a congestion of the bile, is universally known to all initiated in the profession of surgery. This old doctrine has been in some measure revived by Tissot and other believers in the humoral pathology, who attribute the cause of erysipelas to an acrid humour, commonly a bilious one, diffused through the mass of the blood. But while I cannot discern any evidence of the truth of this theory, observation obliges me to confess, that the complaint seems frequently to be connected with a disorder of the chylopoietic viscera, and especially of the liver.

A farther proof that erysipelas is mostly dependent on constitutional causes is, that the affection is particularly frequent in autumn, or in any season when hot weather is succeeded by cold and wet.

Erysipelas attacks both sexes; but women are thought to be rather more subject to it than men, and the reason for this circumstance generally mentioned is, the greater delicacy and tenderness of the skin in females. But it would be quite as rational to suspect their weaker and more irritable constitutions, and their sedentary mode of life. In lying-in hospitals and other charities for the reception of children, new-born infants are often afflicted with a species of erysipelas, which begins in the umbilical region, and thence extends to the pudenda. This case, which sometimes terminates in gangrene and proves fatal, has been ascribed by some writers to injury done to the navel-string during labour, and by others to the bad air frequently allowed to accumulate in establishments of the above description; a cause which too often renders complaints, which are at first trivial, ultimately fatal.

Sometimes the complaint is scarcely cured in one place when it makes its appearance in another; and when this tendency is evinced in a great degree, the case is termed *erysipelas ambulans, vel erraticum*. La Motte has published a striking instance of this form of the disease. A child between nine and ten years of age was attacked with erysipelas of the scalp, forehead, and ears, which afterward extended to the neck and then to the shoulders, while the scalp and face became free from it: in proportion as the disease spread downwards, all the upper parts got well, so that in the end there was no portion of the surface of the body which had escaped, even down to the fingers and toes, the parts last of all affected.—(*Obs. Chir.*)

A very uncommon variety of disease is a *universal erysipelas*. No disorder is more subject than the present to relapses; but a remarkable thing, sometimes attending the return of the complaint, is its being sometimes strictly *periodical*. In chlorotic women, the erysipelatous attack is occasionally made every month just at the period when the menses should take place. —(*Hoffman.*) This periodical nature of erysipelas has been observed in men: Larrey knew two male patients, one of whom used to be attacked with erysipelas twice a year at the time of the equinox; the other had only one attack annually, which was wont to happen in the beginning of the spring. My friend Mr. Maul, of Southampton, once informed me of an erysipelas which was both periodical and universal, affecting a lady several times at intervals of two years.

A doctrine has been started, that erysipelas is sometimes propagated by contagion.—(*Wells, in Trans. for the Improvement of Med. and Surg. Knowledge, vol. 2, art. 17, 1800. A. Riberi, Sulla Gangrena Contagiosa, o Nosocomiale; con alcuni Cenni sopra una Recipela Contagiosa.* 8vo. *Torino*, 1821. *Arnott, in Med. Phys. Journ. vol.* 17.) But, as Dr. Bateman has truly remarked, such cases are at all events extremely rare, and perhaps never happen in well-ventilated and cleanly houses.—(*Synopsis, &c. p.* 131.) In places of an opposite description, the infection of many individuals together might be explained by the operation of the same exciting causes upon them all, without any supposition of contagion. This part of the subject, however, is yet unsettled: Mr. Lawrence believes that erysipelas of the face may be traced in some instances to contagion.—(See *Med. Chir. Trans. vol.* 14, *p.* 39.)

I think we must agree with Mr. Lawrence, that "a consideration of the origin, developement, and effects of erysipelas, whether local or general, leads us irresistibly to the conclusion that the nature of the affection is inflammatory. In its four leading characters of redness, swelling, heat, and pain, and in its effects of effusion, suppuration, and sloughing, it agrees with what is called common or phlegmonous inflammation; while the general disturbance preceding and accompanying the local affection is often exactly alike in the two cases. Erysipelas, then, is merely a particular modification of cutaneous, or cutaneous and cellular inflammation. If we were to class these according to their natural affinities, we should place erysipelas between the exanthemata and phlegmon. It is less diffused than the former—not so circumscribed as the latter. The exanthemata are confined to the skin; erysipelas affects both skin and cellular structure; while phlegmon has its original seat in the latter, the skin being secondarily involved.

The difference between erysipelas and phlegmon, however, is not merely in the original seat or degree of the disturbance: there is also a difference in kind. We may indeed say, generally, that phlegmon is a more violent inflammation than erysipelas, but sloughing of the cellular substance is more frequent in the latter than the former. The most striking and important distinction between the two affections is, that inflammation is confined to one spot in phlegmon, and is distinctly circumscribed in its seat, while it is diffused in erysipelas, and spreads without limit. This difference seems to depend on the adhesive character of the inflammatory process in the former; the substance called coagulating, coagulable, or organizable lymph, effused around the inflamed part, forms a boundary between it and the sound portion, which is altogether wanting in erysipelas. In the latter, the effusion is serous: hence, when matter is formed it is not confined to one spot, but becomes extensively diffused in the cellular tissue." —(*Med. Chir. Trans. vol.* 14, *p.* 17, *&c.*) These views correspond to those given by Mr. Hunter, whose original remarks on erysipelas are particularly valuable both to the pathologist and the practical surgeon.

Like phlegmonous inflammation, erysipelas may be excited by any local irritation. Like other inflammations it may end in suppuration, though of a less perfect sort than that in which phlegmon ends, the pus being rarely contained in a circumscribed cavity. The pulse, in phlegmonous erysipelas, is frequent, hard, sometimes full; and when the patients are bled, their blood has the same appearance, and is covered with the same kind of inflammatory crust, as blood taken away in other kinds of inflammation.

Mr. Lawrence does not agree with some medical authors, among whom may be placed Mr. Hunter, who regard erysipelas as a distinct species of inflammation, and capable of affecting various parts of the body as well as the skin. Some writers (he says) have referred to erysipelas certain inflammations of the conjunctiva, mouth, and fauces; of the respiratory and alimentary mucous surfaces; of the serous membranes in the head, chest, and abdomen, and of the brain, abdominal and thoracic viscera. The distinguishing characters of erysipelas Mr. Lawrence refers to the peculiarities of the cutaneous and cellular structures in which it occurs, and he therefore infers that such an affection cannot exist in parts so differently organized as serous membranes and the viscera. When the remarks of some of the writers in question are carefully considered, it seems as if their meaning were only that erysipelas is connected with a particular state of constitution, in which the inflammation, wheresoever situated would have a tendency to spread rapidly and extensively; but whether the doctrine, even thus modified, is correct, requires farther investigation.

Treatment of Erysipelas.

Simple erysipelas, not exceeding a certain degree of severity, yields to mild purgatives, and a light vegetable diet, with which remedies practitioners usually conjoin diaphoretics and the saline mixture. Whether bleeding is right or not, in this species of erysipelas, is a point on which different sentiments prevail. I believe, however, that venesection, in the milder forms of the complaint, is now pretty generally allowed to be as unnecessary as it is urgently required in more severe examples. It is rather a prevalent notion, that it is unnecessary to repeat bleeding in any case of erysipelas so frequently as is done in other inflammatory diseases. We ought to be guided, however, in this respect, by the violence and extent of the inflammation, the state of the pulse, and other symptoms, never forgetting the patient's age, strength, and other important considerations. Another common belief is, that the patient will bear bleeding better in the country, and in an open, pure air, than in a large city, and especially in an hospital. And it is remarked, that unless there be a considerable tendency to delirium or coma, bloodletting can seldom be repeated with advantage, at least in large towns.—(*Pearson's Principles of Surgery. Bateman's Synopsis, p.* 132, *ed.* 3.) Instead of this practice, the latter author recommends local bleeding and blistering, but *not upon* or *very near the diseased surface*, whereby he avoids producing the troublesome sores, the frequency of which, in former times, after taking blood from erysipelatous parts, led Mr. B. Bell to pronounce a general condemnation of the method. I ought to observe, in relation to the above-mentioned fear of bleeding patients freely in large cities, that it is an hypothesis which seems to be declining, many experienced and judicious surgeons having actually rejected it as unfounded; and, as far as my observations extend, I have no hesitation in stating my opinion, that the abstract consideration, whether a person living in town or country, should not regulate the use of the lancet, which ought to be decided by other more important circumstances in the case. Alexander of Tralles, and Paré, had a high opinion of the beneficial effects of plenty of fresh, cool air in cases of erysipelas; but good air is generally beneficial in all diseases, and, perhaps, not more so in erysipelas than other disorders.

Mr. Lawrence thinks, that as erysipelas resembles other inflammations in its causes, symptoms, and effects, it should be treated on the same principles; that is, on the antiphlogistic plan. Venesection, local bleeding, purging, and low diet are the first measures, to which saline and diaphoretic medicines may be afterward added. He says, the earlier these means are employed the better; vigorous treatment in the beginning seems to him most calculated to shorten the attack, and prevent the disease from spreading beyond its original seat. At the same time he admits, that as the skin and cellular membrane are of secondary importance, it is not so urgently necessary to arrest inflammation in them as in the vital organs; neither does the same reason for very active treatment exist as in affections of the eye, where a slight change of structure may seriously impair the utility of the organ essential to our comfort and pleasure; but the extensive suppuration and mortification which erysipelas sometimes produces may render a limb, in a great measure, totally useless, or may even destroy life. "The disposition of erysipelas to terminate by resolution, is another reason against resorting indiscriminately to active depletion. In many cases the disease passes through a certain course, and ends spontaneously: it is sufficient to put the patient on low diet, to clear the alimentary canal, and then to use mild aperients and diaphoretics. When it proceeds, as it often does, from an unhealthy condition of the alimentary canal, the removal of the internal disorder leads to the cessation of the local complaint. It must, however, be observed, that venesection is sometimes useful both in curing the internal cause and in promoting the termination by resolution." Mr. Lawrence afterward observes, that he does not mean to recommend that measures equally active, and in particular, that bleeding, whether general or local, are to be employed in all cases. In young persons, in the robust, and those of full habit; in instances where the pulse is full and strong, or where there is headache and white tongue; in erysipelas of the head, attended with symptoms denoting affection of the sensorium, and more especially in the very beginning of the affection, venesection will be proper; and it may be necessary to bleed largely, to repeat the evacuation, or to follow venesection by local abstraction of blood. Under such circumstances, the other parts of the antiphlogistic plan must also be employed; that is, the alimentary canal should be cleared by an active purgative, which may be followed by salines and antimonials, with the occasional use of milder aperients, and low diet should be enjoined. As Mr. Lawrence adds, nothing can be more different from such a case, than that of an elderly person, with a small and feeble pulse, in the advanced stage of the disease. The interval between these extremes is filled by numerous gradations, requiring corresponding modifications of treatment. The antiphlogistic plan itself embraces a wider range in point of degree; from blood-letting, local and general, with purging, vomiting, the free use of mercury and antimony, and low diet, to the exhibition of a mild aperient, with some saline medicine. Mr. Lawrence believes, that the treatment of erysipelas, like that of any other inflammation, should be modified according to the age, constitution, previous health, and habits of the patient, and the period of the complaint. "In asserting generally that the antiphlogistic treatment is proper, I speak (says he) of the beginning of the disease, when the original and proper character of the affection is apparent; and I am decidedly of opinion that, in some shape or degree, such treatment will always be beneficial in that stage. In many instances, active antiphlogistic measures are of the greatest service in lessening the severity both of the local and general symptoms. In others, the administration of calomel with aperients, and of diaphoretics with low diet, will be sufficient. When the affection occurs in old and debilitated subjects, the powers of life are soon seriously impaired, and our efforts must be directed rather towards supporting them, than combating the local affection. I have often seen such subjects labouring under erysipelas of the face in its advanced stage, with rapid and feeble pulse, dry and brown tongue, recovered, under circumstances apparently desperate, by the free use of bark and wine." The same writer deems local bleeding sufficient in the milder cases of erysipelas, and often necessary in the more severe ones, as an auxiliary measure. Cupping, when practicable, he sets down as more efficacious than leeches, though objectionable on account of the painful state of the skin. Leeches, he remarks, when applied to the sound skin of some individuals, produce an effect analogous to erysipelas, but they exert no such influence over the inflamed skin, to which they may be applied freely and safely. In order to produce any decided benefit, he thinks that they should be applied in large numbers.

The authorities which may be cited in favour of the treatment of erysipelas on antiphlogistic principles, are Sydenham (*Obs. circa Morborum Acut. Hist. &c. sect.* 6, *c.* 6); Cullen (*Works by Thomson, vol.* 2, *p.* 188); Richter (*Anfangsgr. der Wundarzn. vol.* 1, § 188); Vogel (*Handb. vol.* 3, *p.* 348); J. P. Frank (*De Cur. Hominum Morbis, lib.* 3, *p.* 54); Dr. Duncan, junior (*Edin. Med. Journ. vol.* 19). Several of these writers consider bleeding more particularly proper when erysipelas is seated on the head and face.

As Mr. Lawrence has noticed, high authorities may be brought forward against the use of the lancet in erysipelas, and most of them are comparatively of modern date. Some of them not only object to evacuations of all kinds, but recommend tonics and stimuli, such as bark, ammonia, and wine. Dr. Fordyce declares that he always found bleeding and evacuations hurtful, and Peruvian bark the best remedy. "It should be exhibited (he says) in substance if the patient's stomach will bear it, and in this disease it will almost always bear it; and in as great a quantity as the patient's stomach will bear, which is commonly to the quantity of a drachm every hour!"—(*Trans. of a Society for the improvement of Chir. Knowledge, vol.* 1, *p.* 293.) Some animadversions on the practice of giving bark in this manner will be found in our preceding columns.—(See *Cinchona.*) Dr. Wells is also an advocate for the treatment recommended by Fordyce. With regard to Cullen, he only sanctioned it when the case was attended with typhoid symptoms.

After the inflammation has been checked by antiphlogistic means, the surgeon should not be in too great a hurry to prescribe tonics, stimulants, and a full diet. "Medical practitioners in general (says Mr. Lawrence)

are anxious to begin the strengthening plan; they seem to have the fear of debility constantly before their eyes and lose no time in directing the employment of bark, and recommending animal food with beer or wine. In this way relapses are frequently produced; the inflammation and fever are renewed; farther local mischief is caused, and recovery is retarded."—(*Med. Chir. Trans. vol.* 14, *p.* 59.) When it is doubtful whether stimuli should be employed or not, he deems subcarbonate of ammonia the best medicine. Bark comes next in order to it, and the sulphate of quinine is the most eligible preparation. Wine is sometimes necessary; but Mr. Lawrence thinks it should be given very sparingly.—(See *Med. Chir. Trans. vol.* 14.)

The proposal to treat erysipelas by compression with bandages, as adopted by Bretonneau and Velpeau, seems to require here no farther notice than that it has proved in this country very unsuccessful, and even fatally hurtful.—(See *Duncan, in Med. Chir. Trans. vol.* 1, *p.* 513; *Lawrence, in Med. Chir. Trans. vol.* 14, *p.* 65.) The application of blisters to erysipelatous parts, as sometimes practised by Dupuytren, can only be entitled to the briefest mention, even when viewed as represented by the French surgeons themselves.—(See *Roche and Sanson, Nouveaux Elém. de Pathol. Méd. Chir. t.* 1, *p.* 352.)

In the *bilious* erysipelas, or that originating with strongly marked gastric disorder, whatever degree of heat or fever might exist, Desault gave in the first instance a grain of tartarized antimony dissolved in a considerable quantity of fluid; and the symptoms generally diminished as soon as the effects of the medicine had ceased. He had seen them entirely subside, although the medicine produced no other sensible alteration in the animal economy than an increase of the insensible perspiration and urine; sometimes the symptoms resisted these evacuations, and he was obliged to have recourse once or twice, or even more frequently, to the use of the emetic drink. When the erysipelas was cured, and the bitterness in the mouth and fever had subsided, two or three purges of cassia and manna, with a grain of emetic tartar, were exhibited: during the cure, the patient was ordered to drink freely of a diluting ptisan acidulated with oxymel: and as soon as the symptoms were mitigated, the diet of the patient was allowed to be more nourishing and generous; for when it was too spare, the case was remarked never to proceed so favourably, particularly in hospitals, where the air, generally speaking, is unhealthy. In the bilious erysipelas, Desault observed that the cases of the patients who had been bled previously to their admission into the hospital, were invariably the most serious and obstinate, particularly when the bleeding had been frequently repeated.

In cases of bilious erysipelas, many modern practitioners would be bolder with antimonials than Desault, first by imitating Richter, and giving an emetic at the commencement of the attack, and then by exhibiting more freely either antimonial powder or tartarized antimony, with a dose or two of calomel.

In *phlegmonous* erysipelas, Desault was an advocate for bleeding in the beginning of the disorder, and this practice he followed up by the administration of tartarized antimony and evacuants.

Mr. Lawrence recommends, in the early stage, venesection and the application of leeches in large numbers to the inflamed part, together with the antiphlogistic treatment generally, in order to prevent the full developement of the affection. The bleeding of the leech-bites he directs to be encouraged by fomentations, and cold lotions afterward to be applied. When, however, the inflammation is more advanced (he says), the latter should be exchanged for fomentations and poultices. My own experience in these cases leads me to refer very great efficacy to cold applications, which I find particularly useful in retarding the effusion in the cellular membrane, averting gangrene of this tissue, and stopping altogether the progress of the disorder. In the case of a patient in Fleet-market, whom I attended with Mr. Lawrence and Mr. Bullin, and whose limb was so swelled as to be nearly twice its natural thickness from one end to the other, cold lotions, evacuations, leeches, and other antiphlogistic remedies had a decided effect in giving ease, and preventing all occasion for the practice of extensive incisions. The abscesses were very limited; and two small incisions, made at different periods for the discharge of the matter, answered every purpose. After the bowels have been emptied, Mr. Lawrence prescribes freely calomel and antimony, with saline medicines. The local abstraction of blood he considers more serviceable in phlegmonous erysipelas than venesection. The latter, therefore, he advises to be reserved for instances in which the patient is young and plethoric, the pulse full and strong, or the head much affected.

When such practice is unavailing, Mr. Lawrence finds the plan of making incisions through the inflamed skin and the subjacent adipous and cellular textures, the most powerful means of arresting the complaint. If this be not done (he says), the inflammation will now pursue its course, both in the cellular membrane and skin, in spite of bleeding, whether general or local; suppuration and sloughing rapidly supervene; and these destructive processes soon extend over a large portion of a limb. It was with the view of preventing such consequences, that Mr. Lawrence, in imitation of Mr. C. Hutchison, tried the practice of making free and even very extensive incisions in the inflamed parts, as will be presently noticed.

In cases of *idiopathic* erysipelas, whether *phlegmonous* or *bilious*, external applications have been deemed useless or hurtful by a large proportion of practitioners, among whom is Desault. In the early stage of the disease, Dr. Bateman found powdery substances, like flour, starch, chalk, &c., increase the heat and irritation, and afterward when the fluid of the vesications oozes out, such substances produce additional irritation by forming with the concreting fluid hard crusts upon the tender surface. This practice is also condemned by Mr. Pearson. The only plan, perhaps, which is unobjectionable as a means of allaying the irritation produced by the discharge from the vesication, is that advised by Dr. Willan, and which consists in fomenting or washing the parts from time to time with milk, bran and water, or a decoction of elder-flowers and poppy-heads. In the early stage of the inflammation, Dr. Bateman saw great relief derived from moderate tepid washing, or the application of the diluted liquor ammon. acet.—(*Synopsis of Cutaneous Diseases, p.* 133, *ed.* 3.)

Though Desault forbids local remedies in cases of *idiopathic* erysipelas, he does not extend the prohibition to examples either of bilious or phlegmonous erysipelas from a contusion, wound, or ulcer: regimen and internal medicines, according to Desault, here being insufficient unless topical applications are employed to abate the local irritation, and excite suppuration. With this view he commends cataplasms, but he deems one caution essential, viz. that the application of the poultice should not extend much below the contused surface or the edges of the wound. If any application be permitted on the rest of the erysipelatous surface, he thinks that it should be the liquor plumbi acetatis dilutus made weak.—(*Parisian Chir. Journ. vol.* 2.)

Mr. Pearson prefers cataplasms composed of the powders of aniseed, fennel, chamomile-flowers, &c., mixed with a fourth part, or an equal quantity of bread, and a proper quantity of milk. Linseed powder, he says, may sometimes prove a convenient addition.

As for what is termed *accidental* erysipelas, or that caused by casual local irritation applied directly to the skin, as from acrid substances, heat, friction, the sting of insects, &c., the removal of the cause, the employment of cold, or even ice-cold lotions, and other antiphlogistic means, are the only measures essentially necessary.

In cases of *phlegmonous* erysipelas, if the inflammation continue in an unabated form beyond the seventh or eight day, suppuration is to be apprehended. Here Boyer recommends the employment of emollient applications, and as soon as a fluctuation is distinguishable (or even what he terms "*un empâtement purulent*") he advises the surgeon to make such incisions as may be necessary for the discharge of the matter. He also states that the incisions should be made at several depending points.—(See *Boyer, Traité des Mal. Chir. t.* 2, *p.* 22.) It appears from the observations of Mr. A. C. Hutchison, formerly surgeon to the Naval Hospital at Deal, that seafaring men are very liable to phlegmonous erysipelas of the extremities, particularly of the legs. The cause is ascribed to the irritation of the salt water, and the friction of their loose coarse trousers. In this description of patients the disease frequently proceeds rapidly to the gangrenous state, and the consequence is the loss of many lives and limbs. Even when the

danger of mortification is avoided, abscesses often occur, which spread between the muscles and under the integuments to a surprising extent: "from the ankle to the trochanter and over the glutæi muscles." In the first few cases which came under the care of Mr. Hutchison, this gentleman's plan of treatment, in addition to the usual medical means, consisted of *local bleeding by means of cupping glasses*, followed by fomentations. Subsequently, however, he has adopted *the method of making several free incisions with a scalpel on the inflamed surface* in a longitudinal direction *through the integuments*, and *down to the muscles as early in the disease as possible*, and *before any secretions have taken place. These incisions may be about an inch and a half in length, two or three inches apart, and vary in number from six to eighteen*, according to the extent of surface which the disease is found to occupy. Mr. Hutchison states, that these incisions will yield between fifteen and twenty ounces of blood, and give relief to the tense skin, at the same time that they form channels for the escape of fluid, and the prevention of bags of matter. After the operation, fomentations or saturnine lotions are employed.

By the preceding kind of treatment, Mr. Hutchison thinks the fatal termination of the disease may be rendered less frequent, and gangrenous mischief wholly prevented. He supports this assertion by observing, that he never lost a case in the Deal Hospital for the last five years, during which the practice was followed.—(See *Med. Chir. Trans. vol.* 5, *p.* 278, *&c.*)

Mr. Lawrence thinks the most powerful means of arresting the complaint is by making one or more long incisions through the inflamed skin and the subjacent adipous and cellular textures, which are the seat of the disease. These incisions, he asserts, are followed very quickly and almost instantaneously by relief and cessation of the pain and tension; and this alleviation of the local suffering, he assures us, is accompanied by a corresponding interruption of the inflammation, whether it be in the stage of effusion, or in the more advanced period of suppuration and sloughing. Mr. Lawrence farther maintains that this treatment is employed to the greatest advantage at the beginning, since it prevents the farther extension of inflammation and the occurrence of suppuration and sloughing. At a more advanced stage the incisions limit the extent of suppuration and gangrene; and at a still later time they afford the readiest outlet for matter and sloughs, and facilitate the commencement and progress of granulation and cicatrization.—(*Med. Chir. Trans. vol.* 14, *p.* 67, *&c.*) The great points on which a diversity of opinion exists respecting the treatment by incisions are the period when they are really necessary, and their number and extent. Believing from extensive observation that phlegmonous erysipelas, when properly treated, does not lead so invariably to extensive gangrenous mischief and suppuration under the skin as Mr. Lawrence's account would make us suppose, but, on the contrary, that it frequently admits of resolution, and often occasions only abscesses which may be effectually opened as soon as formed, I cannot acknowledge the wisdom or utility of making incisions for the prevention of evils, the occurrence of which at all is quite a matter of uncertainty. Thus, though Mr. Lawrence has inferred from several of the cases in which he practised early and free incisions, that these had the effect of preventing extensive sloughing and suppuration, the conclusion is certainly without satisfactory proof; and a cure might have taken place very well without them. To the practice, therefore, in the early stage of the disease I should object as unnecessary. At a more advanced period, however, when matter is formed, I am decidedly an advocate for making a free opening for its discharge, but not for inflicting ten or sixteen different wounds for this or any other purpose, nor for using the scalpel with such perfect reliance on the innocence and sweetness of its edge as to make with it a gash requiring a foot or yard ruler for its measurement. Whoever looks over the reports of this treatment, as detailed in the *Lancet* and other works, cannot fail to be struck with the following facts. Several patients, treated in this way, have not been saved, and some have certainly gone out of the world in a very sudden manner. Whether this arose from the shock of an enormous wound on the constitution in its very disturbed state, or from profuse hemorrhage, or other causes, it is needless to inquire. In one or two instances, the cutaneous nerves as well as large veins and arteries, were not spared, and a partial paralysis ensued. Against the proposed treatment by numerous or long incisions I must therefore continue to protest: in the early stage the practice of incisions in any way is not truly indicated for the reason above explained; and at a more advanced period if subcutaneous suppuration or gangrene commence, a prompt and free opening is undoubtedly required according to all the established principles of surgery, but not a wound of preposterous extent. Dr. Dobson, of Greenwich Hospital, makes in all kinds of erysipelas numerous small punctures in the part, and repeats them to the number and extent required mostly twice a day; and often in bad cases three or four times in the twenty-four hours. The quantity of fluid (for it is not blood alone, but blood and effused serum) which these punctures discharge, although sometimes considerable, he says, need never create any alarm. With this practice he joins the exhibition of the camphor mixture, liquor ammon. acet. and tincture of rhubarb. He also employs a lotion, composed of liq. ammon. acet. camphorated spirit, and water.—(See *Med. Chir. Trans. vol.* 14, *p.* 206.) Of this method I shall merely observe that it has not fallen to my lot ever to see it tried; but that, if I were the patient, I should rather submit to it than to the bold sweeping incision or numerous deep cuts which have been recommended by gentlemen whose opinions on other points in surgery I sincerely respect.

[In this country, during the winter months, and especially in variable seasons, *phlegmonous erysipelas* as it is here called, is a frequent consequence of local injury, as burns, wounds, &c., and by speedily running into suppuration, this disease has often proved fatal, although the original mischief was circumscribed and inconsiderable.

I have frequently known this kind of erysipelas to originate from a slight wound on the hand, and in a few days involve the whole arm in the suppurative process. And although the wound or burn scarcely penetrated the cutis, yet the matter would diffuse itself beneath the fascia of the limb, and require the most prompt and efficient remedies to prevent death by the pain and irritation occasioned by distention.

Mr. Lawrence's plan of treatment has been attended with signal success under my own observation, the threatening symptoms subsiding immediately after long and free incisions were made through the skin and subjacent adipose and cellular textures. Professor Delafield of this city has had opportunities of testing this practice to considerable extent, and he informs me that he has uniformly obtained the most satisfactory results.—*Reese.*]

What is termed œdematous erysipelas is generally considered to be an unfit case for bleeding and free evacuations, and almost always to require a tonic plan of treatment. In short, the right practice, in every example of erysipelas, is to let the remedies be regulated in a great measure by the state of the constitution, the pulse, the strong or reduced condition of the system, the sort of fever accompanying the disorder, the age, temperament of the patient, and the particular stage of the complaint. At first, though antiphlogistic treatment may be the only safe plan, circumstances afterward change so considerably that this must be abandoned, and a method quite the reverse of it rigorously adopted.

With regard to the treatment of *gangrenous* erysipelas, nothing more need be said than what is contained in the article on *Mortification*.

Consult *Desault's Parisian Chirurgical Journal, vol.* 2. Also, *Œuvres Chir. de Desault par Bichat, t.* 2, *p.* 581, *&c. Encyclopédie Méthodique, partie Chir. art. Erysipèle. Cullen's First Lines of the Practice of Physic, vol.* 1. *Peart's Pract. Obs. on Erysipelas, &c.* 1802. *Pearson's Principles of Surgery*, 1808. *Some parts of Hunter's Treatise on the Blood, Inflammation, &c. Richerand, Nosogr. Chir. t.* 1, *p.* 118, *&c. ed.* 2. *Lassus, Pathologie Chir. t.* 1, *p.* 8, *&c. ed.* 1809. *Traité des Maladies Chir. par M. le Baron Boyer, t.* 2, *p.* 6, *et seq. Willan on Cutaneous Diseases. A. C. Hutchison, in Med. Chir. Trans. vol.* 5, *p.* 278, *&c. and Practical Obs. in Surgery, ed.* 2. *T. Bateman, A Practical Synopsis of Cutaneous Diseases, p.* 125, *&c. ed.* 3. *Dict. des Sciences Méd. vol.* 13, *p.* 253, *&c. Rayer, Traité des Mal. de la Peau, t.* 1. *Butter's Remarks on Irritative Fever. Devonport*, 1825. *Dr. Duncan, in Edin. Med. Chir. Trans. vol.* 1. *Arnott,*

in Med. Phys. Journ. vol. 57. James on Inflammation. Wells, in Trans. of a Society for the Improvement of Med. and Surgical Knowledge, vol. 1. W. H. Burrell, in Edin. Med. Journ. vol. 24. Lawrence, in Med. Chir. Trans. vol. 14.

ERYTHEMA. (From ἐρυθρός, red.) A redness of any part. A mere rash or efflorescence, not accompanied by any swelling, vesication, or fever; circumstances which, according to Dr. Bateman, distinguish it from erysipelas.—(*Synopsis of Cutaneous Diseases, p.* 119. *ed.* 3.) Its six varieties are described in the latter work. For the erythema mercuriale, see *Mercury*. The term is often wrongly applied to eruptions attended with redness, and distinct papular and vesicular elevation, as we see in the instance of mercurial erythema, which Dr. Bateman says should be named *eczema*.

[From the extraordinary use and consequent abuse of mercurial remedies, which, I regret to state, too much characterizes the practice of many of the medical prescribers of this country, I am induced to add a remark or two on this very interesting disease. The erythimus arising from mercury, which has received several different names by different authors, as the hydrargyria of Alley, the eczema mercuriale of Pearson, the erythema mercuriale of Spens, the *mercurial* lepra of Moriarty, &c., is sometimes compounded with other disorders of an eruptive character, supposed to arise from a syphilitic origin. But in adverting to the various causes which exert their influence in producing affections of the skin resembling that under notice, we must not omit to remember the modifying operation of a cachectic condition of the body, and that, independently of mercury, occasionally other agents are capable of producing like morbid appearances. These disordered changes are often difficult to discriminate, and can perhaps only be known by the history of the case, and by a course of experimental treatment. Mr. Carmichael has well pointed out that diseases likely to be confounded with syphilis, which arise spontaneously from a disordered state of the constitution, frequently assume the form of the tubercular eruption, and he adds, "before ulceration occurs I have seldom been able to distinguish this spontaneous disease from that arising from a venereal infection." Hence, while in the mercurial erythema mercury will often aggravate the evil; in that species of affection which occurs spontaneously we may derive the greatest benefit from mercurials. Moreover, in that which has taken place in the syphilitic habit, mercury may do much harm from the previous injudicious use of this remedy. Hence, too, Bateman has given us an excellent history of a tubercular eruption of a syphilitic appearance, but curable without mercury.—(See *Medico-Chirurg. Trans. vol.* 5.) The history of the mercurial eczema is perhaps best given us by Pearson. Examined by the magnifying-glass, the eruption appears distinctly vesicular, though by the naked eye they can scarcely be distinguished. Notwithstanding the observation of Mr. Pearson, the disorder sometimes proves fatal, and Alley tells us that of forty-three cases which he witnessed within ten years eight patients died. The morbid effects of mercury do not seem to depend upon the quantity given or the preparation administered. The mercurial erythema may arise from calomel or corrosive sublimate, from a few grains of the former as well as from a few drops of a solution of the latter. Hence every practitioner is aware how serious are at times the mischiefs of the mildest mercurial preparations, even in small doses, in some constitutions; and the same remark applies to the mercurial force that is requisite in inducing salivation. From a careful examination of the recorded cases of the mercurial erythema, Professor Francis gives it as his result, that the disease is of more frequent origin from the *external* application of mercury than from its *internal* administration, and inasmuch as unguents are most frequently applied inside of the thighs, so we find the disorder very commonly to commence at those parts. Mr. Carmichael has done great public service by the facts and reasonings with which he has set forth the advantage of antimonials in the mercurial erythema, and accordingly the Plummer's pill is in some degree restored to favour again. Small doses of the antimonium tartarizatum are also among the best alteratives for the mercurial erythema, and these are to be given for some time with occasional intermissions. We are to keep in mind the singular occurrence that in some constitutions antimonials will excite the salivary discharge, as remarked by Dr. Francis; yet this circumstance, of rare occurrence indeed, may be considered as the occasional cause of a more speedy cure. The pulvis ipecacuanha in doses of two or three grains is also serviceable. It may be here stated that a decoction of parsley (*apium petroelinum*) has sometimes been of service as a lotion for the erythema mercuriale. It was the favourite prescription in these cases of a distinguished southern practitioner, who was remarkably successful in the treatment of this disease; and the remedy has proved efficient in other hands. A weak solution of the chloruret of lime will often induce a most salutary change.—*Reese.*]

ESCHAR. (From ἐσχαρόω, to form a scab or crust.) This term is applied to a dry crust, formed by a portion of the solids deprived of life. When any living part has been burned by the actual or potential cautery, all that has been submitted to the action of this application loses its sensibility and vital principle, becomes hard, rough on the surface, and of a black or gray colour, forming what is properly named an *eschar*, a slough, produced by caustics or actual fire.

ESCHAROTICS. (From ἐσχαρόω, to form a crust over.) Applications which form an eschar, or deaden the surface on which they are put. By escharotics, however, surgeons commonly understand the milder kinds of caustics, such as the *hydrargyri nitrico-oxydum, subacetate of copper, &c.*

EXÆRESIS. (From ἐξαιρέω, to remove.) One of the divisions of surgery adopted by the old surgeons; the term implies the removal of parts.

EXCORIATION. (From *excorio*, to take off the skin.) A separation of the cuticle; a soreness, merely affecting the surface of the skin.

EXFOLIATION. (From *exfolio*, to cast the leaf.) The separation of a dead piece of bone from the living is termed *exfoliation*.

One part of a bone is never separated from another by the rotting of the dead part, for what comes away is as firm as it ever was. Exfoliation takes place with most expedition in bones which have the fewest cells, and whose texture is the closest. Before any part of a bone can be thrown off by exfoliation, it must be dead. But even then, till the process of exfoliation begins, the bone adheres as strongly as ever, and would remain for years before it could be separated by putrefaction alone. The human bones are composed of two substances, viz. a true animal matter and an earthy one, the phosphate of lime, which are only mixed with each other. A dead bone acts on the system in the same manner as any other extraneous body. It stimulates the adjacent living parts, in consequence of which, such a process is begun, as must terminate in its being thrown off. The effects of this stimulus are, first, that the living adjacent bone becomes more vascular; a circumstance which always takes place when a part has more to do than is just sufficient for the support of life. Secondly, that the earth of the living part, when it is in contact with the dead bone, is absorbed; and there the bone becomes softer, and adheres by its animal matter only. As Mr. Wilson has stated, "before any mark of separation is seen on the surface, the living bone surrounding the dead for the extent of a mere line, has become as soft as if it had been steeped in acid."—(*On the Skeleton and Diseases of the Bones, p.* 281, 8*vo. Lond.* 1820.) Thirdly, that the living animal part is at last absorbed along the surface of contact: this part of the process commences, however, long before the last is finished; and both of them begin at the surface; though in their course, they do not every where take place in an equal degree at the same time. Fourthly, in proportion to the waste made by the last part of the process, granulations arise from the living surface, and fill up the intermediate space, so that there is no vacuum. These different stages together constitute ulceration. When any part of a bone is once loose, it is pushed to the surface in the same manner as most other inanimate bodies would be, and this stage is partly mechanical and partly a continuation of ulceration. A proof of the third stage above mentioned may be derived from cases in which people die while exfoliation is going on. A small groove or worm-eaten canal can then be discovered, which becomes gradually deeper, and follows the irregularities of the living and dead surfaces. After the application of the trepan, a circular piece of bone is frequently thrown off which is always less than the space from which it

came. This, as Mr. Hunter observed, would never be the case were there not a loss of substance.

"Although (says Mr. Wilson) in general the absorption takes place in the living bone, it still appears, that under peculiar circumstances, the absorbing vessels have the power of acting on and removing the substance of dead bone. This happens after the dead part has been separated from the living, and when, from its shape, and the form of the living surrounding bone, it is prevented from obtaining a passage to the surface of the body; as in exfoliations of the cranium, when the inner table of the exfoliated part is broader and wider than the outer table."—(*On the Skeleton, &c. p.* 282.) In very hard bones, the colour of the dead exfoliating portion is generally white; but in softer bones, it is yellow, dark, and sometimes black.—(*Wilson, op. cit.*)

It was anciently believed that whenever a bone was denuded, the exposed surface must necessarily exfoliate; and this being taken for granted, the old surgeons used to put immediately in practice whatever they thought best calculated to bring on an exfoliation as quickly as possible. For this purpose, the actual cautery was usually applied to the part of the bone which was uncovered; and as, under such treatment, a portion of the bone was of course killed and then exfoliated, the prejudiced practitioner believed, that he had only accelerated a process which must of necessity have followed in a more slow and tedious manner.

According to Mr. Hunter, neither caustics nor the actual cautery hasten exfoliation; they only produce death in a part of the bone, which is the first step towards exfoliation; and if they ever hasten exfoliation when the bone is already dead, it must be by producing inflammation in the adjacent living bone; a change that makes it exert a power of which it was previously incapable.

Exfoliation is not a necessary consequence of a bone being laid bare, and deprived of its periosteum. If the bone be in other respects uninjured, healthy, and enjoy a vigorous circulation of blood through its texture, granulations will be generated on the surface of such bone, and they will cover and firmly adhere to it, without the smallest exfoliation being thrown off; especially in young subjects. But if caustic, stimulating, or drying applications be made use of, or the bone be left for a considerable time exposed, the circulation in the superficial portion of it will necessarily be disturbed and destroyed, and that part of the surface through which the circulation ceases to be carried on, will be separated and cast off by the process of exfoliation.

If any application to an exfoliating portion of bone be at all efficacious, it must be one which will stop the mortification in the affected bone, and promote the absorption of those particles of phosphate of lime which form the connexion between that which is living and that which is actually dead. And as the bone dies from the same causes as the soft parts mortify, we should at least follow in practice the same principles which we adopt in the latter instance; and though from the inferior vascularity and vital power of bones, we cannot expect surgery to have as much control over their affections as over those of the soft parts, yet every good will thus be obtained which it is possible to acquire. Attention to such principles will at least teach us to refrain from making the death of part of a bone more extensive than it would be, if the cautery, caustics, and strong astringents were not employed.

The best mode of attempting to prevent an exfoliation from occurring at all in a bone that has been exposed by a wound is, to cover the part again as soon as possible with the flesh which has been detached from it. This, as I shall hereafter notice (see *Head, Injuries of*), may generally be practised with advantage, when the scalp has been detached from the cranium, provided the flap still retain even the most limited connexion with the rest of the integuments.

When the exposed bone cannot be covered, it should be dressed with the mildest and simplest applications, with plain lint, or lint spread with the unguentum cetaceum.

The dead pieces of bone, when very tedious in exfoliating, when wedged in the substance of the surrounding living bone, and when so situated as to admit of being safely sawed or cut away, may sometimes be advantageously removed in this manner.—(See *Caries* and *Necrosis.*) In such operations, Mr. Hey's saws may be employed with great convenience; and where these are not applicable, that invented by Mr. Machell, and described in Sir A. Cooper's *Surgical Essays*, or another devised by Graefe, and explained by Schwalb (*De Serra Orbiculari, 4to. Berol*, 1819), deserve to be recollected.

In speaking of necrosis, I shall have occasion to notice the efficacy of blisters, kept open with the savin cerate, in quickening the process by which dead portions of bone are loosened, as particularly pointed out by the late Mr. Crowther, in his work on the white-swelling.

Tenon published three Memoirs on the Exfoliation of Bones. The first two are inserted at pages 372 *and* 403, *Mem. de l'Acad. des Sciences*, 1758; *the third at p.* 223 *of the same work, for* 1760. *P. Poissonier, An recenti vulnere nudatis ossibus exfoliatis? conclusio negans, 4to. Parisii*, 1760. *Journ. de Méd. par M. Roux, t.* 31, *p.* 801; *t.* 32, *p.* 181; *t.* 33, *p.* 168; *t.* 36, *p.* 537; *t.* 38, *p.* 153; *t.* 39, *p.* 432. *Theden, Neue Bemerkungen, &c. kap.* 3, *8vo. Berlin*, 1782. *Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 2, *p.* 277, *&c. Wiedmann, in his excellent book, entitled, De Necrosi Ossium, has given an account of the various opinions of several distinguished writers, concerning the way in which a dead portion of bone is separated from the living part; and he has refuted many erroneous doctrines set up by Hippocrates, Van Swieten, B. Bell, &c. See p.* 23, *et seq. op. cit. Dict. des Sciences Méd. art. Exfoliation. J. Thompson's Lectures on Inflammation, p.* 394. 398. *P. Boulay, Sur l'Exfoliation des Os, 4to. Paris*, 1814. *J. Wilson, on the Structure and Physiology of the Skeleton, and on the Diseases of the Bones, &c. p.* 230, *&c. 8vo. Lond.* 1820. *Liston's Essay on Caries, &c. in Edin. Med. Surg. Journ. No.* 78.

EXOMPHALOS. (From ἐξ, out of, and ὀμφαλὸς, the navel.) A hernia at or near the navel.

EXOPHTHALMIA. (From ἐξ, out of, and ὀφθαλμὸς, the eye.)

In the case to which the most judicious surgical writers apply the terms *exophthalmia, ophthalmoptosis, ptosis bulbi oculi*, the eyeball is of its natural size, and free from disease; it merely changes its situation, and partly or completely protrudes from the orbit. It is only confusing the subject to consider, as specimens of this disease, the cases in which the globe of the eye is affected with enlargement, and on that account projects from the orbit in a preternatural degree, as happens in hydrophthalmia, staphyloma, and cancerous diseases of the eye. When the globe of the eye is pushed entirely out of the orbit, it generally lies upon the temple or cheek, and vision is totally destroyed. There are instances, however, in which a considerable degree of sight was recovered, notwithstanding the exophthalmia was complete, and had lasted several years.—(*Hope, in Phil. Trans. for* 1744. *Richter's Bibl. band.* 4, *p.* 343.)

There are three descriptions of causes which may occasion exophthalmia.

1. The first and least common is a violent concussion of the head. A man fell from a height of about fifteen or sixteen feet, and pitched upon his head. The right eye was forced out of its socket, and hung over the cheek. The patient was deprived of his senses immediately after the accident, and affected with coma. There was a contusion over the right parietal bone, but no fracture. The eye spontaneously resumed its natural position a short time after the accident, and in the course of a month, with the assistance of low diet and repeated bleeding, the cure was completed.—(*Mém. de l'Acad. de Chirurgie, t.* 1, *p.* 198, *4to.*) It is alleged, that the eye has been forced out of the orbit in a violent fit of sneezing. But such cases, says Richter, are very uncommon, and always imply a considerable relaxation of those parts which serve to retain the eye in its socket, or some other predisposing causes, to which attention should be paid in the treatment.—(*Richter, Anfangsgr. der Wundarzn. b.* 3, *p.* 407, *ed.* 1795.)

2. A far more frequent cause of exophthalmia is a thrust in the eye with an instrument, which is narrow enough to pass between the orbit and the eyeball, so as to push the latter out of its place.

A stick, a tobacco-pipe (*White's Cases in Surgery, p.* 131), a foil, &c. may cause the accident. Repeated experience proves, says Richter, that in such cases,

though the optic nerve and muscles of the eye may be forcibly stretched, the interior parts of the organ seriously injured, and the dislocated eye generally deprived of the faculty of seeing, yet, when the organ is replaced as speedily as possible, it not only sometimes recovers its natural motion, but also its original power of vision.—(See *Scultet. Appendix, obs.* 69. *Covillard, obs.* 27. *Borellus, centur.* 3, *obs.* 54. *Rhodius, centur.* 1, *obs.* 84. *White's Cases, p.* 131.) But before we reduce the eye, Richter advises us always to examine th instrument which was pushed into the orbit; as, when it is brittle, a fragment of it may remain behind in the socket, and require to be extracted by means of the finger or a probe. When the weapon is pointed or hard, it sometimes pierces the bones of the orbit, and enters the brain, nose, or antrum. In the first case, which is often difficult to ascertain immediately, though after a time it is generally rendered plain enough by the symptoms induced, the consequences are mostly fatal. In the other two cases, although the danger is not pressing, yet the surgeon should be very attentive, in the event of suppuration, to procure and maintain a ready outlet for the matter.

There is generally little difficulty in replacing the eye. Frequently it returns of itself into its natural situation again, as soon as any trivial obstacles to its reduction are removed; and in other instances, it easily admits of being put into its proper place with the hand. The indication, says Richter, is always accomplished with more facility the sooner it is attempted. When the protrusion has existed several days, and the eye and other parts in the orbit are already inflamed, Richter recommends us to endeavour to diminish the inflammation by general antiphlogistic means and external emollient applications, before we try to replace the eye; and the reduction of this organ is afterward to be effected in a gradual manner. When the optic nerve, and one or more of the muscles of the eye are torn, no hope can be entertained that the eyesight and motion of the organ will ever be regained. But this degree of injury, as Richter observes, cannot always be immediately detected, because the optic nerve and muscles are concealed by the conjunctiva; and if the nature of the case were known, still it would be advisable to replace the eyeball, and endeavour to prevent the disfigurement which its loss would unavoidably produce. But, says Richter, it is necessary, especially if the parts behind the eyeball have suffered severely, to use such means as will ensure a ready escape for the matter which may possibly form. Though Richter offers the opinion, it is difficult to conceive how the violence of the injury of the conjunctiva, muscles, and nerve can ever render it most prudent not to reduce the part until after suppuration has taken place. Richter thinks that a surgeon may the more readily make up his mind to this conduct, as many cases have proved that the eyeball, even after being dislocated from the orbit a long while, has been easily replaced. In other instances, the parts which connect the eye with the orbit may be so torn and injured, that it will be most advisable to extirpate the organ.

Richter maintains, however, that this should never be done when there is the least chance of saving the eye. If the bones in the orbit be fractured, the reduction must not be made until the indications which this complication presents have been fulfilled.

When, says Richter, the instrument with which the eye has been pushed out of its socket is blunt and thick, like a finger, a stick, a foil, &c., the eyeball itself always sustains a violent contusion, which brings on vehement inflammation, and lessens or destroys all hope that after the reduction the eyesight will be restored. Sometimes, in these cases, an extravasation of blood in the orbit occurs, the iris is lacerated, the cornea burst, and a part of the humours of the eye discharged. Although, under such circumstances, it is scarcely to be expected that the eyesight can be recovered, yet it is proper to reduce the eye, because, should the organ be destroyed by suppuration, or the loss of its humours, the deformity may be obviated by an artificial eye, which is not the case when the eye has been cut away. It is also to be considered, that the mischief often seems to be worse than it really is, and the eyesight is sometimes regained, contrary to all expectation.

After the reduction of the eye, the first care of the surgeon should be to prevent and diminish inflammation. In some cases, the inflammation is slight; while in others, especially when the eyeball has been severely struck, it is extremely violent. All the usual antiphlogistic means, both general and topical, are to be employed; and of the latter, Richter says, astringents are the best, as the inflammation arises from the contusion and stretching which the parts have suffered. The possible consequences of inflammation, such as suppuration, opacity of the cornea, &c., are to be treated according to the rules laid down in other parts of this Dictionary.—(See particularly *Cornea, Opacity of; Hypopium; Ophthalmy.*) In general, the sight is restored in proportion as the inflammation is diminished. Should this not happen after the ophthalmy has been entirely removed, the surgeon must try what effect such remedies as stimulate the nerves will have upon the optic nerve. An account of the most eligible medicines for this purpose will be found in the article *Amaurosis.*

3. The third cause of exophthalmia is a preternatural tumour in the orbit or neighbouring parts. The swelling, as it enlarges, gradually pushes the eyeball out of its socket. The tumours, which may be formed in the orbit, are of several kinds. The principal, however, are encysted swellings, which contain either fat, an aqueous fluid, a pappy substance, or a thick matter. Sometimes the cellular substance in the orbit is affected with induration and swelling, so as to force the eye partly or completely out of this cavity.

According to Mr. Travers, adipous swellings occupy the interspace of the recti muscles, emerge between the globe and the orbitar circumference, and have an oblong figure. When the conjunctiva is freely divided, the fatty mass is easily drawn forwards with a hook, and dissected out.—(*Synopsis of Diseases of the Eye, p.* 225.)

An abscess in the orbit may cause a protrusion of the eyeball.—(*Pellier.*) Exostoses in the orbit may have the same effect. Sir Astley Cooper has related one case which proved fatal, in consequence of the exostosis making its way to the brain through the orbitar process of the os frontis.—(*Surgical Essays, part* 1, *p.* 157.) Mr. Guthrie has seen two instances: in one, the disease attained the size of a large marble, and then became stationary; in the other, it was much larger, and a portion of it had been ineffectually removed by means of a hot iron, which increased the inconvenience without giving any relief. Hence, if an operation were deemed advisable, Mr. Guthrie would prefer the cautious use of a small chisel or saw.—(*Operative Surgery of the Eye, p.* 154.) This author is, at the same time, aware of the case in which Mr. Brassant brought about the exfoliation of a considerable part of an exostosis of the os planum and internal angular process with caustic, so that the eye returned into its place, and the cure was completed.—(*Mem. de l'Acad. de Chir. t.* 5, *p.* 171, *4to.*) In the records of surgery may be found many examples, in which the displacement of the eye was produced by a tumour that grew out of the frontal sinus.—(See *Langenbeck's Neue Bibl. b.* 2, *p.* 247.) In some cases, in consequence of suppuration in the antrum, the lower part of the orbit is raised, and the eye forced out of its place. Fungous diseases of the antrum are very liable to occasion the same mischief.—(See *Parisian Chirurgical Journ. vol.* 1, *p.* 104, *&c.*)

Schmidt records two cases of exophthalmia, produced by a hydatid of the lachrymal gland. One had a fatal termination; but in the other, a puncture gave vent to an ounce of clear fluid, and cured the protrusion of the eye; but the eyesight was lost.—(*Ueber die Krankheiten des Thränenorgans, p.* 54.) Farther particulars of the latter case may be seen in Mr. Guthrie's work, p. 157.

Not long ago, Langenbeck extracted from the sinus frontalis of a girl a large hydatid, which had forced the outer table considerably forwards, and depressed the orbitar process of the os frontis so far, that the eyeball was propelled as low as the extremity of the nose. After the front of the sinus had been perforated, and the hydatid removed, there was a cavity left two inches and a half in depth.—(*Neue Bibl. b.* 2, *p.* 247. *Hanover,* 1819.) My friend Mr. Lawrence some time ago mentioned to me a remarkable case, which presented itself at the London Eye Infirmary: it was an exophthalmia, which arose from a collection of hydatids in the orbit, and was cured by making an incision, and afterward

promoting their discharge. In all these examples, the eyeball is displaced from the orbit gradually, and vision is at length impeded. Instances, however, are on record, where the sight was never lost, though the eye was protruded for years.—(See *Richter's Chirurg. Bibliothek, band* 4, *stück* 2, *p.* 243. *White's Cases in Surgery, p.* 135.) In an instance lately reported, the sight was not at all lessened, and the iris retained its natural mobility.—(*Langenbeck, Neue Bibl. b.* 2, *p.* 245.)

Experience proves also, that after the reduction, the motion of the eye and power of seeing may be regained, in cases where the eye has been gradually pushed out of the orbit, and been displaced a considerable time, even as long as several years, during all which period vision was lost.—(*Acrell. Brocklesby, in Med. Obs. and Inquiries, vol.* 4, *p.* 371.) Langenbeck relates a very curious case of exophthalmia from a steatoma in the orbit, where, though vision was entirely prevented during the displacement, the pupil was of its regular shape, and the iris capable of motion: after the extirpation of the tumour, the eyesight became so good, that the patient could discern the smallest objects.—(*Neue Bibl. b.* 2, *p.* 240.) In order to reduce the eye into its natural position, it is necessary to remove the cause by which its protrusion is occasioned. Suppuration and fungous tumours in the antrum must be treated according to directions laid down in the article *Antrum*. After the cure of such diseases, the antrum is often reduced to its natural dimensions, and in this circumstance, the orbit may become so wide, that the eyeball will return into it again. Should this not happen, the extirpation of the organ will be proper. The induration and swelling of the cellular substance in the orbit may be sometimes dispersed by means of mercury.—(*Louis, Sur plusieurs Maladies du Globe de l'Œil, in Mém. de l'Acad. Royale de Chirurgie, t.* 13, *éd.* 12*mo.*) When such treatment fails, we are recommended to extirpate the eye.—(*Richter, Anfangsgr. der Wundarzn. b.* 3, *p.* 413.) Exostoses situated in the anterior part of the orbit may sometimes be removed. The continental surgeons generally advise us to expose the tumour by an incision, and to apply caustic or the actual cautery to it, in order to kill the protuberant part of the bone and make it exfoliate. In this country, most practitioners would prefer the employment of cutting instruments for removing such exostoses. When, however, the tumour lies deeply in the orbit, if it cannot be got at, and it should resist the effect of mercurial medicines and mezereon, we are directed to extirpate the eye.—(*Richter, op. et loco cit.*) Abscesses in the orbit ought to be opened, and after this has been done, the eye generally returns into its proper position.—(*Pellier.*) When encysted tumours in the orbit admit of being extirpated in the customary manner, the plan should be adopted; but when this cannot be done, Richter's advice may be followed, which is to open them, press out the contained matter, and afterward extract the cyst. Considerable difficulty, however, frequently attends every effort to remove the whole cyst, and unless this be done, a permanent cicatrization cannot be expected.—(See *Travers's Synopsis, p.* 225. See *Tumours, Encysted.*)

On account of the vicinity of the brain, and the communication between the parts within the orbit and the dura mater, the extirpation of tumours from that cavity is not exempt from risk of fatal consequences, as two cases recently published by Langenbeck, fully prove.—(*Neue Bibl. b.* 2, *p.* 241. 244.) A young lady was referred to Mr. Lawrence and myself, some time ago, by Mr. Maul, of Southampton, for advice respecting a tumour occupying the inner and upper portion of the orbit, and attended with a degree of exophthalmia, constant exacerbation at the period of the menses, and occasionally double vision.—(See *Diplopia.*) We refrained from advising any immediate attempt at extirpation, the swelling being so firm and immoveable, that the disease was suspected to be partly of a bony nature. However, on seeing this case about a fortnight afterward, I was surprised to find the tumour not more than half its former size, and all the firm and (what was conceived to be) bony induration below the superciliary ridge of the os frontis gone, as well as the exophthalmia and derangement of vision. Some sharp bony irregularities, however, could now be most plainly felt, projecting in front of the diminished swelling.

In a late publication, a memorable case of exophthalmia is related by Mr. Travers: the globe of the eye appears to have been gradually forced upwards and outwards, and to have had its motions considerably impeded, in consequence of the orbit being partly occupied by two swellings, which were of the nature of the aneurism by anastomosis.—(See *Aneurism.*) The swellings could not have been removed, without at the same time extirpating the eye. Mr. Travers was therefore induced to try whether applying a ligature to the carotid artery would have the effect of checking and curing the disease; an expectation which was warranted by analogous instances, in which the growth of swellings and their dispersion are brought about by lessening the quantity of blood determined to them. The experiment completely succeeded; the swellings in the vicinity of the eye subsided; the patient was freed from several grievous complaints, to which she had been previously subject; and, among other benefits, a cure of the exophthalmia was one result, which most interests us in the present place. The case is also highly important on other accounts, and more particularly as confirming the fact, that the carotid artery may be tied without any dangerous effects on the brain, and as proving, that in cases of aneurism, the surgeon should not be afraid of proceeding to such an operation.—(See *Med. Chir. Trans. vol.* 2, *art.* 1.) The judgment and decision with which Mr. Travers acted in this case, appear to me highly meritorious.

The carotid artery was also tied by Mr. Dalrymple, surgeon at Norwich, in a case very similar to the preceding, and with equal success.—(See *Med. Chir. Trans. vol.* 6, *p.* 111, *&c.*)

Mr. Guthrie has seen an exophthalmia on each side, the result of an aneurism of each ophthalmic artery, and other disease in the orbits.—(*Operative Surgery of the Eye, p.* 158.)

When the causes of exophthalmia have been removed, the eye must be put into its natural situation. If the organ has been long displaced, the surgeon often finds the fulfilment of this indication attended with difficulty. Indeed, he is frequently obliged to employ methodical bandages for the purpose of promoting the gradual return of the eye into the orbit. Yet, even in such cases, the eyesight is often regained; but if this should not happen spontaneously, stimulants and tonics are to be tried.—(See *Amaurosis.*)

Fab. Hildan. centur. 6, *obs.* 1. *Vander Wiel, centur.* 2, *obs.* 9. *Paw. Obs. Anat.* 23. *Tulpius, lib.* 1, *cap.* 28. *Hope, in Phil. Trans. for* 1744. *Louis, Sur plusieurs Maladies du Globe de l'Œil, &c. in Mém. de l'Acad. de Chirurgie, t.* 13, *in* 12*mo. Brocklesby, in Medical Obs. and Inquiries, vol.* 4, *p.* 371. *White's Cases in Surgery, p.* 131—135, *&c. Warner's Cases in Surgery, p.* 108, *edit.* 3. *Lassus, Pathologie Chir. t.* 2, *p.* 144, *édit.* 2. *Richerand, Nosogr. Chir. t.* 2, *p.* 117, *édit.* 2. *Med. Chir. Trans. vol.* 2, *art.* 1; *vol.* 4, *p.* 316; *and vol.* 6, *p.* 111, *&c. Richter's Anfangsgr. der Wundarzn. b.* 3, *p.* 406, *&c. Gött.* 1795. *Langenbeck, Neue Bibl. b.* 2. *B. Travers, Synopsis of the Diseases of the Eye, p.* 225, *&c. Lond.* 1820. *Dr. Monteath, in Weller's Manual, vol.* 1, *p.* 195. *Petitbeau, in Journ. de Méd. par Corvisart, t.* 14. *G. J. Guthrie, Operative Surgery of the Eye, p.* 145, *&c.* 8*vo. Lond.* 1823.

EXOSTOSIS. (From ἐξ, out of, and ὀστέον, a bone.) An exostosis is a tumour formed by an exuberant growth of a bony matter on the surface of a bone, or, as Boyer says, it is formed by the more or less considerable enlargement of a part or the whole of a bone.—(*Traité des Mal. Chir. t.* 3, *p.* 541.)

If bones resemble the soft parts of the body in their structure, they must resemble them in their diseases, and of course be liable to various kinds of tumours. Nay, an extraordinary increase of the size and density of all the bones of an individual has been observed, which affection ought probably also to be classed with the disease to which surgeons usually apply the term exostosis.

The generality of writers, even the most modern, have admitted many diseases among exostoses, which ought to be considered in a very distinct light; I need only instance the spina ventosa.

One division of exostoses is into *true* and *false*; the former being of a truly osseous consistence, the others being more or less hollow, spongy expansions of the bones, sometimes containing a quantity of fleshy, fungous matter within the shell of the disease. Periostoses, or mere thickenings of the periosteum, are also classed among the *false* exostoses.—(*Dict. des Sciences*

Méd. t. 14, *p.* 218.) According to Sir Astley Cooper, exostoses have two different seats: by *periosteal* exostosis, he means an osseous deposition seated between the external surface of the bone and the internal surface of the periosteum, and firmly adherent to both; by *medullary* exostosis, he signifies a similar formation, originating in the medullary membrane and cancellated structure of the bone. The same experienced surgeon makes two other general divisions of exostoses into the *cartilaginous* and *fungous*, the first being "preceded by the formation of cartilage, which forms the nidus for the ossific deposite," while the second is a tumour softer than cartilage, yet firmer than fungus, in other parts of the body, containing spicula of bone, being of a malignant nature, and depending "upon a peculiar state of constitution and action of vessels." It is a disease similar to "fungus hæmatodes, but somewhat modified by the structure of the part in which it originates."—(*Surgical Essays, part* 1, *p.* 155.) This last form of exostosis is probably the disease treated of in another part of this Dictionary under the title of *Osteosarcoma.*

Exostoses differ very much in respect to size. Those of the cranium are generally small and circumscribed. Exceptions occur, however; for we learn, that Sir Everard Home removed a very large tumour which had a bony base and was situated on the head.—(*A. Cooper, Surgical Essays, part* 1, *p.* 156.) The largest *true* exostoses met with are such as are formed upon the long bones. In the history of surgery may be found numerous cases of enormous exostoses; but it is worthy of notice, that these were nearly all of them of the species termed *false;* and many of them were situated in the jaw, the clavicle, or the extremities of the long bones. Observations of this kind are abundant in *l'Histoire de l'Acad. des Sciences; les Mém. de l'Acad. de Chir.; the Sepulchretum Anatomicum;* the writings of Morgagni, &c.—(*Dict. des Sciences Méd. t.* 14, *p.* 219.)

The bones most frequently affected with exostosis, are those of the cranium, the lower jaw, sternum, humerus, radius, ulna, bones of the carpus, and particularly the femur and tibia. There is, however, no bone of the body which may not become the seat of this disease. It is not uncommon to find all the bones of the cranium affected with exostosis, and the ossa parietalia sometimes an inch thick.

According to Sir Astley Cooper, the exostosis which forms between the outer table of the skull and the pericranium, is of an extremely hard consistence, and generally attended with little pain, while the *fungous* exostosis, springing from the diploe of the skull, is less firm and more vascular. It is described as being of a malignant nature, making its way through the inner table, and occasioning disease of the dura mater and fatal effects on the brain.—(*Surgical Essays, part* 1, *p.* 156.)

Sometimes, as Boyer remarks, the tumour is confined to a small part of the affected bone, composing a mass superadded to its surface, and of various shapes. Sometimes it rises insensibly, having no very distinct limits, and resembling a more or less regular portion of a sphere. In some instances its figure is styloid, and it projects in a greater or less degree. On other occasions, its base is rendered distinct by a pedicle or contraction, which varies in breadth and length in different cases. In particular instances, the exostosis, though limited to the surface of a bone, occupies the whole extent of it. Thus the whole external surface of one of the bones of the skull has been found occupied by an exostosis, while the cerebral surface of the same bone was in the natural state. The whole circumference of the femur sometimes acquires an enormous size, at the same time that its medullary surface continues entirely unchanged. These are the *periosteal* exostoses of Sir Astley Cooper. In other examples, on the contrary, the two surfaces and the whole thickness of the bone are deformed by an augmentation of bulk; and when this happens in a cylindrical bone, the medullary cavity is more or less reduced, or even totally obliterated. There are a few extremely uncommon cases, in which the substance of a bone acquires great solidity, and a hardness compared to that of ivory, without any material increase of bulk. An exostosis rarely occupies the whole extent and thickness of a bone; but when this happens in a cylindrical bone, the articular surfaces generally remain in their natural state.

The structure and consistence of exostoses present great differences. Sometimes, especially when the tumour is not very large, and it is situated on the surface of a cylindrical bone, one may trace with the eye the diverging of the osseous fibres, in the interspaces of which we might say that there is deposited a new bony substance, the organization of which is less distinct. Sometimes the tumour is entirely cellular, and formed of a few broad laminæ, intercepting extensive spaces, which are filled with matter different from the medulla, and of various quality. This case is denominated the *laminated exostosis.* Sometimes the enlarged portion of bone makes a sort of hollow sphere, with thick hard walls, and the cavity of which is filled with fungous granulations, more or less extensive and indolent. According to Boyer, this variety of the disease differs essentially from osteosarcoma, notwithstanding external appearances. The case here alluded to I conclude to be the same as that which Sir Astley Cooper has named the *cartilaginous exostosis of the medullary membrane.* "In this case the shell of the bone becomes extremely expanded, or rather the original shell is absorbed, and a new one deposited; and within this ossified cavity thus produced, a very large mass of cartilage is formed, elastic, firm, and fibrous." It is not malignant, but often ends in a very extensive disease.—(*Surgical Essays, part* 1, *p.* 173.)

In other instances the tumour is perfectly solid, exceeding in consistence that of the hardest bones, and equalling that of ivory. Here the surface is sometimes smooth, and like that of the bone in its natural state; sometimes irregular, full of little projections, and in some degree stalactical. It is very uncommon to find a large portion of an exostosis converted into a pultaceous substance; but it is not at all unfrequent to see this substance composing part of the tumour. Lastly, it very often happens that the same exostosis presents an assemblage of the ivory substance, and of the cellular laminated substance, the cavities of which are partly filled with a pultaceous matter, and partly with a sort of gelatinous substance.

When an exostosis is not very large, it hardly affects the surrounding soft parts; but when it has made considerable progress, the muscles become stretched and emaciated, the cellular substance is thickened, and its layers being adherent together, a kind of confusion is produced among all the adjacent parts. Exostoses not of considerable size may, however, seriously interrupt the functions of certain organs. The action of the flexor muscles of the leg has been known to be obstructed by an exostosis in the vicinity of the knee. A similar tumour arising near the symphysis pubis need not be very large to impede considerably the functions of the urethra, as experience has proved. An exostosis in the orbit has been known to displace the eye and to destroy vision. Lastly, exostoses, when situated near certain important organs, and of large size, may affect with different degrees of gravity the functions of these parts, as the brain, the lungs, &c.—(See *Boyer, Traité des Mal. Chir. t.* 3, *p.* 541—544.)

Sir Astley Cooper has related a case in which the eyes were pushed out of their sockets by two exostoses, which grew from the antra, and one of which destroyed the patient by making its way to the brain through the orbitar process of the os frontis.—(*Surgical Essays, part* 1, *p.* 157.) In one instance, reported by the same author, an exostosis from the sixth or seventh cervical vertebra abolished the pulse at the wrist, by pressing upon the subclavian artery.—(*P.* 159.) In another, a *cartilaginous* exostosis of the medullary membrane of the lower jaw extended so far back that it pressed the epiglottis down upon the rima glottidis, and caused such difficulty of respiration, and so much irritation, that the patient was destroyed.—(*P.* 175.)

Venereal exostoses, or nodes, are observed to arise chiefly on compact bones, and such of these as are superficially covered with soft parts, as for instance the bones of the cranium, and the front surface of the tibia.

The causes of exostosis do not seem to be at all understood. Most writers impute the disease to internal causes, such as scrofula and lues venerea. That the latter affection is the cause of nodes, which are certainly a species of exostosis, no one will deny; but that scrofula is ever concerned in producing any of the other kinds of exostosis must not be admitted, at least before some evidence is adduced in support of the doctrine. Boyer, however, and all the surgeons of the continent

adopt the opinion that scrofula is sometimes a cause of the disease.

Hydatids are occasionally found within exostoses, in which circumstance the former are supposed to be the cause of the enlargement of the bone. A remarkable specimen of such a disease in the tibia is mentioned by Sir Astley Cooper.—(*Surgical Essays, part* 1, *p.* 163.) He refers also to a humerus, in the museum of St. Thomas's Hospital, where the shell of the bone is considerably expanded, the periosteum over it thickened, and in the seat of the cancellated structure, several hydatids, supposed to have been the cause of the enlargement of the exterior surface of the bone, as well as of the increase of its cavity.—(*Vol. cit. p.* 161.) A most interesting case of a bony tumour on the forehead, containing hydatids, has likewise been published by Mr. R. Keate.—(*Med. Chir. Trans. vol.* 10, *p.* 278.)

The case with which bony tumours form in some persons, is a curious and remarkable fact, and renders it probable that constitutional causes here have great influence. Thus such a blow as in the generality of persons would hardly excite notice, will in others bring on swellings of the bone which is struck. Sir Astley Cooper adverts to a young friend of his, in whom an exostosis, which was undoubtedly caused by a blow, is growing on the metacarpal bone of the little finger.—(*Loc. cit.*) Mr. Abernethy mentions in his lectures his having seen a boy from Cornwall, who was so excessively afflicted with an apparent predisposition to exostosis, or an exuberant deposition of bony matter, that a very trifling blow would occasion a bony swelling on any bone of his body. His ligamentum nuchæ was ossified, and prevented the motion of his neck; the margins of his axillæ were also ossified, so that he was, as it were, completely pinioned. Besides all this, the subject in question had numerous other exostoses on various parts of his body. Mr. Abernethy gave, in this case, muriatic and acetic acids, with a view of dissolving the lime, which it was conceived might be too abundant in the system; but even if this theory had been correct, and the acids capable of the chemical action intended, after passing into the circulation, how could they be expected to dissolve only the redundant depositions of phosphate of lime, and at the same time leave the skeleton itself undissolved?

When an exostosis depends upon lues venerea, it is almost always preceded by an acute pain, which in the beginning extends to nearly the whole of the affected bone, but afterward becomes fixed to the point where the exostosis forms, and it is most severe in the night-time. When an exostosis is caused by scrofula, says Boyer, the pain is duller, or rather it is quite inconsiderable. It is the same with the exostosis which succeeds a blow or contusion, without any manifest general cause. In the latter example the pain immediately excited by the accident subsides in a few days, and the swelling occurs so slowly, that no notice is taken of it till it has attained some magnitude.—(*Traité des. Mal. Chir. t.* 3, *p.* 545.)

An exostosis constantly feels hard; but its size is various, and it may be indolent or painful. By these signs, and its firm adhesion to the bones, it may be always distinguished from other tumours. Some exostoses cannot be ascertained before death. Such was the case in which the parietal bone was found, after death, to be three times thicker than natural. Such also was the example related in the memoirs of the Academy at Dijon, in which a person died from an exostosis on the internal side of the os pubis, the tumour having prevented the discharge of the urine and the introduction of a catheter by its pressure on the neck of the bladder.

Exostoses may be either *acute* or *chronic* in their progress. In the first case, which, according to Boyer, happens most commonly in the *cellular* exostosis, described by authors under the name of *laminated*, the appearance and formation of the tumour are quick; the swelling rapidly acquires a considerable size, and it is always preceded by and accompanied with continual violent pain, which the external and internal use of opium has little effect upon, and the intensity of which is not increased by pressure. The pain is sometimes so severe that it occasions a good deal of symptomatic fever. Boyer, who seems not be aware of the origin of what he terms the *cellular*, and what Sir Astley Cooper has named *fungous exostosis*, from the medullary membrane, finds difficulty in accounting for the rapid growth and great sensibility of the tumour, considering the natural density of the bones, and the little energy of their vital properties.

In the hardest kinds of exostosis, says Boyer, the tumour is preceded by no pain, or, if any, it is very slight; the tumour grows slowly, and although it sometimes attains a considerable size, its increase is attended with no particular sensibility, and no disturbance of the animal economy.—(*Boyer, op. cit. t.* 3, *p.* 546.)

Our ignorance of the pathology of exostoses, particularly their causes, accounts for the imperfection of our treatment of them. With the exception of the venereal exostosis, or node, there is no species of this affection, for which it can be said that we have any one medicine of efficacy.

Boyer and other writers on the diseases of the bones seem to regard some exostoses as a perfectly inorganic mass of lime, and consequently they entertain no idea that the absorbent vessels can possibly take away the particles of the tumour, just as the secerning arteries have laid them down. Such writers, however, are well aware, that nodes are capable of being diminished, and this can only be effected by the action of the absorbent system.

Boyer does acknowledge, indeed, that he has seen a venereal exostosis of the humerus, as well as a few other bony swellings, subside; but he represents the event as extremely rare; and he advances it as a principle, that the resolution of exostoses hardly ever happens, and that the greater part of the examples recorded in proof of the occurrence, were nothing more than periostoses.—(*P.* 547.)

When an exostosis is hard, chronic, and free from pain and alteration of the structure of the bone, it is a much more common thing for it to cease to enlarge, and remain stationary during life, without producing inconvenience, provided it be so situated as not to impede the functions of any vital organ.

But in the *cellular* exostosis of Boyer, which I take to be the same disease as the *fungous* exostosis of the medullary membrane of Sir Astley Cooper, the acute and rapid progress of the disease indicates a deeper and more serious alteration of the texture of the bone. A part of the tumour usually consists of a pultaceous or gelatinous matter, and the rest still, endued with its natural organization, though altered by the disease, soon presents one or several cavities, in which there is suppuration. At the same time, the external soft parts, being excessively and rapidly distended, inflame, ulcerate, and leave exposed a more or less extensive portion of the tumour, the disease of which has in many cases been very wrongly supposed to be caries. It is not, observes Boyer, that the part of the swelling denuded by ulceration is not sometimes affected with caries; but then it exists as a complication of the original disease, and as a particularity by no means the result of the ulceration of the soft parts, and of the exposure of the diseased bone to the contact of the air. When the soft parts are thus ulcerated, the opening contracts to a certain point, and becomes fistulous. The suppuration is always of bad quality, and in a quantity proportioned to the size of the cavity of the abscess and the strength of the patient. The fever, which commences at an early period of the disorder, assumes a slow type, and its continuance, together with the copiousness of the ichorous discharge, the irritation, &c., may bring on the patient's dissolution.

The following are the symptoms of what Sir Astley Cooper denominates the *fungous exostosis of the medullary membrane*. The disease begins with a general enlargement of the affected part of the limb, extending a considerable way around the seat of the exostosis itself. This form of the complaint mostly occurs in young persons, though Sir Astley Cooper has seen it in an individual fifty years old. "Its increase proceeds very gradually; and even when it has acquired considerable magnitude, although it produces some diminution of motion in the limb, it does not occasion pain, nor prevent the patient from using it. When any pain does arise, it is of an obtuse kind, only being acute in the event of a nerve being stretched by the tumour. Thus an exostosis of the thigh-bone sometimes causes great agony, by pressing on the sciatic nerve. Paleness, debility, and irregularity of the bowels, are observed to attend the early stage of the disease; and afterward the complexion becomes sallow. In the mean time the diseased part of the limb attains an enormous size; but the skin retains its natu-

ral colour. At many points the swelling feels hard; at others, it is so elastic as to cause the presence of fluid to be suspected; but if an opening be made, only blood is discharged. The surface of the tumour next becomes tuberculated, and the prominences tender, and their surface is often slightly inflamed. The rest is now broken, the appetite impaired, and the bowels extremely irregular. At length the tubercles ulcerate; the skin secretes pus; but when the swelling itself is exposed, it discharges a bloody-coloured serum. A fungus then forms, which sometimes bleeds profusely, and after it has risen very high, sloughing occurs, and considerable portions of the swelling are thrown off. But although the swelling may be lessened by this process, Sir A. Cooper has never known the disease cured by it; and in the end the patient is destroyed by the effects of the repeated bleeding, immense discharge, and constitutional irritation." In this disease, as in common fungus hæmatodes, tumours of a similar nature are often formed in other parts of the body, and after the amputation of the affected bone frequently make their appearance in organs of the greatest importance to life. The swelling is described as originating from the medullary membrane, and as removing the muscles to the distance of three inches or more from the bone, so that they represent a thin layer spread over the tumour. The blood-vessels and large nerves are also similarly displaced. The tuberculated appearance of the skin, which is itself sound, is caused by projecting small masses on the surface of the tumour. Under the muscles is the periosteum, pushed to a considerable distance from the bone. A part of the swelling itself is yellow, like fat; another portion resembles brain; and a third is composed of coagulated blood with interstices filled with serum. In some parts the white substance is found nearly as firm as cartilage; but in general it presents a more spongy appearance; and is interspersed with spiculæ of bone. The shell of the bone itself is in part absorbed; in some places it is only thinner than usual; while in others it is immensely expanded, so as to form a case, like wire-work, over the tumour. The fungous granulations, proceeding from the medullary membrane itself, are exceedingly vascular, and often shoot from the cavity of the bone beyond the level of the integuments.—(*A. Cooper, Surgical Essays, part* 1, *p.* 165—168.)

According to Boyer, spherical exostoses, with an internal cavity, and hypersarcosis, are only attended with violent pain in the beginning, and when they have attained a considerable size they become almost indolent. But the successive formation of the fungosities, contained in their cavity, has the effect of distending its parietes, and rendering them thin, so that such exostoses are exposed to fractures and ulceration. This last effect may, indeed, be a consequence of the progress of the disease, and give rise to a series of consecutive symptoms, which may be compared with those which have been described in the preceding case. The spherical exostosis, however, is less dangerous, perhaps, because the disease extends less deeply. Such tumours admit of being directly attacked; and operations for the destruction of the bony shell, and of the fungous growth which it includes, may be successfully practised; an attempt which would certainly be useless and dangerous in the foregoing instance.

One termination of exostosis, not spoken of by writers, but which has been observed, especially in the hard and stalactical exostosis, is that by necrosis. Tumours of this description, after acquiring a large size, have been attacked with mortification, separated from the bone, which served them as a base, and been surrounded with a reproduction in every respect similar to that with which nature surrounds sequestra formed under any other circumstances. This termination is undoubtedly the most favourable of all, because nature proceeds in it slowly, without any violent disturbance; but, unfortunately, it is the least common. Art can imitate it; but her means are very inferior to those of nature. A most interesting case of an enormous exostosis of the upper maxillary bone, which followed the preceding course, was lately under my notice.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 547—550.)

The hardest exostosis, which has grown slowly, and without causing severe pain, is the least dangerous of all, especially when the constitution is sound, and the patient not of a bad habit. After the disease has attained a certain size, it may become stationary, and continue in this state without inconvenience during life. This is most frequently observed in the *ivory* exostosis. Without having precisely this extreme hardness, however, some exostoses which are tolerably solid, and in which the natural organization of bone is still distinguishable, are capable of undergoing a slight reduction, after the removal of their cause by nature or art. Boyer states, that this sometimes happens in a few scrofulous exostoses, and particularly in such as are venereal, and not of very large size.

The *cellular* exostosis of Boyer, the *fungous* exostosis of Sir A. Cooper, and the cases which are named *osteosarcomata*, are the most serious of all, especially when the texture of the bone is considerably altered, and the disease is in a state of ulceration. The rapid formation of the disease, the violent shock which it imparts to the constitution, and the hectical disturbance which it excites, generally bring the patient into imminent danger, and commonly leave no other resource but that of amputating the limb.

The treatment of exostoses is to be considered in a medical and surgical point of view. When any general cause of the disease is known or suspected, such cause is to be removed by those means which experience has proved to be most efficacious. Thus Boyer recommends mercurial and antiscrofulous remedies, &c., according to the nature of the case.

Whatever may be the species of exostosis, or the nature of its cause, relief, says Boyer, may be derived from the outward use of opium, whenever the disease is attended with severe pain. He speaks favourably of the application of a linseed-meal poultice, made with a decoction of the leaves of nightshade and henbane, to which a strong solution of opium has been added. But he thinks that an antiphlogistic plan, with bleeding, is hardly ever admissible, because it weakens the patient too much in so tedious a disease, and can only be a palliative, incapable of curing or preventing the ravages of the disorder.

When there is no pain, or it has been appeased, during or after any general method of treatment which may have been indicated, the surgeon may try resolvent applications, particularly soap and mercurial plasters, the tincture or ointment of iodine, the liniment of ammonia, bathing in water containing a small quantity of soda, or potassa, hydro-sulphurated washes, &c. Boyer acknowledges, however, that the progress of exostoses can scarcely ever be checked by any general methodical treatment. The muriatic and ascetic acids have been administered, but without effect; nor am I acquainted with any remedies which possess efficacy, excepting iodine and mercury, which last we know will rarely answer, except in cases of nodes. In the commencement of any deep-seated disease in a bone, however, Sir A. Cooper thinks that the best medicine for internal exhibition, is the oxymuriate of quicksilver in small doses, together with the compound decoction of sarsaparilla.—(*Surgical Essays, part* 1, *p.* 169.) Boyer is firmly of opinion that, with the exception of recent small exostoses, the nature of which is even doubtful, the resolution of such tumours is almost impossible. A slight diminution of the swelling, and its becoming perfectly indolent, are the most favourable changes which can be hoped for, whether they occur spontaneously, or are the fruit of surgical assistance.—(*Traité des Mal. Chir. t.* 3, *p.* 554—557.)

Whether any exostoses might be lessened by keeping open a blister over them for a considerable time, is a point, perhaps, worthy of farther investigation. It is certain that such applications tend to diminish venereal nodes, after they have been lessened as much as they can be by mercury; and we also know that blisters kept open promote the absorption of the dead bone in cases of necrosis. In the local treatment, Sir Astley Cooper approves of the use both of leeches and blisters, a discharge from the latter being kept up with equal parts of the mercurial and savin ointments.—(*Surgical Essays, part* 1, *p.* 169.)

When exostoses merely occasion a deformity, and no pain nor inconvenience from the pressure which they produce on the neighbouring parts, it is certainly most advisable not to undertake any operation for their removal; for, as Boyer has truly observed, in by far the greater number of instances, the local affection is much less to be dreaded than the means used for removing it.

Caustics and the cautery have occasionally been applied to exostoses; but they mostly do mischief. Boyer mentions an unfortunate woman, in whom some caustic was applied to an exostosis at the inside of the tibia; but which instead of removing the tumour, caused a necrosis, of which she was not well two years afterward. In a few instances, however, after the removal of fungous or cartilaginous exostosis of the interior of a bone with cutting instruments, the application of the cautery has prevented a reproduction of the diseased mass, as we find exemplified in a case recorded by Sir Astley Cooper, where such a disease of the jaw was thus extirpated.—(*Surgical Essays, part* 1, *p.* 158.) The bold and successful manner, also, in which the hydatid exostosis of the head was attacked with the saw, caustics, and the actual cautery, by Mr. R. Keate, is particularly entitled to the attention of the surgical practitioner.—(*Med. Chir. Trans. vol.* 10, *p.* 288, *&c.*) As far as my information extends, no attempt to stop the progress, or effect the cure of a fungous exostosis, by tying the main artery of the limb, has ever yet succeeded. Two cases, proving the inefficacy of this practice, are detailed by Sir A. Cooper.—(*Vol. cit. p.* 170.)

As the *fungous exostosis of the medullary membrane* is evidently connected with a state of the constitution analogous to what prevails in fungus hæmatodes (see *this word*), the permanent success of amputation should never be too boldly promised; but as no medicines have any material power over the disease, and the operation is the only chance of relief, it ought to be advised.

Cartilaginous exostoses of the medullary membrane may sometimes be extirpated by removing their outer bony covering, and then cutting away the cartilaginous matter closely from the bony surface to which it is attached. Sometimes, as I have noticed, those measures are followed by the use of the actual cautery.

Periosteal exostoses are also either *cartilaginous* or *fungous*, which latter are attended with less general swelling of the limb, and are more prominent than fungous exostoses of the medullary membrane. Ulceration, bleeding, sloughing, and great discharge ensue; and unless some operation be performed, the patient loses his life.—(*A. Cooper, Surgical Essays, part* 1, *p.* 180.)

The *cartilaginous exostosis, between the periosteum and bone,* arises from inflammation of the periosteum and subjacent part of the bone; and a deposition of firm cartilage adherent to both these surfaces takes place. In this substance bony matter is secreted, which is first thrown out from the original bone. As the cartilage increases in bulk, the quantity of phosphate of lime augments, and fresh cartilage is constantly deposited upon the outer surface of the tumour. On dissection;—1st, the periosteum is found thicker than natural; 2dly, immediately below the periosteum cartilage; and 3dly, ossific matter, deposited within the latter, from the shell of the bone, nearly to the inner surface of the periosteum. When the growth of such a swelling ceases, and the disease is of long standing, the exterior surface consists of a shell of osseous matter, similar to that of the original bone, and communicating with its cancelli, in consequence of the primitive shell having been absorbed.—(*A. Cooper, Surgical Essays, part* 1, *p.* 186.) The *periosteal cartilaginous* exostoses constitute the indolent, very hard forms of the disease. In their early stage they may sometimes be checked by small doses of mercury, the decoction of sarsaparilla, and the emplastrum ammoniaci cum hydrargyro.—(*Vol. cit. p.* 196.) When large or troublesome they may be sawed away, as Sir A. Cooper states, without danger, if the disease be well discriminated from the fungous swelling.

When exostoses are productive of much pain, and injure the health, and their situation admits of their being safely removed with the aid of suitable saws, or even with that of a gouge and mallet, the operation may be undertaken. Many tumours of this kind, however, have bases so very extensive and deep, that when situated on the limbs, amputation becomes preferable, to any attempt made to saw or cut away the exostoses and preserve the members on which they are situated.

In removing an exostosis, its base must be as freely exposed by the knife as circumstances will allow, and to this part a small fine saw may be applied. In cutting away some exostoses, the flexible saw, described by Dr. Jeffray, of Glasgow (see *Amputation*), will be found useful. Mr. Hey's saws, and the semicircular trephine, are now so well known to the profession, that I scarcely need recommend them to be remembered in the present cases. Mr. Machell, a surgeon in London, has invented a saw, well calculated for cutting a bone at a great depth, without injuring the muscles. It is a small, fine, perpendicular wheel-like saw, turned by means of a handle connected with machinery. It is highly commended by Sir A. Cooper, who has given a drawing of it in his *Surgical Essays, part* 1. An orbicular saw, invented and used by Professor Graefe, of Berlin, likewise merits particular notice on account of its ingenuity.—(See *C. G. E. Schwalb, De Serra Orbiculari, 4to. Berol.* 1819.) I would likewise recommend to the notice of surgeons the ingenious rotation saw, contrived by Professor Thal, of Copenhagen, and of which a description and engraving may be found in the *Edin. Med. and Surgical Journ. No.* 74. A strong pair of bone-nippers, and especially Mr. Liston's forceps, the edges of which are in the line with the handles, will also be useful.

E. Victorin, De Ossibus tuberosis. Upsal, 1717. *Haller, Disp. Chir. t.* 4, *p.* 561. *P. H. Mœhring, De Exostosi Steatomatode Claviculæ, ejusdem felici Sectione, Gedani,* 1732. *J. Caspart, De Exostosi Cranii rariore, Argent.* 1730. *J. R. Fayolle, De Exostosi, Monsp.* 1774. *Abernethy, in Trans. for the Improvement of Med. and Chir. Knowledge, vol.* 2, *p.* 309. *Bonn, Descriptio Thesauri Ossium Hoviani. Dumont, Journ. de Med. t.* 13. *Hist. de l'Acad. des Sciences,* 1737, *p.* 28. *Houstet, in Mem. de l'Acad. de Chir. t.* 3. *Matani, De Osseis Tumoribus, p.* 20. *Petit, Traité des Mal. des Os, t.* 2, *Morgagni, De Sedibus, &c. ep.* 50. *art.* 56. *Kulmus, De Exostosi Claviculæ. Haller, Collect. Diss. Chir. t.* 4. *R. Keate, in Med. Chir. Trans. vol.* 10. *Sir A. Cooper, Surgical Essays, part* 1, *8vo. Lond.* 1818. *J. F. Lobstein, Compte de son Musée Anatomique, p.* 24, *&c. 8vo. Strasb.* 1820.

EXTRAVASATION. (From *extra*, out of, and *vas*, a vessel.) A term applied by surgeons to the passage of fluids out of their proper vessels or receptacles. Thus, when blood is effused on the surface, or in the ventricles of the brain, it is said that there is an *extravasation.*

When blood is poured from the vessels into the cavity of the peritoneum, in wounds of the abdomen, or when the contents of any of the intestines are effused in the same way, surgeons call this accident an *extravasation.* The urine is also said to be *extravasated,* when, in consequence of a wound, or of sloughing, or ulceration, it makes its way into the cellular substance, or among the abdominal viscera. When the bile spreads among the convolutions of the bowels in wounds of the gall-bladder, this is a species of extravasation.

In wounds of the thorax an extravasation of blood also frequently happens in the cavity of the pleura. Large quantities of blood are often extravasated in consequence of vessels being ruptured by violent blows in the scrotum, on the shoulder, and under the scalp this effect is observed with particular frequency.

In the articles *Head, Injuries of,* and *Wounds,* I have treated of extravasations of blood in the cranium, chest, and abdomen.

EYE, Calculus in the interior of. Scarpa dissected an eye which was almost entirely transformed into a stony substance. It was taken from the body of an old woman, and was not above half as large as the sound one. The cornea appeared dusky, and behind it the iris, of a singular shape, concave, and without any pupil in its centre. The rest of the eyeball, from the limits of the cornea backward, was unusually hard to the touch. The particulars of the dissection of this case will be read with interest, in *Scarpa's Treatise on the Diseases of the Eye.*

Haller met with a similar case.—(See *Obs. Pathol. Oper. Min. obs.* 15.) Fabricius Hildanus, Lancisi, Morgagni, Morand, Zinn, and Pellier make distinct mention of calculi in the interior of the eye. Ossifications of the capsule of the lens, of that of the vitreous humour, and of what was supposed to be the hyaloid membrane are noticed by Mr. Wardrop.—(*Morbid Anatomy of the Human Eye, vol.* 2, *p.* 128, *8vo. Lond.* 1818.)

EYE, Cancer and Extirpation of. One of the well-known characters of carcinoma in general is to attack persons advanced in age rather than children

and young subjects. Hence, an observation made by the experienced Desault, that cancer of the eye is most frequent in childhood, could not but appear a position inconsistent with the usual nature of the disease in general. Yet how was this statement to be contradicted, while it was confirmed by the testimony of Bichat himself, who says, that more than one-third of the patients on whom Desault operated in the Hôtel-Dieu for cancer of the eye were under twelve years of age! Here truth and accuracy as in many other questions relative to disease would never have been attained without the aid of morbid anatomy, whereby distempers which bear a superficial resemblance to each other, while they are in reality of a totally different nature, are prevented from being confounded together. Now, when Scarpa even goes farther than Bichat, and asserts, that *in twenty-four individuals affected with what is called carcinoma of the eye, twenty of those at least are children under twelve years of age*, this declaration, considered with the acknowledged propensity of cancer on all other occasions to attack old rather than young subjects, might have remained a mysterious anomaly in the history of disease, had not the valuable investigations of Mr. Wardrop proved, beyond all doubt, that the afflicting disease which rendered it necessary for so many young subjects to undergo a severe operation, was *not true cancer*, but what is now denominated by modern surgeons, *fungus hæmatodes*.—(*Obs. on Fungus Hæmatodes*, 8vo. *Edin.* 1809.) As Scarpa observes, this author has afforded a solution of the question, by showing from careful observation, founded on pathological anatomy, that the morbid change of structure in the eyeball of a child, commonly called carcinoma, is not in reality produced by cancer, but by another species of malignant fungus, to which the epithet hæmatodes is applied; a disease, indeed, equally, and, with regard to the eye, more formidable and fatal than cancer, but distinguished from it by peculiar characters, which, not being confined to age, sex, or part of the body, attack the eyeball both of the infant and adult.—(*Scarpa, Transl. by Briggs, p.* 502, *ed.* 2.)

According to Scarpa, and, indeed, the sentiments of several other surgeons of the present day, cancer is always preceded by scirrhus, or a morbid induration of the part affected. As the disorganization increases in this hard scirrhous substance, an ichorous fluid is formed in cells within it, and afterward extends towards the external surface of the tumour, causing ulceration of the investing parts. The compact and apparently fibrous mass is then converted into a malignant fungous ulcer, of a livid or cineritious colour, with edges everted and irregularly excavated, and with a discharge of acrid, offensive sanies. The scirrhus composing the base of the malignant fungus, instead of increasing in size, now rather diminishes, but retains all its original hardness, and, after rising a certain way above the ulcerated surface, is destroyed at various points by the same ulcerated process from which it originated. And if any part of the livid fungous sore seem disposed to heal, it is a deceitful appearance, as, in a little time, the smooth points are again attacked by ulceration. To relate in this place all the differences between cancer and fungus hæmatodes of the eye would be superfluous, as the subject is considered in a future article (see *Fungus Hæmatodes*); but I may briefly advert to a few remarkable points of diversity. 1st, The primary origin of fungus hæmatodes is generally in the retina, especially that point at which the optic nerve enters the cavity of the eye. 2dly, True cancer of the eyeball, when it begins on any part of the organ itself, instead of commencing as fungus hæmatodes at the deepest part of the eye, originates on its surface in the conjunctiva; and, as far as present evidence extends, if we except the lachrymal gland, this membrane is the only texture connected with the eye ever primarily affected with carcinoma.—(*Scarpa, On Diseases of the Eye, p.* 526, *edit.* 2; *and Travers, Synopsis of the Diseases of the Eye, p.* 99.) 3dly, Cancer of the eye, as Scarpa truly observes, is less destructive than fungus hæmatodes, and that for two important reasons. In the first place, because carcinoma begins on the exterior parts of the eye, so that whatever relates to the origin and formation of the disease is open to observation; and, secondly, because the cancerous fungus of the eye, on its first appearance, is not actually malignant, but becomes so in process of time, or from improper treatment, previously to which period good surgery may be employed with effect. In this light Scarpa views many excrescences on the conjunctiva and anterior hemisphere of the eye, which appear in consequence of a staphyloma of the cornea, long exposed to the air and ulceration; those which arise from relaxation and chronic inflammation of the conjunctiva; from ulceration of the cornea, neglected or improperly treated; from violent ophthalmy, not of a contagious nature, treated in the acute stage with astringent and irritating applications; from suppuration of the eye, rupture of the cornea, and wasting of the eyeball; or from blows or burns on the part. Nothing, says Scarpa, is more probable, than that all these ulcerated fungi were, on their first appearance, not of malignant character, or certainly not *cancerous*, and that many of them were not actually so at the time of a successful operation being done.

Now, in the opinion of the same valuable author, there is no criterion as yet known of the precise time when a sarcoma of the eye changes from the state of a common ulcerated fungus to that of carcinoma; for the exquisite sensibility, darting pains, rapidity of growth, colour, and ichorous discharge are not an adequate proof of cancer. The symptom, however, on which he is inclined to place the greatest dependence, as a mark of the change in question, is the almost cartilaginous hardness of the malignant ulcerated fungus, which induration, he asserts, is not met with in the benign fungus, and never fails to precede the formation of cancer.—(See *Scarpa, On the Eye, transl. by Briggs, edit.* 2, *p.* 511—513.)

4thly. The last difference of fungus hæmatodes from cancer of the eye here to be noticed, is the pulpy softness of the whole of the diseased mass in the first of these diseases; a character completely opposite to the firm almost cartilaginous consistence of the carcinomatous fungus.

Before describing the operation of removing an eye affected with malignant disease, the following corollaries, drawn by Scarpa, should be recollected. 1. The complete extirpation of the eye for the cure of fungus hæmatodes, although performed on the first appearance of the disease under the form of a yellowish spot deeply seated in the eye, is useless, and rather accelerates the death of the patient.

But although this statement, made by Scarpa, may be mostly true, I am happy to say, that modern experience begins to raise a hope that exceptions to the foregoing melancholy inference are possible. Thus Mr. Wishart removed from a boy nine years old an eye that had been affected with fungus hæmatodes about four months, and no relapse had taken place eighteen months after the operation.—(See *Edin. Med. and Surg. Journ. No.* 74, *p.* 51.)

2. The exterior fungous excrescence of the eye, commonly called carcinoma, beginning on the conjunctiva and anterior hemisphere, *while it is soft, flexible, and pulpy*, although accompanied with symptoms similar to those of carcinoma, is not actually this disease, nor does it become malignant and strictly cancerous until it is *rigid, hard, coriaceous, warty, and in every respect scirrhous.*

3. The inveterate fungous excrescence, hard to the touch in all its parts, covered with ulcerated warts, which has involved the whole of the eyeball, optic nerve, and surrounding parts, and rendered the bones of the orbit carious, and contaminated the lymphatic glands behind the angle of the jaw and in the neck, is incurable.

4. On the contrary the partial or total extirpation of the eye will succeed when attempted before the external fungous excrescence has changed from the state of softness to that of a scirrhous, warty, and carcinomatous hadness.—(*Vol. cit. p.* 526.)

The operation of removing the eye was first performed in the sixteenth century by Bartisch, a German, who employed a coarsely constructed instrument shaped like a spoon, with cutting edges, and by means of which the eye was separated from the surrounding parts, and taken out of the orbit. This instrument was too broad to admit of ready introduction to the deep contracted part of the orbit, so that when it was used either a part of the disease was likely to be left behind, or the thin bones of the orbit to be fractured in the attempt to pass it more deeply into that cavity. Fabricius Hildanus learned these inconveniences from experience, and in order to avoid them, devised a sort of probe-pointed bistoury. Bidloo made use of scissors and a pointed bistoury.

La Vauguyon is the first French surgeon who spoke of this operation; and all his countrymen may be said to have regarded the operation as useless, cruel, and dangerous, until St. Ives performed it with success. Heister preferred operating with the bistoury alone. Several English surgeons used a sort of curved knife, an engraving of which is given in B. Bell's system; but for dissecting out the tumour this instrument was regarded by Louis as less convenient than a straight bistoury.

Thus far the plans of operating advised by authors were not guided by any fixed rules. Louis endeavoured to lay down such rules, and for a long while his method was mostly adopted in France. It consists in dividing the attachments of the eye to the eyelids; then those of the small oblique muscle; next those of the great oblique muscle; then those of the levator palpebræ superioris, varying, according to their insertions, the manner of holding the knife. The eyeball is afterward detached, and the four straight muscles and optic nerve divided with a pair of scissors.

This way of operating, founded upon anatomical principles, seems at first glimpse to offer a method in which, as Louis remarks, each stroke of the instrument is guided by the knowledge of the parts. But it is to be noticed, that these parts, being altered by disease, most commonly do not present the same structure and relations which they do in the natural state; and that the flattened, lacerated, destroyed muscles, on their being confused with the eye itself, cannot serve, as in lithotomy, for the foundation of any precept relative to the operation. Desault considered the scissors unnecessary, because the inclination of the outer side of the orbit will always allow a bistoury to be carried to the bottom of this cavity, so as to divide, from above downwards, the optic nerve and muscular attachments.

Hence, after having practised and taught the method of Louis, he returned to Heister's advice, who directs only a bistoury to be employed. To have an exact idea of the mode of operating, which is always easy and simple with this one instrument, we must suppose the carcinoma to be in three different states. 1. When the tumour hardly projects out of the orbit, so that the eyelids are free. 2. When it is much larger, projects considerably forwards, and pushes in this direction the healthy eyelids, which are in contact with it, together with a portion of the conjunctiva which invests them, and is now detached from them. 3. When, at a much more advanced period, the eyelids participate in the cancerous state. In the first case, the eyelids must be separated from the eye, by cutting through the conjunctiva, where it turns to be reflected over the globe of the eye. In the second instance, the eyelids and conjunctiva, which are in contact with the diseased eye, must be dissected from it. In the third, these parts must be cut away, together with the eye.—(*Œuvres Chir. de Desault, t.* 2.)

After the above observations, and the additional information on the subject, contained in the last edition of the *First Lines of the Practice of Surgery*, I shall conclude this article with a few brief directions.

When the eyeball is exceedingly enlarged, it is necessary to divide the eyelids at the external angle, in order to facilitate the operation. The surgeon can in general operate most conveniently when he employs a common dissecting knife, and when his patient is lying down with his face exposed to a good light. In cutting out a diseased eye, it is necessary to draw the part forwards regularly as its surrounding attachments are divided, in order that its connexions, which are still more deeply situated, may be reached with the knife. This object cannot be very well accomplished with the fingers or forceps, and therefore most surgical writers recommend us either to introduce a ligature through the front of the tumour (see *Travers, Synopsis, p.* 308), or to employ a hook for the purpose of drawing the part in any direction during the operation, which the necessary proceedings may require. When the eyelids are diseased, they must be removed; but if prudence sanctions their being preserved, this is an immense advantage. The eye must not be drawn out too forcibly before the optic nerve is divided, and care must be taken not to penetrate any of the foramina, or thin parts of the orbit with the point of the knife, for fear of injuring the brain. Great care should also be taken to leave no diseased parts in the orbit unremoved. The hemorrhage may be stopped by filling the orbit with scraped lint, and applying a compress and bandage. It is constantly advisable to remove the lachrymal gland, as this part seems to be particularly apt to be the source of such inveterate fungous diseases as too often follow the operation.

Mr. Travers, with a straight double-edged knife, freely divides the conjunctiva and oblique muscles, so as to separate the eyeball and lachrymal gland from the base of the orbit. Drawing the eye then gently forwards with the ligature, he introduces a double-edged knife, "curved breadthwise," at the temporal commissure of the lids, for the purpose of dividing the muscles, vessels and nerves, by which the globe remains attached. The hemorrhage he represses with a small bit of fine sponge put into the orbit, and a light compress applied over the eyelids, and supported with a bandage. The sponge, he says, should not be suffered to remain longer than the following day, when a soft poultice in a muslin bag may be substituted for the compress. He approves of giving an opiate at bedtime, and joins the late Mr. Ware in condemning the practice of cramming the orbit with lint, or charpie, and leaving it to be discharged by suppuration.—(*Synopsis of the Diseases of the Eye, p.* 308.)

For a few days after the operation, antiphlogistic treatment is proper. The patient should be kept in bed until all risk from inflammation is past, and suppuration has been freely established. In one case operated upon by Mr. Guthrie, the symptoms of inflammation were so violent that it was necessary to take away 250 ounces of blood in the course of the first three days.—(*Operative Surgery of the Eye, p.* 183.) Sometimes fungous granulations continually form in the orbit, notwithstanding they are repeatedly destroyed; and sometimes the disease extends even to the brain, and produces fatal consequences. When malignant fungous excrescences grow from the cornea alone, it is clearly unnecessary to extirpate the whole eyeball.

For information relating to the subjects of this article, consult particularly *Memoire sur plusieurs Maladies du Globe de l'Œil; ou l'on examine particuliérement les cas qui exigent l'extirpation de cet organe, et la méthode d'y procéder; par M. Louis, in Mém. de l'Acad. de Chir. t.* 13, *p.* 262, *édit. in* 12*mo. C. F. Kailtschmeid, Programma de oculo ulcere canceroso laborante feliciter extirpato, &c. Jenæ*, 1748. *J. G. G. Voit, Oculi Humani Anatomia et Pathologia ejusdemque in statu morboso Extirpatio*, 8*vo. Norimb.* 1810. *Bertrandi, Traité des Opérations de Chirurgie, p.* 519, *éd.* 1784, *Paris. Sabatier, De la Médecine Opératoire, t.* 3, *p.* 54, *ed.* 1. *Richter, Anfangsgr. der Wundarzn. b.* 3, *p.* 415, *Gött.* 1795. *Mémoire sur l'Extirpation de l'Œil Carcinomateux, in Œuvres Chir. de Desault par Bichat, t.* 2, *p.* 102. *Richerand, Nosographie Chir. t.* 2, *p.* 103, *&c. édit.* 2. *Ware, in Trans. of the Medical Society of London, vol.* 1, *part* 1, *p.* 140, *&c. Lassus, Pathologie Chir. t.* 1, *p.* 450, *edit.* 1809. *Wardrop on Fungus Hæmatodes, p.* 93, *&c. Scarpa on the Principal Diseases of the Eye, chap.* 21, *edit.* 2, *transl. by Briggs*, 8*vo. Lond.* 1818. *B. Travers, A Synopsis of the Diseases of the Eye, sec.* 4, 8*vo. London*, 1820. *J. H. Wishart, in Edin. Med. and Surg. Journ. No.* 74. *G. J. Guthrie, Operative Surgery of the Eye, p.* 178, *&c.* 8*vo. Lond.* 1823.

EYE, DISEASES OF. See *Amaurosis; Cataract; Cornea; Encanthis; Exophthalmia; Fungus Hæmatodes; Gutta Serena; Hemeralopia; Hydrophthalmia; Hypopium; Iris; Leucoma; Nyctalopia; Ophthalmy; Pterygium; Pupil, Closure of; Staphyloma, &c. &c.*

EYELIDS, DISEASES OF. See *Ectropium; Hordeolum; Lagophthalmus; Ptosis; Trichiasis;* and *Tumours, Encysted.* In the examination of the interior of the upper eyelid, a modern and very convenient plan is now pursued, namely, that of everting the part over a probe placed just across the upper edge of the cartilage of the tarsus, which is then to be suddenly inclined outwards, when the whole inner surface of the lid will be exposed, the part continuing in this everted state until replaced by the surgeon.

FEVERS, SURGICAL. Under this head may be comprehended two species of fever, viz. the *inflammatory* and the *hectic*, which are particularly interesting to surgeons, because frequently attendant on surgical disorders.

In treating of inflammation, I have mentioned that a febrile disturbance of the constitution is attendant on every considerable inflammation. In the present article, some account will be offered of the particulars of this disorder.

The fever about to be described is known and distinguished by several names; some calling it *inflammatory*, some *symptomatic*, and others *sympathetic*. It is supposed by certain writers to be sometimes idiopathic; that is, to originate at the same time with the local inflammation, and from the same causes.—(*J. Burns.*) In other instances, and, indeed, we may say, in all ordinary surgical cases, it is symptomatic; or, in other words, it is produced, not directly by the causes which originally produced the inflammation, but in consequence of the sympathy of the whole constitution with the disturbed state of a part.

Mr. Travers's opinions seem partly to coincide with those of Mr. Burns, though differently expressed. He considers constitutional irritation to be of two kinds, direct and reflected; by which he implies, "that the first is wholly and immediately derived from the part, commences and is identified with the local mischief, and the constitution has no share in its production. The second, on the contrary, originates in a peculiar morbid state of the constitution, to which the injury or inflammation has given birth, or it may be previously existing. The first is truly symptomatic, never originating spontaneously, and, being immediately induced by the local irritation, is capable of being essentially mitigated or arrested by its removal. The second is occasionally purely idiopathic, and, being oftener the cause than the effect of the local action, is seldom influenced by the local treatment. In the first, the local changes are dependent on local causes; in the second they depend on constitutional causes."—(See *Travers on Constitutional Irritation*, *p.* 47.) As the expression reflected irritation, if understood in its literal sense, involves the reader in an hypothesis which is perhaps not correct, I do not see any advantage in the employment of it. Used figuratively, however, it may be as allowable as many other expressions in medical language.

Idiopathic inflammatory fever is said to be always preceded by chilliness. The symptomatic or sympathetic inflammatory fever sometimes takes place so quickly in consequence of the violence of the exciting cause or of the local inflammation, that no preceding coldness is observable. If, however, the local inflammation be more slowly induced, and consequently operate more gradually on the system, then the coldness is evidently perceived. The symptomatic fever, induced by scalding or burning a part, is quickly produced, and we have very little time to attend to the earliest period of its formation. On the other hand, the symptomatic fever induced by wounds is excited more slowly, and the period of its formation is longer. This fever is not produced when the inflammation only affects parts in a slight degree; but it makes its appearance if the local inflammation be considerable, or if it affect very sensible parts.—(*Burns.*)

The degree in which the symptomatic fever is excited, does not altogether depend upon the absolute quantity or violence of the inflammation; but, in a great measure, upon the degree of the local inflammatory action, compared with the natural power and action of the part affected. Parts in which the action is naturally low, are extremely painful when inflamed, and the system sympathizes greatly with them. Hence the constitution is very much affected when tendons, bones, or ligaments are the parts inflamed. Severe inflammation of a large joint, every one knows, is apt to excite the most alarming and even fatal derangement of the system. When very sensible parts are inflamed, as, for instance, the eye, the symptomatic fever is generally more considerable than it would be, were it to arise from an equal quantity and degree of inflammation in a less sensible organ.

In common parts, as muscles, cellular membrane, skin, &c., the symptoms will be acute; the pulse strong and full, and the more so if the inflammation be near the heart; but perhaps not so quick as when the part is far from it: the stomach will sympathize less, and the blood will be pushed farther into the small vessels.

If the inflammation be in tendinous, ligamentous, or bony parts, the symptoms will be less acute, the stomach will sympathize more, the pulse will not be so full, but perhaps quicker; there will be more irritability, and the blood, not being propelled so well into small vessels, will forsake the skin.

It seems to be a material circumstance whether the inflammation be in the upper or lower extremity; that is, far from or near the heart; for the symptoms are more violent, the constitution more affected, and the power of resolution less, when the part inflamed is far from the source of the circulation, than when near it, even when the parts are similar, both in texture and use.

If the heart or lungs are inflamed, either immediately or secondarily, by sympathy, the disease has more violent effects upon the constitution than the same quantity of inflammation would have if the part affected were not a vital one, or one with which the vital parts did not sympathize. If the part be such as the vital ones readily sympathize with, then the sympathetic action of the latter will affect the constitution, as in an inflammation of the testicle. In such cases the pulse is much quicker and smaller, and the blood is more sizy than if the inflammation were in a common part, such as muscle, cellular membrane, and skin.

When the stomach is inflamed, the patient feels an oppression and dejection through all the stages of the inflammation; the pulse is generally low and quick, and the pain obtuse, strong, and oppressive; such as the patient can hardly bear. If the intestines are much affected, the same symptoms take place, especially if the inflammation be in the upper part of the canal; but if only the colon be affected, the patient is more roused, and the pulse is fuller than when the stomach alone is inflamed. When the uterus is inflamed, the pulse is extremely quick and low. When the inflammation is either in the intestines, testicle, or uterus, the stomach generally sympathizes. In inflammation of the brain, the pulse varies more than in the same affection of any other part; and perhaps we must, in this instance, form a judgment of the complaint more from other symptoms than the pulse.

When inflammation is situated in a part not very essential to life, and occasions the general affection of the system, called inflammatory fever, the pulse is fuller and stronger than common, and the blood is pushed farther into the extreme arteries than when the inflammation is in a vital part. The patient, after many occasional rigours, is at first rather roused. The pulse is as above described, when the constitution is strong and not irritable; but if this be extremely irritable and weak, as in many women who lead sedentary lives, the pulse may be quick, hard, and small, at the commencement of the inflammation, just as if the vital parts were concerned. The blood may also be sizy; but it will be loose and flat on the surface.—(*Hunter.*)

The kind of constitution makes a great difference; and, as Mr. Travers has justly observed, "it is scarcely necessary to illustrate the influence of an irritable temperament upon the consequences of casual injury or disease. Practically, we all know it well. We say, *such a person would be a bad subject for a compound fracture;* and whoever has had opportunities of watching several subjects of compound fracture under treatment at one and the same time, well knows the import of this phrase, and that the greatest degree of mischief is often accompanied by the least constitutional disturbance, and for this reason is soonest and most perfectly restored. The first few hours will enable an experienced observer to determine whether the subject of a serious injury or operation

will do well or otherwise. How vastly different in different individuals is the inconvenience attending such minor derangements as a bile, an enlarged gland, a whitlow, or a simple ophthalmia! In some, the constitution seems ignorant of the affair, and the individual pursues his ordinary occupations. In others, the whole system sympathizes; the spirits are ruffled; the nights are restless, the appetite fails; the pulse acquires an undue bound; and the white tongue, the creeping chilliness, and slight erratic pains of symptomatic fever are present."—(*Travers on Constitutional Irritation*, *p.* 15.)

We may set down the ordinary symptoms of inflammatory fever, occurring in consequence of local inflammation in common parts and in a healthy habit, as follows: The pulse is frequent, full, and strong; all the secretions are diminished; the patient is vigilant and restless; the perspiration is obstructed, and the skin is hot and dry; the urine is high-coloured and in small quantity; the mouth is parched and the tongue furred; an oppressive thirst is experienced; with disturbance of the nervous system; loss of appetite and sleep; and, in some cases, delirium.

TREATMENT OF INFLAMMATORY FEVER.

Upon this part of the subject very little is to be said; for as, in almost every instance, the febrile disturbance of the system is produced and entirely kept up by the local inflammation, it must be evident that the means employed for diminishing the exciting cause, are also the best for abating the constitutional effects. Hence it very seldom happens that any particular measures are adopted expressly for the fever itself; as this affection is sure to subside in proportion as the local inflammation is lessened or resolved. But when the febrile disturbance is considerable, and the inflammation itself is also considerable, the agitated state of the system may have in its turn a share in keeping up and even increasing the local affection, and should be quieted as much as possible. However, in these very instances, in all probability, we should be led to a more rigorous adoption of the antiphlogistic plan of treatment, by an abstract consideration of the state of the local inflammation itself, without any reference to that of the constitution. Indeed, the increased action of the heart and arteries, and the suppression of the secretions, require the employment of antiphlogistic means and antimonials, the very same things which are indicated for the resolution of the local inflammation itself. Bleeding, purging, cold drinks, low diet; the exhibition of the antimonium tartarizatum, James's powder, or the common antimonial powder; and bathing the feet and body in warm water, are measures which have the greatest efficacy in tranquillizing the constitutional disturbance implied by the term inflammatory fever. But I think it right to repeat, that it is hardly ever necessary to have recourse to such an evacuation as general bleeding merely on account of the fever; as this is only an effect which invariably subsides in proportion as the local cause is diminished.

As Dr. Thomson has remarked, "the inflammatory fever, succeeding to external injuries or to chirurgical operations, undergoes a kind of natural crisis, by the appearance of suppuration. In these instances, therefore, unless when the patient is strong and in full health, when the disease is seated in an organ of much importance to life, or is in danger of spreading, as is the case in all inflammations of the membranes lining the three great cavities of the body, the lancet ought to be used with caution. For we may, by too free a detraction of blood, produce a sudden sinking of the powers of life, and convert the existing constitutional symptoms into fever of a different type or character. But in all cases of inflammation in which any doubt arises with regard to the farther general detraction of blood, it may, I believe, be laid down as a general rule, that it is safer to employ local than general blood-letting."—(*Lectures on Inflammation*, *p.* 170.)

HECTIC FEVER.

The *sympathetic* or *symptomatic* fever already described is an *immediate* affection of the constitution, in consequence of some local disorder; hectic fever is a *remote* effect. When hectic fever is a consequence of local disease, it has commonly been preceded by inflammation and suppuration; but there is an inability to produce granulation and cicatrization; and the cure, of course, cannot be accomplished. The constitution may now be said to be oppressed with a local disease or irritation from which it cannot deliver itself.

A distinction should be made between hectic fever arising entirely from a local complaint in a good constitution, which is only disturbed by too great an irritation, and hectic fever arising principally from the badness of the constitution, which does not dispose the parts to heal. In the first species it is only necessary to remove the part (if removable), and then all will do well; but in the second, nothing is gained by a removal of the part, unless the wound made in the operation is much less, and more easily put into a local method of cure; by reason of which the constitution sinks less under this state and the operation together, than under the former disease. Here the nicest discrimination is requisite.—(*Hunter.*)

Owing to a variety of circumstances, hectic fever comes on at very different periods after the inflammation, and commencement of suppuration. Some constitutions, having less powers of resistance than others, must more easily fall into this state.

Hectic fever takes its rise from a variety of causes, which have been divided into two species with regard to diseased parts; viz. parts called vital, and others not of this nature. Many of the causes of hectic fever, arising from diseases of the vital parts, would not produce this constitutional affection if they were in any other part of the body; such, for instance, is the situation of tumours, either in, or so situated as to press upon a vital part, or one whose functions are immediately connected with life. Scirrhi in the stomach and mesenteric glands, diseased lungs, liver, &c. very soon produce hectic fever.

When hectic fever arises from a disease of a part that is not vital, it commences sooner or later, according as it is in the power of the part to heal or continue the disease. If the part be far from the source of the circulation, the fever will come on sooner with the same quantity of disease. When the disease is in parts which are not vital, and excites hectic fever, it is generally in situations where so much mischief happens as to affect the constitution, and where the powers of healing are little. This is the case with diseases of many of the joints. We must also include parts which have a tendency to such specific diseases as are not readily cured in any situation.

Although hectic fever commonly arises from some incurable local disease of a vital part, or from an extensive disease of a common part, yet it is possible for it to be an original disease in the constitution, without any local cause whatever that can be specified.

Hectic is a slow mode of dissolution; the general symptoms are those of a low or slow fever, attended with weakness. But there is rather weak action than real weakness; for upon the removal of the hectic cause, the action of strength is immediately produced, and every natural function is re-established, however much it may have been previously impaired.

The particular symptoms are debility; a small, quick, and sharp pulse; the blood forsakes the skin; loss of appetite; frequently a rejection of all aliment from the stomach; wasting; a great readiness to be thrown into sweats; spontaneous perspirations, when the patient is in bed; pale coloured and very copious urine; and often a constitutional purging.

Hectic fever has been imputed to the absorption of pus into the circulation; but no doubt much exaggeration has prevailed in the doctrine which ascribes to this cause many of the bad symptoms frequently attacking persons who have sores. When suppuration takes place in particular parts, especially vital ones, hectic fever almost constantly arises. It also attends many inflammations before suppuration has actually happened, as in cases of white swelling of the large joints. The same quantity and species of inflammation and suppuration in any of the fleshy parts, especially such as are near the source of the circulation, have in general no such effect. Hence, in the first instances, the fever is only an effect on the system, produced by a local complaint that has a peculiar property.

The constitution sympathizes more readily with diseases of vital organs, than with those of any other parts; their diseases are also in general more difficult of cure than the same affections of parts which are not vital. All diseases of bones, ligaments, and tendons,

affect the constitution more readily than those of muscles, skin, cellular membrane, &c.

When the disease is in vital parts, and is such as not to kill by its first constitutional effects, the system then becomes teased with a complaint which is disturbing the *necessary actions of health*. In the large joints, a disease continues to harass the constitution by attacking parts which have no power, or rather no disposition, to produce salutary inflammation and suppuration. Thus, the system is also irritated by the existence of an incurable disease. Such is the theory of the cause of hectic fever.

If the absorption of matter always produced the symptoms above described, how could any patient who has a large sore possibly escape hectic? for there is no reason to suppose that one sore can absorb more readily than another. If absorbed matter occasioned such violent effects as have been commonly ascribed to it, why does not venereal matter do the same? We often know that absorption is going on by the progress of buboes. A large one, just on the point of bursting, has been known to be absorbed, in consequence of a few days' sea-sickness. The person continued at sea for four-and-twenty days afterward, yet no hectic symptoms followed, but only the specific constitutional effects, which were of a very different description.

When the cavities of veins are inflamed, matter is sometimes formed within these vessels, and cannot fail to get into the circulation; yet hectic symptoms do not arise. Also very large collections of matter, produced without visible inflammation, as many abscesses of the scrofulous kind, are wholly absorbed in a very short time, but no bad symptoms are the consequence.

We may conclude, therefore, that the absorption of pus has no share in occasioning hectic fever. Many arguments might be adduced to expose the absurdity of the doctrine; but here it will be sufficient to refer the reader to what Mr. Hunter has said farther on the subject, in his work on inflammation

It is much more probable that hectic fever arises from the effect, which the irritation of a vital organ, or other parts, such as joints, has on the constitution, when either incurable in themselves, or are so for a time to the constitution.

TREATMENT OF HECTIC FEVER.

There is no method of curing the consequences above related. All relief must depend on the cure of the cause, viz. the local complaint, or on its removal.

Tonic medicines have been recommended, on account of the evident existence of great debility. Antiseptics have also been given, in consequence of the idea, that when pus is absorbed, it makes the blood disposed to putrefy. For these reasons, bark and wine have been exhibited. In most cases, bark will only assist in supporting the constitution. Until the cause is removed, however, there seems no prospect of curing a disorder of the constitution. It is true, tonic medicines may make the system less susceptible of the disease, and also contribute to diminish the cause itself, by disposing the local complaints to heal. When, however, hectic fever arises from a specific disease, such as the venereal, though bark may enable the constitution to bear the local affection better than it otherwise could do, yet, as Mr. Hunter remarked, it can have little effect upon the syphilitic mischief.

No medicine, not even bark itself, has any direct power of communicating strength to the human constitution. All that can be done in the treatment of hectic fever, when it is thought inexpedient or impracticable to remove the morbid part, is to combat particular symptoms, and to promote digestion. It is by bringing about the latter object that bark in these cases is useful. The infusion of cinchona, and the sulphate of quinine, being more likely to agree with the stomach than the decoction or powder, should generally be preferred. Nourishing food, easy of digestion, should be frequently taken in small quantities at a time. Nothing is more prejudicial to a weak constitution than overloading the stomach. Wine may also be given, but not too freely, and not at all if it should create heartburn, as it sometimes does in hectic patients. Madeira is less apt than port to have this disagreeable effect. In these cases it is likewise often found useful to administer gentle cordial aromatic draughts. But of all medicines, opium is perhaps the most valuable to those who are afflicted with hectic fever; it alleviates pain, procures sleep, and checks the diarrhœa, which so frequently contributes to hasten the patient's dissolution.

When the local complaint connected with this fever is totally incurable, it must, if possible, be removed by a manual operation. Thus, when a diseased joint keeps up hectic fever, and seems to present no hope of cure, amputation must be performed. But when the local disease is attended with a chance of cure, provided the state of the constitution were improved, the surgeon is to endeavour to support the patient's strength. Great discretion, however, must be exercised in deciding how long it is safe to oppose the influence of an obstinate local disease over the system, by the power of medicine; for, although some patients in an abject state of weakness have been restored to health by a removal of the morbid part, many have been suffered to sink so low, that no future treatment could save them from the grave. Clemency in the practice of surgery does not consist so much in delaying strong and vigorous measures, as in boldly deciding to put them in execution as soon as they are indicated.

When hectic fever arises from local diseases in parts which the constitution can bear the removal of, such parts should be taken away, if they cannot be cured consistently with the advice already given. When the disease arises from some incurable disease in an extremity, and amputation is performed, all the abovementioned symptoms generally cease almost immediately after the removal of the limb. Thus, as Mr. Hunter has correctly observed, a hectic pulse at one hundred and twenty has been known to sink to ninety in a few hours after the removal of the hectic cause. Persons have been known to sleep soundly the first night afterward, who had not slept tolerably for several preceding weeks. Cold sweats have stopped immediately, as well as those called colliquative. A purging has immediately ceased, and the urine begun to drop its sediment.

FICATIO, or FICUS. (A fig.) A tubercle about the anus or pudenda resembling a fig.

FINGERS, ABSCESSES OF. See *Whitlow.*

FINGERS, *Amputation of.* See *Amputation.*

FINGERS, *Necrosis of.* In these cases, the surgeon is to endeavour to extract the exfoliating portions of bone immediately they become loose. For this purpose, he is justified in making such incisions as will enable him to fulfil the object in view. Until the process of exfoliation is sufficiently advanced, he can do little more than apply simple dressings, and keep the part in a clean, quiet state.

When the separation of the dead pieces of bone will certainly destroy the utility of the finger, and convert the part into an inconvenient, stiff appendage to the hand; or, when the patient's health is severely impaired by the irritation of the disease, the termination of which cannot be expected within a moderate space of time; amputation is proper. It is a truth, however, that many fingers are amputated which might be preserved; and surgeons ought to consider well before presuming to remove parts which, when curable, may become of the greatest consequence in regard to the perfection of the hand. The bread of many persons, it is well known, depends on the unmutilated state of certain fingers. These remarks are offered, because I have seen several surgeons, fond of seizing every opportunity of cutting their fellow-creatures, remove fingers which might have been usefully saved, either by allotting a little more time for the exfoliation, or by making incisions, and cutting out the dead piece of bone.—[See note on article *Whitlow.*]

FINGERS, *Dislocations of.* See *Dislocation.*

FINGERS, *Fractures of.* See *Fracture.*

FINGERS, SUPERNUMERARY. The instances of children born with a smaller number of fingers than natural are more rare than cases in which the number is greater than usual. Of the latter malformation, examples were noticed in times of great antiquity. Thus, in the 1st book of Chronicles is the following notice of such an occurrence: "There was war at Gath, where was a man of great stature, whose fingers and toes were four-and-twenty, six on each hand, and six on each foot."—(*Chap.* xx. *ver.* 6.) Anne Boleyn, so celebrated for her beauty and her misfortunes, had six fingers on her right hand. Pliny, the naturalist, speaks of two sisters, who had six fingers on each of their hands. In the *Memoirs of the Royal Academy of Sci-*

ences for 1743, is the account of a child which was shown at one of the meetings, and had six toes on each foot, and the same number of fingers on each hand. In each foot there were six metatarsal bones, and in the left hand an equal number of metacarpal bones; but in the right hand there were only five, the outer one of which had two articular surfaces, one for the little, and the other for the supernumerary finger. In the *Copenhagen Transactions*, T. Bartholine has inserted the description of a very curious skeleton; on the right hand there were seven fingers, on the left six; and besides these circumstances, the thumb was double. On the right foot there were eight toes, on the left, nine; the right metatarsus consisting of six bones, the left of seven. Saviard speaks of a still more curious case: he saw a new-born infant at the Hôtel-Dieu, at Paris, which had ten fingers on each hand, and ten toes on each foot; the phalanges seemed as if they were all in a broken, imperfect state.—(*Obs. de Chir.*) The example of the greatest number of fingers and toes is recorded by Voight: including the thumb, there were thirteen fingers on each hand, and twelve toes on each foot.—(*Mag. für das neueste der Naturkunde, b.* 3, *p.* 174.) Individuals are occasionally born with two thumbs on the same hand.—(*Panarolus, Oentec.* 3, *Obs.* 4—8.)

Since allowing the redundant number of fingers to remain would keep up deformity, and create future inconvenience, the surgeon is called upon to amputate them. The redundant fingers are sometimes with, sometimes without, a nail; seldom more numerous than one upon each hand; generally situated just on the outside of the little fingers; and, as far as my observation extends, incapable of motion, in consequence of not being furnished like the rest of the fingers with muscles. For the most part the phalanges are also imperfectly formed or deficient. The best plan is to cut off supernumerary fingers with a scalpel at the place where they are united to the other part of the hand. The operation should be performed while the patient is in the infant state, that is to say, before the superfluous parts have acquired much size, and while the object can be accomplished with the least pain. The incisions ought to be made so as to form a wound with edges which will admit of being brought together with strips of adhesive plaster. As soon as the dressings are applied, the hemorrhage will almost always cease without a ligature.

FISSURE. (From *findo*, to cleave asunder.) A very fine crack in a bone is so called.

FISTULA, in surgery, strictly means a sore which has a narrow orifice, runs very deeply, is callous, and has no disposition to heal. The name is evidently taken from the similitude which the long cavity of such an ulcer has to that of a pipe or reed. A fistula commonly leads to the situation of some disease keeping up suppuration; and from which place the matter cannot readily escape. No technical term has been more misapplied than this; and no misinterpretation of a word has had worse influence in practice than that of the present one. Many simple, healthy abscesses with small openings have too often been called *fistulous*; and being considered as in a callous state, the treatment pursued has in reality at last rendered them so, and been the only reason of their not having healed.

FISTULA IN ANO. See *Anus*.

FISTULA LACHRYMALIS. In correct language, this term can be applied only to one case, viz. that in which there is an ulcerated opening in the lachrymal sac, unattended with any tendency to heal, and from which opening a quantity of puriform fluid is from time to time discharged, especially when the lachrymal sac is compressed. Such has been the confusion, however, respecting the nature of the diseases of the lachrymal passages, and so great has been the force of ancient custom, that down to the present time the generality of British, as well as foreign, surgeons, imply by the expression *fistula lachrymalis* several forms of disease, totally different from each other, and to only one of which the name is at all applicable. In order not to assist in perpetuating this absurd and erroneous plan, from which nothing but mistakes and ignorance can result, I shall follow the example pointed out by Beer, Schmidt, and our countryman Mr. M'Kenzie, and consider the various forms of disease to which the lachrymal passages are subject, not under the head of *fistula lachrymalis*, but under the more sensible title, *Lachrymal Organs, Diseases of the*.

FISTULÆ IN PERINÆO. As Sir Astley Cooper has justly observed, incisions in the urethra generally heal with great facility; a fact amply proved by the common result of the lateral operation; but when apertures are formed in the urethra, either from diseased states of the constitution and the part together, or of the latter alone, and when they are accompanied with any considerable destruction of the sides of the urethra, and of the corpus spongiosum, they are mostly very difficult to cure.—(*Surg. Essays, pt.* 2, *p.* 211.)

When the methods recommended for the removal of strictures (see *Urethra, Strictures of*) have not been attempted, or not succeeded, nature endeavours to relieve herself by making a new passage for the urine, which, although it often prevents immediate death, yet if not remedied is productive of much inconvenience and misery to the patient through life. The mode by which nature endeavours to procure relief is by ulceration on the inside of that part of the urethra which is enlarged, and situated between the stricture and the bladder. Thus the urine becomes applied to a new surface, irritating the part, and occasioning the formation of an abscess into which the urine has access; and when the matter is discharged, be it by nature or by art, the urine passes through the aperture, and generally continues to do so while the stricture remains. —(*A. Cooper, Surgical Essays, part* 2, *p.* 212.)

The ulceration commonly begins near or close to the stricture, although the stricture may be at a considerable distance from the bladder. The stricture is often included in the ulceration, by which means it is removed; but unluckily this does not constantly happen. The ulceration is always on the side of the urethra next to the external surface.

The internal membrane and substance of the urethra having ulcerated, the urine readily gets into the loose cellular membrane of the scrotum and penis, and diffuses itself all over those parts; and as this fluid is very irritating to them, they inflame and swell. The presence of the urine prevents the adhesive inflammation from taking place; it becomes the cause of suppuration wherever it is diffused; and the irritation is often so great that it produces mortification, first in all the cellular membrane, and afterward in several parts of the skin; all of which, if the patient live, slough away, making a free communication between the urethra and external surface, and producing what are termed *fistulæ in perinæo*, though it is plain enough to every surgeon who knows the correct meaning of the word *fistula*, that a recent opening, produced in the perinæum by ulceration or sloughing, ought not to be called a fistula immediately it is formed, and at least not until it has acquired some of the characters specified in our explanation of the term *fistula*.

According to Mr. Hunter, when ulceration takes place farther back than the portion of the urethra between the glans penis and membranous part of the canal, the abscess is generally more circumscribed.

The urine sometimes insinuates itself into the corpus spongiosum urethræ, and is immediately diffused through the whole, even to the glans penis, so as to produce a mortification of all those parts. A fatal instance of this kind is reported by Mr. C. Bell.—(*Surgical Obs. vol.* 1, *p.* 98.)

Although the ulceration of the urethra may be in the perinæum, yet the urine generally passes easily forwards into the scrotum, which contains the loosest cellular substance in the body; and there is always a hardness extending along the perinæum to the swelled scrotum in the track of the pus.—(*Hunter.*)

Sir Astley Cooper is of opinion, that as soon as the abscesses, which are the forerunners of the fistula, can be plainly felt to contain a fluid, it is the best practice to open them with a lancet. The extensive destruction of parts by ulceration will thus be prevented; the place not unfrequently then heals up expeditiously without any fistulous orifice being left, and a tendency to those dangerous extravasations of urine is also prevented, which, if the abscesses are not opened early, often prove destructive to life.—(*Vol. cit. p.* 212.)

Ulceration can only be prevented by destroying the stricture; but when the urine is diffused in the cellular membrane, the removal of the stricture will generally be too late to prevent all the mischief, although it will be necessary for the complete cure. Therefore, an attempt should be made to pass a bougie, for perhaps the stricture may have been destroyed by the ulceration, so

as to allow the instrument to be introduced. When this is the case, bougies must be almost constantly used, in order to procure as free a passage as possible. In these cases, Sir A. Cooper expresses a preference to metallic bougies, the size of which is to be gradually increased until their diameter exceeds the natural diameter of the passage. In some instances, however, he says, that it will be necessary to introduce a pewter catheter, of large size, and to allow it to remain in the bladder, so as at once to act upon the stricture, and hinder the urine from passing through the preternatural opening. In this manner a permanent cure may often be effected. Although this experienced surgeon agrees with most surgeons of the present day, respecting the general inexpediency of employing caustic for the removal of a stricture, under the preceding circumstances, yet he admits that instances do present themselves, in which, from long neglect, the urethra and the parts surrounding the stricture are so altered in structure, that no instrument can be passed through the obstruction without danger, and where the slower action of caustic is safer than the use of a metallic bougie.—(*Surgical Essays, part* 2, *p.* 213.) The experience of modern surgeons tends to prove, however, that there are some cases which form exceptions to the plan of employing bougies or catheters, though a fistulous opening may have occurred in the passage. These cases are the examples in which the apertures in the urethra are the consequence of ulceration and abscess, unaccompanied by stricture, and taking place in a bad constitution, and perhaps only preceded by a slight discharge from the urethra. Here bougies would increase the tendency to ulceration, and aggravate the local and constitutional irritation.—(*A. Cooper*, *p.* 216.)

While we are attempting to cure the stricture, antiphlogistic measures, particularly bleeding, are to be adopted. The parts should be exposed to the steam of hot water; the warm bath made use of; opium and turpentine medicines given by the mouth and in glysters, with a view of diminishing any spasmodic affection. But, as Mr. Hunter observes, all these proceedings are often insufficient; and therefore an immediate effort must be made, both to unload the bladder and to prevent the farther effusion of urine, by making an opening in the urethra somewhere beyond the stricture, but the nearer to it the better.

Introduce a director, or some such instrument, into the urethra, as far as the stricture, and make the end of it as prominent as possible, so as to be felt; which, indeed, is often impossible. If it can be felt, it must be cut upon, and the incision carried on a little farther towards the bladder or anus, so as to open the urethra beyond the stricture. This will both allow the urine to escape, and destroy the stricture. If the instrument cannot be felt at first by the finger, we must cut down towards it; and on afterward feeling it, proceed as above.

When the stricture is opposite the scrotum, as the opening cannot be made in this situation, it must be made in the perinæum; in which case, there can be no direction given by an instrument, as it will not pass sufficiently far, and the only guide is our anatomical knowledge. The opening being made, proceed as directed in the cure of a false passage.—(See *Urethra, False Passage of*,) In whcihsoever way the operation is done, a bougie, or a catheter, which is better, must afterward be introduced, and the wound healed over it.

When the inflammation from the extravasation of urine is attended with suppuration and mortification, the parts must be freely scarified, in order to give vent both to the urine and pus. When there is sloughing, the incisions should be made in the mortified parts.

Sometimes, when the urethra is ulcerated, and the cellular membrane of the penis and prepuce is so much distended as to produce a phymosis, it is impossible to find the orifice of the urethra.

Frequently the new passages for the urine do not heal, on account of the stricture not being removed: and even when this has been cured, they often will not heal, but become truly fistulous, and produce fresh inflammation and suppurations, which often burst by distinct openings. Such new abscesses and openings often form in consequence of the former ones having become too small before the obstruction in the urethra is removed.

Such diseases sometimes bring on intermittent disorders, which do not yield to bark, but cease as soon as the fistulæ and disease of the urethra have been cured.

In order to cure fistulæ in perinæo, unattended with the above-described urgent symptoms, the urethra must be rendered as free as possible, and this alone is often enough; for the urine, finding a ready passage forwards, is not forced into the internal mouth of the fistulæ, which therefore heal up. The cure of the strictures, however, is not always sufficient, and the following operation becomes indispensable.

The sinuses are to be laid open in the same manner as other sinuses, which have no disposition to heal. In doing this, as little as possible of the sound part of the urethra must be opened. Hence the surgeon must direct himself to the inner orifice of the fistulæ, by means of a staff, introduced (if possible) into the bladder, and a probe passed into one of the fistulous passages. The probe should be first bent, that it may more readily follow the turns of the fistula. When it can be made to meet the staff, so much the better; for then the operator can just cut only what is necessary.

When the fistula is so straight, as to admit of a director being introduced, this instrument is the best. When neither the probe nor the director can be made to pass as far as the staff, we must open the sinuses as far as the first instrument goes, and then search for the continuation of the passage, for the purpose of laying it open. The difficulties of this dissection, however, in the thickened, diseased state of the parts in the scrotum and perinæum, are such as can only be duly appreciated by a man who has either made the attempt himself, or seen it made by others. I have myself seen one of the first anatomists in London fail in two instances to trace the continuation of the urethra, and baffled in the endeavour, therefore, to pass an instrument from the orifice of that passage into the bladder. The difficulty and confusion, arising from the hardened, enlarged state of the parts, which are to be cut, have been well depicted by Mr. C. Bell.—(*Surgical Obs. vol.* 1, *p.* 129.)

Having divided the fistulæ as far as their termination in the urethra, a catheter should be introduced and worn, at first, almost constantly. This is better than a bougie, which must be frequently withdrawn to allow the patient to make water, and it often could not be introduced again without being entangled in the wounds.

In many cases the employment of the catheter should not be continued after a certain period. At first, it often assists the cure; but, in the end, it may obstruct the healing, by acting at the bottom of the wound, as an extraneous body.

Hence, when the sores become stationary, let the catheter be withdrawn, and introduced only occasionally. And even after the sores are well, it will be prudent to use the bougie, in order to determine whether the passage is free from disease.

When fistulæ in perinæo have been laid open, the wounds are to be at first dressed down to the bottom as much as possible, which will prevent the reunion of the parts first dressed, and make the granulations shoot from the bottom, so as to consolidate the whole by one bond of union.—(*Hunter on the Venereal Disease, ed.* 2.) Additional observations upon this subject, and, in particular, the opinions of Desault, will be found in the article *Urinary Abscesses and Fistulæ*. Sir A. Cooper's practice, in cases where a considerable portion of the urethra has been destroyed, will be hereafter noticed.—(See *Urethra.*)

FISTULA, SALIVARY. See *Parotid Duct.*

FLUCTUATION. (From *fluctо*, to float.) The perceptible motion communicated to any collection of purulent matter, or other kind of fluid, by applying the fingers to the surface of the tumour, and pressing with them alternately, in such a manner that the fingers of one hand are to be employed in pressing, or rather in briskly tapping upon the part, while those of the other hand remain lightly placed on another side of the swelling. When the ends of one set of fingers are thus delicately applied, and the surgeon taps, or makes repeated pressure with the fingers of the other hand, the impulse given to the fluid is immediately perceptible to him, and the sensation thus received is one of the principal symptoms by which practitioners are enabled to discover the presence of fluid in a great variety of cases. Great skill in ascertaining by the touch the presence of fluid in parts, or being endued with the *tactus eruditus*, as it is termed, distinguishes the man of experience as remarkably, perhaps, as any quality that can be specified.

When the collection of fluid is very deeply situated, the fluctuation is frequently exceedingly obscure, and

sometimes not at all distinguishable. In this circumstance, the presence of the fluid is to be ascertained by the consideration of other symptoms. For example, in cases of hydrops pectoris and empyema, surgeons do not expect to feel the undulation of the fluid in the thorax with their fingers; they consider the patient's difficulty of breathing, the uneasiness attending his lying upon one particular side, the œdema of the parietes of the chest, the dropsical affection of other parts, the more raised and arched position of the ribs on the affected side, the preceding rigors, fever, and several other circumstances, from which a judgment is formed, both with regard to the presence and the peculiar nature of the fluid.

FOMENTATION. By a fomentation, surgeons commonly mean the application of flannel or towels, wet with warm water or some medicinal decoction. In the practice of surgery, fomentations are chiefly of use in relieving pain and inflammation, and in promoting suppuration, when this is desirable. Some particular decoctions, however, are used for fomentations, with a view of affecting, by means of their medicinal qualities, scrofulous, cancerous, and other sores of a specific nature. I shall merely subjoin a few of the most useful fomentations in common use.

FOMENTUM AMMONIÆ MURIATÆ. ℞. Fomenti communis ℔ij. Ammon. mur. ʒj. Spirit. camph. ʒij.

Just before using the hot decoction, add to it the ammonia muriata and spirit. Said to be of service to some indolent ulcers; and, perhaps, it might be of use in promoting the absorption of some tumours, and suppuration in others.

FOMENTUM CHAMÆMELI. ℞. Lini contusi ʒj. Chamæmeli ʒij. Aq. distillat. ℔vj. Paulisper coque, et cola. A fomentation in very common use.

FOMENTUM CONII ℞. Fol. conii recent. ℔j. vel fol. conii exsiccat. ʒiij. Aq. comm. ℔iij. Coque usque reman. ℔ij. et cola. Sometimes applied to scrofulous, cancerous, and phagedenic ulcers.

FOMENTUM GALLÆ. ℞. Gallæ contusæ ʒss. Aq. ferventis ℔ij. Macera per horam, et cola. Used for the prolapsus ani, and sometimes employed as a cold application, in cases of hemorrhoids.

FOMENTUM PAPAVERIS ALBI. ℞. Papav. alb. exsiccati, ʒiv. Aq. pur. ℔vj. Bruise the poppies, put them in the water and boil the liquor, till only a quart remains, which is to be strained. This fomentation is an excellent one, for very painful inflammations of the eyes, and for numerous ulcers and other diseases, attended with intolerable pain.

FORCEPS. An instrument much employed in surgery for a variety of purposes, and having accordingly various constructions. The general design, however, of surgical forceps is to take hold of substances which cannot be conveniently grasped with the fingers; and, of course, the instrument is always formed on the principle of a pair of pincers, having two blades, either with or without handles, according to circumstances. The smallest forceps is that which is employed in the operation of extracting the cataract, and which is useful for removing any particles of opaque matter from the pupil, after the chief part of the crystalline lens has been taken away.

Another forceps, of larger size, is that used for taking up the mouths of the arteries, when these vessels require a ligature, in cases of hemorrhage. This instrument is also frequently employed for taking dressings off sores, removing pieces of dead bone, foreign bodies from wounds, and particularly for raising the fibres, which are about to be cut, in all operations where careful dissection is required. This forceps resembles that which is contained in every case of dissecting instruments, and is often called the *artery* or *dissecting* forceps, from its more important uses.

Neither of the foregoing forceps is made with handles; each opens by its own elasticity; and the ends of the blades only come into contact when pressed together by the surgeon.

The following kinds of forceps are constructed with handles, by means of which they are both opened and shut:

1. The common forceps, contained in every pocket-case of surgical instruments, and used for removing dressings from sores, extracting dead pieces of bone, foreign bodies, &c.

2. Larger forceps, employed for extracting polypi.

3. Forceps of different sizes and constructions, used in the operation of lithotomy, for taking the stone out of the bladder, or for breaking the calculus, when it is too large to be extracted in an entire state.

4. Cutting forceps, as the common bone-nippers, and the sharp forceps, made with the edges in the same line with the handles, used by Mr. Liston for the division of bones.

FRACTURE is a solution of continuity of one or more bones, produced in general by external force; but occasionally, by the powerful action of muscles, as is often exemplified in the broken patella.

The subject of fractures is so interesting a branch of surgery, and the accidents themselves so frequent and important, that the little which English surgeons have done for the improvement of this part of their profession cannot but cause equal surprise and regret. Mr. Pott, it is true, made many excellent observations on the treatment of fractures in general, and his remarks on compound fractures in particular are in some respects the best which are extant; but what surgeon will now presume to defend the weak arguments upon which he has founded the doctrine of paying unqualified attention to the relaxation of the muscles, as if this were an object which should constantly supersede every other consideration, and invariably regulate the posture of the limb? I have no hesitation in declaring my own belief, that the doctrine and practice recommended by Mr. Pott, in regard to fractured thighs has done considerable harm, and the more so, as coming from a man who was deservedly looked upon as one of the best and most experienced judges of surgical practice. Many a surgeon in this country implicitly believed every thing which was asserted by so able a master, and the very observations which some years ago were here considered to be the glory of their author and the pride of English surgery, are now exposed by the surgeons of neighbouring countries, as specimens of wrong precepts and bad practice. M. Roux, in fact, has had but too much room for animadversion upon this subject. Down to the period of his visit to this country, if we except some of Mr. Pott's observations on the use of the eighteen-tailed bandage, the necessity of quietude, the principles on which splints ought to be constructed, and the inestimable remarks on compound fractures by the same distinguished English surgeon, it cannot be said that we had made a single improvement of consequence in the treatment of any particular fracture, while the generality of our surgical writers had given the most faulty and imperfect account of the diagnosis, and every thing else relating to these accidents. What is worse, a view of our practice conveyed no better opinion of this part of our surgery. Observe the care and neatness with which a French surgeon applies the bandages and splints, and consider how well every indication is accomplished by his apparatus, and you will find great cause both for admiration and imitation. On the other hand, see the slovenly way in which an English surgeon generally puts on the splints and roller, and the unscientific method in which he usually treats a fractured thigh or clavicle, and you cannot fail to be ashamed of the comparison. This was a matchless opportunity for M. Roux to draw a parallel in favour of French surgery, and of course he has not neglected it, many pages of his work being devoted to an explanation of the many improvements Desault made; the little, or rather the nothing, which we had done; and the errors, to which we unfortunately still adhere.—(See *Voyage fait à Londres en* 1814, *ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, *p.* 173, *&c.*) It is to be hoped, however, that the period has now arrived, when we shall give to the study of fractures the time, the attention, and the importance which it claims; and when even the young hospital pupil will not be convinced, that his lecturer by one or two cursory discourses can have done justice to the subject. The observations lately published by Sir Astley Cooper, on fractures of the joints, are indeed highly creditable to this part of English surgery, and afford satisfactory evidence of the increased attention which is now paid to the principles which ought to regulate the treatment of each individual example of the accident.

In this article, my plan is to follow the arrangement adopted by Boyer, in his *Traité des Maladies Chirurgicales*, *t.* 3. I shall first speak of fractures in general, and allot separate sections to the consideration of, 1. Their differences; 2. Their causes; 3. Their symp-

toms; 4. Their prognosis; 5. Their treatment; 6. The formation of callus.

The subject will then conclude with a full account of the symptoms, causes, and treatment of the fractures of particular bones.

1. *Differences of Fractures.*

The differences of fractures depend upon what bone is broken; what portion of it is fractured; the direction of the fracture; the respective position of the fragments; and lastly, upon circumstances accompanying the injury, and making it simple, compound, or variously complicated.

1. *In respect to the bone affected.*—Sometimes it is one of the broad bones, as the scapula, the sternum, or the os ilium. Sometimes it is a short bone, like the os calcis; but far more commonly it is one of the long bones. The situation and functions of the broad bones render their fractures unfrequent. The bones of the skull are the only exception to this remark; for they are often broken; but here the assistance of the surgeon is required less for the solution of the continuity itself, than for the affection of the brain, and the extravasation of blood, with which the case is apt to be combined. Fractures of the short bones are still more unusual, because these bones, being nearly equal in their three dimensions, are capable of greater resistance, and are not much within the reach of external violence. Besides, most of them are but little exposed to the operation of outward force, by their situation or functions. Hence, except when limbs are crushed, fractures of short bones are generally caused by muscular action, which frequently breaks the patella, olecranon, and os calcis. The long bones, which serve as pillars, or arches of support, or levers, are, from the very nature of their functions, particularly liable to fractures.

2. *In respect to the part of the bone broken.*—Bones may be fractured at different points of their length. Most commonly, their middle portion is broken, and in this circumstance they usually break like a stick, which has been bent beyond its extensibility by a force applied at each end of it. Sometimes the fracture occurs more or less near the extremities of the bone, which is always an unfavourable event. Lastly, the bone is sometimes broken in several places, and the injury may be produced by two different causes, which operate successively, or simultaneously, upon the broken parts of the bone; or it may be occasioned by one single cause, which acts at the same moment upon several points of it. These distinctions of fractures, deduced from their particular situation (says Boyer), are not mere scholastic refinements; they have a truly important influence over the prognosis and treatment.

3. *In respect to the direction in which the bone is broken.*—A bone may be fractured in various ways, and the fracture receives different names, according to its direction in regard to the axis of the bone. Thus, fractures are distinguished into *transverse* and *oblique*. The obliquity renders the surface of the injury larger, and materially increases the difficulty of maintaining the ends of the bone in contact, after the fracture has been set. Oblique fractures are subject to considerable variety, which depends upon the degree of their obliquity, and whether they are partly oblique and partly transverse. When a bone is broken in different places at once, and divided into several fragments, or splinters, the fracture is termed *comminuted*.

Duverney admitted another class of fractures, viz. *longitudinal*.—(See *Traité des Maladies des Os, t.* 1, *p.* 167.) But such cases were regarded by J. L. Petit as only imaginary, because he conceived that any blow, capable of breaking a bone longitudinally, would much more readily cause a transverse fracture. For the same reason, Louis absolutely rejected the possibility of longitudinal fractures, and this sentiment has prevailed down to the present day.

The following case, however, is related by Leveillé, in order to prove the possibility of longitudinal fractures. He amputated the thigh of an Austrian soldier who was put under his care in the year 1800, in consequence of being struck by a ball in the lower third of the leg at the battle of Marengo. The soldier had walked several miles, after receiving the injury, before he arrived at Pavia. The wound appeared simple and likely to heal as soon as the injured portion of the tibia had exfoliated. The event turned out otherwise, and the thigh was amputated.

Leveillé has preserved the tibia, upon which the impression of the ball may be distinguished, and from this point run several longitudinal and oblique lines, which extend from the lower third towards the upper head of tibia, and pass through the whole thickness of the parietes of the medullary canal. They were acknowledged to be really longitudinal fractures, by Dubois, Chaufrier, Duméril, Deschamps, and Roux, who were appointed by the Ecole de Médecine to inquire into the fact.—(*Leveille, Nouvelle Doctrine Chir. t.* 2, *p.* 158.)

In several cases of fractured thigh-bones from gunshot violence, which were under the care of Dr. Cole and myself in Holland, the bone was split longitudinally to the extent of seven or eight inches. The fact, however, that bullets and other balls do produce longitudinal fractures, is now universally admitted; and were there any doubt upon the subject, a specimen sent to England by my friend Dr. Cole, would soon remove it. Boyer, who, a few years ago, denied the possibility of longitudinal fractures, in his late work remarks: "*On trouve néanmoins, à la suite des plaies d'armes à feu, les os fendus suivant leur longueur, jusques dans leurs articulations,*"—but he is correct when he adds, that such instances afford no proof of the possibility of a simple longitudinal fracture.—(See *Traité des Maladies Chir. t.* 3, *p.* 10.)

4. *In regard to the respective position of the fragments.*—These differences are highly important to be understood, because, as Boyer remarks, the treatment of fractures consists almost entirely in remedying or preventing the displacement of the fragments. It is not to be supposed, however, that such displacement is an absolutely essential symptom of all fractures, for it seldom exists in members composed of two bones, when only one of them is broken. Neither does it constantly happen in every fracture of the neck of a bone, as is exemplified in certain fractures of the neck of the thigh-bone, the fragments of which sometimes change their relative situation only when the patient tries to walk, or the limb is imprudently moved about. Fractures of the leg are also observed, in which there is neither a displacement of the fragments, nor an alteration in the shape of the limb, especially when the tibia alone is fractured near its upper part, where it is very thick. When the ulna alone is broken at its upper part, there is hardly ever any displacement. The corresponding surfaces of the fragments having a large extent cannot be separated, or can only be so with difficulty. Fractures of the fibula are also frequently unattended with displacement. But it is a symptom, that almost constantly occurs when both bones of the leg or forearm are fractured together; as, also, in fractures of limbs which contain only one bone, on account of the little extent of the surfaces of the fracture, and the great number of muscles which tend to displace them.

The displacement may happen in respect to the diameter, length, direction, or circumference of the bone.

In respect to the diameter.—Transverse fractures are the only cases in which this kind of displacement is observed. The two fragments may either be in contact at a part of their surfaces, or they may not be in contact at all. In the latter circumstance, the limb is shortened by the ends of the fracture slipping over each other.

In respect to length.—This mode of displacement, in which the ends of the broken bone pass more or less over each other, constantly occurs in oblique fractures, and sometimes in transverse ones, when the displacement in the direction of the diameter of the bone has been such that the surfaces of the fracture are no longer in contact. It will be hereafter explained, that whenever the limb is shortened in fractures of the extremities, it is the lower fragment that is displaced.

We may refer to the species of displacement here spoken of, that which takes place in fractures of the patella, olecranon, and os calcis; but with this difference, that the fragments, instead of passing over each other separate from each other in the direction of the length of the bone, and continue separated by an interspace more or less considerable.

In respect to the direction of the bone.—In this kind of displacement, the two fragments form an angle more or less prominent, and the bone appears arched. It is principally observed in comminuted fractures. It may also happen in simple fractures; for instance, in the leg, when the limb in a straight posture does not

lie upon a surface exactly horizontal, and the heel is lower than the rest of the limb. The angular projection is then anterior. On the contrary, it would be posterior, if the heel were too much raised.

In respect to the circumference of the bone.—This displacement occurs when the lower fragment performs a rotatory movement, while the upper one continues motionless. Thus, in fractures of the neck of the femur, if the foot is badly supported by the apparatus, its weight, together with that of the limb and the action of the muscles, inclines it outwards, and turns the lower fragment in the same direction.

Besides the simple displacements above described, there are others of a more complicated nature, which happen in several directions at once. For example, such is the displacement observed in a fracture of the thigh-bone, when the lower fragment is drawn upwards and inwards, while the foot is turned outwards.

Let us next consider the causes of the displacement of fractures.

The bones, being only passive instruments of locomotion, possess not, in their own organization, any cause of the change of situation which takes place; but yield to the impulse of external bodies, the weight of the member, and the action of the muscles

The displacement may be produced by an external force, either at the moment when the fracture happens, and by the very action of the fracturing cause itself: or it may be caused by the weight of the body when the fracture precedes the fall; or lastly, it may be brought on by some other external force, acting on the fragments, sooner or later, after the occurrence of the injury.

The outward violence, which is productive of a fracture, operates sometimes directly on the situation of the breach of continuity; sometimes on parts more or less distant from it. In both cases, the action of the force is not confined to the production of the fracture, but is partly spent in causing a displacement of the fragments.

Fractures are generally occasioned by falls. Sometimes, however, the fall does not happen till after the leg or thigh is actually broken. The weight of the body then produces the displacement, by pushing the upper fragment against the soft parts, which are more or less lacerated. This is what happened to Ambrose Paré, who, being kicked by a horse, endeavoured to get out of the way, but instantly fell down, and the two bones of his left leg, which had been fractured, being impelled by the weight of the body, not only passed through the skin, but even through his stocking and boot. Boyer has seen a case nearly similar in a young man about twenty years of age, who, in a standing posture, was struck on the middle of the thigh with the pole of a carriage, which fractured the femur. The patient fell down, and in the fall the upper fragment was not only driven through the muscles and integuments, but also through his breeches.

The weight of the limb itself may produce displacement according to the direction or circumference of the bone, as already detailed. The disturbance of the limb, also, in lifting the patient and carrying him to his bed, may sometimes alter the relative situation of the fragments, and cause them to be displaced.

But of all the causes of the displacement of fractures, the action of the muscles is the common and most powerful one. Among the muscles surrounding a fractured bone, some are attached to it throughout its whole length, and are equally connected with both the fragments. Some arise from the bone above, and are inserted either into that which is articulated with the lower fragment, or into the lower fragment itself. Lastly, there are others which come from a point more or less distant, and terminate in the upper fragment. The muscles round the thigh-bone furnish examples of these three arrangements. The triceps is attached to the bone its whole length. The biceps, semi-membranosus, and semi-tendinosus, come from the pelvis, and are inserted into the leg, a part with which the lower fragment is articulated, and all the motions of which it follows. The great head of the triceps is inserted into this fragment itself. Lastly, the iliacus, psoas, pectineus, &c., come from the loins and pelvis, and are attached to the femur, not far from its upper end.

The muscles attached to both fragments contribute very little to their displacement. They may, however, draw them to the side on which they are situated, and thus change the direction of the limb. The triceps, especially its middle portion, acts in this manner in fractures of the femur, and renders the thigh convex anteriorly. The coraco-brachialis tends to produce the same effect when the humerus is broken below its middle.

The displacement is principally owing to such muscles as are affixed to the lower fragment, or part with which this fragment is articulated. Suppose the humerus to be broken between its upper end and the insertion of the great pectoral. This muscle, aided by the latissimus dorsi and teres major, will draw the lower fragment inwards, and displace it by drawing it to the inner side of the upper fragment, which remains motionless. In fractures of the neck of the thigh-bone, the upper fragment, included within the capsular ligament, affords attachment to no muscle. All those which are affixed to the lower fragment, pull it upwards and backwards, in which direction the displacement is inevitable. In all fractures, the lower fragment follows every movement made by the part of the limb with which it is articulated, and consequently the muscles which are attached to the bones of this last part of the limb, become a powerful cause of displacement. Thus, in a fracture of the thigh-bone, the biceps, semi-tendinosus, and semi-membranosus, draw the leg, and with it the lower fragment, upwards, inwards, and backwards, so as to make the lower end of the fracture ascend at the inside of, and rather behind, the upper one, the extremity of which then projects forwards and outwards. In a fracture of the leg, the gastrocnemius, soleus, and peronei muscles, acting upon the foot, pull the lower fragments of the tibia and fibula, and draw them to the outer and posterior side of the upper fragments. For here, as well as every where else, the strongest muscles, in producing the displacement, draw towards their own side the end of the fracture on which they operate. And as the posterior muscles of the leg are far more numerous and powerful than those on the front of the limb, while those on its outside are not antagonized by any others, the displacement must happen in the direction backwards and outwards. Whenever, therefore, a bone is fractured at a given point, a knowledge of the muscles will enable one to determine *à priori* in what direction the displacement will occur, if no means be taken to impede it, and it proceed altogether from this particular cause.

Lastly, the muscles which are attached only to the upper fragment, may sometimes displace it. In a fracture of the thigh situated immediately below the little trochanter, the psoas and iliacus muscles together carry forwards the extremity of the upper fragment, which elevates the integuments and forms a more or less considerable projection near the fold of the groin. But it is to be observed, that, in general, the displacement of the upper fragment is not common, and that it is the lower one which is drawn out of its proper position.

The manner in which the displacement of fractures is effected by the action of muscles explains one circumstance which frequently attends these cases, especially fractures of the thigh, clavicle, and leg. This is a rising, a projection, of the upper fragment, or that which is nearest the trunk. One might believe, at first sight, that such projection is formed by the upper fragment, which, quitting its natural situation, rises over the lower one. But, on the least reflection, it becomes manifest that the upper end of the fracture projects only because the lower one is displaced and drawn towards that side on which the strongest muscles are situated. Thus, in practice, in order to make the *rising end of the bone* (as it was termed) disappear, it is only necessary to reduce the lower fragment into its natural place. If, instead of doing this, pressure be made on the projecting part, the design fails; and if the plan be still more forcibly pursued and continued, inflammation and sloughing of the integuments and other soft parts, and the conversion of the case into a compound fracture, are likely to be the unfortunate consequences.

5. *In respect to circumstances with which fractures are accompanied.*—The most important division of fractures is into *simple* and *compound*.

By a *simple fracture*, surgeons mean a breach in the continuity of one or more bones, without any external

wound, communicating internally with the fracture, and caused by the protrusion of the ends of the broken bone or bones. By a *compound fracture*, they signify the same sort of injury of a bone or bones, attended with a laceration of the integuments, which laceration is produced by the protrusion of one or both ends of the fracture.

The dangerous nature of compound fractures will be fully explained in the sequel of this article: the subject indeed has been already touched upon in speaking of *Amputation*.

Fractures are said to be *complicated*, when they are attended with diseases or accidents, which render the indications in the treatment more numerous, and require the employment of different remedies, or the practice of sundry operations, for the accomplishment of the cure.

Thus, fractures may be complicated with severe degrees of contusion, wounds of the soft parts, the injury of large blood-vessels, a dislocation, or diseases, and particular states of the constitution, as the scurvy, rickets, lues venerea, pregnancy, &c., which are said to retard the formation of callus, and render the cure more backward.

The complication of fracture with dislocation happens but seldom, and it cannot occur unless the luxation has taken place first, or has been produced at the same time with the fracture, and by the same cause. When once the fracture has happened, the fragments are not sufficiently within the grasp of external force, and are too moveable, to admit of the bone being dislocated.

A patient with fracture may be attacked by an acute disease, which may render the treatment more troublesome, and the cure slower.

[Under the head of differences in fractures may be fitly introduced that injury to the bones of children which is denominated a *bending* of the bones, from falls, blows, and external violence, since this injury requires the same treatment as fractures, although crepitus and displacement of fragments are absent. In the *Amer. Med. Recorder* for 1821, will be found a valuable paper on this subject from Dr. J. R. Barton, of Philadelphia, including another injury to the bones of children which is not unfrequent, which he calls a *partial* or *incomplete fracture* of a single bone or both It is the more important that Dr. B.'s facts and observations should not be overlooked, because it is a subject seldom noticed by surgical writers, although highly important. Some mention is made of it by Underwood and Boyer, and perhaps by these alone. Dr. Barton has accompanied his paper by very accurate drawings of the deformity occasioned by both of the accidents to which he refers.—*Reese*.]

2. *Causes of Fractures.*

The causes of fractures are divided into *predisposing* and *remote*.

In the first class are comprehended the situation and functions of the bones, the age of the patients, and their diseases. Superficial bones are more easily fractured than those which are covered by a considerable quantity of soft parts. The functions of some bones render them more liable to be fractured than others; thus the radius, which supports the hand, is more liable to be fractured than the ulna. The clavicle, which serves to keep the shoulder in its proper position and support on its arched extremity all the motions of the upper extremity, is particularly subject to be broken. The gradual increase of the quantity of the phosphate of lime, in the structure of the bones, makes them brittle in proportion as we advance in years; and, in old age, the proportion of the inorganized to the organized part is so great, that the bones are fractured by the slightest causes. In childhood, the fibrous and organized part bears a greater proportion to the earth, and the bones being consequently more elastic and flexible, are not so easily broken as in old age.

Lues venerea, arthritis, cancer, rachitis, scurvy, and scrofula, says Leveillé, predispose to fractures. B. Bell mentions two venereal patients, of whom the hardest and largest bones were completely broken by the ordinary action of the muscles of the limb. Fabricius Hildanus quotes from Sarazin, a physician of Lyons, the case of a gouty patient, sixty years of age, who, in putting on his glove, broke his arm above the elbow. Desault used often to speak of a nun of Salpétrière, whose arm was broken as a person was handing her out of a carriage. Louis, who was vexed that no union took place, was not a little surprised to find her thigh-bone experience the same fate one day as she was changing her posture in bed. It was then learned that she had a cancer in her right breast. Leveille assures us, that he has observed similar cases in the Hôtel-Dieu, and Sir A. Cooper has met with others.—(See *Cancer*.)

According to Leveillé, the history of two girls is related by Buchner, one of whom died rickety at the age of sixteen, having broken the femur a short time before her death; and the other, after taking the breast very well for two years, and thriving for a time, became affected with rachitis, and met with the same accident as she was merely running along the street.—(*Nouvelle Doctrine Chir. t.* 2, *p.* 163.)

Many extraordinary instances of fractures from the morbid softness and fragility of the bones are upon record. Suffice it here to refer to the Philosophical Transactions; Mém. de l'Acad. Royale des Sciences; Act. Hafnien's.; Ephem. Nat. Cur. dec. 1, ann. 3, obs. 112; Gooch's Chirurgical Works, vol. 2; Saviard, Observations Chir. p. 274; Gibson's Institutes of Surgery, vol. 1, p. 370, &c.—(See also *Fragilitas* and *Mollities Ossium*.)

On the subject of fractures produced by the scurvy, Leveillé recommends us to peruse Marcellus Donatus; Saviard's Observations; Heyne de Morbis Ossium; Poupart's Works inserted in the Mém. de l'Acad. des Sciences, 1699; and the Treatise published at Verona, in 1761, by Jean de Bona. To these works I would add Lord Anson's Voyage, in which the effect of the scurvy in producing the absorption of the callus of old fractures, and a disjunction of the fragments, is very curiously exemplified.

Paré, Platner, Callisen, and several other writers, set down cold as a predisposing cause of fractures. This doctrine has originated from these injuries being more frequent in the winter time, but is quite erroneous, since, in cold countries, the greater number of falls which happen in winter from the slippery and very hard state of the roads, is a circumstance that fully explains why fractures are then more common than in summer.

The remote cause of fractures is external force variously applied in falls, blows, &c. In particular instances the bones are broken by the violent action of the muscles attached to them; this is almost always the case with the fractured patella. The olecranon and os calcis have likewise been broken by a violent contraction of the muscles inserted into them. With respect to the heel, Petit records two instances, one of which was communicated to him by Poncelet, and the other seen by himself in Madame La Présidente de Boissire, who met with the accident in walking a gentle pace in the court of the Hôtel de Soubise. When the injury happens in leaping, or falls from a high situation, Leveillé thinks it more probable that a portion of the os calcis is torn off by the powerful action of the muscles of the calf, than that it is broken by any blow immediately on the part. He states that Desault used frequently to cite two examples of this kind, one of which is recorded in his Œuvres Chirurgicales.

Whether the long bones can be fractured by the mere action of the muscles is yet an unsettled point. In the Philosophical Transactions a fracture of the humerus is ascribed to this cause, and Botentuit saw the same accident produced by striking a shuttlecock with a battledore. According to Debeaumarchef, as a man was descending a ladder at a quick rate, his heel got entangled in an opening, and he made a violent exertion to avoid falling. The consequence was a fracture of the lower third of the leg. Curet informs us that a cabin-boy, aged seventeen, made a considerable effort to keep himself from being thrown down by the rolling of the ship. The femur was fractured by the powerful action of the muscles of the thigh. The lad had no fall, and, with some difficulty, supported himself on the other limb till he received assistance.

We are told, says Leveillé, by Poupée Desportes, that a negro, about twelve or thirteen years old, was seized with such violent spasmodic contractions of the muscles of the lower extremities, that the feet were turned backwards, and the neck of each thigh-bone was fractured, the ends of the broken bones also protruding through the skin upon the outside of the

thigh. A cure was effected after an exfoliation. We read also, in the *Miscellanea Curiosa Acad. Naturæ Curiosorum*, that during a fit of epilepsy, a child ten years old had its left humerus and tibia broken, and that, upon opening the body, other solutions of continuity were observed. Chamseru assisted in dressing a child, eleven or twelve years old, that had broken the humerus in throwing a stone a considerable distance.—(*Leveillé, Nouvelle Doctrine Chir. t.* 2, *p.* 164. 166.)

Richerand, however, positively denies, that a long bone, when healthy, can ever be broken by the mere contraction of the muscles.—(*Nosogr. Chir. t.* 3, *p.* 12, *edit.* 4.)

For my own part, making all due allowance for the inaccuracy of some of the reports made by writers, I think the possibility of the long bones being broken by the violent action of the muscles is sufficiently proved. I have never seen but one example; but it was a very unequivocal one. I once attended, for the late Mr. Ramsden, an exceedingly strong man, at Pentonville, who broke his os brachii in making a powerful blow, although he missed his aim and struck nothing at all. The whole limb was afterward affected with vast swelling and inflammation. This man, I remember, was also visited by Mr. Welbank, of Chancery-lane. According to Nicod, the greater number of fractures of long bones, by mere muscular action, are preceded by pains in the broken limbs; and in one of the cases published by this author, not only was this circumstance remarked, but an abscess and exfoliation of a portion of the fractured humerus ensued. In another instance reported by this gentleman, the clavicle in a state of preternatural fragility from disease, was fractured in an effort to carry the arm far behind the back. After the reunion of the fracture, an abscess took place, and a piece of the bone exfoliated.—(*Annuaire Méd. Chir. des Hôpitaux de Paris, p.* 494—498, *&c.* 4*to. Paris* 1819.)

3. *Symptoms of Fractures.*

Some of the symptoms of fractures are equivocal: the pain and inability to move the limb, commonly enumerated, may arise from a mere bruise, a dislocation, or other cause. The crepitus; the separation and inequalities of the ends of the fracture, when the bone is superficial; the change in the form of the limb; and the shortening of it; are circumstances communicating the most certain information; and the crepitus, in particular, is the principal symptom to be depended upon, though occasionally attendant on dislocations, and arising, as Sir Astley Cooper has explained, from a change in the quality of the synovia.—(*On Dislocations, &c. p.* 6.) The signs of fractures, however, are so exceedingly various, according to the bones which are the subject of injury, that it cannot be said, that there is any one which is invariably present and characteristically confined to them. The writers of systems of surgery usually notice loss of motion in the injured limb, deformity, swelling, tension, pain, &c., as forming the general diagnosis of fractures. However, it is easily comprehensible by any one acquainted with anatomy, that numerous fractures cannot prevent the motion of the part, nor occasion outward deformity; and every surgeon must know, that though at first there may be pain in the situation of a fracture, no swelling and tension take place till after a certain period.

When, therefore, a limb is broken, and the event is not manifest from the distortion of the part, it is proper to trace with the fingers, the outlines of the suspected bone: if it be the tibia, let the surgeon examine with his fingers, whether any inequality can be discovered along the anterior surface, and along the sharp front edge of that bone. If it be the clavicle, let him trace the superficial course of the bone, in the same attentive manner. Wherever any unusual pain occurs, or any unnatural irregularity appears, let him try if a grating or crepitus, cannot be felt, on endeavouring to make one end of the suspected fracture rub against the other. When the humerus or the os femoris is the subject of inquiry, a crepitus is felt almost as soon as the limb is touched; and, in the case of the broken thigh, there is a considerable shortening of the extremity, except in a few cases of fractures, completely transverse. But when there are two bones, as in the leg and the forearm, and only one is broken, the other continues to prevent the limb from being shortened and thrown out of its natural shape, so that a crepitus can only be felt by a very careful examination with the fingers. The difficulty of the diagnosis is increased when the surgeon is consulted late, and great swelling has come on. "Where is the surgeon," says Boyer, "that has not sometimes hesitated to deliver an opinion in certain cases of this description?"—(*Traité des Malad. Chir. t.* 3, *p.* 27.)

When the injured limb is shortened, the surgeon before pronouncing that such change proceeds from the passage of the fragments over each other, must be sure that the bones are not dislocated, and that the limb is not naturally shorter than the other, or in consequence of a previous fracture that has been badly set.

In comparing the length of the lower extremities, one should place the pelvis in a horizontal position, and put the two anterior superior spines of the ossa ilium in the same line; for, if these processes are not on a level, the limb towards which the pelvis inclines, will seem longer than the opposite member.

The practitioner who is well acquainted with the anatomy of the limbs, and particularly with the mutual relations of the eminences of the bones to each other, will readily perceive the alterations produced by a fracture. Whenever, in consequence of a fall or blow, a limb becomes concave at a part where it ought to be convex; or straight, *et vice versâ*; the change of shape and direction must proceed from a fracture with displacement. The inner edge of the great toe, when the leg rests on a horizontal surface, should correspond with the inner edge of the knee-pan. If this natural relation be altered; if the inner edge of the great toe correspond with the outer edge of the knee-pan, there can be no doubt of the existence of a fracture of both bones of the leg.—(*Boyer, vol. cit. t.* 3, *p.* 25.)

I am aware, that considerable harm and great unnecessary pain have been occasioned in the practice of surgery, by too much solicitude to feel the grating of fractured bones, and whenever the case is sufficiently evident to the eyes, the practitioner who gives way to this habit at the expense of torture to the unfortunate patient ought in my opinion to be severely censured. A fracture is an injury necessarily attended with a great deal of pain, and followed by more or less swelling and inflammation; and to increase these evils by roughly or unnecessarily handling the part, is ignorant and cruel, and (if I may use the expression) unsurgical.

In some kinds of fractures, the broken bone is so surrounded with thick fleshy parts, that it is diffiult to feel a crepitus, or ascertain the existence of the injury. Some fractures of the neck of the thigh-bone, unattended with much retraction of the limb, are cases illustrative of this observation. Whether Laennec's stethoscope will become practically useful as a means of elucidating the diagnosis, farther time and experience must determine: Lisfranc is said to have used it with success.—(See *Edinb. Med. and Surg. Journ. No.* 78, *p.* 237.)

4. *Prognosis of Fractures.*

The prognosis of fractures varies, according to the kind of bone injured, what part of it is broken, the direction of the breach of continuity, and what other mischief complicates the case. Fractures of bones which have many strong muscles inserted into them, are more difficult of cure than those of other bones which have not so many powers attached to them capable of disturbing the fragments.

A fracture of the middle part of a long bone is less dangerous than a similar injury near a joint. Fractures near joints may occasion a false anchylosis. Thus, in a fracture of the thigh-bone near the condyles, the inflammation and swelling extend to the knee-joint, which is affected with a degree of stiffness that continues for a long while, and sometimes cannot be entirely cured during life. Moreover, the inflammation of the joint is attended with more severe symptoms, in consequence of the contusion having been more violent. In a fracture near an articulation, it is to be observed, also, that the splints have little command over the short fragment, so that it is often difficult to prevent displacement; and with respect to a transverse fracture of the neck of the thigh-bone *within the capsular ligament*, whether an unequivocal specimen of the reunion of such a case *by means of bony matter* is to be met with in any museum in this country is yet a

disputed point; and notwithstanding the statements in the publications of Messrs. Earle, Amesbury, and Langstaff, doubts still exist in the mind of Sir Astley Cooper and numerous other surgeons of vast experience, concerning the possibility of a bony union in the particular kind of accident here specified.

When a bone is fractured in several places, the case is more serious, and the difficulty of cure much augmented. But the accident is still worse when a limb is fractured in two different places at once; as, for instance, in the thigh and leg. Here it is almost impossible to reduce the fracture of the thigh and maintain the reduction well, so as to preserve the natural length of the limb.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 29.)

Oblique fractures are more troublesome and difficult of cure than transverse ones, because an oblique surface does not resist the retraction of the lower portion of the broken bone, and consequently it is very difficult to keep the ends of the fracture duly applied to each other.

Fractures complicated with violent contusion of the soft parts, or with a wound, rendering them *compound*, are much more dangerous than others free from such accidents. The bad symptoms which render compound fractures so dangerous are of many kinds: hemorrhage; violent and extensive inflammation of the limb, with extreme pain, delirium, and fever; large abscesses, gangrene, &c. Fractures of the leg are generally more serious than similar injuries of the upper extremity. The wound of a large artery may add considerably to the danger of a fracture.

In a debilitated old man, a fracture is less likely to end well than in a healthy child, or strong young subject. In extreme old age, the cure of a fracture is always more difficult and sometimes impossible.—(*Boyer, t.* 3, *p.* 32.) The scurvy certainly retards the formation of callus, and, as I have already noticed, even produces its absorption again; but it is not true, that pregnancy always prevents the union of fractures. Some years ago, I attended, for Mr. Ramsden, a woman in a court leading out of St. Paul's churchyard, who broke both bones of her leg when she was several months gone with child. Her pregnancy, however, did not appear to be at all unfavourable to the cure, as she got quite well in the usual time. "It is not generally settled," says a modern writer, "whether pregnancy should be accounted a complication. I have, as well as some other practitioners, seen a pregnant woman get well of a simple fracture in the ordinary time."—(*Leveillé, Nouvelle Doctrine Chir. t.* 2, *p.* 159.) And in another place he says, "*Contre l'opinion de Fabrice de Hildan, l'expérience m'a prouvé que, chez les femmes grosses, le cal était aussi prompt à se former, que chez toute autre personne.*"—(*Op. cit. t.* 2, *p.* 172.) The experience of Boyer also tends to prove, that pregnancy is not unfavourable to the union of fractures.—(See *Traité des Mal. Chir. t.* 3, *p.* 32.)

The cases in which fractures remain disunited, will be considered in a future section of the present article.

5. *Treatment of Fractures in general.*

The general treatment of fractures embraces three principal indications. The first is to reduce the pieces of bone into their natural situation. The second is to secure and keep them in this state. And the third is to prevent any unpleasant symptoms likely to arise, and relieve them when they have come on.

The first indication is only applicable to cases attended with displacement; for when the fragments are not out of their relative position, the surgeon must strictly refrain from all avoidable disturbance of the limb. His interference should then be limited to putting up the fracture, resisting the accession of all unfavourable symptoms, and removing them, if possible, after they have taken place.

6. *Of the Reduction of Fractures.*

The means employed for the reduction of fractures in general are chiefly three, viz. *extension*, *counter-extension*, and *coaptation*, or *setting*. But, as Boyer remarks, these means should vary according to the species of displacement; and surgical writers have generalized too much in representing them all three as necessary for the reduction of every kind of fracture. In fact, there are several cases in which extension and counter-extension are positively useless: of this nature are fractures of the patella and olecranon, where the displacement consists of a separation of the fragments. Here the reduction may be accomplished by putting the limb in a position in which the muscles attached to the upper part of the bone are relaxed, and then pushing the upper fragment into contact with the lower.

Extension signifies the act of pulling the broken part in a direction from the trunk, with the view of bringing the ends of the fracture into their natural situation. By counter-extension, surgeons imply the act of making extension in the opposite direction, in order to hinder the limb, or even the whole body, from being drawn along by the extending power, which would then be unavailing.

It was formerly recommended to apply the extending force to the lower fragment, and the counter-extension to the upper one. Such practice, indeed, was advised by Mr. Pott, and is still generally preferred in this country; but upon the continent it has been abandoned. The objections made to it by Boyer are, first, that it is frequently difficult, and sometimes impossible, to take hold of the two fragments, as, for example, when the neck of the thigh-bone is broken. Secondly, that by applying the extension and counter-extension to the broken bone itself, most of the muscles which surround it are compressed, and such compression produces in these organs a spasmodic contraction, which often renders the extension and counter-extension useless, and sometimes even hurtful.—(*Traité des Mal. Chir. t.* 3, *p.* 34.) The French surgeons, therefore, apply the extending force to that part of the limb which is articulated with the lower fragment, and the counter-extension to that which is articulated with the upper. For instance, in a fracture of the leg, the extending means act upon the foot, and the counter-extending upon the thigh; and in a fracture of the thigh, the extension is applied to the leg, while the counter-extending power fixes the pelvis.

One circumstance must here occur to the mind of the surgical reader. In this country, it is properly inculcated that one of the first principles to be attended to in the reduction of fractures, is to put the limb in such a position as will relax the most powerful muscles connected with the broken bone; because these muscles principally impede the reduction and disturb the ends of the fracture. But, in the French mode of making the extension and counter-extension, how can this grand principle be observed? If the extending and counter-extending means are not to be applied to the broken bone itself, but to others which are articulated with it, the limb must of necessity be kept in a straight posture at the time of reducing the fracture; for were the limb placed in a half-bent state, the extension and counter-extension, as practised by the continental surgeons, would not be in the same line. If, therefore, it be advantageous to bend the limb at the time of reducing a fracture, the French mode of practising extension and counter-extension must be relinquished. I am not, however, one of those surgeons who are entirely blinded with the idea of the possibility of relaxing the whole of the muscles connected with the broken bone, by merely bending the limb. On the contrary, I am perfectly convinced, with Desault, that, in general, what is gained by the relaxation of some muscles, is lost by the tension of others. But where it is possible to relax, by a certain posture, the set of muscles most capable of preventing the reduction and disturbing the coaptation of a fracture, that posture I would select. Thus, in a fracture of the leg, the strong muscles of the calf undeniably possess this power, and the bent position, which relaxes them, appears to me, therefore, the most judicious and advantageous, not only during the reduction, but during the whole treatment of the case. A few years ago I had under my care, in the military hospital at Cambray, a fracture of the tibia and fibula, which was at first treated in the straight posture. The gentleman who assisted me reduced the fragments, and made them lie tolerably well. But every time the bandage was opened, the bones were always found displaced again. Finding that this inconvenience went on for two or three weeks, we resolved to lay the limb on its outside, in the bent position. Not the least trouble was afterward experienced in keeping the fragments reduced. Unless, therefore, the situation of a wound, abscess, or some particular reason, indicate an advantage or convenience from the straight posture, I always reduce a fractured leg in the bent position, which will be hereafter described.

Here, therefore, I consider the French mode of making the extension and counter-extension as generally inadmissible.

I was also formerly of opinion, that the bent position of the limb on its side, as advised by Mr. Pott, was the best for fractured thighs; but this sentiment has subsequently appeared to me erroneous, and it gives me pleasure to have this opportunity of declaring my entire conversion to the principles and practice adopted in these cases by Desault and others, who urge the necessity of endeavouring to render the apparatus more efficient. The considerations which have led me to this change will be related in speaking of fractured thighs. If, then, the straight posture be advantageous in cases of broken thighs, I think it will be universally allowed, that the parts of the limb recommended by the French surgeons for the application of the extension and counter-extension are the most proper.

The evils and difficulties formerly encountered in setting fractured limbs, undoubtedly proceeded, in a great measure, from the violent extension and counter-extension practised by our ancestors. As they were ignorant of the utility of relaxing the muscles which displaced the ends of the broken bone, they had no means but the employment of actual force to effect the reduction. Since, however, the excellent instructions contained in Mr. Pott's remarks on fractures have received all the attention due to them, practitioners have generally been careful, in the reduction of fractures, to incapacitate the muscles as much as possible by relaxing them, and thus the necessity for the employment of violent extension and counter-extension is effectually removed.

It is difficult to lay down rules respecting the precise degree of force which should be used in making extension; for it must vary in different cases, according to the species of displacement and the number and power of the muscles concerned in producing it. In transverse fractures displaced only according to the diameter of the bone, a very moderate extension suffices, as it is merely practised with a view of lessening the friction of the surfaces of the fracture, which are always more or less rough. But whatever be the direction of the fracture when the fragments pass over each other, the extension and counter-extension must constantly be such as to remove the shortening of the limb, and overcome the force of those muscles which, after all attention has been paid to their relaxation, still oppose the reduction. Extension, however, ought never to be practised in a violent and sudden way; but in as gradual a manner as possible, the utmost care being taken not to shake, nor even move, the limb any more than can be avoided. When the practitioner extends a broken member all at once violently, he excites the muscles to strong spasmodic action, and there is some danger of lacerating them, because their fibres are not allowed the requisite time to yield to the force which elongates them. The extension is to begin in the direction of the lower fragment, and be continued in that which is natural to the body of the bone.

In every case of fracture with displacement, as soon as the necessary extension has been made, the surgeon is to endeavour to place the ends of the broken bone in their natural situation: this is termed *coaptation*, or *setting*. This operation is to be undertaken in different ways, according to the species of displacement, and the practitioner can almost always execute it by acting upon the lower fragment, without applying his fingers directly to the fracture itself, in order to regulate the contact of the extremities of the bone. When, however, it is judged necessary for this purpose to touch the broken part itself, it should be done with the utmost gentleness, so as to avoid pressing the soft parts against the points and splinters of bone.

Although the reduction of fractures may in general be accomplished with tolerable facility, it sometimes happens that the first attempts fail. This is occasionally ascribable to the employment of too much force, and too little management, in making the extension; whereby the muscles are irritated, and act so powerfully, that the design of the surgeon is completely frustrated. Here the grand means of success is putting the limb into such a position as will relax the most powerful muscles which oppose the reduction. Sometimes, however, the irritable and convulsive state of the muscles is not the effect of any wrong mode of proceeding on the part of the surgeon, but arises from the alarm, pain, and injury, caused by the accident itself. Here relaxing the muscles as much as possible is also the most likely method of removing the difficulty. In short, now that the utility of paying attention to this principle is universally known in the profession, a fracture is hardly ever met with which cannot be immediately reduced; particularly if a copious bleeding be premised when the patient is a strong muscular subject. This evacuation, indeed, will also prove, for other reasons, highly beneficial, where the limb is much contused and swollen, and the tendency to inflammation is great.

7. *Of the Means for keeping Fractures reduced.*

After the bones have been put into their natural situation, time alone would complete their cure, were there not in the muscles a continual propensity to displace the ends of the fracture again. In cases of fracture the muscles are often affected with involuntary spasmodic action, by which the broken part would certainly be displaced, were no measures taken to maintain the extremities of the broken bone in contact. Besides, the patient, in easing himself, coughing, sneezing, &c., must unavoidably subject the limb to a degree of motion by which the coaptation would be altogether destroyed. Hence the necessity of employing means for fixing the broken limb so effectually that it may continue perfectly motionless during the whole time requisite for the union of the fracture. This second indication is sometimes troublesome and difficult, and, as Boyer observes, it is in this part of the treatment that the surgeon has an opportunity of evincing his skill. The means employed for the fulfilment of this indication are, an advantageous position, quietude, bandages, splints, and various kinds of apparatus.

In the treatment of all fractures, the position of the part, and indeed of the whole body, is a thing of material importance. Whenever the case is a fracture of the lower extremities, the patient should lie strictly in bed until the callus is completely formed. It is likewise an advantage not to have the bed much more than a yard wide, because the surgeon and assistants can then more conveniently get at any part of the limb. Feather-beds are a great deal too soft and yielding: a horse-hair mattress is far preferable. Boyer, indeed, is so impressed with the utility of letting the patient lie upon a surface which will not sink, that he recommends two mattresses to be used, and a board to be laid under the upper one from the hip to beyond the patient's foot.—(*Traité des Mal. Chir. p.* 39, *vol.* 3.)

The most favourable position for a fractured limb is that in which all the muscles passing over the fracture, and extending either to the lower fragment or to that part of the limb which is articulated with it, are equally relaxed. The injured limb should also have firm support at every point, and its position ought to be regulated so that not only this object be carefully fulfilled, but at the same time the chance of displacement from the action of the muscles, or the weight of the body, or part itself, may be diminished as much as possible.

The natural or rather the most easy position of the limb is that which is usually chosen by a person who reposes himself or who is sleeping; for then all motion is suspended, and every part assumes that posture which is most congenial to it. In this condition, the limbs are not extended, nor yet entirely bent; but only in a moderate state of flexion. Hence, Boyer remarks, that a half-bent position of the limbs is that which is most natural, and that in which all the muscles enjoy an equal degree of relaxation, and, consequently, that it is, generally speaking, the best for fractures. This posture which was recommended by Hippocrates and Galen, has been highly extolled by Pott, who appears to have exaggerated its advantages. Considered in a general way, it is without contradiction preferable to every other position of the limb; but its employment should be liable to exceptions, as will be noticed in treating of particular fractures.—(See *Boyer, Traité des Mal. Chir. t.* 8, *p.* 40.)

In whatever position a broken limb is placed (says this writer), it should bear throughout its whole length equally and perpendicularly upon the surface on which it lies, and not be only partially supported. When, for example, only the extremities of a fractured limb rest upon the bed, the weight of the limb itself will make it bend in the situation of the fracture. The

limb will also be rendered crooked, if the broken part be supported, while the extremities of the limb (especially the inferior) sink lower by their own weight. The displacement of the fracture is not the only inconvenience arising from the limb being laid upon a surface where it is not every where equally supported. The parts which do bear on this surface experience a painful degree of pressure, which, if long continued, is apt to produce inflammation, and even sloughing, of the integuments. Thus, in fractures of the leg, gangrene of the heel has sometimes arisen entirely from this cause. Such inconveniences may be prevented by laying a fractured limb on a surface of corresponding form; that is to say, on a surface which is depressed where the limb has projections, and rises where it presents depressions. The surface should not be so hard as to annoy the patient; yet it ought to be sufficiently firm not to yield to the weight of the limb and apparatus. According to Boyer, the best pillows for the support of broken limbs are stuffed with chaff of oats, a substance which he describes as far preferable to feathers, because it more readily admits of being pushed from the place where the limb is prominent to another situation where the member presents a depression or hollow; and it has the advantages of being less heating than feathers and less apt to spoil.

In whatever position fractured limbs are placed, they ought to be kept perfectly quiet during the whole time requisite for the union. If the broken bone be moved while the callus is forming, the surfaces of the fracture rub against each other, and the process is disturbed; and, indeed, sometimes by repeatedly moving the limb, the consolidation of fractures is entirely prevented, or, at least, rendered very slow and difficult.

In order to maintain the limb in the right position, and in a state of quietude, and to preserve the fragments in proper contact with respect to each other, the surgeon is to caution the patient to avoid moving at all more than can be helped, and every cause likely to subject the limb to any kind of shock or concussion is to be removed. But in particular, it will be necessary to apply a retentive apparatus, usually consisting of some application to the skin itself, bandages, splints, tapes, straps, and buckles, soft pads, &c.—(See *Boyer, Traité des Mal. Chir. t.* 3, *p.* 42.)

Upon the subject of the dressings, bandages, &c. which ought to be applied to fractures, no surgeon has written better than Mr. Pott.

"The intention (says he) in applying any kind of external medicine to a broken limb is, or ought to be, to repress inflammation, to disperse extravasated blood, to keep the skin lax, moist, and perspirable, and at the same time to afford some, though a very small degree of restraint or confinement to the fracture, but not to bind or press; and it should also be calculated as much as possible to prevent itching, an herpetic eruption, or an erysipelatous efflorescence. At St. Bartholomew's Hospital, we use a cerate made by a solution of litharge in vinegar, which, with soap, oil, and wax, is afterward formed into such consistence as just to admit being spread without warming.

This lies very easy, repels inflammation, is not adherent, comes off clean, and very seldom, if ever, irritates, or causes either herpes or erysipelas. But let the form and composition of the application made to the limb be what it may, one thing is clear, viz., that it should be put on in such manner, as that it may be renewed and shifted as often as may be necessary, without moving the limb in any manner: it being certain, that when once a broken thigh or leg has been properly put to rights, and has been deposited properly on the pillow, it ought not ever to be lifted up or moved from it again without necessity, until the fracture is perfectly united; and it is true that such necessity will not very often occur."

Such application having been made as the surgeon thinks right, the next thing to be done is to put on a proper bandage. That formerly used was what is commonly called a roller. This was of different lengths, according to the surgeon's choice, or as it was used in the form of one, two, or more pieces.

"By such kind of bandage three intentions are aimed at, and said to be accomplished, viz. to confine the fracture, to repress or prevent a flux of humours, and to regulate the callus (see *Duverney*); but whoever will reflect seriously on this matter, will soon be convinced, that although some sort of bandage is necessary in every simple fracture, as well for preserving some degree of steadiness to the limb, as for the retention of the applications, yet none nor either of these three ends can be answered merely, or even principally, by bandage of any kind whatever; and, therefore, if this should be found to be true, that is, if it should appear, that whatever kind of deligation be made use of, it cannot be a principal, but only an accessory kind of assistance, and that in a small degree, and very little to be depended upon, it will follow that such kind of bandage as is most difficult to be applied with justness and exactitude, such as is soonest relaxed and out of order, such as stands most frequently in need of renewal, and in such renewal is most likely to give pain and trouble, must be more improper and less eligible than one which is more easily applied, less liable to be out of order, and which can be adjusted without moving the limb, &c.

The best and most useful bandage for a simple fracture of the leg or thigh is what is commonly known by the name of the eighteen-tailed bandage, or rather, one made on the same principle, but with a little difference in the disposition of the pieces. The common method is to make it so that the parts which are to surround the limb make a right angle with that which runs lengthwise under it; instead of which, if they are tacked on so as to make an acute angle, they will fold over each other in an oblique direction, and thereby sit more neatly and more securely, as the parts will thereby have more connexion with, and more dependence on, each other. In compound fractures, as they are called, every body sees and acknowledges the utility of this kind of bandage preferably to the roller, and for very obvious and convincing reasons, but particularly because it does not become necessary to lift up and disturb the limb every time it is dressed, or every time the bandage loosens.

The pain attending motion in a compound fracture, the circumstance of the wound, and the greater degree of instability of parts thereby produced, are certainly very good reasons for dressing such wound with a bandage which does not render motion necessary; but I should be glad to know what can make it necessary, or right, or eligible, to move a limb in the case of simple fracture? what benefit can be proposed by it? what utility can be drawn from it? When a broken bone has been well set, and the limb well placed, what possible advantage can arise from moving it? Surely none; but, on the contrary, pain and probable mischief. Is it not the one great intention to procure unition? Can moving the limb every two or three days contribute to such intention? must it not, on the contrary, obstruct and retard it? Is not perfect quietude as necessary towards the union of the bone in a simple as in a compound fracture? It is true, that in the one there is a wound which requires to be dressed, and the motion of the limb may in general be attended with rather more pain than in the other; but does motion in the simple fracture give ease or procure more expeditious union?

Every benefit then which can be supposed to be obtained from the use of the common bandage or roller, is equally attainable from the use of that which I have just mentioned, with one additional, and to the patient most invaluable advantage, viz. that of never finding it necessary to have his leg or thigh once, during the cure, removed from the pillow on which it has been properly deposited."—(*Pott's Remarks on Fractures, &c.*)

In France a universal preference is given to Scultetus's bandage in every instance where we employ the eighteen-tailed one, from which it chiefly differs in being composed of separate pieces admitting of removal, so that when a part of the bandage is soiled it can be taken away without disturbing the whole of the dressings. The clean pieces are first stitched to those which are about to be removed, and then they are drawn under the part. In cases of compound fracture where the bandage is soiled with the discharge in a very short time, and must be often removed, certainly Scultetus's bandage is the best, particularly as it possesses all the recommendations peculiar to that of the eighteen-tailed kind.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 46.)

With respect to the general objects and uses of bandages in cases of fracture, I ought to notice one design of them, which is strongly inculcated in the modern French schools; namely, that of "benumbing the irri-

tability of the muscles" by the compression resulting from their regular and even application to the whole of the member. In describing the treatment of particular fractures, I shall have occasion to advert to the examples in which a moderate general compression of the muscles may be attended with utility.

"The parts of the general apparatus for a simple fracture, which come next in order (observes Mr. Pott), are the splints;" which are unquestionably the most efficient of all the applications made to a broken limb with a view of keeping the ends of the fracture steady and in a proper state of contact. Without them the surgeon would in vain endeavour to maintain the reduction.

"Splints," says Pott, "are generally made of pasteboard, wood, or some resisting kind of stuff, and are ordered to be applied lengthwise on the broken limb; in some cases three, in others four; for the more steady and quiet detention of the fracture.

That splints properly made and judiciously applied are very serviceable is beyond all doubt; but their utility depends much on their size and the manner in which they are applied.

The true and proper use of splints is to preserve steadiness in the whole limb without compressing the fracture at all. By the former they become very assistant to the curative intention; by the latter they are very capable of causing pain and other inconveniences; at the same time that they cannot, in the nature of things, contribute to the steadiness of the limb.

In order to be of any real use at all, splints should, in the case of a broken leg, reach above the knee and below the ankle; should be only two in number, and should be so guarded with tow, rag, or cotton, that they should press only on the joints, and not at all on the fracture.

By this they become really serviceable; but a short splint which extends only a little above and a little below the fracture, and does not take in the two joints, is an absurdity, and, what is worse, it is a mischievous absurdity.

By pressing on both joints, they keep not only them but the foot steady; by pressing on the fracture only, they cannot retain it in its place, if the foot be in he smallest degree displaced; but they may, and frequently do, occasion mischief, by rudely pressing the parts covering the fracture against the edges and inequalities of it.

In the case of a fractured os femoris, if the limb be laid in an extended posture, one splint should certainly reach from the hip to the outer ankle, and another (somewhat shorter) should extend from the groin to the inner ankle. In the case of a broken tibia and fibula, there never can be occasion for more than two splints, one of which should extend from above the knee to below the ankle on one side, and the other splint should do the same on the other side."—(See *Remarks on Fractures and Dislocations, in Pott's Chirurgical Works, vol.* 1, *p.* 298, *&c. edit.* 1808.)

Assalini strongly disapproves of the employment of all tight bandages, and of covering the whole of a broken limb with splints. He was called to a gentleman of rank at Paris, who had broken the knee-pan transversely. He laid the limb upon a concave splint, the shape of which was adapted to the under surface of a part of the leg and thigh. No bandage was used; merely two leather straps, which crossed upon the knee, and included the fractured bone. A perfect bony union was thus easily effected. Assalini afterward extended the use of a concave splint, applied under the limb, to fractures of the leg and thigh. In the first of these cases, however, only the thigh is received in the hollow splint, and from this two branches, or lateral splints, go along the leg. The apparatus has also a kind of sole for the support of the foot. As this simple contrivance is fastened with a very few straps, and no plasters or bandages are used, the surgeon has constantly a view of the whole front of the limb, and of the fractured part of it, which Assalini thinks a great advantage. In compound fractures, he puts no other dressings on the wound but linen compresses, which are kept continually wet with cold water.—(*Manuale di Chirurgia, parte prima*, 1812.) For farther observations on the subject, see *Splint*.

In oblique fractures of the thigh, and sometimes even in those of the leg, the difficulty of accomplishing by the ordinary means a cure free from deformity, and especially without a shortening of the limb, has led to the idea of employing continual extension. This expression implies the operation of a bandage, or machine, which continually draws the fragments of the broken bone in contrary directions, at the same time that it restrains them from gliding over each other, and maintains them in contact during the whole time necessary for their union. In England this practice has long been relinquished. It appears to have been chased away by the dazzling theory of relaxing every muscle in such manner as to render it incapable of displacing an oblique fracture; a theory with which the surgeons of this country were but too much blinded by the persuasive eloquence of the late Mr. Pott. Desault saw at once, however, every inconsistency in the doctrine of the possibility of relaxing the muscles, so as to incapacitate entirely the whole set connected with a broken thigh; and he never ceased to inculcate in his school, that in such a case the assistance of a mechanical apparatus applied to the limb was the main thing by which the shortening of the limb was to be prevented. When we consider the treatment of fractured thighs, we shall find that the principle of continual but moderate extension has had in France advocates of great talent and eminence, though it is a method to which many surgeons in this country appear to entertain strong but highly exaggerated objections.

By means of continual extension (observes Boyer), we not only succeed in uniting the fracture, while the limb preserves its natural length; but we afford the part a steadiness, which is singularly favourable to the formation of the callus.

In order to derive from continual extension the utmost benefit, and render the method as little painful as possible, and supportable during the whole time of treatment, the machines and bandages, according to Boyer, should be constructed and applied conformably to the following rules.

We should avoid compressing the muscles which pass over the situation of the fracture, and the elongation of which organs is necessary to restore to the limb the length which it has lost by the gliding of the fragments over each other.

With this view, the extending power ought to be applied to that part of the limb which is articulated with the lower head of the fractured bone; and the counter-extending force to that which is articulated with the upper head. If these powers were applied to the broken bone itself, the muscles passing over the fracture would suffer such compression as would excite spasm, and render the continual extension ineffectual and even hurtful.

The extending and counter-extending force ought to be divided upon as large surfaces as possible.

The reason of this rule is obvious. The pressure of external bodies on parts is less painful, in proportion as the surface pressed upon is extensive and the operation supported at once by numerous points. On this principle a narrow band creates stronger and more painful pressure than a broad one; and hence, the rollers and other pieces of the apparatus for making the extension and counter-extension should be as wide as possible.

The powers making continual extension should act according to the direction of the axis of the broken bone.

The continual extension should be practised in as slow, gradual, and insensible a manner as possible.

The muscles easily yield to a force which stretches them, when such force acts slowly, and is very gradually increased, according to the shortness of the limb, and the power of the muscles producing the displacement. But if one were all on a sudden to begin with making violent extension, the rough forcible elongation of the muscles would excite such a spasmodic action of them as would frustrate every attempt to restore the natural length of the limb. And if, in order to fulfil this purpose, the extending force were increased in a ratio to the resistance of the muscles, there would be danger of lacerating these organs, because their fibres would not have time enough to yield.

Lastly, the parts upon which the extending and counter-extending force acts should be defended; and the compression made by the tapes, or other pieces of the bandage and apparatus, ought to be equalized.

These indications may be fulfilled by covering the parts on which the tapes and bandages press with tow or wool pads; and by filling up all the depressions of the limb with the same soft substances, so as to give it a circular form. The bandages will then not hurt the most projecting parts, on which they would make a strong and injurious degree of pressure, if the depressions were not artificially filled up.

By observing these rules, says Boyer, continual extension may always be borne, even by the most delicate and irritable patients: and the important advantage will be obtained of curing the fracture with the proper length of the limb preserved.—(*Traité des Mal. Chir. t.* 3, *p.* 56. 59.)

8 *Means for preventing and removing the unfavourable Symptoms liable to arise from Fractures.*

After having reduced the fracture, applied a suitable apparatus for maintaining the reduction, and put the part in an advantageous position, the practitioner is to attend to the third indication in the treatment, viz. the prevention and removal of any unfavourable symptoms.

With the exception of a few simple fractures of the upper extremity, it is proper in all cases to allow for the first few days only very low diet, broths, tea, &c. When the patient is young and strong, and the swelling and inflammation are likely to be considerable, venesection should be practised. In other circumstances it may in general be dispensed with, because it is well known, that for the quick formation of callus, by which the fracture is to be united, strength and a vigorous circulation are highly favourable. The patient may be permitted to drink as often and as much as he likes, of any cooling acid beverage. A very low diet is only to be continued the first few days, unless great inflammation arise; for experience proves that the method, when too much prolonged, has bad effects, and tends, on the same principle as bleeding, to retard the union of the fracture.

Costiveness is to be averted by the use of clysters and mild aperient medicines. It must be confessed, that in fractures of the lower extremity, the disturbance of the limb caused by the patient's being obliged to move himself, after taking a purgative, is seriously objectionable; but perhaps in all, and certainly in some habits, a neglect to open the bowels soon after the accident would have still more pernicious consequences. In order, however, to lessen the disturbance, a bed-pan should be carefully introduced under the patient. Here, also, I feel it my duty to recommend to the notice of the profession a very complete fracture-bed, invented by my friend Mr. Earle. One great convenience of this bed, the cost of which is moderate, is to enable the patient to void his feces, without the slightest change of position or disturbance; an object effected by the simple contrivance of a little kind of trap, opening under the bed, out of which a small portion of the mattress admits of being withdrawn, and a tin receptacle is placed for the reception of what is voided from the bowels and bladder. Some other advantages of this apparatus will be hereafter briefly mentioned.

With respect to external applications, we should carefully avoid using all such plasters and ointments as irritate the skin, or create a disagreeable itching; for they sometimes bring on erysipelas. The emplastrum saponis in common use is the best for all simple fractures; and it is the best rather because it does no harm, than because it does any essential good. It is, generally speaking, a good plan for the first few days to wet the bandages with cold water; for in this way, the tendency to inflammation and swelling may be considerably lessened. The surgeon, however, should recollect that the bandage shrinks when wet, and may become so tight as to do harm if not attended to. Solutions of the acetate of lead and other salts, make bandages stiff and hard; and as they are perhaps not more efficacious than cold water alone, the latter is sometimes preferred.

When a fracture is well set, the position of the part right, and the bandage and splints neither too tight nor too slack, the less the broken bone is moved, and the less the apparatus and dressings are disturbed the better. Sometimes, however, the practitioner is obliged to take off the splints, and undo the bandage, in order to ascertain that the ends of the fracture lie in even contact. Were he to leave the splints on the part ten days, or a fortnight, without ever being sure of this important point, he might find, when too late for alteration, that the fracture was in a state of displacement, and the limb seriously deformed. Hence, a strong reason for employing the eighteen-tailed bandage, which admits of being opened without disturbing the limb, or even without lifting it from the surface upon which it has been deposited.

In fractures of the lower extremities, particularly of the legs, it sometimes happens the first two or three nights after the reduction, that the limb is affected with convulsive spasms and cramps, which make the patient start in his sleep, and displace the ends of the bone, which must be again reduced.

When the callus has acquired some firmness, the patient should still keep the part or limb quiet, until the union is perfectly consolidated. And in fractures of the lower extremity, even after the union has proceeded so far that the splints admit of being left off, the patient ought not to venture to get out of bed, or bear upon the limb, till several more days have elapsed.

All fractures, however simple and well treated they may be, are constantly followed by weakness and stiffness of the limb. These unpleasant consequences are the greater, the more violently the limb has been contused, the nearer the fracture is to a joint, and the longer the part has remained motionless and without exercise. The stiffness always affects the inferior joint of the broken bone much more than the superior. For the relief of these effects of fractures, it is customary to employ friction, liniments, emollient relaxing applications, cold washes, and bathing; but sometimes, notwithstanding such remedies, the membrane does not quickly recover its strength, but continues stiff and weak for a year, or even a longer time. The most effectual plans for the prevention of this state should therefore be resorted to early. These consist in making the joints nearest the fracture execute slight motions, as soon as the union is sufficiently advanced not to be in danger of interruption from this practice. A great deal of caution, however, is necessary in moving the part, and it is safer for the surgeon to superintend the business himself, than leave it to the patient or others. One of the best proceedings also for the hindrance of much weakness and stiffness in the limb after a fracture is, to discontinue the splints and tight bandages immediately the state of the callus will allow. The manner in which their pressure retards the circulation, and prevents the action of the muscles, is one of the principal causes of the stiffness of the limb; and, consequently, the sooner they can be safely left off the sooner will the patient regain the free use of the limb.

In France, the chief division of fractures is into *simple* and *complicated*; which last includes, among many varieties, the cases which we name *compound*. We shall here briefly notice a few of the complications, and the particular treatment which they require.

Fractures (says Boyer) are always attended with a certain degree of contusion, which is constantly more severe in cases where the violence has acted directly on the situation of the fracture. But such contusion can only be regarded as a complication of the accident, when it exists in so violent a degree as to demand a different treatment from that which is employed in simple fractures.

In this circumstance, the splints and bandage should be applied rather slackly, and the latter ought to be wet with cold water, or some resolvent lotion. The patient is to be bled more or less freely, according to his age, the state of his constitution, and violence of the contusion. The next day, the splints and bandage should be opened; a thing highly necessary to be observed, for where it has been neglected, the limb has been known to mortify, in consequence of the swelling having rendered the bandage too tight.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 63, 64.)

In cases where the contusion is severe, but unattended with a wound of the integuments, the tension and swelling may be so intense, that the cuticle is detached, forming vesicles filled with yellowish serum. These vesicles may deceive an inexperienced surgeon, and lead him to imagine that the limb is threatened, or acturally affected, with gangrene. They ought to be punctured, and covered with pledgets of simple ointment. Here some practitioners apply emollient poultices under the apparatus; but there is inconvenience in their use, and perhaps cold lotions are generally better.

In simple fractures, it does not often happen that a large artery is wounded; but when the injury does occur, and a diffused aneurism takes place, the surgeon is to expose the vessel by an incision, and apply a ligature above and below the opening. We are to be careful, however, before resorting to the operation, that the tumour is not a venous extravasation, which may

almost always be dissipated by resolvent applications.

Fractures are sometimes complicated with a dislocation. Here, if possible, the luxation should invariably be reduced before the fracture is set. The possibility of reducing the dislocation (says Boyer) depends upon the species of articulation, the situation of the fracture, and other circumstances of the case. When it is a ginglymoid joint, when the ligaments are lacerated, and the swelling is not considerable, the luxation may be reduced easily enough: but when it is an orbicular joint, surrounded by numerous muscles; and when the fracture is near the articulation, and situated below the dislocation, the reduction of the latter is impossible. The attempt, indeed, would be injurious, because the necessary extension could not act upon the upper fragment; and were it to operate upon the lower, it could only have the effect of painfully stretching the muscles, and perhaps lacerating them. The fracture, therefore, should be at first attended to, and after its firm union, an endeavour may be made to rectify the dislocation. Boyer conceives that there will be more probability of success, when care is taken to move the limb gently, as soon as the state of the callus will permit it. He also recommends the employment of emollient relaxing applications. He confesses, however, that the attempt rarely succeeds after the perfect union of the fracture. There are, it is true, examples in which old dislocations may be reduced; but these are cases which are not complicated with a fracture; an accident which always renders the muscles and ligaments so stiff, that they cannot yield to the extension requisite for the reduction. "I do not know (says Boyer) that a luxation complicated with fracture has ever been reduced, when the nature of the joint and the circumstances of the case prevented the treatment from beginning with the reduction of the dislocation.—(*Traité des Mal. Chir. t.* 3, *p.* 79.)

COMPOUND FRACTURES.

What Mr. Pott has said upon these cases is, with one or two exceptions to which I shall advert, the essence of good surgery, not in the least deteriorated, as a few other parts of his precepts have been, by the more mature instructions of time and experience, or by that growing state of surgical science, which, fostered by genius and observation, is continually bringing to light new facts.

In a compound fracture, says Mr. Pott, the first object of consideration is, whether the preservation of the fractured limb can, with safety to the patient's life, be attempted; or, in other words, whether the probable chance of destruction, from the nature and circumstances of the accident, is not greater than it would be from the operation of amputation. Many things may occur to make this the case. The bone or bones being broken into many different pieces, and that for a considerable extent, as happens from broad wheels, or other heavy bodies of large surface, passing over or falling on such limbs; the skin, muscles, tendons, &c. being so torn, lacerated, and destroyed, as to render gangrene and mortification the most probable and most immediate consequence; the extremities of the bones forming a joint being crushed, or, as it were, comminuted, and the ligaments connecting such bones being torn and spoiled, are, among others, sufficient reasons for proposing and for performing immediate amputation.

Mr. Pott admits that apparently desperate cases are sometimes cured, and that limbs so shattered and wounded as to render amputation the only *probable* means for the preservation of life, are now and then saved. This is an uncontroverted fact, but a fact which proves very little against the common opinion; because every man of experience also knows that such escapes are very rare, much too rare to admit of being made precedents.

"This consideration relative to amputation is of the more importance, because it most frequently requires immediate determination; every minute of delay is, in many instances, to the patient's disadvantage; and a very short space of time, indeed, frequently makes all the difference between probable safety and fatality. If these cases in general would admit of deliberation for two or three days, and during that time such circumstances might be expected to arise as ought necessarily to determine the surgeon in his conduct, without adding to the patient's hazard, the difference would be considerable; the former would not seem to be so precipitate in his determination as he is frequently thought to be; and the latter, being more convinced of the necessity, would submit to it with less reluctance. But, unhappily for both parties, this is seldom the case; and the first opportunity having been neglected, or not embraced, we are frequently denied another. Here, therefore, the whole exertion of a man's judgment is required, that he may neither rashly and unnecessarily deprive his patient of a limb, nor through a false tenderness and timidity suffer him to perish by endeavouring to preserve such limb."

The limb being thought capable of preservation, the next consideration is the reduction of the fracture.

"If the bone be not protruded forth, the trouble of reducing and of placing the fracture in a good position, will be much less than if the case be otherwise; and in the case of protrusion, or thrusting forth of the bone or bones, the difficulty is always in proportion to the comparative size of the wound through which such bone has passed. In a compound fracture of the leg or thigh, it is always the upper part of the broken bone which is thrust forth. If the fracture be of the transverse kind, and the wound large, a moderate degree of extension will in general easily reduce it; but if the fracture be oblique, and terminates, as it often does, in a long, sharp point, this point very often makes its way through a wound no longer than just to permit such extension. In this case, the very placing the leg in a straight position, in order to make extension, obliges the wound or orifice to gird the bone tight, and makes all that part of it which is out of such wound press hard on the skin of the leg underneath it. In these circumstances, all attempts for reduction in this manner will be found to be impracticable; the more the leg is stretched out, the tighter the bone will be begirt by the wound, and the more it will press on the skin underneath.

Upon this occasion, it is not very unusual to have recourse to the saw, and by that means to remove a portion of the protruded bone.

I will not say that this is always or absolutely unnecessary or wrong, but it most certainly is frequently so. In some few instances, and in the case of extreme sharp-pointedness of the extremity of the bone, it may be, and undoubtedly is right.—(See *Dunn's Obs. in Med. Chir. Trans. vol.* 12.) But in many instances it is totally unnecessary.

The two most proper means of overcoming this difficulty are, change of posture of the limb, and enlargement of the wound. In many cases, the former of these, under proper conduct, will be found fully sufficient; and where it fails, the latter should always be made use of. Whoever will attend to the effect which putting the leg or thigh (having a compound fracture and protruded bone) into a straight position always produces, that is, to the manner in which the wound in such position girds the bone, and to the increased difficulty of reduction thereby induced; and will then, by changing the posture of such limb from an extended one to one moderately bent, observe the alteration thereby made in both the just-mentioned circumstances, will be satisfied of the truth of what I have said, and of the much greater degree of ease and practicability of reduction in the bent than in the extended position, that is, in the relaxed than in the stretched state of the muscles." Reduction being found impracticable, either by extension or change of posture, Mr. Pott recommends an enlargement of the wound.

"If the bone be broken into several pieces, and any of them be either totally separated so as to lie loose in the wound, or if they be so loosened and detached as to render their union highly improbable, all such pieces ought to be taken away; but they should be removed with all possible gentleness, without pain, violence, or laceration, without the risk of hemorrhage, and with as little poking into the wound as possible. If the extremities of the bone be broken into sharp points, which points wound and irritate the surrounding parts, they must be removed also.—(See *Dunn, vol. cit.*) But the whole of this part of the treatment of a compound fracture should be executed with great caution; and the practitioner should remember, that if the parts surrounding the fracture be violated, that is, be torn, irritated, and so disturbed as to excite great pain, high inflammation, &c., it is exactly the same thing to the patient, and to the event of the case, whether such

violence be the necessary consequence of the fracture or of the unnecessary and awkward manner of poking into and disturbing the wound. The great objects of fear and apprehension in a compound fracture (that is, in the first or early state of it) are, pain, irritation, and inflammation; these are to be avoided, prevented, and appeased by all possible means, let every thing else be as it may; and although certain things are always recited as necessary to be done, such as removal of fragments of bone, of foreign bodies, &c. &c. &c., yet it is always to be understood that such acts may be performed without prejudicial or great violence, and without adding at all to the risk or hazard necessarily incurred by the disease.

Reduction of or setting a compound fracture is the same as in the simple; that is, the intention in both is the same, viz. by means of a proper degree of extension to obtain as apt a position of the ends of the fracture with regard to each other, as the nature of the case will admit, and thereby to produce as perfect and as speedy union as possible.

To repeat in this place what has already been said under the head of *Extension* would be tedious and unnecessary. If the arguments there used for making extension, with the limb so moderately bent as to relax the muscles and take off their power of resistance, have any force at all, they must have much more when applied to the present case; if it be allowed to be found very painful to extend, or to put or to keep on the stretch muscles which are not at all or but slightly wounded, and only liable in such extension to be pricked and irritated, it is self-evident that it must be much more so when the same parts are torn and wounded." After a few additional observations in praise of the good effects of relaxing the muscles, Mr. Pott proceeds:—

"The wound dilated (if necessary), loose pieces removed (if there were any), and the fracture reduced in the best possible position, the next thing to be done is to apply a dressing."

When Mr. Pott wrote on this subject, the plan of bringing the edges of the wound together with adhesive plaster, in cases of compound fracture, had not been established; and the advantage of this mode of dressing in the first instance was not duly known. I do not mean the practice of drawing the edges of the wound forcibly together with strips of plaster, nor of encircling and compressing the part with the same; but only the method of applying two or three short pieces of plaster, so as lightly and gently to retain the opposite sides of the wound in contact, and afford them an opportunity of uniting by the first intention. Now, although such attempts will frequently fail, on account of the wound being generally in a contused, irregular, and lacerated state, the chance of success should be taken, because the experiment at all events will occasion no harm, and if it answer, it will change the case at once from a fracture with an open wound to one which has no external communication, or as might almost be said, from a compound into a simple fracture. Some of the following directions, therefore, given by Mr. Pott, I consider in the present state of surgery as only applicable when the wound has suppurated.

The dressing necessary in a compound fracture is of two kinds, viz. that for the wound, and that for the limb. By the former, we mean to maintain a proper opening for the easy and free discharge of gleet, sloughs, matter, extraneous bodies, or fragments of bone, and this in such manner, and by such means, as shall give the least possible pain or fatigue, shall neither irritate by its qualities, nor oppress by its quantity, nor by any means contribute to the detention or lodgement of what ought to be discharged. By the latter our aim should be the prevention or removal of inflammation, in order, if the habit be good and all other circumstances fortunate, that the wound may be healed by what surgeons call the first intention, that is without suppuration or abscess; or, that not being practicable, that gangrene and mortification, or even very large suppuration may be prevented, and such a moderate and kindly degree of it established as may best serve the purpose of a cure. The first, therefore, or the dressing for the wound, can consist of nothing better, or indeed so good, as soft dry lint, laid on so lightly as just to absorb the sanies, but neither to distend the wound, nor be the smallest impediment or obstruction to the discharge of matter. This lint should be kept clear of the edges, and the whole of it should be covered with a pledget spread with a soft easy digestive. The times of dressing must be determined by the nature of the case; if the discharge be small or moderate, once in twenty-four hours will be sufficient; but if it be large, more frequent dressing will be necessary, as well to prevent offence as to remedy the inconveniences arising from a great discharge of an irritating sharp sanies.

When, from neglect, from length of time passed without assistance, from misconduct or drunkenness in the patient, from awkwardness and unhandiness in the assistants, or from any other cause, a tension has taken possession of the limb, and it is become tumid, swollen, and painful, Mr. Pott admits, that a warm cataplasm is the most proper application that can be made; immediate union is impossible, and every thing which can tend towards relaxing the tense, swollen, and irritable state of the parts concerned, must necessarily be right. But when the parts are not in this state, the intention seems to be very different. To relax swollen parts, and to appease pain and irritation by such relaxation, is one thing; to prevent inflammatory defluxion and tumefaction is certainly another; and they ought to be aimed at by very different means. In the former, a large suppuration is a necessary circumstance of relief, and the great means of cure; in the latter it is not, and a very moderate degree of it is all that is required. The warm cataplasm, therefore, although it be the best application that can be made use of in the one case, is certainly not so proper in the other, as applications of a more discutient kind, such as mixtures of spirit. vini, vinegar and water, with the muriate of ammonia, liquor ammoniæ acetatis, liquor plumbi acetatis, and medicines of this class, in whatever form the surgeon may choose. By these, in good habits, in fortunately circumstanced cases, and with the assistance of what should never be neglected (I mean phlebotomy* and the general antiphlogistic regimen), inflammation may sometimes be kept off, and a cure accomplished, without large collections or discharges of matter."

"Compound fractures in general require to be dressed every day; and the wounded parts not admitting the smallest degree of motion without great pain, perfect quietude becomes as necessary as frequent dressing.

The common bandage, therefore (the roller), has always in this case been laid aside, and what is called the eighteen-tailed bandage substituted very judiciously in its place.

Splints of proper length, which reach from joint to joint, comprehend them both, and are applied on each side of the leg only, are very useful both in the simple and in the compound fracture, as they may, thus applied, be made to keep the limb more constantly steady and quiet than it can be kept without them."

Mr. Pott then enters into the consideration of the posture of the limb, which "is so principal a circumstance, that without its concurrence every other will be fruitless. The points to be aimed at are, the even position of the broken parts of the bone, and such disposition of the muscles surrounding them, as is most suitable to their wounded, lacerated state, as shall be least likely to irritate them, by keeping them on the stretch, or to produce high inflammation, and at best large suppuration."

According to Mr. Pott, these cases, of all others, require at first the most rigid observance of the antiphlogistic regimen; pain is to be appeased, and rest obtained, by anodynes; inflammation is to be prevented or removed by bleeding and aperient medicines. And during the first state or stage, the treatment of the limb must be calculated either for the prevention of inflammatory tumefaction by discutients, or, such tumour and tension having already taken possession of the limb, warm fomentation, and relaxing and emollient medicines are required.

"If these, according to the particular exigence of the case, prove successful, the consequence is, either a quiet easy wound, which either heals by the first intention or suppurates very moderately, and gives little or no trouble, or a wound attended at first with considerable inflammation, and that producing large suppuration, with great discharge and troublesome formation and lodgement of matter. If, on the other hand, our

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*The propriety of having recourse to venesection will depend upon the age, strength, and general habit of the patient. In the young, robust, and plethoric, the practice is, on every account, judicious.

attempts do not succeed, the consequence is gangrene and mortification.

These are the three general events or terminations of a compound fracture, and according to these must the surgeon's conduct be regulated.

In the first instance, he has indeed nothing to do but to avoid doing mischief, either by his manner of dressing or by disturbing the limb. Nature, let alone, will accomplish her own purpose; and art has little more to do than to preserve the due position of the limb, and to take care that the dressing applied to the wound proves no impediment.

In the second stage, that of formation and lodgement of matter, in consequence of large suppuration, all a surgeon's judgment will sometimes be required in the treatment both of the patient and his injured limb. Enlargement of the present wound, for the more convenient discharge of matter;* new or counter-openings for the same purpose, or for the extraction of fragments of broken or exfoliated bone, will very frequently be found necessary, and must be executed. In the doing this, care must be taken that what is requisite be done, and no more; and that such requisite operations be performed with as little disturbance and pain as possible."

Previous to large suppuration, or considerable collections and lodgements of matter, evacuation by phlebotomy, an open belly, and antiphlogistic remedies, as well as the free use of anodynes, and such applications to the limb as may most serve the purpose of relaxation, are the remedies which Mr. Pott advises for the relief of the swelling, induration, and high inflammation, attended with pain, irritation, and fever. "But the matter having been formed and let out, and the pain, fever, &c., which were symptomatic thereof, having disappeared or ceased, the use and purpose of such medicines and such applications cease also, and they ought therefore to be discontinued. By evacuation, &c. the patient's strength has necessarily (and indeed properly) been reduced; by cataplasm, &c. the parts have been so relaxed as to procure an abatement or cessation of inflammation, a subsidence of tumefaction, and the establishment of a free suppuration; but these ends once fairly and fully answered, another intention arises, which regards the safety and well-doing of the patient nearly, if not fully, as much as the former; which intention will be necessarily frustrated by pursuing the method hitherto followed. The patient now will require refection and support as much as he before stood in need of reduction; and the limb, whose indurated and inflamed state hitherto required the emollient and relaxing poultice, will now be hurt by such kind of application, and stand in need of such as are endued with contrary qualities, or at least, such as shall not continue to relax. Good, light, easily digested nutriment, and the Peruvian bark, will best answer the purpose of internals; the discontinuation of the cataplasms, and the application of medicines of the corroborating kind, are as necessary with regard to externals."†

"Every body who is acquainted with surgery knows (says Mr. Pott) that, in the case of bad compound fracture, attended with large suppuration, it sometimes happens, even under the best and most judicious treatment, that the discharge becomes too great for the patient to sustain; and that, after all the fatigue, pain and discipline which he has undergone, it becomes necessary to compound for life by the loss of the limb.* This, I say, does sometimes happen under the best and most rational treatment; but I am convinced that it also is now and then the consequence of pursuing the reducing, the antiphlogistic, and the relaxing plan too far. I would therefore take the liberty seriously to advise the young practitioner to attend diligently to his patient's pulse and general state, as well as to that of his fractured limb and wound; and when he finds all febrile complaint at an end, and all inflammatory tumour and hardness gone, and his patient rather languid than feverish, that his pulse is rather weak and low than hard and full, that his appetite begins to fail, and that he is inclined to sweat or purge without assignable cause, and this in consequence of a large discharge of matter from a limb which has suffered great inflammation, but which is now become rather soft and flabby than hard and tumid; that he will in such circumstances set about the support of his patient, and the strengthening of the diseased limb, *totis viribus*; in which I am from experience satisfied he may often be successful, where it may not be generally expected that he would. At least he will have the satisfaction of having made a rational attempt; and if he is obliged at last to have recourse to amputation, he will perform it, and his patient will submit to it, with less reluctance than if no such trial had been made."

According to Mr. Pott, gangrene and mortification are sometimes the inevitable consequences of the mischief done to the limb at the time that the bone is broken; or they are the consequences of the laceration of parts, made by the mere protrusion of the said bone. They are also sometimes the effect of improper or negligent treatment; of great violence used in making extension; of irritation of the wounded parts, by poking after, or in removing fragments or splinters of bone; of painful dressings; of improper disposition of the limb, and of the neglect of phlebotomy, anodynes, evacuation, &c.

"When such accident or such disease is the mere consequence of the injury done to the limb, either at the time of or by the fracture, it generally makes its appearance very early; in which case also its progress is generally too rapid for art to check. For these reasons, when the mischief seems to be of such nature that gangrene and mortification are most likely to ensue, no time can be spared, and the impending mischief must either be submitted to, or prevented by early amputation. I have already said, that a very few hours make all the difference between probable safety and destruction. If we wait till the disease has taken possession of the limb, even in the smallest degree, *the operation will serve no purpose, but that of accelerating the patient's death.* If we wait for an apparent alteration in the part, we shall have waited until all opportunity of being really serviceable is past. The disease takes possession of the cellular membrane surrounding the large blood-vessels and nerves some time before it makes any appearance in the integuments; and will always be found to extend much higher in the former part than its appearance in the latter seems to indicate. *I have more than once seen the experiment made of amputating, after a gangrene has been begun, but I never saw it succeed; it has always hastened the patient's destruction.*†

As far, therefore, as my experience will enable me to judge, or as I may from thence be permitted to dictate, *I would advise that such attempt should never be made;* but the first opportunity having been neglected, or not embraced, all the power of the chirurgic

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* "It is a practice with some, from a timidity in using a knife, to make use of bolsters and plaster compresses for the discharge of lodging matter. Where another or a counter-opening can conveniently and safely be made, it is always preferable, the compress sometimes acting diametrically opposite to the intention with which it is applied, and contributing to the lodgement by confining the matter; besides which, it requires a greater degree of pressure to make it efficacious than a limb in such circumstances generally can bear."

†"It is surprising how large and how disagreeable a discharge will be made for a considerable length of time, in some instances, from the detention and irritation of a splinter of bone. If therefore such discharge be made, and there be neither sinus nor lodgement to account for it, and all other circumstances are favourable, examination should always be made, in order to know whether such cause does not exist, and if it does it must be gently and carefully removed."

* After the bones had united, Mr. Pott never found it necessary to amputate a limb for a compound fracture, on account of the too great discharge.

† In the article *Gun-shot Wounds*, however, the reader will find that there is a species of gangrene, arising from external violence, and totally unconnected with constitutional causes, where the surgeon should deviate from the common rule of deferring amputation until the mortification has ceased to spread. A memoir "*Sur la Gangrène Traumatique*," which was published a few years ago by Baron Larrey, contains the most decisive facts in regard to the propriety of such practice. —(See his *Mém. de Chir. Militaire, t. 2.*) The experience of Mr. Lawrence tends also to confirm the truth of Larrey's observations.—(See *Med. Chir. Trans. vol. 6, p. 184, &c.*)

art is to be employed in assisting nature to separate the diseased part from the sound; an attempt which now and then, under particular circumstances, has proved successful, but which is so rarely so, as not to be much depended upon.

If the parts are so bruised and torn, that the circulation through them is rendered impracticable, or if the gangrene is the immediate effect of such mischief, the consequence of omitting amputation, and of attempting to save the limb is, as I have already observed, most frequently very early destruction; but if the gangrenous mischief be not merely and immediately the effect of the wounded state of the parts, but of high inflammation, badness of general habit, improper disposition of the limb, &c., it is sometimes in our power so to alleviate, correct, and alter these causes, as to obtain a truce with the disease, and a separation of the unsound parts from the sound. The means whereby to accomplish this end must, in the nature of things, be varied according to the producing causes or circumstances: the sanguine and bilious must be lowered and emptied; the weak and debilitated must be assisted by such medicines as will add force to the *vis vitæ*; and errors in the treatment of the wound or fracture must be corrected; but it is evident to common sense, that for these there is no possibility of prescribing any other than very general rules indeed. The nature and circumstances of each individual case must determine the practitioner's conduct.

In general, inflammation will require phlebotomy and an open belly, together with the neutral antiphlogistic medicines; pain and irritation will stand in need of anodynes; and the Peruvian bark, joined, in some cases, and at some times, with those of the cooling kind, at others with the cordial, will be found necessary and useful. So also tension and induration will point out the use of fomentation and warm relaxing cataplasms, and the most soft and lenient treatment and dressing."

Mr. Pott then offers many just observations against stimulating antiseptic applications to the wound and scarification of the limb, as practised while the gangrene is forming. The custom of using stimulating dressings to bad compound fractures first began in cases produced by gun-shot, and had its foundation in the opinion that gun-shot wounds were poisonous, and that the mortification in them was the effect of fire; a doctrine and practice now completely exploded. "A gun-shot wound (says Pott), whether with or without fracture, is a wound accompanied with the highest degree of contusion, and with some degree of laceration; and every greatly contused and lacerated wound requires the same kind of treatment which a gun-shot wound does, as far as regards the soft parts. The intention in both ought to be to appease pain, irritation, and inflammation.

Scarification, in the manner and at the time in which it is generally ordered and performed, has never appeared to me to have served any one good purpose. When the parts are really mortified, incisions made of sufficient depth will give discharge to a quantity of acrid and offensive ichor, will let out the confined air, which is the effect of putrefaction, and thereby will contribute to unloading the whole limb; and they will also make way for the application of proper dressings. But while a gangrene is impending, that is, while the parts are in the highest state of inflammation, what the benefit can be which is supposed or expected to proceed from scratching the surface of the skin with a lancet, I never could imagine; nor, though I have often seen it practised, do I remember ever to have seen any real benefit from it. If the skin be still sound, and of quick sensation, the scratching it in this superficial manner is painful, and adds to the inflamed state of it; if it be not sound, but quite altered, such superficial incision can do no possible service; both the sanies and the imprisoned air are beneath the membrana adiposa; and merely scratching the skin in the superficial manner in which it is generally done will not reach to or discharge either.

From what has been said it will appear, that there are three points of time, or three stages, of a bad compound fracture, in which amputation of the limb may be necessary and right; and these three points of time are so limited, that a good deal of the hazard or safety of the operation depends on the observance or non-observance of them.

"The first is immediately after the accident, before inflammation has taken possession of the parts. If this opportunity be neglected or not embraced, the consequence is either a gangrene or a large suppuration, with formation and lodgement of matter. If the former of these be the case, the operation ought never to be thought of, till there is a perfect and absolute separation of the mortified parts.* If the latter, no man can possibly propose the removal of a limb until it be found by sufficient trial that there is no prospect of obtaining a cure without; and that, by not performing the operation, the patient's strength and life will be exhausted by the discharge. When this becomes the hazard, the sooner amputation is performed the better. In the first instance, the operation ought to take place before inflammatory mischief is incurred; in the second, we are to wait for a kind of crisis of such inflammation; in the third, the proportional strength and state of the patient, compared with the discharge and state of the fracture, must form our determination."—(*Pott's Remarks on Fractures.*)

9. *Of the Formation of Callus, the Consolidation of Fractures, and of the Cases in which they remain without Union.*

In the treatment of fractures, the whole business of the surgeon consists in putting the displaced extremities of the bone into their natural situation again; in keeping them in this situation by means of a suitable apparatus; in endeavouring to avert unfavourable symptoms, and in adopting measures for their removal when they have actually occurred. The consolidation of a broken bone is (strictly speaking) the work of nature, and is effected by a process to which a state of perfect health is above all things propitious.

This consolidation of a broken bone, which is analogous to the union of wounds of the soft parts, is termed the *formation of the callus*, and the new uniting bony substance itself is named *callus*.

1. *Of the Time requisite for the Formation of the Callus, and of general Circumstances which favour, retard, or even completely prevent it.*

Surgical writers have been absurdly anxious to specify a determinate space of time which should be allowed for the formation of the callus, as if this process always went on in different cases with the same uninterrupted regularity. Forty days were often fixed upon as necessary for the purpose. This prejudice is not only false, but dangerous, inasmuch as patients have been thereby induced to suppose themselves cured before they were so in reality, and have, consequently, moved about too boldly, and thus run the risk of occasioning deformity or a new fracture. As Boyer observes, it is impossible to determine precisely, and in a general way, the period requisite for the cure, because it differs according to a variety of circumstances. All we know is, that the callus is usually formed between the twentieth and seventieth day, sooner or later, according to the age and constitution of the patient, the thickness of the bone, the weight which it has to support, the state of the patient's health, &c.

1. *Age.* Fractures are consolidated, *cæteris paribus*, with more ease and quickness in young subjects than in adults or old persons. In general also the callus forms more speedily in proportion as the individual approaches to infancy. In two children, whose arms had been broken in difficult labours, De la Motte saw the humerus united in twelve days, by a very simple apparatus. In fact, at this period of life, every part has a tendency to grow and develope itself, and the

* Compound fractures are cases of external violence. Now, as the mortification proceeds from the injury, and may not be connected with any internal cause, it is an example of what Larrey calls the *Gangrène Traumatique*; and the question whether the surgeon ought to be governed by the old maxim of delaying amputation until the spreading of the mortification has ceased, yet remains unsettled. Were the patient of a sound constitution, and not too far gone, I should not fear to imitate Larrey, and amputate, though the mortification were actually in a spreading state. A few years ago I assisted at an amputation of the shoulder in a case of spreading mortification of the arm from a compound dislocation of the elbow; and though the patient ultimately died of a large abscess over the scapula, the stump went on favourably, and at one period strong hopes of recovery were entertained.

vitality of the bones is more active, their vascularity greater, their gelatinous substance more abundant. On the contrary, in advanced age, the parts have lost all disposition to developement, the vascularity of the bones is in a great measure obliterated, and (to use the expression of Boyer) their vitality is annihilated under the mass of phosphate of lime which accumulates in them.

It has been asserted, that in early infancy the callus is generally produced in excess, and may cause deformity by its redundance. But experience does not confirm the truth of this statement. The real cause of deformity always proceeds from the fracture either being badly set, or not kept properly reduced, or else from the part being moved about before the callus has acquired a due degree of firmness.

2. *Constitution.* A fracture is united much sooner in a strong healthy person, than a weak unhealthy subject. Sometimes, the consolidation is prevented by some inexplicable unknown cause, nothing wrong being remarkable either in the constitution or the part. Ruysch and Van Swieten met with several cases of this kind, in which the patients were apparently quite healthy and judiciously treated; and there are few surgeons of much experience who are not acquainted with similar examples.

3. *Thickness of the Bone, and Weight which it has to support.* The bones are thicker and larger, in proportion as they have a greater weight to bear, and as the muscles inserted into them are more powerful. It is observed, *cæteris paribus*, that the larger the bones are the longer is the time requisite for their union. Thus a broken thigh-bone is longer in growing together again than a fractured tibia; the tibia longer than the humerus, the bones of the forearm, clavicle, ribs, &c.

As the callus remains a good while softer than the rest of the bone, it follows, that if the newly united bone has to bear all the weight of the body in walking, the patient should defer this exercise longer. Hence one reason why fractures of the arm are sooner cured than those of the tibia, and why six or seven weeks at least are necessary in the treatment of a broken thigh-bone, which of itself has to support in progression all the weight of the trunk.

4. *State of Health.* Fractures unite with more quickness and facility when the patient enjoys good health. The scurvy has a manifest and powerful effect in retarding the consolidation of fractures, and even in causing the absorption of the callus several years after its formation, so that a bone becomes flexible again at the point where it was formerly broken. In Lord Anson's voyage this phenomenon is particularly recorded.—(See *p.* 142, *edit.* 15, *in* 8*vo.*) Langenbeck is acquainted with several cases, in which the callus at the end of eight weeks became again soft and the bone flexible, in consequence of the patient's being attacked with fevers or erysipelas.—(*Neue Bibl. b.* 1, *p.* 90.) Cancer, lues venerea, and rickets are also stated by surgical writers to obstruct, and sometimes hinder altogether, the formation of callus.

Fabricius Hildanus has cited two cases, which tend to prove that the union of fractures is retarded by pregnancy.—(*Cent* 5, *obs.* 87. *Cent.* 6, *obs.* 68.) Alanson has also related a case in which the union, which had been delayed during pregnancy, took place after delivery (*Med. Obs. and Inq. vol.* 4, *No.* 37); and Werner has published an account of a fracture of the radius in a pregnant woman, where the cure was apparently retarded for a long time by this circumstance, and though the union took place previously to delivery, the callus was not very firm till after that event.—(*Richter, Bibl. b.* 11, *p.* 591.) From the facts, however, mentioned in a preceding page of this article, there can now be no doubt that pregnancy frequently does not prevent the formation of callus in the ordinary time, though the observation of Mr. Wardrop is true, that many instances have been observed of bones being fractured during pregnancy, and never showing any disposition to unite till after delivery.—(*Med. Chir. Trans. vol.* 5, *p.* 359.)

Besides the remarks made here and in a foregoing page, on the causes preventing the union of fractures, a few additional observations on the same subject will be introduced in the sequel of this article, when we speak of the modes of attempting the cure of old disunited fractures.

2. *Of some local Circumstances necessary for the Consolidation of Fractures.*

As Boyer has well explained, three local circumstances are necessary to obtain a firm callus without deformity. 1. The two fragments must be possessed of sufficient vascularity. 2. The surfaces of the fracture must correspond. 3. They must be kept in a completely motionless state.

The two fragments must be sufficiently vascular. If one of them should be too scantily supplied with blood, the fracture would be incapable of union. This, as is asserted by Boyer, though denied by Amesbury and others, is what happens in certain fractures of the neck of the femur, where the head of this bone is entirely detached, and the ligamentous substance which is reflected over its neck, and serves as its periosteum, is totally lacerated, as well as the vessels which ramify upon it. Hence, the upper fragment lodged in the cotyloid cavity no longer receives from the vessels sent to it through the ligamentum teres a sufficiency of blood for the process of the formation of callus. This is especially likely to be the case when the patient is far advanced in years, and the vessels considerably lessened in diameter. An adequate circulation must therefore exist in both portions of bone; for without it the attempt at union will fail.

The surfaces of the fracture must correspond exactly. This circumstance is not absolutely necessary for the consolidation of the fracture; but without it the formation of the callus is always slow and difficult. For instance, in a transverse fracture of the thigh-bone, the fragments, after being displaced according to the thickness of the bone, may undergo a second displacement according to its length, by passing beyond each other. The surfaces of the fracture are then not at all in contact, and the portions of bone only touch each other by their sides, which, being covered by the periosteum, can unite with difficulty. Here, at the end of the second month, the union will frequently have made but little progress; nor can the cure be accomplished without deformity and shortening of the limb.

The fragments must be retained in a completely motionless state. This condition is so essential to the formation of callus, that if the ends of a fracture were daily moved, they could not unite. The two extremities of the bone would then heal separately, just like the sides of a wound which have not been put in contact. The ends of a fracture, however, which cicatrize separately do not (according to Boyer) always become smooth, nor is there ordinarily any capsular ligament formed.—(*Traité des Mal. Chir. t.* 3, *p.* 86.)

3. *Different Opinions on the Formation of Callus.*

As Boyer remarks, perhaps no subject has excited more discussion than the formation of callus. The ancients ascribed it to the extravasation of a gelatinous fluid which was called the osseous juice, and which, becoming hard, served to unite the ends of the broken bone, just as glue serves to unite two pieces of wood. Hence, in order to favour the production of callus, they were in the habit of recommending their patients to eat abundantly of every sort of viscid farinaceous aliment, the glutinous parts of animals, and especially osteocolla, of which Fabricius Hildanus relates miracles.

But if these accounts were true, callus must be inorganic, or else one would be compelled to admit, that the inspissation of an inorganic fluid was capable of producing an organized substance; which is an absurdity. Besides, observation demonstrates that callus is an organized matter, like the substance of the bone itself, which it resembles, and that when subjected to anatomical and chemical experiments, it exhibits all the appearances of the proper substance of bones.

According to Duhamel, callus is formed by the periosteum, which he regards as the organ of ossification. When a bone is fractured (says this naturalist), the periosteum of the two fragments first grows together, and then swells, and forms a circular rising round the fracture. The thickened membrane is converted into a gelatinous substance, which soon becomes a cartilaginous matter. In this vessels develope themselves, and different points of ossification commence, which multiply and unite. Thus, when every part of the periosteum near the fracture is hardened and ossified, this membrane is changed, as it were, into a sort of clasp, which extends over the two fragments, and holds them together.

It was objected to Duhamel's theory, that if a bone be slit longitudinally in the situation of a former fracture, the fragments are observed to have their substances blended completely together, and not simply to lie in contact in the manner of two pieces of wood placed end to end, and kept in contact by means of a clasp. Duhamel, with a view of obviating this difficulty, supposed that the periosteum elongated itself from the circumference towards the centre of the bone, and that such continuation of this membrane underwent the same changes as that portion which was contiguous to the fracture, and thus served to unite the ends of the fragments between which it was interposed. He admits, also, in some cases that the internal periosteum or medullary membrane may furnish productions extending between the ends of the fracture, like the continuation of the external periosteum with which they become connected. Lastly, he supposed that in young subjects, whose bones had not acquired their full degree of hardness, the cartilaginous part was capable of extension, and that, in cases of fracture, it contributed to the more perfect union of the fragments.

The system of Duhamel was opposed by Haller and Dethleef, who, after a long series of well-performed experiments, came to the conclusion, that the callus was formed by a gelatinous juice, which exudes from the extremity of the fractured bone, particularly from the medullary texture, and is effused all about the fracture; that such juice is organized, forms a cartilage, and at length ossifies.

But as Boyer justly remarks, whatever difference there may seem to be between this doctrine and that of Duhamel, it is merely in the mode of explaining the facts. All these observers noticed the same phenomena; and all the experiments of Dethleef accorded perfectly well with those of Duhamel. Both found, during the first days, immediately after the fracture, a lymph extravasated between the fragments, and a small tumour in the situation of the fracture. Both also remarked, that this tumour became softer, and that it afterward formed a gelatinous, then a cartilaginous, and lastly a bony substance, which composed the uniting medium. But Duhamel contends, that the cartilage is produced by the periosteum, while Haller and Dethleef argue that it is the production of the extravasated lymph.

Professor Boyer thinks, that Duhamel imputes too much to the periosteum; but that Haller and Dethleef were also wrong if they supposed, as Fougeroux alleges, that an unorganized lymph could produce an organized substance by inspissation.—(See *Le second Mémoire sur les Os, par M. Bordenave, recueilli et publié par M. Fougeroux*, p. 124.) It appears to Boyer much more natural to believe that the gelatinous lymph already contains the rudiments of organization, which become visible as they are developed; just as it is usually believed, that the rudiments of all our organs are contained in the transparent mucilage, of which the embryo seems to consist.

The experiments of Duhamel and Dethleef were carefully repeated by Bordenave, who ascertained several new and interesting facts. The result was the same in regard to the phenomena observed; but the explanation of them was different.

Instead of attributing the formation of callus to the periosteum, like Duhamel, or to the extravasation of lymph, like Dethleef, Bordenave conceived that broken bones unite again by a process analogous to that which nature employs for the union of the divided soft parts. His inference is principally founded on two facts generally admitted. 1st, That there is in the bones a vascular texture designed to maintain the circulation in them. 2dly, That such texture dilates when fractures are uniting, as appears from the swelling in the situation of the fracture, without which swelling there could be no union. Bordenave farther remarks, with Haller and Dethleef, 1st, That callus, at the commencement of its formation, appears to consist of a glutinous fluid effused from the ruptured vessels. 2dly, That this substance afterward assumes the form of cartilage, to which certain vessels are distributed, which deposite the bony matter, and thus begin the generation of callus. 3dly, That the particles of bone, being all joined together, the callus changes into a porous substance, which in time becomes solid and compact, like the substance of bones.

Doubtless (says Boyer) we shall always remain ignorant of the process which nature employs for the union of the bones, as well as for that of the soft parts. Every theory which can be invented on this point will only be conjectures more or less probable. However, if this author were to adopt any system exclusively, he expresses that he should prefer that of Bordenave.

The mechanism of nature in the formation of callus, must be analogous to that which she adopts in the union of wounds. The principal difference seems to be, that in the union of a fracture the vessels after a time deposite the phosphate of lime. The vessels of the periosteum, medullary membrane, and probably also those of the soft parts in the immediate vicinity of the fracture, first effuse coagulating lymph. This gradually becomes vascular, and in proportion as the vessels acquire the power of secreting earthy matter, it is by degrees converted into new bone, termed *callus*, which from being at first soft and flexible, at length becomes firm and unyielding, and fit for constituting the future bond of union between the two extremities of the fracture.

The observations made by Baron Larrey lead him to reject as entirely erroneous the doctrine which refers the production of callus to the periosteum, and he adopts the opinion, that the union and reparation of bones are the work of their own vessels. He adverts to examples in which, after the use of the trephine in young subjects, the perforation becomes more or less closed by new bone, thrown out from the circumference towards the centre. Here, says he, the ossification assuredly can neither be referred to the pericranium nor the dura mater. The first of these membranes has been extensively destroyed, and if the second were concerned, a vertical substance, shutting up the opening, would be apparent. In farther support of his opinions, Baron Larrey cites the well-known celerity with which fractures of the lower jaw unite, on account of the great vascularity of that bone; and he believes, with Sir Astley Cooper, that if the ends of a fracture do not touch in consequence of a loss of substance, the intervening space remains unfilled up by a new bone; a position which seems rather repugnant to what has been said concerning the mode of reparation after the use of the trephine.

Larrey has often seen the superficial layers of the tibia exfoliate, after a necrosis produced by a cause which had destroyed the whole of the periosteum on the front surface of that bone, as is sometimes the case in hospital gangrene. He has seen these layers replaced by red vascular granulations disposed in parallel lines, which granulations soon ossified, that is to say, phosphate of lime was substituted for the vermillion colour of the vessels, and gave the new-formed substance the appearance and consistence of bone. Lastly, this substance was covered with a new cellular membrane, derived from the adjacent textures; but in the place of the cicatrix, a depression always remained, proportioned to the loss of substance. If the formation of callus depended on the periosteum, Larrey argues, that the broken patella could never unite by bone, as it is often found to do, when the fragments are kept closely in contact. Here he contends that the union is brought about by the action and inosculation of the vessels belonging to the substance of the fragments themselves. Lastly, he adverts to preparations in which the vessels of callus have been actually injected by the celebrated Soemmering.—(See *Journ. Complém. du Dict. des Sciences Méd. t.* 8, *p.* 107, *&c.* 8*vo. Paris*, 1820.)

Mr. Liston, of Edinburgh, coincides very much with Baron Larrey. "To the surrounding soft parts (says he) has been attributed a great share of the work in the union of broken bones; and when bones have been fractured in circumstances not admitting of this assistance, the process of separation, it is said, cannot be accomplished. In dissecting a fractured limb, which has been removed during the process of union by callus, it will be found that *the new bone is uniformly attached to the sound part of the old*, the vessels of the part employed in this process being much increased in size; *the newly deposited bone, which in its turn carries on the process, being perforated by numerous and large foramina, for the entrance of corresponding ramifications of arteries. The new formation will be perceived shooting from the opposed ends till these are united*; and the masses in which they are deposited will be direct, and but slightly prominent, or, on the other hand, irregular and unshapely, according as the

separated ends are favourably or unfavourably placed. I can conceive it possible (says Mr. Liston), and, in fact, have frequently found new bone connected with the soft parts; but this was the produce of a splinter which had still retained its vitality, and *whose vessels* had formed a contribution to the general action. Great powers, not only in the production, but also in the removal of bone, have been long allowed to the periosteum. No one, I will venture to say, has as yet detected this membrane in either of these acts. *New bone has not been found adhering to the periosteum, either in fractures or necrosis*; far less has a complete substitute composed of the ossified periosteum been ever discovered enclosing a sequestrum. In every instance the new formation is deposited in nodules adhering firmly to the old bone, and, as remarked above, freely perforated by nutritious arteries. The vessels of the bone, no doubt, are ramified on the external and internal periosteum; but it is only after their entrance into the perforations, that they become disposed to pour out ossific matter."—(*Edin. Med. and Surg. Journ. No.* 78, *p.* 47.)

From experiments instituted by Breschet and Villermé, it would appear that the union of broken bones is not exclusively owing to the effusion of a particular fluid which concretes and gradually changes into an osseous substance; nor to the ossification of the swollen and elongated periosteum; nor, in the majority of instances, to granulations produced from the surfaces of the fracture; but it is frequently dependent upon all these circumstances together, or at least several of them; and, in every case, it is the result of a series of changes, observable in the soft parts immediately adjoining the fracture, in the periosteum, in the medullary structure, in the cavities and very texture of the bones themselves, and in the substance intervening between the two fragments. In simple fractures, the following are stated to be the principal circumstances remarked during the process.

1. Extravasation and coagulation of a small quantity of blood between the ends of the fracture, which blood escapes from torn or ruptured vessels.

2. A fluid, at first of a viscid quality, effused and secreted, as it were, between the periosteum and the bone, and likewise exuding from the surfaces of the fracture and the soft parts.

3. A gradual increase in the quantity and consistence of the preceding substances blended together, forming every day a stronger and stronger connexion between the parts; then their change to a red intermediate substance between the fragments, and between the bone and the periosteum to a substance which is at first soft, but in the end acquires the characters of bone.

4. At the fractured part, a reunion of the periosteum and soft parts, which are equally indurated and confused together, with the intermediate substance between the fragments.

5. A diminution, and then an obliteration of the medullary cavity, at first by a cartilaginous, and then a bony deposition.

6. Successive ossification of the whole of the swelling composing the callus, and of the substance between the fragments, preceded by a fibrous and cartilaginous state.

7. The return of the soft parts around the fracture, and then of the periosteum, to their natural state.

8. After the union of the surfaces of the fracture, the medullary cavity and texture are gradually re-established, and the swelling formed by the callus always diminishes.

But in compound fractures, besides these circumstances, the production of granulations from the surfaces of the bone is also to be taken into the account. —(See *Dict. des Sciences Méd. t.* 38, *p.* 436.) This difference from what happens in the process of union of simple fractures is also particularly noticed by Mr. Wilson: "From the parts being exposed (in a compound fracture), the first bond of union, viz. the coagulable lymph of the blood, is removed or destroyed before it can become vascular. Inflammation in consequence of the injury comes on, suppuration takes place, and when the parts are healthy, granulations arise. These granulations from the broken extremities of the bone soon assume the ossifying disposition, and when they come in contact with each other, unite."—(*On the Skeleton, Diseases of the Bones, &c. p.* 233, 8vo *Lond.* 1820.) It is a curious fact, that broken cartilages are united by means of bone; a circumstance which has often been noticed in respect to the cartilages of the ribs.

Whatever may be the process by which callus is formed, it is during the first two or three weeks after the fracture that the fragments undergo the changes which promote their reunion. But it is between the twentieth and thirtieth, and especially between the thirtieth and fiftieth days, that nature labours effectually in consolidating the callus. Hence, at this period, our care to retain the ends of the fracture in exact contact and perfectly at rest, should be redoubled; for though there are a few instances in which deformity really proceeds from irregular ossifications, it is a fact, that the deformity almost always originates from the fracture being disturbed and not kept properly reduced.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 86, *&c.*)

4. *Of the Conduct to be adopted at the ordinary Period of the Consolidation of Fractures, and of the Treatment of False Joints.*

When the requisite time for a broken bone to become firmly united has elapsed, it is proper to examine carefully and cautiously the place of the fracture, in order to learn whether the callus has acquired a suitable degree of strength. If the bone should be found to bend in the least at the injured part, the callus is not sufficiently strong, and the limb should be immediately put up in the apparatus again, with a view of preventing a new fracture, or, at all events, deformity.

For the same reason, the patient should not be allowed to make use of his limb, as soon as the fracture has united. In fractures of the lower extremity, he ought to use crutches, and only let the weight of the trunk by degrees bear upon the injured limb. From neglect of this precaution the callus has been known to be absorbed, the limb to be shortened, and the patient become a cripple. An accidental slip may also produce the fracture again; for, notwithstanding the assertion of writers, the callus, so far from being firmer than the rest of the bone, is at first considerably weaker.—(*Boyer, t.* 3, *p.* 93.)

If, when the necessary time for the completion of the union has expired, the callus is not yet firm, we must examine, 1st, The relative position of the fragments and the consistence of the callus: 2dly, The causes which may have retarded its consolidation.

That the state of the constitution has considerable influence over the process by which broken bones are reunited, is unquestionable. Schmucker found the formation of callus, even in the most simple fractures, sometimes delayed eight months, and in one example more than a year; but the patients were all of them unhealthy subjects.—(*Vermischte Chir. Schriften, b.* 1, *p.* 26.)

There are certain indescribable constitutions, in which bones, more particularly, however, the os brachii, will not unite again after being broken. These temperaments are also very various; at least, I infer so from two subjects to whom I paid particular attention. One was a strong, robust man, whose chief peculiarity seemed to be his indifference to pain: the ends of his broken humerus were cut down too, turned out, and sawed off, by Mr. Long, in St. Bartholomew's Hospital, and the limb was afterward put in splints and taken the greatest care of; but no union followed. The other case was a broken tibia and fibula, which remained disunited for about four months; but afterward grew together. The latter subject was a complete instance of hypochondriasis. I afterward saw a woman, under Sir James Earle, in the above hospital, whose os brachii did not unite in the least, though it had been broken several months. Every attempt to move the bone occasioned excruciating torture. The woman died of some illness in the hospital, and on dissecting the arm, the cause of the fracture not having united was found to arise from the upper, sharp, pointed extremity of the lower portion of the broken bone having been forcibly drawn up by the muscles, and penetrated the substance of the biceps, in which it still remained. I am indebted to Mr. Earle for the description of the appearance in the dissection, and I do not know that this kind of impediment to the union of a fracture has been noticed by any earlier writer than Mr. Charles White, who appears to have conceived the possibility of the occurrence.—(*Cases in Surgery, p.* 70, *edit.* 1770.)

The causes of fractures remaining disunited will,

according to Richerand, be found to depend either upon the broken ends of the bone not being properly in contact; the limb having been moved too much; the advanced age of the patient; or upon a general inertia and languor of the constitution.—(*Nosographie Chir. tom.* 3, *p.* 37, *édit.* 2.)

It is observed by Larrey, that the gun-shot wounds of the extremities, complicated with fracture, especially with that of the humerus, received by the soldiers of the French army in Syria, were almost all followed by the formation of accidental joints. The two fragments of the broken bone continued moveable, their asperities and projecting angles having been destroyed by friction, and their ends being rounded and covered with a cartilaginous substance, so as to facilitate the motions which the patients executed in various directions, in an imperfect manner and without pain. Larrey acquaints us that many invalids were sent back to France with such infirmity.

"I ascribe," he says, "the causes of these accidental articulations:

1. To the continual motion to which the wounded soldiers were exposed, after their departure from Syria till their arrival in Egypt, in consequence of their having been obliged either to walk this journey on foot, or to be carried it on beasts.

2. To the bad quality of the food and the brackish water which the men were under the necessity of drinking in this painful journey.

3. To the state of the atmosphere in Syria, almost entirely destitute of vital air, and impregnated with pernicious gases, issuing from the numerous marshes near which we were a long while stationed.

All these causes may have prevented the formation of callus, either by diminishing the quantity of the phosphate of lime, or moving the bones out of that state of coaptation in which they should constantly lie, in order to unite.

Bandages, embrocations, rest, and regimen proved quite ineffectual."—(*Larrey, Mém. de Chir. Mil. t.* 2, *p.* 131, 132. *Langenbeck, Neue Bibl. b.* 1, *p.* 81.)

The presence of an ulcer, a sinus, loose splinters of bone, a necrosis, or other suppurating disease near a fracture, is a circumstance that often appears seriously to retard or completely to prevent the formation of callus. How frequently have I noticed, in cases of compound fracture, that while the wound suppurates largely, and while there are spiculæ and dead portions of bone unextracted, no solid union takes place; but that, as soon as the wound, ulcer, or sinus admits of being healed, and the suppuration ceases, the callus begins to form in the most favourable manner. Schmucker relates a case illustrating the truth of these observations, where the tibia and fibula were broken so obliquely, that the ends of the fracture could not be made to lie well, a necrosis of a portion of the tibia followed, and no callus was formed at the end of eight months, when a sinus on each side of the leg still continued. This eminent surgeon now laid the sinuses open, and extracted the dead pieces of bone, by which means the impediment to the formation of callus was removed, and the fracture, which had till then remained loose and moveable, became firmly united in two months.—(*Vermischte Chir. Schriften, b.* 1, *p.* 25, 26.)

False or preternatural articulations, which occur in cases of fracture without union, have been generally supposed to resemble common joints. According to Boyer, this opinion is incorrect. The ends of the fracture, which are sometimes rounded and sometimes pointed, are connected together by a cellular and ligamentous substance. But their surfaces are not covered by a smooth cartilaginous matter, nor is there constantly a capsular ligament. "I am convinced of this fact, by the dissection of several ununited fractures, the fragments of which are preserved in my museum."—(*Boyer, t.* 3, *p.* 94.) And, in another place, the same professor, speaking of these false joints, remarks: "I repeat, that I have never found in their structure any thing which could be compared with an articulation; neither capsular ligament nor smooth cartilaginous surfaces. On the contrary, I have invariably found in the false joints of the thigh-bone and humerus, which I have had opportunities of dissecting, a fibrous ligamentous substance, extending from one fragment to the other, and it is very probable that, with some modifications, it is the same with all the other cases which I have not seen.

But, in the forearm, the ends of the fracture may assume a structure which bears a greater resemblance to an articulation. This is what happened in an example which was communicated to Bayle by Sylvestre, in the *République des Lettres, Juillet*, 1685, *p.* 718, *&c.* A similar case is recorded by Fabricius Hildanus, *obs.* 91, *centur.* 3."—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 101—103.)

On this subject Langenbeck observes, that the edges of the fragments heal and resemble those of a hare-lip. "When the parts are incessantly moved, the end of one fragment becomes excavated in the form of an articular cavity. I have in my possession (says he) a lower jaw and an olecranon, the fractures of which are not united. For the connecting medium, nature has provided a white substance resembling ligament. In a male patient I have also seen an articular connexion established in the body of the thigh-bone subsequently to a fracture."—(*Neue Bibl. b.* 1, *p.* 93.) When a capsule is formed, it is alleged not to be of a ligamentous nature.—(*Bichat, Anatomie Générale, t.* 3, *p.* 191.)

In the Hunterian collection may be seen a false joint in the bones of the forearm, where the resemblance to a natural articulation was greater than what Boyer has seen in other situations.

A valuable dissertation on false joints has been published by Reisseisen, entitled "*De Articulationibus analogis, quæ fracturis ossium superveniunt*;" but I am sorry that it has not been in my power to meet with a copy of it.

A false joint in the arm or forearm does not absolutely prevent the motion of the limb, which may yet be of considerable use; but when the disease is in the thigh or leg, the member cannot support the weight of the body, and the patient is unable to walk without crutches.

The diversity of causes which may be concerned in preventing the union of fractures, plainly shows, that the treatment should be different in different cases.

When the want of union is ascribable to the ends of the fracture not being in a state of coaptation, and to their having been moved about too frequently, the obvious indications are, to set the fracture better, and to take adequate measures for keeping its extremities in contact and perfectly motionless.

If the union has been prevented by a portion of muscle or other soft part getting between the ends of the bone, the only means of affording a chance of union would be cutting through the integuments, removing the displaced soft parts, and placing the ends of the bone in contact.—(*Wardrop, in Med. Chir. Trans. vol.* 5, *p.* 363.)

When the advanced age of the patient seems to be the cause of the union not taking place, the application of the proper apparatus is to be continued a considerable time, since experience proves, that in old subjects, the cure of fractures often requires many months. In such examples, also, tonic and cordial medicines, with a nutritive diet, are highly proper.

When several months have elapsed since the accident, and there is reason to apprehend that a preternatural joint is formed, a variety of plans have been proposed and practised.

The most ancient method of treatment is that of forcibly rubbing the ends of the fracture against each other, so as to make them inflame and take on a disposition to form callus. This plan was recommended by the late Mr. John Hunter, and has had the approbation of many other distinguished modern practitioners. Mr. Hunter used even to advise us, in the case of a disunited fracture of the leg or thigh, to let the patient get up and attempt to walk with the splints on the limb, so that the requisite irritation might be produced. The idea of exciting a degree of inflammation in the situation of the fracture, certainly appears rational, and I believe the practice has been attended with a limited degree of success. Mr. White records an example, in which he cured a broken thigh on this principle, a strong leather case having been made for the limb.—(*Cases in Surgery, p,* 75.) A broken tibia, treated on similar principles, is mentioned by Mr. Amesbury.—(*On Fractures, p.* 211, *ed.* 2.) The method is spoken of in Celsus: *si vetustas occupavit, membrum extendendum est ut aliquid lædatur: ossa inter se manu dimovenda, ut concurrendo exasperentur, et ut si quid pingue est, eradatur, totumque id quasi recens fiat, &c.*

The foregoing treatment, however, is only likely to answer before a new joint, or at all events, a ligamentous fibrous connexion is completely formed, and when the limb has hitherto been kept entirely motionless.

When the case is old, and there are grounds for believing that a preternatural articulation or fibrous ligamentous connexion has taken place, we are advised to cut down to the ends of the bone, rasp or saw them off, and then treat the limb just as if the case were a recent compound fracture.

This bold practice was first suggested by Mr. C. White. "Robert Elliot, of Eyham, in Derbyshire, a very healthful boy, nine years old, had the misfortune, about midsummer in the year 1759, by a fall to fracture the humerus, near the middle of the bone. He was immediately taken to a bone-setter in that neighbourhood, who applied a bandage and splints to his arm, and treated him as properly," says Mr. White, "as I suppose he was capable of, for two or three months. His endeavours, however, were by no means productive of the desired effect, the bones not being at all united. A surgeon of eminence in Bakewell was afterward called in; but as he soon found he could be of no service to him, and as the case was very curious, he advised the lad's friends to send him to the Infirmary at Manchester. He was accordingly brought thither the Christmas following, and admitted an in-patient. Upon examination, we found it to be a simple oblique fracture, and that the ends of the bone rode over each other: his arm was become not only entirely useless, but even a burden to him, and not likely to be otherwise as there was little probability that it could ever unite, it being now six months since the accident happened.

Amputation was therefore proposed as the only method of relief: but I could not give my consent to it, for as the boy was young and had a good constitution, it was hardly possible that it could be owing to any fault in the solids or fluids, but that either nature was disappointed in her work by frequent friction while the callus was forming, or rather, that the oblique ends of the bone, being sharp, had divided a part of a muscle, and some portion of it had probably insinuated itself between the two ends of the bone, preventing their union. Whichever of these might be the case, I was of opinion," continues Mr. White, "that he might be relieved by the following operation, viz. by making a longitudinal incision down to the bone, by bringing out one of the ends of it, which might be done with great ease, as the arm was flexible, and cutting it off either by the saw or cutting pincers; then by bringing out the other, and cutting off that likewise, and afterward by replacing them end to end, and treating the whole as a compound fracture.

The objections made by the other gentlemen concerned to this proposal were, first, the danger of wounding the humeral artery by the knife. Secondly, the laceration of the artery by bringing out the ends of the bones. And, thirdly, that we had no authority for such an operation. As to the first, that was easily obviated, by making the incision on the side of the arm opposite to the humeral artery. The place of election appeared to me to be at the external and lower edge of the deltoid muscle, as the fracture was very near to the insertion of that muscle into the humerus; the danger of wounding the vessel not only being by that means avoided, but after the operation, while the patient was confined to his bed, the matter would be prevented from lodging, and the wound be easily come at, to renew the dressings. The second objection will not appear to be very great, when we consider that in compound fractures the bone is frequently thrust with great violence through the integuments, and seldom attended with laceration of any considerable artery; and as this would be done with great caution, that danger would appear very trifling. The third and last objection is no more than a general one to all improvements.

This method which I have been proposing," says Mr. White, "was at last resolved upon, and I assisted in the operation, which was performed by a gentleman of great abilities in his profession, on January 3d, in the present year (1760). The patient did not lose above a spoonful of blood in the operation, though the tourniquet was not made use of. When the operation and dressings were finished, the limb was placed in a fracture-box, contrived on purpose, the lad confined to his bed, and the rest of the treatment was nothing different from that of a compound fracture.

The wound was nearly healed in a fortnight's time, when an erysipelas came on, and spread itself all over the arm, attended with some degree of swelling: this, by fomentations and the antiphlogistic method, soon went off, and the cure proceeded happily, without any other interruption. In about six weeks after the operation the callus began to form, and is now quite firm. The arm is as long as the other, but somewhat smaller, in consequence of such long-continued bandages: he daily acquires strength in it, and will soon be fit to be discharged."—(*Cases in Surgery, p.* 69, *&c.*)

In another instance of a broken tibia, which continued disunited an extraordinary length of time, Mr. White practised an operation somewhat similar to the foregoing one, with complete success. He made a longitudinal incision, about four inches in length, through the integuments which covered the fracture. By the application of a trephine, he cut off the upper end of the bone, and as the lower end could not be easily sawed off, he contented himself with scraping it. In the course of the subsequent treatment he had occasion to take off, with the cutting pincers, a small angle of tibia, and to touch the lower part of the bone with the butter of antimony, as well as to introduce the same caustic between the extremities of the fracture, in order to destroy a substance which intervened. A trifling exfoliation followed. In twelve weeks the bone was firmly united.—(*Op. cit. p.* 81, 82.)

Besides Mr. White's cases, there are now some other instances upon record where the operation which he first proposed has succeeded. In the year 1813 Langenbeck operated upon a humerus in the foregoing manner, and the result was perfectly successful. The ununited fracture was situated at the insertion of the deltoid.—(*Neue Bibl. b.* 1, *p.* 95.) Mr. Rowlands, of Chester, by a similar operation, cured a fractured thigh, which had lost all disposition to unite.—(See *Med. Chir. Trans. vol.* 2, *p.* 47.) Viguerie, surgeon to the Hôtel-Dieu, at Toulouse, has also practised Mr. White's operation with success.—(See *Larrey, Mém. de Chir. Militaire, t.* 2, *p.* 132.)

On the other hand, the operation has frequently failed. In the instance in which I saw it executed on the humerus by Mr. Long, in St. Bartholomew's Hospital, it did not answer, though the ends of the bone were most fairly sawed off, and the case treated with particular care and skill. Boyer states that he once performed the same operation in a similar case; but that it had not the desired effect.—(*Traité des Mal. Chir. t.* 3, *p.* 110.) Dr. Physick, of New-York, when he was a student in 1785, saw this proceeding unsuccessfully adopted in a case where the humerus remained disunited.—(See *Medical Repository, vol.* 1, *New-York,* 1804.) Besides these examples, I have heard of others, in which Mr. Cline, Mr. Green (*Med. Chir. Review, Feb.* 1828; and *Lond. Med. Gazette p.* 357), and other practitioners, have tried the experiment with no better success. What is still more discouraging, the operation has sometimes proved fatal.—(*Richerand, Nosogr. Chir. t.* 3, *p.* 39, *ed.* 2. *Larrey, Mém. de Chirurgie Militaire, t.* 2, *p.* 132.)

The difficulties, the danger, and the frequent ill success of the foregoing operation, rendered another mode of treatment extremely desirable, when Dr. Physick, of New-York, suggested the plan of introducing a seton through the preternatural joint, with a view of exciting inflammation, and bringing about a union of the bone. This suggestion promises to be a considerable improvement in modern surgery. Dr. Physick had an opportunity of performing the new operation on the 18th December, 1802, in an example of disunited humerus, twenty months after the occurrence of the accident. "Before passing the needle (says Dr. Physick), I desired the assistants to make some extension of the arm, in order that the seton might be introduced, as much as possible, between the ends of the bone. Some lint and a pledget were applied to the orifices made by the seton-needle, and secured by a roller. The patient suffered very little pain from the operation. After a few days the inflammation (which was not greater than what is commonly excited by a similar operation through the flesh of any other part) was succeeded by a moderate suppuration. The arm was now again extended, and splints applied. The dressings were renewed daily for twelve weeks, during which time no amendment was perceived; but soon afterward the bending of the arm at the fracture was observed not to be so easy as it had

been, and the patient complained of much more pain than usual, whenever an attempt was made to bend it at that place. From this time the formation of the new bony union went on rapidly, and on the 4th of May, 1803, was so perfectly completed, that the patient could move his arm in all directions as well as before the accident happened. The seton was now removed, and the small sores occasioned by it healed up entirely in a few days. On the 28th of May, 1803, he was discharged from the hospital perfectly well, and he has since repeatedly told me his arm is as strong as ever it was."—(*Physick, in Medical Repository, vol.* 1, *New-York.*) In the London Medical Repository for Aug. 1823, a case is also noticed, in which Dr. Physick cured an ununited fracture of the lower jaw by means of a seton.

On this subject an interesting memoir was read by Laroche to the Ecole de Médecine at Paris (*Germinal, an* 13). It was entitled "*Dissertation sur la non-reunion de quelques fractures, et en particulier de celles du bras, et sur un moyen nouveau de guerir les fausses articulations qui en resultent.*" The author of this production affirms, that when he was at Augsburg, he saw Baron Percy, then with the army of the Rhine, pass a seton through the imperfectly healed cicatrix of a compound fracture of the thigh, which fracture seemed to have lost all disposition to unite. The method answered so well, that in two months the patient was able to walk without crutches.

Mr. Brodie has also successfully employed the seton in a case of ununited broken thigh. The patient was a boy about 13.—(See *Med. Chir. Trans. vol.* 5, *p.* 387, *&c.*) In this country the same operation has been practised for the cure of a disunited humerus by Mr. Stansfield, of Leeds.—(See *op. cit. vol.* 7, *p.* 103, *&c.*) It appears, also, that Mr. Charles Bell applied the method to a fracture of the leg, at the time when Roux was in England. The patient was a child six years old, and the broken bones had continued without union three years. The case had been originally mistaken by some unskilful surgeon for a mere contusion. Roux knew not whether the operation succeeded or not.—(*Parallèle de la Chir. Angloise, &c. p.* 195.)

We are not to expect, however, that Dr. Physick's new operation will succeed in every instance. Like most other surgical means, it is liable to occasional failures, among which, I believe, we must include the attempt made on a disunited thigh by Mr. Wardrop (see *Med. Chir. Trans. vol.* 5, *p.* 365), though a partial amendment is mentioned. In a case recorded by Mr. Amesbury, the seton did not answer. Mr. Hutchison was also obliged to take out the seton in a case of ununited humerus, and no cure was effected.—(See *Practical Obs. p.* 162.) Three instances of failure were seen by Mr. Amesbury (*On Fractures, p.* 224), and an additional one has been recorded by Mr. Earle.—(See *Med. Chir. Trans. vol.* 12, *p.* 195.)

In the same case, and also in another which I saw under this gentleman's care, the plan of cutting down to the ends of the fracture, and rubbing them with caustic potassa was tried, but without success.

Instead of several of the foregoing severe and often unsuccessful plans, Mr. Amesbury has tried, with much encouragement, the influence of local pressure and rest. He maintains the ends of the fracture closely pressed together, the pressure, when the fracture is transverse, operating longitudinally, and when oblique, transversely. A short sling, pads, and a particular apparatus are used accordingly.—(*On Fractures, p.* 236.) Mr. Buchanan, of Hull, has related two cases, in which a union of the fractures followed a perseverance in the application of tincture of iodine.—(*On Diseased Joints, p.* 75.)

[This tribute to the ingenuity and skill of our countryman, Dr. Physick, is without doubt well merited; for the use of the seton in cases of artificial joint has found advocates in almost every country, and been attended with great utility and success. Its occasional failure, however, has led to the trial of *local pressure* by Mr. Amesbury; and in the *London Med. and Phys. Journal for* 1827, Mr. Brodie has recorded an instance of the success of this practice, after the failure of the seton. Dr. Thos. H. Wright, of Baltimore, and Dr. Webster, of Philadelphia, have each reported successful cases of Mr. Amesbury's treatment of ununited fracture, and pressure seems to promise to take the place of the seton in this country among surgeons generally. Dr. Wright's cases may be found in the *Am. Journal of the Med. Sciences for* 1828.—*Reese.*]

FRACTURES OF THE OSSA NASI.

These bones, from their situation, are much exposed to fractures. The fragments are sometimes not deranged; but most frequently they are depressed. In order to replace them the surgeon must pass a female catheter, a ring-handled forceps, or any such instrument into the nostrils, and using it as a lever, push the fragments outwards; while, with the index finger of the left hand, he prevents them from being pushed out too far. When the fragments are disposed to fall inwards again, some authors advise supporting them with an elastic gum cannula, or lint, introduced into the nostril; but I am inclined to believe, with Mr. C. Bell, that no tubes can be employed so as to support the broken bones; and when these have been replaced, they will not readily change their position, as they are acted upon by no muscles.—(See *Operative Surgery, t.* 2, *p.* 222.)

Besides, as Delpech remarks, since the tubes cannot reach the fragments, they cannot support them, and they must be attended with all the inconvenience of foreign bodies placed in contact with parts already inflamed, or about to become so.—(*Précis des Mal. Chir. t.* 1, *p.* 222.)

As fractures of the ossa nasi are the result of falls, and direct blows on the face, the soft parts are always either very much contused or wounded.

Fractures of the ossa nasi are sometimes attended with very dangerous symptoms; depending either upon the concussion of the brain, produced by the same blow which causes the fracture, or on the cribriform lamella and the crista galli of the os ethmoides being driven inwards, so as to injure and compress the brain. This last danger, however, some modern surgeons consider as void of foundation; and whenever the symptoms indicate an affection of the brain, the nature of the case is referred to the intimate connexion between the bones of the nose and the os frontis.—(*Delpech, Précis des Mal. Chir. t.* 1, *p.* 221, *8vo. Paris*, 1816.)

When there are symptoms of pressure on the brain (see *Head, Injuries of*), and the ossa nasi are much depressed, the surgeon must immediately raise them, and endeavour to draw gently forwards the perpendicular process of the os ethmoides, which is connected with the cribriform lamella and crista galli. Perhaps a pair of closed common forceps, introduced into each nostril, might best enable the surgeon to do what is necessary. Bleeding and the antiphlogistic treatment are always proper: for the vicinity of the eye renders it liable to become inflamed; and when there are symptoms of injury of the brain, extravasation, &c., the necessity of such practice is still more strongly indicated.

FRACTURES OF THE LOWER JAW.

This bone is sometimes fractured near the chin; but seldom so as to produce a division of the symphysis, the solution of continuity generally happening between this part and the insertion of the masseter. In other instances the fracture occurs near the angles of the jaw, that is to say, between the insertion of the masseter and the root of the coronoid process. The bone may also be broken in two places at the same time; in which event the middle portion is extremely difficult to keep right, because many of the muscles which draw the lower jaw downwards are attached to that part.

The condyles and coronoid processes are also sometimes broken; the former the most frequently.

Fractures of the lower jaw may be either perpendicular to its basis, oblique, or longitudinal: of the latter, examples have been known in which a portion of the alveolar process, with the teeth in it, was detached from the rest of the bone.

The soft parts are generally contused and wounded. J. L. Petit mentions one case in which the bone was broken, and the coronoid process quite denuded, by the kick of a horse.

Fractures of the lower jaw are subject to displacement in the following way. When the fracture is near the symphysis, the side on which the processus innominatus is situated is drawn downwards and backwards by the sub-maxillary muscles, while the other fragment is supported by the muscles which close the jaw. When the fracture is more backwards, the displacement occurs in the same way, but not so easily When the bone is fractured in two places, the middle portion is always pulled downwards and backwards by the muscles attached to the chin, while the two

lateral pieces are kept up by the levator muscles. When the ramus of the jaw is broken, the masseter, being attached to both pieces, prevents any considerable degree of displacement. When the neck of the condyle is fractured, the pterygoideus externus may pull the condyle forwards.

When a blow is received on the lower jaw, or the bone is injured by a fall, or by the pressure of some heavy body; when an acute pain is experienced in the part, and an inequality can be felt at the basis of the bone; when some of the teeth, corresponding to that inequality, are lower than the others; and when a crepitus is perceptible on moving the two pieces of the jaw on each other; there can be no doubt of a fracture. When the gums are lacerated, or the bone denuded by a wound, the case is (if possible) still more manifest.

Fractures of the rami and condyles produce great pain near the ear, particularly when the jaw is moved; and a crepitus may also be felt.

Fractures of the lower jaw, whether simple or double, are easily set by pushing the displaced part upwards and a little forwards, and then pressing on the basis of the bone, so as to bring it exactly on a level with the portion which has preserved its natural position. Indeed, the correctness of the reduction can always be rightly judged of by attending to the line which the base of the jaw ought to form, and observing that the arch of the teeth is as regular as nature will allow. The maintenance of the reduction, however, is difficult; and can only be well executed by supporting the lower jaw, and keeping it applied to the upper one. As the latter indication cannot be properly fulfilled in persons whose teeth are very irregular, it is sometimes necessary to interpose an even piece of cork between the teeth on each side of the mouth, and against this cork the lower jaw is to be kept up with the bandage presently noticed, while the aperture left between the incisores in the situation where no cork is placed, allows food and medicines to be introduced with a small spoon.

As soon as the fracture is set, the surgeon should adapt some thick pasteboard, previously wet and softened with vinegar, to the outside of the jaw, both along its side and under its basis. Over this moistened pasteboard, a bandage with four tails is to be applied, the centre being placed on the patient's chin, while the two posterior tails are to be pinned to the front part of a nightcap, and the two anterior ones fastened to a part of the same cap more backwards.* When the pasteboard becomes dry, it forms the most convenient apparatus imaginable for surrounding and supporting the fracture. A piece of soap-plaster may now be applied to the skin underneath, which will prevent any ill effects of the hardness and pressure of the pasteboard.

Until the bone is firmly united, the patient should be allowed only such food as does not require mastication, and it may be given by means of a small spoon introduced between the teeth. Broths, soups, jellies, tea, and other slops appear most eligible.

In order to keep the middle portion of the bone from being drawn downwards and backwards towards the larynx, it is frequently necessary to apply tolerably thick compresses just under and behind the chin; which are to be well supported by the bandage already described.

I need hardly state the necessity of enjoining the patient to avoid talking, or moving the jaw more than can possibly be avoided.

When the condyle is fractured, as it is incessantly drawn forwards by the action of the pterygoideus externus, and on account of its deep situation cannot be pressed back, the lower portion must, if possible, be pushed into contact with it. For this purpose the bandage must be made to operate particularly on the angle of the jaw, where a thick compress should be placed.

Compound fractures of the lower jaw are to be treated on the same principles as similar injuries of other bones. If possible, the external wound should be healed by the first intention; and when this attempt fails, care must be taken to keep the wound clean by changing the dressings about once in three days; but not oftener, lest the fracture suffer too much disturbance. It is observed that compound fractures of the jaw, and even simple ones, which are followed by abscesses, are particularly liable to be succeeded by troublesome and tedious exfoliations.

In very bad fractures, in which all motion of the jaw must have the most pernicious effect, I consider it prudent to administer every kind of nourishment in a fluid form through an elastic gum catheter, introduced through one of the nostrils down the œsophagus.

It now and then happens that fractures of the lower jaw continue ununited: Dr. Physick's successful treatment of one such case with a seton I have already noticed.

FRACTURES OF THE VERTEBRÆ.

On account of the shortness and thickness of these bones, they cannot be broken without considerable violence. The spinous processes which project backwards are the most exposed to such injury; for they are the weakest parts of the vertebræ, and most superficially situated. On this account it is possible for them to be broken without any mischief being done to the spinal marrow. The violence, which is great enough to break the bodies of the vertebræ, must produce a greater or less concussion or other mischief of the spinal marrow; from which accident much more perilous consequences are to be apprehended than from the injury of the bones abstractedly considered. The displaced pieces of bone may press on the spinal marrow, or even wound it, so as to occasion a paralytic affection of all the parts which derive their nerves from the continuation of this substance below the fracture.

Sir Astley Cooper divides fractures of the bodies of the vertebræ with displacement into two classes; first, those which occur above the third cervical vertebra; and, secondly, others which happen below that bone. The first cases, he says, are almost always *immediately* fatal, if the displacement be to the usual extent. In the second description of cases, death takes place at various periods after the injury. The reason of this difference is ascribed to the circumstance of the phrenic nerve originating from the third and fourth cervical pairs, whence in the first class of cases death is immediately produced by paralysis of the diaphragm, and the stoppage of respiration.—(*On Dislocations, p.* 552.)

As the mere concussion of the spine may occasion symptoms which very much resemble those usually occurring when the vertebræ are fractured, the diagnosis is generally obscure. An inequality in the line of the spinous processes and a crepitus may sometimes be distinctly felt. The lower extremities, the rectum, and bladder are generally paralytic; the patient is afflicted with retention of urine and feces, or with an involuntary discharge of the latter.—(*Boyer.*)

If the lumbar vertebræ be displaced, the lower extremities are rendered so completely insensible, that they may be pinched, burnt, or blistered without the patient suffering any pain. The penis in such cases is generally erect. In general, also, according to Sir Astley Cooper's observations, patients with fractured lumbar vertebræ die within a month or six weeks; but he knew of one patient that lived two years, and then died of gangrene of the nates. In fractures and displacement of the dorsal vertebræ, the symptoms are very similar; but the paralysis extends higher, and the abdomen becomes excessively inflated. Death commonly follows in two or three weeks; but Sir Astley Cooper remembers one case, in which a gentleman survived the accident nine months. Fractures of the cervical vertebræ, below the origin of the phrenic nerve, occasion paralysis of the arms, though it is seldom complete. Sometimes, when the fracture is oblique, one arm is more affected than the other. As the inter-

* [Dr. J. Rhea Barton, of Philadelphia, to whose science and skill I have had frequent occasion to allude, has devised a bandage for fractures of the jaw, to which a preference is now generally given in this country, as well for its superiority in retaining the fragments in a state of coaptation, as for the facility it affords in securing the dressings occasionally applied to wounds of the face and chin. He commences with "a roller an inch and a half wide just below the prominence in the occipitis, and continues it obliquely over the centre of the parietal bone across the juncture of the coronal and sagittal sutures, over the zygomatic arch, under the chin, and pursuing the same direction on the opposite side, until he arrives at the back of the head; he then passes it obliquely around and parallel to the base of the lower jaw over the chin; and continues the same course on the other side until it ends where he commenced, and repeats."—*Reese.*]

costal muscles are paralytic, great difficulty of respiration prevails. The abdomen is also considerably inflated. Death generally follows in from three to seven days.

Sir Astley Cooper notices the following as the appearances found in the dissection of such cases. The spinous process of the displaced vertebra is depressed; the articular processes are fractured; the body of the vertebra is broken through, the separation rarely happening in the intervertebral substance. The body of the vertebra usually projects forwards half an inch or an inch. Between the vertebra and the sheath of the spinal marrow blood is extravasated, and frequently on the lower part itself. When the displacement is slight, the spinal marrow is compressed and bruised. When greater, it is torn by the bony arch of the spinous processes, and a bulb is formed at each end, but the dura mater continues whole.—(See *A. Cooper on Dislocations, &c. p.* 554, *&c.*)

Fractures of the spinous processes without other serious mischief are not dangerous, and are the only instances of fractures of the vertebræ which admit of being detected with certainty.

Any attempt to set fractures of the bodies of the vertebræ, even were they known to exist, would be both useless and dangerous. General treatment can alone be employed. Cupping will tend to prevent inflammation in the situation of the injury. When the patient is affected with a flatulent distention of the abdomen, vomiting, hiccough, &c., the belly may be rubbed with camphorated liniment, and purgative clysters and antispasmodics given. If requisite, the urine must be drawn off with a catheter. When the bladder, rectum, and lower extremities are paralytic, it is common to rub the back, loins, sacrum, and limbs with liniments containing the tinctura lyttæ.—(*Boyer.*) With respect to the external and internal use of stimulants, however, it can never be judicious, when there is reason to apprehend much inflammation of the injured parts; and as for the idea of thus restoring the nervous influence, there can be little chance of success, the cause of its interruption being here of a mechanical nature.—(*Delpech, Mal. Chir. t.* 1, *p.* 222.)

Some authors recommend trepanning, or cutting out a portion of the fractured bone, when the compression of the spinal marrow or its injury by a splinter is suspected; but, according to my judgment, the indication can never be sufficiently clear to authorize the operation, which, on account of the great depth of the intervening soft parts, must be very tedious, and even difficult to effect without a great risk of increasing the injury which the spinal marrow may already have received. An unsuccessful operation of this kind was once performed by Mr. H. Cline, and another by Mr. Tyrrell.

Some cases, published by Mr. C. Bell, tend to prove that the danger to be apprehended from injuries of the vertebræ is the same as that which accompanies injuries of the brain. Hence, he joins the generality of practitioners in recommending general and local bleeding, and keeping the patient perfectly quiet. And, with respect to operations for the removal of fragments of bone, it is his decided belief that an incision through the skin and muscles covering the spine, and the withdrawing of a portion of the circle of bone which surrounds the marrow would be inevitably fatal, the membranes of that part being particularly susceptible of inflammation and suppuration. And even if a sharp spicula of fractured bone had run into the spinal marrow, and caused palsy of the lower parts of the body, Mr. C. Bell thinks that exposing the medulla to extract the fragment would so aggravate the mischief, that inflammation, suppuration, and death would be the inevitable consequences.—(*Surgical Obs. vol.* 1, *p.* 157.) The same author describes inflammation of the spinal marrow as "attended with an almost universal nervous irritation, which is presently followed by excitement of the brain: in the mean time, matter is poured into the sheath of the spinal marrow, and either by its pressure causing palsy, or by its irritation disturbing the functions of the part, so as to be attended with the same consequences. The excitement of the brain being followed by effusion, death ensues."—(*P.* 159.) Cases are also referred to, where palsy of the lower extremities comes on several months after an injury of the spine, owing to thickening of the membrane of the medulla, or disease of the latter part itself. Here Mr. C. Bell recommends perseverance in local bleeding and deep issues.—(*P.* 160.)

A fracture of the processus dentatus proves instantly fatal, as happened in the example mentioned by Sir A. Cooper.—(*On Dislocations, &c. p.* 548.) In the practice of Mr. Cline, a case occurred, in which a boy with a fracture of the atlas lived a year after the accident.—(*A. Cooper, op. cit. p.* 549. See also *L. T. Soemmering, Bemerkungen über Verrenkung und Bruch des Ruckgraths, 8vo. Berlin*, 1793. *F. A. F. Cuenotte, Dis. Med. Chir. sistens Casum Subluxationis Vertebræ Dorsi cum Fractura complicatæ, postfactam Repositionem et varia dira Symptomata duodecima demum Septimana funestæ. Argent.* 1761. *Case of Fractured Spine, Lancet, vol.* 2, *p.* 97.)

FRACTURES OF THE STERNUM.

The sternum is not frequently broken, and the reason of this fact is imputed to the position of this bone, resting, as it were, upon the cartilages of the ribs, and also in some measure to its spongy texture. When the accident does occur, it is from the direct application of external violence to the injured part; and hence the fracture is always accompanied with great contusion, or even a wound of the integuments, and more or less injury of the thoracic viscera. As Boyer remarks, the sternum, in consequence of the elasticity of the cartilages of the ribs, may be readily propelled backwards by pressure in this direction; and the result is an actual change in the form, and a real diminution of the chest. Now, since this cavity is always accurately filled by its contents, these alterations cannot happen in a considerable and sudden manner, without a risk of the thoracic viscera being contused and even ruptured. Thus, when the sternum has been fractured by violent blows on the chest, the heart and lungs have been found severely contused, and sometimes lacerated; and there will always be greater danger of such mischief, when the fracture is attended with depression of one or more of the fragments. In some cases, a large quantity of blood is effused in the cellular membrane of the anterior mediastinum; and, in others, the accident is followed by inflammation and suppuration in the same situation, and necrosis of the broken part of the bone. Since the lungs are also liable to be ruptured by the same force which causes the fracture, or wounded by the depressed pieces of bone, emphysema may become another complication, as we see exemplified in a case related by Flajani.—(*Collezione d'Osservaz. &c. di Chir. t.* 3, *p.* 214, *8vo. Roma*, 1802.)

A fracture of the sternum is rendered obvious by the inequalities perceptible when the surface of the bone is examined with the fingers; by a depression or elevation of the broken pieces; a crepitus, and an unusual moveableness of the injured part in respiration. In many cases, the fracture may be seen, the soft parts being torn or otherwise wounded. The breathing is difficult, and mostly accompanied with cough, spitting of blood, palpitations, and inability to lie on the back. According to the observations of Petit and Baldinger, several of these latter symptoms may continue, with less intensity, a long while after the fracture is cured. —(*Leveillé, Nouvelle Doctrine Chir. t.* 2, *p.* 243.)

Fractures of the sternum, when mere solutions of continuity, only require common treatment; viz. a piece of soap-plaster to the situation of the injury, a roller round the chest, quietude, bleeding, and a low regimen, with a view of preventing what may be considered as the most dangerous consequence, inflammation of the parts within the chest.

In cases attended with great depression of the fractured bone, the necessary incisions should be made, in order to raise with an elevator the portions of the bone driven inwards, or to extract with forceps any loose splinters, which seem to be similarly circumstanced. However, it is not often necessary to trephine the sternum, either to raise a depressed portion of the bone, or to give vent to extravasated fluid. In the first of these circumstances, I believe, with Mr. C. Bell, that the formal application of the trephine can never be right or necessary, though the surgeon may be called upon to extract loose splinters.—(See *Operative Surgery, vol.* 2, *p.* 218.) Such an operation, however, may occasionally be proper when abscesses form under the sternum, or the bone is affected with necrosis, and the natural separation of the diseased parts is likely to occupy a considerable time.

Fractures of the sternum are more frequently produced by gun-shot violence than any other cause; and in these cases, there are generally many splinters requiring extraction. At the battle of Marengo, the French general Champeux received such a wound, with which he lived nearly a month: the injury was attended with so many splinters, that when they were removed, the pulsations of the heart were visible to a considerable extent.—(*Leveillé, vol. cit. p.* 244.)

The ensiform cartilage, when ossified in old subjects, is liable to fracture. Little more, however, can be done in such a case, than relaxing the abdominal muscles by raising the thorax and pelvis, and then applying a piece of soap-plaster and a roller over the part, for the purpose of keeping it steady. When the blow has been violent, the patient should always be bled.

FRACTURES OF THE RIBS.

These generally happen near the greatest convexity of the bones, several of which are often broken together. The first rib being protected by the clavicle, and the lower ribs being very flexible, are less liable to be fractured than the middle ones.

When the spicula of a fractured rib is beaten inwards, it may lacerate the pleura, wound the lungs, and cause the dangerous train of symptoms attendant on emphysema.—(See *Emphysema.*)

A pointed extremity of the rib, projecting inwards, may also cause an extravasation of blood; or by its irritation produce inflammation in the chest. A fracture which is not at all displaced is very difficult to detect, particularly in fat subjects; and, no doubt, is very frequently never discovered. The surgeon should place his hand on the part where the patient seems to experience a pricking pain in the motions of respiration, or where the violence has been applied. The patient should then be requested to cough, in which action the ribs must necessarily undergo a sudden motion, by which a crepitus will often be rendered perceptible. All the best practitioners, however, are in the habit of adopting the same treatment, when there is reason to suspect a rib to be fractured, as if this were actually known to be the case by the occurrence of a crepitus, or the projection of one end of the fracture; which, indeed, in the instances which are displaced, makes the nature of the accident sufficiently plain.

A broken rib cannot be displaced either in the direction of the diameter of the bone, or in that of its length. The ribs, being fixed posteriorly to the spine, and anteriorly to the sternum, cannot become shortened. Nor can one of the broken pieces become higher or lower than the other, because the same muscles are attached to both fragments, and keep them at an equal distance from the neighbouring ribs. The only possible displacement is either outwards or inwards.—(*Boyer.*)

Simple fractures of the ribs, free from urgent symptoms, require very simple treatment. The grand object is to keep the broken bones as motionless as possible. For this purpose, after a piece of soap-plaster has been applied to the side, and over it proper compresses, a broad linen roller is to be firmly put round the chest, so as to impede the motion of the ribs, and compel the patient to perform respiration chiefly by the descent and elevation of the diaphragm. A scapulary will prevent the bandage from slipping downwards. When the fractured part is depressed inwards, the compresses should be placed on the anterior and posterior part of the bone. As a roller is apt to become slack, many surgeons, with good reason, prefer a piece of strong linen, large enough to surround the chest, and laced with pack-thread, so as to compress the ribs in the due degree.

When there is reason, from the symptoms, to think the lungs injured, or disposed to inflame, copious and repeated bleedings should be practised. Indeed, as peripneumony is always liable to succeed the accident, and is a most dangerous occurrence, every person free from debility, either having a broken rib, or supposed to have such, should always be bled in the first instance. The spermaceti mixture, with opium, is an excellent medicine for appeasing any cough, which may disturb the fracture, and give the patient infinite pain.

FRACTURES OF THE SACRUM.

Although more superficial than the other bones of the pelvis, the sacrum is less frequently fractured; a fact, explicable, as Boyer has remarked, by its thickness, its spongy texture, and the advantageous way in which it supports the weight and efforts of the whole trunk. For the sacrum to be broken, the violence must be very great, like that resulting from the fall of a very heavy body, or the passage of a carriage-wheel on the convex side of the bone, or a fall from a great height on that part. On the other hand, fractures of the sacrum, when they do happen, are more serious than those of the ossa innominata, because, in addition to the great degree of contusion and laceration, with which they in common with the latter cases are complicated, there is almost always great damage done to the sacral nerves; a kind of injury which may have fatal consequences. Hence retention of urine, inability to retain this fluid, involuntary discharge of the feces, paralysis of the lower extremities, &c. Another principal danger also depends upon the injury which the pelvic viscera may have suffered from the same violence which broke the bone.

When the fracture is situated at the upper part of the sacrum, which seldom happens on account of the thickness of the bone in that situation, there is no displacement, unless the bone is smashed, and the fragments are driven inwards by the same force which produced the fracture; a case which always implies severe injury of the external and internal soft parts. But when the fracture occupies the lower portion of the bone, where it is less thick, the inferior fragment may be displaced inwards, towards the rectum. And, as Boyer observes, fractures of the higher part of the bone are not in general easily detected.—(*Traite des Mal. Chir. t.* 3, *p.* 152.)

When the violence has been such as to make it probable that it has extended its effects to the pelvic viscera, every means in the power of art must be adopted for the prevention of inflammation. In particular, copious bleeding should be practised, and, if necessary, repeated. Leeches should also be applied to the vicinity of the sacrum, and the parts kept cool with the lotio plumbi acetatis. Any difficulty, either in the expulsion or retention of the urine and feces, will likewise claim immediate and constant attention.—(See *Urine, Retention of; Incontinence of, &c.*) With regard to the particular means for promoting the union of the fractured sacrum, quietude is the most important, and after the risk of inflammation is over, all that can be done is to apply a piece of the emplastrum saponis to the part, and put a roller round the pelvis, or a T bandage.

FRACTURES OF THE OS COCCYGIS.

Though much slighter than the sacrum, it is less frequently broken, because less exposed to external force, and capable of a degree of motion, by which it eludes the effect of violence. But in elderly persons, in whom the different pieces of the os coccygis are connected by anchylosis, a fall on the buttock may fracture this bone. The accident is known by the moveableness of the fragments, and the acute pain produced when the thighs are moved, the fragments being then disturbed by the action of the glutei muscles, some of whose fibres are attached to them.—(*Boyer, t.* 3, *p.* 160.)

The treatment of fractures of the os coccygis consists in enjoining quietude, employing discutient or emollient applications, according to the particular state of the soft parts, and taking blood away from the patient; adopting the antiphlogistic regimen, and enjoining the patient to avoid lying on his back or sitting down. He should also avoid walking, so as to put the glutei muscles into action, which would disturb the broken bone All formal attempts at reduction are not only useless in respect to the fracture, but highly injurious to the soft parts, which are not in a state to bear handling without ill effects.

FRACTURES OF THE OSSA INNOMINATA.

The situation and shape of the ossa innominata, and the thickness of the soft parts by which they are covered, explain why they are but seldom fractured. When such accidents happen, they are generally produced by the passage of heavy carriage-wheels over the pelvis, falls from great heights, the kick of a horse, &c., and are always attended with considerable contusion of the external soft parts, and sometimes with great injury of the pelvic viscera. The anterior superior spinous process of the ileum is sometimes broken off by the kick of a horse.—(*Boyer.*)

The two ossa innominata may be broken together; but commonly only one of them is thus injured. Most frequently the fracture takes place in the upper expanded portion of the bone, known under the name of the ileum, though sometimes it happens either in the ischium or the os pubis. The solution of continuity may be limited to one part of the bone, or extend to several parts of it; and there may be a greater or less number of fragments, and these attended or not with displacement. In many instances, in which the pelvis has been violently jambed between two bodies, or run over by a heavy carriage, the bones of the pelvis, besides being fractured, are dislocated, some interesting examples of which accident have been recently published.—(*A. Cooper's Surgical Essays, part* 1, *p.* 49, *&c.*)

During my apprenticeship at St. Bartholomew's Hospital, several cases occurred in which the os ileum, os ischium, and os pubis, were found fractured on opening the bodies after death; and when the great violence necessary to produce the accident is considered, we cannot wonder that the injured state of the pelvic viscera should frequently prove fatal. Fractures of the ossa innominata are unavoidably attended with more or less contusion of the soft parts on the outside of the pelvis; and when the violence has been very great, the pelvic viscera may be seriously bruised, crushed, or lacerated, and the large nerves contained in the pelvis, or the spinal marrow itself, injured: hence, extravasation of blood or urine in the cellular membrane of the pelvis; ecchymoses deeply situated even in the substance of the muscles or other organs; injury of the kidneys; complete loss of motion; a paralysis of the lower extremities; discharge of blood or a black bilious matter by vomiting or stool, either immediately or at more or less distant periods from that of the accident; retention of urine; fever; painful tension of the abdomen, from inflammation of the peritoneum and bowels; the formation of abscesses, which are sometimes of great extent; sloughing; and death.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 154.)

As the same author has observed, the violence occasioning a fracture of the ossa innominata may produce a displacement of the fragments, and carry them more or less away from their natural situation. When the pubes or ischium is broken, the splinters may be propelled into the canal of the urethra, or even through the bladder, and give rise to extravasation of the urine; or by merely compressing these organs, they may cause more or less interruption of their functions. But unless the fragments be displaced by the same force which caused the fracture, they can hardly be drawn out of their place by any other circumstance, since they are retained by the muscles attached to both fragments, and by surrounding ligamentous expansions.

Owing to the deep situation of fractures of the pelvis, and to there being no displacement nor mobility of the fragments, the diagnosis is sometimes attended with great difficulty. A suspicion of the accident may be entertained, when the pelvis has suffered great violence, the patient experiences great agony, and all motion of the trunk and lower extremities is difficult and painful. Under these circumstances, if the fracture should be in the ileum, especially its upper and front portion, or in the os pubis, the mobility of the fragments or even a crepitus may be distinguished in a thin subject, if, when he is lying horizontally, with his thighs and legs bent, and his head and chest elevated, the projecting part of the os innominatum be taken hold of, and an attempt be made to move the fragments in opposite directions. In this business, however, one caution is given by Boyer, viz. not to mistake the crepitation of an emphysema, often attending large extravasations of blood, for the grating of the fractured bone.

In cases in which the fracture affects a part of the os innominatum very deeply placed, and it is limited to a single point of the os pubis or the ischium, so that no detached moveable fragment has been produced, the exact nature of the case is rarely made out with certainty before the patient's death, and the dissection of the parts.

Fractures of the ossa innominata are cases accompanied with serious danger. When the fragments are displaced, and do not admit of being rectified again, the disorder arising from this cause may have fatal consequences. And, as Boyer observes, even when such displacement does not exist, these fractures are not the less to be apprehended on account of the injury which the spinal marrow and the nerves, vessels, muscles, and viscera within the pelvis are likely to have sustained. These complications, which are almost inseparable from the fracture, may prove indeed directly fatal, or destroy the patient at a period more or less remote from the time of the accident. One terrible accident of this kind, which I saw about two years ago, with Mr. Ives, of Cobham, proved fatal in about half an hour. Sometimes, however, the fracture is not extensive, and the violence which produced it has not caused any very serious injury of the viscera and soft parts: but examples of this kind are uncommon.

In these last cases, which are the most simple, a cure of the fracture may be easily effected by means of rest; a position in which all the chief muscles attached to the pelvis are relaxed; discutient applications; and a roller, or T bandage.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 156.) The grand indication is to obviate the consequences of inflammation of the parts within the pelvis, and even of the peritoneum and abdominal viscera, by copious and repeated blood-letting. Any complaints respecting the evacuation of the urine and feces must also receive immediate attention. When there is great contusion, and the bones are very badly broken, the patient cannot move nor go to stool without suffering the most excruciating pain. To afford some assistance in such circumstances, Boyer, in a particular case, passed a piece of strong girth web under the pelvis, and, collecting the corners into one, fastened them to a pulley suspended from the top of the bed. This enabled the patient to raise himself with very little efforts, so that a flat vessel could be placed under him. It appears to me that a bed constructed on the principles recommended by the late Sir James Earle, might be of infinite service in these cases as well as in many others, particularly compound fractures and paralytic affections from diseased vertebræ.—(See *Observations on Fractures of the Lower Limbs; to which is added an account of a contrivance to administer cleanliness and comfort to the bed-ridden; by Sir J. Earle*, 1807.) Mr. Earle has also exerted his mechanical ingenuity with great success in the invention of a bed, admirably well calculated for the treatment of fractures, and other cases, in which it is an object of high importance to enable the patient to empty the bowels without changing his position.

Sometimes, notwithstanding the rigorous adoption of antiphlogistic measures, abscesses cannot be prevented from forming in the pelvis; particularly when there are detached splinters driven inwards. These collections of matter should be opened as soon as a distinct fluctuation can be felt. The splinters may wound the urethra or bladder, and cause an extravasation of urine. Desault extracted a splinter which had had this effect from the bottom of a wound made for the discharge of the effused urine. In these cases, a catheter should be kept introduced, in order to prevent the urine from collecting in the bladder, and afterward insinuating itself into the cavity of the abdomen.—(*Chopart.*) A very interesting case of fracture of the ossa innominata, attended with rupture of the bladder, and followed by a fatal peritonitis, has been recorded by Cloquet.—(*Nouveau Journ. de Médecine, Mars*, 1820.) The ossa pubis were forced half an inch from each other. The horizontal branch of the pubes, and the ascending ramus of the ischium, were broken; the sacrum dislocated from the ossa ileum, and driven forwards within the cavity of the pelvis. The right sacro-iliac symphysis was broken only at its fore part, and its bones still retained their connexion. Vast quantities of blood were found extravasated in the lumbar region and about the pudenda. As soon as the abdomen was opened, three pints of a yellowish fluid, having a urinary smell, immediately gushed out. In this case, catheters of various sizes were introduced, even a syringe adapted to them was used, but nothing could be thus drawn off but a few drops of blood. The possibility of mistaking a fracture of the acetabulum for a dislocation of the thigh-bone, and the differences of these cases as explained by Sir A. Cooper, have been mentioned in the article *Dislocation*.

FRACTURES OF THE THIGH.

The os femoris is liable to be broken at every point, from its condyles to its very head; but it is at the middle third of this extent that fractures mostly occur. The fracture is sometimes transverse, but more frequently oblique. The latter direction of the injury makes a serious difference in the difficulty of curing the case without future deformity or lameness. Sometimes the fracture is comminuted, the bone being broken in more places than one; and sometimes the case is attended with a wound, communicating with the fracture, and making it what is termed *compound*. As Petit remarks, however, the thigh-bone is less seldom broken into several pieces than other bones more superficially situated.

A fractured thigh is attended with the following symptoms: a local acute pain at the instant of the accident; a sudden inability to move the limb; a preternatural mobility of one portion of the bone; sometimes a very distinct crepitus, when the two ends of the fracture are pressed against each other; deformity in regard to the length, thickness, and direction of the limb. The latter change, viz. the deformity, ought to be accurately understood; for, having a continual tendency to recur, especially in oblique fractures, our chief trouble in the treatment is to prevent it.—(*Desault, par Bichat, t.* 1, *p.* 181.)

Almost all fractures of the thigh are attended with deformity. When this is considered in relation to length, it appears that, in oblique fractures, the broken limb is always shorter than the opposite one; a circumstance denoting that the ends of the fracture ride over each other. We may also easily convince ourselves, by examination, that the deformity is owing to the lower end of the fracture having ascended above the upper one, which remains stationary. What power, except the muscles, can communicate to the lower portion of the fractured bone, a motion from below upwards? At one end attached to the pelvis, and at the other to this part of the bone, the patella, the tibia, and fibula, they make the former insertion their fixed point, and, drawing upwards the leg, the knee, and the lower portion of the thigh, they cause directly or indirectly the displacement in question. In producing this effect, the triceps, semi-tendinosus, semi-membranosus, rectus, gracilis, sartorius, &c., are the chief agents.

For the purpose of exemplifying the power of the muscles to displace the ends of the fracture, mention is made, in Desault's works, by Bichat, of a carpenter who fell from a scaffold and broke his thigh. The limb, the next day, was as long as the other; but the man had a complete palsy of his lower extremities, and could not discharge his urine. The moxa was applied, the muscles soon regained their power, and then the shortening of the limb began to make its appearance.

Besides the action of muscles, there is another cause of displacement. However firm the bed may be on which the patient is laid, the buttocks, more prominent than the rest of the body, soon form a depression in the bedding, and thence follows an inclination in the plane on which the trunk lies, which, gliding from above downwards, pushes before it the upper end of the fracture, and makes it ride over the lower one. The muscles, irritated by the points of bone, increase their contraction, and draw upwards the lower part of the bone: and from this double motion of the two ends of the fracture in opposite directions, their riding over each other results.

Transverse fractures are less liable to be displaced in the longitudinal direction of the bone, because, when once in contact, the ends of the fracture form a mutual resistance to each other; the lower ends, drawn upwards by the muscles, meets with resistance from the upper one, which being itself inclined downwards by the weight of the trunk, pushes the former before it, and thus both retain their position in relation to each other.

The deformity of a fractured thigh, in the transverse direction, always accompanies that which is longitudinal; but sometimes it exists alone. This is the case, when, in a transverse fracture, the two ends of the bone lose their contact; one being carried outwards, the other inwards; or one remaining in its place, while the other is separated. The upper end of the fracture is not now, as in the foregoing instance, motionless in regard to the muscular action; the contraction of the pectineus, psoas, iliacus internus, and upper part of the triceps, draws it from its natural direction, and contributes to displace it.

The deformity of the limb in regard to its direction, is either the consequence of the blow, which produced the fracture, or, what is more common, of the ill-directed exertions of persons who carry the patient. Thus we see that an injudicious posture bends the two portions, so as to make an angle.

Whatever may be the kind of deformity, the lower end of the fracture may retain the natural position in which it is placed, or else undergo a rotatory motion on its axis outwards, which is very common, or inwards, which is more unusual. This rotation always aggravates the displaced state of the fracture, and should be attended to in the reduction.—(*Desault, par Bichat, t.* 1, *p.* 180. 185.)

Every one, at all initiated in the surgical profession, knows that there are two very different methods of treating fractured thighs. In one, which was recommended and practised by Desault, and is still universally preferred in France, the limb is kept in the straight or extended position. In the other, the limb is laid upon its side, with the knee bent; a mode which was extolled by the celebrated Mr. Pott, and since his time has found many partisans in this country. To these two positions for fractured thighs may now be added that in which the patient lies upon his back, with his thigh and leg in the bent position, supported on two oblique planes, or surfaces, the apex or angle of which is beneath the ham. This last position, however, has been more particularly recommended for fractures of the neck of the femur, though, if it be advantageous for them, I see no reason for not giving it a fair trial in other fractures of that bone.

That Mr. Pott lost sight of certain advantages of the straight position; that he was blind to the imperfections of the bent posture; and that he exaggerated the power, which we have, of relaxing all the muscles of a limb by position; few reflecting surgeons of the present day will be inclined to deny.

Were we to resign the privilege of thinking for ourselves, and implicitly to mould our opinions according to any authority, however high, we should often fall into very avoidable errors. Were we to believe the literal sense of several passages in Mr. Pott's Remarks upon Fractures, we should suppose it possible and practicable to relax at once, by a certain posture of the limb, every muscle connected with a fractured bone. In the first vol. of his works, page 389, edit. 1783, he observes, in speaking of what must best answer the purpose of incapacitating the muscles from displacing the fracture: "Is it not obvious, that putting the limb into such position as shall relax the whole set of muscles belonging to, or in connexion with, the broken bone, must best answer such purpose?" and in the next page, "What is the reason why no man, however superficially acquainted with his art, ever finds much trouble in setting a fractured os humeri? is it not because both patient and surgeon concur in putting the arm into a state of flexion, that is, into such a state as relaxes all the muscles surrounding the broken bone?" Also, in page 393, he continues, "Change of posture must be the remedy, or rather, the placing the limb in such manner as to relax all its muscles." That to have all the muscles relaxed in cases of fracture would be desirable, were it also practicable, every one will admit; but the possibility of accomplishing it, so long as different muscles have different uses, different situations, and different attachments to the bones, every one must grant to be only a visionary project. For instance, do not the patient and surgeon, in the case of fractured os humeri adverted to above, rather concur in putting the fibres of the triceps and anconeus into a state of tension, at the same moment that they relax the biceps and brachialis internus?

The position of the fractured os femoris, says Mr. Pott, should be on its outside, resting on the great trochanter; the patient's whole body should be inclined to the same side; the knee should be in a middle state between perfect flexion or extension, or half-bent; the leg and foot, lying on their outside also, should be well supported by smooth pillows, and should be rather higher in their level than the thigh; one very broad splint of deal, hollowed out and well covered with wool, rag, or tow, should be placed under the thigh, from above the trochanter quite below the knee; and

another, somewhat shorter, should extend from the groin below the knee on the inside, or rather in this posture on the upper side. The bandage should be of the eighteen-tail kind, and when the bone has been set, and the thigh well placed on the pillow, it should not, without necessity (which necessity in this method will seldom occur), be ever moved from it again, until the fracture is united; and this union will always be accomplished in more or less time, in proportion as the limb shall have been more or less disturbed.—(*Pott.*)

Here only two splints are mentioned; the surgeons of the present day usually employ four. After placing the patient in a proper position, the necessary extension is to be made. Then the under splint, having upon it a broad soft pad, and an eighteen-tailed bandage, is to be laid under the thigh, from the great trochanter to the outer condyle. The surgeon, before applying the soap plaster, laying down the tails of the bandage, and putting on the other three splints, is to take care that the fracture lies as evenly as possible.

In the position for a fractured thigh, Mr. Pott, we find, directs the leg and foot to be rather higher in their level than the thigh; with what particular design, I have not myself been able to make out. Whoever meditates upon the consequence of elevating the leg and foot above the level of the thigh, in the bent position, will know that it is to twist the condyles of the os femoris more outward than is natural. When a patient is placed according to Mr. Pott's direction, upon a common bed, the middle soon sinks so much that the leg becomes situated very considerably higher than the thigh, and I am disposed to think that this is one cause why so many broken thighs are united in so deformed a manner, that the foot remains permanently distorted outwards. The great propensity of the triceps and other muscles to produce this effect, may also serve to explain the frequency of the deformity. It is not merely the depression of the middle of the bed which is disadvantageous: as the weight of the patient's body falls more upon one side of the bed than the other, in the bent position of the limb, unless the sacking be tight and the mattress very firm, it happens that such a declivity is formed as to render it exceedingly difficult, if not impracticable, to make the patient continue duly upon his side. It cannot be enjoined too forcibly, that fractured thighs should always be laid upon beds not likely to sink much. When this happens, no rational dependence can be put in the efficacy of the bent position, and, as Desault has explained, the same thing is hurtful also in the straight posture.

The most enthusiastic advocates for the bent position must allow, that it leaves the leg and foot too moveable and unsupported, and that, though it may relax the muscles, which have the most power to disturb the coaptation of a fractured thigh, it yet leaves a mass of muscle unrelaxed, quite sufficient to displace the ends of the bone. Hence, practitioners should endeavour to improve the apparatus employed, so that it may make a permanent resistance to the action of the muscles, and in the straight position such resistance may certainly be practised with most effect and convenience.

The whole tenor of Mr. Pott's observations on fractures would lead one to suppose, that from the moment a muscle is partially relaxed, it becomes incapable of acting on or displacing a fracture. But if this were correct (which it cannot be), we should not have the power of completely bending or extending our limbs; for as soon as the set of muscles designed for this purpose were partly relaxed by the half-flexion or half-extension of the joint, they would be deprived of all farther power. Therefore, in addition to the arguments to be brought against the bent posture, arising from its not actually relaxing all the muscles connected with the broken bone, we are also to take into the account the fact, that the partial relaxation of any muscle by no means incapacitates it from acting.

In the earlier editions of this Dictionary, I expressed a preference to Mr. Pott's method of treating broken thighs. More mature reflection, however, and subsequent experience have made me a convert to the sentiments of Desault on this subject. The terrible compound fractured thighs, which I had under my care in the campaign in Holland in the year 1814, could not have been at all retained by any apparatus put merely upon the thigh itself. The superiority of long splints, extending the whole length of the limb, was in these cases particularly manifest. With such splints, which maintain steady the fracture itself, the knee, leg, ankle, and foot, your patient may, in fact, even be removed upon an emergency from one place to another, without any considerable disturbance of the broken part. But how could this be done in the bent position, with short splints, merely applied to the thigh, affording no support to the leg, and not confining the motions of the knee and foot?

There are some excellent remarks on the treatment of fractured thighs in the writings of Desault. It is observed, that, if we compare the natural powers of displacement with the artificial resistance of almost every apparatus, we shall find that the disproportion between such forces is too great to let the former yield to the latter. The action of the muscles, however, which is always at first very strong, may afterward be gradually diminished by the extension exercised on them. A power incessantly operating can effect, what another greater power, temporarily applied, cannot at once accomplish, and the compression of circular bandages tends also to lessen the force of the muscles.

Desault cured in the Hôtel-Dieu an immense number of fractured thighs, without any kind of deformity. This success, it is said, was owing particularly to the well-combined employment of extension and compression of the muscles. The advantage of keeping the muscles a long while extended, in order to diminish their power, is especially evident in the reduction of certain dislocations, as those of the shoulder, in which we often cannot succeed till the muscles have been kept on the stretch for a greater or less time. The fracture of the patella and olecranon equally demonstrates the utility of compression for the same purpose; as when the muscles are not steadily compressed by the bandage, they draw upwards the fragment of bone with double or triple force.

To the reduction of fractured thighs in the bent posture, Desault entertained the following objections: the difficulty of making the extension and counter-extension, when the limb is so placed; the necessity of then applying them to the fractured bone itself, instead of a situation remote from the fracture, as, for example, the lower part of the leg; the impossibility of comparing with precision the broken thigh with the sound one, in order to judge of the regularity of its shape; the irksomeness of this position long continued, though it may at first seem most natural; the inconvenient and painful pressure of a part of the trunk on the great trochanter of the affected side; the derangement to which the limb is exposed when the patient has a motion; the difficulty of fixing the leg firmly enough to prevent the effect of its motion on the thigh-bone; the manifest impossibility of adopting this method, when both thighs are fractured; lastly, experience in France having been little in favour of such posture.

Also, what is gained by the relaxation of some muscles, is lost by the tension of others. For such reasons (certainly strong ones), Desault abandoned the bent position, and always employed the straight one, which was advised by Hippocrates.

Petit, Heister, and Duverney recommend the extending means to be applied just above the condyles of the os femoris. Dupouy remarked that this practice rendered it necessary to employ very great force, and he preferred extension from the foot. Fabre took also into consideration the inconvenience of the partial pressure made on the muscles, which, irritating and stimulating them to action, multiplies the obstacles to the setting of the fracture. For nearly similar motives Desault espoused their doctrine, introduced it at the Hôtel-Dieu, and the success which he experienced from the practice contributed materially to its more extensive adoption.

Desault, as we have stated, preferred the straight posture, and laid his patients on surfaces not likely to sink with the weight of the body. The feather-beds, formerly in common use at the Hôtel-Dieu, had this inconvenience. For these, in cases of fractures, Desault substituted a firm, tolerably hard mattress, which did not allow the continual change of posture to occur which a soft bed does. The object of every apparatus being to keep the ends of the fracture from being displaced, the mechanism of every contrivance for this purpose should be directed against the causes of the displacement. These are, 1, the action of the muscles drawing upwards the lower end of the fracture; 2, the weight of the trunk propelling downwards the upper

end. Hence, every apparatus intended to prevent displacement of a thigh fractured obliquely, should, 1, draw and keep downwards the lower end of the fracture; 2, carry and maintain upwards the upper end of the fracture, and the trunk which is above it. This principle is of general application, and only subject to a few exceptions in transverse fractures, attended merely with displacement in the direction of the diameter of the limb, or else none at all. 3, There must also be in the apparatus a resistance to the rotation of the lower portion of the broken bone, so as to keep the limb steady, even in case of any sudden motion.

If we compare the operation of the different pieces of our apparatus with the above indications, Desault says, we shall find, that without permanent extension they are not very effectual. With regard to bandages, whether a roller or eighteen-tailed bandage be used, they all have one common mode of operating; they press the muscles towards the ends of the fracture, so as to make them form a kind of natural case for the fracture, and thus they make lateral resistance against the parts. In this manner bandages materially aid in preventing displacement sidewise, and are particularly useful in transverse fractures. But what is there to hinder the two inclined surfaces of an oblique fracture from slipping one over the other? What power is there to keep the limb from receiving the effects of accidental shocks? Is the pelvis kept back? Is the action of the muscles resisted? The latter is indeed somewhat diminished by the pressure, and this is the chief use of the bandage; but will such compression be enough to prevent the longitudinal displacement of the broken bone, especially if the bandage be applied slackly as some advise?

These remarks apply also to compresses: *petit moyen contre une grande cause.*

Splints are useful in firmly fixing the limb, and guarding it from the effects of accidental shocks, or of contractions of the muscles. They operate more powerfully than bandages, in preventing lateral displacement; and hence they suffice for transverse fractures, without permanent extension. They also resist the rotation of the thigh outwards or inwards. But when the breach of continuity is oblique, will they hinder the ends of the bone from gliding over each other, and the consequent shortening of the limb? They obviously could only do so by the friction of the different pieces of the apparatus, especially the tapes, which fasten it; and then, to make the resistance effectual, they must be tied so tightly as to create danger of mortification. Will the splints prevent the trunk from descending, and propelling before it the upper end of the fracture? Will they hinder the action of the muscles on the lower end? Will they, in short, fulfil all the above indications? Their chief use is to prevent lateral displacement, and keep the limb steady. Hence, they should extend along the leg as well as the thigh, which cannot fail to be disturbed whenever the lower part of the limb is allowed to move.

The pads serve principally to keep the limb from being galled by the splints, and their action in preventing displacement of the fracture must be but trivial.

According to Desault, the ordinary pieces of apparatus, which do not execute any permanent extension, may suffice for transverse fractures; but they are always ineffectual when the division is oblique, because they do not fulfil the twofold indication of drawing downwards the lower end of the fracture, and keeping the other one upwards.

He inculcated that the object particularly to be aimed at was such a disposition, that the foot, leg, thigh, and pelvis should constitute but one whole; so that, though the different parts thereof might be drawn in different directions, yet they would still, with respect to one another, preserve the same mutual relation. He invented the following apparatus to answer these purposes.

A strong splint, long enough to extend from the crista of the os ileum to a certain length beyond the sole of the foot, and rather more than two inches and a half broad, with each of its extremities pierced in the form of a mortise, and terminating in a semicircular niche, is a principal part of Desault's apparatus. It is applied to the exterior side of the thigh, by means of two strong linen rollers, each more than a yard long.

The middle part of one roller is to be applied to the inside of the thigh, at its upper part; its ends are brought to the exterior side of the thigh, passed through the mortise, and knotted on the semicircular niche. Pads are to be previously placed under its middle part, in order to prevent any disagreeable pressure; as well as on the tuberosity of the ischium, which Desault considered as the principal point of action of this band. The inferior part of the leg is next covered with pads, on which the middle part of the second roller is placed, the extremities of which cross on the instep and upper part of the foot, then on the sole, after which they are conveyed outwards, and one end passed through the mortise, and knotted with the other on the niche, with such a degree of force as to pull the inferior portion of the femur downwards, and push the splint upwards, and, by this means, the pelvis and superior portion of the fractured bone. On the internal side of the limb is placed a second splint, which extends from the superior part of the thigh to a certain distance beyond the foot. A third is placed on the anterior part of the limb from the abdomen to the knee. The superior extremities of the anterior and exterior splints are fixed by means of a bandage passed round the pelvis. A roller, the middle part of which is placed under the sole of the foot, and the extremities crossed on its superior surface, and fastened to the splints, operates with them in preventing the foot from moving.

Before applying the apparatus, Desault covered the whole limb with compresses, wet with a solution of the acetate of lead. Over these Scultetus's bandage was put, and a roller round the foot, all wet with the same lotion. For more particulars the reader is referred to the *Parisian Chirurgical Journal*, *vol.* 1. *Œuvres Chir. de Desault, par Bichat*, *t.* 1. *Rosalino Giardina, Memoria sulla Fratture, con alcune Modificazione all' Apparato di Desault*, 8*vo. Palermo*, 1814. *Boyer, Traité des Maladies Chir. t.* 3. *Richerand, Nosogr. Chir. t.* 3, *édit* 4. Boyer's apparatus for fractured thighs is described in the last edition of the *First Lines of the Practice of Surgery.*

Instead of the position advised by Pott, or that recommended by Desault and Boyer, Mr. C. Bell prefers the posture in which the patient lies upon his back, with the limb supported in the bent attitude by means of a wooden frame. This machine is simple enough, consisting of boards ten or eleven inches in breadth, one reaching from the heel to the ham, the other from the ham to the tuberosity of the ischium. Under the knee-joint they are united at an angle, while a horizontal board connects their lower ends together. Thus they form two sloping surfaces, to which cushions are adapted, and over which the limb can be placed in an easy bent position. Near the edge of the inclined boards, holes are made furnished with pegs. After the bone has been set, a long splint is applied from the hip to the side of the knee, and another along the inside of the thigh.—(See *Operative Surgery*, *vol.* 2, *p.* 189.) I entertain a very favourable opinion of this mode of placing fractured thighs. However, the foregoing apparatus does not sufficiently secure the leg and foot from motion, though, with the aid of a roller and a foot-board, this advantage might easily be obtained. The fracture-apparatus, devised by my friend Mr. Earle, is excellently calculated for this mode of treatment, with these additional recommendations, that the obliquity of the two surfaces on which the limb reposes can be altered as occasion may require: there is a foot-board for the support of the foot, and a contrivance by which the patient is enabled to have stools without moving himself or changing his posture in the slightest degree.—(See his *Practical Observations in Surgery*, *p.* 125, *&c.* 8*vo. Lond.* 1823.)

Fractures of the Neck of the Thigh-Bone.

As this is a subject which has of late years excited considerable discussion, the reader cannot be too particular in noticing, that three distinct kinds of fracture, very different in their nature, treatment, and result, have been generally confounded together under the name of "fractures of the neck of the thigh-bone;" for much of the dispute that has prevailed, whether these fractures will unite like those of other bones, seems to have proceeded from the three species of fracture not having been properly discriminated. Two of the cases unite by means of callus, like other fractures; but the other, as it usually occurs, is conceived by some surgeons not to admit of a similar mode of union; or, at all events, they declare that the fact has

not yet been demonstrated. Sir Astley Cooper has therefore divided these cases, first, into *fractures which happen through the neck of the bone, entirely within the capsular ligament;* being the examples in which he thinks a union by bone has not yet been proved; secondly, into fractures through the neck of the bone *at its junction with the trochanter major, which fractures are of course external to the capsular ligament:* thirdly, into *fractures through the trochanter major, beyond its junction with the neck of the bone.*—(*On Dislocations, &c. p.* 114—116.)

Fractures of the neck of the thigh-bone are infinitely more frequent than dislocations at the hip, and may arise from a fall, either upon the great trochanter, the sole of the foot, or the knee. According to Desault, the first accident produces the injury much more frequently than the two latter. Of thirty cases which were seen by Desault, four-and-twenty arose from falls on the side. All those inserted by Sabatier in his interesting Memoir were the result of a similar accident. These authors, it is to be remarked, are not speaking particularly of the fracture within the capsular ligament; and hence, perhaps, the reason of their sentiments differing from those of Sir Astley Cooper, who observes, that in London the fracture within the capsule is most commonly produced by a person slipping off the edge of the foot-pavement. According to this eminent surgeon, a fracture of the neck of the thigh-bone, within the capsular ligament, seldom happens but at an advanced period of life; and the reason of the facility with which the injury takes place in old persons, he ascribes to the interstitial absorption which that part of the femur undergoes in individuals past a certain age, whereby it becomes shortened, and altered in its angle with the shaft of the bone. He admits, however, that the accident is frequently caused by a fall upon the trochanter major.—(*Surgical Essays, part* 2, *p.* 35, 36. *Also, Larrey, Journ. Complem. t.* 8, *p.* 98, 8*vo. Paris*, 1820.) Fractures of the neck of the thigh-bone within the capsule are more common in women than men.—(*J. Wilson, On the Skeleton, &c. p.* 245. *A. Cooper, On Dislocations, &c. p.* 122.)

The division is more frequently transverse than oblique; the neck being sometimes, in the former case, wedged in the body of the bone, as Desault found in several instances; a model of one of which, in wax, is preserved in the collection of *L'Ecole de Santé*, and the natural specimen of which was in the possession of Bichat. A fracture of the neck of the thigh-bone is sometimes complicated with one of the trochanter major.

With respect to the diagnosis of a fracture within the capsular ligament, an acute pain is felt, a sudden inability to walk occurs, and the patient cannot raise himself from the ground. The latter circumstance, however, is not invariable. In the fourth vol. of the *Mem. de l'Acad. de Chirurgie*, a case is related, in which the patient walked home after the accident, and even got up the next day. Desault published a similar example. The locking of one end of the fracture in the other may offer an explanation of this circumstance. The dissections made by Dr. Colles have recently led to another discovery, viz. that sometimes the solution of continuity does not extend completely through the neck of the femur.—(See *Dublin Hospital Reports, vol.* 2.) Three cases proving this fact are there adduced; a fact which at once explains the ability of some patients to walk directly after the injury, and the absence of all retraction of the limb. According to Mr. Amesbury, incomplete oblique fractures of the neck of the femur are easily produced in the recently dead subject.—(*On Fractures of the Upper Third of the Thigh-Bone, p.* 3.)

A shortening of the limb almost always takes place: the "leg becomes from one to two inches shorter than the other; for the connexion of the trochanter major with the head of the bone, by means of the cervix, being destroyed by the fracture, the trochanter is drawn up by the muscles as high as the ligament will permit, and consequently rests upon the edge of the acetabulum, and upon the ileum above it."—(*Sir A. Cooper on Dislocations, &c. p.* 117.) The action of the muscles drawing upwards the lower end of the fracture, the weight of the trunk in propelling downwards the pelvis and upper end of the fracture, are the two causes of the shortening of the limb. In general, a slight effort suffices for the restoration of the natural length of the limb; but the shortness recurs almost as soon as the extension ceases. "This evidence of the nature of the accident continues," as Sir A. Cooper correctly remarks, "until the muscles acquire a fixed contraction, which enables them to resist any extension which is not of the most powerful kind."—(*Surgical Essays, part* 2, *p.* 31.) Goursault and Sabatier remark, that sometimes the shortening of the member does not take place till a long while after the accident. In opposition to the common belief that the limb is shortened, Baron Larrey asserts, that the member is at first actually lengthened.—(*Journ. Complem. t.* 8, *p.* 99.) This statement I have never seen confirmed, and it is contradicted by daily experience. And to prove how widely Larrey differs from Sir A. Cooper, the following passage will suffice. "In order to form a still more decided judgment of this accident (says the latter writer) after the patient has been examined in the recumbent posture, let him be directed to stand by his bedside supported by an assistant, so as to bear his weight upon the sound limb. Immediately he does this, the surgeon observes most distinctly the shortened state of the injured leg, the toes resting on the ground, but the heel not reaching it, the everted foot and knee, and the diminished prominence of the hip."—(*Surgical Essays, part* 2, *p.* 34.) The lessened projection of the trochanter major arises from its not being supported by the neck of the bone, as it always is in the natural state of the parts. A swelling is observable at the upper and front part of the thigh, always proportioned to the retraction of which it appears to be an effect.

The projection of the great trochanter is almost entirely effaced. Directed upwards and backwards, this eminence becomes approximated to the crista of the os ileum; but, if pushed in the opposite direction, it readily yields; and, when it has arrived at its natural level, the patient becomes capable of moving his thigh.

The knee is a little bent. Abduction of the limb always occasions acute pain, and it is noticed by Sir A. Cooper, that the rotation inwards is particularly painful, because the broken extremity of the bone then rubs against the capsular ligament.—(*Vol. cit. p.* 33.) If, while the hand is placed on the great trochanter, the limb is rotated on its axis, this bony projection may be felt revolving on itself, as on a pivot, instead of describing, as in the natural state, the segment of a circle, of which the neck of the femur is the radius. This symptom, which was particularly noticed by Desault, is very manifest when the fracture is situated at the base of the neck, less so when at its middle; and it is not very perceptible when the breach is near the head of the bone. In the rotatory motions, the lower fragment rubbing against the upper one produces a distinct crepitus, which, however, is not an invariable symptom, as Larrey would lead one to suppose. In fact, as Sir A. Cooper has explained, it is not discoverable while the patient is lying upon his back with the limb shortened; but if the leg be drawn down, so as to bring the limbs to the same length, and rotation be then performed, especially inwards, the crepitus is sometimes observed, in consequence of the broken ends of the bone being thus brought into contact.—(*On Dislocations, &c. p.* 121.)

It appears to Mr. Amesbury, that the head of the bone moves so readily in the acetabulum, "that the least impetus, even through the periosteum and reflected membrane (supposing them to be entire), will cause it to move simultaneously with the shaft; and if it should do so in the same relative proportion, crepitus cannot be felt. If crepitus be not elicited by bending the limb upon the pelvis, the surgeon may try to produce it by causing the limb to be *gently rotated*, while he endeavours to fix the head of the bone by pressing it with his fingers back against the acetabulum."—(*On Fractures of the Upper Third of the Thigh-Bone, p.* 15.)

The toes are usually turned outwards; a position which Sabatier considers as the inevitable effect of the fracture, though Paré and Petit noticed that it did not constantly occur. Two cases, adduced by these illustrious surgeons, were not credited by M. Louis; but the experience of Desault fully confirmed the possibility of the limb not being always rotated outwards: and, as Sir A. Cooper has remarked, three or four hours generally elapse before the turning of the limb outwards is rendered most obvious by the fixed con-

traction of the muscles.--(*Surgical Essays, part* 2, *p.* 32.)

Mr. Langstaff dissected one case, in which the great toe was in the first instance everted, but subsequently turned inwards when the patient began to use the limb. "The preparation shows the fracture to have been within the capsular ligament, close to the head of the bone, and gives a decided refutation to the opinion of the length of the broken portion attached to the trochanter being the cause of the inversion, inasmuch as this part has been removed by absorption. The point of the foot was everted, while it retained its proper length, and only became inverted by a wise provision of nature to assist progression after it had begun to be shortened. This circumstance received great illustration in the person of Henry West, a boy from whom Mr. White, of the Westminster Hospital, removed the head, neck, and part of the trochanter of the left thigh-bone, in consequence of scrofulous disease of the hip-joint, attended by abscess. He recovered after the removal of the bone. The thigh is three inches and a half shorter than the other, and the toes turn inwards, not only in walking, but when he lies on his back in a quiescent posture, or prepared for sleep."—(*Guthrie, in Med. Chir. Trans. vol.* 13, *p.* 109.) The possibility of the foot being turned inwards directly after the accident, is the subject that now more immediately interests us. Of this occurrence an example is reported by Mr. Stanley. "A middle-aged man fell in the street, and his hip struck the curb-stone. The immediate consequences were, that the limb was inverted and shortened to the extent of an inch, and no crepitus could be discovered. It was presumed that a dislocation had occurred, and accordingly an extension of the limb was made, and so great was the constitutional irritation occasioned by the repeated trials to reduce the supposed dislocation, that the man died about five months from the time of the accident. In the dissection of the hip, a fracture was found, extending obliquely through the middle of the neck of the femur, but *entirely within the capsule*. A portion of fibrous and synovial membrane on the anterior side of the neck of the bone had escaped laceration." "In a male subject that had been brought for dissection, it was observed, that the left lower extremity was turned inwards and considerably shortened. On examining the hip, a fracture was found, extending through the neck and shaft of the femur. The neck had been broken at its junction with the shaft, and a fracture had extended from the upper part of the trochanter major downwards at the posterior side of the femur, a little below the trochanter minor. The upper part of the shaft was thus split into two portions, one of which was of sufficient magnitude to include the trochanter minor and nearly the whole of the trochanter major.

In the last two cases, it may be asked, to what cause the inversion of the limb should be attributed? Whether to the direction of the fracture? If not, whether there be any other circumstance adequate to its explanation? In the instance of fracture within the capsule, the portion of the synovial and fibrous membrane which had escaped laceration on the anterior side of the neck of the bone might probably prevent the limb from being turned outwards; but (says Mr. Stanley) why it should have been turned inwards, I confess myself unable to explain. In the instance of fracture without the capsule, by considering the direction of the fracture, in reference to the attachments of the muscles, we obtain an explanation of both points. For, as nearly the whole of the muscles that rotate the thigh outwards were connected with the separated portion of bone, they must have ceased to influence the limb in one direction, and of course have left their antagonists at liberty to turn it in the other; and the fractured surfaces being permitted to unite without any change in the position of the limb, the inversion would become permanent."—(*Med. Chir. Trans. vol.* 13, *p.* 508.) The merit of having first explained the cause of the inversion of the foot in certain fractures on the outside of the capsular ligament is due, I believe, to Mr. Guthrie. "When (says he) the fracture has taken place in such a manner as to be external to the insertion of these rotators outwards, yet sufficiently within the insertion of the glutæus medius and minimus, so as not to deprive them of their due action, the toe will be turned inwards and must always be so; or remain without any alteration of position, according to certain variations in the inclination of the fracture affecting the power of these muscles." In the instance recorded by Mr. Guthrie, the little trochanter was broken off; but whether it be an essential complication, he conceives must be determined by future observation.—(*Vol. cit. p.* 112.) The principles on which this gentleman founds his explanation have since been corroborated by the particulars of a case that was examined by Mr. Syme.—(See *Edin. Med. Journ. April*, 1826.) The reason of the foot being occasionally inverted, even when the fracture is quite within the capsular ligament, still remains, however, a point in surgery requiring explanation.

The ordinary position of the toes outwards is commonly, and I believe correctly, imputed to the rotator muscles. Bichat conceived, however, that if this doctrine were true, such position ought always to exist; and he reminds us, that all the muscles which proceed from the pelvis to the trochanter are, with the exception of the quadratus, in a state of relaxation, by the approximation of the femur to their point of insertion; and that the contracted muscles would not allow the foot to be so easily turned inwards again. Hence Bichat thought it probable, that the weight of the foot itself might pull the limb into the position in which it is commonly found. On the other hand, it is remarked by Sir A. Cooper, that any one may satisfy himself that the rotation of the limb outwards is in part owing to the muscles, by feeling the resistance which is made to rotation inwards, which resistance, however, he thinks, may in some measure depend upon the length of the portion of the neck of the femur, which remains attached to the trochanter major, and rests against the ileum.—(*Surgical Essays, part* 2, *p.* 32.)

In addition to the foregoing observations respecting the diagnosis, it is to be remembered, that a fracture within the capsular ligament seldom happens but at an advanced period of life, and is much more frequent in women than men.—(*Sir A. Cooper on Dislocations, &c. p.* 123.)

A fracture of the neck of the thigh-bone, on the outside of the capsular ligament, is attended with but little shortening of the limb, and is frequently met with in persons under fifty, though it may and does occur in older subjects. Also, while the fracture within the capsule takes place from very slight causes, this is generally the result of great violence, severe blows, falls, and the passage of heavy carriages over the pelvis. The crepitus can be easily felt without previously drawing down the limb, and the case is characterized by greater suffering than what is usually noticed when the fracture is within the capsule. But the most important circumstance in which a fracture on the outside of the capsule differs from one within it is, in its readily admitting of bony union, which it is much more difficult to accomplish in the latter case, and so rare as to be doubted by a surgeon of the highest reputation and greatest experience.—(See *Sir A. Cooper on Dislocations, &c. p.* 185, &c.)

In an oblique fracture through the trochanter major, without injury of the neck of the bone, the leg is very little, and sometimes not at all, shortened; the foot is benumbed; the patient cannot turn in bed without great difficulty and pain; in some cases the detached portion of the trochanter is drawn forwards towards the ileum; in others it falls towards the tuberosity of the ischium; but in general it is widely separated from that portion which remains connected with the neck of the bone. The foot is considerably turned outwards, and a crepitus not readily detected. This accident may happen at any period of life. It unites readily, and the patient recovers with a very good use of the limb.—(*Vol. cit. p.* 158.)

Many years ago, it was supposed that fractures of the neck of the thigh-bone could not be cured, without some shortening of the limb and lameness. Ludwig, Sabatier, and Louis broached this doctrine, and imputed the circumstance to the destruction of the neck of the bone. That this sometimes happens has been well ascertained. A late surgical visiter to Paris informs us, that in several specimens which he examined in different museums, whether imperfect union or no union at all had followed the fracture, this absorption of the neck of the bone had taken place to a great extent, and in some to so great an extent that the articulating surface of the bone which plays in the acetabulum rested between the trochanters, consolidated to the body of the bone by ligamentous union, and the thickening of

the surrounding parts, while all the intervening neck of the bone was absorbed.—(See *Sketches of the Medical Schools of Paris, by J. Cross, p.* 90.) M. Roux has also nearly always found the neck of the femur shortened and deformed after its reunion.—(*Parallèle de la Chir. Angloise avec la Chir. Francoise, p.* 178.) Desault, however, in his practice, is said to have rarely met with instances of lameness from such a cause.

A question that has lately been much agitated (see *Earle's Practical Obs. in Surgery, Lond.* 1823; *and Amesbury's Obs. on the Nature and Treatment of Fractures of the Upper Third of the Thigh-bone, &c. Lond.* 1829, *ed.* 2) is, whether reunion by bone ever follows *cases in which the fracture is entirely within the capsule*, and the head of the bone insulated, except at its attachment to the acetabulum by the round ligament? A few years ago, the decision of the French surgeons used to be in the affirmative, and they pretended actually to demonstrate the fact by preparations in their museums. M. Roux, indeed, sent over a specimen to Sir A. Cooper, with the hope of producing conviction; but this eminent surgeon was not satisfied with the evidence, because the traces of reunion in the preparation appear to him to indicate a sort of fracture, where the internal fragment still retained some connexion with the capsular ligament.—(*Roux, Parallèle de la Chirurgie Angloise, &c. p.* 179, 180.) In fact, it was a case in which the fracture happened at the junction of the cervix with the trochanter. And Sir A. Cooper distinctly states, that in all the examinations which he has made of *transverse fractures of the cervix femoris, within the capsular ligament, he has never met with a bony union, or with any which did not admit of motion of one bone upon the other.*—(*Surgical Essays, part* 2, *p.* 39.) He imputes the want of bony union to the fragments not being in contact and duly pressed against each other, and to the little action in the head of the bone separated from the cervix, "its life being supported solely by the ligamentum teres, which has some few vessels ramifying from it to the head of the bone." For the particular appearances found in the dissection of these cases, I must refer to the statements of Dr. Colles (*Dublin Hospital Reports, vol.* 2), and to Sir Astley Cooper's own account, from which it seems that "no ossific union is produced; that nature makes slight attempts for its production upon the neck of the bone and upon the trochanter major, but scarcely any upon the head of the bone; and that if any union is produced, it is by ligament only."—(*Vol. cit. p.* 46.) Mr. Wilson's observations are all in confirmation of the same explanation (*On the Skeleton, p.* 247); and he adverts to two preparations in the museum of the College of Surgeons, which have been supposed to be proofs of a bony reunion of the neck of the femur, subsequently to a fracture within the capsular ligament; but (says Mr. Wilson) "I have very attentively examined these two preparations, and cannot perceive one decisive proof in either of the bone having been actually fractured." One of these cases is that which was published by Mr. Liston in the *Edin. Med. and Surg. Journ.* Lastly, Dr. Colles, of Dublin, dissected several cases, in which the neck of the femur had been broken. In one, where the injury was within the capsular ligament, "no effort of nature had been made to create a reunion between the two pieces of the fracture, and *the stability of the limb had depended upon the strength of those ligamentous bands, by which each piece was connected with the capsular ligament of the joint, aided, no doubt, by the extraordinary thickness which the capsular ligament had acquired.*"—(*Dublin Hospital Reports, vol.* 2, *p.* 336.) In the first two instances reported by this author, "the broken surfaces moved on each other, and were converted into a state approaching to ivory. No attempt had been made to reunite the fracture, and the pieces of bone were held in apposition only by new ligamentous productions from the capsular ligament, which were inserted into the external surfaces of each piece. In No. 3 there had been a slight attempt made at reunion. In Nos. 7, 8, and 9, we observed *a phenomenon, which*, I believe, *is now for the first time mentioned, a fracture of only part of the bone.* No. 6 presented us with that mode of reunion which some have supposed the most perfect of which this fracture is susceptible. While Nos. 10 and 11 exhibit a mode of reunion very little inferior to callus in point of firmness, but very different in its nature, and which I conceive is peculiar to the fracture of the neck of the femur." Dr. Colles also found that, in all these cases (except, perhaps, No. 5), the *capsular ligament was not lacerated.* In every instance, however, there was an *increased thickness of the capsule*, and *a removal of all or the greater part of the neck of the bone.* "Although the ligamentous bands seem, in a majority of instances, to have proceeded from the capsular ligament, yet it is evident from No. 6, that these may arise merely from the broken surfaces of the bone; for in this case, not a single fibre was attached to the capsular ligament, the new bond of union being covered by the reflected portion of the synovial membrane or periosteum of the neck. We have an illustration of this in *Ruysch, tab.* 1, *thes.* 9." In Nos. 10 and 11, the fragments were united by a cartilaginous substance. In Nos. 7, 8, and 9, the unbroken portion of the neck was so softened, that it more resembled cartilage than bone, and, in this state, "it was laid down upon the fractured surface, and united to it."—(*Dr. Colles, in Dublin Hospital Reports, vol.* 2, *p.* 353—355.) In the Museum of the Ecole de Médecine at Paris, there are some preparations which the professors exhibit at their lectures, in order to prove that bony union may succeed a fracture of the femur. These specimens were carefully examined by Mr. Cross; but none of them proved to him that bony union ever follows where the head of the bone becomes insulated, excepting its attachment to the pelvis by the ligamentum teres.—(*Sketches of the Medical Schools at Paris, p.* 93.) On the other hand, Boyer observes, that experience fully proves the possibility of uniting such fractures of the neck of the thigh-bone as are situated within the capsular ligament; but he acknowledges that there are certain circumstances which may prevent this desirable event. "From all that has been hitherto said on the prognosis of a fracture of the neck of the femur, we may conclude (says Boyer) that this fracture is more serious than that of any other part of the same bone, because the difficulty of keeping it reduced is greater. That it may in general be reunited, especially in young, healthy subjects (in whom, however, be it observed, the accident hardly ever occurs); but more easily when it is situated near the base of the neck than near the head of the bone. That the languid vitality of one of the fragments, and the impossibility of ascertaining whether the coaptation be exact, make the cure slow, and the time necessary for their consolidation uncertain. That the neglect of means adapted to maintaining the limb in its proper length and natural straightness, and the fragments sufficiently motionless, may cause them to unite by an intermediate substance. Lastly, that the situation of the fracture near the head of the femur; *the complete laceration of the elongation of the capsule investing the neck of the bone*; the great age of the patient; and particularly the constitution labouring under some diathesis, which affects the osseous system, may render the cure absolutely impossible; *that, in this circumstance, one of the fragments is more or less destroyed by the friction of the other against it*, and in the joint a disease is formed, which tends to carry off the patient."—(*Traité des Mal. Chir. t.* 3, *p.* 284.) This professor lays much stress on the complete laceration of the continuation of the capsule over the neck of the bone, as an occurrence preventive of union. But he thinks it does not frequently happen, because the capsular ligament hinders much displacement of the fragment (*op. cit. p.* 278); a remark rather at variance with the shortened state of the limb. As for Baron Larrey, he appears to entertain no doubt of the possibility of uniting fractures of the neck of the femur within the capsular ligament, and concludes his tract on this subject with the case of General Fririon, who was perfectly cured after a supposed injury of this description.—(See *Journ. Complém. t.* 8, *p.* 118.) That some French surgeons, however, are now beginning to be less positive in their belief, is sufficiently manifest from the circumstance of a reward having been offered in France for the best explanation of the cause of such fractures not uniting by bone.—(*Sir A. Cooper, Appendix, p.* 43.)

How is this discordance to be reconciled and accounted for? After the very numerous and careful dissections which have been performed by Sir. A. Cooper and Dr. Colles, with the view of ascertaining the state of the joint, after fractures of the neck of the thigh-bone, little doubt can be entertained that, where the fracture is *transverse*, and *within the capsular ligament, a bony reunion, if not absolutely impossible, is at least so*

rare an occurrence as not to be calculated upon. The difference of the French surgeons upon this question is to be ascribed to their not having duly discriminated from the foregoing kind of case either fractures extending more or less in the direction of the axis of the neck of the bone, or other fractures external to the capsular ligament. How much, however, the safety of a practitioner's reputation will depend upon the prognosis which is given must be quite evident; for in *the transverse fracture within the capsule, lameness is almost sure to follow, though its degree cannot at first be exactly estimated.*—(*Sir A. Cooper, Surgical Essays, part* 2, *p.* 51.)

As far as I am able to judge of this subject, Sir Astley Cooper has been the means of introducing clear and discriminate views of it, and, without his able exertions, the important differences in the nature, symptoms, and curableness of the various kinds of fractures of the neck and upper part of the thigh-bone, depending upon their exact situation and direction, might yet have continued very imperfectly comprehended. This remark is made without any intention of deducting from the merits of Desault, Platner, and Mr. John Bell; all of whom seem to have expressed their belief, that a fracture within the capsular ligament will not admit of union by callus.--(*C. Bell on Injuries of the Spine and Thigh-bone*, 4*to. Lond.* 1824, *p.* 52, *&c.*)

Mr. Amesbury, in his late treatise, attempts to prove, that all fractures of the neck of the thigh-bone admit of union, whether they be situated quite within the capsular ligament or not, and whether the reflected portion of that ligament be ruptured or not; and he ascribes the usual want of success, not to the nature of the injury, not to the insufficient circulation in the pelvic portion of the bone, but to the imperfection of the mechanical means employed in the treatment. As, however, the important point under consideration, namely, whether transverse fractures of the neck of the femur, situated entirely within the capsular ligament, admit of bony union, is one that can only be determined by experience, Mr. Amesbury follows up his arguments by a reference to cases. "Though," says he, "Sir Astley has not, I believe, yet seen a specimen sufficient to convince *him* that this variety of fracture has ever united by bone, there are now four preparations, which satisfy the minds of many other surgeons that osseous union is occasionally produced." The first case adduced is one that was under the care of Mr. Cribbe, of Holburn, and is described by Mr. Langstaff, who has the prepartion: "The woman was about 50 years of age when the accident occurred. The foot was everted, and there was shortening of the limb at this time; and, after death it was shorter than the other full two inches and a half. She was confined to bed nearly twelve months: during the remainder of her life, which was ten years, she walked with crutches. This (says Mr. Langstaff, alluding to the preparation) is a specimen of fracture of the neck of the thigh-bone within the capsular ligament; the principal part of the neck is absorbed; the head and remaining portion of the neck were united principally by bone, and partly by a cartilaginous substance. The capsular ligament was immensely thickened, and embraced the joint very closely. The cartilaginous covering of the head of the bone and acetabulum had suffered partial absorption; the internal surface of the capsular ligament was coated with lymph. On making a section of the bone, it was evident, that there had been *a fracture of the neck within the capsular ligament, and that union had taken place by osseous and cartilaginous media.*"—(See *Med. Chir. Trans. vol.* 13.) Mr. Amesbury then adverts to Dr. Brulatour's case reported in the same volume of the latter work. This gentleman died about nine months after the injury. The following appearances presented themselves. 1. The capsule a little thickened. 2. The cotyloid cavity sound. 3. The interarticular ligament in a natural state. 4. The neck of the femur shortened: from the bottom of the head to the top of the great trochanter was only four lines, and from the same point to the top of the small trochanter six lines. 5. An unequal line surrounded the neck, denoting the direction of the fracture. 6. At the bottom of the head of the femur, and at the external and posterior part, a considerable bony deposite had taken place. A section of the bone was made in a line drawn from the centre of the head of the femur to the bottom of the great trochanter, so as perfectly to expose the callus. The line of bone indicated by the callus was smooth and polished as ivory. The line of callus denoted also that the bottom of the head of the femur had been broken at its superior and posterior parts.

In another example communicated to Mr. Amesbury by Mr. Chorley, of Leeds, a gentleman died twelve months after the accident, and on examining the hip, the synovial covering was found united with the shortened neck of the bone nearly at the head. Here nature had also thrown out broad ligamentous bands, one on each side of the joint. They were firmly united to the head of the bone. When the soft parts had been removed, the head of the bone was seen depressed in a line with the shaft. The fracture was slightly oblique, commencing at the upper part close against the cartilaginous covering of the head of the bone, and extending downwards and outwards, so as to terminate in a point at the lower surface of the neck, one inch from the cartilaginous covering of the head. The posterior surface of the shell of the neck had the appearance of having been splintered, so as to make a part of the fractured end of the pelvic portion extend in one situation a little on the outside of the capsular ligament, and where no union had taken place.

In a fourth instance, where the necks of both thigh-bones had been broken at different periods, the parts were examined after the patient's decease. On the right side, the fracture extended through the neck of the bone, in a direction downwards and outwards. In one part a portion of the reflected membrane remained entire; but was separated from the neck of the bone in such a manner as not to prevent the retraction of the limb. The head of the bone was somewhat excavated; and that portion of the neck attached to the trochanter was partially absorbed. There was no soft substance between the surfaces of the fracture. A bond of union, however, consisting of fibrinous matter, adhered to the sides of the ends of the fracture, and in one part it was strong. No surgical attempt had been made to unite the fracture on the right side. On the left, the neck of the bone had been broken within the capsule, and was firmly united. The cervix was nearly absorbed; and the head was depressed, so as to come within about two lines of the trochanter minor, to which it was united at its base by a small short process of bone. Strong bands of ligament were seen connecting the pelvic portion of bone to the capsule, which had become thickened and much smaller than natural. There had been a longitudinal fracture of the trochanter major, but quite independent of the injury of the cervix. The fracture of the latter part was united with the head, about two inches and a half below its natural situation; which leads Mr. Amesbury to believe, that what he terms the close coverings of the neck of the bone had been nearly or quite divided. A longitudinal section of the head and neck of the bone showed, according to Mr. Amesbury, that the fracture had taken place close to the head. The uniting callus had become cancellated; but he says that the direction of the fracture could be seen "by the situation of the trochanteral portion of the neck, when examined in different parts of its circumference."—(See *Amesbury on Fractures, &c p.* 43, *&c.*)

With respect to some of these cases and dissections, if they are correctly described, they sufficiently establish the possibility of bony union in fractures entirely within the capsular ligament; but in order that the point may be completely settled, I should recommend Mr. Amesbury to submit the preparations to which he refers to a committee of the profession, including those gentlemen who have not hitherto been satisfied with any specimens yet presented to them. The rapidity with which absorption proceeds in the head and neck of the thigh-bone after fractures, brings about such changes as must soon greatly obscure the exact original situation and direction of the injury, and particularly the question whether the injury reached also on the outside of the capsular ligament. That fractures extending beyond the capsular ligament may be united by bone, is admitted by all parties, as well as the fact, that those entirely within the capsule are often united with the intervention of fibrous or ligamentous bands. In confirmation of this circumstance, I have already cited the dissections performed by Dr. Colles, of Dublin; and, in farther proof of it, I refer to the preparations in the museum of the College of Surgeons at Edin-

burgh, as specified by Mr. B. Bell of that city.—(See *Treatise on the Diseases of the Bones*, p. 205, &c. 1828.)

Having spoken of the nature of fractures of the neck of the thigh-bone, within and without the capsular ligament, I come next to the consideration of the proper practice to be adopted. In the first description of the injury, as osseous union is rare, perhaps even not attainable, ought we to endeavour to keep the fragments as nearly in a state of apposition as possible, and subject the patient to rest and confinement, with the view of promoting the other modes of union so well pointed out in Dr. Colles' paper? Or should we, as Sir A. Cooper does, avoid confining the patient to any long or continued extension, "as being likely to be productive of ill-health, without the possibility of producing union?" Yet it appears both from this gentleman's own statements, and from those of Dr. Colles, Mr. Langstaff, Mr. B. Bell, and others, that though a bony union cannot always be effected, other connecting means may be established, and the more perfect these are, the less will be the subsequent lameness. As long, therefore, as these facts are incontrovertible, I should be disposed to recommend surgeons to do every thing in their power to keep the limb quiet, and in a desirable posture for a due length of time. On this point all surgeons must, on reflection, be unanimous. It is one that I have always insisted upon in my surgical writings, and it is one that is very properly defended by Mr. Amesbury in his recent publication. Whether, for this purpose, Boyer's apparatus, with the limb in the straight posture; or the apparatus with two inclined surfaces, with the limb in the bent position, and the patient on his back; or, lastly, Hagedorn's ingenious and scientific treatment, as explained in the last edition of the *First Lines of Surgery*, should be preferred, time and experience must determine. Sir A. Cooper merely places one pillow under the whole length of the limb, and puts another transversely under the patient's knee, so as to keep the limb in an easy bent position. In a fortnight or three weeks the patient is allowed to sit upon a high chair, and in a few more days he begins to take exercise upon crutches. After a time, these are laid aside, a stick substituted for them, and in a few months this assistance may be dispensed with. At the end of the treatment, a shoe must be worn with a sole of equal thickness to the diminished length of the limb.—(*Surgical Essays*, *part* 2, *p.* 50.) For the management of fractures of the neck of the thigh-bone, Messrs. Amesbury and Earle employ fracture-beds, constructed with the view of fulfilling all the main indications, and in particular of keeping the ends of the fracture at rest in the best position. Their contrivances display great ingenuity, and well deserve the attention of the profession.

In the treatment of such fractures of the neck of the femur as are situated on the outside of the capsular ligament, Sir A. Cooper prefers the position in which the patient lies on his back, with the injured limb in a bent posture, supported on what is termed the double-inclined plane, the kind of instrument already spoken of, as being sometimes employed by Mr. C. Bell. When the limb has been placed over this machine in an easy bent position, a long splint, reaching above the trochanter major, is applied to the outer side of the thigh, and fastened to the pelvis with a strong leather strap, so as to press one portion of bone towards the other. The lower part of the splint is also fastened to the outside of the knee with a strap. The limb is to be kept as quiet as possible for eight weeks, at the end of which time the patient may leave his bed, if the attempt should not cause too much pain; but the splint is to be continued another fortnight.—(*Surgical Essays*, *part* 2, *p.* 59.) Desault's apparatus has been described in the foregoing columns, and those of Boyer and Hagedorn are explained and represented in the *First Lines of Surgery*.

Larrey, who disapproves of the plan of continued extension, has lately proposed a particular apparatus for fractures of the neck of the femur; but as it appears to me very inferior to other methods already mentioned, I shall here merely refer to the *Journ. Compl. t.* 8, *p.* 116, where a description of it may be found

I am glad to find the number of advocates for Pott's method of treatment annually diminishing. Indeed, the bad effects and painful consequences of having the whole weight of the trunk operating upon the fractured ends of the bone, which are often not properly in contact, are too obvious to need any comment. Yet this injudicious pressure is made in the bent position, which also forbids the use of long effective splints, and all assistance from moderate continued extension.

A fracture of the neck of the thigh-bone may be complicated with a dislocation of the head of the bone.—(See *J. G. Haase, De Fracturâ Colli Ossis Femoris, cum Luxatione Capitis ejusdem Ossis conjuncta, Lips.* 1798.) For farther information relative to fractures of the neck of the femur, the following authors may be consulted. *C. G. Ludwig de Collo Femoris ejusque Fractura Programma, Lips.* 1755. *Bellocq, in Mém. de l'Acad. de Chir. t.* 3. *Aitken's and Gooch's machines are described in B. Bell's Surgery, vol.* 4. *Sabatier, in Mém. de l'Acad. de Chir. t.* 4. *Duverney, Traité des Mal. des Os, t.* 1. *Unger, in Richter's Bibl. b.* 6, *p.* 520. *Theden, Neue Bemerkungen, &c. th.* 2. *Brunninghausen über den Bruch des Schenkelbeinhalses, &c. Wurzb.* 1789. *Van Gescher über die Entstellungen des Rückgrats, und über der Verrenkungen und Bruch dez Schenkelbeins, aus d. Holland. Hedenus, in Bernstein's Darstellung des Chir. Verbandes, tab.* 42, *fig.* 82 *and* 83. *M. Hagedorn über der Bruch des Schenkelbeinhalses, &c. Leipz.* 1808. *J. N. Sauter, Anweisung die Beinbrüche der Gleidmassen vorzüglich die complicierten und den Schenkelbeinhalsbruch nach einer neuen, &c. Methode, ohne Schienen, sicher zu heilen, 8vo. Konstanz.* 1812. *J. Wilson on the Structure and Physiology of the Skeleton, &c. p.* 243, *&c. 8vo. Lond.* 1820. *Dr. Colles, in Dublin Hospital Reports, vol.* 2. *Sir A. Cooper, Surgical Essays, part* 2; *and Treatise on Dislocations, &c. 4to.* 1822, *with Appendix*, 1823. *H. Earle, Practical Obs. on Surgery*, 1823. *Lancet, Nos.* 5 *and* 8, *vol.* 1, *p.* 302. *Boyer, Traité des Mal. Chir. t.* 3. *John Bell, Principles of Surgery, 4to.* 1801, *p.* 549, *&c. C. Bell, on Injuries of the Spine and Thigh-Bone, 4to.* 1824. *G. Langstaff, Cases of Fractured Neck of the Thigh-Bone within the Capsular Ligament, with the Dissections and Obs. in Méd. Chir. Trans. vol.* 13. *E. Stanley, Cases of Injuries of the Hip-Joint, vol. cit. G. J. Guthrie on the Diagnosis, and on the Inversion of the Foot in Fracture of the Neck, &c. of the Thigh-Bone, vol. cit. p.* 103. *Syme, in Edin. Med. Journ. April*, 1826. *B Bell, on Diseases of the Bone*, 1828. *J. Amesbury, Obs. on Fractures of the Upper Third of the Thigh-Bone, &c. 2d ed.* 1829.

OBLIQUE FRACTURES OF THE EXTERNAL OR INTERNAL CONDYLE OF THE FEMUR INTO THE JOINT.

In these cases, Sir A. Cooper prefers the straight position, because the tibia presses the extremity of the broken condyle into a line with that which is not injured. The limb is to be put in the extended posture upon a pillow, and evaporating lotions and leeches are to be used for the removal of the swelling and inflammation. "When this object has been effected, a roller is to be applied around the knee, and a piece of stiff pasteboard, about sixteen inches long, and sufficiently wide to extend entirely under the joint, and to pass on each side of it, so as to reach to the edge of the patella, is to be dipped in warm water, and applied under the knee, and confined by a roller. When this is dry, it has exactly adapted itself to the form of the joint, and this form it afterward retains, so as best to confine the bones. Splints of wood or tin may be used on each side of the joint; but they are apt to make uneasy pressure. In five weeks, passive motion of the limb may be gently begun, to prevent anchylosis."—(*Surgical Essays*, *part* 2, *p.* 101; *also, Treatise*, *p.* 221.) This author afterward describes a compound fracture of the external condyle, a portion of which was after a time extracted, and the case ended so favourably, that the patient, who was a boy, was able to bend and extend the leg without pain.

For fractures just above the condyles, Sir A. Cooper recommends the bent position, without which, he says, deformity is sure to follow. He advises the limb to be placed over the double inclined plane, and a roller applied round the lower portion of the femur.—(*P.* 103.)

FRACTURES OF THE PATELLA.

This bone is most frequently broken transversely, and the accident may be produced either by the action of external bodies, or by that of the extensor muscles. In the latter case, the fall is subsequent to the fracture,

and, as Camper has remarked, it is mostly only an effect of it. For instance, the line of gravity of the body is, by some cause or another, inclined backwards; the muscles in front contract to bring it forwards again; the extensors act on the patella; this breaks, and the fall ensues. That it is the action of the muscles and not the fall which usually breaks the knee-pan, is well ascertained. Sometimes the fracture occurs, though the patient completely succeeds in preventing himself from falling backwards, as we find exemplified in two cases reported by Sir A. Cooper.—(*Surgical Essays, part* 2, *p.* 85.) A soldier broke his patella in endeavouring to kick his sergeant: the olecranon has been broken in throwing a stone. In the operating theatre of the Hôtel-Dieu, both the knee-pans of a patient were broken by the violent spasms of the muscles, which followed an operation for the stone. The force of the muscles occasionally ruptures the common tendon of the extensor muscles, or, what is more frequent, the ligament of the patella. Of these cases, Petit, Desault, and Sabatier met with examples. When the patella is broken longitudinally, the cause is always outward violence.—(*Œuvres Chir. de Desault, t.* 1, *p.* 252.)

A transverse fracture of the patella may also originate from a blow or fall on the part; but in common cases it is produced by the violent action of the extensor muscles of the leg. It is only of late years, however, that the true mode in which the bone is usually broken has been understood. As Boyer observes, for the production of a transverse fracture of the knee-pan, the extensor muscles of the leg need not act with a convulsive force, their ordinary action being strong enough to produce the effect in question when the body is inclined backwards, and the patient is in danger of falling upon his occiput. In this state, the thigh being bent, the extensor muscles of the leg contract powerfully, in order to bring the body forwards and prevent the fall backwards; and the patella, whose posterior surface then rests only by a point against the fore part of the condyles of the femur, is placed between the resistance of the ligament binding it to the tibia, and the action of the extensor muscles. A fracture now happens the more easily, because, by the flexion of the knee, the line of the extensor muscles and that of the ligament of the patella are rendered oblique, with respect to the vertical axis of this bone, which is bent backwards at the point, where it rests upon the condyles.—(*Traité des Mal. Chir. t.* 3, *p.* 322. *C. Bell's Operative Surgery, vol.* 2, *p.* 201, 8*vo. Lond.* 1809. *A. Cooper's Surgical Essays, part* 2, *p.* 86.) By violent spasmodic action of the extensor muscles, however, the patella may be broken transversely, while the limb is perfectly straight. A very singular case is mentioned by Sir A. Cooper, where a patella, which had been formerly broken and united by ligament, was again divided into two portions, in consequence of the destruction of the uniting medium by ulceration.—(*Vol. cit. p.* 100.) A case is also on record, where the ligamentous uniting substance was so incorporated with the skin, that when the latter happened to be lacerated, the knee-joint was laid open, and amputation became necessary.—(*C. Bell, Op. Surgery, vol.* 2, *p.* 204.)

In transverse fractures, there is a considerable separation between the two fragments of the bone, very perceptible to the finger when the hand is placed on the knee. This separation is not occasioned equally by both portions; the upper one, embraced by the extensor muscles, is drawn upwards very forcibly by these powers, which the patella no longer resists; while the inferior portion, being merely connected with the ligament below, is not moved by any muscle, and can only be displaced by the motions of the leg to which it is attached. Hence the separation is least when the limb is extended, being then only produced by the upper fragment; greatest when the limb is bent, because both pieces contribute to it; and it may be increased or diminished by bending the knee more or less.

As Boyer has particularly noticed, the laceration or not of the tendinous expansion upon the front of the patella, makes a material difference in these cases, because it is a part of great importance in the cure. According to this author, a portion of it in simple fractures of the patella generally escapes laceration, and the separation of the fragments is then not very considerable; but violent action of the extensor muscles, the fall subsequent to the fracture or bending of the knee too much, may separate the pieces of bone far from each other, and rupture the tendinous expansion.—(*Traité des Mal. Chir. t.* 3, *p.* 328.) According to Sir A. Cooper, "when the ligament is but little torn, the separation will be but half an inch; but under great extent of injury, the bone is drawn five inches upwards, the capsular ligament and tendinous aponeurosis covering it being then greatly lacerated."—(*Surgical Essays, part* 2, *p.* 84.)

The upper portion of bone may be moved transversely, and pain is thus excited, but no crepitus can be felt, as the two pieces of bone are not sufficiently near each other. When the swelling of the knee, consequent to fractures of the patella, is very great, the symptoms of the injury may be more or less obscure. However, in consequence of the inability of the extensor muscles to move the leg, except in a few cases where the fracture is very low, the patient cannot stand without difficulty, and is unable to walk.

In the treatment, the chief indications are to overcome the action of the extensor muscles of the leg, and to keep the fragments as near each other as possible, partly by a judicious position of the limb, and partly by mechanical means. The first indication is fulfilled by relaxing the above-mentioned muscles; 1st, by extending the leg; 2dly, by bending the thigh on the pelvis, or, in other words, raising the femur, so that the distance between the knee and anterior superior spinous process of the ileum may be as little as possible; which object, however, will also require the body to be raised, and the pelvis somewhat inclined forwards. In short, as Richter long ago advised, the patient should be almost in a sitting posture, the trunk forming a right angle with the thigh.—(*Bibl. Chir. b.* 6, *p.* 611, *Göttingen*, 1782.) 3dly, The muscles are to be compressed with a roller. The second indication, or that of placing and maintaining the fragments in contact, or as nearly so as circumstances will allow, is in a great measure already answered by the above-recommended position of the limb and trunk; but it is not perfectly fulfilled unless the upper portion of the bone be also pressed towards the lower fragment, and mechanically held in this situation by the pressure of an apparatus or bandage. And, in pushing the upper fragment towards the lower one, the surgeon should always be careful that the skin be not depressed and pinched between them.

Having described the principles which ought to be observed, I do not know that any great utility would result from a detail of the various methods of treating a broken patella, preferred by different surgeons. In the last edition of the *First Lines of Surgery* may be found a description of the plan and apparatus employed by Baron Boyer. Desault's practice, which was related in the third edition of this Dictionary, I now omit as not being exactly such as modern surgeons would adopt; not from any of his principles being erroneous, but because his apparatus is more complicated than necessary.

After putting the patient to bed upon a mattress, and in the desirable posture, with the limb confined, supported, and raised, as above directed, upon a well-padded hollow splint, Sir A. Cooper applies at first no bandage to the knee, but covers it with linen wet with a lotion composed of liq. plumbi acet. dilut. ℥v. and spir. vin. ℥j. If, on the succeeding day or two, there be much tension or ecchymosis, leeches should be applied, and the lotion continued; but the employment of a bandage is not to commence until the tension has subsided; for Sir A. Cooper assures us that he has seen the greatest suffering, and such swelling as threatened gangrene, produced in these cases by the too early use of a roller. Instead of a circular bandage, placed above and below the broken bone, and drawn together with tape, &c., so as to bring the upper fragment towards the lower one, this experienced surgeon prefers the following method. A leather strap is buckled round the thigh, above the broken and elevated portion of bone, and from this circular piece of leather another strap passes under the middle of the foot, the leg being extended, and the foot considerably raised. This strap is brought up to each side of the patella, and buckled to the leather band already applied to the lower part of the thigh. It may also be fastened to the foot or any part of the leg with tapes. The limb is

to be confined in this position five weeks if the patient be an adult, and six if advanced in years. Then a slight passive motion is to be begun, and to be gently increased from day to day, until the flexion of the knee is complete.—(*Surgical Essays, part* 2, *p.* 91.) But, although the impropriety of making any constriction of the knee with a bandage, while the skin is swelled and inflamed, must be obvious, the surgeon ought to be apprized that such swelling and inflammation ought not to occasion the least delay in placing the limb in the right posture, and pressing the upper fragment towards the lower one. Mohrenheim ascribes the lameness formerly so frequent after this fracture, partly to the custom of not thinking of bringing the pieces of bone together until the swelling had subsided, and partly to the fashion of bending the joint too soon, with a view of preserving its motion. But, says he, nothing can be clearer than that it is most advantageous to attend to the union of the fracture first, and to the flexibility of the joint afterward.—(*Beobachtungen, b.* 2, 8*vo.* 1783.) Boyer has likewise remarked, that the uniting substance is apt to yield, and become lengthened, by bending the knee too early, and he therefore never allows this motion to be performed before the end of two months. When the ligamentous substance is long, and the patient very slow in regaining the use of the extensor muscles, he should sit every day on a table, and endeavour to bring them into action, and as this increases, a weight may be affixed to the foot, as Hunter, Sheldon, &c. recommend.

Nothing keeps the leg more surely extended than a long, broad, excavated splint, with a suitable pad, applied to the posterior part of the thigh and leg, and fixed there with a roller, while the thigh itself is to be bent by raising the whole limb, from the heel to the top of the thigh, with pillows, which, of course, must form a gradual ascent from the tuberosity of the ischium to the foot.

The broken patella is almost always united by means of a ligamentous substance, instead of bone.

However, that an osseous union may follow a transverse fracture of the patella, and still more frequently a perpendicular one, is a fact of which there is not now the slightest doubt. Thus, Lallement has published an unequivocal specimen of a transverse fracture united by bone, with the history of the case, and the appearances after the death of the patient from some other affection.—(*Boyer, Traité des Mal. Chir. t.* 3, *p.* 355, &c.) In the collection of Dr. William Hunter, there is one well-marked instance of the bony union of a transverse fracture of the patella, and other examples have been seen in the dead subject by Mr. Wilson.—(*On the Structure, Physiology, &c. of the Skeleton, p.* 240.) In Mr. Charles Bell's museum may also be seen similar specimens.—(*On Injuries of the Spine and Thigh-bone, p.* 57, 58.) The reason why transverse fractures of the patella do not commonly unite by callus, is not owing to the want of power in this bone to produce an osseous connecting substance; for, as Larrey has several times noticed, if the fragments are kept in perfect contact by means of a suitable apparatus, their bony reunion becomes so complete, that scarcely any vestige of the injury can afterward be traced.—(*Journ. Complém. t.* 8, *p.* 114.) Indeed, it is a fact, on which Larrey dwells, as affording a proof that callus is produced not by the periosteum, but by the vessels of the bones themselves. And what must add strength to the purport of the foregoing remarks is the consideration, that perpendicular or longitudinal fractures of the patella, which are not liable to any displacement from the action of the extensor muscles of the leg, readily admit of bony union.—(*Wilson on the Structure and Physiology, &c. of the Skeleton, p.* 239.) This is a statement which, I think, could not be rendered doubtful by any experiments made on animals, without the advantages of quietude and proper treatment. Yet, there are other facts related, which prove that, both in longitudinal and transverse fractures, a ligamentous union is generally produced, when the fragments are separated; but, if these are not drawn asunder, an osseous union takes place. Thus, in one case reported by Sir A. Cooper, one-third of the patella was separated from the rest of this bone, and had united by ligament, a free motion being left between the fragments.—(*Surgical Essays, part* 2, *p.* 94.) The same gentleman divided the patella longitudinally in a dog, without extending the division into the tendon above, or the ligament below, so that the fragments could not be separated. In three weeks a close bony union was the result.—(*P.* 95.) A case is also related, in which a gentleman fractured the patella transversely, and the lower portion likewise perpendicularly. The transverse fracture united as usual by ligament; the perpendicular one by bone.—(*P.* 96.) Mr. Charles Bell gives another explanation of the cause of union being by bone or ligament. In the common case, says he, of fracture of the patella by the sudden action of the quadriceps extensor, the pieces are separated without that degree of violence which is necessary to produce reunion by bone. But when the patella is broken by a blow or kick, there is not only less retraction, but "the injury, bloody effusion, tumefaction, and rigidity of the parts, resemble that which attends the fracture of any other bone, and the fragments unite by bone."—(*On Injuries of the Spine &c. p.* 58.)

The incorrect notions formerly entertained respecting the inconveniences of an exudation and projection of the callus into the joint after a fracture of the patella, and especially when the fragments are kept in contact, were long ago refuted by Pott and Sheldon.—(*Pott's Chir. Works, vol.* 1, *p.* 332, *ed. of* 1808. *Sheldon's Essay on the Fracture of the Patella, &c.* 8*vo. Lond.* 1789.) On the contrary, as Sir A. Cooper particularly remarks, "the internal articular surface of the bone preserves its natural smoothness."—(*Essays, part* 2, *p.* 86.) How such doctrine of a superabundant callus could be reconciled with the doubts about a bony union being ever possible, appears difficult of explanation.

Pott, and some others, thought that there being commonly an interspace afterward, between the two pieces of the patella, with a certain length of the connecting substance, might be advantageous in the motion of the joint; but Desault, Boyer, Sir A. Cooper, Sir J. Earle, and others, have always found that the greater the distance between the two pieces of the bone, the greater is the difficulty afterward in walking up a rising or over an unequal ground.

In the treatment of a longitudinal or perpendicular fracture of the patella, the leg should be kept extended, leeches used, and a cold lotion applied. After a few days a roller is to be put round the limb, and then a laced knee-cap with straps buckled round the limb above and below the patella.—(*A. Cooper, vol. cit. p.* 96.) The experience of Dupuytren confirms the fact, that a longitudinal fracture of the patella is soon firmly consolidated.—(*Annuaire Méd. Chir. de Paris, p.* 94, 4*to. Paris,* 1819.) Compound fractures of the patella frequently terminate in the death of the patient, unless amputation be done early. The injury, however, does not invariably lead either to the loss of life or limb. I saw a case in St. Bartholomew's Hospital, in the year 1820, under Mr. Vincent, where the patella was broken to pieces, and the opening so extensive that the fingers readily passed into the joint; yet, after a tedious confinement, the formation of abscesses, and the separation of several fragments of bone, the patient recovered with a stiff joint. In general, however, I believe, with Sir A. Cooper, that in compound fractures of the patella, if the laceration be extensive, or the contusion very considerable, amputation will be required: but if the wound be small, the patient not irritable, and no sloughing of the integuments or ligament likely to occur, it will be best to try to save the limb.—(*Vol. cit. p.* 99.) The wound should be reunited as speedily as possible, and advantage taken of evaporating lotions, perfect rest in a desirable posture, a very low regimen, leeches, venesection, and saline opening medicines. Since writing the above remarks I have seen another case of bad compound fracture of the patella in St. Bartholomew's Hospital, where it has been about a month. No fragments of bone have yet been removed, but a good deal of matter issues daily from the wound. The case must be regarded as in a very precarious state, though, if hectic symptoms should not lower the patient too much, the limb will probably be saved.

In addition to the works already cited, consult *D. H. Meibomius de Patellæ Osse, ejusque Læsionibus et Curatione, Franck.* 1697. *P. Camper, Diss. de Fracturâ Patellæ et Olecrani,* 4*to. Hagæ Comit.* 1789. *Buirer in v. Siebold, Chiron, t.* 1, *p.* 64. *T. Alcock, in Trans. of the Associated Apothecaries, &c. vol.* 1.

FRACTURES OF THE LEG

May be transverse or oblique. The first case is al-

leged to be most common in children. Experience proves that the two bones of the leg are much more frequently broken together than singly; a fact ascribed by Boyer to the strength of the knee and ankle-joints.—(*Traité des Mal. Chir. t.* 3, *p.* 360.) The direction of an oblique fracture of the tibia is found to be pretty constantly from below upwards, and from within outwards, the end of the upper fragment mostly presenting itself under the skin at the front and inner part of the leg. In these cases, the longitudinal displacement of the fracture is less constant than the horizontal and angular. However, when it does happen, the inferior fragments are drawn outwards and backwards, while the superior project internally and forwards. The angular displacement may be produced either by the action of the posterior muscles of the leg, or the weight of the foot, and in both cases the angle projects forwards. But it may be directed posteriorly, if the heel be too much raised. A rotatory displacement, most commonly happening in the direction outwards, is produced by the inclination of the foot, and if this be turned too much inwards, the rotatory displacement will be in that direction. A longitudinal displacement cannot take place in transverse fractures, on account of the considerable extent of the surfaces of bone; but in oblique fractures, the inferior fragments are almost always drawn upwards by the action of the posterior muscles of the leg, in which position of the parts the lower ends of the superior fragments project forwards, and may be felt by the hand. Sometimes, however, when the solution of continuity is obliquely downwards and outwards, the anterior projection will be produced by the lower pieces. In both kinds of displacement, the pointed ends of the bones may tear and penetrate the integuments, and cause a compound fracture.

The usual symptoms denoting a fracture of both bones of the leg are, a change in the direction and shape of the limb, pain, and incapability of walking, or bearing upon the limb, mobility of the fractured pieces, and a distinct crepitus.

Fractures near the knee are not very subject to displacement, on account of the thickness of the tibia at that part; but they are more dangerous than those of the middle of the bone, because often followed by inflammation of the knee-joint. Fractures close to the ankle are still more dangerous. Oblique fractures are very difficult of management, and when their displacement is upwards and outwards, the integuments are in danger of being torn by the projecting points of the superior portion of the tibia.—(*Boyer.*) To bad compound fractures of the leg most of the observations are applicable already delivered on compound fractures in general.

When the size of the tibia is compared with that of the fibula, and the close connexion of these bones to each other is remembered, an opinion might be formed, that the first could never be broken without the second. Experience, however, proves the contrary. And reasons for this fact, as Boyer remarks, may be deduced from the consideration that the tibia is the bone which supports the weight of the body, and that it is situated at the fore part of the limb, simply covered by the skin and much exposed to the effects of violence.—(*Traité des Mal. Chir. t.* 3, *p.* 373.) When the tibia alone is broken, the fracture is said to be generally transverse.

If the injury happens near the knee, the great extent of the fractured surfaces prevents any considerable displacement of the fragments; and the fibula, acting as a support on the external side, contributes also to this effect. Boyer, however, has seen one instance in which the tibia was broken by the kick of a horse, and the fragments displaced in the direction of the axis of the bone, which displacement could not be rectified, so that the bone remained permanently arched at the part.

The absence of displacement often renders the diagnosis of fractures of the tibia very difficult, and the difficulty is farther increased by the little pain and inconvenience produced by such a fracture, with which persons have been known even to walk.

Whenever there is reason to suspect the accident, in consequence of a blow or a fall on the leg, the part should be minutely examined. The fingers are to be moved along the anterior side of the tibia, the slightest inequality in which may be easily perceived, on account of its being covered only by the skin; and the motion of the pieces may be distinguished by grasping the opposite ends of the bone, and pushing them in contrary directions. However, this motion and the crepitus are not always very plain, on account of the fibula not allowing the fractured portions to be sufficiently moved on one another.

In a review of the position and strength of the two bones of the leg, it will appear that the tibia supports alone the whole weight of the body, every shock, directed in the axis of the limb, and many kinds of force applied also in the transverse direction, without operating upon any particular point. Hence the frequency of fractures of the tibia; and if the fibula is generally broken at the same time, the latter injury is but subsequent to the other, and takes place because this slender bone is not capable of bearing the weight of the body, the impulse of external violence, and even the action of the muscles, after the tibia has given way.—(*Dupuytren, Annuaire Méd. Chir. des Hôpitaux de Paris, p.* 15, 4*to. Paris*, 1819.) On the other hand, as the same distinguished surgeon remarks, the fibula being principally designed as a support for the outside of the foot, it is particularly when this function is to be executed, and its lower end has to make resistance to efforts made in that direction, that it is fractured; and if the lower part of the tibia be also sometimes broken by the same force, it is almost always consecutively, and not by the effect of a direct and simultaneous action upon the two bones.—(*P.* 17.) All fractures of the fibula, however, are not caused in the preceding manner; and Dupuytren concurs with Boyer, Mr. C. Bell, and all the best writers on this subject, in dividing these cases into two kinds: first, those in which the force is applied directly to the bone itself; secondly, the more important and serious cases, in which the force operates upon the fibula, through the medium of the foot. With respect to the first class of cases, the situation of the fibula on the outer side of the leg, a situation which would seem to expose it much to external violence; its slenderness; the interspace left between it and the tibia at the middle part of the leg; and the way in which each end of it rests upon the latter bone; would lead one to expect that its middle portion must often be broken; yet the case is less frequent than might be apprehended. And, as Dupuytren observes, there are two reasons for this fact; viz. the protection which the fibula receives from the peronæi muscles, and the rarity of circumstances capable of producing a fracture by a direct cause. These fractures, which are not usually attended with deformity, and in some cases even do not hinder the patient from bearing upon the foot, cannot for the most part be ascertained, unless attention be paid to the manner in which the accident was produced, and to the presence of ecchymosis, and of more or less pain in the part which has been struck, or pressed upon; together with a degree of irregularity of the fibula, perceptible by the fingers, and a more or less distinct moveableness and crepitus of the ends of the fracture.

The usual causes of this sort of fracture are blows on the fibula, gun-shot wounds, the fall of heavy bodies on the outside of the leg, or the passage of them over the same part. The foot is generally twisted, either inwards or outwards; and in most instances the accident is easily cured by means of rest, without being accompanied by any of the symptoms so often complicating other fractures of the fibula, produced by distortion of the foot.—(*Dupuytren, vol. cit. p.* 40.) A striking analogy may be remarked between fractures of the central part of the fibula and those of the corresponding portion of the ulna, and this in respect to causes, symptoms, treatment, and consequences. Fractures of the middle of the ulna, like those of the body of the fibula, are always occasioned by blows or falls on the fractured part, or by violence applied directly to the bone. Such fractures are scarcely ever attended with any deformity in the limb, incapacity of moving it, or displacement of the fragments; and just as some individuals are able to walk with a broken fibula, others, notwithstanding a fracture of the ulna, are found capable of using their forearm nearly as well as if it were free from injury. The latter case, like that of a fracture of the fibula, can only be known by the recollection of the way in which the hurt was received, the pain, ecchymosis, irregularities, motion, and crepitus, which last effects are also not very obvious so high up the bone. Like fractures of the body of the fibula, those of the body of the ulna only require rest and discutient applications, and very seldom the bandages, &c. neces-

sary in the treatment of fractures of both bones of the forearm, or of those of the radius alone.—(*Vol. cit. p.* 50.)

Fractures of the fibula from an *indirect* cause may happen from the foot being violently twisted either inwards or outwards. In both instances the cause of the fracture is a change in the direction of the line in which the weight of the body is transmitted. In the first case, the said line, instead of following, as it commonly does, the axis of the tibia, and falling upon the astragalus, crosses the lower end of the tibia and the ankle-joint, obliquely from within outwards, and after passing across the malleolus externus, extends to the outside of the member. The parts then supporting the weight of the body are the malleolus externus and the lower end of the tibia; besides which state of parts, the same malleolus is subjected to the traction of the external lateral ligaments, which operate with great force, in consequence of those ligaments being now nearly at a right angle with the lower end of the fibula, while this process itself is in contact with the astragalus, which is propelled from within outwards by the tibia. The latter bone, being thicker and stronger than the fibula, generally resists; and if the malleolus internus sometimes happens to break, it is secondarily, as an effect of the displacement of the foot outwards.

In the other example, where the foot is twisted outwards, the centre of gravity of the body, instead of following its usual course, obliquely crosses the lower end of the fibula, the ankle-joint, and the malleolus internus, and falls on the ground at a greater or less distance from the inner edge of the foot. On the one side, the internal lateral ligaments and malleolus, and on the other, the lower end of the fibula, are then the parts which have to bear the weight of the whole body and the force of the muscles; and they are also the parts which are torn and fractured; first, the internal lateral ligaments, or the malleolus; and, secondly, the lower portion of the fibula.—(*Annuaire Méd. Chir. de Paris*, 1819, *p.* 66, 67.) Some of the symptoms of a fracture of the fibula, from an *indirect* cause, depend upon the fracture of that bone, and others upon the dislocation of the foot. They are divided by Dupuytren into two kinds; viz. *presumptive* and *characteristic*. The first are, the way in which the patient received his hurt; a noise or sort of crack heard by him at the instant of the injury; a fixed pain at the lower part of the fibula; a difficulty or inability of walking; more or less swelling round the ankle, especially about the malleolus externus and lower portion of the fibula. The *characteristic symptoms* are, an irregularity and unnatural moveableness of some point of the lower end of the fibula; a crepitus, which can be more or less distinctly felt by pressing upon and moving the part; mobility of the whole foot transversely or horizontally; a facility of bringing the lower end of the fibula towards the tibia by pressure; a change in the point of incidence of the axis of the limb upon the foot; distortion of the foot outwards, and sometimes backwards; rotation of the same part upon its axis from within outwards; an angular depression, more or less manifest, at the outer and lower part of the leg; projection of the internal malleolus; disappearance of almost all these symptoms, as soon as reduction is effected by a force applied to the foot; and their immediate recurrence when such force is discontinued, particularly if the limb be in the extended posture.—(*Vol. cit. p.* 68.)

In considering the varieties of simple fracture of the fibula, the first to which Dupuytren adverts is that in which the bone is broken *more than three inches above the extremity of the malleolus externus; a case neither accompanied nor followed by any displacement of the foot*, and almost always produced by the direct application of violence to the broken part of the bone.

A second variety of simple fractures of the fibula is when the bone has been broken, either by direct or indirect force, within three inches from the end of the malleolus externus, and when the foot is not displaced, though much displacement is possible, and, indeed, often arises from the slightest effort or movement made by the patient. The most frequent point of injury is about two inches and a half above the extremity of the outer malleolus. This is generally the place of a fracture caused by a twist of the foot outwards; but the accident may happen lower down, as is commonly seen, when the fracture is occasioned by a twist of the foot inwards.

These fractures of the fibula, abstractedly viewed, are not of much importance in themselves; but with reference to the manner in which they facilitate the dislocation of the foot, they are very serious.

Among the most frequent complications of fractures of the fibula, are the rupture of the internal lateral ligaments, the detachment of the point of the inner malleolus, and fracture of the lower part of the tibia. When these injuries originate from a violent twist of the foot outwards, they precede the fracture of the fibula; but when they are caused by a twist inwards, they follow the breaking of that bone.—(*Dupuytren, vol. cit. p.* 96.)

Besides distortion of the foot outwards or inwards, as attending certain fractures of the fibula, another complication may be dislocation of the foot backwards, produced by the action of the muscles of the calf, and not by the same causes which broke the bone. However, whenever the malleolus internus has not given way, the dislocation is incomplete, and the foot is inclined outwards as well as backwards. In the complete luxation, as Dupuytren remarks, the bent posture is found exceedingly advantageous, though he admits that it will not always answer in maintaining the reduction.

TREATMENT OF FRACTURES OF THE LEG.

As in cases of fractured thighs, the practitioner may adopt either a bent or a straight position of the limb: in this country, surgeons mostly follow Mr. Pott's advice, and select the first one, of which alone I shall treat. That the bent position is, generally speaking, the most advantageous for a broken leg, I am well convinced. The strong muscles of the calf of the leg are the powers which tend to displace the ends of the fracture, and their relaxation is a thing of the first-rate importance. It is quite different in the thigh, where the muscles are so numerous, that the attempt to relax, by any position of the limb, all such as have the power of displacing the fragments, would be in vain. I am ready to acknowledge, however, that in the bent posture the apparatus is defective, inasmuch as it does not keep the knee-joint from moving; but yet it is certain that such motion has not so injurious an effect upon fractures of the leg as it has upon those of the thigh. When the case is complicated with a wound, which cannot be dressed in the bent posture of the limb, without great disturbance of the fracture, the straight position ought unquestionably to be preferred. With respect to one of Mr. Pott's objections to this position, viz. that it makes the knee stiff for a long while afterward, I suspect that we should not lay much stress upon the circumstance; because, as Boyer has correctly observed, it is always the joint situated below the fracture that is thus affected.

"In the fracture of the fibula only (says Pott), the position is not of much consequence; because, by the tibia remaining entire, the figure of the leg is preserved, and extension quite unnecessary; but still, even here, the laying the leg on its side instead of on the calf is attended with one very good consequence, viz. that the confinement of the knee, in a moderately bent position, does not render it so incapable of flexion and use afterward as the straight or extended position of it does; and consequently, that the patient will be much sooner able to walk whose leg has been kept in the former posture, than he whose leg has been confined in the latter.

In the fracture of both tibia and fibula, the knee should be moderately bent, the thigh, body, and leg being in the same position as in the broken thigh. If common splints be used, one should be placed underneath the leg, extending from above the knee to below the ankle, the foot being properly supported by pillows, bolsters, &c., and another splint of the same length should be placed on the upper side, comprehending both joints in the same manner; which disposition of splints ought always to be observed, as to their length, if the leg be laid extended in the common way, only changing the nominal position of them, as the posture of the leg is changed, and calling what is inferior in one case exterior in the other; and what is superior in one, in the other inferior.

If Mr. Sharp's splints be made use of, there is in one of them a provision for the more easy support of the foot and ankle, by an excavation in, and a prolonga-

tion of, the lower or fibular splint, for the purpose of keeping the foot steady."—(*Pott.*)

The strong muscles of the leg being relaxed by placing the limb in the bent position, as advised by Pott, the surgeon is to make such extension as seems requisite for bringing the ends of the fracture into even apposition. Then he is carefully to raise the leg a little way from the surface of the bed, by taking firmly hold of the limb above and below the fracture, and elevating the broken bones together in such a way as shall keep both the upper and lower portions as nearly as possible on the same level. At this moment an assistant should put exactly beneath the leg the under splint, which has been previously made ready by covering it with a soft pad, and laying over this an eighteen-tailed bandage. The limb is now to be gently depressed till it rests on the apparatus. The surgeon, before proceeding farther, must once more observe that the ends of the bones are evenly in contact. Being assured of this important point, he is to apply a piece of soap-plaster, and lay down the tails of the bandage. Another soft pad well filled with tow, is next to be put over the upper surface of the leg, and over that the other splint, when the straps are to be tightened.

Mr. Pott's method of treating fractures of the fibula complicated with luxation of the tibia, is described in the article *Dislocation*; and Dupuytren's practice in the last edition of the *First Lines of the Practice of Surgery*.

In an oblique fracture of the head of the tibia, extending into the knee-joint, Sir A. Cooper recommends the straight position, in which the femur has the good effect of keeping the articular surfaces of the tibia even. A roller is to be used for pressing one fragment towards the other; a pasteboard splint is also to be applied with the same view; and early passive motion of the joint is to be practised in order to prevent anchylosis.

When the fracture is oblique, but does not reach into the joint, the same author prefers placing the limb on the double-inclined plane.—(*Surgical Essays, part 1, p. 103; and on Dislocations, &c. p. 235.*)

FRACTURES OF THE SCAPULA.

As Boyer correctly observes, fractures of the scapula are not very common; a circumstance explicable by the deep and covered position of the greater part of this bone, and its great mobility. Nor can these accidents arise without considerable direct violence. However, there are some parts of the scapula, which, being more superficial, and of a form more likely to be acted upon by external bodies, are more frequently fractured: such are the acromion and inferior angle of the bone. Fractures of the coracoid process, and even of the neck of the scapula, are also mentioned; but the instances of such accidents are not common; and though these parts of the bone may appear in the skeleton likely to be often broken, their deep situation in the living subject generally saves them. Indeed, as Boyer says, they generally require great violence to break them, and then the contusion of the soft parts is a worse injury than the fracture itself: thus, this author has seen the coracoid process broken by the blow of the pole of a carriage, and the patient lost his life from the violence at the same time inflicted upon all the soft parts about the shoulder.—(*Traité des Mal. Chir. t. 3, p. 161.*)

When the acromion is broken, the weight of the arm, and the contraction of the deltoid muscle, draw it downwards, while the trapezius and levator scapulæ draw the rest of the bone upwards and backwards. The roundness of the injured shoulder is lost, and part of the attachment of the deltoid being broken off, the head of the os humeri sinks towards the axilla, as far as the capsular ligament will permit. On tracing the acromion from the spine of the scapula to the clavicle, the surgeon will feel a depression just at their junction. The distance from the sternal end of the clavicle to the extremity of the shoulder is lessened. The natural form of the shoulder may be restored by raising the arm by the elbow; but the deformity returns immediately the arm is suffered to fall again. The accident may be distinguished from a dislocation, if the surgeon raise the shoulder by pushing the humerus upwards, when a crepitus will be perceptible to the surgeon's hand applied over the acromion, on the limb being rotated.—(*A. Cooper on Dislocations, &c. p. 455.*)

When the lower angle is broken, the serratus major anticus draws it forwards, while the rest of the scapula remains in its natural situation; or if the angular portion be considerable, the teres major, and some fibres of the latissimus dorsi, contribute to its displacement forwards and upwards.

When the coracoid process is fractured, the pectoralis minor, coraco-brachialis, and short head of the biceps concur in drawing it forwards and downwards.

When the neck of the scapula is fractured, the weight of the arm makes it drop down so considerably as to give the appearance of a dislocation; but the facility of lifting the os brachii upwards, the crepitus, and the falling of the limb downwards again, immediately it is unsupported, are circumstances clearly marking that the case is not a dislocation. According to Sir Astley Cooper, the crepitus is best perceived through the medium of the coracoid process. The degree in which the glenoid cavity and the head of the humerus descend, he observes, depends very much upon whether the ligament between the under part of the spine of the scapula and the glenoid cavity is lacerated or not.—(*On Dislocations, &c. p. 459.*)

Sometimes great pains and a crepitus are experienced on moving the shoulder-joint after an accident; and yet the spine, the neck of the scapula, and all the above parts, are not broken. In this circumstance, it is to be suspected either that a small portion of the head of the os brachii, or a little piece of the glenoid cavity of the scapula, is broken off; which latter occurrence, I think, is not very uncommon.

When the inferior angle is broken the part remains motionless, while the rest of the scapula is moved; and it is so separated, that no mistake can be made.—(*Boyer.*)

Fractures of the spine and body of the bone are all attended with a crepitus; and in the first cases, an irregularity of the injured part may generally be felt.

The prognosis of fractures of the scapula varies according to the situation of the injury, and the attendant circumstances. Fractures of the body of the bone, whatever may be their direction, are generally very simple and readily cured. Those of the acromion and lower angle are more troublesome to keep right; but the most serious cases are fractures of the coracoid process and neck of the bone, which cannot be kept right without great difficulty, and are said to be frequently followed by a considerable stiffness of the arm, inability to raise it, its atrophy, and even paralysis. In other respects, the danger of fractures of the scapula depends less upon the solution of continuity in the bone, than the contusion of the soft parts or injury of the thoracic viscera. However, when the fracture is comminuted and the splinters are forced into the subscapularis muscle, abscesses may form under the bone, and, according to Boyer, require a perforation to be made in it (*Mal. Chir. t. 3, p. 165*); a proceeding which I cannot bring myself to think would ever be judicious, as making a depending opening in the soft parts must be far better practice. In military surgery the scapula is often injured by sabre-cuts; but as Dr. Hennen remarks, this bone, when preserved from motion, is found in these cases to unite with great readiness and without future inconvenience.—(*Principles of Military Surgery, p. 48, ed. 2.*)

According to Boyer, when the scapula is fractured longitudinally or transversely, it is merely necessary to fix the arm to the side by means of a bandage which includes the arm and trunk from the shoulder to the elbow. Thus the motions of the shoulder, which are only concomitant with those of the arm, are prevented.

When the inferior angle is broken and drawn downwards and forwards by the serratus major anticus, the scapula must be pushed towards the fragment by inclining the arm itself inwards, downwards, and forwards, where it is to be kept with a roller. The fragment is also to be kept backwards as much as possible with compresses and a roller, and the arm is to be supported in a sling.

The fractured acromion requires the arm to be so raised that the head of the os brachii will push up the acromion, while an assistant pushes the scapula forwards and downwards in a contrary direction to that of the arm. To maintain this position, a circular bandage is to be applied round the arm and body.

Desault used to apply also a small pillow under the axilla before putting on the bandage, in order to make

the head of the os brachii project more upwards on bringing the arm near the side; but Sir Astley Cooper finds that a pillow so placed does harm by throwing the head of the os humeri outwards, and widely separating the acromion from the spine of the scapula. He approves of raising the elbow and keeping the arm fixed. He also relaxes the deltoid muscle by means of a cushion put between the elbow and the side, the elbow inclining a little backwards: the limb is to be bound to the chest in this position with a roller. The union may take place by bone, but owing to the difficulty of maintaining the coaptation, the uniting substance is generally ligamentous.—(*A. Cooper on Dislocations*, p. 455.)

When the coracoid process is fractured, the muscles attached to it are to be relaxed by bringing the arm forwards towards the breast and confining it there in a sling; while the shoulder is kept downwards and forwards, and a compress confined just under the broken part with a roller.

The treatment of a fracture of the neck of the scapula consists in keeping the head of the os humeri outwards by means of a thick cushion in the axilla; in keeping the glenoid cavity and arm raised with a sling; and in preventing all motion of the arm by binding it to the trunk with a roller. In some of these cases, the apparatus proposed by Mr. Earle might be very useful.—(*Pract. Obs. in Surg.* 1823.)

FRACTURES OF THE CLAVICLE.

This bone, being long and slender, unsupported at its middle, and protected externally only by the integuments, is very often broken. Its serving to keep the scapula at a proper distance from the sternum, and as a *point d'appui* for the os brachii, every impulse of which it receives makes its fractures still more common.

It may be broken at any part; but its middle, where the curvature is greatest, is most frequently the situation of the injury. It is not very often fractured at its scapulary extremity. However, a direct force falling on the shoulder may break any part of the clavicle on which it immediately acts. The soft parts in this kind of case will also be contused or even lacerated.

A comminuted fracture may be thus occasioned, and if the violence be very great, the subclavian vessels and nerves may be torn. The fall of a heavy body on the shoulder often gives rise to a paralysis of the arm.

When the fracturing force is applied to the ends of the bone, as in a fall on the point of the shoulder or on the hands while the arms are extended, the clavicle may be very much bent, and fractured so obliquely, that the broken portions protrude through the skin.

Fractures of this bone are usually attended with displacement, except when the injury takes place at the scapulary extremity and within the ligament, tying the clavicle and coracoid process together.

The external portion of the clavicle is always that which is displaced. The internal part cannot be moved out of its natural situation, by reason of the costo-clavicular ligaments, and of its being drawn in opposite directions by the sterno-cleido-mastoideus and pectoralis major muscles. The external portion, drawn down both by the weight of the arm and the action of the deltoid muscle, and forwards and inwards by the pectoralis major, is carried under the internal portion, which projects over it. The broken clavicle no longer keeping the shoulder at a due distance from the sternum, the arm falls forwards towards the breast. The patient finds it impossible to put his hand to his forehead, because this act makes a semicircular motion of the humerus necessary, which cannot be done while that bone has not a firm *point d'appui*. The shoulder and upper extremity may be observed to be nearer the breast than those of the opposite side. The motion of the pieces of bone on one another may be felt, as well as the projection of the end of the internal portion. When the shoulder is moved a crepitus may also be perceived; but this is productive of great pain, and the diagnosis is so obvious that it is quite unnecessary.

The ancients, and many moderns, have supposed, that, in order to set a fracture of the clavicle, the shoulder must be drawn back, and fixed in that position. The patient was placed on a low stool, so that an assistant might put his knee between the shoulders, which he drew back at the same time with both hands, while the surgeon applied the bandage which was to keep the parts in this position. But when the shoulders are thus drawn towards one another, the scapula is obviously pushed towards the sternum, and with it the external portion of the clavicle, which passes under the internal fragment.

The figure of 8 bandage has commonly been used for maintaining the parts in this position. While the assistant keeps back the shoulders, as above described, the surgeon is to apply one end of a roller to the armpit on the side affected, and then make it cross obliquely to the opposite shoulder, round which it is to pass, and from this to the other shoulder, about which it is to be applied in the same manner, and afterward repeatedly crossed before and behind. The tightness with which it is necessary to apply this bandage produces a great deal of excoriation about the armpits, and the effect is to make the ends of the fracture overlap each other, the very thing which it is wished to avoid. Boyer remarks, that the iron cross proposed by Heister, the corslet described by Brasdor in the *Mém. de l'Acad. de Chir.*, and the leather strap recommended by Brunninghausen, are only modifications of the figure of 8 bandage, and are not at all better.

Desault advised extension to be made by means of the limb, which is articulated with the fractured bone. This is done by converting the humerus into a lever, by carrying its lower end forwards, inwards, and upwards, pushing the shoulder backwards, upwards, and outwards, and putting a cushion in the armpit to serve as a fulcrum.

Desault used to put in the armpit a hair or flock cushion, five or six inches long, and three inches and a quarter thick at its base. Two strings are attached to the corners of the base, which is placed upwards: they cross the back and breast, and are tied on the shoulder of the other arm. The cushion being thus placed in the armpit, and the forearm bent, Desault used to take hold of the patient's elbow, and carry it forwards, upwards, and inwards, pressing it forcibly against the breast. By this manœuvre, the humerus carries the shoulder outwards, the ends of the fracture become situated opposite each other, and all deformity is removed.

An assistant is to support the arm in this position, while the surgeon, having a single-headed roller nine yards long, is to place one end of it in the armpit of the opposite side, and then apply the bandage over the upper part of the arm, and across the back to the same situation. The arm and trunk are to be covered with such circles of the roller, as far down as the elbow, drawing the bandage more tightly the lower it descends.

Compresses, dipped in camphorated spirit, are next to be placed along the fractured bone. Desault then took a second roller, of the same length as the first, and put one end of it under the opposite armpit, whence it was carried across the breast over the compress and fracture, then down behind the shoulder and arm, and after having passed under the elbow, upwards on the breast. Desault next brought it across to the sound shoulder, under and round which he passed it, for the purpose of fixing the first turn. He then conveyed the roller across the back, brought it over the compresses, carried it down in front of the shoulder and arm, under the elbow, and obliquely behind the back to the armpit, where the application began. The same plan was repeated, until all the roller was spent. The apparatus was secured by pins, wherever they promised to be useful, and the patient's hand was kept in a sling.

Boyer has invented an apparatus for fractured clavicles, which is more simple than that employed by Desault.

The cushion is to be applied under the arm. The apparatus consists of a girdle of linen cloth, which passes round the trunk on a level with the elbow. It is fixed on by means of three straps and as many buckles. At an equal distance from its extremities are placed externally on each side two buckles, two before and two behind the arm. On the lower part of the arm is to be laced a piece of quilted cloth, five or six fingers broad. Four straps are attached to it, which correspond to the buckles on the outside of the girdle, and serve both to keep the arm close to the trunk, and from moving either backwards or forwards.

Certainly, the methods recommended by Desault and Boyer are very judicious and scientific. They are not, however, much adopted in this country, perhaps in con-

sequence of the general aversion among English surgeons to every apparatus which is not exceedingly simple. It is to be hoped, at the same time, that in the treatment of fractured clavicles, they will always attend to the principles which Desault and Boyer have inculcated. If they understand why the position of the arm should be such as these eminent surgeons point out, they will have no difficulty in doing what is proper, and with a cushion, sling, and a couple of rollers, they will easily maintain the proper posture. A simple and good apparatus for fractures of the clavicle, and those of the neck of the scapula, has been recently proposed by Mr. Earle.—(See his *Practical Observations on Surgery*, *p.* 187, *&c.*) It is also calculated for cases of dislocated clavicle, and other injuries of the shoulder.

I cannot quit this subject without cautioning surgeons never to fall into the error of supposing the rising end of a broken clavicle to be the end which is displaced. This is the one which is truly in its right situation, and which has often been made, by injudicious pressure, to protrude through the integuments, one or two instances of which have fallen under my own observation.

[Until within a few years, fractured clavicle was almost universally treated in this country by Desault's bandage. The objections to it have been apparent for a long time, for although, properly applied, it is adequate to fulfil all the indications necessary in this kind of injury, yet its complexity, its liability to be deranged, and the pressure it makes upon the mammæ in female patients, rendered a substitute for it in many cases very desirable. Dr. Skipwith H. Coale, of Baltimore, constructed an apparatus, in 1816, for this purpose, which in his hands was entirely successful in bad cases of oblique fracture of the clavicle, and was highly recommended by Professors Davidge and Gibson, of the University of Maryland. It was made of leather straps and buckles, performing the triple purposes for which Desault's bandage was adapted, and its simplicity as well as its permanence, together with its adaptation to female patients, has brought it into general favour in the south. Dr. Stephen Brown, of New-York, has introduced to the profession an improvement or modification of Desault's bandage, which is now in general use in many parts of the United States. It consists of a single headed roller, eleven yards long, and three and a half inches wide, the convolutions of which are so perfectly simple, that a description of his method will be found sufficient to enable any practitioner to apply it with neatness and facility.

A full description of this apparatus may be found in the 4th vol. of the *Am. Med. Recorder*. And as it fulfils every necessary indication, without being liable to the objections acknowledged to exist against that of Desault, it is well worthy of the confidence of surgeons generally, and, indeed, it promises in this country altogether to supersede it.—*Reese.*]

FRACTURES OF THE OS BRACHII OR HUMERUS.

This bone may be fractured at any point of its length: at its middle, either of its extremities, or above the insertion of the pectoralis major, latissimus dorsi, and teres major. The last case is termed fracture of the neck of the humerus; but that denomination has not the merit of being strictly anatomical. It is possible, however, that what is strictly called the neck of the humerus may be fractured, particularly by a gun-shot wound. By neck of the humerus, we understand that circular narrowing which separates the tuberosities from the head.

The fractures of this bone may be transverse or oblique, simple or compound. Transverse fractures of its middle part, below the insertion of the deltoid muscle, are attended with but little displacement, for the brachialis internus and the triceps, being attached posteriorly and anteriorly to both fragments, counteract one another, and admit only a slight angular displacement. When the fracture takes place above the insertion of the deltoid muscle, the inferior portion is first drawn outwards and then upwards on the external side of the superior. Fractures of the humerus, near its lower end, such particularly as are transverse, are not subject to much displacement: a circumstance to be attributed to the breadth of the fractured surfaces; to their being covered posteriorly by the triceps muscle, and anteriorly by the brachialis internus, which admit only a slight angular displacement, by the inferior portion being drawn a little forwards.

Oblique fractures are always attended with displacement, whatever be the part of the bone broken. The inferior portion being drawn upwards by the action of the deltoides, biceps, coraco-brachialis, and long portion of the triceps, glides easily on the superior, and passes above its lower extremity. Finally, fractures of the neck of the humerus are always attended with displacement, produced by the action of the pectoralis major, latissimus dorsi, and teres major, which, being attached to the lower portion near its superior extremity, draw it first inwards and then upwards, in which last direction it is powerfully urged by the biceps, coraco-brachialis, and long portion of the triceps. In this case, the superior portion itself is directed a little outwards by the action of the infraspinatus, supraspinatus and teres minor, which make the head of the humerus perform a rotatory motion in the glenoid cavity.

The shortening and change in the direction of the limb, the crepitus, which may be very distinctly perceived by moving the broken pieces in opposite directions, the pain and impossibility of moving the arm, &c., joined to the history of the case, render the diagnosis sufficiently plain.

Fractures of the neck of the humerus, however, are not so easily ascertained, and, from want of attention, have been frequently confounded with luxations of that bone. Yet the diagnostic symptoms of these two affections are very different.

When the neck of the humerus is fractured, a depression is observed at the upper part and external side of the arm, very different from what accompanies the luxation of that bone downwards and inwards. In the latter case, a deep depression is found, just below the projection of the acromion, in the natural situation of the head of the humerus; whereas, in fracture of the neck of that bone, the shoulder retains its natural form, the acromion does not project, and the depression is found below the point of the shoulder. Besides, on examining the armpit, instead of finding there a round tumour, formed by the head of the humerus, the fractured and unequal extremity of that bone will be easily distinguished. The motion of the broken portions, and the crepitus thus produced, serve still farther to establish the diagnosis.—(*Boyer.*)

In a simple fracture of the body of the humerus, the prognosis is generally favourable; but fractures near the elbow are liable to be followed by more or less stiffness of the joint, often very difficult of removal.

In ordinary fractures of the os brachii, it is usual to apply two pieces of soap-plaster, which together surround the limb, at the situation where the accident has happened. Extension, if necessary, being now made by an assistant, who at once draws the lower portion of the bone downwards and bends the elbow, the surgeon is to apply a roller round the limb. The external splint is to extend from the acromion to the outer condyle, and being lined with a soft pad, the wood cannot hurt the limb by pressure. The internal splint is to reach from the margins of the axilla to a little below the inner condyle, and is to be well guarded with a pad, filled with tow, or any other soft materials.

Some surgeons are content with the application of two splints; but though the two above described are those on which we are to place the greatest reliance, yet as the cylindrical form of the arm conveniently allows us completely to incase this part of the limb in splints, I consider the employment of four better: one on the outside, one on the inside, one on the front, and another on the back of the arm. These are to be carefully fixed in their respective situations by means of tape.

Throughout the treatment, the elbow and whole of the forearm are to be quietly and effectually supported in a sling.

FRACTURE OF THE HEAD OR NECK OF THE OS BRACHII.

Chirurgical language here differs from that adopted by anatomists, and, under the name of fracture of the neck of the humerus, is not meant that of the circular, hardly perceptible depression, which separates the head from the tuberosities of this bone. By this expression, surgeons imply the fracture of that contracted part of the humerus, which is bounded above by these tuberosities; which below is continuous with the body of the bone; which has the tendons of the pectoralis major, latissimus dorsi, and teres major inserted below it; and

which many practitioners extend even as low as the insertion of the deltoid muscle.

Indisputable facts, however, prove the possibility of the anatomical neck of the bone being fractured, and C. Larbaud showed Bichat the humerus of a young man, aged 17, the head of which bone was accurately detached from its body, by a division which had passed obliquely through the upper part of the tuberosities. Another example proved by dissection, has been very lately recorded by Delpech.—(*Chirurgie Clinique.*) An instance of this kind, I think, was pointed out to me in the spring of 1821, in St. Bartholomew's Hospital. The patient was a boy, whose elbow had been strongly kept up, on the supposition that the case was a fracture of the neck of the scapula, and, consequently, the irregular end of the humerus formed a remarkable projection in front of the acromion, yet capable of being pushed back, where, however, it would not remain. When the accident is produced by a direct blow or fall on the fleshy part of the shoulder, the deltoid is sometimes contused and affected with ecchymosis. Even blood may be effused from some of the ruptured articular veins or arteries, and form a collection which Desault recommended to be speedily opened, though the reason of such practice, as a general thing, must be questionable, because large extravasations of blood about the shoulder are usually very soon absorbed.

Sir Astley Cooper has seen this accident both in old and in young persons; but, according to his observation, it rarely occurs in middle age. In the young, he says, it happens at the junction of the epiphysis, where the cartilage is situated; and in the old it arises from the greater softness of this part of the bone.—(*On Dislocations, &c. p.* 459.)

An acute pain is experienced at the moment of the fall; sometimes the noise of something breaking is heard. There is always a sudden inability to move the limb, which, left to itself, remains motionless. But, on external force being applied, it readily yields, and admits of being moved with the greatest ease in every direction. Such motion is attended with severe pain, and, if carried too far, may cause ill consequences, as has been observed in patients in whom the fracture has been mistaken for dislocation.

Below the acromion a depression is remarkable, always situated lower down than that which attends a dislocation. If we place one hand on the head, while the lower part of the bone is moved in various directions with the other hand; or if, while extension is made, an assistant communicates to the bone a rotatory motion, the following circumstances are perceived. 1. The head of the humerus remains motionless. 2. A more or less distinct crepitus is felt, arising from the two ends of the fracture rubbing against each other. These two symptoms are characteristic of the accident; but the swelling of the joint may prevent us from detecting them.

Sometimes there is no displacement of the ends of the fracture, and then, as most of the symptoms are absent, the diagnosis is still more difficult. In general, however, the ends of the fracture are displaced, and in this circumstance it is the lower one which is out of its proper position, and not the upper one, which is of little extent, and is not acted upon by many muscles.

The displacement is generally not very perceptible in regard to length unless the fracture be very oblique, and its pointed spiculæ irritate the muscles, and make them contract with increased power; or unless the blow, which was very violent, continued to operate after the bone had been broken, and forced the ends of the fracture from their state of apposition. In this way the body of the humerus has deen drawn or driven upwards, so as to protrude through the deltoid muscle and integuments far above the height of the head of the bone.

But commonly, as Petit observes, the weight of the limb powerfully resists the action of the muscles, and the displacement of the fracture is more liable to be transverse. In this circumstance the lower end of the fracture is displaced outwards or inwards, and rarely in any other direction. In the most frequent case, the elbow is separated from the trunk, and cannot be brought near it without pain; and in the instance of the bone being displaced outwards, the limb has a tendency to the opposite direction. According to Sir Astley Cooper, the upper end of the main portion of the humerus sinks into the axilla, where it can be felt, and the deltoid is drawn down by it, so that the roundness of the shoulder is diminished.—(*On Dislocations, &c. p.* 459.)

The reduction takes place of itself on employing a very little force methodically directed, according as the fracture is displaced inwards or outwards. If the surgeon put his hands on the situation of the fracture, it is rather to examine the state of the ends of the broken bone than to accomplish a thing seldom required, namely, what is implied by the term coaptation.

Every apparatus for the cure of fractures being only resistances made by art to the powers causing the displacement of the broken part, it follows that the whole should act in an inverse ratio to such powers. These consist, 1. Of the action of external bodies, favoured by the extreme mobility of the arm and shoulder: 2. Of the action of the latissimus dorsi, pectoralis major, and teres major, which draw inwards the lower end of the fracture, or of the deltoid, which pulls it outwards: 3. Of the contractions of the muscles of the arm, which tend to draw the end of the fracture a little upwards.

Hence, in the treatment, the three indications are, 1. To render the arm and shoulder immoveable; 2. To bring either outwards or inwards the lower end of the fracture; 3. To draw downwards the same. The last object merits less attention than the two others, because the weight of the arm is alone almost sufficient for the purpose. Desault used to employ the following apparatus:

1. Two long rollers. 2. Three strong splints, of different lengths, and between two and three inches broad. 3. A cushion or pillow, three or four inches thick at one of its ends, terminating at the other in a narrow point, and long enough to reach from the axilla to the elbow. 4. A sling to support the forearm. 5. A towel to cover the whole of the apparatus.

The reduction having been effected, the assistants are to continue the extension. Then the surgeon is to take the first roller, which is to be wet with the liq. plumbi acet. dil., and he is to fix one of its heads by applying two circular turns to the upper part of the forearm. The bandage is now to be rolled moderately tight round the arm upwards, making each turn overlap two-thirds of that which is immediately below it. When the roller has reached the upper part of the limb, it must be doubled back a few times to prevent the folds which the inequality of the part would create. The bandage is afterward to be carried twice under the opposite axilla, and the rest of it, rolled up, is to be brought up to the top of the shoulder, and committed to the care of an assistant.

The first splint is to be placed in front, reaching from the bend of the arm as high as the acromion. The second, on the outside, from the external condyle to the same height. The third, behind, from the olecranon to the margin of the axilla. The pillow, interposed between the arm and thorax, serves as a fourth splint, which becomes useless. An assistant applies these parts of the apparatus, and holds them on by applying his hands near the bend of the arm, in order not to obstruct the application of the remainder of the bandage.

The surgeon takes hold of the bandage again, and applies it over the splints with moderate tightness, and the bandage ends at the upper part of the forearm where it began.

While the assistants still keep up the extension, the surgeon is to place the pillow between the arm and trunk, taking care to put the thick end upwards, if the fracture be displaced inwards; but downwards if this should be displaced outwards, which Desault found most common. Then the pillow is to be fastened with two pins to the upper part of the roller.

The arm is to be brought near the trunk, and fixed upon the pillow by means of the second roller applied round the arm and thorax. The turns of this bandage should be rather tight below and slack above, if the fracture be displaced inwards; but if outwards, they should be slack below and tight above.

The forearm is to be supported in a sling, and the whole of the apparatus is to be enveloped in a napkin, which will prevent the bandages from being pushed out of their places.

If the effect of the above apparatus in fulfilling the indications above specified is considered, we shall easily see that they are very well accomplished. The arm, firmly fixed against the trunk, can only move with it, and then nothing displaces the lower end of the fracture, which is equally motionless. The shoulder can-

not communicate any motion to the upper end of the fracture. The pillow, differently disposed, according to the direction in which the lower extremity of the fracture is displaced, serves to keep this part in the opposite position.

Should this part of the bone project inwards, the thick end of the pillow will remove it farther from the chest. The bone will be kept at this distance from the side by the turns of the bandage, which, being very tight downwards, will act upon the limb as a lever, the fulcrum for which will be the pillow, and the resistance the action of the pectoralis major, latissimus dorsi, and teres major. Thus the bandage will have the effect of bringing the elbow nearer the trunk, and move the lower end of the fracture in the opposite direction, so that it may here be considered as an artificial muscle directly opposing the natural ones.

When the lower end of the fracture is drawn outwards, the contrary effect will be produced, both from the pressure exercised by the bandage on the upper end of the displaced portion of the bone, and from the situation of the elbow; which is kept outwards by the thick part of the pillow. The outer splint will also prevent the lower end of the fracture from being displaced outwards, both by its mechanical resistance to the bone, and by compressing the deltoid muscle, which is the chief cause of such displacement. All displacement of the lower end of the fracture forwards or backwards is prevented by the back splint; and as for the longitudinal displacement, which is already prevented by the weight of the limb, it is still more effectually hindered by the compression of the muscles of the arm both by the splints and roller.—(See *Œuvres Chir. de Desault, par Bichat*, *t.* 1.)

Sir Astley Cooper recommends a roller to be applied from the elbow to the shoulder-joint; two splints to be bound on the inner and outer sides of the arm with a roller; a cushion to be placed in the axilla in order to throw out the head of the bone; and gently supporting the arm in a sling; for if the elbow is much raised, he says, the bones will overlap, and the union be attended with deformity.—(*On Dislocations, &c. p.* 461.)

FRACTURES OF THE LOWER ENDS OF THE OS BRACHII, WITH SEPARATION OF THE CONDYLES.

Fractures of the os brachii, with detachment of its condyles, seem to have escaped the notice of most authors who have written on the diseases of the bones. The accident, however, is not uncommon, and Desault in particular had frequent occasion to meet with it.

Whatever its causes may be, the two condyles are usually separated from each other by a longitudinal division, which, extending more or less upwards, is bounded by another transverse or oblique division, which occupies the whole thickness of the bone. Hence, there are three different pieces of bone and two fractures.

Sometimes, the division is more simple; as when, taking a direction outwards or inwards, it crosses obliquely down the lower end of the os brachii, terminates in the joint, and only detaches one of the condyles from the body of the bone.

In the first case the deformity is greater, and the fractured part is more moveable. When pressure is made either before or behind, on the track of the longitudinal fracture, the two condyles, becoming farther separated from each other, leave a fissure between them, and the fractured part is widened. The forearm is almost always in a state of pronation. On taking hold of the condyles and moving them in different directions, a distinct crepitus is perceived.

In the second case, the separation of the condyles from each other is not so easy; but a crepitus can always be distinguished on moving the detached condyle. In one case, in which only the external condyle was broken, Desault found the limb always supine; a position which the muscles inserted into this part were, doubtless, concerned in producing.

In both cases, an acute pain, the almost inevitable effect of bending or extending the forearm; an habitual half-bent state of this part of the limb, and sometimes a subsequent swelling of it, together with more or less tumefaction round the joint, are observable. When the blow has been very violent, or a pointed piece of the bone protrudes through the flesh, the accident may be complicated with a wound, splinters of bone, &c.

When the condyles of the humerus are obliquely broken off just above the joint, the appearances, as described by Sir Astley Cooper, are those of a dislocation of the radius and ulna backwards; but the nature of the case is evinced by the circumstance of the displacement recurring as soon as the extension is stopped, and also by the crepitus, generally perceptible when the forearm is rotated upon the humerus.—(*On Dislocations, &c. p.* 481.)

The old writers consider the communication of a fracture with a joint a fatal kind of complication. Swelling and inflammation of the adjacent parts; continuance of pain after the reduction; large abscesses; even mortification of the soft parts, and caries of the bones, are, according to such authors, the almost inevitable consequences of these fractures, and anchylosis the most favourable termination. Paré, Petit, Heister, Duverney, all give this exaggerated picture. However, analogous fractures of the olecranon and patella prove that this representation is magnified beyond truth. Modern observation has dispelled the ancient doctrine of the effusion of callus into the joint, and with it one of the principal causes assigned by authors for the symptoms so much dreaded.

The detached condyles being drawn in opposite directions by the muscles of the arm and forearm, commonly remain unmoved between these two powers, and are but little displaced. External force may, however, put them out of their proper situation, and they may then be displaced forwards or backwards, or they may separate from each other sidewise, leaving an interspace between them. Hence, the apparatus should resist them in these four directions, and this object is easily accomplished by means of four splints kept on with a roller. The two lateral splints are particularly necessary when the condyles are separated from the body of the bone with an interspace between them. If one of them be still continuous with the humerus, no splint on this side will be requisite.

The apparatus need not extend as high as when the arm is fractured higher up; but the roller should be continued over the forearm, in order that the joint may correspond to the middle of the bandage, which should here be firmer than any where else. This method is also of use in producing a gentle compression of the muscles implanted into the condyles.

Desault recommends the front and back splints to be flexible at their middle part, which should be applied to the bend of the arm and elbow.—(*Œuvres Chir. de Desault, par Bichat*, *t.* 1.)

The treatment advised by Sir Astley Cooper consists in bending the arm, drawing it forwards so as to reduce the parts, and then applying a roller. The best splint for this case, he says, is one formed at right angles, the upper portion of it being placed behind the upper arm, and the lower under the forearm. He also directs the application of a splint to the fore part of the upper arm. The splints are to be fixed with straps; evaporating lotions used; and the arm kept in a bent position in a sling. In a fortnight, if the patient be young, and in three weeks if he be an adult, passive motion may be gently employed for the purpose of hindering an anchylosis.—(*On Dislocations, &c. p.* 482.) According to the same author, when the internal condyle is broken off obliquely the ulna loses its natural support and projects backwards.

FRACTURE OF THE FOREARM.

The forearm is more frequently broken than the arm, because external force operates more directly upon it than the latter part, especially in falls on the hands, which are frequent accidents. Bichat in his account of Desault's practice, mentions, that fractures of the forearm often held the first place in the comparative table of such cases kept at the Hôtel-Dieu.

We know that the forearm is composed of two bones, the ulna and radius. The last is much more liable to fractures than the first, because it is articulated with the hand by a large surface, and all the shocks received by the latter part are communicated to it. The situation of it also more immediately exposes it to such causes as may break it. However, both the bones are frequently broken together.

FRACTURES OF BOTH BONES

May occur at the extremities or middle of the forearm. They are frequent at the middle, very common below, but seldom happen at the upper part of the

forearm, where the numerous muscles, and the considerable thickness of the ulna, resist causes which would otherwise occasion the accident. The bones are usually broken in the same line, but sometimes in two different directions. The fracture is almost always single, but in a few instances it is double; and Desault, in particular, was one day called to a patient, over whose forearm the wheels of a cart had passed, so as to break the bones at their middle and lower part, into six distinct portions. The middle ones, notwithstanding they were quite detached, united very well with hardly any deformity.

These accidents are most commonly occasioned by direct external violence; but sometimes they are produced by a counter-stroke, which is generally the case when the patient falls on his hand. But in this instance, as the hand is principally connected with the lower broad articular surface of the radius, this bone alone has to sustain almost the whole shock of the blow, and hence is usually the only one broken.

The symptoms indicating fractures of the forearm are not likely to lead the surgeon into any mistake: motion at a part of the limb where it was previously inflexible; a crepitus, almost always easily felt; sometimes a distinct depression in the situation of the fracture; occasionally a projection of the ends of the fracture beneath the skin; pain on moving the part; a noise sometimes audible to the patient at the moment of the accident; an inability to perform the motion of pronation and supination; and an almost constant half-bent state of the forearm.

There is one case, however, in which the fracture being very near the wrist-joint, similar appearances to those of a dislocation of this part may arise. But attention to whether the styloid processes are above or below the deformity will discover whether the case be a fracture or dislocation. In a fracture, the part is also more moveable, and there is a crepitus.—(*Œuvres Chir. de Desault, par Bichat, t.* 1.) According to Boyer, the two cases may be distinguished by simply moving the hand; by which motion, if there be a luxation without fracture, the styloid processes of the radius and ulna will not change their situation; but if a fracture exist, they will follow the motion of the hand.

The connexion of the two bones of the forearm by the interosseous ligament, which occupies the interspace by which they are separated, and the manner in which the muscles attached to both are inserted into them, render any displacement of the broken pieces in the longitudinal direction very difficult; and in reality, such displacement is seldom observed, and never in any considerable degree. When it does take place, it is to be ascribed to the cause of the fracture, rather than to muscular contraction. On the contrary, in the transverse displacement, the four pieces approach one another, and the interosseous space is diminished or entirely obliterated near the seat of the fracture; attended with evident deformity of the part. There is an angular displacement which the fracturing cause always produces, either forwards or backwards, according to its direction.

Boyer gives the following account of the treatment of the fracture of both bones of the forearm.

The forearm is to be bent to a right angle with the arm, and the hand placed in a position between the pronation and supination. The forearm and hand being thus placed, an assistant takes hold of the four fingers of the patient, and extends the fractured parts, while another assistant makes counter-extension by fixing the humerus with both his hands. By these means the operator is enabled to restore the bones to their natural situation, and to push the soft parts into the interosseous space, by a gentle and graduated pressure on the anterior and posterior sides of the arm.

The bones are kept in their place by applying first on the anterior and posterior sides of the forearm two longitudinal and graduated compresses, the base of which is to be in contact with the arm. The depth of these compresses should be proportioned to the thickness of the arm, increasing as the diameter of the arm diminishes. In the next place, the surgeon takes a single-headed roller, about six yards long, and makes three turns of it on the fractured part; he then descends to the hand by circles partially placed over one another, and envelopes the hand by passing the bandage between the thumb and index finger: the bandage is next carried upwards in the same manner, and reflected wherever the inequality of the arm may render it necessary. The compresses and bandage being thus far applied, the surgeon lays on two splints, one anteriorly, the other posteriorly, and applies the remainder of the bandage over them. The compresses and splints should be of the same length as the forearm. It would be useless to employ lateral splints in this case, unless (what is scarcely ever to be expected or met with) a displacement should have taken place in that direction. Lateral splints would counteract the compresses and two other splints, by lessening the radio-cubital diameter of the arm, and with the action of the pronators, tend to push the ends of the fracture into the interosseous space. The surgeon's attention should be particularly directed to preserve the interosseous space; for, if this be obliterated, the radius cannot rotate on the ulna, nor the motion of pronation or supination be executed; and this object may be obtained with certainty by applying the compresses and splints in such a manner, that the fleshy parts may be forced into and confined in the interosseous space, and by renewing the bandage every seven or eight days.

If the fracture be simple, and the contusion inconsiderable, the patient need not be confined to bed, but may walk about with his arm in a sling.

FRACTURES OF THE RADIUS

Are the most frequent of those of the forearm. The radius being almost the sole support of the hand, and placed in the same line with the humerus, is for both these reasons more exposed to fractures than the ulna.

Fractures of the radius, whether transverse or oblique, near its middle part or extremities, may be caused by a fall or blow on the forearm, or as happens in most cases, by a fall on the palm of the hand. When likely to fall we extend our arms, and let the hands come first to the ground; in which case, the radius pressed between the hand on the ground and the humerus, from which it receives the whole momentum of the body, is bent, and if the fall be sufficiently violent, broken more or less near its middle part. When after an accident of this kind, pain and difficulty of performing the motions of pronation and supination supervene, the probability of a fracture of the radius is very strong. The truth is fully ascertained by pressing with the fingers along the external side of the forearm. Also, in endeavouring to perform supination or pronation of the hand, a crepitus and a motion of the broken portions will be perceived. When the fracture takes place near the head of the radius, the diagnosis is more difficult, on account of the depth of soft parts over that part of the bone. In this case, the thumb is to be placed under the external condyle of the os humeri, and on the superior extremity of the radius, and at the same time the hand is to be brought into the prone and supine positions. If in these trials, which are always painful, the head of the radius rests motionless, there can be no doubt of the bone being fractured. Here the causes of displacement are the same as in fractures of the forearm; it can never take place, except in the direction of the diameter of the bone, and is effected principally by the action of the pronating muscles. The ulna serves as a splint in fractures of the radius; and the more effectually, as these two bones are connected with one another throughout their whole length.

In general, when only the radius is fractured, no extension is requisite. During the treatment, the elbow is to be bent, and the hand put in the mid-state between pronation and supination; that is to say, the palm of the hand is to face the patient's breast. Having reduced the ends of the fracture when they appear to be displaced, the soap plaster is to be applied, and over this a slack roller. This bandage is, indeed, of no utility; but it makes the limb seem, to the unknowing bystanders, more comfortable than if it were omitted, and as it does no harm, the surgeon may honestly apply it. However, no one can doubt, that tight bandages may act very perniciously, by pressing the radius and ulna together, causing them to grow to each other, or at all events, making the fracture unite in an uneven manner. Only two splints are necessary; one is to be placed along the inside, the other along the outside, of the forearm. Soft pads must always be placed between the skin and the splints, in order to obviate the pressure of the hard materials of which the latter are formed. The inner splint should extend to about the last joint of the fingers; but not completely to the end

of the nails; for many patients, after having had their fingers kept for several weeks in a state of perfect extension, have been a very long time in becoming able to bend them again.

Sometimes it may be proper to apply a compress just under the ends of the fracture, to prevent their being depressed towards the ulna too much, the consequence of which has occasionally been the loss of the prone and supine motions of the hand.

In setting a fractured radius, the hand should be inclined to the ulnar side of the forearm.

FRACTURES OF THE ULNA.

Fractures of this bone are less frequent than those of the radius, and take place generally at its lower extremity, which is most slender and least covered. A fracture of this bone is almost always the result of a force acting immediately on the part fractured; as, for instance, when in a fall the internal side of the forearm strikes against a hard resisting body. On applying the hand judiciously to the inside of the forearm, this fracture is easily ascertained by the depression at that part, in consequence of the inferior portion being drawn towards the radius by the action of the pronator radii quadratus. This displacement, however, is less considerable than what takes place in fractures of the radius. The superior portion of the ulna remains unmoved.—(*J. L. Petit.*)

In this case, the assistant, who makes whatever little extension may be necessary, should incline the hand to the radial side of the forearm, while the surgeon pushes the flesh between the two bones, and applies the apparatus as in the preceding case. In all fractures of the bones of the forearm, and particularly in those which are near the head of the radius, a false anchylosis is to be apprehended, and should be guarded against by moving the elbow gently and frequently, when the consolidation is in a certain degree advanced.

Fractures of the forearm always require the part to be kept quietly in a sling.

FRACTURES OF THE OLECRANON.

The olecranon may be fractured either at its base, its centre, or its extremity; but the second case is the most frequent. The division is almost always transverse, though occasionally oblique. The accident is very rarely produced by the action of the muscles, but almost always by external violence, directly applied to the part in a blow or fall upon the elbow.

With regard to symptoms, the contraction of the triceps, being no longer resisted by any connexion with the ulna, draws upwards the short fragment to which it adheres, so as to produce, between it and the lower one, a more or less evident interspace. This interspace is situated at the back part of the joint, and may be increased or diminished at will, by augmenting the flexion of the forearm, and putting the triceps into action, or extending the limb. Another symptom is the impossibility of spontaneously extending the forearm, the necessary effect of the detachment of the triceps from the ulna. It appears from the dissections made by Sir Astley Cooper, that the extent of the separation depends upon the degree of laceration of the capsular ligament, and of that portion of ligament which proceeds from the side of the coronoid process to that of the olecranon.—(*On Dislocations, &c. p.* 487.) It must be owing to the untorn state either of the latter part, or of the aponeurosis covering the olecranon, that patients occasionally retain the power of extending the forearm, as is exemplified in the case reported by Mr. Earle, where, on the sixth day after the accident (and not before) this power was destroyed by a sudden flexion of the forearm.—(*Practical Obs. p.* 147.) The forearm is constantly half-bent, the biceps and brachialis having no antagonists. The olecranon is more or less drawn up higher than the condyles of the os brachii, which latter parts, on the contrary, are naturally situated higher than the olecranon, when the forearm is half-bent. The upper piece of bone may be moved in every direction without the ulna participating in the motion. Besides these symptoms, we must take into the account the considerable pain experienced, and the crepitus perceptible, when the fragment is approximated to the surface from which it is detached.

The indications are, to push the retracted portion of the olecranon downwards, and to keep it in this position at the same time that the ulna is made to meet it, as it were, by extending the forearm. According to Desault, however, the forearm should not be completely extended, as when the pieces of bone touch at their back part, they leave a vacancy in front, which is apt to be followed by an irregular callus, prejudicial to the free motion of the elbow. Hence, it was his practice to put the arm between the half-bent and the completely extended state, and to maintain this posture by means of a splint along the fore part of the arm. But as position operates only on the lower part of the olecranon, the upper one requires to be brought near the former and fixed there, which is, doubtless, the most difficult object to effect, because the triceps is continually resisting.

Desault used to adopt the following method: the forearm being held in the above position, the surgeon is to begin applying a roller round the wrist, and to continue it as high as the elbow. The skin covering this part, being wrinkled in consequence of the extension of the limb, might insinuate itself between the ends of the fracture, and consequently it must now be pulled upwards by an assistant. The surgeon is then to push the olecranon towards the ulna, and confine it in this situation with a turn of the roller, with which the joint is then to be covered, by applying it in the form of a figure of 8.

A strong splint a little bent, just before the elbow, is next laid along the arm and forearm, and fixed by means of a roller. The limb is then to be evenly supported on a pillow.

The cure of the fractured olecranon is seldom effected by the immediate reunion of its fragments: there generally remains a greater or less interspace between them, which is filled up by a substance not of a bony consistence. Indeed, the tenor of the remarks and experiments lately published by Sir Astley Cooper on this subject is to represent the broken olecranon as similarly circumstanced with respect to bony union, as the fractured neck of the femur. He has seen union by bone effected in the living subject; but this was when the fracture had taken place very near the shaft of the ulna. The ligamentous substance, he says, which generally forms the bond of union, often has one or even several apertures in it, when it is of considerable length. The arm is observed to be weakened in proportion to the length of the ligament.—(*On Dislocations, &c. p.* 489.)

Camper laid great stress upon the inutility of keeping the arm perfectly extended: he found patients recover sooner and better when the elbow was kept half-bent, and the joint gently exercised at as early a period as possible. "Agglutinationem scilicet motiri non debet chirurgus, sed sublatis tumore ac inflammatione quiete et remediis aptis, cubitum quotidie prudenter movere, ut unio per tricipitis tendinem, seu per concretionem membranosam fometur, et os ossi non admoveatur. Verbo quemadmodum C. Celsus in *Med.* lib. 8, c. 10, § 4, p. 537, de cubito fracto præcepit. Quod si ex summo cubito quid fractum sit, glutinare id vinciendo alienum est, fit enim brachium immobile, ac, si nihil aliud quam dolore occurrendum est, idem qui fuit ejus usus est."—(*Camper de Fracturâ Patellæ, p.* 66, *Hagæ*, 1789.) Mr. Earle is also an advocate for placing the limb in a slightly bent position.—(*Pract. Obs. p.* 165.) The late Mr. Sheldon, however, does not concur with Desault and Camper, respecting the position of the limb during the treatment, but insists upon the utility of keeping the forearm perfectly extended.

When there is much swelling, Sir A. Cooper employs leeches and evaporating lotions for two or three days; but when not much violence has been done to the limb, he applies the bandage at once. He places the arm in a straight position, presses down the fragment until it touches the ulna, and, after putting a slip of linen along each side of the joint, puts a roller round the limb above and below the olecranon. By tying the slips of linen which pass under the rollers, these are drawn nearer together, and the fragment of the olecranon is thus kept as near as possible to the ulna. Lastly, a splint well padded is applied along the front of the arm, and secured with a bandage, which is frequently wetted with spirit of wine and water.—(*On Dislocations, &c. p.* 490.)

On an average, the olecranon becomes firmly united about the twenty-sixth day.—(*Desault.*) In a month the splint is to be removed and passive motion begun.—(*A. Cooper.*)

FRACTURE OF THE CORONOID PROCESS.

Two examples of this accident are noticed by Sir Astley Cooper: in one case, seen by him several months after its occurrence, the same appearances presented themselves as were remarked by the surgeon who first attended the patient; namely, the ulna projected backwards while the arm was extended, but it could be drawn forwards and the elbow bent without much difficulty, when the deformity disappeared. In the other instance, which presented itself in the dissection-room, the coronoid process, which had been broken off, was united by ligament, and so moveable that when the forearm was extended, the ulna glided backwards upon the condyles of the humerus. Sir Astley Cooper is of opinion that the case admits of no other mode of union: he recommends keeping the arm steadily in the bent position for three weeks.—(*On Dislocations, &c. p.* 434.)

FRACTURES OF THE CARPAL AND METACARPAL BONES, AND PHALANGES OF THE FINGERS.

The bones of the carpus, when broken, are usually crushed, as it were, between very heavy bodies, or the limb has been entangled in powerful machinery, or suffered gun-shot violence. It must be obvious, therefore, that as the soft parts are also seriously injured, these cases are generally followed by severe and troublesome symptoms, and sometimes require the performance of amputation, either immediately or subsequently. When an attempt is to be made to save the part, the chief indications are to extract splinters of bone, and prevent inflammation, abscesses, and mortification. The parts may at first be kept wet with a cold evaporating lotion, any wound present being lightly and superficially dressed; but afterward, as soon as all tendency to bleeding is over, emollient poultices may be applied over the dressings instead of the lotion. The dressings themselves, however, should not be removed for the first three or four days, all unnecessary disturbance of the crushed parts being highly injurious. Should abscesses form, early openings should be practised, so as to prevent the matter from extending up the forearm. Duly supporting the hand and forearm in a sling is of the greatest importance. The metacarpal bones of the little finger and thumb are more frequently broken than the other three. A fracture of a metacarpal bone is generally produced by violence applied directly to the part, as no force capable of causing the accident can well act upon the two ends of the bone so as to break it. The fracture may be simple, but more commonly it is compound, the soft parts being wounded and lacerated by the same violence which has injured the bone. In most cases, also, unless the force has operated by a very limited surface, more than one metacarpal bone is fractured. At first, the same kind of treatment is requisite as in the preceding cases, and, after the inflammation has subsided, a hand-board or splint may be employed. When the hand is very badly crushed, amputation is indicated.

In fractures of the finger-bones, the treatment consists in applying a piece of soap-plaster, rolling the part with tape, covering it in paste-board, sometimes placing the hand on a flat splint or finger-board, and always keeping the hand, forearm, and elbow well supported in a sling.

For *Fractures of the Cranium*, see *Head, Injuries of.*

For information on fractures, consult particularly *J. L. Petit, Traité des Maladies des Os. Duverney, Traité des Maladies des Os. Jonathan Wathen, The Conductor and Containing Splints; or, a Description of two new-invented Instruments, for the more safe Conveyance, as well as the more easy and perfect Cure, of Fractures of the Leg, 2d ed. 8vo. Lond.* 1767. *W. Sharp, in vol.* 57 *of the Philosophical Trans. part* 2, 1767. *An Account of a New Method of treating Fractured Legs. Pott's Remarks on Fractures and Dislocations. T. Kirkland, Obs. upon Mr. Pott's General Remarks on Fractures, &c. 8vo. Lond.* 1770; *also, Appendix to the same, 8vo. Lond.* 1771. *Cases in Surgery, by C. White, edit.* 1770. *J. Aitken, Essays on several Important Subjects in Surgery, chiefly on the Nature of Fractures of the Long Bones of the Extremities, particularly those of the Thigh and Leg, 8vo.* 1771. *Boyer, Traité des Mal. Chir. t.* 3, *Encyclopédie Methodique, partie Chir. art. Fracture, Cuisse, Omoplate, Ileum, &c. &c. Œuvres Chir. de Desault, par Bichat, t.* 1. *Parts of the Parisian Chirurgical Journal. Sir J. Earle, A Letter, containing some Observations on the Fractures of the Lower Limbs; to which is added an Account of a Contrivance to administer Cleanliness and Comfort to the Bed-ridden, or Persons confined to Bed by Age, Accident, Sickness, or other Infirmity, 8vo. Lond.* 1807. *Leveillé, Nouvelle Doctrine Chir. t.* 2, 1812. *Assalini, Manuale di Chirurgia, parte prima, Milano,* 1812. *Dupuytren, Des Fractures ou Courbures des Os des Enfans, in Bulletin de la Faculté de Méd. Paris,* 1811. *Idem, Sur la Fracture de l'Extrémité inférieure du Péroné, les Luxations et les Accidens qui en sont la suite, in Annuaire Méd. Chir. de Paris, 4to. Paris,* 1819. *Roux, Relation d'un Voyage fait à Londres en* 1814, *ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 173, *&c. Paris,* 1815. *Med. Chir. Trans. vol.* 2, *p.* 47, *&c.; vol.* 5, *p.* 358, *&c.; vol.* 7, *p.* 103. *Sketches of the Medical Schools of Paris, by J. Cross, p.* 87, *&c. Sir A. Cooper, A Treatise on Dislocations and Fractures of the Joints, 4to. Lond.* 1822; *and Obs. on Fractures of the Neck of the Thigh-Bone,* 1823. *H. Earle, Practical Observations in Surgery, 8vo.* 1823. *W. Gibson's Institutes and Practice of Surgery, 8vo. vol.* 1, *Philadelphia,* 1824. *B. Bell, on the Diseases of the Bones, 12mo. Edin.* 1828. *J. Amesbury on Fractures of the Upper Third of the Thigh-Bone, and Fractures of long standing, ed.* 2, *8vo. Lond.* 1829.

FRÆNUM LINGUÆ. In infants, the tongue is sometimes too closely tied down, by reason of the frænum being extremely short, or continued too far forwards. In the latter case, the child will not be able to use its tongue with sufficient ease in the actions of sucking, swallowing, &c., in consequence of its point being confined at the bottom of the mouth. Though this affection is not unfrequent, it is less common than is generally supposed by parents and nurses. When the child is small and the nurse's nipple large, it is common for her to suppose the child to be tongue-tied, when, in fact, it is only the smallness of the child's tongue that prevents it from surrounding the nipple, so as to enable it to suck with facility. Mothers also commonly suspect the existence of such an erroneous formation, whenever the child is long in beginning to talk.

The reality of the case may always be easily ascertained by examining the child's mouth. In the natural state, the point of the tongue is always capable of being turned upwards towards the palate, as the frænum does not reach along above a quarter of an inch of the lower part of the tongue from the apex. But in tongue-tied children, by looking upon one side, we may see the frænum extending from the back part to the very point, so that the whole length of the tongue is tied down and unnaturally confined.

The plan of cure is to divide as much of the frænum as seems proper for setting the tongue at liberty. The incision, however, should not be carried more extensively backwards than is necessary, lest the raninal arteries be cut; an accident that has been known to prove fatal. For the same reason, the scissors used for this operation should have no points. I think the following piece of advice offered by a modern author may be of service to practitioners, who ever find it necessary to divide the frænum linguæ: "It is not the relations of the trunk of the lingual artery alone which the student ought to make himself acquainted with. He will do well to study the position of the arteria ranina in respect to the frænum linguæ. This information will teach him the impropriety of pointing the scissors upwards and backwards, when snipping the frænum; an operation, by-the-by, oftener performed than needed. He will learn that the ranular artery lies just above the attachment of the frænum; so that, if he would avoid it, he must turn the points of the scissors rather downwards; if he do not, the artery will probably suffer." —(*A. Burns, Surgical Anatomy of the Head and Neck, p.* 239.)

When an infant has the power of sucking, this proceeding should never be resorted to, even though the frænum may have the appearance of being too short, or extending too far forwards.—(*Fab. Hildanus, centur.* 3, *obs.* 28. *Petit, Traité des Mal. Chir. t.* 3, *p.* 265, *edit.* 1774.)

Although the operation of dividing the frænum linguæ is for the most part done without any bad consequences,

surgeons should remember well that it is liable to dangers, especially when performed either unnecessarily or unskilfully.

Besides the fatal events which have occasionally resulted from wounding the raninal arteries, the records of surgery furnish us with proofs that the mere bleeding from the raninal veins, and the small vessels of the frænum, may continue so long, in consequence of the infant's incessantly sucking, as to produce death. In such cases, the child swallows the blood as fast as it issues from the vessels, so that the cause of death may even escape observation. But if the body be opened, the stomach and intestines will be found to contain large quantities of blood.—(See *Dionis, Cours d'Opérations de Chirurgie, 7e Démonstration. Petit, Traité des Maladies Chir. t.* 3, *p.* 282, *&c.*)

Another accident, sometimes following an unnecessary or too extensive a division of the frænum, consists in the tongue becoming thrown backwards over the glottis into the pharynx, where it lies fixed, and causes suffocation. The observations of Petit on this subject are highly interesting.—(See *Op. cit. t.* 3, *p.* 267, *&c.*)

Lastly, it should be known, that an infant's inability to move its tongue, or suck, is not always owing to a malformation of the frænum. Sometimes the tongue is applied and glued, as it were, to the roof of the mouth, by a kind of mucous substance; and in this case, it should be separated with the handle of a spatula. By this means, infants have been saved who were unable to suck during several days, and were in imminent danger of perishing from want of nourishment.—(See *Mémoires de l'Acad. de Chir. t.* 3, *p.* 16, *éd. 4to.*)

See particularly *Petit, Traité des Maladies Chir. t.* 3, *p.* 260, *&c. Dionis, Cours d'Opérations, 7e Démonstr. Sabatier, Médecine Opératoire, t.* 3, *p.* 132, *&c. Lassus, Pathologie Chir. t.* 2, *p.* 454. *Richerand, Nosogr. Chir. t.* 3, *p.* 284, *ed.* 2. *Richter, Anfangsgr. der Wundarzn. b.* 4, *kap.* 2, *p.* 11, *ed.* 1800.

FRAGILITAS OSSIUM. A morbid brittleness of the bones. Although it may take place at different periods of life, it is remarked to be more common in childhood and in persons of advanced age.—(See *B. Bell on Diseases of the Bones, p.* 74.)

Boyer imputes *mollities ossium* to a deficiency of lime in their structure; *fragilitas ossium* to a deficiency of the soft matter naturally entering into their texture. He states, that a certain degree of fragilitas ossium necessarily occurs in old age, because the proportion of lime in the bones naturally increases as we grow old, while that of the organized part diminishes. Hence, the bones of old persons more easily break than those of young subjects, and are longer in uniting again As Mr. Wilson observes, however, they never are found so friable and fragile, as to crumble like a calcined bone, but, on the contrary, they contain a large quantity of oil; a fact particularly noticed by Saillant (see *Hist. de la Société de Méd.* 1776, *p.* 316), and when dried after death, they are so greasy as to be unfit to be preserved as preparations. Their organized vascular part is diminished, but their oily animal matter is increased.—(*On the Skeleton and Diseases of Bones, p.* 258.)

In persons who have been long afflicted with cancerous diseases, the bones become sometimes as brittle as if they had been calcined. Saviard and Louis relate cases of this description.—(*Obs. Chir. et Journ. des Savans*, 1691. *Obs. et Remarques sur les Effets du Virus Cancereux, Paris*, 1750. *Poutecu, Œuvres Posthumes, t.* 1.) Two remarkable instances of this kind have been published by Mr. Salter, of Poole. In the first, the patient, a female, aged 82, felt the right thigh suddenly break as she was standing at her drawers. For several months previous to the accident, she had had constant and very severe pain in the part of the bone which was broken, and she had been long afflicted with a cancerous ulceration of the mamma. After death, the bone was so flexible, that no bony union could have taken place A regular dissection of the limb was not allowed. In Mr. Salter's second case, the patient was also a female, 56 years of age, and for five months preceding the accident had laboured under violent pain of the right thigh, and a thickening of the periosteum a little above the patella. As her friends were putting her into a cart, the bone snapped about three inches below the trochanter. For several years she had a scirrhus of the left breast. This had been removed, and the wound healed, but afterward broke out in the form of cancerous ulceration. In this stage the fracture took place, and was followed in about three months by her death. Mr. Salter removed the thigh-bone, and brought it home for examination; but, previously to its removal, the affected limb was observed to be considerably shorter than the other, and flexible at its middle, and a good deal deformed by a projection just below the trochanter major. The muscles of the thigh were pale and shrunk; a bloody fluid escaped from the capsular ligament of the knee-joint, and two or three clots of pure blood were in the articular cavity. On removing the patella, a small ulcer was discovered in the upper and external part of the articular surface of the bone. Among other particulars, it is stated that the thigh-bone was remarkably soft throughout its whole length, and the knife could be pushed through it at any part; but at its middle it was most conspicuously deficient in earthy matter. At about three inches from either extremity, it could be bent in any direction; and it was on the upper part of this portion that the fracture had taken place, but the precise situation of it was not distinctly visible; and Mr. Salter conceives, that there had been no complete separation like what occurs in common fractures. The distortion did not arise from any overlapping, but from a bending of the bone. The muscles about the upper part of the limb were confounded together into a uniform mass of a pale red colour, firm and cartilaginous, with bony spiculæ thickly dispersed through them, and puriform matter slightly tinged with blood issuing from the cut surfaces. The integuments had suffered no change. In the situation of the swelling noticed above the patella, the tendon of the cruralis was much thickened and altered in texture, and a considerable quantity of pus came from under it; the subjacent periosteum was also much thickened, and readily detached. The parietes of the bone were here nearly absorbed, and the medullary cavity was filled with a bloody pultaceous substance.—(See *Med. Chir. Trans. vol.* 15, *p.* 186.) It is justly inferred by Mr. Salter, that as these cases corresponded in so many points, the predisposing cause of fracture was probably the same in both. Both the patients laboured under cancer of the breast, and both suffered much from previous pain and lameness. These cases, it is to be remarked, were rather specimens of mollities ossium, or preternatural flexibility of the bones affected, and seem to have differed from some examples of fragility on record, not only in their cause, but in the circumstance of no attempt at ossification having taken place in the broken or flexible parts. They resemble, in some respects, Mr. Howship's case; yet differ in the affection being restricted to one bone, and being the sequel of a cancerous disease of the breast.

Louis mentions a nun who broke her arm by merely leaning on a servant; and in the *London Medical Journal* an account is given of a person who could not even turn in bed without breaking some of his bones. One of Professor Gibson's patients, residing near Trenton, in the United States, has a son 19 years of age, who from infancy has been subject to fractures from the slightest causes, owing to an extraordinary brittleness of the bones. "The bones of the arm, fore-arm, thigh, and leg have all been broken repeatedly, even from so trivial an accident as catching the foot in a fold of carpet while walking across the room. The clavicles have suffered more than any other bone, having been fractured eight times. What is remarkable, the boy has always enjoyed excellent health, and the bones have united without difficulty or much deformity.—(*Institutes, &c. of Surgery, vol.* 1, *p.* 370.)

Similar cases are mentioned by Mr. B. Bell. A child, he observes, fractures a limb. The fracture unites, and is consolidated perhaps in less than the usual period. Some time afterward, on lifting a moderate weight, or on giving the limb a slight twist, it is again broken, and again unites. Mr. Bell saw this occur three times in different parts of the right humerus of a child five years of age, within the short period of eighteen months. "Several similar cases," he says, "have been under my care; in all of them, the patients seemed to enjoy robust health, were apparently untainted by scrofula, and their fragile bones united in a shorter space of time than I have generally observed to be the case in individuals whose bones were tougher." —(*On Diseases of Bones, p.* 71.) The same author has been able to discern in only two cases of fragility a palpable deviation from the healthy structure of the bones affected. The subject of one case was a gentleman at

the middle period of life, who fractured his humerus in unscrewing a music-stool. The fracture was comminuted and did not unite. The arm was at length amputated, by Mr. George Bell, at the shoulder. On examining the limb, the muscles around the fractured bone were found in a pulpy state The bone surrounded with blood partly fluid and partly coagulated, was almost friable, and its whole surface perforated by innumerable small, irregularly shaped holes, giving it a reticulated appearance.—(*Op. cit. p.* 72.)

In the latter stages of syphilis, the bones are alleged to be sometimes remarkably brittle.—(*Ephem. Nat. Cur. dec.* 1, *ann.* 3, *obs.* 112. *Walther, Museum Anat. t.* 2, *p.* 29.)

In bad cases of scurvy, the bones occasionally become so brittle, that they are broken by the slightest cause, and do not grow together again.—(*Boettcher von den Krankh. der Knochen, p.* 68.)

Dr. Good was once present at a church, in which a lady, nearly seventy years old, broke both the thigh-bones in merely kneeling down; and on being taken hold of to be carried away, had an os humeri also broken, without any violence, and with little pain. Hardly any constitutional disturbance ensued, and in a few weeks the bones united.—(*Study of Medicine, vol.* 5, *p.* 332, *ed.* 3.)

The fragilitas ossium of old age is incurable; but in children the tendency depends on some other constitutional disease, and can only be cured by a removal of the latter.—(See *Boyer on Diseases of the Bones, vol.* 2.)

This author, in one of his last works, expresses his opinion that the doctrine of mollities and fragilitas ossium being distinct and different diseases, is by no means sufficiently proved by a due number of accurate observations.—(*Traité des Mal. Chir. t.* 3, *p.* 607, 608.) Consult *Waldschmidt, Dis. de Fracturâ Ossium sine Causâ violentâ externâ, Kilon.* 1721. *Acrel, Chir. Vorfälle, b.* 2, *p.* 136. *Courtial, Nouvelles Obs. Anat. sur les Os, p.* 64, 12*mo. Paris*, 1705. *Marcellus Donatus, lib.* 5, *c.* 1, *p.* 528. *Walther, Museum Anat. vol.* 2, *p.* 29. *Schmucker, Vermischte Schriften, b.* 1, *p.* 385. *Kentish, in Edin. Med. Comment. vol.* 1. *Hist. de l'Acad. des Sciences*, 1765, *p.* 65. *Hist. de la Soc. Royale de Médecine*, 1777 *and* 1778, *p.* 224. *Journ. de Méd. t.* 77, *p.* 267; *t.* 84, *p.* 216. *Isenflamm, Pract. Bemerk. über Knochen, p.* 368. 415. 466. *Fabricius Hildanus, cent.* 2, *obs.* 66, 67, 68; *cent.* 5, *obs.* 89. *D'Aubenton, Description du Cabinet du Roi, t.* 3. *Ossa Venere sponte fracta. Meckren, Obs. Med. Chir. p.* 341. *Amst.* 1682. *Weidmann de Necrosi Ossium, p.* 2. *Francofurti*, 1793; *and the writings of Duverney, Petit, and Pringle. Gooch's Obs. Appendix. J. Wilson on the Skeleton, &c. p.* 258, 8*vo. Lond.* 1820. *Gibson's Institutes of Surgery, vol.* 1, *p.* 370; *and vol.* 2, *p.* 70, *Philadelphia*, 1825. *B. Bell on Diseases of the Bones, p.* 71, *Edin.* 1828. *Salter, in Med. Chir. Trans. vol.* 15. *Howship, in Edin. Med. Chir. Trans. vol.* 2.

FUNGUS. Any sponge-like excrescence. Granulations are often called *fungous* when they are too high, large, flabby, and unhealthy.

FUNGUS HÆMATODES. (From *fungus*, and *αἷμα*, blood.) *The Bleeding Fungus. Spongoid Inflammation. Soft Cancer. Carcinome Sanglante. Medullary Sarcoma.*

This disease, which has been accurately described only of late years, was formerly generally confounded with cancer. The public are indebted to Mr. J. Burns, of Glasgow, for the first good account of it; and the subsequent writings of Mr. Hey, of Leeds, Mr. Freer, of Birmingham, Mr. J. Wardrop, Mr. Langstaff, and others, have made us still better acquainted with the subject.

It is unquestionably one of the most alarming diseases incidental to the human body, because we know of no specific remedy for it; and an operation can only be useful at a time when it is very difficult to persuade a patient to submit to it.

Indeed, when the diseased part is extirpated at an early period, a recovery hardly ever follows; for experience proves that it is not a disease of a local nature, but almost always extends to a variety of organs and structures at the same time, either to the brain, the liver, or lungs, &c. It is of the utmost consequence to be aware of this fact, since we should otherwise be induced to attempt many hopeless operations, and deliver a prognosis that might cause disappointment and censure. In a large proportion of patients, afflicted with fungus hæmatodes, the general disorder of the system is indicated by a peculiarly unhealthy aspect; a sallow, greenish-yellow colour of the skin, which is frequently covered with clammy perspiration; constant troublesome cough; difficulty of breathing, &c.

Fungus Hæmatodes is the name used by Mr. Hey. Mr. J. Burns has called the disease *spongoid inflammation*, from the spongy elastic feel which peculiarly characterizes it, and which continues even after ulceration takes place. Fungus hæmatodes has most frequently been seen to attack the eyeball, the upper and lower extremities, the testicle, and the mamma. But the uterus, ovary, liver, spleen, brain, lungs, thyroid gland, hip, and shoulder-joints, have also been the seat of the disease. A distemper which presents itself in so many parts must be subject to variety in its appearances.

FUNGUS HÆMATODES OF THE EYE.

1. When it attacks the eye, the first symptoms are observable in the posterior chamber, an appearance like that of polished iron presenting itself at the bottom of the eye.—(*Scarpa, on Diseases of the Eye, p.* 505, *ed.* 2.) The pupil becomes dilated and immoveable, and instead of having its natural deep black colour, it is of a dark amber, and sometimes of a greenish hue. The change of colour becomes gradually more and more remarkable, and at length is discovered to be occasioned by a solid substance, which proceeds from the bottom of the eye towards the cornea. The surface of this substance is generally rugged and unequal, and ramifications of the central artery of the retina may sometimes be seen running across it. The front surface of the new mass at length advances as far forwards as the iris, and the amber or brown appearance of the pupil, has, in this stage, been known to mislead surgeons into the supposition of there being a cataract, and makes them actually attempt couching. The disease continuing to increase, the eyeball loses its natural figure, and assumes an irregular knobby appearance. The sclerotica also loses its white colour, and becomes of a dark blue or livid hue. Sometimes matter now collects between the tumour and the cornea. The latter membrane in time ulcerates, and the fungus shoots out. In a few instances, it makes its way through the sclerotica, and is then covered by the conjunctiva. The surface of the excrescence is irregular, often covered with coagulated blood, and bleeds profusely from slight causes. When the fungus is very large, the most prominent parts slough away, attended with a fetid sanious discharge. In the course of the disease, the absorbent glands, under the jaw, and about the parotid gland become contaminated. On dissection, a diseased mass is found extending forwards from the entrance of the optic nerve, the vitreous, crystalline, and aqueous humours being absorbed. The retina is annihilated, and the choroid coat propelled forwards, or quite destroyed. The tumour seems to consist of a sort of medullary matter, resembling brain. The optic nerve is thicker and harder than natural, of a brownish ash-colour, and destitute of its usual tubular appearance. In other cases, the nerve is split into two or more pieces, the interspaces being filled up with the morbid growth.—(*Wardrop.*) Nay, as Mr. Travers has stated, the optic ganglion, tractus opticus, and thalamus have been repeatedly found diseased, and the surrounding adipose substance in the orbit affected to a considerable extent in places also where there was no direct communication with the diseased contents of the globe. —(*Synopsis of the Diseases of the Eye, p.* 221.) Even the brain has been observed to share in the disease, sometimes dark red spots appearing on the dura mater; sometimes small spots, containing a fluid like cream, being found between the pia mater and tunica arachnoides. Mr. Travers has a preparation, exhibiting a genuine example of the disease affecting the anterior right lobe of the cerebrum, and protruding the eye from its socket, while the eye itself was perfectly free from disease.—(*Op. cit. p.* 223.) When the lymphatic glands at the angle of the jaw are enlarged, as they frequently are, they are also found converted into a kind of medullary matter, similar to that which composes the diseased mass in the eyeball. When the skin bursts over a diseased absorbent gland, a sloughy ulcer is produced; but no fungus is emitted, unless the affection of the gland with fungus hæmatodes be primary. Fungus hæmatodes of the eye has been erroneously regarded

as cancer by the best writers. We learn from Bichat, that more than one-third of the patients on whom Desault operated for *supposed* carcinoma of the eye were under twelve years of age. Twenty out of twenty-four cases of fungus hæmatodes of the eye, with which Mr. Wardrop has been acquainted, happened to children under twelve years of age. Now, as cancer is rather a disease of aged than young persons, and we find from Mr. Wardrop, that fungus hæmatodes of the eye mostly affects persons under twelve years of age, it is tolerably certain that most of Desault's cases, reported to be cancers of the eye, were in fact the equally terrible disease now engaging our consideration. According to Mr. Travers, the only parts of the eye and its appendages subject to be primarily attacked by cancer are the lachrymal gland, conjunctiva, and eyelids; while the evidence of many cases has assured him, that fungus hæmatodes may originate in any texture of the eye, with the exception of the lens and cornea.—(*Synopsis of the Diseases of the Eye*, p. 216. 222. and 421.) This account, however, differs from that delivered by Mr. Wardrop and Professor Scarpa, who describe the disease as first commencing in the retina, and particularly at the point where the optic nerve enters the eye. "For (says the latter author), on the first appearance of the yellowish or greenish spot, the retina, on examination, is found to be entirely deficient, or, in other words, to have degenerated into the malignant fungus. It is also found, that the choroid membrane, while the fungus hæmatodes is in its incipient state, does not appear to have suffered any remarkable alteration in its texture, and that it is only at a more advanced period of the disease that this membrane becomes thickened and separated from its connexion with the sclerotica. The choroid membrane, even in the most advanced stage of the disorder, preserves, more than all others, its natural texture."—(*On the Principal Diseases of the Eye*, p. 507, *ed.* 2.) In cases of fungus hæmatodes, the sight of young subjects is generally destroyed before the attention of parents is excited to the distemper. Frequently, however, a blow, followed by ophthalmy, precedes the growth of the diseased mass. When no external violence has occurred, the first symptom is a trivial fulness of the vessels of the conjunctiva, the iris becoming, at the same time, extremely vascular, and altered in colour, and the pupil dilated and immoveable. There is seldom much complaint made of pain; but the child is sometimes observed to be languid and feverish. In adults, fungus hæmatodes of the eye generally comes on without any apparent cause, though sometimes in consequence of a blow. At first, the tunica conjunctiva is slightly reddened, and vision indistinct. The redness and obscurity of sight increases slowly, and an agonizing nocturnal headache is experienced; the eye bursts, and the humours are discharged.

With regard to the cure of the fungus hæmatodes of the eye, the only chance of effecting this desirable object depends upon the early extirpation of the diseased organ. It must be acknowledged, however, that most of the operations, in which the morbid eye has been removed, have hitherto proved unsuccessful, owing to a recurrence of the disease. The reason of such ill success may be imputed to the optic nerve and other parts being almost always in a morbid state, before an attempt is made to remove the eye. One case, however, described by Mr. Travers, as having its seat in the cellular texture connecting the conjunctiva to the cornea, was operated upon, and no recurrence of the disease had occurred a twelvemonth afterward. No other texture was affected more than the contiguity and extent of the disease explained.—(*Synopsis of the Diseases of the Eye*, p. 413.) The most successful extirpation of an eye in an advanced stage of this disease, and, perhaps, the only satisfactory one at present on record, is that which was performed by Mr. Wishart, the cure continuing complete eighteen months after the operation.—(See *Edin. Med. Journ. vol.* 19, p. 51.) The operation has nearly always been found to fail when the disease is advanced so far that the posterior chamber is filled by the fungous mass. With the very few exceptions which there are to this statement, it may be correctly said, that, as no internal medicines nor external applications afford the least hope of checking any form of the fungus hæmatodes, it is manifest, that when the distemper of the eye exceeds certain bounds, the miserable patient is placed beyond the reach of any effectual aid from surgery. In a case which I saw in April, 1821, in the London Eye Infirmary, the disease formed a diseased mass as large as an orange, accompanied with enlarged lymphatic glands over the parotid. The patient was an infant. In this instance, Mr. Lawrence used, as a local application, the liquor opii sedativus, prepared by Mr. Battley, which was found to lessen considerably the child's sufferings.—(See particularly *Wardrop's Obs. on Fungus Hæmatodes. Scarpa, On the Principal Diseases of the Eye, chap.* 21. *Some Cases in Saunders's Treatise on Diseases of the Eye; and B. Travers's Synopsis of the Diseases of the Eye, Svo. Lond.* 1820.)

FUNGUS HÆMATODES OF THE LIMBS.

2. In the extremities, the disease begins with a small colourless tumour, which is soft and elastic, if there be no thick covering over it, such as a fascia; but otherwise it is tense. At first, it is free from uneasiness; but by degrees a severe acute pain darts occasionally through it more and more frequently, and at length becomes incessant. For a considerable the tumour is smooth and even; but afterward it projects irregularly at one or more points; and the skin at these places becomes of a livid red colour, and feels thinner. In this situation it easily yields to pressure, but instantly bounds up again. Small openings now form in these projections, through which is discharged a thin bloody matter. Almost immediately after these tumours burst, a small fungus protrudes like a papilla, and this rapidly increases both in breadth and height, and has exactly the appearance of a carcinomatous fungus, and frequently bleeds profusely. The matter is thin, and exceedingly fetid, and the pain becomes of the smarting kind. The integuments, for a little way round these ulcers, are red and tender. After ulceration takes place, the neigbouring glands swell, and assume exactly the spongy qualities of the primary tumour. If the patient still survive the disease in its present advanced progress, similar tumours form in other parts of the body, and the patient dies hectic.

After death or amputation the tumour is found to consist of a soft substance, somewhat like the brain, of a grayish colour, and greasy appearance, with thin membrane-like divisions running through it, and cells or abscesses in different places, containing a thin bloody matter, occasionally in very considerable quantity. There does not seem uniformly to be any entire cyst surrounding the tumour; for it very frequently dives down between the muscles, or down to the bone, to which it often appears to adhere. The neighbouring muscles are of a pale colour, and lose their fibrous appearance, becoming more like liver than muscle. The bones are always carious in the vicinity of the disease.

The distemper is sometimes caused by external violence, though in general there is no evident cause whatever.—(*Dissertations on Inflammation, by J. Burns, vol.* 2.)

Mr. Hey has given several cases of the fungus hæmatodes. If I notice the most particular circumstances relative to one of these, it will suffice to inform the reader of the form in which this terrible affliction has presented itself in this gentleman's practice.

A young man, aged twenty-one, two years before applying to Mr. Hey, perceived a small swelling on the inside of the right knee, not far from the patella. This tumour was moveable, and did not impede the motion of the joint: it was not discoloured, but was painful when moved or pressed upon. It continued in this state half a year, and then, the man having hurt his knee against a stone, it gradually increased in bulk, but did not exceed the size of an egg. The skin was now discoloured with blue specks, which were taken to be veins. He could still walk with ease, and follow his business.

Two months before his admission into the Leeds Infirmary he met with a fall, and violently bent his knee, but did not strike it against any thing. The tumour began immediately to enlarge; and, within a few hours, it extended half way up the inside of the thigh. About a fortnight after this accident the skin burst at the lowest part of the tumour, and discharged some blood. A dark-coloured fungus, about the size of a pigeon's egg, here made its appearance, and a few weeks afterward the skin burst at another part of the large tumour, and some blood was again discharged. From the fissure arose another fungus, which had increased in the

course of the last week to the size of a small melon, and now measured eight inches from one side of its base to the other. The base of the fungus frequently bled, especially when the man allowed his limb to hang down.

The whole tumour was now of an enormous size, being nineteen inches across, when the measure was carried over the last-mentioned fungus. From its highest part in the thigh to the lowest part, just below the knee, it measured seventeen inches, without including the fungus. The base of the tumour at the knee, exclusive of that part which ran up the thigh, measured twenty-four inches in circumference. The tumour was situated on the inner side of the limb, and was distinctly defined. The skin covering the disease was in some places livid, and had several fissures and small ulcerations upon it; but had not burst asunder, except in the two places above described. The tumour was soft, and gave a sensation of some contained fluid, when gently pressed with the hands alternately in opposite directions. The patient said he had walked without pain in his knee a week before his admission into the Infirmary; and he had lost very little blood in his journey to Leeds. He complained of the greatest uneasiness in the highest part of the tumour. It had become hot and painful in the night-time for some days past. His pulse was 114 in a minute, his tongue was clean, and his appetite had been good till the last few days. He had never felt any pulsation in the tumour.

In a consultation it was determined, that the tumour should be laid open, by cutting off a portion of the distended integuments; and that, after removing the contents, if the sac should be found in a sound state, the disease should be treated as a simple wound; but if in a morbid state, amputation of the limb should be immediately performed.

A large oval piece of the integuments being removed, the tumour was found to contain a very large quantity of a substance not much unlike coagulated blood; but more nearly resembling the medullary part of the brain in its consistence and oily nature. It was of a variegated reddish colour, in some parts approaching to white, and, as blood issued from it, Mr. Hey conceived it was organized. This mass was partly diffused through the circumjacent parts in innumerable pouches, to which it adhered, and was partly contained in a large sac of an aponeurotic texture, which was connected with the capsule of the knee-joint. There was a great and universal effusion of blood from the internal surface of the sac, and from the pouches containing this morbid mass.

Amputation of the limb was immediately performed, on finding such to be the nature of the case. Mr. Hey unfortunately, however, left a portion of the diseased surface behind on the inner part of the thigh, and hoping that a small narrow portion of the upper part of the sac would soon become a clean sore, and not impede the cure, he made the circular incision two inches below its higher part.

On examining the amputated limb, the vastus internus was found to be brown, and much softer than the other muscles, which were healthy. There were many small portions of blood extravasated in the substance of this muscle. The sac was formed on the aponeurotic covering of the muscle, and ended below where this aponeurosis begins to cover the capsular ligament of the knee. The two fungous substances above described appeared to have been only extensions of the morbid mass, where this had made its way through the sac and the integuments. The joint of the knee and muscles of the leg were perfectly sound.

I need not detail all the particulars after the operation. Suffice it to say, the man suffered a good deal of constitutional disorder. After a few weeks, the granulations upon the stump became good, and the cicatrization was nearly completed at the end of the sixth week after the amputation. At this period, the small and superficial portion of the upper part of the great sac, which Mr. Hey had unfortunately left, was now healed; but a tumour now about four inches in length, and between two and three in breadth, had gradually risen at the lower and under part of the thigh beneath the cicatrix. This contained a soft substance, exactly similar, as far as the touch could discover, to that which had filled the large sac. This tumour became painful, and sometimes discharged a bloody serum, sometimes dark-coloured blood, through four or five small openings in the cicatrix.

Mr. Hey laid open the tumour, and removed its contents; but no advantage was gained by this proceeding. The interior surface was found to be too much diseased to produce good granulations. Blood continued to ooze out of the wound for a few days. Then the inner surface became covered with a blackish substance, which gradually extended itself, and formed a new fungus. A variety of escharotics were applied to destroy the fungous and morbid surface of the wound, but to no purpose; the growth of the fungus always exceeded the quantity destroyed. Undiluted oil of vitriol applied freely had very little effect.

An attempt was once more made to cut away the disease; but on examining the wound carefully, after the contained substance was removed, the muscular substance was found degenerated into a hard mass, which felt somewhat like cartilage. The adipose membrane was also diseased, and formed into large cells, which had contained the fungous substance. Hence, another amputation seemed the only resource.

After this operation, the whole surface of the stump seemed sound, except the principal artery, which was filled with a somewhat stiff matter, resembling coagulated blood, which prevented its bleeding. The inside of the vessel, on being touched with the scalpel, felt hard, and communicated a sensation like that of scraping bone.

The man was sent home as soon as his state would admit of it; but he died consumptive about six months afterward. Besides this instance in the thigh, Mr. Hey relates cases of fungus hæmatodes situated in the female breast, in the leg, in the neck (extending from the jaw to the clavicle, and producing suffocation), on the back part of the neck, on the back part of the shoulder, and at the extremity of the forearm, near the wrist.

"If I do not mistake (says Mr. Hey), this disease not unfrequently affects the globe of the eye, causing an enlargement of it, with the destruction of its internal organization. If the eye is not extirpated, the sclerotis bursts at the last, a bloody sanious matter is discharged, and the patient sinks under the complaint."—(*P.* 283.)

Besides some cases in similar situations to those mentioned by Mr. Hey, one is related by Mr. Burns, in which the hip-joint was the seat of this terrible affection. After detailing the progress of the case to the poor man's death, this author states, that he found, on dissection, the hip-joint completely surrounded with a soft matter, resembling the brain, enclosed in thin cells, and here and there cells full of thin bloody water: the head of the thigh-bone was quite carious, as was also the acetabulum. The muscles were very pale, and almost like boiled liver, having completely lost their fibrous appearance and muscular properties. The same sort of morbid mischief was also found within the pelvis, most of the inside of the bones on the affected side being carious. An attempt had been made, before the patient died, to tap the bladder; but the trocar had only entered a cell filled with bloody water, and situated in a mass of the soft brain-like substance.

I have already said enough to render the description of the dreadful nature of the fungus hæmatodes tolerably complete. Little can be said of the treatment; for we know not of one medicine that seems to have the least power of putting a stop to the disease, and, with the exception of a case under Mr. Cline, where the breast healed up after the diseased mass had been thrown off by sloughing (*Lancet*, *vol.* 2, *p.* 401), we have no reason to believe that there is ever the smallest chance of any spontaneous amendment, much less of such a cure. Also, in the case just now cited, it is not known whether any relapse followed.

We have seen that when the chief part of a fungus hæmatodes is cut away, and only a small portion of its cyst left behind, the fungus is reproduced from this part, and soon becomes as formidable, nay, more formidable than it was before, and this notwithstanding the application of the most powerful escharotics. Neither the hydrargyrus nitratus ruber, the hydrargyrus muriatus, the antimonium muriatum, nor the undiluted vitriolic acid, has always been able to repress the growth of such fungus.—(*Hey.*)

No known remedy has the power of checking or removing the complaint. Friction, with anodyne balsams, sometimes gives relief in the early stages; but it does not retard the progress of the disease.

In short, the only chance of cure consists in extirpating the whole of the distempered parts, removing not only the soft, brain-like, fungous substance, but every part of the cysts, sacs, or pouches in which it may be contained. An operation of this kind, however, is only advisable in the early stages, while the disease is entirely local, if it ever be so, a circumstance much to be doubted; for, after the neighbouring glands have become affected, the chance of recovery is almost destroyed. It is sometimes difficult, however, to persuade patients at an early period to submit to amputation or extirpation, because the pain and inconveniences are inconsiderable; but the operation should be urged with all the force which a conviction of its absolute necessity and the fatal peril of delay ought to inspire.

The attempts to cure the disease by cutting it away, have been attended with such ill success that some surgeons deem it advisable not to follow this method, but amputate the limb at once. The annexed views of the matter appear to me to be most judicious and rational. First, that if an attempt be made to cut away the tumour and save the limb, the surgeon must be careful to remove at the same time a considerable quantity of the soft parts in the circumference of the swelling. Secondly, that the earlier this is done the more likely is it to succeed. Thirdly, that after the tumour is taken out, an attentive examination of the surface of the wound should be made, and every suspicious part or fibre be cut away. Fourthly, that should the disease still recur, amputation ought to be instantly performed. Fifthly, that caustics should never be applied to this disease. Sixthly, that even when one of these operations effectually extirpates the distemper of the limb, the patient's entire recovery is always rendered exceedingly uncertain by reason of the viscera and other invisible parts being frequently affected, at the time of the operation, with the same sort of disease.

FUNGUS HÆMATODES OF THE TESTICLE.

3. Fungus hæmatodes of the testicle sometimes begins in its glandular part, sometimes in the epididymis. Its progress is slow, and the pain generally not severe. Nor is there at first any inequality or hardness of the diseased part, nor change in the scrotum. When the testicle has become exceedingly large, it feels remarkably soft and elastic, as if it contained a fluid. Hence, the case has often been mistaken for a hydrocele, and punctured with a trocar.—(*Wardrop; Earle, in Med. Chir. Trans. vol.* 3, *p.* 60.) Occasionally, when the tumour is large, it is in some places hard, in others soft. The hydrocele may be known by the water beginning to collect at the bottom of the scrotum, and then ascending towards the spermatic cord, and by the swelling being circumscribed towards the abdominal ring; whereas, the fungus hæmatodes begins with a gradual enlargement of the testicle itself, followed by a fulness which extends up the spermatic cord. It is not in the slightest degree diaphanous, and is much heavier than a similar bulk of water.—(*Earle, op. cit.*) As the disease advances, abscesses form, and the scrotum ulcerates, but no fungus shoots out. When the inguinal glands become contaminated, they often acquire an immense size; and as soon as the skin over them bursts, large portions of them slough away. Fungus hæmatodes of the testicle is said to afflict young more frequently than old subjects. On dissection, the substance of the diseased testicle is found to present a medullary or pulpy appearance, generally of a pale brownish colour, though sometimes red. In most cases the tunica vaginalis and tunica albuginea are adherent together; occasionally there is fluid between them.

In an example dissected by Mr. Lawrence, the swelling of the testicle consisted of cellular septa filled with pulpy matter. Numerous tubercles of the disease were found in the omentum, and about the pelvis, intermixed with recently effused coagula. A mass of soft matter, equal in size to a man's head, lay on the spine behind the aorta and vena cava, *which last vessel was closed for some extent.* The spermatic vessels could not be found.—(See *Med. Chir. Trans. vol.* 8, *part* 1, *art.* 13.)

The only chance of a cure must be derived from a very early performance of castration, before the disease has extended to the inguinal glands, or far up the spermatic cord Indeed, very little hope should be placed in the removal of the testicle; for fungus hæmatodes appears to be rather a constitutional than a local disease. Nearly every case on record has terminated fatally, and upon dissection either the liver, the lungs, the brain, the mesenteric glands, or other internal parts, have been found affected with the same disease. In one case dissected by Mr. Lawrence, tubercles of a similar structure to the disease in the axilla were found in the lungs, heart, and, in short, in nearly all the thoracic and abdominal viscera, though the contents of the skull were free from disease.—(See *Cases recorded by Wardrop, Earle, Laurence, and Langstaff, in Med. Chir. Trans. vol.* 3 *and* 8.)

Whe shall quit this subject with stating some of the principal differences between two diseases which have been commonly confounded. A scirrhous tumour is, from its commencement, hard, firm, and incompressible, and is composed of two substances; one hardened and fibrous, the other soft and inorganic. The fibrous matter is the most abundant, consisting of septa, which are paler than the soft substance between them. A scirrhous tumour, situated in the gland is not capable of being separated from the latter part, so much are the two structures blended. A scirrhus in another situation sometimes condenses the surrounding cellular substance, so as to form a kind of capsule, and assume a circumscribed appearance. When a scirrhous swelling ulcerates, a thin ichor is discharged, and a good deal of the hard fibrous substance is destroyed by the ulceration; other parts become affected, and the patient dies from the increased ravages of the disease, and its irritation on the constitution. Sometimes, though not always, after a scirrhus has ulcerated, it emits a fungus of a very hard texture. Such excrescence, however, is at last destroyed by the ulceration. Cancerous sores, also, frequently put on for a short time, in some places, an appearance of cicatrization. On the other hand, the fungus hæmatodes, while of moderate size, is a soft elastic swelling, with an equal surface, and a deceitful feel of fluctuation. It is in general quite circumscribed, being included within a capsule. The substance of the tumour, instead of being for the most part hard, consists of a soft, pulpy, medullary matter, which readily mixes with water. When ulceration occurs, the tumour is not lessened by this process, as in scirrhus; but a fungus is emitted, and the whole swelling grows with increased rapidity. Cancerous diseases are mostly met with in persons of advanced age, while fungus hæmatodes generally afflicts young subjects.—(*Wardrop.*) Many dissections have now proved, that the substance of fungus hæmatodes may contain cellular septa, which include the pulpy medullary matter.

Fungus hæmatodes, in its early stage, is generally attended with less acute pain than what is experienced in cases of scirrhus. The tumour also has a less definite boundary than a scirrhus, and it is more difficult to say where the diseased structure terminates, and where the healthy commences. When the disease is in the breast, there is less tendency than in scirrhous cases to disease in the axillary glands, which may remain sound though the disorder in the breast may have advanced to suppuration and ulceration. In the breast the disease is also much quicker in its progress than scirrhus.—(*A. Cooper, Lancet, vol.* 2, *p.* 399.)

In cases of external cancer, the viscera are not in general affected at the same time with cancerous disease; but in the majority of examples of fungus hæmatodes, this distemper is found affecting in the same subject a variety of parts. In addition to the outward tumour, we find swellings of a similar nature, perhaps, in the liver, the lungs, the mesenteric glands, or even in the brain. Yet M. Roux will have it, that cancer and fungus hæmatodes are the same disease; or at least that the latter is only a species of the former, and that in both cases the same peculiar diathesis prevails.—(*Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 216, 217.)

See *Dissertations on Inflammation, by J. Burns, vol.* 2. *Hey's Practical Observations in Surgery, ed.* 3. *Freer on Aneurism. Observations on Fungus Hæmatodes, or Soft Cancer, by James Wardrop,* 8*vo. Edin.* 1809. *This last publication is highly deserving of the attention of the surgical practitioner, the disease in different organs being well described, and its character discriminated from that of cancer.*

A case of this disease is related in vol. 5 *of the Lon-*

don Medical Journal. It was the consequence of an attempt to cure a ganglion by means of a seton, and it proved fatal. A case is also related by Mr. Abernethy, in Surgical Observations, 1804, *p.* 99. *See also a Case of Diseased Testicle, accompanied with Disease of the Lungs and Brain, by H. Earle, in Medico-Chirurg. Trans. vol.* 3, *p.* 59, *&c. in which vol. four other cases are recorded by Mr. Lawrence, p.* 71, *et seq., and one by Mr. Langstaff, p.* 277; *which last I remember to have visited in company with this gentleman and Mr. Lawrence, a short time before the patient died. See also Langstaff's Cases and Observations in the* 8*th and* 9*th vols. of the same work. Voyage fait à Londres en* 1814; *ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p.* 211, *&c. On Fungus Hæmatodes of the Eye there are some valuable observations in the last edition of Scarpa's Treatise on the Diseases of that organ. See also Saunders on Diseases of the Eye, and B. Travers's Synopsis of Diseases of the Eye*, 8*vo. Lond.* 1820. *G. Frick on Diseases of the Eye, p.* 287, *ed. by Welbank*, 8*vo. Lond.* 1826.

Respecting medullary sarcoma, which is generally considered as the same affection as fungus hæmatodes, some farther observations will be delivered in the article *Tumours*.

FURUNCULUS. (From *furo*, to rage.) A bile, so named from the violence of the heat and inflammation attending it.

A bile is a circumscribed, very prominent, hard, deep-red, inflammatory swelling, which is exceedingly painful, and commonly terminates in a slow and imperfect suppuration. The figure of the tumour is generally that of a cone, the base of which is considerably below the surface. Upon the most elevated point of the bile there is usually a whitish or livid pustule, which is exquisitely sensible, and immediately beneath this is the seat of the abscess. The matter is mostly slow in forming, is seldom very abundant, and never healthy at first, being always blended with blood. The complaint is seldom attended with fever, except when the tumour is very large, situated on a sensible part, or when several of these swellings occur at the same time in different places. In the last circumstance they often occasion in children, and even in irritable adults, restlessness, loss of appetite, spasms, &c. They rarely exceed a pigeon's egg in size, and they may originate on any part of the body.

Biles commonly arise from constitutional causes. Young persons, and especially subjects of full plethoric habits, are most subject to them. The disease is also observed to occur with most frequency in the spring.—(*Lassus, Pathologie Chir. t.* 1, *p.* 16.) According to Richerand, the origin of biles depends upon a disordered state of the gastric organs.—(*Nosographie Chir. t.* 1, *p.* 124, *édit.* 2.) Frequently they arise without any evident cause, and apparently in healthy constitutions. At other times they follow eruptive diseases and typhus. —(*W. Gibson, Institutes, &c. of Surgery, p.* 48, *vol.* 1.)

The suppuration attending a bile is never perfect, and the matter which forms is not only tinged with blood, but surrounded with a sloughy substance, which must generally be discharged before the part affected will suppurate kindly, and the disease end. Richter compares the slough to a kind of bag or cyst, and the whole bile to an inflamed encysted tumour.

The best plan is mostly to endeavour to make biles suppurate as freely as possible by applying external emollient remedies. This seems to be the natural course of the disease in its progress to a cure, and, indeed, all endeavours to disperse furunculous tumours commonly fail, or succeed very imperfectly; only removing the inflammation, and leaving behind an indolent hardness; which occasions various inconveniences, according to its situation, every now and then inflames anew, and never entirely disappears until a free suppuration has been established.

In a very few cases, perhaps, it may be proper to try to resolve biles. For this purpose, besides bleeding, gentle evacuations, and a low diet, which are requisite in this as well as other local inflammations, some prescribe as external applications honey strongly acidulated with sulphuric acid, alcohol, or camphorated oil.

But in the generality of instances suppuration must be promoted by the use of emollient poultices. The tumour, when allowed to burst, generally does so at its apex. However, as the opening is generally long in forming, and too small to allow the sloughy cellular substance to be discharged, it is always best, as soon as matter is known to exist in the tumour, to make a free opening with a lancet, and immediately afterward to press out as much of the matter and sloughs as can be prudently done. This having been accomplished, and the rest of the sloughs pressed out as soon as it is practicable, healthy pus will be secreted, and the part will granulate and heal. Until the suppuration becomes of the healthy kind, and the sloughy substances are entirely discharged, an emollient linseed poultice is the best application; and when granulations begin to fill up the cavity, plain lint and a simple pledget are the only dressings necessary.

For the purpose of stimulating the cavity, and causing it to fill up, Professor Gibson, of Philadelphia, has sometimes employed with success an injection of the nitrate of silver.

Where there is reason to suppose the gastric organs to be in a disordered state, an emetic should be given in the early part of the treatment, and afterward small repeated doses of any of the mild purging salts.

When an indolent hardness continues after the inflammatory and suppurative state of biles has been removed, the part should be rubbed with camphorated mercurial ointment.

Besides the above *acute* bile, authors describe a *chronic* one, which is said frequently to occur in subjects who have suffered severely from the small-pox, measles, lues venerea, scrofula, and in constitutions which have been injured by the use of mercury.

The *chronic* bile is commonly situated upon the extremities, is of the same size as the acute one, has a hard base, is not attended with much pain, nor any considerable discoloration of the skin, until suppuration is far advanced, and the matter is seldom quite formed before the end of three or four weeks. This, like the former, sometimes appears in a considerable number at a time. The discharge is always thinner than good pus, and when the bile is large, and has been long in suppurating, a great deal of sloughy cellular membrane must be cast off before the sore will heal.

The principal thing requisite in the local treatment of all furunculous and carbuncular tumours is to make an early free opening into them, and to press out the matter and sloughs, employing emollient poultices till all the mortified parts are detached and removed, and afterward simple dressings.—(See *Pearson's Principles of Surgery. Richter, Anfangsgründe der Wundarzn. b.* 1. *Lassus, Pathologie Chir. t.* 1, *p.* 15. *Richerand, Nosographie Chir. t.* 1, *p.* 123, *édit.* 2. *W. Gibson's Institutes of Surgery, vol.* 1, *Philadelphia*, 1824. *C. J. M. Langenbeck, Nosologie, &c. b.* 1, *p.* 357, *Gött.* 1822. *M. J. Chelius, Handb. der Chir. b.* 1, *p.* 74, *Heidelb.* 1826.)

G

GANGLION. (Γαγγλίον.) In surgery, a tumour on a tendon or aponeurosis.

A ganglion is an encysted, circumscribed, moveable swelling, commonly free from pain, causing no alteration in the colour of the skin, and formed upon tendons in different parts of the body, but most frequently upon the back of the hand and over the wrist. A French gentleman consulted me, who had one upon the upper part of his foot, which created a great sensation of weakness in the motion of the foot; and I have taken notice that ganglions occur particularly often just below the knee-pan in housemaids who are in the habit of kneeling a great deal in order to scour rooms. A curious example is recorded, in which a ganglion, situated exactly over the arteria radialis and the arteria superficialis volæ, was at first supposed to be an aneurism. —(See *Edin. Med. and Surg. Journ. for April*, 1821.)

These tumours, when compressed, seem to possess

considerable elasticity. They often occur unpreceded by any accident; frequently, they are the consequence of bruises and violent sprains. They seldom attain a considerable size, and ordinarily are not painful, though every now and then there are instances to the contrary. When opened, they are found to be filled with a viscid, transparent fluid, resembling white of egg. If they do not disappear of themselves, or are not cured while recent by surgical means, they, in some cases, become so large that they cause great inconvenience, by obstructing the motion of the part and rendering it painful.

Discutient applications sometimes succeed in curing ganglions, and in this country friction with the oleum origani is a very common method. I have often seen such tumours very much lessened by this plan of treatment, but seldom cured; for no sooner has the friction discontinued than the fluid in the cyst in general accumulates again.

Compression is usually more effectual than discutient liniments. Persons with ganglions have been recommended to rub them strongly with their thumb several times a day. After this has been repeated very often the tumour has sometimes disappeared. But the best method is to make continual pressure on ganglions by means of a piece of sheet-lead bound upon the part with a bandage. There is no objection, however, to using once or twice a day, in conjunction with this treatment, frictions with the oleum origani or camphorated mercurial ointment, provided these measures together do not seem likely to make the tumour inflame, an event which should always be carefully avoided. Ganglions, when irritated too much, have been known to become most malignant fungous diseases.

Setons have been recommended to be introduced through ganglions with a view of curing them. This method, however, is not an eligible one; for it is by no means free from danger, as the records of surgery fully prove. Cancerous diseases, and even a malignant fatal fungus (*Med. Journ. vol.* 5), have arisen from the irritation of a seton passed through a ganglion.

Frequently, when a ganglion inflames and ulcerates, the cyst throws out a fungus which is of a very malignant nature. Hence, the practitioner should avoid making an opening into the swelling, or doing any thing which is likely to occasion sloughing or ulceration of the disease. Ganglions may be cured by pressure sufficient to rupture the cyst, and some authors have recommended putting the hand affected upon a table, and then striking the ganglion several times with the fist or a mallet. The cyst of a recent ganglion may also be burst by compressing it strongly with the thumbs with or without the intervention of a piece of money; the fluid is effused into the adjacent cellular membrane; and pressure being now employed, the opposite sides of the cavity become united by the adhesive inflammation, and the recurrence of the disease is prevented. On this principle Sir Astley Cooper cures the disease. —(See *L'Encyclopédie Méthodique, partie Chir. art. Ganglion; Lassus, Pathologie Chir. t.* 1, *p.* 400, *&c.; Leveillé, Nouvelle Doctrine Chir. t.* 3, *p.* 7.)

In almost every instance, a ganglion may be cured by pressure and friction; and if not actually cured, the disease may be rendered so bearable by these means, that few patients would choose to have the tumour cut out. Under this plan, the swelling becomes very much diminished, and should it enlarge again, the mode of relief is so simple, and the case so little troublesome, that patients generally content themselves with occasionally wearing a piece of lead on the part.

But when ganglions resist all attempts to disperse or palliate them; when they become extremely inconvenient, either by obstructing the functions of the joint or causing pain, they should be carefully dissected out by first making a longitudinal incision in the skin covering them, then separating the cyst on every side from the contiguous parts, and lastly cutting every particle of it off the subjacent tendon or fascia. The greatest care must be taken not to make any opening in the cyst, so as to let out its contents, and make it collapse; a circumstance which would render the dissection of it entirely out much more difficult.

The operation being accomplished, the skin is to be brought together with sticking plaster, and a compress placed over the situation of the tumour, with a view of healing the wound and the cavity by adhesion.

When the ganglion has burst, or is ulcerated, it is best to remove the diseased skin together with the cyst, and of course the incision must be oval or circular, as may seem most convenient. The grand object is, not to allow any particle of the cyst to remain behind, as it would be very likely to throw out a fungus, and prevent a cure. In Warner's *Cases of Surgery* is an account of two considerable ganglions which this gentleman, in imitation of Celsus and Paulus Ægineta, thought it right to extirpate. These had become adherent to the tendons of the fingers. In the operation he was obliged to cut the transverse ligament of the wrist; and the patients, who before could not shut their hands, nor close their fingers, perfectly regained the use of these parts. Mr. Gooch relates a case of the same kind, which had been occasioned by a violent bruise three or four years before. The tumour reached from the wrist to the middle of the hand, and created a great deal of pain. Mr. Gooch extirpated it, and then restored the position of the hand and free motion of the joint by the use of emollient applications and suitable pressure, made with a machine constructed for the purpose. Other cases, confirming the safety of cutting out ganglions, are recorded in the *London Medical Journal for* 1787, *p.* 154; by *Eller, in Mém. de l'Acad. des Sciences de Berlin, t.* 2, *ann.* 1746; *Schmucker, in Chir. Wahrnehmungen, b.* 1, *p.* 332; *Girard, Lupiologie.*

The ganglions which occur just below the knee I have seen cured by a little blister applied over them, and kept open by the savin cerate. Camphorated blisters, indeed, have been proposed as a means of dispersing other ganglions.—(*Jaeger, Chir. Cautelen, b.* 2.)

For information relative to ganglions, consult *Warner's Cases in Surgery. Chirurgical Works of B. Gooch, vol.* 2, *p.* 376. *Heister's Surgery. B. Bell's Surgery. Latta's System of Surgery. L'Encylopidie Méthodique, partie Chir. art. Ganglion. Richter, Anfangsgr. der Wundarzn. b.* 1. *Lassus, Pathologie Chir. t.* 1, *p.* 399. *Dict. des Sciences Méd. t.* 17, *p.* 311.

GANGRENE. (From γραίνω, to feed upon.) An incipient mortification, so named from its eating away the flesh.

Authors have generally distinguished mortification into two stages: the first, or incipient one, they name *gangrene*, which is attended with a sudden diminution of pain in the place affected; a livid discoloration of the part, which, after being yellowish, becomes of a greenish hue; a detachment of the cuticle, under which a turbid fluid is effused; lastly, the swelling, tension, and hardness of the previous inflammation subside, and on touching the part a crepitus is perceptible, owing to the generation of air in the gangrenous parts.

When the part has become quite cold, black, fibrous, incapable of moving, and destitute of all feeling, circulation, and life, this is the second stage of mortification, termed *sphacelus*. Gangrene, however, is frequently used synonymously with the word mortification.—(See *Mortification.*)

GASTROCELE. (From γαστὴρ, the stomach, and κήλη, a tumour.) A hernia of the stomach.

GASTRORAPHIA, or GASTRORAPHE. (From γαστὴρ, the belly, and ῥαφὴ, a suture.) A suture of the belly, and some of its contents.

Although the term *gastroraphe*, in strictness of etymology, signifies the sewing up of any wound of the belly, yet Mr. S. Sharp informs us that in his time the word implied, that the wound of the abdomen was complicated with another of the bowels.

The moderns, I think, seem to limit the meaning of the word to the operation of sewing up a wound in the parietes of the abdomen.

What was formerly meant by gastroraphe could scarcely ever be practised, because the symptoms laid down for distinguishing when an intestine is wounded do not with any certainty determine in what particular part it is wounded; which want of information makes it absurd to open the abdomen in order to get at it. Hence the operation of stitching the bowels can only take place when they fall out of the abdomen, and when we can see where the wound is situated. And, indeed, even in these circumstances, the employment of sutures is a practice the propriety of which is questionable, as will be farther considered in the article *Wounds.*

The circumstances making the practice of sewing up a wounded intestine proper are so rare, that Duverney, who was the most eminent surgeon in the French army a great many years, and at a period when duels were particularly frequent, and his country at war, declared

that he had never had a single opportunity of practising gastroraphe, according to the former acceptation of that word.

Gastroraphe, or merely sewing up a wound of the parietes of the abdomen, may be done, as Mr. Sharp explains, with common interrupted suture (see *Suture*), or with the quilled one, which is better, as follows:

A ligature, capable of splitting into two, has a needle attached to each end of it. The lip of the wound is to be pierced, from within outwards, about an inch from its edge. The other needle is to be passed in the same way through the opposite lip. Then the two needles are to be cut off. As many such sutures must be made as the extent of the wound may require.

The sides of the wound are next to be brought together, and the ligatures tied, not in a bow, in the way of the interrupted suture, because the continual action of the abdominal muscles might make the ligatures cut their way through the parts. On the contrary, it is better to divide each end of the ligatures into two portions, and to tie these over a piece of bougie laid along the line at which the ligatures emerge from the flesh. This is to be done to all the ligatures on one side first. Then the wound being closed, another piece of bougie is to be placed along the other lip of the wound, and the opposite ligatures tied over it with sufficient tightness to keep the sides of the wound in contact. This suture is certainly preferable to the interrupted one, because a great deal of its pressure is made on the two pieces of bougie, and of course it is less likely to cut its way out. Its operation is to be assisted with compresses laid over each side of the wound, and the uniting bandage.

In four or five days the sutures may generally be removed, and sticking plaster alone employed.—(See *Wounds of the Abdomen.*)

It is generally allowed that sutures are violent means, to which we should only resort when it is impossible to keep the lips of a wound in contact by the observance of a proper posture and the aid of a methodical bandage. M. Pibrac believes such circumstances exceedingly uncommon, and in his excellent production in the third volume of the *Memoirs of the Royal Academy of Surgery*, relative to the abuse of sutures, cases are related which fully prove that wounds of the belly readily unite by means of a suitable posture and a proper bandage, without the practice of gastroraphe. These cases, however, are less decisive and convincing (if possible to be so) than the relations of the Cæsarean operation, the extensive wound of which has often been healed by simple means, after the failure of sutures. In fact, it is not only possible to dispense with gastroraphe, it is even mostly advisable to do so; for experience has proved that this operation has sometimes occasioned very bad symptoms.

Under certain circumstances, however, it may be essentially necessary to practise gastroraphe. For instance, were a large wound to be made across the parietes of the abdomen, a suture might become indispensably requisite to prevent the protrusion of the bowels. Yet even in this case the sutures should be as few in number as possible. In a longitudinal wound of the abdomen, a bandage of the eighteen-tailed kind might prove very useful, and do away all occasion for gastroraphe. —(See *Sutures.*)

I shall conclude this article with a fact, perhaps more curious than instructive, related by M. Bordier, of Pondicherry, in the *Journal de Médecine*, *vol.* 26, *p.* 538. An Indian soldier, angry with his wife, killed her, and attempted to destroy himself by giving himself a wound with a broad kind of dagger in the abdomen, so as to cause a protrusion of the bowels. A doctor of the country being sent for, dissected between the muscles and skin, and introduced a thin piece of lead, which kept up the bowels. The wound soon healed up, the lead having produced no inconvenience. The man was afterward hanged, and M. Bordier, when the body was opened, assured himself more particularly of the fact. Indeed, numerous cases prove that lead may lodge in the living body without occasioning the inconvenience which results from the presence of many other kinds of extraneous bodies.

See *Le Dran, Opérationes de Chirurgie. Sharp's Treatise on the Operations of Surgery. L'Encyclopédie Méthodique, partie Chirurgicale, art. Gastroraphe. Sabatier, Médicine Opératoire, t.* 1.

GLAUCOMA (from γλαυκὸς, bluish green) is now defined by modern surgeons to be a greenish or gray opacity of the vitreous humour, attended with the loss or a considerable impairment of sight.—(*Weller on Diseases of the Eye, transl. by Monteith, vol.* 2, *p.* 27.) In the words of Mr. Guthrie, the disease essentially consists in an alteration of the component parts of the vitreous humour, accompanied with derangement of the structure of the hyaloid membrane, retina, and tunica choroidea, the vessels of which are always more or less varicose. —(*Operative Surgery of the Eye, p.* 214.) Professor Beer considers the subjects of glaucoma and the cataracta viridis or glaucomatosa together in the same chapter. He observes that these diseases occur rather frequently, not only as true effects of inflammation of the eye, but sometimes quite unpreceded by this affection. Although glaucoma may continue for a long time as the only disorder, without the crystalline lens being changed in the slightest degree, yet Beer has never seen the case reversed, and the lens become altered as it does in glaucoma first, and the vitreous humour afterward. In what this author describes as gouty ophthalmy, glaucoma is said to come on with the following symptoms. The iris is not observed to expand, but rather to become contracted; the pupil is not equally dilated, but extends more towards the canthi, the iris at length becoming scarcely perceptible towards each angle of the eye, especially the outer one, and the pupil of course assuming something of the appearance which is seen in the eye of a ruminating animal. In a case, however, which I once saw in the London Eye Infirmary under Mr. Lawrence, it was particularly remarked, that the diameter of the pupil was not greatest in the transverse direction; a circumstance which Beer's account would lead us to expect was constant. And it particularly merits notice, that as the iris shrinks towards the margin of the cornea, its pupillary edge is inverted towards the lens, so that its smaller circle completely disappears. In this very dilated state of the pupil, a gray, greenish opacity is perceived, seeming to be very deep, and arising from a real loss of transparency in the vitreous humour. At this period the lens evidently becomes opaque, acquiring a sea-green hue, and the cataracta viridis, or glaucomatosa, now swells and appears to project forwards into the anterior chamber. The pain then becomes more incessant and violent; the varicose affection of the eyeball seriously increases; and the eyesight, which began hourly to diminish from the moment when the pupil was first observed to be in any degree expanded and opaque, and the iris motionless, is now so entirely destroyed, that not the slightest perception of *external* light remains, though the patient may vainly congratulate himself on discerning luminous appearances produced within the eye itself, in the form of a fiery, shining circle, especially when the organ is gently pressed upon. An eye in this condition (says Beer) has really a look as if it were dead, the cornea being as flaccid and void of lustre as in a corpse. Finally, when these symptoms have attained their utmost pitch, an atrophy of the eyeball follows, and the painful sensations about the organ cease. In corpulent individuals, however, they still continue with greater violence. Sooner or later the other eye is also either attacked with arthritic iritis, or ophthalmy, or becomes affected with glaucoma, which is ushered in by violent and incessant headache.—(*Beer, Lehre von den Augenkrankheiten, b.* 1, *p.* 581, *&c.* 8*vo. Wien*, 1813.) According to this author, glaucoma and the green cataract are never the consequences of any description of ophthalmy, but what he terms *arthritic.*—(*B.* 2, *p.* 255. *Wien*, 1817.) I believe, however, with Mr. Guthrie, that the inflammation is really an unhealthy disorganizing inflammation, not necessarily dependent upon nor connected with gout (*Operative Surgery of the Eye, p.* 216), of the effects of which disorder the German practitioners entertain the most vague notions. Both these affections, after they are conjoined with a general varicose disease of the eyeball, are set down by Beer as generally incurable. According to Weller, when the vitreous humour first begins to be muddy, the disease may sometimes be checked.—(*On Diseases of the Eye, vol.* 2, *p.* 29.) The means of relief depended upon in Germany are, frictions on the eyebrow with tinct. opii croc., or liniment. ammon.; the avoidance of cold; camphorated bags of aromatic herbs applied over the eye, but the effect of which must be rather insignificant; issues; setons; rubbing the antimonial ointment over the spine, or behind the ears, &c.—(*Vol. cit. p.* 228.)

Other authors recommend applying blisters, and

giving internally the extract of cicuta, calomel, and soap. —(*Encyclopédie Méthodique, partie Chir.*) The topical use of ether might be tried; but from the history of the disease, the chances of cure must evidently be nearly hopeless.—(See also *Tr. G. Benedict de Morbis Humoris Vitrei*, 4*to. Lips.* 1809.)

GLEET. By the term *gleet* is commonly understood a continued running or discharge, after the inflammatory symptoms of a clap have for some time ceased, unattended with pain, scalding in making water, &c. Mr. Hunter remarks, that it differs from a gonorrhœa in being uninfectious, and in the discharge consisting of globular bodies, contained in a slimy mucus instead of serum. He says, that a gleet seems to take its rise from a habit of action which the parts have contracted. The disease, however, sometimes stops of itself, even after every method has been ineffectually tried. This probably depends upon accidental changes in the constitution, and not at all upon the nature of the disease itself. Mr. Hunter had a suspicion that some gleets were connected with scrofula. Certain it is, the sea-bath cures more gleets than the common cold bath, or any other mode of bathing; and a cure may sometimes, but not always be accomplished by an injection of diluted sea-water.

Gleets are often attended with a relaxed constitution. They also sometimes arise from other affections of the urethra, besides gonorrhœa. A stricture is almost always accompanied with a gleet; and so sometimes is disease of the prostate gland.

It is remarked by Mr. Hunter, that if a gleet does not arise from any evident cause, and cannot be supposed to be a return of a former gleet, in consequence of a gonorrhœa, either a stricture or diseased prostate gland is to be suspected: an inquiry should be made whether the stream of urine is smaller than common, whether there is any difficulty in voiding it, and whether the calls to make it are frequent. If there should be such symptom, a bougie, rather under the common size, should be introduced; and if it passes into the bladder with tolerable ease, the disease is probably in the prostate gland, which should next be examined.—(See *Urethra, Strictures of*; and *Prostate Gland.*)

Balsams, turpentines, and the tinctura canth., given internally, are of service, especially in slight cases; and when they are useful they prove so almost immediately. Hence, if they had neither lessened nor removed the gleet in five or six days, Mr. Hunter never continued them longer. The same observation applies to cubebs, so celebrated of late as a remedy for gonorrhœa and gleet, and the common dose of which is 3 ij. in any convenient fluid three times a day. As the discharge when removed is also apt to recur, such medicines should be continued for some time after the symptoms have disappeared.

When the whole constitution is weak, the cold bath, sea-bath, bark, and steel may be given. The astringent gums and salt of steel, given as internal astringents, have little power.

With regard to local applications, the astringents commonly used are, the decoction of bark, sulphate of zinc, alum, and preparations of lead. The aqua vitriolica cærulea, of the old London Dispensatory, diluted with eight times its quantity of water, makes a very good injection.

Irritating applications consist either of injections or bougies, simple or medicated with irritating medicines. Violent exercise may be considered as having the same effect. Such applications should never be used till the other methods have been fully tried and found unsuccessful. They at first increase the discharge, and on this account are sometimes abandoned too early. Two grains of the oxymuriate of mercury, dissolved in eight ounces of distilled water, make a very good irritating injection. In irritable habits such an application may do great harm, and therefore, if possible, the capability of the parts to bear its employment should first be made out.

Bougies sometimes act violently, but Mr. Hunter thought them more efficacious than injections. A simple unmedicated one is generally sufficient, and must be used a month or six weeks before the cure can be depended upon. Bougies medicated with camphor or turpentine were formerly employed for the cure of gleet: they did not require so long a trial as common bougies: at present, I believe, they are not used at all by any surgeon of eminence. Whatever bougies are employed should be under the common size.

Mr. Hunter knew a gleet disappear on the breaking out of two chancres on the glans. Gleets have also been cured by a blister on the under side of the urethra, and by electricity.

In every plan of treatment, rest or quietness is generally of great consequence; but, after the failure of the usual modes, riding on horseback will sometimes immediately effect a cure.

Regularity and moderation in diet are to be observed.

Intercourse with women often causes a return or increase of gleet; and in such cases, it gives suspicion of a fresh infection; but the difference between this and a fresh infection is, that here the return is almost immediately after the connexion.

Gleets in women are cured nearly in the same manner as those of men. Turpentines, however, have no specific effect on the vagina; and the astringent injections used may also be stronger than those intended for male patients.

[The tincture of cantharides, pretty freely administered, and for some time, is a powerful means of restoring the tone of the genital organs, and of curing gleet. Its use, however, must be persisted in for some time. In that condition of the system in which a gleety discharge depends upon a diseased state of the prostate gland, Dr. Francis, of New-York, has given the muriated tincture of gold with relief, in cases where the muriated tincture of iron proved irritating, and seemed to augment existing evils. Our American remedy, the *pyrola*, ought not in instances of this sort to be overlooked. While it invigorates the tone of the digestive organs, it is valuable in various affections of the urinary organs.—*Reese.*]

See *A Treatise on the Venereal Disease, by John Hunter, ed.* 2. Also, *Swediaur's Practical Observations on Venereal Complaints.*

GLOSSOCATOCHUS. (From γλῶσσα, the tongue, and κατέχω, to depress.) The ancient glossocatochus was a sort of forceps, one of the blades of which served to depress the tongue, while the other was applied under the chin.

GOITRE. See *Bronchocele.*

GONORRHŒA. (From γονὴ, the semen, and ῥέω, to flow.) Etymologically, an involuntary discharge of the semen: but always, according to modern surgery, a discharge of purulent infectious matter, from the urethra in the male, and from the vagina and surfaces of the labia, nymphæ, clitoris, &c., in the female subject.

Dr. Swediaur, after censuring the etymological import as conveying an erroneous idea, says, if a Greek name is to be retained, he would call it blennorrhagia, from βλέννα, mucus, and ῥέω, to flow. However, as most of the moderns consider the discharge as pus, not mucus, the etymological import of blenorrhœa is as objectionable as that of gonorrhœa. Mr. Howship has repeatedly examined the discharge with a microscope, but without perceiving any essential difference between such discharge and the pus effused from an ulcer.—(*On Complaints affecting the Secretion and Excretion of the Urine, p.* 260.) In English, the disease is commonly called a *clap*, from the old French word *clapisses*, which were public shops, kept and inhabited by single prostitutes, and generally confined to a particular quarter of the town, as is even now the case in several of the great towns in Italy. In German, the disorder is named a *tripper*, from dripping; and in French, a *chaudepisse*, from the heat and scalding in making water.—(*Swediaur.*)

We shall first present the reader with some of Mr. Hunter's opinions concerning the nature of gonorrhœa, its symptoms, and treatment; and, lastly, take notice of the observations of some other writers.

When an irritating matter of any kind is applied to a secreting surface it increases that secretion, and changes it from its natural state to some other. In the present instance, it is changed from mucus to pus.

Till about the year 1753, it was generally supposed, that the matter from the urethra in cases of gonorrhœa arose from ulcers in the passage; but about that time it was ascertained that pus might be secreted without a breach of substance. It was first accidentally proved by dissection, that pus might be formed in the bag of the pleura without ulceration; and Mr. Hunter afterward examined the urethra of malefactors and others, who were executed or died while known to be affected with gonorrhœa, and demonstrated that the canal was entirely free from every appearance of ulcer.

The time when a gonorrhœa first appears after infec-

tion, is extremely various. It generally comes on sooner than a chancre. Mr. Hunter had reason to believe that in some instances the disease began in a few hours; while in others, six weeks previously elapsed; but he had known it begin at all the intermediate periods. However, it was his opinion, that about six, eight, ten, or twelve days after infection is the most common period.

The surface of the urethra is subject to inflammation and suppuration from various other causes besides the venereal poison; and sometimes discharges happen spontaneously, when no immediate cause can be assigned. Such may be called *simple* gonorrhœa, having nothing of the venereal infection in them.

Mr. Hunter knew of cases in which the urethra sympathized with the cutting of a tooth, and all the symptoms of a gonorrhœa were produced. This happened several times to the same patient. The urethra is known to be sometimes the seat of the gout; and Mr. Hunter was acquainted with instances of its being the seat of rheumatism.

When a secreting surface has once received the inflammatory action, its secretions are increased and visibly altered. Also, when irritation has produced inflammation and an ulcer in the solid parts, a secretion of matter takes place, the intention of which, in both, seems to be to wash away the irritating matter. But in inflammations arising from specific or morbid poisons, the irritation cannot be thus got rid of; for although the first irritating matter be washed away, yet the new matter has the same quality as the original had; and therefore, upon the same principle, it would produce a perpetual source of irritations, even if the venereal inflammation, like many other specific diseases, were not, what it really is, kept up by the specific quality of the inflammation itself. This inflammation seems, however, to be only capable of lasting a limited time, the symptoms peculiar to it vanishing of themselves, by the parts becoming less and less susceptible of irritation; and the subsequent venereal matter can have no power of continuing the original irritation, for otherwise there would be no end to the disease. The time which the susceptibility of the irritation lasts must depend upon the difference in the constitution, and not upon any difference in the poison itself.

Mr. Hunter believed that the venereal disease only ceased spontaneously when it attacked a secreting surface, and produced a mere secretion of pus without ulceration. Such were some of the sentiments of this great man, who was a firm believer in the identity of the poisons of syphilis and gonorrhœa; but this idea, and the hypothesis about the impossibility of any spontaneous cure of venereal sores, are now very generally relinquished.

The first symptom of gonorrhœa is generally an itching at the orifice of the urethra, sometimes extending over the whole glans. A little fulness of the lips of the urethra, the effect of inflammation, is next observable, and soon afterward a running appears.

The itching changes into pain, more particularly at the time of voiding the urine. There is often no pain till some time after the appearance of the discharge and other symptoms; and in many gonorrhœas there is hardly any pain at all even when the discharge is very considerable. At other times, a great degree of soreness occurs long before any discharge appears. There is generally a particular fulness in the penis, and more especially in the glans. The glans has also a kind of transparency, especially near the beginning of the urethra, where the skin, being distended, smooth, and red, resembles a ripe cherry. The mouth of the urethra is, in many instances, evidently excoriated. The surface of the glans itself is often in a half-excoriated state, consequently very tender; and it secretes a sort of discharge. The canal of the urethra becomes narrower, which is known by the stream of urine being smaller than common. This proceeds from the fulness of the penis in general, and either from the lining of the urethra being swollen or in a spasmodic state. The fear of the patient while voiding his urine, also disposes the urethra to contract; and the stream of urine is generally much scattered and broken as soon as it leaves the passage. There is frequently some degree of hemorrhage from the urethra, perhaps from the distention of the vessels, more especially when there is a chordee, or a tendency to it. Small swellings often occur along the lower surface of the penis, in the course of the urethra. These Mr. Hunter suspected to be enlarged glands of the passage. They occasionally suppurate and burst outwardly, but now and then in the urethra itself. Mr. Hunter has also suspected such tumours to be ducts, or lacunæ of the glands of the urethra distended with mucus, in consequence of the mouth of the duct being closed, in a manner similar to what happens to the duct leading from the lachrymal sac to the nose, and so as to induce inflammation, suppuration, and ulceration. Hardness and swelling may also occur in the situation of Cowper's glands, and end in considerable abscesses in the perinæum. The latter tumours break either internally or externally, and sometimes in both ways, so as to produce fistulæ in perinæo.

A soreness is often felt all along the under side of the penis, frequently extending as far as the anus. The pain is particularly great in erections; but the case differs from chordee by the penis remaining straight. In most cases of gonorrhœa, erections are frequent, and even sometimes threaten to bring on mortification; as opium is of great service, Mr. Hunter thought that there was reason to suppose them of a spasmodic nature.

The natural slimy discharge from the glands of the urethra is first changed from a fine, transparent, ropy secretion to a watery, whitish fluid; and the lubricating fluid which the passage naturally exhales becomes less transparent; both these secretions becoming gradually thicker, assume more and more the qualities of common pus.

The matter of gonorrhœa often changes its colour and consistence, sometimes from a white to a yellow, and often to a greenish colour. These changes depend on the increase and decrease of the inflammation, and not on the poisonous quality of the matter itself; for an irritation of these parts, equal to that produced in a gonorrhœa, will produce the same appearances.

The discharge is produced from the membrane lining the urethra, and from the lacunæ, but in general only for about two or three inches from the external orifice. Mr. Hunter says, seldom farther than an inch and a half, or two inches at most. This he terms the specific extent of the inflammation. Whenever he had an opportunity of examining the urethra affected with gonorrhœa, he always found the lacunæ loaded with matter, and more visible than in the natural state. Before the time of this celebrated man, it was commonly supposed that the discharge arose from the whole surface of the urethra, and even from Cowper's glands, the prostate and vesiculæ seminales.

But if the matter were secreted from all these parts, the pus would collect in the bulb, as the semen does, and thence be emitted in jerks; for nothing can be in the bulbous part of the urethra without stimulating it to action, especially when in a state of irritation and inflammation.

When the inflammation is violent, some of the vessels of the urethra often burst, and a discharge of blood ensues. Sometimes such blood is only just enough to give the matter a tinge. In other instances, erections cause an extravasation by stretching the part.

When the inflammation goes more deeply than the membranous lining, and affects the reticular membrane of the urethra, it produces in it an extravasation of coagulable lymph, the consequence of which is a chordee.—(See *Chordee*.)

Mr. Hunter suspected that the disease is communicated or creeps along from the glans to the urethra, or, at least, from the lips of the urethra to its inner surface, as it is impossible that the infectious matter can, during coition, get as far as the disease extends. He mentions an instance, in which a gentleman, who had not cohabited with any woman for many weeks, to all appearance caught a gonorrhœa from a piece of plaster, which had adhered to his glans penis in a necessary abroad. The infection is accounted for, by supposing that some person with a clap had previously been to this place, and had left behind some of the discharge, and that the above gentleman had allowed his penis to remain in contact with the matter till it had dried.

Many symptoms depending on the sympathy of other parts with the urethra sometimes accompany a gonorrhœa. An uneasiness, partaking of soreness and pain, and a kind of weariness, are felt about every part of the pelvis. The scrotum, testicles, perinæum, anus, and hips become disagreeably sensible, and the testicles often require to be suspended. So irritable, indeed, are

they in such cases, that the least accident, or even exercise, which would have no effect of this kind at another time, will make them swell. The glands of the groin are often affected sympathetically, and even swell a little, but they do not suppurate, as they generally do when they inflame from the absorption of matter. Mr. Hunter has seen the irritation of a gonorrhœa so extensive as to affect with real pain the thighs, buttocks, and abdominal muscles. He knew one gentleman who never had a gonorrhœa without being immediately seized with universal rheumatic pains.

When the disorder, exclusive of the affections from sympathy, is not more violent than has been described, Mr. Hunter termed it a *common or simple venereal gonorrhœa*; but if the patient is very susceptible of such irritation, or of any other mode of action which may accompany the venereal, then the symptoms are in proportion more violent. In such circumstances, we sometimes find the irritation and inflammation exceed the specific distance, and extend through the whole urethra. There is often a considerable degree of pain in the perinæum; and a frequent, though not a constant, symptom is a spasmodic contraction of the acceleratores urinæ and erectores muscles. In these cases, the inflammation is sometimes considerable, and goes deeply into the cellular membrane, but without producing any effect except swelling. In other instances, it goes on to suppuration, often becoming one of the causes of fistulæ in perinæo. Thus, Cowper's glands may suppurate, and the irritation often extends even to the bladder itself.

When the bladder is affected, it becomes more susceptible of every kind of irritation. It will not bear the usual distention, and therefore the patient cannot retain his water the ordinary time; and the moment the desire of making water takes place, he is obliged instantly to make it, with violent pain in the bladder, and still more in the glans penis, exactly similar to what happens in a fit of the stone. If the bladder be not allowed to discharge its contents immediately, the pain becomes almost intolerable; and even when the water is evacuated, there remains for some time a considerable pain both in the bladder and glans.

Sometimes, though rarely, when the bladder is much affected, the ureters, and even the kidneys sympathize; and Mr. Hunter had reason to suspect that the irritation might be communicated to the peritoneum by means of the vas deferens.

Mr. Hunter mentions a case, in which, while the inflammatory symptoms of a gonorrhœa were abating, an incontinence of urine came on; but in time got spontaneously well.

A very common symptom attending a gonorrhœa is a swelling of the testicle.—(See *Hernia Humoralis.*)

Another occasional consequence is a sympathetic swelling of the inguinal glands.—(See *Bubo.*)

A hard cord is sometimes observed, leading from the prepuce along the back of the penis, and often directing its course to one of the groins, and affecting the glands. At the part of the prepuce where the cord takes its rise, there is most commonly a swelling. This sometimes happens when an excoriation and a discharge from the prepuce or glans penis exist. In one case, Mr. Howship thought the large vein on the dorsum of the penis was inflamed and thickened.—(*On Complaints affecting the Secretion and Excretion of the Urine, &c. p.* 266.)

From the above account, the symptoms of gonorrhœa in different cases seem to be subject to infinite variety. The discharge often appears without any pain, and the coming on of the pain is not at any stated time after the appearance of the discharge. There is often no pain at all, although the discharge is in considerable quantity, and of a bad appearance. The pain often goes off while the discharge continues, and will return again. In some cases, an itching is felt for a considerable time, which is sometimes succeeded by pain; though in many cases it continues till the end of the disease. On the other hand, the pain is often troublesome and considerable, even when there is little or no discharge. The neighbouring parts sympathize, as the glands of the groin, the testicle, the loins and pubes, the upper parts of the thighs, and the abdominal muscles. Sometimes the disease appears a few hours after the application of the poison; sometimes not till six weeks have elapsed. Lastly, it is often impossible to determine whether the case is a venereal discharge, or rather one produced by the application of infectious matter, or only an accidental discharge, arising from some unknown cause.

GONORRHŒA IN WOMEN.

The disorder is not so easily ascertained in them as in men, because they are subject to a disorder called *fluor albus*, which resembles gonorrhœa. A mere discharge in women is less a proof of the existence of a gonorrhœa than even a discharge without pain in men. The kind of matter does not enable us to distinguish a gonorrhœa from a fluor albus; for in the latter affection, the discharge often puts on all the appearance of venereal matter. Pain is not necessarily present, and therefore forms no line of distinction. The appearance of the parts often gives us but little information; "for (says Mr. Hunter) I have frequently examined the parts of those who confessed all the symptoms, such as increase of discharge, pain in making water, soreness in walking, or when the parts were touched, yet I could see no difference between these and sound parts. I know of no other way of judging, in cases where there are no symptoms sensible to the person herself, or where the patient has a mind to deny any uncommon symptoms, but from the circumstances preceding the discharge; such as her having been connected with men supposed to be unsound, or her being able to give the disorder to others; which last circumstance, being derived from the testimony of another person, is not always to be trusted to, for obvious reasons." But though there may sometimes be great difficulty in forming a judgment of some of these cases, the surgeon may frequently come to a right conclusion, by recollecting, as Mr. Dunn has reminded me, that, besides the difference depending on the suddenly severe symptoms of gonorrhœa, fluor albus may be known by the great debility; the sinking of the stomach; the weariness of the limbs; the pain of the back, always increased by the erect posture; the severe headaches; the painful menstruation, together with the very gradual increase of the disease.

From the manner in which the disease is contracted, it must principally attack the vagina, a part not endowed with much sensation. In many cases, however, it produces a considerable soreness on the inside of the labia, nymphæ, clitoris, caruncule myrtiformes, and meatus urinarius. In certain cases, these parts are so sore, that they will not bear to be touched; the person can hardly walk; the urine gives pain in its passage through the urethra, and when it comes into contact with the above-mentioned parts.

The bladder, and even the kidneys, occasionally sympathize. The mucous glands on the inside of the labia often swell, and sometimes suppurate, forming small abscesses, which open near the orifice of the vagina.

According to Mr. Hunter, the venereal matter from the vagina sometimes runs down the perinæum to the anus, and produces a gonorrhœa or chancre in that situation. The disease in women may probably wear itself out, as in men; but it may exist in the vagina for years, if the testimony of patients can be relied on.

TREATMENT OF GONORRHŒA.

As every form of the venereal disease is supposed to arise from the same cause, and as we have a specific for some forms, we might expect that this would be a certain cure for every one; and therefore, that it must be no difficult task to cure the disease, when in the form of inflammation and suppuration in the urethra. Experience teaches us, however, that the gonorrhœa is the most variable in its symptoms, while under a cure; and the most uncertain, with respect to its cure, of any forms of the venereal disease (if it ever be a form of this disease at all), many cases terminating in a week, while others continue for months under the same treatment.

The only curative object is, to destroy the disposition and specific mode of action in the solids of the parts, and as they become changed, the poisonous quality of the matter produced will also be destroyed. This effects the cure of the disease, but does not always remove the consequence.

Gonorrhœa is incapable of being continued beyond a certain time in any constitution; and when it is violent, or of long duration, it is owing to the part being very susceptible of such irritation, and readily retain-

ing it. As no specific remedy for gonorrhœa is known, it is fortunate that time alone will effect a cure. It is worthy of consideration, however, whether medicine can be of any service. Mr. Hunter is inclined to think it not of the least use in nine cases out of ten. But even this would be of some consequence, if the cases capable of being benefited could be distinguished.

The means of cure generally adopted are of two kinds, internal remedies and local applications; but whatever plan is pursued, we are always to attend more to the nature of the constitution, or to any accompanying disease in the parts themselves, or parts connected with them, than to the gonorrhœa itself.

When the symptoms are violent, but of the common inflammatory kind, known by the extent of the inflammation not exceeding the specific distance, the local treatment may be either irritating or soothing.

According to Mr. Hunter, irritating applications are less dangerous in these cases, than when irritable inflammation is present, and they may alter the specific action; but to produce this effect their irritation must be greater than that of the original injury. The parts will afterward recover of themselves, as from any other common inflammation.

Mr. Hunter believes, however, that in the beginning the soothing plan is the best. If the inflammation be great, and of the irritable kind, no violence is to be used, for it would only increase the symptoms; and nothing should be done that can tend to stop the discharge, as it would not put a stop to the inflammation. The constitution is to be altered, if possible, by remedies adapted to each disposition, and reducing the disease to its simple form. If the constitution cannot be altered, nothing is to be done, and the action is to be allowed to wear itself out.

When the inflammation has abated, the cure may be attempted by internal remedies or local applications which do not operate violently, whereby the irritation might be reproduced. Gentle astringents may be applied.

But if the disease has begun mildly, an irritating injection may be used, in order quickly to get rid of the specific mode of action. This application will increase the symptoms for a time; but when it is left off they will often abate or wholly disappear; and after such abatement astringents may be used, the discharge being the only thing to be removed.

When itching, pain, and other uncommon sensations are felt for some time before the discharge appears, Mr. Hunter diffidently expresses his inclination to recommend the soothing plan, instead of the irritating one, in order to bring on the discharge, which is a step towards the resolution of the irritation; and he adds, that to use astringents would be bad practice, as by retarding the discharge they would only protract the cure. When there are strictures or swelled testicles, astringents should not be used; for while there is a discharge such complaints are relieved.

Mr. Hunter thus expresses himself in regard to the effect of mercury in gonorrhœa: "I doubt very much of mercury having any specific virtue in this species of the disease; for I find that it is as soon cured without mercury as with it, &c. So little effect, indeed, has this medicine upon a gonorrhœa, that I have known a gonorrhœa take place [while the patient was] under a course of mercury sufficient for the cure of a chancre. Men have also been known to contract a gonorrhœa when loaded with mercury for the cure of a lues venerea: the gonorrhœa, nevertheless, has been as difficult of cure as in ordinary cases."

Mr. Hunter does not say much in favour of evacuants, diuretics, and astringents given internally. He allows, however, that astringents, which act specifically on the parts, as the balsams conjoined with any other medicine which may be thought right, may help to lessen the discharge, in proportion as the inflammation abates.

Local applications may be either internal to the urethra, external to the penis, or both. Those which are applied to the urethra seem to promise most efficacy, because they come into immediate contact with the diseased parts. They may be either in a solid or fluid form. A fluid is only a very temporary application. The solid ones, or bougies, may remain a long while; but in general irritate immediately, from their solidity alone; and Mr. Hunter says, the less bougies are used when the parts are in an inflamed state the better, though he never saw any bad effects from them when applied with caution.

At present bougies are rarely used in cases of gonorrhœa, in consequence of the irritation which they produce, and their tendency to bring on swelling of the testes.

The fluid applications or injections in use are innumerable; and as gonorrhœa frequently gets well with so many of various kinds, we may infer, that the complaint would, in time, get well of itself. However, there cannot be a doubt that injections often have an immediate effect on the symptoms, and hence must have power; though the injection which possesses the greatest power is unknown. As injections are only temporary applications, they must be used often, especially when found useful, and not of an irritating kind.

Mr. Hunter divides injections into four kinds, the *irritating*, *sedative*, *emollient*, and *astringent*. According to his doctrines, irritating injections of every kind act in this disease upon the same principle; that is, by producing an irritation of another kind, which ought to be greater than the venereal; by which means the venereal is destroyed and lost, and the disease cured, although the pain and discharge may still be kept up by the injection; effects, however, which will soon go off when the injection is laid aside. In this way bougies also perform a cure. Most of the irritating injections have an astringent effect, and prove simply astringent when mild.

Irritating injections should never be used when there is already much inflammation; especially in constitutions which are known to be incapable of bearing much irritation: nor should they be used when the inflammation has spread beyond the specific distance; nor when the testicles are tender; nor when, upon the discharge ceasing quickly, these parts have become sore; nor when the perinæum is very susceptible of inflammation, and especially if it formerly should have suppurated; nor when there is a tendency in the bladder to irritation, known by the frequency of making water.

In mild cases, and in constitutions which are not irritable, such injections often succeed, and remvoe the disease almost immediately. The practice, however, ought to be attempted with caution, and not, perhaps, till milder methods have failed. Two grains of the hydrargyrus muriatus, dissolved in eight ounces of distilled water, form a very good irritating injection; but an injection of only half this strength may be used, when it is not intended to attempt a cure so quickly. If, however, the injection, even in that proportion, gives considerable pain in its application, or occasions a great increase of pain in making water, it should be farther diluted.

Sedative injections will always be of service when the inflammation is considerable, and they are very useful in relieving the pain. Perhaps the best sedative is opium, as well when given by the mouth or anus, as when applied to the part affected in the form of an injection. But even opium will not act as a sedative in all constitutions and parts; but, on the contrary, often has opposite effects, producing great irritability. Lead may be reckoned a sedative, so far as it abates inflammation, while at the same time it may act as a gentle astringent. Fourteen grains of acetate of lead, in ℥viij. of distilled water, make a good sedative astringent injection.

Drinking freely of diluting liquors may, perhaps, have a sedative effect, as it in part removes some of the causes of irritation, by rendering the urine less stimulating to the bladder when the irritation is there, and to the urethra in its passage through it. Diluting drinks may possibly lessen the susceptibility of irritation. The vegetable mucilages of certain seeds and plants, and the emollient gums, are recommended. Mr. Hunter does not entertain much opinion of their efficacy, though some of his patients told him that they experienced less uneasiness in making water, when their drink was impregnated with mucilaginous substances.

Emollient injections are the most proper when the inflammation is very great; and they probably act by first simply washing away the matter, and then leaving a soft application to the part, so as to be singularly serviceable by lessening the irritating effects of the urine. Indeed, practice proves this; for a solution of gum arabic, milk and water, or sweet oil, will often lessen the

pain and other symptoms, when the more active injections have done nothing, or seemed to do harm.

The irritation at the orifice of the urethra is frequently so great that the point of the syringe cannot be suffered to enter. In this case, no injection should be used till the inflammation has abated; but, in the mean while, fomentations may be employed.

Astringent injections act by lessening the discharge. They should only be used towards the latter end of the disease, when it has become mild. But if the disease should begin mildly, they may be used at the very beginning; for by gradually lessening the discharge, without increasing the inflammation, we complete the cure, and prevent a continuance of the discharge called *gleet*. They will have an irritating quality if used strong, and hence increase the discharge, instead of lessening it. Mr. Hunter's experience did not teach him that one astringent was much better than another. The astringent gums, as dragon's blood, the balsams, and the turpentines, dissolved in water; the juices of many vegetables, as oak bark, Peruvian bark, tormentil root, and perhaps all the metallic salts, as green, blue, and white vitriols; the salts of mercury, and also alum; probably all act much in the same way; though the mere changing of an injection is often efficacious. The local use of the nitric acid, properly diluted, has been commended by Vigaroux, Toepelmann, and others, as a safe remedy for the stoppage of gonorrhœa.—(See *Pearson on the Effects of various Articles in the Cure of Lues Venerea*, *p.* 205, *ed.* 2; *and Neuere Erfahr. über zweckm. Behdl. venerisch. Schleimensflüsse, &c. Leipz.* 1809.)

The external applications are poultices and fomentations, which can only be useful when the prepuce, glans, and orifice of the urethra are inflamed.

Since Mr. Hunter's time, many surgeons have been in the habit of keeping the penis, in the incipient inflammatory stage of gonorrhœa, covered with linen, continually wet with the liquor plumbi acetatis dilutus; a practice which is certainly both rational and beneficial. Mr. Abernethy, in his *Lectures on Surgery*, speaks in favour of this method. And some surgeons, among whom is my intelligent correspondent Mr. Dunn, of Scarborough, have seen great relief derived from the use of a suspensor scroti, or double handkerchief, which, combined with rest and the elevation of the penis, the last-mentioned practitioner has frequently found, indeed, of more service than any thing else.

In the treatment of gonorrhœa, the liquor potassæ is a favourite internal medicine with many practitioners, who begin with prescribing it, and continue its use until the inflammatory stage has subsided. However, according to Mr. Howship, its effects are very uncertain, and sometimes it excites uneasiness and irritation about the neck of the bladder, and difficulty of voiding the urine. Hence, whenever he now directs this medicine, it is in combination with some aperient, so that it may not remain long in the bowels.—(*On Complaints affecting the Secretion and Excretion of the Urine*, *p.* 269.)

The latter gentleman, and a great many other modern surgeons, have relinquished the use of all injections in the treatment of gonorrhœa, and manage the disease on common antiphlogistic principles. Mr. Howship states, that when injections are used, they are not unfrequently followed by a most distressing and permanent irritability of the bladder.—(*On Complaints affecting the Secretion and Excretion of the Urine*, *p.* 268.) But the common objection to them is founded upon the suspicion that they increase the frequency of hernia humoralis and strictures.

When the glands of the urethra are enlarged, mercurial ointment may be rubbed on the part; but this will probably be of most service after the inflammation has subsided.

TREATMENT OF GONORRHŒA IN WOMEN.

This is nearly the same as that of the disease in men, but is more simple. When the disorder is in the vagina, injections are best; and after their use the external parts should be well washed. It is almost impossible for the patient to throw an injection into the urethra, when it is affected. The same injections are proper as for men; but they may be made doubly strong. When the glands of the vagina suppurate and form abscesses, these should be opened and dressed; but the practice of smearing the parts with mercurial ointment, as advised by Mr. Hunter, is now entirely abandoned.

CONSTITUTIONAL TREATMENT OF GONORRHŒA.

In many strong plethoric constitutions, the symptoms are violent, and there is a great tendency to inflammatory fever. In such instances, opiate clysters, though at first productive of relief, sometimes occasion in the end fever, and consequently aggravate all the symptoms. In these cases the balsam of copaiba also sometimes increases the inflammatory symptoms. In a constitution of this kind, the treatment consists chiefly in evacuations, the best of which are bleeding and gentle purging. The patient must live sparingly, and, above all, use little exercise.

In a weak and irritable constitution, the symptoms are frequently violent, the inflammation extending beyond the specific distance, running along the urethra, and even affecting the bladder. Here the indication is to strengthen; and, according to Mr. Hunter, bark alone has been known to effect a cure. All evacuations are hurtful.

A fever has been known to stop the discharge, relieve the pain in making water, and finally cure the disease. On other occasions, Mr. Hunter has seen all the symptoms of gonorrhœa cease on the accession of a fever and return when the fever was subdued. In other examples, a gonorrhœa, mild at first, has been rendered severe by the coming on of a fever, and upon its subsidence, the gonorrhœa has ceased. Although a fever does not always cure a gonorrhœa, yet, as it may do so, nothing should be done while it lasts. If the local complaint should continue after the fever has gone, it is to be treated according to symptoms.

A gonorrhœa may be considerably affected by the patient's manner of living, and by other diseases attacking the constitution. Most things which hurry or increase the circulation aggravate the symptoms; such as violent exercise, drinking strong liquors, eating strong, indigestible food, some kinds of which act specifically on the urethra, so as to increase the symptoms more than simply heating the body do; such as pepper, spices in general, and spirits.

In cases which have begun mildly, in which the inflammation is only slight, or in others, in which the violent symptoms have subsided, such medicines as have a tendency to lessen the discharge may be given, together with the local remedies before mentioned. Turpentines are the most efficacious, particularly the balsam of copaiba and cubebs.—(See *Edin. Med. and Surgical Journ. for January*, 1818, *and for the same month*, 1819; *also H. Jeffrey's Pract. Obs. on Cubebs*, 8vo. *Lond.* 1821.) Of the latter medicine 3 ij. may be given thrice in the 24 hours; but with respect to these and all other medicines which act upon the disease through the medium of the urine, if they succeed at all, it is always within a week or ten days from the beginning of their use; and, therefore, if no amendment take place in this time, they should not be continued. Cantharides, the salts of lead and copper, and alum, have also been recommended.

The opinions entertained by Mr. Hunter, respecting the identity of the infection of gonorrhœa, and that of the venereal disease, led him to prescribe small doses of mercury, in consequence of the possibility of absorption, and with the view of preventing lues venerea.

TREATMENT OF SOME OCCASIONAL EFFECTS OF GONORRHŒA.

Bleeding from the Urethra is sometimes relieved by the balsam copaiba. Mr. Hunter did not find astringent injections of use.

Painful Erections are greatly prevented by taking twenty drops of tinctura opii at bedtime. Cicuta has also some power in this way; and many surgeons, among whom is Mr. Dunn, of Scarborough, have a favourable opinion of camphorated poultices, and of the internal exhibition of camphor; a medicine which I ought to have mentioned in former editions, as a common means of lessening the pain and inconvenience of erections in the inflammatory stage of gonorrhœa

Chordee. See this word.

Bladder affected. Opiate clysters, the warm bath, and bleeding, if the patient is of full habit, are proper. Leeches may be applied to the perinæum. When this affection lasts a considerable time, and is not mitigated by common methods, Mr. Hunter advises trying an

opiate plaster on the pubes, or the loins, where the nerves of the bladder originate; or a small blister on the perinæum. In another place he mentions bark, cicuta, sea-air, and sea-bathing, among the proper means.

Swelled Testicles. See *Hernia Humoralis.*

For a more full account of gonorrhœa, according to the above doctrines, see *A Treatise on the Venereal Disease, by John Hunter*, from page 29 to 90.

ON THE QUESTION WHETHER GONORRHŒA IS REALLY A FORM OF THE VENEREAL DISEASE.

The foregoing remarks, and others in Mr. Hunter's work, would lead one to believe, that the poison of gonorrhœa and the venereal virus are the same. Here it is my duty impartially to state the arguments which have been urged for and against this important doctrine.

Mr. Hunter assures us, that he has seen all the symptoms of lues venerea originating from gonorrhœa only; that he had even produced venereal chancres by inoculating with the matter of gonorrhœa; and that he afterward repeated these experiments in a manner in which he could not be deceived.—(*P.* 293, *et seq.*)

Mr. Hunter's experiments, it is true, have been repeated with a different result; but, as a late writer has remarked, can we wonder at this, when we consider from how many causes gonorrhœa may arise, and how impossible it is to distinguish the venereal from any other?—(*Obs. on Morbid Poisons, by J. Adams, M.D. p.* 91, *ed.* 2.)

Another argument adduced by Hunter, in favour of the poisons of gonorrhœa and chancre being the same, is the probability that the Otaheitans had the venereal disease propagated to them by European sailors, who were affected with gonorrhœa; for these can hardly be supposed to have had a chancre during a voyage of five months, without the penis being destroyed.

It is impossible, however, to say what time may elapse between the application of the venereal poison to the penis and the commencement of the ulceration. Therefore, Bougainville's sailors, alluded to by Mr. Hunter, might have contracted the infection at Rio de la Plata; but actual ulcers on the penis might not have formed till about five months afterward, when the ship arrived at Otaheite.

In attempting to explain why a gonorrhœa and a chancre do not equally produce lues venerea, and why the medicine which almost universally cures chancre has less effect on gonorrhœa, a modern advocate for Mr. Hunter's doctrine says, that we must take into consideration, that the seat of the two diseases is different; that the same cause may produce different effects upon different parts; that the same poison, when mixed with different fluids, may be more or less violent in its operation; and that there may be greater or less attraction of certain fluids to a part, according to its nature and composition.—(*Inquiry into some Effects of the Venereal Poison, by S. Sawrey*, 1802, *p.* 4.) Mr. Sawrey very truly remarks, p. 6, that if the gonorrhœal matter has clearly and decidedly produced chancre, or contaminated the system *in any one instance*, the question is determined. It could in no instance produce these effects, unless it had the power of doing so. This writer brings forward some cases to prove, that the poison of gonorrhœa may produce gonorrhœa or chancre; but the limits of this work only afford room to observe that these instances are by no means decisive of the point, because some objections may be urged against them, as indeed Mr. Sawrey himself allows. That Mr. Hunter's cases are inconclusive, I have particularly endeavoured to explain in the last edition of the *First Lines of the Practice of Surgery.*

Why does not gonorrhœa commonly produce ulceration in the urethra? Mr. Sawrey tries to solve this question, by saying, that the product of the venereal inflammation, the diseased contents of the small arteries of the urethra, are thrown out of these open-mouthed vessels into this canal, without any breach of their texture, which otherwise would be a necessary consequence.

Why does not gonorrhœa equally contaminate the system as chancre? In gonorrhœa, says Mr. Sawrey, the discharge is very plentiful; it is not, in general, attended with ulceration; the poison is much more diluted and mixed with a mucous and puriform fluid. It is deposited in the urethra and its lacunæ, where little or no pressure is applied, and it finds easy egress out of the canal. In chancre, there is breach of substance, the poison is not much diluted, &c.

Why does not chancre generally in the same person produce gonorrhœa and gonorrhœa chancre? Mr. Sawrey, in answer, expresses his belief, that these incidents are not very unfrequent. He says, he has known persons having a chancre, which continued for months, become affected after that time with a clap, without any farther exposure. His opinion is, that the matter of the chancre had insinuated itself into the urethra and produced the disease; though he confesses, many would explain the circumstance by supposing that the chancre and gonorrhœa were both communicated at the same time by two different poisons.

Mr. Hunter remarks, that the presence of one disease renders the adjacent parts less susceptible of the influence of the other.

Mr. Sawrey concludes his second chapter with inclining to the idea, that the matter of gonorrhœa is not strictly pus, but of a more mucous nature than that of a chancre. However, when he mentions chemical attractions, as drawing the poison from mucus to the urethra, and from pus to the dry parts, in order to explain the last of the above questions, every sober reader must feel sorry that a work which contains some really sensible observations should comprehend this most unfortunate one.

Mr. Whately also supported the opinion, that the matter of gonorrhœa and that of chancre are the same. —(*On Gonorrhœa Virulenta.*)

Another defender of this side of the question is Dr. Swediaur, who endeavours to prove the fallacy of the following positions: 1. *That the poison which produces the clap does never, like that of chancres, produce any venereal symptoms in the mass, or lues itself.* 2. *That the poison of the clap never produces chancres, and that the poison of chancres never produces a clap.* 3. *That mercury never contributes to, nor accelerates, the cure of a clap; but that, on the contrary, every blenorrhagia may be certainly cured without mercury, and without any danger of leaving a lues behind.*

His arguments run thus:—the reason why claps do not, like chancres, constantly produce the lues is, that most of them excite only a superficial inflammation in the membrane of the urethra, without any ulceration. Hence, absorption cannot easily take place, the poison being out of the course of the circulation. But he has seen claps with an ulcer in the urethra, followed by the most unequivocal symptoms of lues itself. He mentions the urethra being defended with a large quantity of mucus, as the thing impeding the common formation of ulcers, which do occasionally occur when the mucus is not secreted as usual, or is washed away. He asserts, that in many cases, where he had occasion to examine both parties, he was convinced that the chancres were communicated by a person affected with a simple gonorrhœa; and *vice versâ*, that a virulent clap had been the consequence of an infection from a person having merely chancres. He says, that if a patient with a venereal running does not take care to keep the prepuce and glans perfectly clean, chancres will very often be produced. He owns a great many claps are cured without mercury; yet, repeated experience has shown him a cure cannot be always thus accomplished. Mild cases, without ulcer or excoriation in the urethra, may certainly be radically cured without a grain of mercury; and though mercury should be given, it would not have the least effect; not because the disease does not proceed from the venereal poison, but because it is out of the course of the circulation. He contends, that the topical use of mercury in injections acts usefully even in these cases. But when a clap is joined with ulceration in the urethra, it is always cured more safely and expeditiously with mercury, and is frequently incurable without it. A lues also follows cases attended with ulcers in the urethra. He allows, that all claps are not venereal.—(See *Pract. Obs. on Venereal Complaints, by J. Swediaur.*)

One argument urged against the identity of gonorrhœal and chancrous virus is, that gonorrhœa was described as a symptom till nearly half a century after the other symptoms of the venereal disease were known. Fallopius is among the first who observed gonorrhœa as a symptom of the venereal disease. "If, however," says Dr. Adams, "venereal gonorrhœa was unnoticed

till about fifty years after the other forms of the disease were described, what does this prove, but that contagious gonorrhœa was so common as to be disregarded as a symptom of the new complaint? Can there be a doubt, from the caution given by Moses, that gonorrhœa was considered as contagious in his days? During the classical age, we find inconveniences of the urinary passages were imputed to incontinence; and the police of several states, before the siege of Naples, made laws for preserving the health of such as would content themselves with public stews instead of disturbing the peace of families.

This is enough to lessen our surprise that gonorrhœa should be unnoticed for some time after the appearance of the venereal disease. But so far is it from proving that the two contagions are different, that the fairest inference we can draw is in favour of their identity. For if by this time the venereal disease began to be so far understood, that secondary symptoms were found the consequence of primary ones in the genitals, it is most probable, that the first suspicion of venereal gonorrhœa arose from the occurrence of such secondary appearances, where no other primary symptoms could be traced."—(*Adams, on Morbid Poisons, p.* 95, *ed.* 2.)

In relating the arguments maintained by the best modern writers to repel the attacks made on the doctrine that gonorrhœa and chancre arise from the same poison, we have been compelled to disclose the chief grounds on which the assailants venture to entertain a contrary theory.

The sentiments of Mr. B. Bell are quite at variance with those of Hunter, Sawrey, Swediaur, Adams, Howship, &c.; but my limits will only allow me just to enumerate a few of his leading arguments.

If the matter of gonorrhœa and that of chancre were of the same nature, we must admit that a person with a chancre only can communicate to another, not only every symptom of pox, but of gonorrhœa; and that another, with gonorrhœa only, can give to all with whom he may have connexion, chancres, with their various consequences. This ought indeed to be a very frequent occurrence; whereas all allow that it is even in appearance very rare.

On the supposition that the matter of gonorrhœa and lues venerea being the same, the latter ought to be a much more frequent occurrence than the former, from the greater ease with which the matter of infection must, in every instance, be applied to those parts on which it can produce chancres, than that of the urethra, where, instead of chancre of ulceration, it almost always excites gonorrhœa. It is difficult to conceive how the matter, by which the disease is communicated, should find access to the urethra; while all the external parts of the penis, particularly the glans, must be easily and universally exposed to it; and yet gonorrhœa is a much more frequent disease than pox. Cases of gonorrhœa are in proportion to those of chancre, according to Mr. B. Bell's experience, as three to one. It is obvious that the very reverse should happen, if the two diseases were produced by the same kind of matter.

I need not adduce other arguments, as the reader must be already acquainted with any worth knowing, from what is said in the previous part of this article.

The grand practical consideration depending on the possibility of the venereal disease arising from gonorrhœa is, whether mercurials should not be exhibited, in all cases, with the view of preventing such a consequence.

Waving, on my own part, all attempts to decide the point, whether the matter of a chancre and that of one species of gonorrhœa are of the same nature, I shall merely content myself with stating, that, as far as my observation and inquiries extend, the majority of the best practitioners of the present day consider the exhibition of mercury unnecessary, and consequently improper, in all cases of gonorrhœa. This fact almost amounts to a proof that, if venereal symptoms do ever follow a clap, they are so rare, and, I may add, always so imputable to other causes, that the employment of mercury, as a preventive, would, upon the whole, do more injury than benefit to mankind; and this even admitting (what to my mind has never been unequivocally proved) that the matter of gonorrhœa is really capable, in a very few instances, of giving rise to the venereal disease.

The reader must weigh the different arguments himself. Some of Mr. B. Bell's reasoning is certainly untenable, as Mr. Sawrey has clearly shown; but the latter, also, is not invulnerable in many points, which he strives to defend.

J. Andrée, An Essay on the Theory and Cure of the Venereal Gonorrhœa, and the Diseases which happen in consequence of that Disorder, 8vo. *Lond.* 1777. *J. Nevill, A Description of the Venereal Gonorrhœa*, 8vo. *Lond.* 1754. *J. Norman, Method of Curing the Virulent Stillicidium, or Gonorrhœa, with an Account of the Efficacy of Plummer's Alterative Pills*, 8vo. *J. Clubbe, An Essay on the Gonorrhœa Virulenta, in which the different Opinions respecting the Treatment of the Disease are carefully examined, &c.* 8vo., *Lond.* 1786. *W. Thomas, An Essay on Gonorrhœa, with some Obs. on the Use of Opium in the Cure of that Disease*, 8vo. *Lond.* 1780. *A Treatise on the Venereal Disease, by J. Hunter*, 1788. *W. Rowley, The most cogent Reasons why astringent Injections, &c. should be banished, &c.* 8vo. *Lond.* 1800. *J. H. G. Schlegel, Versuch einer Geschichte des Streites über die Identität des Venus und Trippergiftes*, 12mo. *Jenæ*, 1796. *Whately on the Gonorrhœa Virulenta*, 8vo. *Lond.* 1801. *Pract. Obs. on Venereal Complaints, by F. Swediaur, M.D. edit.* 3. *An Inquiry into some of the Effects of the Venereal Poison, by S. Sawrey*, 1802. *Obs on Morbid Poisons, by J. Adams, M.D. edit.* 2, 1807. *J. C. Jacobs, Démonstration de l'Identité des Virus de la Vérole et de la Gonorrhée*, 8vo. *Bruxelles*, 1811. *J. F. Hernandez, Essai Analytique sur la Non-identité des Virus Gonorrhoique et Syphilitique*, 8vo. *Toulon*, 1812. *R. Carmichael, Essays on the Venereal Diseases which have been confounded with Syphilis, &c.* 4to. *Lond.* 1814; *and his Obs. on the Symptoms and Specific Distinctions of Venereal Diseases*, 8vo. *Lond.* 1818. *John Howship, on Complaints affecting the Secretion and Excretion of the Urine*, 8vo. *Lond.* 1823.

GORGET. An instrument used in the operation of lithotomy, for the purpose of cutting the prostate gland and neck of the bladder, so as to enable the operator to introduce the forceps and extract the stone. It is, in fact, a sort of knife, at the end of which is a beak that fits the groove of the staff, and admits of being pushed along it into the bladder.

Besides cutting gorgets, constructed for the preceding design, there are also blunt ones, intended to be introduced into the wound, where their concavity serves as a guide for the forceps into the bladder.

GRANULATIONS. The little, grain-like, fleshy bodies, which form on the surfaces of ulcers and suppurating wounds, and serve both for filling up the cavities and bringing nearer together and uniting their sides.

We must here consider the operations of nature, in bringing parts as nearly as possible to their original state, whose disposition, action, and structure have been altered by accident or disease. Having formed pus, she immediately begins to form new matter upon surfaces in which there has been a breach of continuity. This process is called *granulating* or *incarnation*; and the substance formed is called *granulations*.

Granulations are an accretion of animal matter upon the wounded or exposed surface; they are formed by an exudation of the coagulating lymph from the vessels; into which new substance the old vessels very probably extend, and in which new ones are formed. Hence, granulations are extremely vascular; indeed, more so than almost any other animal substance. "That this is the case (says Mr. Hunter) is seen in sores every day. I have often been able to trace the growth and vascularity of this new substance. I have seen upon a sore a white substance exactly similar, in every visible respect, to coagulating lymph. I have not attempted to wipe it off, and the next day of dressing I have found this very substance vascular; for, by wiping or touching it with a probe, it has bled freely. I have observed the same appearance on the surface of a bone that has been laid bare. I once scraped off some of the external surface of a bone of the foot, to see if the surface would granulate. I remarked, the following day, that the surface of the bone was covered with a whitish substance, having a tinge of blue. When I passed my probe into it, I did not feel the bone bare, but only its resistance. I conceived this

substance to be coagulable lymph thrown out from inflammation, and that it would be forced off when suppuration came on; but on the succeeding day I found it vascular, and appearing like healthy granulations." The vessels in granulations pass from the original parts to their basis, and thence towards their external surface, in tolerably regular parallel lines. The surface of this new substance has the same disposition to secrete pus as the parts which produced it. The surfaces of granulations are very convex, the reverse of ulceration, having a great many small points or eminences, so as to appear rough. The smaller such points are, the more healthy are the granulations. The colour of healthy granulations is a deep florid red. When livid, they are unhealthy, and have only a languid circulation. Healthy granulations, on an exposed or flat surface, rise nearly even with the surface of the surrounding skin, and often a little higher; but when they exceed this, and take on a growing disposition, they are unhealthy, become soft, spongy, and without any disposition to form skin. Healthy granulations are always prone to unite to each other, so as to be the means of uniting parts.

Granulations are not easily formed on the side of an abscess nearest the surface of the body.

They are not endowed with the same powers as parts originally formed. Hence they more readily ulcerate and mortify. The curious mode in which granulations contract when sores are healing, and even for some time after they are healed, has been explained in the article *Cicatrization*.—(See *A Treatise on the Blood, Inflammation, &c. by John Hunter, p.* 473, *etseq.* 1794.)

It is a question whether granulations can ever be formed without suppuration? Mr. Hunter seems inclined to think that they may occasionally be produced without it, and he supports his opinion by the relation of the dissection of a fractured limb, in which he observed a substance resembling granulations. Dr. John Thomson, on the other hand, declares that he has never seen any thing which he could regard as an example of a granulation, and still less of a granulating surface, where pus was not formed.—(See *Lectures on Inflammation, p.* 408.)

The exact process by which the blood-vessels, nerves, and absorbents of granulations are formed, is still among the secrets of nature. The observations of Mr. Hunter on the subject amount only to conjecture. "The growth of nerves and their developement in new-formed flesh or granulations (says Dr. J. Thomson), is a subject of equal curiosity with the growth of blood-vessels in the same structure. Their existence in granulations is proved by the pain which is felt on our pinching, rubbing, or wiping, the surface of a sore. Even the granulations which arise from the surface of bone are sensible (a statement not admitted by Sir Astley Cooper), though we are not very well able to prove the sensibility of the larger branches of nerves, from which the newly formed and sensible nerves and filaments in the granulation are immediately derived. All the difficulties which I formerly mentioned to you, as occurring in the explanation of the manner in which coagulable lymph or granulations are penetrated with blood-vessels, present themselves the moment we begin to reflect on the manner in which the same granulations are provided with nerves; and these difficulties are still increased, when we reflect that the same granulations are in the course of a few hours provided, not only with blood-vessels and nerves, but also with a system of absorbents. The existence of absorbents in granulations is proved not only by the changes of bulk which we see them daily undergo, becoming gradually, in the healthy state, smaller, firmer, and more compact, but also, by the frequent disappearance in whole or in part of a granulating surface by the process of ulcerative absorption."—(See *Thomson's Lectures on Inflammation, p.* 419.) According to Sir Astley Cooper, granulations which spring from parts endued with great sensibility, like muscles, are extremely sensitive; but granulations which arise from bones, he says, have no sensibility whatever. These observations are qualified with the condition that the bone be uninflamed, and it is acknowledged, that granulations arising from the cancellated structure of bones are sometimes extremely sensitive. He describes granulations from tendons as quite insensible, and those from aponeuroses and fasciæ as possessing very little sensibility.—(See *Lancet, vol.* 1, *p.* 222.) Every young dresser of sores at an hospital who has been too lavish of the red precipitate ointment, must have learned from experience, that granulations are furnished with absorbent vessels, and that mercury may be absorbed from the surface of ulcers, and bring on an unwished-for salivation of the patient. It is observed by Sir Astley Cooper, that in recently formed ulcers, the granulations are not good absorbent surfaces; but that when the sores have existed a good while, they readily take into the system any substance which may be applied to them. Thus, when old sinuses are injected with a solution of the oxymuriate of mercury, with the view of stimulating them to heal, the patients are sometimes salivated by the mercury being absorbed into the system. Sir Astley has seen the same effect produced by the application of the lotion of lime-water and the submuriate of mercury to the surface of ulcers. Indeed, the absorbent power of granulations is frequently the means of producing baneful effects upon the constitution, by the introduction of deleterious substances into the circulation. Thus arsenic, applied to sores, is often conveyed into the system, and, on this account, is to be regarded as a dangerous external remedy. Sir Astley Cooper quotes one instance, in which the patient seems to have been poisoned by the indiscriminate application of arsenic to a fungus of the eye. Opium, also, when applied to the surfaces of sores, is very readily absorbed, producing similar effects to those which arise from its introduction into the stomach. Thus, when the quantity absorbed is too great, excessive costiveness, extreme pain in the head, and torpor of the system, are the consequences, which require the frequent administration of active purgatives for their removal.—(See *Lancet, vol.* 1, *p.* 219, *&c.*) A temporary amaurosis has been known to be produced by the absorption of the extract of belladonna from the surface of irritable malignant ulcers.—(*F. Tyrrell; A. Cooper's Lectures, vol.* 1, *p.* 169.)

GUAIACUM. Many writers of the sixteenth century contended that guaiacum was a true specific for the venereal disease; and the celebrated Boerhaave, in the eighteenth, maintained the same opinion. Mr. Pearson mentions, that when he was first intrusted with the care of the Lock Hospital, in 1781, Mr. Bromfield and Mr. Williams were in the habit of reposing great confidence in the efficacy of a decoction of guaiacum wood. This was administered to such patients as had already employed the usual quantity of mercury; but who complained of nocturnal pains, or had gummata, nodes, ozæna, and such other effects of the venereal virus, connected with secondary symptoms, as did not yield to a course of mercurial frictions. The diet consisted of raisins and hard biscuit; from two to four pints of the decoction were taken every day; the hot bath was used twice a week; and a dose of antimonial wine and laudanum, or Dover's powder, was commonly taken every evening. Constant confinement to bed was not deemed necessary; neither was exposure to the vapour of burning spirit, with a view of exciting perspiration, often practised; as only a moist state of the skin was desired. This treatment was, sometimes, of singular advantage to those whose health had sustained injury from the disease, long confinement, and mercury. The strength increased; bad ulcers healed; exfoliations were completed; and these anomalous symptoms, which would have been exasperated by mercury, soon yielded to guaiacum.

Besides such cases, in which the good effects of guaiacum caused it to be erroneously regarded as a specific for the lues venerea, the medicine was also formerly given by some, on the first attack of the venereal disease. The disorder being thus benefited, a radical cure was considered to be accomplished; and, though frequent relapses followed, yet, as these partly yielded to the same remedy, its reputation was still kept up. Many diseases also, which got well, were probably not really venereal cases. Mr. Pearson seems to allow, that, in syphilitic affections, it may, indeed, operate like a true antidote, suspending, for a time, the progress of certain venereal symptoms, and removing other appearances altogether; but he observes, that experience has evinced that the unsubdued virus yet remains active in the constitution.

Mr. Pearson found guaiacum of little use in pains of the bones, except when it proved sudorific; but that it was then inferior to antimony or ammonia. When the constitution has been impaired by mercury and long

confinement, a thickened state of the ligaments, or periosteum, or foul ulcers, still remaining, Mr. Pearson says, these effects will often subside during the exhibition of the decoction. He says it will often suspend, for a short time, the progress of certain secondary symptoms of the lues venerea; for instance, ulcers of the tonsils, venereal eruptions, and even nodes. Mr. Pearson, however, never knew one instance, in which guaiacum eradicated the virus; and he contends, that its being conjoined with mercury neither increases the virtue of this mineral, lessens its bad effects, nor diminishes the necessity of giving a certain quantity of it. He has seen guaiacum produce good effects in cutaneous diseases, the ozæna, and scrofulous affections of the membranes and ligaments.—(See *Pearson on the Effects of Various Articles in the Cure of Lues Venerea, edit.* 2, 1807.) Many of the foregoing observations on the virtues of guaiacum in syphilis are considerably affected by the fact, now so completely established, that this disease is generally capable, in the end, of a spontaneous and lasting cure.—(See *Venereal Disease.*)

GUMMA. A soft tumour, so named from the resemblance of its contents to gum.

GUN-SHOT WOUNDS receive their name from the manner in which they are produced, being generally caused by hard, obtuse, metallic bodies, projected from cannons, muskets, or some other species of firearm. With such injuries, it is also usual to comprehend a variety of dreadful accidents arising from the explosion of shells, or the violence with which pieces of stones from ramparts, or splinters of wood on board of ship, are driven about. Gun-shot wounds are the most considerable of the contused kind; and what is to be said of them will apply, more or less, to all contused wounds, according to the degree of contusion. They are particularly characterized by what the French surgeons are fond of calling a *disorganization* of their surface. The excessive contusion and violence observable in gun-shot wounds depend upon the rapidity with which the bodies occasioning them are propelled. The parts touched by the ball are frequently converted into a blackish slough, the colour of which made our ancestors suppose, that bodies projected by gunpowder became heated, and actually burned the flesh with which they came into contact. But reason and experience have now proved, that whatever may be the rapidity of a projectile, it never acquires in its passage any perceptible heat. Indeed, a modern writer asserts, that such a degree of heat as would be requisite to make a ball burn parts in its passage, would really melt it. —(*Richerand, Nosographie Chir. t.* 1, *p.* 217, *edit.* 2.) In general, gun-shot wounds do not bleed much, unless large blood-vessels be injured; their circumference is often livid; and the shock that attends their infliction, or the injury done to the nerves, may occasion in the limb or part a kind of torpor, sometimes extending itself to the whole system.

However, as Dr. Hennen most truly observes, "the effects of a gun-shot wound differ so materially in different men, and the appearances are so various, according to the nature of the part wounded, and the greater or less force with which it has been struck, that no invariable train of symptoms can be laid down as its *necessary* concomitants. If a musket or pistol-ball has struck a fleshy part, without injuring any material blood-vessel, we see a hole about the size of, or smaller than, the bullet itself, with a more or less discoloured lip, forced inwards; and if it has passed through the parts, we find an everted edge, and a more ragged and larger orifice at the point of its exit. The hemorrhage is in this case very slight, and the pain inconsiderable, insomuch that, in many instances, the wounded man is not aware of his having received any injury. If, however, the ball has torn a large vessel, or nerve, the hemorrhage will generally be profuse, or the pain of the wound severe, and the power of the part lost. Some men will have a limb carried off or shattered to pieces by a cannon-ball, without exhibiting the slightest symptoms of mental or corporeal agitation; nay, even without being conscious of the occurrence: and when they are, they will coolly argue on the probable result of the injury; while a deadly paleness, instant vomiting, profuse perspiration, and universal tremor will seize another on the receipt of a slight flesh wound. This tremor, which has been so much talked of, and which to an inexperienced eye is really terrifying, is soon relieved by a mouthful of wine or spirits, or by an opiate; but above all by the tenderness and sympathizing manner of the surgeon, and his assurance of the patient's safety."—(*Principles of Mil. Surgery, p.* 33, *ed.* 2.)

On the other hand, it is correctly noticed by Mr. Guthrie, that the continuance of the constitutional alarm or shock ought to excite great suspicion of serious injury; and when wounds have been received in such situations, or bear such appearances, as render it doubtful whether any parts of vital importance have been injured or not, the manner in which the constitutional perturbation lasts may be assumed as evidence of the fact, when other symptoms more indicative of the injury are wanting; and under all such circumstances, a very cautious prognosis should be delivered. —(*On Gun-shot Wounds, p.* 11, *ed.* 2.)

Respecting the general character of gun-shot wounds not to bleed much unless large vessels be injured, it is a fact which necessarily depends upon the degree of contusion usually attending these injuries. But it is also true, as the preceding author has stated, that although some gun-shot wounds bleed but little at first, there is in the greater number of cases more or less of blood; and in wounds of vascular parts, like the face and neck, the quantity lost is often considerable, though the main arterial branches may not be injured.—(*Op. cit. p.* 6, *ed.* 2.)

In gun-shot wounds, another circumstance is observed, which is often remarked in other cases, viz. when a large artery is partially divided, the bleeding is more profuse and dangerous than when the vessel is completely severed, and the hemorrhage, if not repressed by a tourniquet, or other means, will often continue until the patient dies. Thus, Mr. Guthrie speaks of three cases in which life was lost from wounds of the femoral, humeral, and carotid arteries, no effectual means of stopping the hemorrhage having been adopted.—(*P.* 8.)

Until Ambrose Paré introduced more correct theories upon the subject of gun-shot wounds, ideas the most false, and errors highly prejudicial, prevailed both in their history and treatment, and particularly respecting what have been falsely named wind-contusions. Cannon-balls and bullets sometimes produce dreadful degrees of injury, without occasioning any breach of continuity in the integuments. This observation is so strictly true, that the muscles and bones may actually be crushed and broken to atoms, without the skin being at all wounded. Such cases were for a long while imputed to the violent motion supposed to be communicated to the air by the ball itself. It was imagined, that this elastic fluid, being rapidly displaced by the shock of the projectile, was capable of making such pressure on surrounding bodies, as to destroy their texture. But how could this violent pressure originate in the midst of the open and unbounded air? If this theory were true, the effect in question would constantly happen, whenever a ball passes near any part of the body. The contrary, however, is so much the case, that pieces of soldiers' and seamen's hats, of their feathers, clothes, and even hair, are shot away in every battle, without any other mischief being done.

In consequence of the manner in which such injuries of the soft parts, and even of the bones, unattended with any breach in the skin, have been supposed to be produced, they have been erroneously termed *wind-contusions.* In fact, these cases are now universally acknowledged by all the most accurate observers never to proceed from the cause to which formerly they were always ascribed.

The air does not move with the same rapidity as the ball; but its motion is less in proportion as it is a more subtile matter, and must be too feeble to account for such a violent degree of injury. The air to which the ball must really communicate the greatest motion is what is directly before it; and this never bruises the part untouched by the ball itself. It is only the air situated laterally to the shot that is imagined to do injury, and it cannot be greatly agitated. The violent consequences of sudden explosions, and the effects produced on the organ of hearing by strong commotions of the air, prove nothing relative to the point in question. Lastly, experience does not confirm the reality of such wind-contusions; for cannon-balls often tear off whole members, without the adjacent parts being in the least injured.—(See *Le Vacher, in Mémoires de l'Acad. de Chir. t.* 4, *p.* 22.)

An eminent professor, who visited the continent for the purpose of seeing the wounded after the battle of Waterloo, fully coincides with M. le Vacher and all the moderns upon this subject. "We saw, and were informed of many instances in which cannon-balls had passed quite close to all the parts of the body, and had removed portions of the clothes and accoutrements, without producing the slightest injury of any kind. In other instances, portions of the body itself were removed by cannon-balls, without the contiguous parts having been much injured. In one case, the point of the nose was carried off by a cannon-ball without respiration being at all affected; and in another very remarkable case, the external part of the ear was shot away, without even the power of hearing being sensibly impaired."—(See *Report of Observations made in the British Military Hospitals in Belgium, &c. by J. Thomson, p.* 33, *Edin.* 1816.)

I could cite many cases, which I have seen myself, in proof of the truth of Le Vacher's opinions; but the point is now so universally admitted, that I shall merely add one observation that occurred to the notice of many as well as myself. At the bombardment of the French fleet in the basin of Antwerp early in 1814, a cannon-shot shattered the legs of two officers so badly, that the limbs were amputated. These gentlemen were walking at the moment of the accident in the village of Merksam, taking hold of the arm of my friend Assistant-surgeon Stobo, of the 37th regiment, who was in the middle. Now the ball which produced the injury did not the slightest harm to the latter gentleman, although it must have passed as close as possible to his lower extremities, and most probably between them.

Neither can what have been improperly called *wind-contusions* be attributed to an electrical shock on the parts, in consequence of the ball being rendered electrical by friction in the caliber of the gun, and giving off the electricity as it passes by (Vide *Plenck's Sammlungen*, 1 *theil*, *p.* 99); for metals never acquire this property from friction.

The mischief imputed to the air is occasioned by the ball itself. Its producing a violent contusion, without tearing the skin and entering the limb, is to be ascribed to the oblique direction in which it strikes the part, or, in other instances, to the feebleness with which the ball strikes the surface of the body, in consequence of its having lost the greater part of its momentum, and acting principally by its weight, being, in short, what is called a spent ball. Daily observation evinces that balls, which strike a surface obliquely, do not penetrate, but are reflected; though they may be impelled with the greatest force, and the body struck may be as soft and yielding as water. This alteration in the course of the ball, not only happens on the surface of the human body, but also in the substance of a limb which it has entered. Thus, a bone, a tendon, &c. may change the direction of a ball which touches them at all obliquely. Hence, it is manifest, how it happens that the track of a gun-shot wound is not always straight, and how balls sometimes run under the integuments nearly all round the body or limb.

The causes of several of the peculiarities, attending gun-shot wounds, are to be sought among the laws by which moving bodies are governed, and by which the mechanical effect of a ball, propelled against any part of the body, must therefore be determined. The form, the momentum, and the direction of the shot that is received; the position, and the variety of structure, or, in other words, the variety of density and powers of resistance, in the part receiving it, must always be considered, in order to account satisfactorily for the effects which it produces. And though, says Mr. Chevalier, in many cases, a mathematical explication of the course of the ball cannot be given, this arises entirely from the want of data, the laws of matter being fixed and immutable. But when the data are known, as, for instance, the velocity and direction of the shot, the position of the patient, or of the wounded part at the time of the accident, and the structure of the parts penetrated, a much more probable conjecture of the course of the ball may generally be formed, than if these circumstances had not been regarded.

On the principle of the density and resistance of parts, attempts have been made to explain the reason of the concussion or shock which is given, in many instances, to the whole system by gun-shot wounds, and which is represented, by writers on this subject, to be often attended with grave and even alarming effects, extending, not only over the injured part, but affecting the system at large. Thus, a shot striking against a tendon or a bone, in one of the extremities, will produce a greater concussion than if it struck only against softer parts. A shot striking a muscle in action will produce more concussion than if it struck against the same part of the same muscle at rest; and a shot striking the head or wounding the liver, lungs, or intestinal canal, will generally bring on instantaneous derangement of the whole system, with which the functions of these parts are so closely connected.—(*T. Chevalier on Gun-shot Wounds, part* 1, *sect.* 7.)

Respecting the mechanical effects of the concussion, I am disposed to think, with Mr. Guthrie, that they have been rather exaggerated, and that in reality a more accurate explanation of the disorder of the system might be derived from other considerations: "A shot through the lungs (says he) will cause an instantaneous derangement of the whole system, but the resistance afforded by the part has little to do with it; it is the lesion of the organic functions, intimately connected with life, that is the cause of the derangement. In the same manner, I do not conceive, that the general affection of the system depends alone on the shock received, but on the effect the injury committed has on the nervous system."—(*On Gun-shot Wounds, p.* 26, *ed.* 2.)

A ball, when it strikes a part of the body, may cause four kinds of injury. 1. It may only occasion a contusion, without penetrating the part, on account of its being too much spent, or of the oblique way in which it strikes the surface of the body. 2. It may enter and lodge in the substance of a part; in which case the wound has only one aperture. 3. It may pierce through and through; and then there are two openings, one at the entrance, the other at the exit of the ball. The circumference of the aperture, where the shot entered, is usually depressed; that of the opening, from which it came out, elevated. At the entrance, there is commonly more contusion, than at the exit of the ball. The former opening is generally narrower; the latter wider and more irregular, especially when the round smooth figure of the ball has been changed by its having struck a bone. 4. A cannon-ball may tear off a whole limb.—(*Richter, Anfangsgr. der Wundarzn. b.* 1.)

Gun-shot wounds differ very much, according to the kind of body projected, its velocity, and the nature and peculiarities of the parts injured. The projected bodies are mostly bullets, sometimes cannon-balls, sometimes pieces of broken shells, and very often, on board of ship, splinters of wood. On account of the contusion which the parts suffer, from the violent passage of the ball through them, there is most commonly a part of the solids surrounding the wound deadened, which is afterward thrown off in the form of a slough, generally preventing such wounds from healing by the first intention, and making most of them necessarily suppurate. This does not take place equally in every gun-shot wound, nor in every part of the same wound; and the difference commonly arises from the variety in the velocity of the body projected; for where the ball has passed with little velocity, which is sometimes the case at its entrance, but still more frequently at the part last wounded, the injury may often be healed by the first intention.—(*J. Hunter, p.* 523.)

Until I had the pleasure of reading the last edition of a valuable book on gun-shot wounds, I did not know that, at the present day, any surgeons entertained the idea, that the whole track of every gun-shot wound must unavoidably suppurate and slough (*Guthrie on Gun-shot Wounds, p.* 62, *ed.* 2); but if this sentiment prevail, it is plain from the preceding statement, that the authority of Mr. Hunter cannot be adduced in its support. At the same time, I believe, that few army-surgeons will be inclined to question the correctness of Mr. Hunter's account of the general occurrence of a degree of sloughing, or of the deadened state of a part of the surface of a wound, particularly in the vicinity of the entrance of the ball or the truth of his observations about the common necessity of the separation of such slough before the parts will heal; and whether the dead parts be thrown off in small fragments with the matter, or larger portions, the fact is still correct.

Foreign bodies more frequently lodge in gun-shot wounds than any others, and are commonly of three

kinds. 1. Pieces of clothing or other things which the ball forced before it into the limb. 2. The ball itself. 3. Loose splinters of bone. It is only when the ball strikes the naked flesh, touches no bone, and goes quite through the part, that the wound can be free from extraneous matter. Foreign bodies are the cause of numerous unfavourable symptoms, by irritating sensible parts, and exciting pain, inflammation, convulsions, hemorrhage, long suppurations, &c.; and the more uneven, pointed, and hard they are, the more likely they are to produce these evils. Hence spiculæ of bone are always the most to be dreaded.—(*Richter.*)

The great obliquity and length of the fissures produced in the cylindrical bones by musket-balls, are such as are not remarked in any common cases of fracture. When I was with the army in Holland, in the year 1814, I had in my hospital at Oudenbosch several fatal compound fractures of the thigh, caused by gunshot violence. The fissures in some of these examples were found to extend two-thirds of the length of the bone. This fact is noticed by Mr. Guthrie: "The fractures extend far above and below the immediate part struck by the ball, and, as far as depends upon my information from the examination of limbs that were amputated, farther downwards than upwards; so that, from a fracture in the middle of the thigh, I have often seen fissures extend into the condyles, and cause ulceration of the cartilages of the knee-joint," &c.—(*On Gun-shot Wounds, p.* 190.)

When the ball strikes a bone, the concussion produced is another occasion of bad symptoms, to be added to those already mentioned. When slight, its effects are confined to the injured limb; but sometimes they extend to the neighbouring joints, in which they produce inflammation and abscesses.

It is commonly stated in surgical books, that when a cannon-ball tears off a limb, it produces a violent concussion of the whole body, and a general derangement of all its functions. This, however, is by no means always true. I saw, some years ago in London, a young sailor, whose arm had been completely torn off at the shoulder, by a cannon-ball from one of the forts at Guadaloupe, in March, 1808; he suffered no dreadful concussion of his body, nor were his senses at all impaired. This case was very remarkable, as the scapula was so shattered that Mr. Cummings, of Antigua, was under the necessity of removing the whole of it. The patient recovered in two months. From the accounts which I heard, I do not believe that the axillary artery bled immediately after the accident. The young man was shown to the gentlemen of St. Bartholomew's Hospital, quite well.

One curious effect occasionally follows gun-shot wounds; but I do not pretend to understand the rationale of it: viz. inflammation and suppuration of some internal viscus, especially of the liver. Mr. Rose classes these occurrences among the effects of constitutional irritation arising from local injury, and considers them as striking illustrations of the irregular action in the vascular system to which that irritation may give rise. He is also of opinion that an explanation of the subject may be deduced from the principles laid down by Mr. Travers.—(See *Med. Chir. Trans. vol.* 14, *p.* 263; *and Travers's Inquiry concerning Constitutional Irritation*, 8*vo. Lond.* 1826.) Several cases of the above nature are related in the *Mém. de l'Acad. de Chirurgie*, and according to Mr. Guthrie many patients in the Peninsula who had undergone secondary amputations for gun-shot injuries were destroyed by affections of their lungs, liver, &c.—(*On Gun-shot Wounds of the Extremities, p.* 74, *et seq.*)

From the circumstance of the inner surface of gun-shot wounds being often more or less deadened, they are late in inflaming. But when a ball has fractured a bone, which fracture has occasioned great injury of the soft parts, independently of that caused immediately by the ball itself, the inflammation will come on as quickly as in cases of compound fracture; because the deadened part bears no proportion to the laceration or wound in general.—(*J. Hunter, p.* 524.)

From the same circumstance of a part being often deadened, gun-shot wounds frequently cannot be completely understood in the first instance, for in many cases it is at first impossible to know what parts are killed, whether bone, tendon, or soft part. Nor can this be ascertained till the slough separates, which often makes the wound much more complicated than was previously imagined. For very often some viscus, or a part of some viscus, or a part of some large artery, or even a bone has been killed by the violence. If a piece of intestine has been killed, the contents of the bowel will begin to come through the wound when the slough separates. If a portion of a large blood-vessel be killed, a profuse and even fatal hemorrhage may come on, when the slough is detached, although no material quantity of blood may have been previously lost.—(See *Hunter, p.* 525.) Thus, several days after the receipt of the wound, and when all danger from inflammation is over, a bleeding per anum, occasioned by the separation of a slough from some internal vessel, may destroy the patient, as happened in a very interesting case reported by Mr. Guthrie.—(*P.* 13, *ed.* 2.) A soldier of the 2d battalion of the 44th regiment was shot in the ham at the assault of Bergen-op-zoom in 1814. There was no hemorrhage for ten days; but at the end of this period the popliteal artery gave way, and I was obliged to take up the femoral artery, by which means the bleeding was effectually stopped, and the man recovered. This fact, and another related by Baron Boyer (*Annuaire Méd. Chir. de Paris, p.* 364, 4*to. Paris*, 1819), prove that a ligature on the femoral artery may sufficiently check the current of blood through the popliteal artery to put a stop to hemorrhage from a wound in it; and though such practice in some other cases of wounded arteries is inefficient on account of the facility with which the blood passes through the anastomoses into the part of those vessels below the ligature (see *Arteries*), its general success in gun-shot wounds of the ham, would be of infinite advantage, not only on account of the difficulties of taking up the popliteal artery itself (difficulties ably depicted by Scarpa), but because laying open the inflamed and diseased parts would frequently have a fatal termination. At the same time I would have surgeons always recollect the important difference between an aneurismal and a wounded artery; for, as in the first case there is no outlet for the blood, the transmission of this fluid into the part of the vessel below the ligature may keep up a pulsation in the tumour, and retard the cure of the disease, but is attended with no risk of hemorrhage: while the same free passage of the blood into the wounded portion of a large artery would give rise to dangerous bleeding; and hence the general necessity of applying two ligatures, one immediately above, the other below, the aperture in such a vessel. A single ligature on the brachial artery fails, as I had an opportunity of seeing in Holland in a case of gun-shot wound, where either that vessel or the commencement of the radial or ulnar gave way, on the loosening of the sloughs, and, as there was considerable swelling, œdema, and inflammation of the limb, threatening gangrene, the surgeon under whose care the patient was deemed it right to perform amputation.

I should be sorry if these observations were to hold out any general encouragement of the wrong and dangerous practice of applying only one ligature above a wound in a large artery, or in any recent case of *false diffused* aneurism. The remarks delivered above were chiefly intended to refer to gun-shot wounds of the ham, with injury of the popliteal artery, and hemorrhage first breaking out several days after the receipt of the wound, when all the parts behind the knee are enormously swelled, and in a state of inflammation and suppuration. Here the hope of avoiding any additional violence or injury of the diseased parts behind the knee may be a good reason for taking the chance of stopping the bleeding by a ligature applied to the femoral artery; a reason, however, which would not exist in the case of a recent wound of the popliteal artery with a knife. At the same time I believe this means of checking the current of blood will not always suffice, and that occasionally either the dangerous expedient of cutting open the swelling in this diseased state of the ham, and of applying a ligature above and below the aperture in the popliteal artery, must unavoidably be encountered, or amputation performed. Why the first plan has answered in some cases and not in others, may depend upon the size and condition of the wound or opening in the artery, and, in examples of sloughing, upon the degree in which the tube of the vessel may have been closed by the adhesive inflammation. Some wrong conclusions may also have been made respecting the trunk of the vessel being wounded or opened, while in fact only a branch of it

was concerned. As a qualification, therefore, of any inferences which might be drawn from the partial success of applying one ligature only in cases of large wounded arteries, I annex the following remarks, published some little time ago in an ably-conducted periodical work. "It appears to us that some of the cases which M. Roux has given, as the most favourable for the operation of Hunter, are the least so; for example, he performs it in the cases where aneurism has formed in consequence of the wound of the artery. In support of this he gives two cases, where, upon the authority of M. Mirault, of Angers, the ligature of the artery above the wound was sufficient. In one case, the humeral was the artery said to be wounded; in the other the femoral. We doubt if the femoral were really wounded in this case; for, on referring to the report, we do not find sufficient evidence of that fact: it appears more probable that a branch only was wounded. We have seen the operation of Hunter performed unsuccessfully in two cases of aneurism consequent upon a wound of the artery; and we have seen the preparation of a third case, where the same operation was performed and failed; that is to say, the inosculations were so free that hemorrhage returned by the lower orifice. In the first case, the popliteal artery was ruptured by a spicula of bone. The second was a wound of the femoral artery by an iron spike; and the third was a stab of the femoral artery by a knife. In each of these cases the hemorrhage returned by the lower part of the artery. There is in the *Bulletins de la Faculté de Médecine* for 1813, a case by the same Mirault, of an aneurism of the femoral artery, in consequence of a wound some considerable time before. Mirault operated according to the method of Hunter, that is, he tied the artery above the aneurism. The sac burst, two hemorrhages ensued, and the second carried off the patient on the fifteenth day after the operation. (N.B. Here, however, it is proper to remark, that if the case had been a true aneurism, and the sac had burst, while a stream of blood was yet passing through it, as always happens for some days after the ligature of the artery above the tumour, hemorrhage would have occurred, just as it did in the present case of false aneurism. The premature bursting of the tumour, in fact, converted the case directly into one analogous to a wounded artery, the blood having a passage outwards.) It is rather curious, that the first case which occurred to M. Roux after his return from England, should be one which forms a strong argument against performing the operation of Hunter for a wounded artery. The case here alluded to was that of a wound of the femoral artery with a knife a little below the middle of the thigh, where M. Roux immediately cut down to the vessel some way above the injury, and there applied two ligatures, besides a reserve ligature. On the tenth day hemorrhage came on, when the tightening of the latter ligature having no effect, M. Roux exposed the artery higher up, and applied fresh ligatures immediately below the profunda. This stopped the hemorrhage from the upper end of the vessel; but on the following morning fresh bleeding took place from the lower end of the artery, and it became necessary to lay open the artery below the wound, and also apply ligatures there. No farther bleeding took place."—(See *Quarterly Journ. of Foreign Medicine*, *vol.* 1, *p.* 14, 8vo. *Lond.* 1819.) The tenor of the preceding observations is unquestionably correct, inasmuch as wounded arteries and recent false diffused aneurisms are concerned; but with respect to cases of false circumscribed aneurisms of some standing, without any external opening in the skin, they are examples to which the same principles should not always be applied, which are so properly recommended to be observed with regard to the other instances. In these latter the blood may either escape from the lower end of the vessel out of the external wound, or into the cellular membrane after the ligature is applied above the aperture in the artery; but no sooner is a false aneurism encysted, than these dangers are prevented.

When the ball moves with little velocity, the mischief is generally less; the bones are not so likely to be fractured; the parts are less deadened, &c. However, when the velocity is just great enough to splinter a bone which is touched, the splintering is generally more extensive than if the impetus of the ball had been much greater, in which case a piece is more likely to be taken out. When the ball moves slowly, it is more likely to be turned by any resistance it may encounter in its passage through parts, and hence the wound is more apt to take a winding course.

When a ball enters a part with great velocity, but is almost spent before it comes out again, in consequence of the resistance it has met with, there may be a good deal of sloughing about the entrance, and little or none about the exit, owing to the different degrees of celerity with which the ball traversed the parts.—(See *Hunter.*)

Gun-shot wounds may have either one or two apertures, according as the ball has lodged or passed quite through the part. In some cases, the openings are diametrically opposite each other; in others they are not so, the direction of the ball having been changed by the resistance which it met with from a bone, cartilage, tendon, &c. Thus a ball has been known to enter just on the inside of the ankle, and come out near the knee; to enter the forehead and come out at the temple, &c.—(*Richerand, Nosographie Chir. t.* 1, *p.* 219, *edit.* 2.) Dr. Hennen mentions an instance in which a ball entered near the pomum adami, and after running completely round the neck, was found in the very orifice in which it had entered. "This circuitous route is a very frequent occurrence, particularly when balls strike the ribs or abdominal muscles; for they are turned from the direct line by a very slight resistance indeed, although they will at times run along a continued surface, as the length of a bone along a muscle or a fascia, to a very extraordinary distance." Dr. Hennen refers to cases in which the ball traversed almost the whole extent of the body and extremities. "In one instance which occurred in a soldier, with his arm extended in the act of endeavouring to climb up a scaling ladder, a ball, which entered about the centre of the humerus, passed along the limb and over the posterior part of the thorax, coursed among the abdominal muscles, dipped deep through the glutæi, and presented on the fore part of the opposite thigh, about midway down. In another case, a ball which struck the breast of a man standing erect in the ranks, lodged in the scrotum."—(*Principles of Military Surgery*, *p.* 34, *ed.* 2.) The opening where the ball enters is always smaller than that from which it escapes, and its margin is forced inwards, while the circumference of the other aperture is quite prominent. The contusion and injury which the parts suffer are also greatest about the entrance of the ball, owing to the more considerable impetus with which it moves. The yellowish livid hue around gun-shot wounds is a sort of ecchymosis, or extravasation of blood. The injured member is often benumbed and stupified, and when mortification occurs, it spreads with extraordinary rapidity. When the whole constitution is thrown into this kind of torpor, the most fatal consequences are to be apprehended. "C'est dans cet état (says Richerand), que mourut le chevauléger, dont parle Quesnay; l'état d'hébetude était tel, que cet individu, à qui l'on proposa l'amputation de la jambe, répondit, que ce n'était pas son affaire."—(*Nosographie Chirurg. tom.* 1, *p.* 221, *édit.* 2.) In cases of gun-shot wounds, sudden shiverings, syncope, and nervous symptoms are not unfrequent. Such occurrences, with other bad effects, made the ancients suspect that something poisonous was carried into the wound; an opinion which is now well known to be erroneous.

When there is only one opening, we may infer that the wound contains a foreign body. An exception to this observation occurs, however, when a ball, instead of tearing the clothes or linen, carries a portion of them, in the form of a sac, into the wound, and when such portion of the clothes is withdrawn the ball falls out; and if this circumstance be not noticed, the presence of a single opening may lead to the idea, that the bullet is lodged in the part. An instance of this kind is cited by Paré for the purpose of refuting the former notion, that the ball burned the parts. A case in which a piece of a shirt was carried in this manner four inches into the flesh, is mentioned by Mr. Guthrie.—(*P.* 20, *ed.* 2.) It is possible also for a ball to be stopped immediately it has entered the body, and then to be ejected by the elasticity of the parts against which it strikes, as the cartilages of the ribs.—(*Guthrie*, *p.* 19, *ed.* 2.) When there are two apertures made by one shot, the ball has escaped: but pieces of the clothes, &c. may still be lodged in the part. Care must be taken, however, not

to confound with these cases others, in which the plurality of openings has been made by different balls.

As a modern writer has accurately explained, "It is no uncommon thing for a ball, in striking against the sharp edge of a bone, to be split into two pieces, each of which takes a different direction. Sometimes it happens that one of the pieces remains in the place which it struck, while the other continues its course through the body. Of a ball split by the edge of the patella, I have known one half pass through at the moment of the injury, and the other remain in the joint for months, without its presence there being suspected. In the same manner I have known a ball divided by striking against the spine of the scapula, and one portion of it pass directly through the chest, from the point of impulse, while the other moved along the integuments, till it reached the elbow-joint. But the most frequent examples of the division of bullets which we had occasion to see, were those which were produced by balls striking against the spherical surface of the cranium. It sometimes happens, that one portion of the ball enters the cranium, while the other either remains without, or passes over its external surface. Not unfrequently, in injuries of the cranium, the balls are lodged between its two tables, in some instances much flattened and altered in their shape, and in other instances without their form being changed." From these facts it must be evident, that even when a gun-shot wound has two orifices, the surgeon cannot be certain that the bullet has not been divided, and that no portion is lodged, unless the entire ball itself happen to be found.—(See *Thomson's Obs. in Military Hospitals in Belgium*, *p.* 37, *&c.*)

As the ends of the torn vessels are contused and compressed, gun-shot wounds have at first less propensity to bleed seriously than most other wounds, unless vessels of importance happen to be injured. In the beginning there may even be little hemorrhage, though a considerable artery be so hurt, that it afterward sloughs, and a dangerous or fatal bleeding arises. Thus (as I have already mentioned), in one of my own patients who had received a musket-ball through the ham, the popliteal artery gave way about ten days after the injury, and compelled me to take up the femoral artery; and in the Elizabeth Hospital at Brussels, among the patients under the care of my friend Mr. Collier and myself, about a week after the battle of Waterloo, the cases of hemorrhage, on the loosening of the sloughs, were tolerably numerous, not at all coinciding with a recent calculation, that the proportion of such examples, requiring the ligature of arteries, is only three or four in 1000.—(*Guthrie on Gun-shot Wounds*, *p.* 8, *ed.* 2.) In Holland, the truth of Mr. Hunter's observation upon this point appeared to me to be completely confirmed.

It has long been known, that a limb may be torn or shot off, even near to the trunk of the body, and hardly any hemorrhage arise. We had numerous proofs of this fact after the battle of Waterloo. I had under my care a man of the rifle brigade, whose arm was shattered to pieces as high as the shoulder, yet there was no hemorrhage. I amputated the thigh of a Dutch soldier whose leg had been completely shot off by a cannon-ball; but there was no hemorrhage before the operation. At Merksam, in 1814, I saw a case in which the greater part of the clavicle, scapula, and many adjacent parts had been carried away by a cannon-ball; and yet no bleeding of consequence occurred.

Sometimes, after these violent injuries, the large arteries do not bleed in amputation. "We saw a man (says Dr. Thomson), whose leg had been shot off by a cannon-ball; in amputating his limb above the knee, the arteries of the thigh were not perceived to bleed; nor did any of them afterward require to be tied. A case similar to this also presented itself, in which the arm had been shot away close to the shoulder-joint."

Sometimes the contusion produced by a cannon-ball, or the passage of a bullet in the vicinity of a large artery, seems to cause a laceration of the inner coat of the vessel, and a subsequent obliteration of its cavity by the effusion of coagulable lymph. Facts in proof of this statement are recorded by Dr. Thomson.—(See *Obs. in the Military Hospitals in Belgium*, *p.* 34, 35.)

Angular, uneven bodies, such as pieces of iron, cut lead, &c., produce far more dangerous wounds than round even bodies, like leaden bullets. Wounds occasioned by a small shot are frequently more perilous than others produced by larger balls; because their track is so narrow that it cannot be traced, nor consequently the extraneous body itself extracted. Such a shot often injures a viscus, when there is not the smallest external symptom of the occurrence. Sometimes a great part of the danger also arises from the number of the shots which have entered.

TREATMENT OF GUN-SHOT WOUNDS.

The first thing in the treatment of a gun-shot wound in one of the extremities is, to determine whether it be most advisable to amputate the limb immediately, or to undertake the cure of the wound. When a bone, especially at a joint, is very much shattered; when the fleshy parts, particularly the great blood-vessels and nerves, are lacerated; when the whole limb has suffered a violent concussion, and is cold and senseless; there is no hope of preserving it. In this case, it is the surgeon's duty to amputate at once, and not to delay till inflammation, fever, and a tendency to mortification come on. But besides this violent degree of injury in which the propriety of amputation is obvious, there are several lower degrees, in which it is often a difficult thing to decide whether the operation be necessary or not. Here the surgeon must look not only to the injury, but also to the patient's constitution, and even to external circumstances, such as the possibility or impossibility of procuring good accommodation, rest, attendance, and pure air. But it is impossible to determine the necessity of amputation by general rules. In every individual case, the surgeon must consider maturely the particular circumstances, before he ventures to decide. The grounds against the operation are, the pain which it causes at the period when the whole system is disordered by a terrible injury; the privation of a limb; and frequent examples, in which nature, aided by judicious surgery, repairs the most horrible wounds. The following are the reasons in favour of the operation. By it the patient gets rid of a dreadful contused wound, which threatens the greatest peril, and which is exchanged, as it were, for a simple incised one. The pain of amputation is not of more moment than the pain which the requisite incisions, and the extraction of foreign bodies would cause in case the operation were abandoned. In cases of gun-shot wounds, the loss of the limb cannot be taken into the account; for the surgeon only undertakes the operation where he designs to save the patient's life by that privation, and anticipates that the part itself cannot be preserved. Even if he should deprive the patient of a limb that perhaps might have been preserved, there is this atonement, that he can furnish him with an artificial leg, which often proves far more serviceable than the lost limb would have proved, had it been preserved. Should the operation be fixed on, it is to be immediately performed above the wound.—(*Richter, Anfangsgr. der Wundarzn. b.* 1.)

When amputation is deemed unnecessary, the surgeon, according to precepts formerly in vogue, is to dilate the wound by one or more incisions. Many of the missile weapons employed by the ancients, when received into the body, required incisions before they could be extracted; and this was the case, not only with regard to darts and arrows, but also with regard to bits of stone, pieces of iron, and leaden bullets, which were thrown by means of slings. Celsus mentions the necessity of enlarging the orifices, through which these bodies had entered, and may therefore be justly regarded as the first who recommended the practice of dilatation in the treatment of wounds made by leaden bullets.—(*Thomson's Obs. in the Military Hospitals of Belgium*, *p.* 39.)

Such dilatation has been said to have numerous advantages: to facilitate the extraction of foreign bodies; to occasion a topical bleeding, and afford an outlet for the extravasated fluid in the circumference of the wound; to convert the fistulous form of the track of the ball into an open wound; and, lastly, to divide ligamentous aponeuroses, which otherwise might give rise to spasmodic and other untoward symptoms.

More modern experience proves, however (*Hunter*, *p.* 529), that the utility of such incisions has been overrated; that they generally increase the inflammation, which in these cases is so much to be apprehended; that wounds which are not dilated commonly heal more speedily than others which are; and that there are only a few cases in which incisions are beneficial. In fact, as Dr. Hennen has correctly stated, the knife

is now rarely, if ever, employed in the first instance by English surgeons, except for the purpose of extracting balls, splinters of bone, and other extraneous bodies, or for facilitating the application of ligatures to bleeding vessels.—(See *Principles of Military Surgery*, *p.* 49, *ed.* 2.)

The injuries arising from the practice of indiscriminate dilatation (says Dr. Thomson), were very early pointed out by Botallus; and it is singular how much the opinions of this author, with regard to this point in military surgery, coincide with those of Mr. Hunter.—(*Op. cit. p.* 40.)

The cases of gun-shot wounds are various. Sometimes the track of the ball lies superficially under the skin, and only has one opening. When it lies in soft parts, and the ball has neither touched a bone, nor a considerable blood-vessel, all incisions are useless, let the wound have one or two apertures. Though dilating the wound has been practised with a view of giving vent to matter, eschars, and foreign bodies, and even its whole track has been laid open when superficial; yet experience proves the inutility of such steps. As when a ball has passed with great force there is often a real loss of substance in the skin, a portion of which is driven inwards before the ball, it follows that the opening of a gun-shot wound must be more capacious than that of a punctured one. By the separation of sloughs, the wound becomes still more dilated, so that not only matter, but foreign bodies which approach the skin, easily find an exit. Besides, incisions commonly close again very soon, and in a few days the wound falls into the same state as if no dilatation at all had been made.—(*Hunter*, *p.* 532.)

Ligamentous fibres and fasciæ are often situated about the orifice of a gun-shot wound, and some surgeons have made it a rule always to divide them completely, lest, when the wound inflames, the tension and confinement of parts should cause violent spasms and nervous symptoms, and afterward impede the discharge of matter and foreign bodies. When they obviously have the first effects, the propriety of dividing them cannot be doubted; but with a mere expectation of the other evils I consider the practice injudicious. Here, as Mr. Hunter wisely remarks, the method would be very good if tension and inflammation were not a consequence of wounds, or if it could be proved that the effects of dilating a part that is already wounded were different from those of the first wound; but the employment of the knife, being only an extension of the first mischief, must be contradictory to common sense and common observation.—(*On Gun-shot Wounds*, *p.* 534, 4*to.*)

The extraction of foreign bodies ranks as one of the most urgent motives for the dilatation of the wound, and no doubt it is right to remove at first as many of them as possible. Their lodgement irritates the wound, causes violent nervous and inflammatory symptoms, and copious suppuration; circumstances which the timely extraction of them may prevent. Yet let it be remembered that the extraction of foreign bodies is frequently attended with immense irritation, and that, while they lie too firmly fixed in parts, it is often a matter of impossibility. After the sloughs have separated, and the wound has become widened, suppuration frequently does not prevail long before the extraneous substances become loose, spontaneously approach the skin, and easily admit of removal without any dilatation.

Hence, it is generally prudent to extract at first only such foreign bodies as are near the external opening, quite loose, and removeable without much irritation; or such as press on parts of importance, and thereby excite dangerous symptoms. The surgeon should avoid interfering with those which are deeply and firmly lodged in the wound. He should await suppuration and the detachment of sloughs, and when the foreign bodies become moveable and apparent, he should extract them with or without an incision, as circumstances may demand. The examination of the wound ought to be made as much as possible with the finger, which irritates less, and feels more distinctly, than a probe. A great variety of instruments have been devised, either for ascertaining the position of balls and other foreign bodies in gun-shot wounds, or for extracting them. But however numerous and diversified bullet-drawers may be, they all admit of being divided into three kinds. The first are constructed on the principle of a pair of forceps; others are shaped more or less like spoons; and a third description are made on the plan of a cork-screw or worm. These last are only designed for cases in which the ball is fixed in the substance of a bone, and is quite immoveable; for if it were lodged in the soft parts, the pressure requisite for introducing the screw into it would injure and lacerate the parts at the bottom of the wound. Bullet-drawers, constructed on the plan of forceps, have the inconvenience of not being adapted for seizing the ball unless their blades are expanded, which always stretches the wound, and creates a great deal of irritation. Forceps have been contrived with blades which may be introduced separately, and then joined together with a screw. When a ball lies superficially, the fingers or a small pair of forceps will extract it most conveniently. And with respect to bullet-extractors, as Dr. Hennen has justly observed, they are completely superseded by the common forceps, or that of Baron Percy, though unfortunately the aid of instruments is most required in tortuous, deep passages where we can least make use of them.—(*Principles of Military Surgery*, *p.* 76, *ed.* 2.)

The event of the treatment above recommended is various. Extraneous substances remaining in the wound either loosen gradually, or come into view so as to be easily removeable; or they continue concealed, prevent the cure, and give birth to a fistulous ulcer. In some instances, the wound closes, and the foreign bodies remain in the limb during life without inconvenience; and in other cases after a time they bring on a renewal of inflammation and suppuration. Sometimes a foreign body varies its situation, sinking down, and afterward making its appearance at a different part, where it may excite inflammation and suppuration.

When the ball lodges in the wound, it is usually difficult to trace it, as the parts collapse after its passage, and leave an opening in the skin much smaller than the ball itself. The ball does not regularly take a straight direction through the injured part, but often a very tortuous one, particularly when the ball is nearly spent. In every case in which it is not easily discoverable all painful examinations should be abandoned, and the foreign body left in its situation until its place is better known, and the first inflammation is over.

Sometimes the ball may be both easily found and extracted. At other times it lodges on the opposite side of the limb, closely under the skin. According to Mr. Hunter, if the integuments under which the ball is lodged should be so contused that they will probably slough, they are to be considered as already dead, and an opening is to be made in them for the extraction of the ball. But when the ball lies so remotely from the skin that it can only just be felt, and the skin itself is quite uninjured, no counter-opening ought to be made. The wound heals better when the ball is left in, and far less inflammation takes place in the vicinity of this extraneous body than about the orifice of the wound. A counter-opening always renders the inflammation at the bottom of the wound as great as at its orifice. It is better to let the wound heal up, and extract the balls afterward.—(See *Hunter*, *p.* 541.)

To the justness of this advice Mr. Guthrie does not assent, who assures us that he has cut out a great number of balls which were not more than an inch from the surface, and never found any inconvenience ensue. But when the ball lies three or four inches from the surface, and cannot be distinctly felt, he thinks that no incision should at first be made with the view of extracting it.—(*On Gun-shot Wounds*, *p.* 94, 95, *ed.* 2.)

Sometimes the ball penetrates the spongy part of a bone, and lodges firmly in it. When it has only entered superficially, it may sometimes be loosened and extracted by means of an elevator with a thin and somewhat curved extremity, and when it is more firmly fixed a screw bullet-drawer will sometimes serve for its removal. Should the attempt fail, the employment of a trepan for the removal of the ball is recommended by some writers; while others, fearful of the irritation, difficulty, and effects of such an operation, and recollecting that balls have sometimes remained fixed in bones for many years without any serious inconvenience, condemn that practice. On the contrary, Mr. Guthrie lays it down as a general rule, subject to a few exceptions, that a ball shall never be allowed to remain in a bone; for, says he, "if a ball lodge in the head of a bone, and is not removed, it generally causes caries of the bone, disease of the joint, amputation, or death. If in the shaft of a long bone, necrosis for the most part

follows, with months and years of misery. On a flat bone caries is equally the result, and if it be surrounded by large muscles, sinuses form in various directions, contractions of the limb take place, and the patient drags on for years, careless of life, and ready to submit to any thing to obtain relief."—(*On Gun-shot Wounds*, p. 91. 93, *ed.* 2.) In many of these cases one thing deserves to be recollected, however, that the necrosis, abscesses, and sinuses are less the effect of the lodgement of the ball, than of the violence originally committed on the parts against which it has struck. Although Baron Larrey only sanctions the attempt to remove balls with a trephine when they actually produce dangerous effects (*Mém. de Chir. Mil. t.* 4, *p.* 185), I am disposed to believe that whenever the situation of the ball is such that it can be removed at once from a bone with tolerable certainty, and without too much irritation, the practice is commendable. This branch of the treatment of gun-shot wounds appears to me still to require farther elucidation, for though experience has been abundant, the right rules and principles of practice are not yet laid down in the best modern works.

As soon as the requisite incisions are made, and foreign bodies extracted, the prime objects in the treatment of gun-shot wounds are accomplished, and the rest is, in reality, not different from the surgery of other wounds.

With regard to probing gun-shot wounds; when it is evident that the shot has passed out, and no particular object can be fulfilled with the probe, it is often better to dispense with such examination, at least till suppuration has come on. Introducing any instrument is generally productive both of pain and irritation. But when the ball or any other extraneous substance has lodged in the wound, and its situation is not immediately evident, it will often be advisable to search for it at once, in order that it may be extracted, if its situation will allow, before inflammation begins. The surgeon, therefore, considering all the circumstances which can assist him in forming a reasonable conjecture of the course of the wound, must give to a probe that curvature or form which he thinks most likely to pass readily along it, and must then proceed to make the examination. But when this is very painful, and the course of the wound obscure, it will often be better to desist, and renew the search when suppuration has taken place, in which stage it can be undertaken with more ease and a greater prospect of success. When gun-shot wounds are inflamed, the tenderness and swelling of the parts are peculiarly strong reasons against painful probings, or efforts to extract foreign bodies as long as this state lasts.—(See *Chevalier on Gun-shot Wounds*, p. 67, 68, *edit.* 3.)

There is no fact in the practice of surgery better established than that the cramming of narrow stabs and gun-shot wounds with lint is particularly hurtful. The only possible reason for doing so in the latter cases must be to keep the orifice of the wound from healing up, and confining extraneous bodies, matter, &c. The apprehension of this happening at first is quite unfounded; for the inside of the mouth of the injured part is often lined with a slough or eschar, which must necessarily be detached before the parts can heal. The first dressings, therefore, should be quite superficial, and of a mild, unirritating nature. On the field of battle, indeed, it would be well for many of the wounded, if the surgeon were to content himself with applying simple pledgets, and covering the part with linen wet with cold water. This method would prove much more beneficial than the hasty and indiscriminate use of adhesive plasters, sutures, and tight bandages, from the bad effects of which thousands of soldiers have lost limbs or lives, which, under more judicious treatment, might have been saved. Hunter used to employ fomentations, pledgets of simple ointments, and frequently over the latter an emollient poultice. In the suppurative stage of gun-shot wounds poultices are generally allowed to be the best applications.

Possessing these ideas, I cannot altogether approve the following directions, though they are certainly better than are given in many surgical books. "A small bit of soft lint may be placed lightly between the lips of the wound, *in order to keep it from closing*. In some instances, it should be introduced a little beyond the lips, *in order to conduct off the fluids effused, and to prevent irregular adhesions from forming near the surface during the inflammatory stage;* as these would impede the direct exit of the discharge. But the wound is not to be filled with lint, much less crammed with it. A pledget of some simple ointment being then laid on with tow or cloths to receive the discharge, and these prevented from coming off by a bandage loosely applied, the patient may be put to bed, and so placed, if possible, as to keep the orifice of the wound dependent."—(*Chevalier*, p. 125, 126.) The reasons for what I consider objectionable, namely, introducing lint on first dressing the wound, are too frivolous to need comment.

In considering the effects of poultices and cold applications upon gun-shot wounds, Mr. Guthrie expresses his decided preference to the use of cold water:—"The inflammation is, in some instances, materially prevented, in many greatly controlled, and, in almost all, very much subdued by it, while the suppurative process is not impeded, in the generality of cases, in a degree sufficient to interrupt the subsequent one of granulation. In all simple cases of gun-shot wounds, that is to say, flesh wounds, in persons of a healthy constitution, a piece of lint which has been dipped in oil, or on which some ointment has been spread, is the best application at first to prevent irritation, with two slips of adhesive plaster placed across to retain it in its situation. A compress, or some folds of linen wetted with cold water, are then to be applied over it, and kept constantly wet and cold, even by the use of ice, if it can be obtained, and be found comfortable to the feelings of the patient. A roller is of no use, except to prevent the compress from changing its position during sleep, and is, therefore, at that period useful; but as a surgical application it is useless, if not positively injurious, because it binds a part which ought, to a certain extent, to swell, and by pressure causes irritation. Rollers ought not to be applied surgically until after some days have elapsed, and it is inexpedient to employ them in the field of battle, even if they were useful, except where some parts are to be kept in position; because, when they are applied in the first instance, they soon become stiff and bloody, are for the most part cut, and are seldom preserved after the first dressing so as to become useful at the period when the surgical application of a roller is indispensable." To this just censure of the wrong employment of rollers, Mr. Guthrie annexes some remarks, in which he enters into a general condemnation of poultices, as applications to gun-shot wounds, believing that, in many instances, cold water may be employed with the best effect during the whole progress of the cure. These remarks are tempered with the following admission:—"Cold water is not, however, an infallible or even always an advantageous remedy: there are many persons with whom cold applications do not agree; there are more with whom they disagree after a certain period; and, in either case, they should not be persisted in. Cold does no good in any stage of inflammation, when the sensation accruing from the first application of it is not agreeable to the feelings of the patient; when, in fact, it does not give relief; for if it produces a sensation of shivering, or an uncomfortable feeling of any kind, with stiffness of the part, it is doing harm, and a change to the genial sensation of warmth will not only prove more agreeable but more advantageous. This occurs in general about the period when suppuration has taken place; and cold, in such cases, is preventing the full effect of the action which warmth encourages. Fomentations are then proper; and if a poultice be preferred for convenience by day or by night, an evaporating one of bread will be found sufficient. In the spring of the year, the marsh mallow makes an excellent poultice, and so do turnips, gourds, carrots, &c., independently of oatmeal, linseed meal, Indian meal, and other farinaceous substances. In all those cases where a poultice is resorted to, as much attention is to be paid to the period of removing as of applying it. It is used to alleviate pain, stiffness, swelling, the uneasiness arising from cold, and to encourage the commencing or interrupted action of the vessels towards the formation of matter; and as soon as the effect intended has been gained, the poultice should be abandoned, and recourse again had to cold water with compress and bandage."—(*P.* 62—67, *ed.* 2.) Although I fully coincide with Mr. Guthrie, respecting the general advantage of cold water, the dangers of tight bandages, and the bad effects of continuing poultices too long, I do not join him in

many of the sentiments which he has expressed about these last invaluable applications. On the contrary, I appreciate them as the best means, wherever a slough is to be thrown off or matter is decidedly forming, and as these effects are very frequent in cases of gun-shot wounds, my own opinion of the utility of cold applications is limited to the first three or four days after the receipt of the injury. Nor ought cold applications ever to be continued where the torpor, low temperature, and languid circulation in the limb indicate a risk of gangrene. Hence, when a principal artery is tied, their employment is always wrong and hazardous. At the same time I have no hesitation in declaring my firm belief, that fifty times more mischief has been done by tight rollers applied to recent gun-shot wounds, than by either poultices or cold applications.

Formerly, when the track of the ball had two apertures, a seton was sometimes drawn through it, with the view of preventing a premature closure of the wound, and introducing proper applications. The seton was also imagined to give free vent to pus, and to promote the evacuation of foreign bodies. But a gun-shot wound is little inclined to close prematurely, and while a seton rather obstructs the exit of pus, it may as easily push foreign bodies more deeply into the limb, as out of it. There are preferable modes of applying the necessary remedies, and as a seton is an extraneous substance itself, its employment cannot fail to be highly pernicious.

Gun-shot wounds generally demand the employment of antiphlogistic means, just as other cases, attended with equal inflammation. When they are in the inflamed state, the application of leeches is highly proper. In these cases bleeding is recommended, and in such a manner as if it were of more service in them than wounds in general. But the necessity for the practice is really not greater than in other wounds, which have done the same degree of mischief, and from which the same quantity of inflammation and other consequences are expected. Bleeding is certainly proper here, just as it is in all considerable wounds attended with a strong, full habit, and great chance of extensive inflammation, and much symptomatic fever. In every instance, however, the practitioner must take particular care not to be too bold in the practice of bleeding; for when the patient is reduced below a certain degree, his strength is inadequate to support the large and long-continued suppurations which often cannot be avoided.—(See *Hunter*, *p.* 563, 564.)

As the orifices of the vessels torn by the ball are compressed, and, as it were, obliterated, sometimes no hemorrhage of importance is remarked at first. But as I have already stated, after some days, and frequently at a very late period, when the sloughs separate, copious hemorrhages may occur, which are the more dangerous as they come on unexpectedly, and often when the suppuration has already induced great debility. The surgeon himself may occasion the bleeding, by removing the dressings carelessly. Hence, in every case where, from the situation of the wound, there is reason to apprehend injury of some considerable vessel, the patient must be constantly and attentively watched, and every thing necessary for the immediate stoppage of hemorrhage provided.

Another kind of hemorrhage, still more dangerous than the former, particularly occurs in such gun-shot wounds as have long been in a state of copious suppuration. The blood does not issue from one individual vessel, but from the whole surface of the wound, as from a sponge, and is so thin as to resemble blood and water. This hemorrhage is very dangerous, because it is particularly apt to exhaust the patient, who is already debilitated, and its causes are difficult of removal. The case demands the exhibition of bark and diluted sulphuric acid; the decoction of bark with a proportion of muriatic acid being applied to the wound.—(*Richter.*)

Gun-shot wounds in crowded military hospitals, especially when they are established in unhealthy, low situations, and due attention is not paid to ventilation, cleanliness, and fumigations with nitric acid gas, are often attacked with hospital gangrene, a very serious and dangerous complication, of which I shall speak under the head of *Hospital Gangrene.*

The plan of removing the first dressings too soon is as injurious in gun-shot wounds as other cases, by creating a premature disturbance of the parts. This observation is particularly true where dry lint has been used, and it is adherent to the wound. Unless the occurrence of bleeding, severe pain, or other untoward symptoms were to render a different line of conduct necessary, I think such dressings should rarely be removed before the end of the fourth day. And if cold water has not been continually applied over the lint, so as to keep it moist, or if such lint has not been spread with some mild salve or dipped in oil, I deem it a good rule to apply an emollient poultice over it the evening preceding the morning on which the dressings are to be first changed. By this means they will be loosened, and admit of being taken away without pain or irritation. With the same view, plenty of warm water should be squeezed from a sponge, and allowed to fall upon the dressings. Pledgets of oil or ointment should generally be taken off earlier than dry lint, for they are less adherent, and, in warm weather, soon become rancid and irritating.

For a few days the matter seldom assumes a healthy appearance; but as soon as the sloughs separate, it then becomes of a proper quality, and the wound is to be treated as a simple abscess.

Sometimes the healing process does not commence, though suppuration has prevailed a considerable time. On the contrary, notwithstanding the exhibition of tonics and a generous diet, the suppuration ceases to proceed favourably, and the wound becomes unhealthy, and the matter thin. The bones show no disposition to unite, and the patient, reduced by hectic symptoms, is rapidly approaching dissolution. In this state, life may sometimes be preserved by amputation; the *anceps*, but *unicum remedium*. We ought never to be deterred from undertaking the operation by the fever and weakness, which frequently soon disappear when the local cause is removed.

OF AMPUTATION IN CASES OF GUN-SHOT WOUNDS.

The 2d edition of this Dictionary, published in 1813, contained all the valuable observations of Baron Larrey in favour of *immediate* amputation in every instance in which the operation is considered indispensable. Since then, the public have been favoured with several good practical books, in which the propriety and necessity of early or immediate amputation in such cases are urgently inculcated, and the truth of the doctrine is illustrated by additional facts. It is to be observed, however, that for nearly two hundred years past, there have always been some advocates for this judicious practice. "Du Chesne (says Dr. J. Thomson) is the first writer on military surgery, in whose works I have found the recommendation to amputate in the severe injuries of the extremities; and it is worthy of remark, that *he directs the operation to be performed before inflammation and other constitutional symptoms* shall have supervened."—(See *Traité de la Cure générale et particulière des Arcbusades, par Jos. Du Chesne, Paris*, 1625, *p.* 143; and *Thomson's Report, &c. p.* 160.) Wiseman not only recommended and practised immediate amputation, but the same thing was not unfrequently done by the military surgeons of his time.—(*Chirurgical Treatises, by R. Wiseman, 3d edit. Lond.* 1696, *p.* 410.) The celebrated Le Dran, in his excellent little manual of military surgery, declared himself an advocate for *immediate* amputation in all cases in which that operation from the first appears to be indispensable. Le Dran has at the same time stated briefly, but most distinctly, the comparative advantages of that practice, with those which may be expected by delay.—(See *Traité ou Réflexions tirées de la Pratique sur les Plaies d'Armes à feu, par H. F. Le Dran, à Paris*, 1737.) Ranby, who was sergeant-surgeon to king George II., entertained similar opinions to those of Le Dran, with regard to the utility of immediate amputation. In order to give immediate relief to the wounded, and to facilitate the performance of the necessary operations, Ranby proposed that the surgeons, during battle, should be collected into small bodies, and stationed in the rear of the army.—(See *The Method of Treating Gun-shot Wounds, by John Ranby, edit.* 3, *p.* 29, *London*, 1781.)

After the battle of Fontenoy, in the year 1756, the Royal Academy of Surgery in France offered a prize for the best dissertation on the gun-shot injuries requiring immediate amputation, and on other cases of the same nature, where the operation, though deemed in-

evitable, might be delayed. "*L'amputation étant absolument nécessaire dans les plaies compliquées de fracas des os, et principalement celles qui sont faites par armes à feu, déterminer les cas où il faut faire l'opération sur le champ, et ceux où il convient de la différer, et en donner les raisons.*" The prize was adjudged to the dissertation of M. Faure, the main object of whose paper was to recommend delaying the operation. The side of the question espoused by M. Faure has found some modern advocates of distinguished talents and celebrity. Suffice it to mention the names of Hunter, Baron Percy, and Lombard. It is, however, only justice to M. Faure to state in this place, that though he regarded immediate amputation as full of danger, he admitted that there were several kinds of injuries of the extremities in which it was indispensably and immediately required. "The enumeration (says Dr. Thomson) which this author has given of these injuries is more full and distinct than any which had been published before his time; and, what may appear singular, *it does not differ, in any essential respect, from the enumerations given by later writers*, who, in combating his opinions, have represented him as an enemy to amputation in almost all injuries of the extremities.—(See *Report of Observations made in the Military Hospitals in Belgium*, p. 169.)

In 1792, Baron Percy, who was a few years ago at the head of the medical department of the French army, published a book, in which he gives a preference to delaying amputation at first, even in cases where it is certain that the operation cannot ultimately be dispensed with.—(See *Manuel de Chirurgien d'Armée.*) Even as late as 1804, Lombard, professor in the Military Academy of Strasburg, defended the doctrines of M. Faure.—(See *Clinique Chirurgicale des Plaies faites par Armes à feu.*)

Although in France the Academy of Surgery thought proper to decree the prize to M. Faure, whose doctrine thus received the highest approbation, yet in that country very opposite tenets were set up by some men of distinguished talents and extensive military practice. Thus, Le Dran, consulting-surgeon to the French army, in his work on gun-shot wounds, published in 1737, expressly states, "that when the amputation of a limb is indispensably necessary in the case of a gun-shot wound, it ought to be done without delay."—(*Aphorism* 9.) De la Martinière in particular also wrote some excellent arguments in reply to Bilguer; arguments which, I think, would do honour to the most accomplished surgeon of the age in which we live.—(See *Mémoire sur le Traitement des Plaies d'Armes à feu, in Mém. de l'Acad. de Chirurgie, t.* 11, *p.* 1, *edit. in* 12*mo.*) M. Boucher, of Lisle, was an advocate for the same side of the question.—(See *Obs. sur des Plaies d'Armes à feu, &c. in Mém. de l'Acad. de Chir. t.* 5, *p.* 279, *&c. edit. in* 12*mo.*) Schmucker, who was many years surgeon-general to the Prussian armies, published in 1776 an essay on amputation, in which he particularly mentions, that during his stay at Paris, in 1738, the surgeons of the Hôtel-Dieu had been in the habit of performing immediate amputation in severe injuries of the extremities. *He also declares himself an advocate for operating immediately in all cases, in which amputation from the first appears to be necessary*, and insists, in a particular manner, on the increased danger which he had seen arise from the operation during the second period. He gives (as Dr. J. Thomson has observed) a minute and circumstantial enumeration of those injuries, both of the upper and lower extremities, in which he conceived amputation to be necessary, and in many of which he had actually performed it with great success. Schmucker appears to Dr. Thomson to have given a better account than any preceding military surgeon of the injuries of the thigh; and from the results of his experience, he was led to believe, that *though compound fractures of the lower part of the thigh-bone might, in favourable circumstances, be cured without amputation, yet that this operation is peculiarly necessary in all cases in which the fracture is situated in, or above, the middle of that bone.*—(*J. L. Schmucker, Vermischte Chirurgische Schriften, b.* 1, *Berlin*, 1785). With the foregoing high authority we have to join one of not less celebrity, namely, that of Baron Larrey, who has proved most convincingly, that when amputation is to be done in cases of gun-shot wounds, nothing is so pernicious as delay.—(See *Mémoires de Chirurgie Militaire, tom.* 2, *p.* 451, *&c.*)

It becomes me here to state also, that the principles inculcated by Baron Larrey are, in point of fact, the same as those which were so strenuously insisted upon by Mr. Pott, whose principal remarks on the necessity of amputation in certain cases are detailed in another part of this publication.—(See *Amputation.*) Mr. Pott, indeed, was not an army-surgeon, and what he says was not particularly designed to apply to military practice; but he has represented, as well as any body can do, the propriety of immediate amputation for injuries which leave no doubt that such operation cannot be dispensed with.

Mr. John Bell, among the moderns, appears to me likewise to have much merit for the able manner in which he defended the propriety of early amputation, long before the sentiments of later writers were ever heard of. He distinctly states, that "amputation should, in those cases where the limb is plainly and irrecoverably disordered, be performed upon the spot."—(See *Discourses on the Nature, &c. of Wounds*, p. 488, *edit.* 3.) In short, notwithstanding all the modern pretensions to novelty upon this interesting topic, we must acknowledge, with Dr. Thomson, that the evidence in favour of the advantages of immediate amputation, has always preponderated over that for delay.—(See *Report of Obs. made in the Military Hospitals in Belgium*, p. 225.)

The strongest body of evidence upon this matter is undoubtedly adduced by Baron Larrey, whose situation at the head of the medical department of the French armies afforded him most numerous opportunities of judging from actual experience. "Upon this subject (says he), now that twenty years of continual war have carried our art to the highest pitch of perfection, there can only be one opinion. It is after having incessantly directed the medical service, all this time, in quality of head-surgeon and inspector-general of the armies, that I proceed to discuss the different opinions delivered in the Academy, and to settle definitively this great question, which I regard as the most important in military surgery.

If we are to be told that the amputation of a limb is a cruel operation, dangerous in its consequences, and always grievous to the patient who is thereby mutilated; that, consequently, there is more honour in saving a limb, than in cutting it off with dexterity and success; these arguments may be refuted by answering, that amputation is an operation of necessity, which offers a chance of preservation to the unfortunate, whose death appears certain under any other treatment; and that if any doubt should exist of amputation being absolutely indispensable to the patient's safety, the operation is to be deferred, till nature has declared herself, and given a positive indication for it. We are also justified in adding, that this chance of preservation is at the present day much greater than at the epoch of the Academy of Surgery. We learn from M. Faure, that of about three hundred amputations, performed after the battle of Fontenoy, only thirty were followed by success, while, on the contrary (says Baron Larrey), we have saved more than three-fourths of the patients on whom amputation has been done, and some of whom also had two limbs removed." This improvement is ascribed by Larrey, 1. To our now knowing better how to take advantage of the indication and favourable time for amputating. 2. To the better method of dressing. 3. To the mode of operating being more simple, less painful, and more expeditious than that formerly in vogue.

To the preceding authorities against delaying amputation, in cases of gun-shot wounds requiring such operation, I have to add Mr. Guthrie, deputy-inspector of military hospitals, whose opportunities of observation, during the late war in Spain, were particularly extensive. In his work he has detailed the opinions of many eminent foreign and British surgeons, respecting the propriety or impropriety of the doctrine of immediate amputation; and he has introduced some good criticisms, particularly on Bilguer's statement of the success which was experienced in the Prussian hospitals from not performing the operation. Mr. Guthrie, however, does not recommend amputation to be done immediately, if the patient be particularly depressed by the shock of the injury directly after its receipt; a piece of advice, which, I believe, has in reality been at all times followed, not only in respect to amputations in cases of gun-shot wounds, but all other severe local injuries. "I believe it to be (says Mr. Guthrie) a stretch of fancy in those surgeons who conceive that if the knife followed the shot in all cases, the patient would have the best

chance of success. No one will deny that if the shot performed a regular amputation, it would not be better than to have it to do afterward: but if they mean to say the operation should in general be performed immediately after the injury, I can only oppose to them the facts above stated, and the general result of my experience, which is decidedly in favour of allowing the first *moments* of agitation to pass over before any thing be done; a period extending from that to one, six, or eight hours, according to the difference of constitution and the different injuries that have been sustained. But *from one to three hours* will in most cases be found sufficient.—(*On Gun-shot Wounds, p.* 226, *edit.* 2, *Lond.* 1820.) In the first edition of this gentleman's book, some little want of precision rather concealed his exact meaning with respect to the period of time which should generally be allowed to transpire between the receipt of the injury and the performance of amputation; but after all the disposition to controversy upon this point, it appears there is little to fight about, as there is rather a misunderstanding than a difference of opinion. All acknowledge the advantage of doing the operation immediately, when the patient is not faint and depressed by the shock of the accident; all admit the prudence of deferring the use of the knife in other cases until the constitution has revived sufficiently to be capable of bearing the removal of the limb.—(See *A. C. Hutchison, Pract. Obs. in Surgery, 8vo. Lond. edit.* 2; and *his farther Observations on the proper Period for amputating in Gun-shot Wounds*, 1817. *Quarrier, in Med. Chir. Trans. vol.* 8; and *Dewar, in Med. Chir. Journ. April*, 1819.)

As far as my experience goes, when the necessity of amputation is undoubted, all delay is improper beyond the short period during which the faintness immediately arising from the injury usually lasts. In the campaign in Holland, 1814, the most successful amputations were those done in the field-hospitals directly after the arrival of the patients, or rather, as Dr. Hennen has expressed it, with as little delay as possible. "While hundreds are waiting for the decision of the surgeon, he will never be at a loss to select individuals who can safely and advantageously bear to be operated upon, as quickly as himself, or assistants, can offer their aid; but he will betray a miserable want of science, indeed, if, in this crowd of sufferers, he indiscriminately amputates the weak, the terrified, the sinking, and the determined. While he is giving his aid to a few of the latter class, encouragement and a cordial will soon make a change in the state of the weakly or the terrified; and a longer period and more active measures will render even the sinking proper subjects for operation.—(*On Military Surgery, p.* 45, *ed.* 2.) It appears from some returns collected by Mr. Guthrie, that in the Peninsula, the comparative loss, in secondary or delayed operations, and in primary or immediate amputations, was as follows:—

	Secondary.		Primary.
Upper extremities	12	to	1
Lower extremities	3	to	1

The great success attending amputation on the field of battle was also convincingly proved after the battle of Toulouse. Here, of 47 immediate amputations, 38 were cured, while of the 51 delayed operations, on that occasion, 21 had fatal terminations.—(*P.* 42—44, *ed.* 1.) After the attack on New-Orleans, out of 45 primary amputations, 38 patients recovered, while only 2 of 7 secondary amputations terminated in the preservation of the patients.—(*Op. cit. p.* 294, *edit.* 2.)

OF IMMEDIATE AMPUTATION.

When a limb that has received a gun-shot wound cannot be saved, amputation should be immediately practised. The first four-and-twenty hours, Baron Larrey observes, are the only time that nature remains tranquil (I should say, she does not remain quiet so long), and we must hasten to take advantage of this period in order to administer the necessary remedy.

In the army a variety of circumstances make the urgency for amputation still greater. 1. The inconvenience attending the transport of the wounded from the field of battle to the military hospitals, in carriages badly suspended, the jolting of which would produce such disorder in the wound, and in the whole body, that most patients would die in the journey, especially if it were long, and the weather either extremely hot or cold.

2. The danger of a long continuance in the hospitals; a danger which amputation materially diminishes, by changing a gun-shot injury into a wound that may be speedily healed, and reducing the causes of fever, and the hospital gangrene.

3. The cases in which there is a necessity for abandoning the wounded. In this circumstance, it is of importance to have amputated, for after the operation the patients may remain some days without being dressed, and the dressings are afterward more easy. Besides, it might often happen, that these unfortunate objects would not meet with surgeons of sufficient skill to do the operation; a circumstance, says Larrey, that we have seen happen among certain nations, whose caravans for the medical service of the army (*ambulances*), are not constructed like those in use with the French.

OF CASES IN WHICH AMPUTATION SHOULD BE DONE IMMEDIATELY.

First case. A limb carried away by a cannon-ball, or the explosion of a howitzer or bomb, requires amputation without any loss of time; the least delay puts the patient's life in danger.

In this case, the necessity of the practice is inculcated by M. Faure himself, as well as by Schmucker, Richter, Larrey, Dr. Thomson, and every modern writer upon gun-shot wounds.

When a cannon-ball has torn off a limb, amputation of the stump should be perfor.ned, in order to procure the patient an even, smooth incision, instead of an irregular, jagged, and highly dangerous wound. As the limb has commonly suffered a violent concussion, is almost bereft of sense and power of motion, and the bone frequently has a fissure extending some way upwards, the amputation is sometimes recommended to be done, if possible, above the nearest joint. Were the operation not done, this kind of injury would require large and free incisions for the extraction of foreign bodies, the shortening of projecting muscles and tendons, and the discharge of abscesses; and, as these incisions are likely to occasion at least as much irritation as amputation itself, without being productive of equal good, the avoidance even of pain cannot be urged as a reason against the practice. The occasional healing of such wounds only proves, that it is not altogether impossible, in certain instances, to effect a cure without amputation. The surgeon can the more readily make up his mind to amputate, as in this case the operation does not occasion the loss of a limb. As for the place of the incision, no one would be justified in amputating above the knee, when the limb is injured at the foot or ankle.

The skin has been violently stretched and lacerated; the muscles have been ruptured and irregularly torn away; the tendons and aponeuroses lacerated; the nerves and vessels divided and forcibly dragged; lastly, the bones broken and smashed to a greater or less extent. These first effects are followed by a general or partial commotion; by a kind of torpor in the injured part, and a good way above the wound; by a painful trembling in the remains of the member, an event that is singularly afflicting to the patient; and by a local swelling preceding the erethismus, which quickly shows itself. The hemorrhage, says Baron Larrey, an accident much more to be apprehended than has been supposed, often comes on a few moments after the injury, and, if prompt succour were not afforded, would put a period to the patient's existence. "I can even declare, that had it not been for the activity of the train of flying surgical carriages (*ambulances volantes*), by means of which the wounded have always been dressed upon the field of battle, many soldiers would have perished from this accident alone."

If the operation is not speedily done, pain commences, fever occurs, and the functions of the system become disordered; the irritation then increases, and convulsive motions take place. If the patient should not be a victim to these first symptoms, gangrene of the stump follows, the fatal consequences of which it is extremely difficult to prevent.

After this short exposition, it is easy to see that, in this case, amputation ought to be practised immediately, and to delay the operation, and merely apply simple dressings, would be affording time for the preceding accidents to arise.

At Strasburg, during the bombardment of the fort of Kell, in 1792, three volunteers, says Baron Larrey, had limbs shot off by the explosion of shells: one, an arm;

another, a forearm; and the third, a leg. They were conveyed to the hospital for the wounded in that town, which was superintended by M. Boy. Several days were suffered to elapse before amputation was performed; not one of the patients escaped.

At Mentz, after the retreat from Frankfort, several of the wounded, who had had limbs shot off, did not have amputation done till some time afterward, and not one of them recovered.

At Nice, after the taking of Saourgio, two amputations were practised at the hospital No. 2, one of the forearm, the other of the arm, nine or ten days after the receipt of the injuries: both the patients died.

At Perpignan, Baron Larrey visited two soldiers, on whom amputation had been done, seven or eight days after the receipt of gun-shot injuries in the action of the 14th of July, 1794. One had had a leg shot off, and the other his right arm. Notwithstanding Larrey's utmost care, he could not save their lives: one died of tetanus; the other of gangrene.

In the month of August, 1805, two cannoniers of the guards, in discharging the artillery, had each a hand shot away, and all the fore part of their bodies burnt. These were the two men whose office it was to charge the gun. At the moment when they had just rammed down the wadding on the cartridge, a spark that had been left unextinguished, from the neglect to keep the touch-hole closed, set fire to the powder: the ramrod was violently repelled by the explosion, together with every thing that was situated in front of the charge. The right hand of one of the cannoniers was completely torn off, between the two phalanges of the carpus, and thrown more than two hundred paces. The counter-shock even threw the man down into the ditch of the square of the Hôtel des Invalides. The left hand of the other cannonier was torn away, together with the forearm at the elbow-joint, and also forced to a considerable distance. The tendons and muscles sustained vast injury, and the worst symptoms would have occurred, if amputation had not been instantly performed. In one case amputation was done at the wrist; and in the other at the lower third of the arm. The two operations were followed by complete success, although the burns upon the face and chest, in both the patients, were serious and extensive.

Second case. When a body, propelled by gunpowder, strikes a limb in such a manner as to smash the bones, violently contuse, lacerate, and deeply tear away the soft parts, amputation ought to be immediately performed. If this measure be neglected, all the injured parts will soon be seized with gangrene; and besides, as Larrey has explained, the accidents which the gravity of the first case produces will also here be excited. It is only doing justice to the memory of M. Faure to state, that this second case was one which he also particularly instanced as demanding the immediate performance of amputation.—(See *Prix de l'Acad. Royale de Chirurgie, t.* 8, *p.* 23, *ed.* 12*mo.*)

Third case. If a similar body were to carry away a great mass of the soft parts, and the principal vessels of a limb (of the thigh, for instance), without fracturing the bone, the patient would be in a state demanding immediate amputation; for, independently of the accidents which would originate from a considerable loss of substance, the limb must inevitably mortify. Mr. Guthrie also says, "A cannon-shot destroying the artery and vein on the inside (of the thigh), without injuring the bone, requires amputation."—(*P.* 185.) When, however, the femoral artery or vein is injured by a musket-ball, or small canister-shot, this gentleman recommends tying the vessel above and below the wound in it, if the nature of the case be evinced by hemorrhage. But he believes, that when both vein and artery are injured, amputation is necessary.—(*P.* 186.) With respect to bleeding from the femoral vein, as it may easily be stopped by moderate pressure, the propriety of using any ligature at all is questionable.

"An injury of the femoral artery (observes Mr. Guthrie) requiring an operation, accompanied with fracture of the bone of the most simple kind, is a proper case for immediate amputation; for, although many patients would recover from either accident alone, none would, I believe, surmount the two united; and the higher the accident is in the thigh, the more imperious is the necessity for amputation."—(*Guthrie, On Gun-shot Wounds, p.* 187.)

Fourth case. A grape-shot strikes the thick part of a member, breaks the bone, divides and tears the muscles, and destroys the large nerves, without, however, touching the main artery. According to Larrey, this is a fourth case requiring immediate amputation.

Mr. Guthrie seems to coincide on this point with Larrey: "If a cannon-shot strike the back part of the thigh, and carry away the muscular part behind, and with it the great sciatic nerve, amputation is necessary, even if the bone be untouched, &c. In this case, I would not perform the operation by the circular incision, but would preserve a flap from the fore part or sides, as I could get it, to cover the bone, which should be short."—(*Guthrie, On Gun-shot Wounds of the Extremities, p.* 184.)

Fifth case. If a spent cannon-shot, or one that has been reflected, should strike a member obliquely, without producing a solution of continuity in the skin, as often happens, the parts which resist its action, such as the bones, muscles, tendons, aponeuroses, and vessels, may be ruptured and lacerated. The extent of the internal disorder is to be examined; and if the bones should feel, through the soft parts, as if they were smashed, and if there should be reason to suspect, from the swelling, and a sort of fluctuation, that the vessels are lacerated, amputation ought to be immediately practised. We learn from Larrey, that this is also the advice of Baron Percy. Sometimes, however, the vessels and bones escape injury, and the muscles are almost the only parts disordered. In this circumstance we are enjoined to follow the counsel of De la Martinière, who recommended making an incision through the skin. By this means, a quantity of thick blackish blood will be discharged, and the practitioner must await events. According to Larrey, such incision is equally necessary in the preceding case before amputation, in order to ascertain the extent of the mischief which the parts have sustained.

It is to such injury done to internal organs, that we must ascribe the death of many individuals, which was for a long while attributed to the commotion produced in the air.—(See *Ravaton, Traité des Plaies d'Armes à feu.*)

Although, says Larrey, this opinion has been sanctioned by surgeons of high repute, we may easily convince ourselves of its falsity, if we carefully consider, 1st, the direction and course of solid hard bodies, and their relation to the air through which they have to pass; 2dly, the internal disorder observable in the dead bodies of persons whose death is imputed to the mere impression of the air agitated by the ball; 3dly, the properties of the elastic substances, such as the integuments, cellular substance, &c., struck by the shot.

It is universally agreed among philosophers, that a solid body, moving in a fluid, only acts upon a column of this fluid, the base of which column is nearly equal to the surface which the solid body presents.—(See *Le Vacher sur quelques Particularités concernant les Plaies faites par Armes à feu, in Mém. de l'Acad. de Chirurgie, t.* 11, *p.* 34, *ed.* 12*mo.*)

Thus, a cannon-ball, in traversing a space equal to its diameter, can only displace a portion of air, in the relation of three to two, compared with the size of the shot. This fluid, in consequence of its divisibility and homogenealness with the ambient air, is dispersed in all directions, and confounded with the total mass of the atmosphere. The effects of this aeriform substance amount to nothing, and not a doubt can be entertained, that if there is the slightest solution of continuity of any part of the body, it must depend upon the direct action of the ball itself.

Besides, if the quickness of the motion of a ball be considered, which quickness is known to diminish in an inverse ratio to the squares of the distance, it will be seen that the space through which the shot has passed before striking the object against which it was directed, will already have materially lessened the celerity of the projectile, while the motion of the column of air must be totally lost.

The different movements which the ball describes in its course, and the elasticity of the skin, enable us to explain how internal injuries are produced, without any external solution of continuity, and often even without ecchymoses. The motion communicated to the ball by the power which projects it is, for a given space, rectilinear. If, at this distance, it strikes against the body, it carries the part away to an extent proportioned to the mass with which it touches the part. But the ball, after having traversed a certain distance, undergoes,

in consequence of the resistance of the air, and the attraction of gravity, a change of motion, and now turns on its own axis in the diagonal direction.

If the shot should strike any rounded part of the body, towards the end of its course, it will run round a great portion of the circumference of the part, by the effect of its curvilinear movement. It is also in this manner, observes Larrey, that the wheel of a carriage acts in passing obliquely over the thigh or leg of an individual stretched upon the ground. In this case, the results are the same as those of which we have been speaking. The most elastic parts yield to the impulse of the contusing body; while such as offer resistance, as, for instance, the bones, tendons, muscles, and aponeuroses, are fractured, ruptured, and lacerated. For the same reason, it sometimes happens that the viscera are similarly injured.

At first sight, all the parts appear to be entire; but a careful examination will not let us remain long in doubt about the internal mischief. In this case, an ecchymosis cannot manifest itself outwardly, because the extravasation of blood naturally takes place in the deep excavations occasioned by the rupture of the muscles and other parts, and because this fluid cannot make its way through the texture of the skin. Such extravasations can only be detected by the touch.

The foregoing reasoning is supported by experience. How often, says Larrey, have we not seen the ball carry away pieces of helmets, hats, cartridge-boxes, knapsacks, or other parts of the soldier's dress, without doing any other injury? The same ball, perhaps, takes off his arm, often at a time when it is closely applied to the body of his comrade, and yet the latter does not receive the slightest harm. The shot may pass between the thighs, and these members hardly exhibit an ecchymosis at the points which are gently grazed; the only example in which ecchymosis does occur. In other instances, the ball severs the arm from the trunk, and the functions of the thoracic viscera are not at all injured.

Baron Larrey then relates the following case, which is analogous to one which I saw near Antwerp, and have already mentioned in the foregoing columns. M. Méget, a captain, marching in the front of a square of men, in the heat of the battle of Altzey, 30th March, 1793, had his right leg almost entirely carried away by a large cannon-shot, without the contiguous limb of his lieutenant, who was as close as possible to him, receiving the least injury. The violent general commotion excited, and the extreme severity of the weather, made this officer's condition imminently perilous. The progress of the symptoms, however, was checked by amputation, which was instantly performed. M. Méget was then conveyed to the hospital at Landau, fifteen leagues from the field of battle, where he got quite well.

Larrey declines relating numerous other analogous amputations, which he has been called upon to practise under the same circumstances. M. Buffy, a captain of the artillery of the army of the Rhine, was struck by a howitzer; his left arm being injured, and his head so nearly grazed that the corner of his hat, which was placed forwards over his face, was shot away as far as the crown. This officer, the skin of whose nose was even torn off, was not deprived of his senses, and he was actually courageous enough to continue for some minutes commanding his company. At length, he was conveyed to Larrey's *ambulance*, who amputated his arm: in about a month the patient was well.

Larrey expresses his belief, that what have been erroneously termed *wind contusions*, if attended with the mischief above specified, require immediate amputation. The least delay makes the patient's preservation extremely doubtful. The internal injury of the member may be ascertained by the touch, by the loss of motion, by the little sensibility retained by the parts, which have been struck: and, lastly, by practising an incision, as already recommended.

In order to confirm the principle which he endeavours to establish in opposition to many writers, Larrey indulges himself with the following digression.

At the siege of Roses, two cannoniers, having nearly similar wounds, were brought from the trenches to the ambulance, which Baron Larrey had posted at the village of Palau. They had been struck by a large shot, which, towards the termination of its course, had grazed posteriorly both shoulders. In one, Larrey perceived a slight ecchymosis over all the back part of the trunk without any apparent solution of continuity. Respiration hardly went on, and the man spit up a large quantity of frothy vermilion blood. The pulse was small and intermitting, and the extremities were cold. He died an hour after the accident, as Larrey had prognosticated. This gentleman opened the body in the presence of M. Dubois, inspector of the military hospitals of the army of the eastern Pyrenees. The skin was entire; the muscles, aponeuroses, nerves, and vessels of the shoulders were ruptured and lacerated, the scapula broken in pieces, the spinous processes of the corresponding dorsal vertebræ, and the posterior extremity of the adjacent ribs, fractured. The spinal marrow had suffered injury; the neighbouring part of the lungs was lacerated, and a considerable extravasation had taken place in each cavity of the chest.

The second cannonier died of similar symptoms, three-quarters of an hour after his arrival at the hospital. On opening the body, the same sort of mischief was discovered, as in the preceding example.

In the German campaigns of the French armies, Larrey met with several similar cases, and accurate examination has invariably convinced him of the direct action of a spherical body, propelled by means of gunpowder.

Sixth case. According to Baron Larrey, when the articular heads are much broken, especially those which form the joints of the foot or knee, and the ligaments which strengthen these articulations are broken and lacerated by the fire of a howitzer or a grape-shot, or other kind of ball, immediate amputation is indispensable. The same indication would occur, were the ball lodged in the thickness of the articular head of a bone, or were it so engaged in the joint as not to admit of being extracted by simple and ordinary means.—(See also *Guthrie on Gun-shot Wounds, p.* 197.)

Fractures extending into the joints, and accompanied with great laceration of the ligaments, were cases of gun-shot injuries pointed out by M. Faure as indispensably requiring immediate amputation.—(See *Prix de l'Acad. de Chir. t.* 8.) Thus we see, that this author was not so averse to early amputation as several modern writers have represented.

It is only in this manner that the patients can be rescued from the dreadful pain, the spasmodic affections, the violent convulsions, the acute fever, the considerable tension, and the general inflammation of the limb, which, Larrey observes, are the invariable consequences of bad fractures of the large joints. But, adds this author, if the voice of experience be not listened to, and amputation be deferred, the parts become disorganized, and the patient's life is put into imminent peril.

It is evident, says he, that in this case if we wish to prevent the patient from dying of the subsequent symptoms, amputation should be performed before twelve, or at most twenty-four hours have elapsed: even M. Faure himself professed this opinion in regard to certain descriptions of injury.—(*Mém. de Chir. Militaire, t.* 2.)

With respect to wounds of the knee, the sentiments of Mr. Guthrie nearly coincide with those of Larrey. "I most solemnly protest (says Mr. G.), I do not remember a case do well, in which I knew the articulating end of the femur or tibia to be fractured by a ball that passed through the joint, although I have tried great numbers, even to the last battle of Toulouse. I know that persons wounded in this way have lived; for a recovery it cannot be called, where the limb is useless, bent backwards, and a constant source of irritation and distress, after several months of acute suffering, to obtain even this partial security from impending death; but if one case of recovery should take place in fifty, is it any sort of equivalent for the sacrifice of the other forty-nine? Or is the preserving of a limb of this kind an equivalent for the loss of one man?"—(*On Gun-shot Wounds, p.* 196.)

In the attack of the village of Merksam, near Antwerp, early in 1814, a soldier of the 95th regiment was brought to our field-hospital, having received a musket-ball through the knee-joint. The staff-surgeons on duty, and Mr. Curtis, surgeon of the 1st guards, were preparing to amputate the limb, when a surgeon attached to the 95th, urgently recommended deferring

the operation. Superficial dressings were applied, and the patient sent to the rear. He lived several months after the accident, at times affording hopes of a perfect recovery; but in the end, he fell a victim to hectic symptoms.

Indeed, such is the general unfortunate result of these cases, that Dr. Hennen lays it down as a law of military surgery, that no lacerated joint, particularly the knee, ankle, or elbow, should ever leave the field unamputated where the patient is not obviously sinking.—(*On Military Surgery, p.* 41, *ed.* 2.)

According to Mr. Guthrie, fractures of the patella, without injury of the other bones, admit of delay, provided the bone is not much splintered.

Seventh case. Larrey observes, that if a large biscayen, a small cannon-shot, or a piece of a bomb-shell, in passing through the substance of a member, should have extensively denuded the bone without breaking it, amputation is equally indicated, although the soft parts may not appear to have particularly suffered. Indeed, the violent concussion produced by the accident has shaken and disorganized all the parts; the medullary substance is injured, the vessels are lacerated, the nerves immoderately stretched, and thrown into a state of stupor; the muscles are deprived of their tone; and the circulation and sensibility in the limb are obstructed. Before we decide, however, Baron Larrey cautions us to observe attentively the symptoms which characterize this kind of disorder. The case can be supposed to happen only in the leg where the bone is very superficial, and merely covered at its anterior part with the skin.

The following are described as the symptoms: the limb is insensible, the foot cold as ice, the bone partly exposed, and, on careful examination, it will be found that the integuments, and even the periosteum, are extensively detached from it. The commotion extends to a considerable distance; the functions of the body are disordered; and all the secretions experience a more or less palpable disturbance. The intellectual faculties are suspended, and the circulation is retarded. The pulse is small and concentrated; the countenance pale; and the eyes have a dull, moist appearance. The patient feels such anxiety, that he cannot long remain in one posture, and requests that his leg may be quickly taken off, as it incommodes him severely, and he experiences very acute pain in the knee. When all these characteristic symptoms are conjoined, says Larrey, we should not hesitate to amputate immediately: for otherwise the leg will be attacked with sphacelus, and the patient certainly perish.

Larrey adduces several interesting cases in support of the preceding observations.

Eighth case. When a large ginglymoid articulation, such as the elbow, or especally the knee, has been extensively opened with a cutting instrument, and blood is extravasated in the joint, Larrey deems immediate amputation necessary. In these cases, the synovial membranes, the ligaments, and aponeuroses inflame, the part swells, and erethismus rapidly takes place; and acute pains, abscesses, deep sinuses, caries, febrile symptoms, and death are the speedy consequences. Larrey has seen numerous subjects die of such injuries, on account of the operation having been postponed through a hope of saving the limb. In his *Mémoires de Chirurgie Militaire, tom.* 2, some of these are detailed.

Although a wound may penetrate a joint, yet if it be small, and unattended with extravasation of blood, M. Larrey informs us, it will generally heal, provided too much compression be not employed. This gentleman believes in the common doctrine of the pernicious effect of the air on the cavities of the body; yet in this place a doubt seems to affect him: speaking of the less danger of small wounds of joints, he says, "*à quoi tient cette différence, puisque l'air pénètre dans l'articulation dans l'un comme dans l autre cas?*"

When two limbs have been at the same time so injured as to require amputation, we should not be afraid of amputating them both immediately, without any interval. We have, says Larrey, several times performed this double amputation with almost as much success as the amputation of a single member. He has recorded an excellent case in confirmation of this statement.—(*Mém. de Chir. Militaire, t.* 2, *p.* 478.)

When a limb is differently injured at the same time in two places, and one of the wounds requires amputation (suppose a wound of the leg with a splintered fracture of the bone, and a second of the thigh, done with a ball, but without any fracture of the os femoris, or other bad accident), Larrey recommends us first to dress the simple wound of the thigh and amputate the leg immediately afterward, if the knee be free from injury. When it is necessary to amputate above this joint, the less important wound need not be dressed till after the operation, provided it can be comprehended in the section of the member, or be so near the place of the incision as to alter the indication. When the wound demanding amputation is the upper one, the operation of course is to be done above it, without paying any regard to the injury situated lower down.

Ninth case. To the foregoing species of gun-shot wounds, pointed out by Baron Larrey as urgently requiring immediate amputation, my own experience and the observations of Dr. Thomson justify me in adding compound fractures of the thigh from gun-shot violence. I am particularly glad that the latter gentleman has devoted a proper degree of attention to these cases; for the opportunities which I had of judging when abroad, incline me to believe, that military surgeons are hardly yet sufficiently impressed with the propriety of immediate amputation in gun-shot fractures of the thigh. There were brought into my hospital at Oudenbosch, in 1814, about eight of such cases, all in the worst state for an operation, because several days had elapsed after the receipt of the injuries. All these patients died, excepting one, whose fracture was not far above the condyles, and I do not know, that he ever regained a very useful limb. Another had indeed been rescued by amputation from the dangers of the injury; but was unfortunately lost by secondary hemorrhage about three days after the operation. The bleeding was almost instantly suppressed; yet such was the weakness of the patient, that the irritation of securing the vessel, and the loss of blood together, destroyed at once every hope of recovery. Were I to judge, then, from my own personal observations in the army, and from some other cases which I saw under my colleagues, I should without hesitation recommend immediate amputation in all cases of compound fractures of the thigh, caused by grape-shot, musket-balls, &c. If there are any exceptions to this advice, they are such as are specified in the article *Amputation*.

"Gun-shot fractures of the thigh (says Dr. J. Thomson) have been universally allowed to be attended with a high degree of danger; indeed, till of late years, very few instances have been recorded of recovery from these injuries. Ravaton acknowledges, that in his long and extensive experience, he had never seen an example of recovery from a gun-shot fracture of the thigh; and Bilguer, in his calculations with regard to those who recover from gun-shot fractures, sets aside those of the thigh-bone as being of a nature altogether hopeless. In the present improved state of military surgery, instances not unfrequently occur of recovery from this fracture; but of these the number will be found, I believe, to be exceedingly small in comparison with those who die, particularly when the fracture has had its seat above the middle of the bone, &c.

According to the observations of Percy, scarcely two of ten recover of those who have suffered gun-shot fractures of the thigh-bone. Mr. Guthrie, who seems to have paid greater attention to this subject than any preceding author, says, that "upon a review of the many cases which I have seen, I do not believe that more than one-sixth recovered so as to have useful limbs; two-thirds of the whole died either with or without amputation; and the limbs of the remaining sixth were not only nearly useless, but a cause of much uneasiness to them for the remainder of their lives."—(See *Guthrie on Gun-shot Wounds, p.* 191.)

"In fractures by musket-bullets of the lower part of the thigh-bone (says Dr. Thomson) recovery not unfrequently takes place, and both Schmucker and Mr. Guthrie conceive, that they are injuries in which amputation may be delayed with safety. It would be very agreeable, that this opinion should be confirmed by future experience; but it appears to me, that before it can be received as a maxim in military surgery, much more extensive and accurate observation than we yet possess, will be required with regard to the proportion of those who recover without amputation, or after secondary operations, and of those who recover after primary amputation. Of those who had suffered

this injury, we saw comparatively but a small number recovering in Belgium, and they had been attended with severe local and constitutional symptoms."—(See *Obs. made in the Military Hospitals in Belgium*, p. 247, *et seq.*)

In the article *Amputation* I have described the manner in which balls produce fissures of several inches in length in the thigh-bone. This state of the bone, observes Dr. Thomson, must be very unfavourable to recovery, and his conclusion is, that in general, even in fractures of the lower part of the thigh-bone, a greater number of lives will be preserved in military practice by immediate amputation, than by attempting the cure without that operation. "When the bone appears, on a careful examination, to be broken without being much splintered, and when the patient can be removed easily to a place of rest and safety, it may be right to attempt to preserve the limb; but if the bone be much splintered, or if the conveyance is to be long or uncertain, it will, in most instances, I am convinced, be a much safer practice, even in fractures of this part of the thigh-bone, to amputate without delay.

Musket-bullets, in passing through the femur near to the knee-joint, produce fissures of the condyles, which generally communicate with the joint. These cases, like those in which the bullets have passed directly through the joint, require immediate amputation.

The writings of military surgeons contain but few histories of cases in which the thigh-bone had been fractured above its middle by the passage of musket-bullets. These are cases, I believe, which have generally had a fatal termination; and the danger attendant upon the amputation which they require seems long to have deterred surgeons from attempting to ascertain what advantages might be derived from the employment of that operation. Schmucker recommends, and states that he had practised with success, immediate amputation in those cases in which a sufficient space was left below the groin for the application of the tourniquet. It is curious to remark, in the history of amputation, how long surgeons were in discovering the ease and safety with which the femoral artery may be compressed by the fingers, or pads, in its passage over the brim of the pelvis. Boy, from the immediate danger, protracted suffering, and ultimate want of success which he had observed to follow this kind of injury, urges strenuously the propriety of immediate amputation. Mr. Guthrie's opinion, with regard to the dangerous nature of these injuries, and the advantages to be derived in them from immediate amputation, coincides in every respect with those of Schmucker and Boy. He observes, that those whose thigh-bone has been fractured in its upper part by a musket-bullet generally die with great suffering, before the end of the sixth or eighth week; and that few even of those escape, in whom that bone has been fractured in its middle part. Of the few whom we saw, who had survived gun-shot fractures in the upper part of the thigh-bone in Belgium, scarcely any one could be said to be in a favourable condition. In all, the limbs were much contracted, distorted, and swollen, and abscesses had formed round and in the neighbourhood of the fractured extremities of the bones. In some instances, these abscesses had extended down the thigh; but more frequently they passed upwards and occupied the region of the hip-joint and buttocks. In several instances, in which incisions had been made for the evacuation of matter, the fractured and exfoliating extremities of the bones, sometimes comminuted, and sometimes forming the whole cylinder, could be felt bare, rough, and extensively separated from the soft parts which surrounded them. In other instances, these extremities were partially enclosed in depositions of new bone, which, from the quantity thrown out, seemed to be present in a morbid degree. It was obvious, that in all of these cases, several months would be required for the reunion of the fractured extremities; that in some much pain and misery were still to be endured from the processes of suppuration, ulceration, exfoliation, and ejection of dead bone; that in some cases, the patients were incurring great danger from hectic fever and from diarrhœa; that the ultimate recovery in most of them was doubtful, and that of those in whom this might take place, there was but little probability that any would be able to use their limbs! The sight of these cases (says Dr. Thomson) made a deep impression upon my mind, and has tended to increase my conviction that this is, of all others, the class of injuries in which immediate amputation is most indispensably required."—(See *Obs. made in the Military Hospitals in Belgium*, p. 254—258.)

Dr. Thomson adds, that what has been said of the danger of fractures produced by musket-bullets in the upper part of the femur, is true in a still greater degree of those which have their seat in the neck or head of that bone. In such instances, Dr. Thomson joins the generality of modern army surgeons in strongly recommending amputation at the hip-joint; a subject of which I have already spoken.—(See *Amputation.*)

ON GUN-SHOT WOUNDS IN WHICH AMPUTATION MAY BE DEFERRED.

If, says Baron Larrey, it be possible to specify the cases in which amputation ought to be immediately performed, it is impossible to determine, *à priori*, those which will require the operation subsequently. One gun-shot wound, for example, will be cured by ordinary treatment, while another that is at first less severe, will afterward render amputation indispensable, whether this be owing to the patient's bad constitution, or the febrile complaints which are induced. However this may be, the safe rule for fulfilling the indication that presents itself is, to amputate consecutively only in circumstances in which every endeavour to save the limb is manifestly in vain. Upon this point Larrey's doctrine differs from that of Faure.

The latter practitioner admits cases, which he terms cases *of the second kind*, in which he delays amputation, not with any hope of saving the limb, but in order to let the first symptoms subside. The operation done between the fifteenth and twentieth day appears to him less dangerous than when performed immediately after the receipt of the injury. At the above period, according to M. Faure, the commotion occasioned by the gun-shot injury is dispelled; the patient can reconcile himself to amputation, the mere mention of which fills the pusillanimous with terror in a greater or less degree; the debility of the individual is no objection; and it is laid down as an axiom, "that the consequences of every amputation, done in the first instance, are in general extremely dangerous." In support of this theory, M. Faure adduces ten cases of gun-shot injuries, in which, after the battle of Fontenoy, the operation was delayed, in order that it might afterward be performed with more success: a plan which, according to the author, proved completely successful. —(See *Prix de l'Acad. de Chirurgie, tom.* 8, *édit. in* 12*mo.*)

This division of the cases for amputation into two classes, not consistent with nature, Larrey conceives, has been the cause of a great deal of harm. Very often the partisans of M. Faure have not dared to resort in the first instance to amputation, the dangers of which they exaggerate; while on other occasions they amputate consecutively without any success.

Larrey, after arguing that the effects of commotion, instead of increasing, gradually diminish and disappear after the operation, ventures into some hypothesis about the proximate cause of the ill effects of commotion, which, as being wild and unsatisfactory, I shall not here repeat.

Baron Larrey will not even admit that the patient's alarm ought to be a reason for postponing the operation: because the patient, just after the accident, will be much less afraid of the risk which he has to encounter, than at the expiration of the first four-and-twenty hours, when he has had time to reflect upon the consequences of the injury or of amputation; a remark made by the illustrious Paré.

"Experience agreeing with my theory (says Baron Larrey), has proved, both to the army and navy surgeons, that the bad symptoms which soon follow such gun-shot injuries, as must occasion the loss of a limb, are much more to be dreaded than those of immediate amputation. Out of a vast number of the wounded who suffered amputation in the course of the first four-and-twenty hours after the memorable naval battle of the 1st of June, 1794, a very few lost their lives. This fact has been attested by several of our colleagues, and especially by Fercoc, surgeon of the ship *Le Jemappe*."

The following is said to be an extract from one of his letters.

"After the naval engagement on the 1st of June, 1794, a great number of amputations were done immediately

after the receipt of the injuries. Sixty of the patients whose limbs had been thus cut off were taken to the naval hospital at Brest, and put under the care of M. Duret. With the exception of two, who died of tetanus, all the rest were cured; and there was one who had both his arms amputated. The surgeon of the *Téméraire*, which ship was captured by the English, was desirous, in compliance with the advice of their medical men, to defer the operation which many of the wounded stood in need of, till his arrival in port; but he had the mortification to see them all die during the passage," &c.

Larrey next acquaints us, that when he was sent to the army of Italy, in 1796, he had also the pain of seeing in the hospitals great numbers of the wounded fall victims to the confidence which many of the surgeons of that army placed in the principles of M. Faure. General Buonaparte saw that the *ambulance volante* was the only thing that, in the event of fresh hostilities, could prevent such accidents: and in consequence of his orders, Larrey formed the three divisions *d'ambulance* which are described in his *Mémoires de Chirurgie Militaire.*

Since this period it has always been customary in the French armies, on the day of battle, to make every preparation for performing amputations as speedily as possible. The mere sight of these *ambulances* (always attached to the advanced-guard), says M. Larey, encourages the soldiers, and inspires them with the greatest courage. On this occasion, the following anecdote is cited from Ambrose Paré.

This famous surgeon having been urgently sent for by the Duke de Guise, besieged in Metz, to attend the wounded of his army, who were in want of assistance, Ambrose Paré was shown to the frightened soldiers at the breach. Upon this, they immediately filled the air with shouts of the most lively joy, and cried out: "*Nous ne pouvons plus mourir, s'il arrive que nous soyons blessés, puisque Paré est parmi nous.*" Their courage revived, and their confidence in this skilful surgeon contributed to the preservation of a place, before which a formidable army was destroyed.

Larrey desires us to interrogate the invalids who have lost one or two of their limbs, and nearly all will tell us that they suffered amputation a few minutes after the accident, or in the first four-and-twenty hours.

"If Faure now retains any partisans," says Larrey, "I recommend them to repair to the field of battle the day after an action: they would then soon be convinced, that without the prompt performance of amputation, great numbers of soldiers must inevitably lose their lives. In Egypt this truth was particularly manifested."

The following communication upon this point was made to Baron Larrey by M. Masclet, a French surgeon on duty at Alexandria.

"In the naval hospital of this port I have seen eleven soldiers or sailors, who were wounded in the naval action off Aboukir, and who had suffered amputation in the first four-and-twenty hours. In five of these cases the operation had been done on the arm; in two on the thigh; and in three others on the leg. All these men are recovering. In the army hospital there have been only three thigh-amputations, which we performed seven or eight days after the battle, and these three patients died a few days after the operation, although the operation was done methodically, and no grave symptoms prevailed at the time of its performance. You see, sir, experience has in this instance quite confirmed your principles."

In 1780, during the American war, we are informed by Larrey, that the surgeons of the French army performed a great number of amputations, according to the opinion then generally adopted in France, that the operation should not be undertaken till after the subsidence of the first symptoms. Almost all the patients thus treated died after the operation. On the contrary, the Americans, who had the boldness to amputate immediately (or in the first twenty-four hours) upon many of their wounded countrymen, lost only a very few. Yet M. Dubor, at that time surgeon to the Artois dragoons, and from whom Larrey has collected this fact, relates, that the situation of the hospital for the French wounded was, on many accounts, the most advantageous.—(*Dubor, Thèse Inaugurale, soutenue* 16 *Sept.* 1803, *à l'Ecole de Strasburg.*)

Admitting that, by a concurrence of fortunate circumstances, which are not always to be calculated upon, some patients escape the danger of the first symptoms, as Larrey remarks, this proves nothing in favour of doing the operation afterward: it must be seen what nature will do towards the event of the case.

If, at the end of twenty or thirty days, the prognosis is as bad as it was previously, amputation cannot be avoided. Thus all the sufferings which the patient has endured have been undergone for nothing, and the operation will now be attended with considerable risk, inasmuch as the patient may lie in a dangerously weakened state.

If nature revives at all, no doubt the success of the operation becomes more probable; but in this case the surgeon, instead of having recourse to amputation, should redouble his efforts to preserve the limb.

[Dr. Brown, of the U. S. navy, during the late war, dissected out the head of the humerus after a gun-shot wound received at the battle on Lake Champlain; and soon after, Dr. Henry Hunt, of Washington, D. C., removed the coracoid and acromion apophyses of the scapula, the humeral end of the clavicle, together with a superior projecting portion of the os humeri, from the same patient.—(See *Am. Med. Recorder for* 1828.)

In this case the limb was preserved by these bold operations; whereas, if amputation even at the joint had been attempted, the patient's life might have been the forfeit.—*Reese.*]

CASES DEMANDING AMPUTATION CONSECUTIVELY.

Upon this subject Larrey gives us the annexed information.

First Case. A spreading Mortification. If the disorder be owing to an internal and general cause, it would then be rashness in the surgeon to amputate before nature had put limits to the disease. Larrey describes this kind of gangrene as being distinguished from that which is named *traumatic*, by the symptoms which precede and accompany it. These symptoms are similar to those which are observed in nervous ataxia or adynamia. Here the operation ought to be deferred, and endeavours made to combat the general causes with regimen and internal medicines.

But when the gangrene is *traumatic*, Larrey advises the limb to be immediately cut off above the disorganized part. Several facts in support of this doctrine are related by this experienced surgeon in his *Mémoire sur la Gangrene Traumatique.*—(See *Mortification.*)

In that part of the Dictionary will be found additional observations in favour of the practice adopted and recommended by Larrey, which is so opposite to that inculcated by Sharp, Pott, and the generality of writers.

In the article *Amputation* I have noticed a particular case of gangrene, which has been pointed out by Mr. Guthrie, as demanding the early performance of amputation and a deviation from the old rule of waiting till the mortification has ceased to spread.—(See *Guthrie on Gun-shot Wounds of the Extremities, p.* 63, *&c.*)

Second Case. Convulsions of the wounded Limb. It is one of Larrey's doctrines (though of a very questionable description), that amputation of the member, performed immediately the first symptoms of tetanus manifest themselves, interrupts all communication between the source of the disorder and the rest of the body. He states, that the operation unloads the vessels, and thus puts a stop to the tension of the nerves and to the convulsions of the muscles. These first effects, he says, are followed by a general collapsus, which promotes the excretions, sleep, and the equilibrium of every part of the system. He argues, that the whole of the momentary pain caused by the operation cannot increase the existing irritation: besides the sufferings of tetanus render those of amputation more bearable, and lessen their intensity, especially when the principal nerves of the limb are strongly compressed. Some observations will be made on this subject in the article *Tetanus.*

Third Case. Bad state of the Discharge. It often happens, that in gun-shot wounds complicated with fractures, notwithstanding the most skilful treatment, the discharge becomes of a bad quality; the fragments of bone lie surrounded with the matter, and have not the least tendency to unite: the patient is attacked with hectic fever, and a colliquative diarrhœa. Under these circumstances, life may sometimes be preserved by amputation.

Fourth Case. Bad state of the Stump. In hospitals, as Baron Larrey observes, the cure of amputations is sometimes prevented by a fever of a bad character.

The stump swells, the integuments become at first retracted, and then everted and diseased a good way upwards. The wound changes into a fungous ulcer, the cicatrization of which is hindered by the deep disorder of the bone and the ulceration of the soft parts. The extremity of the bone projects. In order to remedy this last evil, it has been proposed to saw off the projecting part of the bone, and with this even to amputate all the flesh beyond the level of the skin. Larrey condemns such practice as unnecessary and dangerous, and he recommends giving nature time to bring about the exfoliation of the diseased projecting part of the bone, and heal the wound.—(See *Memoirés de Chir. Militaire, t.* 2.)

GUN-SHOT WOUNDS OF THE ABDOMEN.

These cases may be divided into two kinds; one only penetrates the parietes of the belly, without hurting the contained parts; the other does mischief also to the viscera. The event of these two kinds of wounds is very different. In the first, little danger is to be expected, if properly treated; but in the second the success will be extremely uncertain, for in many instances nothing can be done for the patient, and on other occasions a good deal.

It is observed by Mr. Hunter, that such wounds of the abdomen as do not injure parts like the stomach, intestines, bladder, ureters, gall-badder, large blood-vessels, &c., all which contain particular fluids, will generally end well. But he adds that there will be a great difference when the ball has passed with immense velocity, as a slough will be produced; whereas, when the ball has moved with less impetus, there will not be so much sloughing, and the parts will, in some degree, heal by the first intention. Even when the ball occasions a slough, the wound frequently terminates well, the adhesive inflammation taking place in the peritoneum all round the wound, so as to exclude the general cavity of the abdomen from taking part in the inflammation. Such is often the favourable event when the ball, besides entering the abdomen, has wounded parts like the omentum, mesentery, &c., and gone quite through the body.—(*Hunter on Inflammation, Gun-shot Wounds, &c. p.* 543.)

In gun-shot wounds of the belly, an extravasation is apt to take place on the sloughs becoming loose, about eight, ten, twelve, or fourteen days after the accident; but, says Mr. Hunter, although this new symptom is in general very disagreeable, most of the danger is usually over before it can appear.

In the article *Wounds* I have detailed at large the general principles which should be observed in the treatment of wounds of the belly; consequently, it would be superfluous here to go over the whole of this extensive subject again. As a modern writer observes, "In their treatment, the violence of symptoms is to be combated more by general means than by any of the mechanical aids of surgery. The search for extraneous bodies, unless superficially situated, is altogether out of the question, except they can be felt with the probe, as in Ravaton's case (*Chir. d'Armée, p.* 211), or in other cases of lodgement in the bladder, where they may become the object of secondary operations. Enlargement or contraction of the original wound, as the case may require, for returning the protruded intestine, securing the intestine itself, and promoting the adhesion of the parts, are all that the surgeon has to do in the way of operation; and even in this the less he interferes the better. Nature makes wonderful exertions to relieve every injury inflicted upon her, and they are often surprisingly successful, if not injudiciously interfered with. In a penetrating wound of the abdomen, whether by gun-shot or by a cutting instrument, if no protrusion of intestine take place (and this, it must be observed, in musket or pistol wounds rarely occurs), the lancet, with its powerful concomitants, abstinence and rest, particularly in the supine posture, are our chief dependence. Great pain and tension, which usually accompany these wounds, must be relieved by leeches to the abdomen (if they can be procured), by topical applications of fomentations, and the warm bath; and if any internal medicine is given as a purgative, it must, for obvious reasons, be of the mildest nature. The removal of the ingesta, as a source of irritation, is best effected by frequently repeated oleaginous clysters" (see *Hennen's Principles of Military Surgery, p.* 431, *ed.* 2); and with respect to dressings, as the same author has observed concerning cases in which a ball has passed directly through the abdomen, the mildest application should be employed, and no plugging with tents, nor introduction of medicated dressings, thought of.—(*P.* 406.) In this publication may be found cases, in which musket-balls were passed by stool (*p.* 404); in which an artificial anus was formed (*p.* 407, *&c.*); or the kidneys, liver (*p.* 430—432), diaphragm (*p.* 437), and other viscera, injured.

The following case, exhibiting the possibility of recovery, though the small intestine be completely severed with a ball, is interesting, particularly as cases of this kind have been regarded as positively fatal. The success was also obtained, notwithstanding the treatment appears to have been rather too officious, especially in regard to four incisions made in the end of the bowel, when one would have removed the constriction spoken of.

At the assault of Cairo, 1799, M. N. was shot in the abdomen with a ball, which divided the muscular parietes of this cavity on the right side, and a portion of the ileum. Larrey, being upon the field of battle, gave him the first assistance. The two ends of the intestine protruded in a separated and inflated state. The upper end was everted in such a way, that its contracted edge, like the prepuce in a case of paraphymosis, strangulated the intestinal tube. The course of the feces was thus obstructed, and the contents of the bowel accumulated above the constriction.

Although the patient's recovery was nearly hopeless, both from the nature of the wound and from the debility and cholera morbus, which had already seized him in the short period that he remained without succour in one of the intrenchments, Larrey was desirous of trying what could be done for so singular a case. He first made four small cuts through the constricted part of the intestine, with a pair of curved scissors, and put the bowel into its ordinary state. He passed a ligature through the piece of the mesentery, corresponding to the two extremities of the bowel. These he reduced as far as the margin of the opening, which he had taken care to dilate; and the dressings having been applied, he awaited events. The first days were attended with alarming symptoms, which, however, afterward subsided. Those which depended upon the loss of the alimentary matter, successively abated; and after two months, the ends of the ileum were opposite each other, and disposed to become connected together. Larrey seconded the efforts of nature, and dressed the patient with a tampon or sort of tent, that was occasionally employed, for two months. The patient was then discharged from the hospital quite cured.

In several instances, says Larrey, the sigmoid flexure of the colon was injured, and yet the wounds were cured without any fecal fistulæ. At the siege of Acre, three examples occurred; and at that of Cairo two. Larrey dilated the entrance and exit of the ball. Clysters, made of the decoction of linseed, and emollient beverages, were frequently exhibited; and the patients were kept on low diet, and in the most quiet state.

Sword-wounds, and those made with the bayonet or lance, may injure some part of the bladder, or even pass through both sides of this organ. In the latter case, the injury is usually fatal, as the urine escapes from the inner wound into the abdomen, and immediately excites mortal inflammation. Baron Larrey dressed on the field of battle several soldiers, whose bladders were thus completely transfixed, and who all perished of inflammation and gangrene, within the first forty-eight hours. However, he observes, that if the weapon enter the bladder at that part of its fundus which is not covered by the peritoneum, the case is curable, unless complicated with too much internal hemorrhage.

The surest criterion of these cases is the escape of the urine from the external wound; and its discharge may either be momentary, occasional, or continual; differences to be accounted for by the situation of the wound, and the changes which happen in the bladder. When the bladder is full, and its upper part is pierced, the urine will issue only just at the moment of the accident, and as soon as it is discharged, the edges of the wound will come together, and permanently close, especially if the urine can pass freely through the natural channel. But when this favourable condition is absent, the bladder becomes enormously distended again, the wound is opened anew, and the urine discharged once more from the external opening. The same things might happen, if one were to withdraw too soon the

elastic gum catheter, which has been introduced: and by introducing the instrument again, the urine might be diverted from the wound, and its natural course re-established. Lastly, Larrey observes, that when the wound is situated at one of the lowest points of the bladder, the discharge of urine may be incessant, and be of more or less duration.

When the track of these punctured wounds is extensive, and not direct, abscesses form at different points where the urine passes. These abscesses Larrey directs to be immediately opened, and their recurrence prevented by the introduction of an elastic gum catheter through the urethra; one of the chief means of relief in all wounds of the bladder. Together with this treatment, he recommends the warm bath, the application of camphorated oily liniments to the belly, antispasmodic cooling medicines, frequent clysters, and sometimes cupping in the vicinity of the wound, or bleeding.—(See *Mém. de Chir. Mil. t.* 4, *p.* 286, 287.) On the last two means of relief, it would have been better if Larrey had laid more stress; for, next to the catheter, they are unquestionably the most essential.

Baron Larrey informs us, that the gun-shot wounds of the bladder which occurred in Egypt had for the most part a favourable termination. The most remarkable case was that of F. Chaumette, a light-horseman, who was wounded at the battle of Tabor. The ball passed across the hypogastrium, about one finger-breadth above the pubes, to the point of the left buttock, which corresponds to the ischiatic notch. The direction of the wound, and the issue of feces and urine from the two orifices, left no doubt that the bladder and rectum were injured. M. Milioz, who directed the surgical affairs of the division of the army under Kleber, diligently pursued the same kind of treatment which he had seen Larrey adopt at the siege of Acre. During the suppurative stage, the patient was affected with fever; and after the sloughs were detached, the discharge was very copious. A catheter that was passed into the bladder prevented an extravasation of the urine, and at the same time promoted the union of the wound of that viscus. This was healed the first, and the patient upon his return to Cairo was quite cured.

Larrey has recorded several other interesting cases of wounds, either of the bladder alone, or of it and the rectum together, to which I must content myself with referring.—(See *Mém. de Chir. Militaire, t.* 2, *p.* 160. 165; *t.* 3, *p.* 340, *&c.*; *t.* 4, *p.* 296, *&c.*)

A ball may go through both sides of the bladder, and then either perforate the neighbouring parts and escape externally, or bury itself deeply in the flesh. When it has gone quite through the bladder, and afterward passed out of the body again, urine blended with blood immediately issues from one or both apertures, according to their situation. The flow of urine through the urethra is either lessened, or completely suppressed; but through this passage the patient generally voids more or less blood. Acute and incessant pain is felt in the course of the wound, together with a frequent painful desire to make water, nausea, sometimes actual vomiting, and extreme anxiety and restlessness. Either in its passage inwards, or its course outwards, the ball may have injured or perforated the rectum; in which case, the urine passes into this bowel, and, mixing with the feces, is discharged from the anus.

When a part of the bladder towards the cavity of the abdomen is injured, as, for instance, its posterior surface, which is covered by the peritoneum, the urine is generally extravasated within the belly, and inflammation of the preceding membrane is the immediate consequence. This inflammation spreads with rapidity, and attacks all the viscera, producing vast distention of the abdomen, fever, coma, and other bad symptoms, soon terminating in gangrene and death.—(*Larrey, Mém. de Chir. Mil. t*, 4, *p.* 292, 293.)

During the first four-and-twenty hours, very little urine escapes from gun-shot wounds of the bladder, in consequence of the swelling, which almost instantly affects the lips of the wound. When the bladder is full, this fluid is discharged only at the moment of the accident, and mostly only from the wound, by which the ball has made its exit. An extravasation is prevented by the thick slough which fills all the track of the injury, and it is not till the deadened parts become loose, that any effusion can happen. Hence, it is of the highest importance to introduce an elastic gum catheter into the urethra, where it should be kept, and the instrument should be large enough to fill exactly this canal; for, according to Baron Larrey's observations, if, at the period when the sloughs are detached, the urine has not a ready passage outwards, it passes through the wound, and is extravasated the more readily, inasmuch as the separation of the sloughs has occasioned many openings, by which the fluid may insinuate itself into the cellular membrane. Hence gangrenous mischief and death.

On two points, my own experience would not lead me to join in the sentiments of Larrey: first, in opposition to his statement, I am sure that there is risk of extravasation of urine earlier than the period which he specifies, having known this accident commence, as it were, within a few hours after the receipt of the wound; and, therefore, I should not depend upon the sloughs being always at first a complete barrier to extravasation of urine (indeed, their formation throughout the whole track of a gun-shot wound is by no means a regular occurrence), but invariably pass a catheter as soon as possible, for the more certain prevention of this dangerous consequence. Secondly, the period of the separation of sloughs may, indeed, often be contemporary with the first appearance or symptoms of extravasation, particularly in cases where the employment of the catheter is for some time deferred, as in Baron Larrey's practice, because then a partial extravasation of the urine, soon after the injury, and previous to the introduction of the catheter, will cause rapid sloughing, and actually prevent the adhesive inflammation from closing up the cavities of the cellular membrane in time to prevent a fatal extension of that irritating fluid among the surrounding parts. Were it not for the partial early effusion of urine, no doubt, the adhesive inflammation would, in these cases, soon have the same effect, in obviating the danger of urinary extravasation, which it has after lithotomy, or paracentesis of the bladder.—(See *Bladder.*)

It is the practice of Baron Larrey to dilate the wounds, in order to facilitate the escape of the urine, which might otherwise lodge in the track of the ball; and perhaps here the method may frequently be right, though I should conceive its propriety must usually depend upon whether the urine has a tendency to continue to flow out through the wounds or not, and upon the presence of obstruction or not. And in confirmation of this opinion, I may cite Dr. Hennen's declaration, that in these cases, he has very rarely found it necessary to enlarge the wound when the catheter and proper dressings have been employed.—(*On Military Surgery, p.* 421, *ed.* 2.) And as soon as possible a large elastic gum catheter should be introduced, and left in the urethra, taking care to withdraw it, and pass in a clean one every two or three days, so that no incrustations may occur. Sometimes, however, the passage of a catheter is very difficult, as is the case when there are splinters of bone in the urethra, or the parts about the neck of the bladder are inflamed.—(*Mém. de Chir. Militaire, t.* 4, *p.* 294.) Emollient clysters and acidulated demulcent drinks are to be prescribed, and the patient is to be kept upon a very low regimen, and in the most quiet state. The dressings are to be light and simple, and cleanliness observed.—(*Op. cit. t.* 2, *p.* 165—170.) Instead of camphorated embrocations to the abdomen, another means commended by Larrey, it appears to me, that this author's directions would have been more complete and judicious, had he advised in these cases bleeding, both topical and general.

From the injury of arterial ramifications, or varicose vessels, blood is sometimes extravasated within the wounded bladder, and causes deep-seated irritation. According to Baron Larrey, the case is indicated by the symptoms of retention of urine, and those of inflammation, with a small pulse, pallor of the countenance, and dryness of the wounds.—(*T.* 4, *p.* 295.) A more decided criterion, I should think, would be the partial escape of urine mixed with blood, a symptom which could deceive only where the urethra itself had been injured. Larrey states, that blood extravasated in the bladder rarely coagulates, because blended with urine; and hence, he advises its discharge to be facilitated by means of a catheter, and tepid, emollient, anodyne injections.—(*T.* 4, *p.* 295.)

Sometimes balls carry before them into the bladder fragments of bone, small coins, pieces of buttons, &c.; or bits of bullets break off, and lodge in that viscus. When these extraneous bodies are not above a certain size, they are frequently voided through the urethra (see *Cases in Dr. Hennen's work, p.* 419. 422. 424, *&c. ed.* 2); and their evacuation may be materially facili-

tated by the introduction of an elastic gum catheter, the size of which is to be increased gradually, until the largest can be passed, when the foreign substances will readily enter the tube, or pass out through the dilated urethra. In this way Baron Larrey has saved gravel patients from a vast deal of suffering.—(*Mém. de Chir. Mil. t.* 4, *p.* 302.) In such cases, the urethral forceps made by Mr. Weiss might often be used with advantage.—(See *Lithotomy.*) When the ball is too large to be taken out in this manner, the lateral operation is to be performed, and it ought to be done before the bladder falls into an ulcerated or gangrenous state, from the pressure and irritation of the foreign body. However, as wounds of this organ frequently give rise to dangerous inflammation, Larrey recommends this operation to be done either before its attack or not till after its subsidence.—(*Vol. cit. p.* 309.) In fact, almost all the operations of this kind on record have been done some considerable time after the receipt of the wound, and to this practice my own judgment would lead me to give a general preference. In one case, however, Larrey operated on the fourth day after the receipt of the wound, and with success.

After the battle of Waterloo, I was not a little surprised to find, in the St. Elizabeth Hospital at Brussels, a considerable number of cases, in which either the intestines, the stomach, the omentum, or the bladder protruded. I think we had in the division under Mr. Collier and myself not less than three protrusions of the bladder. An order which I received to join the army in the field on the 27th of June, deprived me of the opportunity of witnessing the progress and termination of these interesting cases. However, many had ended fatally before my departure from Brussels.

GUN-SHOT WOUNDS OF THE THORAX.

Wounds of the lungs, abstracted from other mischief, are now well known not to be always fatal. Balls have been found in the substance of the lungs after having lodged there twenty years, during all which time the patients were healthy, and free from symptoms indicative of the case.—(*Percy, Manuel, &c. p.* 25.) Mr. Hunter had some reason to believe, that wounds of the lungs made with balls were generally less dangerous than such as were made with sharp-pointed instruments; for he had seen several patients recover after they had been shot through the lungs, while other persons died of very small wounds of those organs, done with swords and bayonets. Perhaps one cause of this fact may be owing to the circumstance of gun-shot wounds generally bleeding less than other wounds, so that there is not so much danger of blood being effused in the cavity of the chest or the cells of the lungs. The indisposition of the orifice of a gun-shot wound to heal up too soon, is also another circumstance that must lessen the hazard, as whatever matter happens to be extravasated has thereby an opportunity of escaping.

But from what has been stated, it must not be inferred that gun-shot wounds of the lungs are not accompanied with a serious degree of danger. Frequently the patient expires instantly, being suffocated in consequence of profuse hemorrhage from those organs; for though it be true that gun-shot wounds generally do not bleed much when the injured vessels are under a certain size, yet the contrary is the case when the wounded vessels are like those situated towards the root of the lungs. Gun-shot wounds of the chest also often prove fatal by the inflammation that is excited within this cavity.

Appearances sometimes create a belief, that a ball has passed completely through the chest and lungs, when the fact is otherwise. "Thus (as Dr. Hennen observes), I have traced a ball by dissection, passing into the cavity of the thorax, making the circuit of the lungs, penetrating nearly opposite the point of entrance, and giving the appearance of the man having been shot fairly across, while bloody sputa seemed to prove the fact, and in reality rendered the same measures, to a certain extent, as necessary as if the case had been what was suspected. The bloody sputa, however, were only secondary, and neither so active and alarming as those which pour out at once from the lungs when wounded."—(*Military Surgery, p.* 368, *ed.* 2.) A second cause of deception is the frequent long course of a ball, round the chest under the skin and muscles, previously to its exit, whereby an appearance is presented, as if the patient had been shot through the thorax. And another source of deception, as to the actual penetration of balls, is, "where they strike against a handkerchief, linen, cloth, &c., and are drawn out unperceived in their folds, a peculiarity which has not escaped M. Larrey, who gives an interesting notice on it in the *Bulletins de la Faculté de Méd. Paris*, 1815, *No.* 2. I have also given an instance in the preceding pages."—(*Hennen, loco cit.*) In these cases, the absence of bloody expectoration directly after the injury, the undisturbed state of respiration, and the greater freedom from oppression, anxiety, syncope, and other bad symptoms, than in cases where the lungs are hurt, form grounds for a correct opinion on the true nature of the accident.

It cannot be supposed that adhesions always take place round the opening of a gun-shot wound in the chest, because the lungs must sometimes collapse, and become considerably distant from the pleura, especially when the communication established between the atmospheric air and the cavity of the thorax is very free and direct. However, as adhesions are extremely common between the outer surface of the lungs, and the inner surface of the pleura costalis, they must in many instances exist before the receipt of a wound, and, of course, prevent the usual collapse of the lungs.

As the general symptoms and treatment of wounds of the chest are detailed in the article *Wounds*, I shall not here detain the reader long upon the subject. When a patient has been shot in the chest, the most important indication is to prevent and subdue inflammation of the lungs and pleura. In few other cases can repeated and large bleedings be so advantageously practised. Here there will not be so much danger of an extravasation of blood as in stabs; and even if an effusion of that fluid were to happen within the cavity of the pleura, the opening would generally be sufficient for its escape, and it would not be so frequently found necessary to dilate the wound, or make a new opening, as when the injury has been inflicted with a sharp-pointed weapon.

In this last kind of case, when attended in the beginning with bleeding, Baron Larrey particularly insists upon the advantage of immediately bringing the edges of the wound together with adhesive plaster, instead of leaving it open, as advised by the generality of writers; and he endeavours to prove, that this immediate closure of the wound has great effect in stopping the hemorrhage from the pulmonary vessels. Supposing an extravasation of blood in the chest were to follow, he argues that it would be better to let it out afterward by a suitable incision, than to suffer the patient to perish of hemorrhage at once by not closing the wound.—(*Mém. de Chir. Mil. t.* 4, *p.* 151, &c.) Dr. Hennen is in favour of the same practice.—(*On Military Surgery, p.* 373, *ed.* 2.) In a penetrating gun-shot wound of the chest, after taking away from thirty to forty ounces of blood, the surgeon should extract all extraneous substances and splinters of bone within reach, and even dilate the external wound for this purpose, if necessary. Light, unirritating dressings are then to be applied. The patient may now be (comparatively speaking) easy, until the spitting of blood, and danger of suffocation from inward hemorrhage come on again, when the lancet must be again employed; "and if by this management, repeated as often as circumstances demand, the patient survives the first twelve hours, hopes may begin to be entertained of his recovering from the immediate effects of hemorrhage;" and until this danger is over, as Dr. Hennen truly observes, the lancet is the only thing which can save life. Afterward, when the paroxysms of pain, the sense of suffocation, and the return of hemorrhage have become more moderate, digitalis may be prescribed with the most beneficial effect; and if the cough be very troublesome, no medicine is more useful than the spermaceti mixture with opium. With this treatment must be combined the exhibition of saline purgatives, mild laxative clysters, and a strictly low diet, the patient being allowed only slops.—(See *Hennen's Military Surgery, p.* 373, *ed.* 2.)

When matter forms in the thorax, in consequence of gun-shot wounds, the opening will generally suffice for its escape; but should the collection of pus be confined, and occasion dangerous symptoms, the external wound must either be enlarged, or a new incision practised, as circumstances may indicate. The mode of making an opening into the chest is considered in the article *Paracentesis.*

When a ball lodges, without falling into the chest, it may lie either in the substance of the parietes of this cavity between the muscles, or in one of the intercostal spaces, and continue there a very long time without causing much inconvenience, or making its way outwards. But when it is lodged in the thoracic cavity itself, it descends by its weight, and sometimes excites considerable irritation, suppuration, sinuses, and hectic symptoms; in this case, if its situation can be ascertained, Baron Larrey recommends an attempt to extract it. In an early stage of the case, he says that the intercostal space will often be wide enough to let the ball pass through it; but that, at a later period, this space becomes too narrow, and it will be necessary to cut away a portion of the upper edge of the rib with a lenticular knife, which is to be preferred to a trephine or saw. This advice is supported by some very interesting cases.—(See *Mém. de Chir. Mil. t.* 4, *p.* 253.) Frequently the ball fractures the rib, and, with the aid of dilatation, sufficient room for its extraction may be made: but the possibility and propriety of removing it through the original opening will, of course, depend upon the situation of the foreign body, and the urgency of the symptoms. A case is recorded in which a ball, weighing three ounces and a half, was thus removed.—(*Med. and Surg. Journ. vol.* 3, *p.* 353.)

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London*, 1781. *Observations sur les Plaies d'Armes à feu, compliquées de Fracture aux Articulations des Extremités, ou au Voisinage de ces Articulations, par M. Boucher, in Mém. de l'Acad. de Chirurgie, t.* 5, *p.* 279, *édit. in* 12*mo. Observations sur des Plaies d'Armes à feu, compliquées sur tout de Fracas des Os, par M. Boucher, in opere cit. t.* 6, *p.* 109, *&c. édit. in* 12*mo. Observations sur les Plaies d'Armes à feu: 1. Sur un Coup de Fusil, avec Fracas des deux Machoires; par M. Cannac: 2. Sur une Plaie d'Arme à feu traversant la Poitrine d'un côté à l'autre; par M. Gerard: 3. Sur une Plaie d'Arme à feu, pénétrante depuis la Partie antérieure du Pubis jusqu'à l'Os Sacrum; par M. Andouillé: 4. Sur une Jambe écrasée par un Obus, ou petite Bombe; par M. Cannac: 5. Sur une Plaie à la Partie inférieure et interne de la Jambe, faite par un Eclat de Granade, sans Fracas d'Os; par M. Cannac: 6. Précis de plusieurs Observations sur les Plaies d'Armes à feu en différentes Parties, par M. Bordenave: —all these papers are inserted in Mém. de l'Acad. de Chirurgie, t.* 6, *in* 12*mo.; and in t.* 11 *of the same edition are inserted Mémoires sur le Traitement des Plaies d'Armes à feu, par M. de la Martinière, et Mémoires sur quelques Particularités concernant les Plaies faites par Armes à feu, par M. Vacher. M. Faure's memoirs relative to amputation in cases of gun-shot wounds may be seen in t.* 8 *of the Recueil des Pièces qui ont concouru pour le Prix de l'Acad. de Chirurgie, édit. in* 12*mo. John Hunter's Treatise on the Blood, Inflammation, and Gun-shot Wounds*, 1794. *Richter, Anfangsgründe der Wundarzneykunst, b.* 1. *Schmucker, Vermischte Chir. Schriften*, 3 *vols.* 8*vo. Berlin*, 1776. 1782. *Chirurgische Wahrnehmungen, Berlin*, 2 *vols.* 8*vo.* 1744. 1789: *works of high value. 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Hutchison's Practical Observations in Surgery*, 1816; *and Farther Obs. on the Period for amputating in Gun-shot Wounds, Lond.* 1817. *Millingen's Manuel*, 8*vo. Lond.* 1819. *J. Hennen's Principles of Military Surgery*, 2*d edit.* 8*vo. Edinb.* 1820; *a publication which I cannot too strongly recommend, not only to army and navy surgeons, but to practitioners in general. James Mann, Med. Sketches of the Campaigns of* 1812, 13, 14; *to which are added Surgical Cases, Obs. on Military Hospitals and Flying Hospitals attached to a moving Army, &c.* 8*vo. Dedham*, 1816.

GUTTA SERENA. A term said to have been first applied by Actuarius to amaurosis, or the species of blindness arising from a morbid state of the retina or optic nerve.—(See *Amaurosis.*)

In the present place I mean first briefly to advert to a case which the late Mr. Ware has described as combined with a particular kind of ophthalmy, that occasions excruciating pain, and requires peculiar treatment. One example of this kind was greatly relieved by a puncture made through the tunica sclerotica into the ball of the eye with a grooved needle, somewhat larger than a common-sized couching needle, nearly in the part where this instrument is introduced in the operation of depressing the cataract. Through the groove of the instrument a watery fluid immediately issued, which was not unlike that which Mr. Ware several times found after death effused between the choroid coat and retina in cases of gutta serena. After the pain of the operation had ceased, the patient became quite easy, and the inflammation soon subsided. Mr. Ware afterward performed a similar operation in a considerable number of resembling instances, and in several of them the proceeding was attended with almost immediate good effect.—(See *Ware on the Operation of largely puncturing the Capsule of the Crystalline Humour, &c. and on the Gutta Serena, accompanied with Pain and Inflammation*, 1812.)

Under the head of gutta serena I promised to notice Beer's opinions concerning amaurotic remedies, which he divides into two classes, viz. *general* or *internal* means, and *local* or *external*. Sometimes only the first are requisite; more rarely only the second; but frequently both together.

Among the internal remedies are emetics, which may be useful in two ways, either as real evacuants, or as nauseating means. It was Beer's opinion that for the purpose of exciting actual vomiting they should be exhibited only when the stomach is foul, and no considerable plethora exists; and he deems them improper whenever any great determination of blood to the head and eyes prevails, or any increased velocity of the circulation. Should the surgeon find it necessary to employ emetic medicines, simply as alteratives, he must consider well whether the digestive organs will bear their great and long-continued operation.—(*Lehre von den Augenkr. b.* 2, *p.* 463.) Notwithstanding the favourable accounts given by Schmucker, Richter, and Scarpa of the good effects of emetics in many cases of amaurosis abroad, this treatment has had but little success in England. Mr. Travers even declares that he does not recollect an instance of decided benefit from the emetic practice, although he has fairly tried it. "The cases of gastric disorder, to which it is especially appli-

cable are most benefited by a long-continued course of the blue pill, with gentle saline purgatives and tonic bitters."—(*Synopsis of Diseases of the Eye, p.* 304.) Mr. Lawrence also states in his lectures, that in this country the treatment of amaurosis by emetics is not attended with the success that has resulted from it abroad.

When the bowels are loaded, and there is frequent determination of blood to the head and eyes, and an accelerated circulation, and, particularly, if after these effects the sight is always manifestly worse, brisk purgatives may be prescribed. When, however, constipation has prevailed for a long time, drastic purgatives should not be exhibited before one or two loose motions have been procured with laxative clysters. Gentle aperients are more particularly indicated when the patient does not have a stool daily, and the evacuation is never made with ease nor without considerable straining; when he often passes two or three days without any evacuation at all, circumstances sure to be followed by repeated determination of blood to the head and eyes, and other ill consequences, which, according to Beer, have a very prejudicial effect on amaurosis.

Beer is of opinion that diaphoretics should be employed with great caution, because they are apt to bring on violent determinations of blood and an accelerated state of the circulation; and they can only be employed with judgment and a hope of benefit when there are good grounds for believing that a previous stoppage of the cutaneous functions has had a real share in producing or keeping up the blindness. They are still more strongly indicated when the cessation of those functions is, in some measure, evinced by the dry state of the integuments, wandering pains between the skin and muscles, and considerable melioration of the eyesight after the breaking out of any accidental perspiration.—(*B.* 2, *p.* 465.)

Professor Beer thinks that in amaurosis medicines for promoting the menstrual discharge are too often employed on empirical principles, to the serious detriment of the patient, the cessation of this discharge being mostly regarded as the cause of the amaurosis, while, in reality, it is very seldom really so, both affections being dependent upon one and the same cause. Hence much circumspection and the closest investigation are necessary to trace the connexion between these morbid effects, and to ascertain when such medicines can be given without risk.

Still greater mischief results from the treatment of amaurotic children with anthelmintics; nay, Beer assures us, that he has seen numerous amaurotic boys and girls thus wrongly treated, who had not the slightest symptoms of worms. However, when amaurosis is unattended with any leading indications, anthelmintics may be tried, for they are less injurious to the eyes than many other medicines, though, as they consist of drastic purgative means, they must soon occasion great debility.

According to Beer, when there is good ground for suspecting the patient to be suffering from the effects of syphilis, mercurials may be given with great prospect of benefit. Also, when no suspicion of this kind can be entertained, but amaurosis is accompanied with infarction of the abdominal viscera, especially chronic disease of the liver, or serious chronic swellings and indurations of the glands, a periodical headache of no determinate character in other respects, and aggravation of the blindness after every such attack, mercurial preparations, as Beer can assert from manifold observation, are productive of the best effects upon the disease of the eyes. Yet, says he, under these circumstances mercury should never be exhibited where the individuals are of a debilitated scorbutic diathesis or subject to bleedings, and more particularly where there is the least mark of a dissolution of the vitreous humour.—(*Lehre von den Augenkr. b.* 2, *p.* 466.) Upon the whole, from what I am able to learn of the practice in London, mercury, preceded by antiphlogistic remedies, is more extensively and successfully used as a remedy for amaurosis than any other medicine in the whole pharmacopœia. "When the amaurosis is recent and sudden (says Mr. Travers), and either the signs of an obscure inflammation are present, or only the amplitude and inactivity of the pupil correspond to the patient's history—mercury should be introduced with all convenient rapidity into the system, I mean, so as to ruffle it in the least possible degree. No advantage is obtained by salivation; on the contrary, I think it hurtful: when mercury is beneficial, its efficacy is perceived as soon as the mouth is sore."—(*Synopsis of the Diseases of the Eye, p.* 305.)

Antinervous medicines have at all times ranked very high on empirical principles, as means for the cure of amaurosis; but how often is this disease not simply a nervous affection? Beer divides the medicines of this sort, employed in cases of amaurosis, into three classes, namely, *antiparalytic*, *antispasmodic*, and *tonic*. To the *first class* belong arnica, naphtha, camphor, millepedes, sulphur auratum, antimonii, liquor ammoniæ lavendulatus, pulsatilla, black hellebore, and phosphorus. These medicines can be safely given to amaurotic patients when an evident general nervous debility and morbid irritability prevail, without any other particular appearances of disease, and especially when, at the same time, there are genuine paralytic appearances in the eye itself, or in the parts immediately surrounding it, or not very far from it. Among the *antispasmodic* remedies, particularly when used on empirical principles, Beer has found the most efficacious to be valerian, liquor ammoniæ carbonatis, asafœtida, opium, hyosciamus, castoreum, musk, flores zinci, and extract of chamomile. *Tonic* nervous remedies (says Beer) are to be used with more caution; for bitter medicines, when injudiciously prescribed for nervous, debilitated individuals, rather promote the formation of amaurosis. When calamus aromaticus is in question, care must be taken that there be no tendency to pectoral complaints, which this medicine is too apt to bring on in weak subjects, in which event the sight is always very much impaired by it. In costive habits, bark is likewise apt to render the blindness worse. And according to the same experienced oculist, it is necessary to be very circumspect with steel medicines, empirically prescribed, as they frequently occasion determinations of blood to the head and eyes, and quicken the circulation, whereby every remnant of vision may be abolished. Steel medicines do the greatest and quickest injury to amaurotic eyes, when combined with narcotics. Above all things, it is generally prudent, in cases of amaurosis, carefully to abstain from all the stronger and long-operating nervous medicines, whenever plethora, determinations of blood, and tendency to inflammation exist.—(*Lehre von den Augenkr. b.* 2, *p.* 467.) In this country, I do not believe that antinervous and antispasmodic medicines have obtained credit for their efficacy in this disease. Thus, Mr. Travers states, that he has never known any real benefit derived from camphor, asafœtida, valerian, &c., though he has seen much good derived from tonics, the mineral acids, bark, steel, and arsenic, after a due regulation of the digestive functions.—(*Synopsis, &c. p.* 304.) In arnica montana, aconite, euphrasia, and stimulants in general, he has no confidence.

Local or *external* medicines for amaurosis are divided by Beer into two classes, namely, into those which are applied to parts more or less distant from the eyes, and having some sympathetic connexion with these organs, and into others which are usually put upon the eye itself.

In the first class, bleeding has obtained high repute, either by venesection in the common way, the application of leeches to the pudenda, the arms, behind the ears, or upon the temple; cupping the back, or by opening the temporal artery or jugular vein. Bleeding is indicated when manifest plethora, a determination of blood to the head and eyes, or an accelerated circulation is combined with a considerable decrease of vision; when the menses are nearly or quite suppressed in plethoric subjects, a manifest determination of blood to the parts of generation prevails; or the same thing occurs in hemorrhoidal patients.—(*Beer, Lehre, &c. p.* 469.)

According to Mr. Travers, all the cases of direct debility and proper paralysis of the optic nerve are aggravated by loss of blood.—(*Synopsis, &c. p.* 303.)

Professor Beer gives his testimony also in favour of the efficacy of such applications as produce a counter-irritation, not merely as rubefacients, but as means occasioning an evacuation of lymph; such are blisters, sinapisms laid on the back or calves of the legs, vesication by means of the bark of mezereon, issues, and setons. These means are proper when the blindness is attended with continual but wandering pains in the aponeurotic covering of the head, or in the vicinity of the eye, with a whizzing noise and irritating pain in the ear, or with the suppression of a purulent discharge from the meatus auditorius In such cases, however, there must be no particular plethora, still less any determination of blood to the head and eyes. Here

should also be mentioned friction with antimonial ointment, which is especially indicated where there is reason to believe that the amaurosis has been preceded, and partly produced, by a long interruption of the cutaneous secretion.

Beer says, that aperient clysters are attended with the most decided good effects in that amaurotic weakness of sight which sometimes occurs towards the end of pregnancy, and is combined with obstinate constipation, continual headache, evident determination of blood to the head and eyes, and such an inflammatory diathesis as cannot be mistaken. On the other hand, the employment of clysters as anodyne remedies, not as evacuants, is principally useful in hypochondriacal and hysterical amaurotic patients, when they are troubled with much general cramp and spasms in the abdomen.—(*Vol. cit. p.* 470.)

According to the statements of the same writer, baths, whether warm or cold, adapted for the whole body or in the form of a slipper-bath, a pediluvium or affusion, have hitherto not proved very efficacious remedies for amaurosis; and this, whether they consist of simple water, or aromatic decoctions, or of waters impregnated with sulphur or iron. The reason why baths in general are less frequently employed as empirical remedies in cases of amaurosis, and why they are still more rarely successful, may be because in the very cases of amaurosis in which baths of various kinds are clearly indicated, the greatest attention must be paid to the patient's constitution, to the state of the skin especially, and to the temperature of the fluid employed; for, in a healthy subject, too warm a bath may, under certain circumstances (as, for instance, when there is plethora), of itself occasion a serious amaurotic amblyopia; and therefore, under similar circumstances, must be likely to increase any present amaurotic weakness of sight into complete blindness. In general, warm or slipper-baths must be employed as empirical remedies in amaurosis only when the regular action of the skin is disturbed, without febrile symptoms, when the affection of the eyes has been preceded by the sudden stoppage of a profuse perspiration, or some cutaneous efflorescence is coexistent with the amaurosis. On the contrary, pediluvia with salt, mustard, &c. are chiefly proper when amaurosis is accompanied with a determination of blood to the head and eyes, or any local inflammations, after which the eyesight is always found to be worse. In cases of amaurosis, affusion can be seldom used empirically, and only under those circumstances where modern experience has proved the shower-bath to be allowable. Cold bathing generally agrees badly with an amaurotic patient, and when his skin is extremely sensible, when wandering pains are felt between the integuments and muscles, or there is a tendency to erysipelatous inflammation, the power of vision evidently declines after every trial of the plan. But, according to Beer, mineral waters impregnated with iron, in the form either of a bath for one half or for the whole of the body, generally produce, under these circumstances, the most favourable effects upon the skin, and, through the medium of it, upon the diseased eye. The case, however, is to be excepted where flying rheumatic, and perhaps gouty, pains constantly tease the patient, unaccompanied with fever, and where bathing of the whole body in sulphurous mineral water should be preferred.—(*Lehre von den Augenkr. b.* 2, *p.* 471, 472.)

If we are to believe Beer, the empirical employment of applications which have the effect of increasing the secretion of mucus is very seldom proper, such as irritating gargles, the smoking of tobacco, and sternutatory powders; for these means can only be adopted with any prospect of benefit when amaurosis is accompanied with plethora, a sense of spasm and weight about the frontal sinuses, an incessant, obtuse heaviness at the bridge of the nose, and unusual dryness of the nostril, in an individual who has frequently suffered catarrhal complaints, but some time previously to the origin of the amaurotic symptoms has continued nearly or quite free from colds; and when the patient has no tendency to plethora, determination of blood to the head and eyes, and acceleration of the circulation.—(*Vol. cit. p.* 473.)

The application of sternutative powders to the nostrils is, perhaps, to be regarded as a mode of treatment established on empirical principles, unless we can place confidence in the statement of Schmucker, Richter, and Beer, that an unusual dryness of the mucous membrane of the nose, following tedious and severe catarrhs, may have the effect of inducing amaurosis. The snuff employed by Schmucker is thus composed: ℞. Mercur. viv. 3 i. Sacchar. alb. 3 iij. Lill. alb. rad. valerian ā ā 3 j. Misce.

The late Mr. Ware imputed considerable efficacy to electricity and a mercurial snuff in cases of gutta serena. The snuff was compounded of ten grains of turbith mineral (*hydrargyrus sulphuratus*), well mixed with about a drachm of the pulvis sternutatorius, glycirrhiza, or common sugar. A small pinch of this snuff taken up the nose is found to stimulate it very considerably; sometimes exciting sneezing, but in general producing a very large discharge of mucus.—(See *Chir. Obs. relative to the Eye, vol.* 1.)

Among the remedies which are intended to be applied directly to the eye and its surrounding parts, local bleeding merits the first rank. The extraction of blood by means of leeches, or by cupping the temples, is the only mode in which the practice can here be executed. The method, however, is only proper when manifest turgescence of the vessels of the conjunctiva and sclerotica is combined with a feeling of constant pressure about the eye, a sense of fulness and tension in the ball, and evident plethora, without any local inflammation or increase in the velocity of the circulation.

Experience proves also, says Beer, that the empirical application of rubefacients, or drawing-plasters, to the temples or eyebrows is fraught with not less efficacy when all sensibility in the retina appears to be extinguished, without any defect in the texture of the eye, any varicose dilatation of its blood-vessels, or any particular determination of blood to it. Applications producing an evacuation of lymph, including both blisters and antimonial ointment, may be alternately employed upon the eyelids and temples, when there are grounds for believing that the functions of the skin have already been long suspended by porrigo, or the stoppage of perspiration on the forehead.—(*Beer, Lehre von den Augenkr. b.* 2, *p.* 474.)

As in the rational plan of treatment, the rubbing of fluid, pungent or irritating medicines upon the eyebrows, in certain kinds of amaurotic blindness, is often attended with considerable efficacy; so, in Beer's opinion, it should not be neglected in cases where the surgeon is compelled to have recourse to empirical methods of cure; for instance, where it is observable that generally in the evening, or the shade, the eyesight immediately grows weaker; that on the patient's first awaking in the morning, it is weaker than in the middle of the day; and, what particularly merits notice, while the case is unattended with any sensations of imaginary flashes of light; a very feeble or entirely abolished motion of the iris; not the least vestige of any defect in the structure of the eye; and no symptoms of determination of blood to the head and eyes, or of a general tendency to inflammation. Beer recommends pungent applications to be first tried, such as the spiritus aromaticus, or Cologne water. These may be followed by aqueous substances, naphtha, &c.; then by narcotics, like the tincture of opium; and lastly, by irritating remedies, like the tinctura lyttæ. The tincture of iodine I should also consider an application well deserving of trial. Fluid applications which are applied in the form of vapour to the eye demand greater circumspection, like naphtha, the liquor ammoniæ, &c. These may be best applied by putting a small quantity of them into the hand, over which the eye must be held in such a manner that none of the fluid will come into contact with it. But as soon as the eye begins to be irritated by the vapour, the tears to run, or actual pain is felt, the hand is to be removed, lest too much irritation be produced.—(*Beer, vol. cit. p.* 475.)

Not only in the empirical, but also in every scientific mode of treating amaurosis, says this author, such remedies as are intended to produce a shock upon the nerves and vessels require the utmost caution, because, of all the various classes of remedies, they are the most powerful; and consequently; if misapplied, are likely to convert an amaurotic weakness of sight into complete blindness. This mournful event is most rapidly produced when applications of this description are employed in plethoric subjects affected with partial determinations of blood and local inflammations, a varicose state of the blood-vessels of the eye, defects in the transparent media of that organ, or frequent headache. To this class of remedies belong especially the

shower bath, electricity, galvanism, &c. On the empirical plan, they can only be used with safety or advantage when decided marks of paralysis, either in the amaurotic eye or its appendages, are present.—(*Lehre von den Augenkr. b.* 2, *p.* 477.)

Mr. Ware has observed that the pupil has been generally dilated in the cases benefited by electricity. He notices, however, that there are many instances in which a contraction of the pupil is the only change which takes place in the appearance of the eye. In this sort of case, the impairment of sight is usually preceded by severe pain, and the original cause may be an internal ophthalmy of long continuance. The crystalline is sometimes visibly opaque. Here electricity has been found useful; but Mr. Ware states, that in these instances the sublimate has proved superiorly and more certainly efficacious, and consequently he prefers it to all external applications whatever. He recommends one-fourth of a grain as a quantity proper for a common dose, and says that it agrees best with the stomach when first dissolved, as Van Swieten directs, in half an ounce of brandy, and taken in a basin of sago or gruel. For young patients the dose must be diminished in proportion to their youth. The medicine is to be continued as uninterruptedly as the constitution will allow, for a month, six weeks, or even longer.

Electricity is said to have proved more strikingly useful in cases of amaurosis originating from lightning, than when the disease has arisen from any other cause. Mr. Ware relates a most interesting instance of the success of electricity in a case which came on very suddenly after great pain in the teeth and a swelling of the face had gone off. The disorder came on more suddenly, the temporary blindness was more entire, the eyelids were more affected, and the cure more speedy, than in the instances related by Mr. Hey, in the 5th vol. of the *Med. Obs. and Inq.*—(*Chir. Observ. relative to the Eye, by J. Ware, vol.* 1.) However, the amaurosis produced by lightning may also be sometimes cured in other ways. Mr. Wardrop mentions that he has only seen one case of this kind, and the sight was restored by the repeated application of small blisters over the frontal nerve.—(*Essays on the Morbid Anatomy of the Human Eye, vol.* 2, *p.* 173.)

With the exception of one case related by Valsalva, Scarpa was unacquainted with any instance of amaurosis, arising from a wound of the eyebrow, that was relieved, and he has, therefore, set down this species as incurable. The opinion, however, is not perhaps correct; for the first case related by Mr. Hey arose from this cause, and was cured by giving every night the following dose: ℞. *Calomel. camphor.* ā ā gr. iij. *Conserv. cynosb.* q. s. *probe misceant et f. bolus*, in conjunction with electricity. The lady, however, had been previously bled twice, had taken some nervous medicines, and had had a blister between the shoulders. The patient was first set upon a stool with glass feet, and had sparks drawn from the eyes and parts surrounding the orbits, especially where the superciliary and infra-orbitary branches of the fifth pair of nerves spread themselves. After this operation had been continued half an hour, she was made to receive, for an equal time, slight shocks through the affected parts. In a few days, sight began to return, and in less than three months it was quite restored. In another case, one grain of calomel and two of camphor given every night, and the employment of electricity, effected a cure. The disease had come on gradually, without any previous accident or pains in the head. The patient was a boy nine years old.

There are several other very interesting cases of amaurosis related by Mr. Hey, all of which make electricity appear an efficacious remedy, though it is true, as Scarpa observes, that in most of these instances internal medicines were also given, and bleeding occasionally practised. Mr. Hey attributes the benefit chiefly to the electricity, because, in two of his cases, no medicines were used, yet the progress of the amendment seemed to be as speedy in them as in the rest; and in two instances a degree of sight was obtained by the first application of electricity. At present, I think electricity and galvanism, as means of benefiting amaurosis, are less valued in England than on the continent. Mr. Travers states, that he has had recourse to them in many cases, some of which were of a very favourable description, but he never saw any good produced by them.—(*Synopsis of the Diseases of the Eye, p.* 303.)

How far, however, the statements of Beer, Ware &c., about the efficacy of local applications, can be trusted, is yet a question; for they disagree with reports made by other writers. Thus, with the exception of cupping, issues, setons, and particularly blisters, Mr. Travers declares, that his experience leads him to attach no value to the various forms of external remedies.—(*Synopsis, &c. p.* 30, 8*vo. Lond.* 1820.)

H

HÆMATOCELE. (From αἷμα, blood, and κήλη, a tumour.) A swelling of the scrotum, or spermatic cord, proceeding from, or caused by, blood.

According to Mr. Pott, when the tunica vaginalis has been long or much distended, "it becomes thick and tough; and the vessels (especially those of its inner surface) are sometimes so large as to be very visible, and even varicose. If one of these lies in the way of the instrument wherewith the palliative cure is performed, it is sometimes wounded; in which case the first part of the serum which is discharged is pretty deeply tinged with blood.

Upon the collapsion of the membranes, and of the empty bag, this kind of hemorrhage generally ceases, and nothing more comes of it. But it sometimes happens, either from the toughness of the tunic, or from the varicose state of the vessel, that the wound (especially if made by a lancet) does not immediately unite; but continues to discharge blood into the cavity of the said tunic, thereby producing a new tumour, and a fresh necessity of operation."

This is what Mr. Pott calls the first species of hæmatocele, which evidently proceeds from a wound of a vessel of the vaginal tunic.

"Upon the sudden discharge of the fluid from the bag of an over-stretched hydrocele, and thereby removing all counter-pressure against the sides of the vessels, some of which are become varicose, one of them will sometimes, without having been wounded, burst; hence the last running of water from a hydrocele is often bloody. If the quantity of blood shed from the vessel so burst be small, it is soon absorbed again; and creating no trouble, the thing is not known. But if the quantity be considerable, it, like the preceding, occasions a new tumour, and calls for a repetition of the operation." This Mr. Pott calls the second species, "which, like the first, belongs entirely to the vaginal coat, and has no concern either with the testicle or with the spermatic vessels. In both, the bag, which was full of water, becomes in a short space of time distended with blood; which blood, if not carried off by absorption, must be discharged by opening the containing cyst; but in neither of these can castration (though said to be the only remedy) be ever necessary; the mere division of the sacculus, and the application of dry lint to its inside, will in general, if not always, restrain the hemorrhage, and answer every purpose for which so severe a remedy has been prescribed." With respect to filling the cavity of the tunica vaginalis with lint, I believe few good surgeons of the present day would consider the measure at all necessary or proper. I have seen three or four cases of hæmatocele of the above kind laid open, but never knew the surgeon compelled by the bleeding to cram the tunica vaginalis with lint, to the great irritation and injury of the testicle itself. On the contrary, after taking out the blood, letting the parts collapse, and applying the cold lotio plumbi acetatis for a few hours to the scrotum, by means of linen wet with the application, the surgeon substituted for the lotion an emollient poultice, and had recourse to fomentations, saline purgatives, leeches, and even venesection, according to circumstances.

The next example regarded by Pott and Richter as a form of hæmatocele, is not admitted by Richerand, Jourdan (see *Dict. des Sciences Méd. t.* 20, *p.* 126), and other modern surgeons.

"If," says Mr. Pott, "blood be extravasated within the tunica albuginea, or proper coat of the testicle, in consequence of a great relaxation and (as it were) dissolution of part of the vascular compages of that gland, and the quantity be considerable, it will afford or produce a fluctuation to the hand of an examiner very like to that of a hydrocele of the tunica vaginalis; allowing something for the different density of the different fluids, and the greater depth of the former from the surface.

If this be mistaken for a simple hydrocele, and an opening be made, the discharge will be blood; not fluid or very thin; not like to blood circulating through its proper vessels; but dark and dusky in colour, and nearly of the consistence of thin chocolate (like to what is most frequently found in the imperforate vagina). The quantity discharged will be much smaller than was expected from the size of the tumour; which size will not be considerably diminished. When this small quantity of blood has been so drawn off, the testicle will, upon examination, be found to be much larger than it ought to be, as well as much more loose and flabby: instead of that roundness and resistance arising from a healthy state of the gland, within its firm strong coat, it is soft, and capable of being compressed almost flat, and that generally without any of that pain and uneasiness which always attend the compression of a sound testicle. If the bleeding ceases upon the withdrawing the cannula (supposing a trocar to have been used), and the puncture closes, a fresh accumulation of the same kind of fluid is soon made, and the same degree of tumefaction is produced as before the operation; if the orifice does not close, the hemorrhage continues, and very soon becomes alarming."

In the first two species, "the blood comes from the tunica vaginalis, the testis itself being safe and unconcerned, and the remedy is found by opening the cavity of the said tunic; but in this the hemorrhage comes from the substance of the testicle; from the convolutions of the spermatic artery within the tunica albuginea: the division of the vaginal coat can here do no good; and an incision made into the albuginea can only increase the mischief; the testicle is spoiled, or rendered useless, by that kind of alteration made in it previous to the extravasation; and castration is the only cure which a patient in such circumstances can depend upon."

I confess that no good reason appears for arranging cases of the preceding kind with hæmatocele; for what are they but diseased testicles which have been punctured, either on account of their seeming to contain a fluid, or really having within them cysts filled with a chocolate-coloured or other fluid, as I have seen in hundreds of instances of sarcocele, and whatever blood is discharged is not extravasated in the substance of the testis previously to the puncture, but issues as a necessary consequence of that proceeding: however, of the propriety of the practice advised by Mr. Pott, no doubt can be entertained.

The last species of this disease noticed by Mr. Pott "arises from a bursting of a branch of the spermatic vein, between the groin and scrotum, in what is generally known by the name of the spermatic process. This, which is generally produced by great or sudden exertions of strength, feats of agility, &c., may happen to persons in the best health, whose blood and juices are in the best order, and whose genital parts are free from blemish or disease.

The effusion or extravasation is made into the cellular membrane, which invests and envelopes the spermatic vessels, and has something the appearance of a true hernia. When the case is clear, and the extravasated blood does not give way to discutient applications, the only remedy is to lay the tumour fairly open through its whole length. If the vessel or breach be small, the hemorrhage may be restrained by mere compression with dry lint, or by the use of styptics; but if it be large, and these means do not succeed, the ligature must be made use of."

I cannot conceive, that in any case of a mere rupture of one of the spermatic veins, it can ever be justifiable to tie the whole spermatic cord, and then perform castration; though Mr. Pott advises this plan, in case the bleeding branch cannot be tied singly. Discutient applications, and an occasional purge, will almost always disperse the swelling; and if not, opening it, taking out the blood, applying cold, or, if necessary, filling the cavity with lint, and using compression, would be, according to my humble judgment, the most judicious treatment.

A case precisely of the latter kind is not very common, yet Mr. Pott has not omitted it as one of the forms of hæmatocele: but why he has not taken notice of the most frequent of all the varieties of the disease, I am at a loss to conjecture; I mean the extravasation of blood in the loose cellular membrane of the scrotum from blows on the part, and sometimes from lithotomy, castration, &c., quite unconnected with any rupture of the spermatic veins. These are the cases which are mostly met with in practice. I have seen them followed by suppuration; but in general the effused blood is gradually absorbed, with the aid of discutient applications, leeches, fomentations, poultices, and saline purges. A surgeon should generally be reluctant to lay open the tumour, as, in many instances, sloughing and very severe symptoms have been the result.

Celsus and Paulus Ægineta are the best of the old writers on hæmatocele. For modern information, consult Pott's Chir. Works, vol. 2. *B. Bell, On Hydrocele. Flajani, Collezione d'Osservazioni, &c., t.* 2. *Richter, Anfangsgr. der Wundarzn. b.* 6. *Richerand, Nosographie Chir. t.* 4. *Ossiander, in Arnemann's Magazin für die Wundarzn. b.* 1, *p.* 355; *the patient died after an opening had been made in the swelling. Follet, in Journ. de Méd. continué, vol.* 13, *p.* 422: *a case from contusion, cured by an incision. Harris, in Mem. of Lond. Med. Society, vol.* 5.

HARE-LIP. (*Labia Leporina.*) A fissure or perpendicular division of one or both lips. The term has arisen from the fancied resemblance of the part to the upper lip of a hare. Occasionally the fissure is more or less oblique. In general, it is directly below the septum of the nose; but sometimes it corresponds to one of the nostrils. The two portions of the lip are generally moveable, and not adherent to the alveolary process; in less common cases they are closely attached to the fore part of the jaw.

Children are frequently born with this kind of malformation, which is called a *natural* hare-lip, while that which is produced by a wound is named *accidental*. Sometimes the portions of the lip, which ought to be united, have a considerable interspace between them; while in other instances they are not much apart. The cleft is occasionally double, a little lobe or small portion of the lip being situated between the two fissures.

The fissure commonly affects only the lip itself, and usually the upper one. In many cases, however, it extends along the bones and soft parts forming the palate, even as far as the uvula; and sometimes those bones are entirely wanting. In a few instances, the jaw not only is imperfectly ossified in front, so that a cleft presents itself there, but one side of it projects forwards, and is at the same time inclined too much outwards, drawing with it the corresponding part of the palate, and the septum nasi, so that a very unsightly distortion of the nostril and nose is produced. The case, I believe, has not been described in surgical books.

A hare-lip, in its least degree, occasions considerable deformity; and when more marked, it frequently hinders infants from sucking, and makes it indispensable to nourish them by other means. When the lower lip alone is affected, which is rare as a malformation, the child can neither retain its saliva, nor learn to speak, except with the greatest impediment. The constant escape of the saliva, besides being an annoyance, is found to be detrimental to the health; for its loss impairs the digestive functions, the patient becomes emaciated, and even death would sometimes ensue, if the incessant discharge of so necessary a fluid in the animal economy were not prevented. Thus, a lady, who was in this state, consulted Tronchin, who immediately saw the cause of her indisposition, and recommended the fissure in the lip to be united; the operation was done, and the dyspeptic symptoms then ceased. And when the fissure pervades the palate, the patient not only articulates very imperfectly, but cannot masticate nor swallow, except with great difficulty, on account of the food readily getting up into the nose.

An early removal of the deformity must obviously be

very desirable; but, as it cannot be accomplished without an operation attended with some degree of pain, Dionis, Garengeot, and others advise waiting till the child is four or five years old, on the supposition that, at an earlier age, the child's agitations and cries would render the operation impracticable, or derange all the proceedings taken to ensure its success. It is plain, however, that such reasons are not of great weight. A child, four or five years old, and very often even one eight or ten years of age, is more difficult to manage than an infant only a few months old. Every child of the above age has a thousand times more dread of the pain, than of the deformity or of the inconveniences of the complaint, to which he is habituated; while an infant of tender years fears nothing, and only feels the pain of the moment.

A more rational objection is the liability of infants to convulsions after operations, and this has induced many excellent surgeons to postpone the cure of the hare-lip till the child is about two years old. This custom is also sanctioned by Sir Astley Cooper, who mentions in his lectures several instances, which have either been communicated to him by others, or have occurred in his own practice, where operations for the cure of hare-lips in very young infants have had a fatal termination, in consequence of an attack of convulsions or diarrhœa. The period when dentition is completed, or the age of two years, he therefore sets down as the most advantageous for the operation, and if parents urge its being done earlier, he very properly advises the surgeon to let them be duly apprized of the risk, so that in the event of the child being cut off, he may not incur blame for having operated at a disadvantageous period of life.—(See *Lancet*, *vol.* 3, *p.* 108.) The latter end of 1823, I met Sir Astley Cooper in consultation in a case where this very question occurred. The deformity was particularly unsightly, in consequence of the upper jaw-bone being imperfectly ossified in front, and one side of it forming a considerable projection forwards through the fissure which extended into the nostril, at the same time that the nose was seriously distorted to one side of the face. The parents, persons of the first respectability, were therefore uncommonly solicitous for an early operation, some instances of the success of which in very young infants had already been communicated to them by their friends. The projection of bone, they had also learned, might be cut away, so as to permit the soft parts to meet, which they now would not do. The risk of an operation on the infant in question, then scarcely two months old, was fairly explained to the parents; but I doubt whether they could have been prevailed upon to wait three months longer, had not Sir Astley Cooper represented to them the disadvantages of cutting away the bony projection, and urged the allowance of a little time to reduce the protuberance by means of pressure. As I had not had any previous conference with Sir Astley on the subject, I was particularly gratified in finding his advice agree precisely with what I had already given, when the case was first shown to me. Exactly when the infant was five months old, a period selected on account of its being the latest previously to the usual time of the commencement of the ailments of dentition, I performed the operation in the presence of Messrs. Ives, of Chertsey, and Mr. Ives, jun., of Chobham. By this time the bone had been so effectually depressed, by means of a kind of spring-truss, constructed by Messrs. Salmon and Ody for the purpose, and worn several hours daily, that the soft parts admitted of being brought over it with tolerable facility. Union followed very well, and, though it was one of the worst hare-lips ever seen by Mr. Ives, senior, or myself, without an extensive division of the palate, the disfigurement is now very trivial, and the wrong direction of the nose constantly undergoing farther diminution, in proportion as the jaw recedes under the pressure of the apparatus, which is still employed.

This is the youngest infant on which I have operated; but, in October, 1824, I performed the operation on an infant twelve months old, at Walton on Thames, where I was kindly assisted by Mr. Stillwell, surgeon in that town. Union took place very favourably, without any indisposition whatever. Only one pin was used at the lower part of the lip, as I found that the upper part of the division could be perfectly and readily closed with a strip of adhesive plaster.

Mr. Sharp observes, "there are many lips where the loss of substance is so great, that the edges of the fissure cannot be brought together, or at best where they can but just touch; in which case it need not be advised to forbear the attempt: it is likewise forbid in young children, and with reason, if they suck; but otherwise it may be undertaken with great safety, and even with more probability of success than in others that are older."—(*Operations in Surgery*, *chap.* 34.)

Le Dran performed the operation on children of all ages, even on those at the breast. B. Bell did it with success on an infant only three months old. Muys advises it to be undertaken as soon as the child is six months old. Roonhuysen operated on children ten weeks after their birth, and all his contemporaries have praised his singular dexterity and success. As an essential step to the success of the operation, he recommended hindering the children from sleeping a certain length of time before it was undertaken, in order that they might fall asleep immediately afterward; and with the same view opiates have been prescribed.

Putting out of consideration the partial success which has attended the use of blistering plaster for making the edges of the fissure raw and capable of union, all practitioners entertain the same sentiment with regard to the object of this operation, which consists in reducing the preternatural solution of continuity to the state of a simple wound, by cutting off the edges of the separated parts throughout their length, and then keeping these parts in contact until they have completely grown together. But although such principles have been generally admitted, there was formerly some difference of opinion with respect to the best method to be followed in practice; some operators having preferred sutures for keeping the edges of the wound in contact; while others disapproved of them, believing that a perfect cure might always be accomplished by means of adhesive plaster and a uniting bandage, so as to save the patient from all the pain and annoyance of sutures.

M. Louis thought that the use of sutures in the operation for the hare-lip proceeded from a false idea respecting the nature of the disease; for, the fissure in the lip being wrongly imputed to loss of substance, it was deemed impossible to keep the parts in contact, except by a suture.

"The separation of the edges of the fissure in the lip," says M. Louis, "is only the effect of the retraction of the muscles, and is always proportioned to the extent of the cleft. Persons with hare-lips are capable of bringing the edges of the fissure together by muscular action, by puckering up their mouths. On the other hand, the separation is considerably increased when they laugh, and the breach appears excessively large after superficially paring off its edges on both sides. The interspace in the hare-lip must not, therefore, be mistaken for a loss of substance. This truth is confirmed by the effects of sticking-plaster, which has sometimes been applied to the hare-lip, as a preparatory measure before the operation, and which materially lessens the separation of the parts.

According to the confession of all who have written in favour of the twisted suture, it seems advisable only on the false idea, that the hare-lip is the effect of a greater or less loss of substance: and they say, positively, that we must not have recourse to it when there is only a simple division to be united. The twisted suture must then be proscribed from the operation for the natural hare-lip, since it is proved that this malformation is unattended with loss of substance. At the same time, a loss of substance is but too real, after the extirpation of scirrhous and cancerous tumours, to which the lips are very subject. Yet, even in these cases, the extensibility of the lips allows an attempt to be made to reunite the double incision, by which the tumour has been removed, and it succeeds without the smallest deformity, when care is taken to direct each incision obliquely, so that both of them form, where they meet, an acute angle, in the base of which the tumour is comprised. Here the means of union ought to be the more efficacious, because the difficulty of keeping the edges of the wound approximated is greater. M. Pibrac, in his memoir on the abuse of sutures, when speaking of the hare-lip, has already explained, that they are badly-conceived means, and more hurtful in proportion as there is a greater loss of substance, because the greater the interspace is between the two parts, the more fear is there of their efforts on the

needles or pins left in the wound. Hence, care has always been taken to make the dressings aid the operation of the suture. After this consideration, judiciously made by the partisans of this plan, there was only one more step to be taken, according to M. Pibrac, in order to evince the necessity of proscribing it. The cap or copper headpiece described by Verduc and Nuck, for compressing the cheeks; the clasps of Heister; and strips of adhesive plaster; are all only inventions for the support of the parts, and keeping them from being disunited. When the suture failed, it was by these means that the original deformity was corrected, together with that produced by the laceration, which would not have occurred without the suture. As then, the dressings, when methodically applied, are capable of effectually rectifying the mischief of the suture, M. Louis inquires, why should they be considered only as a resource in a mere accidental case! Why should they not be made the chief and primary means of reuniting the lip, even when there is a loss of substance?

Nothing can be opposed to the proofs adduced upon this point. They are even drawn from the practice of those who have employed sutures without success. Such persons have themselves furnished the proofs of the bandage being capable of repairing the mischief resulting from the twisted suture."

M. Louis, with a view of perfecting our notions on this matter, lays it down as a fact, that the retraction of the muscles being the cause of the separation of the edges of the fissure, it is not to these edges we are to apply the force which is to unite them; but that it should be applied farther to the very parts, whose action (the cause of the separation) is to be impeded, and whose contraction is thus to be prevented. A great many means for supporting the wound, only irritate the muscles and excite them to action, and it is this action which we should endeavour to overcome. The means for promoting union can only be methodical, when directly employed to prevent such action, by an immediate application on the point where it is to be resisted. The facility with which the parts may be brought forwards, so as to bring the two commissures of the lips into contact by the mere pressure of the hands, shows what may be expected from a very simple apparatus, which will execute the same office without any effort, in a firm and permanent manner, and which will render sutures unnecessary, the inconveniences of which are too well known.

M. Louis, after having explained the reasons of the theory on which he founded his method, relates several cases, taken either from his own practice or that of others, to illustrate its advantages. He details the history of twenty cases in which his plan perfectly succeeded, both in accidental hare-lips, with considerable loss of substance, and in natural ones. In most of these instances, however, it was thought proper to assist the bandage with one stitch at the extremity of the fissure, close to the vermilion border of the lip, for the purpose of keeping the parts securely on a level.

Notwithstanding the operation as performed with the twisted suture is opposed by an authority of such weight as that of M. Louis, still it is the method most commonly practised. No modern surgeons doubt that a hare-lip may be cured by means of adhesive plaster and uniting bandages, quite as perfectly as with a suture; and all readily allow, that the first of these methods, as being more simple and less painful, would be preferable to the latter one, if it were equally sure of succeeding. But it is considered far more uncertain in its effect. To accomplish a complete cure, the parts to be united must be maintained in perfect contact, until they have contracted the necessary adhesion; and how can we always depend upon a bandage for keeping them from being displaced! What other means, besides a suture, affords in this respect perfect security?

I shall first describe the operation as usually done by surgeons of the present day with the twisted suture. The first thing is to examine whether there is any adhesion of the lip to the gum; and if there be, to divide it with a knife. Some authors (*Sharp*) recommend the frænulum, which attaches the lip to the gum, always to be divided: but when the hare-lip is at some distance from this part, it will not be in the way of the operation, and need not be cut. On the other hand, when the frænulum is situated in the centre of the division, it is clear that in operating, we must necessarily include it in the incision, and it should therefore be divided beforehand, taking care not to encroach too much upon the gum, lest the alveolary process be laid bare; nor too much upon the lip, because making it thinner would be unfavourable to its union.

When one of the incisor teeth opposite the fissure projects forwards, it must be drawn, lest it distend and irritate the parts after they have been brought into contact.

Sometimes, but particularly in cases in which there is a cleft in the bony part of the palate, a portion of the os maxillare superius forms such a projection just in the situation of the fissure in the lip, that it would render the union very difficult, if not impracticable. In this circumstance, the common plan has been to cut off the projecting angles of bone with a strong pair of bone-nippers. The part was then healed, and the operation for the hare-lip performed. Instead of cutting off the projection of bone, which is always a painful measure, Desault used to employ simple compression, by which means the prominence was usually reduced in a few weeks, and the opportunity afforded of operating for the cure of the hare-lip.—(*Œuvres Chir. par Bichat, t.* 2, *p.* 207.) Of course, the actual necessity of using bone-nippers, or even of having recourse to compression of the bony projection, will depend upon circumstances; for if the prominence of bone be sharp and irregular, no surgeon, I conceive, would hesitate about the removal of such inequalities in preference to the trial of pressure. Mr. Dunn, of Scarborough, has expressed to me his doubts whether cutting off the projections of the alveolary process be ever necessary, as the pressure of the entire lip gradually diminishes the deformity. "I had (says he) two very unseemly cases, with an immense division of the palate, together with a projection of the alveolary process, which, with the incisor teeth, resembled the talons of a bird. A tubercular appendage of skin hung upon the base of the nose. By drawing the teeth in the first case very delicately, I avoided fracturing the bony projection. I then cut off one edge of the nasal appendage, and of the lip on the same side, and attached them together with two needles. The wound was sufficiently united in a week or ten days to allow the same operation on the other side. In less than three weeks the boy was sent home quite well, to the astonishment of the neighbourhood, where his frightful appearance had made him an object of disgust and ridicule. I succeeded in the other case even without the extraction of the teeth. Both the patients can now articulate labial sounds, retain their saliva, and are gradually losing the inconvenience of the passage of the mucus from the nose into the mouth, as the fissure is more contracted, and the projection by no means so disagreeable." These facts should lessen the haste with which certain operators proceed to cut off every projection of the alveolary process; for a moderate prominence of bone without any sharp, irritating edges or angles, will not hinder the success of the operation; and even the propriety of removing teeth must entirely depend upon their being likely, by their direction, to irritate the lip, and disturb the union of the fissure.

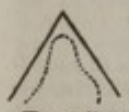
One serious objection to cutting away the projection of the jaw is the deformity afterward likely to continue during life from the deficiency of the incisores teeth; and another is, the subsequent overlapping of the lower jaw, and its projection beyond the upper one; communicating to the mouth an appearance seen in very old subjects. These were the considerations which induced me, in the case above mentioned, to employ pressure, which is much more conveniently applied by means of a kind of spring-truss, adapted to the child's head, than with bandages, which would be seriously annoying, and the right action of which could not be regulated without the utmost difficulty. When also some of the bone must be cut away on account of its roughness and angular prominences, I advise the practitioner to remove only the irritating points, and afterward have recourse to pressure.

In the operation, the grand object is to make as smooth and even a cut as possible, in order that it may more certainly unite by the first intention, and of such a shape that the cicatrix may form only one narrow line. The edges of the fissure should, therefore, never be cut off with scissors, which constantly bruise the fibres which they divide, and a sharp knife is always to be preferred. The best plan is, either to place any flat instrument, such as a piece of horn, wood, or

pasteboard, underneath one portion of the lip, and then holding the part stretched and supported on it, to cut away the whole of the callous edge; or else to hold the part with a pair of forceps, the under blade of which is much broader than the upper one: the first serves to support the lip, the other contributes also to this effect, and, at the same time, serves as a sort of ruler for guiding the knife in an accurately straight line. When the forceps are preferred, the surgeon must of course leave on the side of the upper blade just as much of the edge of the fissure as is to be removed, so that it can be cut off with one sweep of the knife. This is to be done on each side of the cleft, observing the rule, to make the new wound in straight lines, because the sides of it can never be made to correspond without this caution. For instance, if the hare-lip had this shape, the incision of the edges must be continued in straight lines till they meet in the manner here represented.



In short, the two incisions are to be perfectly straight, and are to meet at an angle above, in order that the whole track of the wound may be brought together, and united by the first intention.



Two silver pins, made with steel points, are next to be introduced through the edges of the wound, so as to keep them accurately in contact; the lowest pin being introduced first, near the inferior termination of the wound, and the upper pin afterward, about a quarter of an inch higher up. A piece of thread is then to be repeatedly wound round the ends of the pins, from one side of the division to the other, first transversely, then obliquely, from the right or left end of one pin above, to the opposite end of the lower one, &c. Thus the thread is made to cross as many points of the wound as possible, which greatly contributes to maintaining its edges in even apposition. Any portion of the wound above the pins not closed by the preceding means may now have its edges brought together with a strip of adhesive plaster. Lastly, the ends of the pins are to be supported by small dossils of lint, placed between them and the flesh; a minute but essential circumstance, which, as my friend Mr. Dunn, of Scarborough, reminds me, I forgot to mention in a former edition of this work. It is obvious that a great deal of exactness is requisite in introducing the pins, in order that the edges of the incision may afterward be precisely applied to each other. For this purpose, some surgeons previously place the sides of the wound in the best position, and mark with a pen the points at which the pins should enter and come out again; a method which, as far as my observations extend, merits imitation. The pins ought never to extend more deeply than about two-thirds through the substance of the lip, and it would be a great improvement always to have them of a flat, instead of a round shape, and a little curved, as this is the course which they naturally ought to take when introduced. The steel points should also admit of being easily taken off, whenthe pins have been applied; and, perhaps, having them to screw off and on is the best mode, as removing them in this way is not so likely to be attended with any sudden jerk which might be injurious to the wound, as if they were made to pull off. In general, the pins may be safely removed in about four days, when the support of sticking plaster will be quite sufficient.

After the operation, the surgeon should never omit the use of compresses and a bandage for keeping forward the cheeks, so that the risk of the pins making their way out by ulceration, arising from the dragging of the soft parts on them, may be prevented. With this view, a close, strong nightcap, with a piece of broad tape attached to the back part of it, and with two ends of sufficient and equal length, is to be put on; a compress is then to be laid over one cheek, and fixed by bringing one portion of the tape forwards over it, which is to be fastened to the cap on the opposite side of the head. The other compress is then to be applied, and fixed in a similar manner. Lastly, a bandage is to be put under the chin, and brought over each compress up to the top of the head, where the ends of it are to be fastened to the cap. During all these proceedings, until the compresses are well secured, the assistant must support them steadily with his hands. Lastly, the bandage, compresses, and cap should all be securely stitched together.

The process just described is what is well known by the name of the *twisted suture*, which is applicable to other surgical cases, in which the grand object is to heal some fistula or opening by the first intention. Mr. Sharp says, it is of great service in fistulæ of the urethra, remaining after the operation for the stone, in which case the callous edges may be cut off, and the lips of the wound held together by the above method.

Although the generality of surgeons used the twisted suture, I ought to notice that Sir A. Cooper gives the preference to the common interrupted suture, on account of the difficulty sometimes experienced in withdrawing the pins, and the liability of the new adhesions to be broken on the occasion; whereas the threads of a common suture may be cut and taken out with the greatest facility.—(See *Lancet*, *vol.* 3, *p.* 107.) However, as most children cry on the removal of the suture, whether one kind or the other be employed, the only safe plan is not to withdraw the pins or ligatures till four complete days have elapsed from the time of the operation, when the adhesions will be tolerably strong; and the cheeks should always be held forwards by a skilful assistant during the period of changing the dressings, and until the compresses on the cheeks have been again duly secured with a bandage.

[When pins are used in this operation, they ought to be made of gold, which is not liable to become oxidized. Instead, however, of these pins, which are ordinarily made with steel points, Dr. Barton, of Philadelphia, prefers to use a piece of iron wire, with a point made by simply cutting it with a pair of scissors; thus avoiding the risk of the steel point slipping off the pin, an accident which has often happened, and left the point within the lip.

So many failures have occurred from the pins being torn out by the child, or catching in the nurse's clothes, that if there were no other objection to the use of pins, they ought to be abandoned. Many surgeons in this country (and among these Dr. Mott) have adopted the interrupted suture in cases of hare-lip, and with the most satisfactory results; and it is confidently believed that the twisted suture ought to be abandoned, on account of the obvious objections which attach to every modification of the shape, configuration, and materials of the pins. It will be seen that Sir A. Cooper has laid it aside altogether.—*Reese.*]

What has hitherto been stated refers to the most simple form of the hare-lip, viz. to that which presents only one fissure. When there are two clefts, the cure is accomplished on the same principle, but it is rather more difficult of execution; so that the old surgeons, until the time of Heister, almost all regarded the operation for the double hare-lip as impracticable. Only a few described it, with the direction to operate on each fissure, just as if it were single. M. de la Faye even operated in this way with success.—(*Mém. de l'Acad. de Chir. t.* 4, 4*to.*) M. Louis was of opinion, that all difficulties would be obviated by doing the operation at two different times, and awaiting the perfect cure of one of the fissures before that of the other was undertaken. Heitster had similar ideas, but he never put the scheme in practice, nor did he even positively advise it.

After all, however, experience proves that it is not essential to perform two operations for the cure of the double hare-lip. Desault found that when the edges of the two fissures were pared off, and care taken to let one of the pins pass across the central piece of the lip, the practice answered extremely well.—(See *Œuvres Chir. t.* 2, *p.* 201.)

In cutting off the edges of the fissure, the incision must be carried to the upper part of the lip; and even when the fissure does not reach wholly up the lip, the same thing should be done; for in this manner the sides of the wound will admit of being applied together more uniformly, and the cicatrix will have a better appearance. We should also not be too sparing of the edges, which are to be cut off. Practitioners, says M. Louis, persuaded that the hare-lip was a division with loss of substance, have invariably advised the removal of the *callous* edges. But in the natural hare-lip, there is no callosity; the margins of the fissure are composed, like those of the lip itself, of a pulpy, fresh-coloured, vermilion flesh, covered with an exceedingly delicate cuticle. The whole of the part having this appearance must be taken away, together with a little of the true skin. At the lower part of the fissure, towards the

nearest commissure, a rounded red substance is commonly situated, which it is absolutely necessary to include in the incision. Were this neglected, the union below would be unequal, and, through an injudicious economy, a degree of deformity would remain. The grand object, however, is to make the two incisions diverge at an acute angle, so that the edges may be put into reciprocal contact their whole length, without the least inequality.

M. Louis used to operate as follows: the patient being seated in a good light, his head is to be supported on an assistant's breast, who with the fingers of both hands pushes the cheeks forwards, in order to bring the edges of the fissure near to each other. These are to be laid on a piece of pasteboard, which is to be put between the jaw and lip, and be an inch and a half long, from twelve to fifteen lines broad, and at most one line thick. The upper end should be rounded by flattening the corners. In order to facilitate the incision, the lip is to be stretched over the pasteboard, the operator holding one portion over the right with the thumb and index finger of the left hand, while the assistant does the same thing on the left side. Things being thus disposed, the edges of the hare-lip are to be cut off with two sweeps of the bistoury, in two oblique lines, forming an acute angle above the fissure.

For the removal of the edges of the hare-lip, scissors have sometimes been preferred to a knife; but notwithstanding Desault's partiality to them, as most convenient (see *Œuvres Chir. t.* 2, *p.* 179), they are now very generally disused. The pinching and bruising which result from the action of the two blades are circumstances which cannot be favourable to the union of the wound; and though they may not commonly be serious enough to prevent union by the first intention, they might occasionally tend, with any other untoward occurrence, to hinder this desirable event. Let not practitioners here be led by Mr. B. Bell's statement, that in one instance he cut off one side of the fissure with a knife, and the other with scissors; that the latter cut produced least pain, and that on this side there was no more swelling nor inflammation than on the opposite one.

The pins should be introduced at least two-thirds of the way through the substance of the lip, lest a furrow should remain on the inside of the part, which might prove troublesome by allowing pieces of food to lodge in it. There is, however, a stronger reason for attending to this circumstance, viz. the hemorrhage which may take place when it is neglected. As soon as the edges of the wound have been brought together by means of the suture, and the pins are properly placed, the bleeding almost always ceases; but when the pins have not been introduced deeply enough, and the posterior surfaces of the incisions are not applied to each other, the blood may continue to run into the mouth, and give the surgeon an immense deal of trouble. In the memoir written by Louis, there is a case in which the patient died in consequence of such an accident. Persons who had undergone the operation were always advised to swallow their spittle, even though mixed with blood, in order to avoid disturbing the wound by getting rid of it otherwise. In the case alluded to, the patient, who had been operated upon for a cancerous affection of the lip, swallowed the blood as he had been directed to do, and he bled so profusely that he died. On the examination of the body, the stomach and small intestines were found full of blood. "This deplorable case," says the illustrious author who relates it, "deserves to be recorded for public instruction, for the purpose of keeping alive the attention of surgeons on all occasions, where, in consequence of any operation whatsoever, there is reason to apprehend bleeding in the cavity of the mouth. Platner is the only writer who, as far as I know, foresaw this kind of danger. The bleeding from the edges of the wound stops of itself (says he) as soon as they have been brought into contact and stitched together; but care must be taken that the patient does not swallow the blood, which might make him vomit, or else suffocate him. Hence, his head should be elevated that the blood may escape externally, a precaution more particularly necessary in young children."

Having described the mode of operating for the hare-lip as approved of by the generality of practitioners, and detailed every thing which seemed material, I have now only to explain the method adopted by M. Louis. His sentiments respecting several particular points of the operation have been already stated; and an account of the means which he employed in lieu of the twisted suture, for uniting the edges of the wound, is all that remains to be noticed.

Several bandages for supporting the two portions of the divided lip, and lessening the pressure which they make against the pins, have been mentioned by authors. Franco and Quesnay, in particular, describe two kinds. These means were not only employed as auxiliary, but even sometimes as curative ones, when it was impossible to use needles. To such bandages, too complicated and too uncertain in their effect, M. Louis prefers a simple linen roller, one inch wide, three ells long, and rolled up into two unequal heads. He begins with applying the body of this bandage to the middle of the forehead; he unrolls the two heads from before backwards, above the ears, between the upper part of the cartilage and the cranium, in order to let them cross on the nape of the neck, and then pass forwards again. The assistant who supports the head, and pushes forwards the cheeks, must lift up the ends of his fingers, in the place of which, on each side, a thick compress is to be put. This being covered, and pushed from behind forwards by the roller, will constantly perform the office of the assistant's fingers, who is to continue to support the apparatus, until it is all completely applied. The longest of the two heads of the roller being slit in two places near the lip, presents two parallel openings; the remnant of the shortest one is divided into two parts, as far as its end. The two little narrow bands in which it terminates must then pass through the openings of the former, and cross upon the middle of the lip. The ends of the roller being carried from before backwards, are then to be made to cross again on the nape of the neck, where the shortest is to end. The remainder of the long one is to be employed in making turns round the head. This bandage may be still more securely fixed by means of a piece of tape, which is to pass the forehead over the sagittal suture, and be pinned at each end to the circumvolutions of the roller; while a second piece of tape is to cross the first one at the top of the head, and also to be attached at its extremities to the uniting bandage, and the compresses placed under the zygomatic arches, for the purpose of pushing forwards the cheeks.

This bandage is extremely simple, and would answer well as an auxiliary to the twisted suture. I think this last means will always be the favourite of the practical surgeon, because the desired effect can be produced by it with much less trouble than must be taken with the bandage, in order to render the operation of the latter sufficiently certain. Besides, as I have noticed, M. Louis himself mostly made one stitch near the red part of the lip, so that he cannot be said to have trusted altogether to the bandage.

What has been said concerning the operation for the hare-lip, is equally applicable, not only to the treatment of cancer of the lip, but also to that of accidental cuts or lacerations of this part, from any cause whatsoever. We shall only remark, that in a recent wound, all the surgeon has to do, is to apply the twisted suture and adhesive plaster without delay.

When there is a fissure in the bones forming the roof of the mouth, it usually diminishes, and gradually closes, after the hare-lip is cured. But this does not always happen, and when the parts remain so considerably separated as to obstruct speech and deglutition, or cause any other inconvenience, a plate of gold or silver, exactly adapted to the arch of the palate, and steadied by means of a piece of sponge fixed to its convex side and introduced into the cleft, may sometimes be usefully employed. When the sponge is of suitable size and very dry before being used, the moisture of the adjacent parts will make it swell, and in many cases be sufficient to keep it in its situation, so as greatly to facilitate speaking and swallowing. Sometimes, however, the fissure is so shaped that the sponge cannot be fixed in it: this principally happens when the opening widens very much towards the front of the jaw. In such cases, it has been proposed to fix a plate of gold by means of springs covered with the same metal. Platina, which is cheaper, might be used for the same purpose. The subject, however, of artificial palates is one on which much mechanical ingenuity may yet be usefully exerted, and it can hardly be expected that I should here do more than give refer-

ences to works in which the reader may find information upon it.—(See *Fauchard, Le Chirurgien-Dentiste, 2 tom. 12mo. Paris, 1728. Camper, Vermischte Schriften, No. 13. Loder's Journ. b. 2, p. 25, p. 185, &c. Von Steveling über eine merkwürdige kunstliche Ersetzung mehrerer, sowohl zur Sprache, als zum Schlucken nothwendiger, zerstörter Werkzeuge; 8vo. Heidelb. 1793. Siebold, Chir. Tagebuch, No. 20. J. H. F. Autenrieth, Supplementa ad Hist. Embryonis Humani, quibus accedunt Observata quædam circa Palatum fissum, verosimillimamque illi medendi Methodum, 4to. Tubing. 1797. Cullerion, in Journ. Gén. &c. t. 19. Recueil Périod. &c. t. 11, p. 22. Dict. des Sciences Méd. t. 37, art. Obturateur. C. Graefe et Ph. von Walther, Journ. der Chir. b. 1, p. 1, 8vo. Berlin, 1820; in this work Graefe has described a method of curing fissures in the soft palate by means of a particular kind of suture, with the various instruments necessary in the operation.*)

[The operation of staphyloraphy, or palate suture was first performed in 1816, by Professor Graefe, of Berlin, and soon afterward repeated in Paris by M. Roux.

Professor Warren, of Harvard University, was the first to perform it in this country, and Professor Stevens, of New-York, has since repeated it on a young man, æt. 25, for a frightful congenital division of the palate, with very satisfactory success. This latter case is reported at length in the New-York Medical and Surgical Journal, for April, 1827.—*Reese.*]

For information relative to the hare-lip, see *B. Bell's Surgery, vol. 4. Heister's Surgery. Le Dran's Operations. Sharp's Operations. F. D. Herissant, Mém. de l'Acad. des Sciences, année 1743, p. 86: a very curious case, complicated with a fissure in the palate, and two oblong apertures at the sides of this cleft. In play, the child would sometimes fill his mouth with water, and through those apertures let it spout out at the nostrils, in imitation of what takes place in whales. G. D. La Faye, Mém. de l'Acad. Royale de Chir. t. 1, p. 605, année 1743. E. Sandifort, Obs. Anat. Pathol. 4to. et Museum Anat. p. 110. 164, Lugd. Bat. 1777. Flajani, Collezione d'Oss., &c. t. 8, 8vo. Roma. Latta's Surgery, vol. 2. Louis, in Mém. de l'Acad. de Chir. t. 4, p. 385, 4to. année 1768, t. 5, p. 292, année 1774. De la Médecine Opératoire, par Sabatier, t. 3, p. 272, 8vo. Paris, 1810. Œuvres Chir. de Desault, par Bichat, t. 2, p. 173. Traité des Opérations de Chirurgie, par A. Bertrandi, chap. 19. P. N. Haguette, Sur le Bec-de-lièvre naturel, 4to. Paris, 1804. J. Kirby, Cases, &c. 8vo. Lond. 1819: forceps recommended for holding the lip in the operation. Richter, Anfangsgr. der Wundarzn. b. 2, kap. 7. Locher de Operatione labii leporini, Jenæ, 1792. Fretur de Labio leporino, Halæ, 1793. Rieg. von. der Hasenscharte, Frankf. 1803. M. J. Chelius, Handb. der Chir. b. 1, p. 425, Heidelb. 1826. Sprengel, Geschichte der Chir. Operationen, b. 1, p. 155. Graefe, Angiectasie, v. Langenbeck Bibl. b. 2, p. 359. Eckoldt, Ueber eine sehr complicirte Hasenscharte; Leipz. 1804, fol.*

HEAD, INJURIES OF THE. From the variety of parts of which the scalp is composed, from their structure, connexions, and uses, injuries done to it by external violence become of much more consequence than the same kind of ills can prove, when inflicted on the common integuments of the rest of the body. One principal reason of the danger in these cases depends upon the free communication between the vessels of the pericranium and those of the dura mater, through the diploe of the skull; for when inflammation is kindled in the former membrane, it may extend itself to the latter. According to Sir Astley Cooper, there are three modes in which wounds of the scalp may induce fatal consequences. 1st, by producing what is called an erysipelatous inflammation on the head; 2dly, by producing extensive suppuration under the tendon of the occipito-frontalis muscle; 3dly, by rendering a simple fracture compound, so as to cause more extensive inflammation of the dura mater.—(*Lectures, vol. 1, p. 350.*) The latter observation, as far as my information reaches, is new, and deserves the serious consideration of the practitioner; for in the great hospital where I was educated, and in all the practice which I have seen in the army and elsewhere, no analogy of this kind was ever suspected between ordinary compound fractures and those of the cranium. If the doctrine be correct, it forms another weighty argument against the method of cutting down to a fracture of the skull without urgent motives.

Incised wounds of the scalp are, indeed, less liable than contused or lacerated ones to produce bad consequences; but they are not entirely devoid of danger; in proof of which, Sir Astley Cooper mentions the case of a lady of rank in the country who died from the removal of an encysted tumour of the scalp.—(*Lectures, vol. 1, p. 349.*) Passing over these cases, however, which generally heal as well the generality of cuts in the skin of other parts of the body, and require no particularity of treatment, Mr. Pott proceeds immediately to lacerated and punctured wounds. "The former may be reduced to two kinds: viz. those in which the scalp, though torn or unequally divided, still keeps its natural situation, and is not stripped nor separated from the cranium to any considerable distance beyond the breadth of the wound; and those in which it is considerably detached from the parts it ought to cover. The first of these, if simple, and not combined with the symptoms or appearances of any other mischief, does not require any particular or different treatment from what the same kind of wounds require on all other parts;" but with respect to those in which the scalp is separated and detached from the parts it ought to cover, Mr. Pott makes no scruple of declaring it as his opinion, that its preservation ought always to be attempted, *unless it be so torn as to be absolutely spoiled, or there are manifest present symptoms of other mischief.* In former days, the excision of the lacerated and detached scalp was the general practice; but Mr. Pott had so often made the experiment of endeavouring to preserve the torn piece, and so often succeeded, that he recommended it as a thing always to be attempted, even though a part of the cranium were perfectly bare.

Here I may remark that all practitioners now invariably avoid cutting away the scalp, even in the circumstances in which such practice was allowed by Pott. By *spoiled*, this eminent writer must mean so injured as necessarily to slough afterward. However, as no harm results from taking the chance of its not sloughing, which never can be with certainty foretold; and as the excision of the part is painful and productive of no benefit, even if sloughing must follow; such operation is, in every point of view, hurtful and wrong. With respect to other mischief, as a reason, the examination of the cranium, and even the application of the trephine, never require any of the scalp to be cut away.—(See *Trephine.*)

Let the surgeon, therefore, free the torn piece from all dirt or foreign bodies, and restore it as quickly and as perfectly as he can to its natural situation.

Notwithstanding Mr. Pott assents to the employment of sutures for uniting certain lacerated wounds of the scalp, the best practitioners of the present day generally employ only sticking plaster. Sometimes the loosened scalp will unite with the parts from which it is torn and separated, and there will be no other sore than what arises from the impracticability of bringing the lips of the wound into smooth and immediate contact, the scar of which sore must be small in proportion. Sometimes such perfect reunion is not to be obtained; in which case, matter will be formed and collected in those places where the parts do not coalesce: but this does not necessarily make any difference either in the general intention or in the event; this matter may easily be discharged by one or two small openings made with a lancet; the head will still preserve its natural covering; and the cure will be very little retarded by a few small abscesses.

In some cases (as Pott proceeds to describe), the whole separated piece will unite perfectly, and give little or no trouble, especially in young and healthy persons. In some, the union will take place in certain parts and not in others (also Brodie, in *Med. Chir. Trans. vol. 14, p. 408*); and consequently matter will be formed, and require to be discharged, perhaps at several different points; and in some particular cases, circumstances, and habits, there will be no union at all, the torn cellular membrane or the naked aponeurosis will inflame and become sloughy, a considerable quantity of matter will be collected, and, perhaps, the cranium will be denuded. But even in this state of things, which does not very often happen, where care has been taken, and is almost the worst which can happen in the case of mere simple laceration and detachment,

If the surgeon will not be too soon or too much alarmed, nor in a hurry to cut, he will often find the cure much more feasible than he may at first imagine: let him take care to keep the inflammation under by proper means, let him have patience till the matter is fairly and fully formed, and the sloughs perfectly separated, and when this is accomplished, let him make a proper number of dependent openings for the discharge of them, and let him by bandage and other proper management keep the parts in constant contact with each other, and he will often find, that although he was foiled in his first intention of procuring immediate union, yet he will frequently succeed in this his second; he will yet save the scalp, shorten the cure, and prevent the great deformity arising (particularly to women) not only from the scar, but from the total loss of hair.

This union may often be procured, even though the cranium should have been perfectly denuded by the accident; and it is true, not only though it should have been stripped of its pericranium at first (see *Abernethy on the Injuries of the Head, case* 6), but even if that pericranium should have become sloughy and cast off, as Mr. Pott has often seen.

"Exfoliation from a cranium laid bare by external violence, and to which no other injury has been done than merely stripping it of its covering, is a circumstance (says Pott) which would not so often happen if it was not taken for granted that it must be, and the bone treated according to such expectation. The soft open texture of the bones of children and young people will frequently furnish an incarnation, which will cover their surface, and render exfoliation quite unnecessary (see also Brodie, in *Med. Chir. Trans. vol.* 14, *p.* 409): and even in those of mature age, and in whom the bones are still harder, exfoliation is full as often the effect of art as the intention of nature, and produced by a method of dressing calculated to accomplish such end, under a supposition of its being necessary. Sometimes, indeed, it happens that a small scale will necessarily separate, and the sore cannot be perfectly healed till such separation has been made; but this kind of exfoliation will be very small and thin in proportion to that produced by art, that is, that produced by dressing the surface of the bare bone with spirituous tinctures, &c.

Small wounds, that is, such as are made by instruments or bodies which pierce or puncture rather than cut, are in general more apt to become inflamed and to give trouble than those which are larger; and, in this part particularly, are sometimes attended with so high inflammation, and with such symptoms, as alarm both patient and surgeon.

If the wound affects the cellular membrane only, and has not reached the aponeurosis or pericranium, the inflammation and tumour affect the whole head and face, the skin of which wears a yellowish cast, and is sometimes thick set with small blisters, containing the same coloured serum: it receives the impression of the fingers, and becomes pale for a moment, but returns immediately to its inflamed colour; it is not very painful to the touch, and the eyelids and ears are always comprehended in the tumefaction, the former of which are sometimes so distended as to be closed; a feverish heat and thirst generally accompany it; the patient is restless, has a quick pulse, and most commonly a nausea and inclination to vomit.

This accident generally happens to persons of bilious habit, and is indeed an inflammation of the erysipelatous kind: it is somewhat alarming to look at, but is not often attended with danger. The wound does indeed neither look well, nor yield a kindly discharge, while the fever continues, but still it has nothing threatening in its appearance, none of that look which bespeaks internal mischief; the scalp continues to adhere firmly to the skull, and the patient does not complain of that tensive pain, nor is he afflicted with that fatiguing restlessness which generally attends mischief underneath the cranium.

Phlebotomy, lenient purges, and the use of the common febrifuge medicines, particularly those of the neutral kind, generally remove it in a short time. When the inflammation is gone off, it leaves on the skin for a little while a yellowish tint and a dry scurf, and, upon the disappearance of the disease, the wound immediately recovers a healthy aspect, and soon heals without any farther trouble. I do not believe that the exhibition of bark, in this form of erysipelas, is ever productive of any decided benefit.

Wounds and contusions of the head, which affect the brain and its membranes, are also subject to an erysipelatous kind of swelling and inflammation; but it is very different both in its character and consequences from the preceding.

In this (which is one of the effects of inflammation of the meninges), the febrile symptoms are much higher, the pulse harder and more frequent, the anxiety and restlessness extremely fatiguing, the pain in the head intense; and as this kind of appearance is, in these circumstances, most frequently the immediate precursor of matter forming between the skull and dura mater, it is generally attended with irregular shiverings, which are not followed by a critical sweat, nor afford any relief to the patient. To which it may be added, that in the former case the erysipelas generally appears within the first three or four days; whereas, in the latter, it seldom comes on till several days after the accident, when the symptomatic fever is got to some height. In the simple erysipelas, although the wound be crude and undigested, yet it has no other mark of mischief; the pericranium adheres firmly to the skull, and upon the cessation of the fever, all appearances become immediately favourable. In that which accompanies injury done to the parts underneath, the wound not only has a spongy, glassy, unhealthy aspect, but the pericranium in its neighbourhood separates spontaneously from the bone, and quits all cohesion with it. In short, one is an accident proceeding from a bilious habit, and not indicating any mischief beyond itself; the other is a symptom or a part of a disease, which is occasioned by injury done to the membranes of the brain: one portends little or no ill to the patient, and almost always ends well; the other implies great hazard, and most commonly ends fatally. It is therefore hardly necessary to say, that it behooves every practitioner to be careful in distinguishing them from each other.

If the wound be a small one, and *has passed through the cellular membrane to the aponeurosis and pericranium*, it is sometimes attended with very disagreeable, and even very alarming symptoms, but which arise from a different cause, and are very distinguishable from what has been yet mentioned.

In this, the inflamed scalp does not rise into that degree of tumefaction as in the erysipelas, neither does it pit, or retain the impression of the fingers of an examiner. It is of a deep red colour, unmixed with the yellow tint of the erysipelas; it appears tense, and is extremely painful to the touch: as it is not an affection of the cellular membrane, and as the ears and the eyelids are not covered by the parts in which the wound is inflicted, they are seldom if ever comprehended in the tumour, though they may partake of the general inflammation of the skin; it is generally attended with acute pain in the head, and such a degree of fever as prevents sleep, and sometimes brings on a delirium.

A patient in these circumstances will admit more free evacuations by phlebotomy than one labouring under an erysipelas: the use of warm fomentation is required in both, in order to keep the skin clean and perspirable, but an emollient cataplasm, which is generally forbid in the former, may in this latter case be used with great advantage.

When the symptoms are not very pressing, nor the habit very inflammable, this method will prove sufficient; but it sometimes happens that the scalp is so tense, the pain so great, and the symptomatic fever so high, that by waiting for the slow effect of such means, the patient runs a risk from the continuance of the fever, or else the injured aponeurosis and pericranium, becoming sloughy, produce an abscess, and render the case both tedious and troublesome. A division of the wounded part by a simple incision down to the bone, about half an inch or an inch in length, will most commonly remove all the bad symptoms, and, if it be done in time, will render every thing else unnecessary." We here perceive that, in this form of inflammation, the practice of making an incision had the sanction of Pott; but the extent of the wound recommended is moderate, and very different from what has been recently proposed for phlegmonous erysipelas of the limbs. With respect to the good effects of such an incision, Desault considers them greatly exag-

gerated by authors; and while he admits that they are useful when the inflammation extends under the aponeurosis, he is not inclined to sanction it as a right proceeding in other instances.—(See *Œuvres Chir. par Bichat*, *t.* 2, *p.* 8.)

Thus Mr. Pott was of opinion, that the differences of the symptoms in the foregoing cases depended upon whether the wound only affected the skin and cellular membrane or reached more deeply to the aponeurosis and pericranium; a doctrine which has been justly regarded as questionable. With respect to the observation that in a puncture of the aponeurosis the swelling is confined within the limits of this fascia, and does not extend to the ears and eyelids, it is a sentiment which Desault thought arose rather from anatomical speculations than the observation of nature. The doctrine, indeed, must appear doubtful, when it is recollected, 1st, That the aponeurosis and pericranium are parts of scarcely any sensibility. 2dly, That the opinion had its origin at a period when these parts were imagined to be highly sensible. 3dly, That in other parts of the body, a wound in which a fascia or the periosteum is concerned is rarely attended with the above-described severe symptoms. 4thly, That here the wounds often affect only the skin and cellular membrane, and yet these symptoms occur even with a phlegmonous character. 5tly, On the contrary, in other instances, in which the aponeurosis and pericranium are undoubtedly wounded, no bad symptoms at all take place. 6thly, These symptoms may almost always be removed by the exhibition of tartarized antimony.—(*Œuvres Chir. de Desault*, *t.* 2, *p.* 8.) In the case often named inflammation of the fascia, after bleeding, it is not the fascia itself, which is the real and chief seat of the pain, inflammation, &c., but the subjacent cellular membrane and muscles. The theory of Desault is, that the erysipelatous affections of the scalp, so frequent after injuries of the head, are connected with disorder of the functions of the liver, produced by such accidents. Yet it is difficult to understand why a mere puncture of the scalp should cause this disorder of the liver more commonly than the same kind of wound of any other superficial part of the body.

The injuries to which the scalp is liable from contusion, or appearances produced in it by such general cause, may be divided into those in which the mischief is confined merely to the scalp, and those in which other parts are interested.

The former, which only come under our present consideration, are not indeed of importance, considered abstractedly. The tumour is either very readily dissipated, or the extravasated blood causing it is easily got rid of by a small opening. J. L. Petit first, and afterward Pott, particularly noticed this case, on account of an accidental circumstance which sometimes attends it, and renders it liable to be very much mistaken.

"When the scalp receives a very smart blow, it often happens that a quantity of extravasated blood immediately forms a tumour, easily distinguishable from all others, and generally very easily cured. But it also sometimes happens, that this kind of tumour produces to the fingers of an unadvised or inattentive examiner a sensation so like to that of a fracture, with depression of the cranium, as may be easily mistaken." Now if, upon such supposition, a surgeon immediately makes an incision into the tumid scalp, he may give his patient a great deal of unnecessary pain, and for that reason run some risk of his own character.

"The touch is in this case so liable to deception, that recourse should always be had to other circumstances and symptoms, before an opinion be given.

If a person with such tumour, occasioned by a blow, and attended with such appearances and feel, has any complaint which seems to be the effect of pressure made on the brain and nerves, or of any mischief done to the parts within the cranium, the division of the scalp, in order to inquire into the state of the skull, is right and necessary; but if there are no such general symptoms, and the patient is in every respect perfectly well, the mere feel of something like a fracture will not authorize or vindicate such operation, since it will often be found that such sensation is a deception, and that, when the extravasated fluid is removed, or dissipated, the cranium is perfectly sound and uninjured."—(*Pott.*)

With the exception of instances in which the dura mater suppurates from a blow on the head, and the symptoms are such as to require the trephine, or other examples in which an abscess forms under the scalp, or a large quantity of blood is effused in the same situation, none of the cases which have here been considered can justify making incisions in the scalp. When blood is extravasated under the scalp, the surgeon need not be too officious with his knife, merely because there is a tumour containing blood. The facility with which an effusion of blood under the scalp is dispersed is well illustrated in a case mentioned by Mr. Brodie. He was consulted about a young gentleman, under whose scalp an effusion of blood extended from the superciliary ridges to the nape of the neck, and from ear to ear. The blood appeared to be in a fluid state, and was so copious, that no part of the cranium could be felt. In a few weeks, and with the aid of a cold lotion, the whole tumour was dispersed. Mr. Brodie observes, that whatever might be the vessel ruptured, it must have continued to bleed a considerable time, in order to produce so large an extravasation. I have seen three or four cases nearly as remarkable as the preceding, and having a similar favourable termination under the use of simple discutient lotions and occasional purgatives. In one instance, attended by Mr. Brodie, he succeeded in preventing the effusion from attaining the extent described in his other case, by means of pressure applied to the point where the blow had been received, and a vessel ruptured.—(See *Med. Chir. Trans. vol.* 15, *p.* 406.)

The utility of an incision in what was supposed by Pott to be an inflammation of the aponeurosis is at least questionable, as far as it is done under the idea of merely obviating tension, without there being any matter to be discharged. Incisions, expressly for the purpose of exposing the bone, are only right as a preparatory step to trephining, when the necessity for this operation is indicated by decided and urgent symptoms of pressure on the brain. Now such pressure, in any of the examples above treated of, can only arise from a suppuration under the skull, a subject which will presently be considered.

Dr. Hennen, in his truly practical work, has very properly advised surgeons not to be content with clipping away a little of the hair around the injury, but always to have the head shaved to a proper extent. This proceeding, which is perfectly harmless in itself, is more generally right than the custom of cutting the scalp, which has been too frequently employed without any rational aim. The free removal of the hair directly after the accident often brings into view marks indicative of other parts of the head having been struck besides that which is at first noticed, and thus the practitioner will have a more correct notion of the serious nature of the accident than he might otherwise have conceived, and be more strict in his mode of treatment. Nay, fractures and depression of the skull, sometimes not denoted by any disturbance of the functions of the brain, and liable to escape observation while concealed under the hair, are frequently detected after its removal, and the surgeon being now aware of the extent and situation of the mischief, must of course be better qualified to conduct the treatment. In short, as Dr. Hennen has observed, "independent of the more accurate view (thus procured), we facilitate the application of leeches, if they may be found necessary, and of a most excellent adjuvant on all occasions, viz., cold applications."

It affords me particular pleasure to be able to number so good a surgeon as Dr. Hennen among the advocates of Schmucker's plan of having the head well shaved and covered with cloths wet with a very cold lotion; a practice which the latter eminent surgeon always adopted, whether a sabre-cut or gun-shot injury of this part had the appearance of being serious or not. "As soon as the patient was brought to the hospital with a wound of the head, whether the injury looked important or not (says Schmucker), I directed the hair to be immediately removed, and after the necessary dilatation applied dressings. Sixteen ounces of blood were next taken away, and the evacuation, in less quantity, repeated, according to circumstances, three or four times within the space of twenty-four hours. The pulse now generally became softer, and the determination of blood to the head lessened. Over the dressings and the whole of the head, thick cloths, dipped in the cold mixture hereafter specified, were laid, and renewed

every hour. These cloths were kept in their place with the bandage called the grand couvre-chef.—(See *Bandage.*) As internal medicines, the nitrate of potassa, neutral salts, and emollient and stimulating clysters, and gentle aperients were given. These means were employed, both in slight injuries and in those where the bones were depressed, and the fissures and fractures were accompanied with violent convulsive twitchings, coma, paralysis, and other bad symptoms; and even in cases where the use of the trephine was indispensable, the practice was continued until the cure was complete." Schmucker assures us, that under such treatment, fewer patients with wounds of the head were lost than used previously to happen, especially of those whose injuries at first had the appearance of being but slight. —(See *Chir. Wahrnehmungen, b.* 1, *p.* 154.)

Schmucker was led to try this practice by the great benefit which he had seen afforded by the application of cold water to the head in cases of mania, attended with great determination of blood to the brain. And in order to increase the efficacy of the water, he added to every five gallons of it two quarts of vinegar, sixteen ounces of nitre, and eight of the muriate of ammonia. This mixture was then preserved for use in a cold place.—(*Vol. cit. p.* 153.) Or, in order to avail ourselves fully of the frigorific effects of this mixture, it should be prepared, as Dr. Hennen observes, in small quantities, and used immediately before its temperature has risen; or "snow, or pounded ice, or ice-water applied to the parts in a half filled bladder, or cloths simply dipped in cold water, will often answer every purpose.—(*On Military Surgery, p.* 279, *ed.* 2.) Dr. Hennen mentions one important fact, in recommendation of cold applications, antimonials, and saline purgatives, preceded by the common blue pill, and assisted with quiet and abstinence, viz. by such means, "those troublesome puffy enlargements and erysipelatous affections of the scalp, which so often succeed to bruises, are prevented, and where the evacuant plan is duly observed, the extensive and formidable erysipelatous affections, so common formerly, are rare and mild at present in military hospitals."

2. *Effects of Contusion on the Dura Mater and Parts within the Skull.*

In consequence of blows, falls, and other shocks, either blood may be effused under the cranium, or inflammation and suppuration of the dura mater may arise. The best description of the latter case is that delivered by Mr. Pott.

Smart and severe strokes on the middle part of the bones, at a distance from the sutures, he says, are most frequently followed by this kind of mischief: the coats of the small vessels, which sustain the injury, inflame and become sloughy, and in consequence of such alteration in them, the pericranium separates from the outside of that part of the bone which received the blow, and the dura mater from the inside, the latter of which membranes, soon after such inflammation, becomes sloughy also, and furnishes matter, which matter being collected between the said membrane and the cranium, and having no natural outlet, whereby to escape or be discharged, brings on a train of very terrible symptoms, and is a very frequent cause of destruction. The effect of this kind of violence is frequently confined to the vessels connecting the dura mater to the cranium, in which case the matter is external to the said membrane; but sometimes the matter formed in consequence of such violence is found on the surface of the brain, or between the pia and dura mater, as well as on the surface of the latter; or, perhaps, in all these three situations at the same time.

The difference of this kind of disease from either an extravasation of blood or a concussion of the brain is great and obvious. "All the complaints produced by extravasation are such as proceed from pressure made on the brain and nerves, and obstruction to the circulation of the blood through the former; stupidity, loss of sense and voluntary motion, laborious and obstructed pulse and respiration, &c., and (which is of importance to remark), *if the effusion be at all considerable, these symptoms appear immediately or very soon after the accident.*

The symptoms attending an inflamed or sloughy state of the membranes, in consequence of external violence, are very different; they are all of the febrile kind, and never at first imply any unnatural pressure: such are pain in the head, restlessness, want of sleep, frequent and hard pulse, hot and dry skin, flushed countenance, inflamed eyes, nausea, vomiting, rigor; and, towards the end, convulsion and delirium. And *none of these appear at first, that is, immediately after the accident; seldom until some days are passed.*"

This last observation, made by Pott, is one that is well worthy of the practitioner's constant recollection, lest he wrongly fancy his patient secure too soon, and neglect the early use of the only means by which a recovery can be effected. Thus, as Sir Astley Cooper notices, the time when inflammation of the brain (and, it may be added, of its membranes) follows the violence is generally about a week; rarely sooner. Frequently it does not come on till a fortnight or three weeks after the injury; and even more time must elapse before the patient is quite safe, or ought to deviate from a strict and temperate regimen. In confirmation of this remark, a case is mentioned, where the neglect to keep the bowels regular brought on a fatal attack of inflammation of the brain, as late as four months after the receipt of a blow on the head.—(*Lectures, &c. p.* 339.)

One set or class of symptoms is produced by an extravasated fluid making pressure on the brain and origin of the nerves, so as to impair or abolish voluntary motion and the senses; the other is caused by the inflamed or putrid state of the membranes covering the brain, and seldom affects the organs of sense, until the latter end of the disease, that is, until a considerable quantity of matter is formed, which matter must press like any other fluid.

"If there be neither fissure nor fracture of the skull, nor extravasation nor commotion underneath it, and the scalp be neither considerably bruised nor wounded, the mischief is seldom discovered or attended to for some few days. The first attack is generally by pain in the part which received the blow. This pain, though beginning in that point, is soon extended all over the head, and is attended with a languor, or dejection of strength and spirits, which are soon followed by a nausea and inclination to vomit, a vertigo or giddiness, a quick and hard pulse, and an incapacity of sleeping, at least quietly. A day or two after this attack, if no means preventive of inflammation are used, the part stricken generally swells, and becomes puffy and tender, but not painful; neither does the tumour arise to any considerable height, nor spread to any great extent: if this tumid part of the scalp be now divided, the pericranium will be found of a darkish hue; and either quite detached or very easily separable from the skull, between which and it will be found a small quantity of dark-coloured ichor.

If the disorder has made such progress that the pericranium is quite separated and detached from the skull, the latter will even now be found to be somewhat altered in colour from a sound, healthy bone.

From this time the symptoms generally advance more hastily and more apparently; the fever increases, the skin becomes hotter, the pulse quicker and harder, the sleep more disturbed, the anxiety and restlessness more fatiguing; and to these are generally added irregular rigors, which are not followed by any critical sweat, and which, instead of relieving the patient, add considerably to his sufferings. If the scalp has not been divided or removed, until the symptoms are thus far advanced, the alteration of the colour of the bone will be found to be more remarkable; it will be found to be whiter and more dry than a healthy one; or, as Fallopius has very justly observed, it will be found to be more like a dead bone: the sanies or fluid between it and the pericranium will also, in this state, be found to be more in quantity, and the said membrane will have a more livid, diseased aspect.

In this state of matters, if the dura mater be denuded it will be found to be detached from the inside of the cranium, to have lost its bright silver hue, and to be, as it were, smeared over with a kind of mucus, or with matter, but not with blood. Every hour after this period, all the symptoms are exasperated, and advance with hasty strides: the headache and thirst become more intense, the strength decreases, the rigors are more frequent, and at last convulsive motions, attended in some with delirium, in others with paralysis or comatose stupidity, finish the tragedy.

If the scalp has not been divided till this point of time, and it be done now, a very offensive discoloured kind of fluid will be found lying on the bare cranium,

whose appearance will be still more unlike to the healthy natural one; if the bone be now perforated, matter will be found between it and the dura mater, generally in considerable quantity, but different in different cases and circumstances. Sometimes it will be in great abundance, and diffused over a very large part of the membrane; and sometimes the quantity will be less, and consequently the space which it occupies smaller. Sometimes it lies only on the exterior surface of the dura mater; and sometimes it is between it and the pia mater, or also even on the surface of the brain, or within the substance of it, &c.

As the inflammation and separation of the dura mater is not an *immediate* consequence of the violence, so neither are the symptoms immediate, seldom until some days have passed; the fever at first is slight, but increases gradually; as the membrane becomes more and more diseased, all the febrile symptoms are heightened; the formation of matter occasions rigors, frequent and irregular, until such a quantity is collected as brings on delirium, spasm, and death."

When the scalp has been wounded, Mr. Pott observes, the wound will for some little time have the same appearance as a mere simple wound of this part, unattended with other mischief, would have; it will, like that, at first discharge a thin sanies or gleet, and then begin to suppurate; it will digest, begin to incarn, and look perfectly well; but after a few days, all these favourable appearances will vanish; the sore will lose its florid complexion and granulated surface; will become pale, glassy, and flabby; instead of good matter, it will discharge only a thin discoloured sanies; the lint with which it is dressed, instead of coming off easily (as in a kindly suppurating sore), will stick to all parts of it; and the pericranium, instead of adhering firmly to the bone, will separate from it all round to some distance from the edges.

"This alteration in the face and circumstances of the sore is produced merely by the diseased state of the parts underneath the skull; which is a circumstance of great importance in support of the doctrine advanced; and is demonstrably proved, by observing that this diseased aspect of the sore and this spontaneous separation of the pericranium are always confined to that part which covers the altered or injured portion of the dura mater, and do not at all affect the rest of the scalp: nay, if it has by accident been wounded in any other part, or a portion has been removed from any part where no injury has been done to the dura mater, no such separation will happen, the detachment above will always correspond to that below, and be found no where else.

The first appearance of alteration in the wound immediately succeeds the febrile attack; and as the febrile symptoms increase, the sore becomes worse and worse; that is, degenerates more and more from a healthy, kindly aspect.

Through the whole time from the first attack of the fever to the last and fatal period, an attentive observer will remark the gradual alteration of the colour of the bone, if it be bare. At first, it will be found to be whiter and more dry than the natural one; and as the symptoms increase, and either matter is collected or the dura mater becomes sloughy, the bone inclines more and more to a kind of purulent hue or whitish yellow: and it may also be worth while in this place to remark, that if the blow was on or very near to a suture, and the subject young, the said suture will often separate in such a manner as to let through it a loose, painful, ill-natured fungus; at which time, also, it is not uncommon for the patient's head and face to be attacked with an erysipelas.

In those cases in which the scalp is very little injured by the bruise, and in which there is no wound nor any immediate alarming symptoms or appearances, the patient feels little or no inconvenience, and seldom makes any complaint, until some few days are past. At the end of this uncertain time, he is generally attacked by the symptoms already recited; these are not pressing at first, but they soon increase to such a degree, as to baffle all our art: from whence it will appear, that when this is the case, the patient frequently suffers from what seems at first to indicate his safety, and prevents such attempts being made, and such care from being taken of him, as might prove preventive of mischief.

But if the integuments are so injured as to excite or claim our early regard, very useful information may from thence be collected; for whether the scalp be considerably bruised, or whether it be found necessary to divide it for the discharge of extravasated blood, or on account of worse appearances or more urgent symptoms, the state of the pericranium may be thereby sooner and more certainly known: if in the place of such bruise, the pericranium be found spontaneously detached from the skull, having a quantity of discoloured sanies between them under the tumid part, in the manner already mentioned, it may be regarded as a pretty certain indication, either that the dura mater is beginning to separate in the same manner, or that, if some preventive means be not immediately used, it will soon suffer; that is, it will inflame, separate from the skull, and give room for a collection of matter between them. And with regard to the wound itself, whether it was made at the time of the accident, or afterward artificially, it is the same thing; if the alteration of its appearance be as related, if the edges of it spontaneously quit their adhesion to the bone, and the febrile symptoms are at the same time making their attack, these circumstances will serve to convey the same information, and to prove the same thing.

The particular effect of contusion is frequently found to attend on fissures, and undepressed fractures of the cranium, as well as on extravasations of fluid, in cases where the bone is entire; and, on the other hand, all these do often happen without the concurrence of this individual mischief. All this is matter of accident: but let the other circumstances be what they may, the spontaneous separation of the altered pericranium, in consequence of a severe blow, is almost always followed by a suppuration between the cranium and dura mater; a circumstance extremely well worth attending to in fissures and undepressed fractures of the skull, because it is from this circumstance principally that the bad symptoms and the hazard in such cases arise.

It is no very uncommon thing for a smart blow on the head to produce some immediate bad symptoms, which after a short space of time disappear and leave the patient perfectly well. A slight pain in the head, a little acceleration of pulse, a vertigo and sickness, sometimes immediately follow such accident, but do not continue many hours, especially if any evacuation has been used. These are not improbably owing to a light commotion of the brain, which having suffered no material injury thereby, soon cease. But if, after an interval of some time, the same symptoms are renewed; if the patient, having been well, becomes again feverish and restless, and that without any new cause; if he complains of being languid and uneasy, sleeps disturbedly, loses his appetite, has a hot skin, a hard, quick pulse, and a flushed, heated countenance; and neither irregularity of diet nor accidental cold has been productive of these; the mischief is most certainly impending, and that most probably under the skull.

If the symptoms of pressure, such as stupidity, loss of sense, voluntary motion, &c., appear some few days after the head has suffered injury from external mischief, they do most probably imply an effusion of a fluid somewhere; this effusion may be in the substance of the brain, in its ventricles, between its membranes, or on the surface of the dura mater; and which of these is the real situation of such extravasation is a matter of great uncertainty, none of them being attended with any peculiar mark or sign that can be depended upon as pointing it out precisely; but the inflammation of the dura mater, and the formation of matter between it and the skull, in consequence of contusion, is generally indicated and preceded by one which Mr. Pott has hardly ever known to fail; *a puffy, circumscribed, indolent tumour of the scalp, and a spontaneous separation of the pericranium from the skull under such tumour.*

These appearances, therefore, following a smart blow on the head, and attended with languor, pain, restlessness, watching, quick pulse, headache, and slight, irregular shiverings, do almost infallibly indicate an inflamed dura mater, and pus either forming or formed between it and the cranium."

By detachment of the pericranium is not meant every separation of it from the bone which it should cover. It may be, and often is, cut, torn, or scraped off, without any such consequence; but these separations are violent; whereas that which Mr. Pott means is spontaneous, and is produced by the destruction of those vessels by which it was connected with the skull, and by which the communication between it and

the internal parts was carried on; and therefore it is to be observed, that it is not the mere removal of that membrane which causes the bad symptoms, but it is the inflammation of the dura mater; of which inflammation this spontaneous secession of the pericranium is an almost certain indication.

Sometimes the scalp is so wounded at the time of the accident, or so torn away, as to leave the bone perfectly bare; and yet the violence has not been such as to produce the evil just now spoken of. In this case, if the pericranium be only turned back along with the detached portion of scalp, there may be probability of its reunion; and it should therefore be immediately made clean and replaced, for the purpose of such experiment; which, if it succeeds, will save time and prevent considerable deformity. Should the attempt fail, it can only be in consequence of the detached part sloughing. Hence, removing it with a knife, though allowed by Pott, is now never practised. Frequently, when the scalp does not adhere at once, it becomes attached to the cranium afterward by a granulating process. When the detached piece sloughs, the worst that can happen is an exfoliation from the bare skull.

Sometimes the force which detaches or removes the scalp also occasions the mischief in question; but, the integuments being wounded or removed, we cannot have the criterion of the tumour of the scalp for the direction of our judgment. Our whole attention must be directed to the wound and general symptoms. The edges of the former will digest as well, and look as kindly for a few days, as if no mischief was done underneath. But after some little space of time, when the patient begins to be restless and hot, and to complain of pain in the head, these edges will lose their vermilion hue, and become pale and flabby. Instead of matter, they will discharge a thin gleet, and the pericranium will loosen from the skull to some distance from the said edges. Immediately after this, all the general symptoms are increased and exasperated; and as the inflammation of the membrane is heightened or extended, they become daily worse and worse, until a quantity of matter is formed and collected, and brings on that fatal period, which, though uncertain as to date, very seldom fails to arrive.

"The method of attempting the relief of this kind of injury consists in two points: viz. *to endeavour to prevent the inflammation of the dura mater*; or, that being neglected or found impracticable, *to give discharge to the fluid collected within the cranium, in consequence of such inflammation.*

Of all the remedies in the power of art, for inflammations of membranous parts, there is none equal to phlebotomy. To this truth many diseases bear testimony; pleurisies, ophthalmies, strangulated hernias, &c.; and if any thing can particularly contribute to the prevention of the ills likely to follow severe contusions of the head, it is this kind of evacuation; but then it must be made use of in such a manner as to become truly a preventive; that is, it must be made use of immediately and freely."

Acceleration or hardness of pulse, restlessness, anxiety, and any degree of fever, after a smart blow on the head, are always to be suspected and attended to. Immediate, plentiful, and repeated evacuations by bleeding have in many instances removed these in persons to whom Mr. Pott firmly believes very terrible mischief would have happened, had not such precaution been used. In this, as well as some other parts of practice, we neither have nor can have any other method of judging, than by comparing together cases apparently similar. Mr. Pott had more than once or twice seen that increased velocity and hardness of pulse, and that oppressive languor, which most frequently precede mischief under the bone, removed by free and repeated bloodletting; and had often, much too often, seen cases end fatally, whose beginnings were fully as slight, but in which such evacuation had been either neglected or not complied with. This judicious writer, "would by no means be thought to infer from hence, that early bleeding will always prove a certain preservative; and that they only die to whom it has not been applied: this, like all other human means, is fallible; and perhaps there are more cases out of its reach than within it, but where preventive means can take place, this is certainly the best and the most frequently successful.

The second intention, viz. *the discharge of matter collected under the cranium*, can be answered only by the perforation of it.

When from the symptoms and appearances already described, there is just reason for supposing matter to be formed under the skull, the operation of perforation cannot be performed too soon: it seldom happens that it is done soon enough."

In short, whenever the dura mater, after the head has received external violence, separates or is detached spontaneously from the bone underneath it, and such separation is attended with the collection of a small quantity of thin brown ichor, an alteration of colour in the separated pericranium, unnatural dryness of the bone, chilliness, horripilatio, languor, and some degree of fever, Mr. Pott considers the operation indispensably necessary to save the patient's life.

When the skull has been once perforated, and the dura mater thereby laid bare, the state of the matter must principally determine the surgeon's future conduct. In some cases, one opening will prove sufficient for all necessary purposes; in others, several may be necessary.

Notwithstanding the operation of perforation be absolutely and unavoidably necessary, as Mr. Pott remarks, "the repetition of bloodletting or cooling laxative medicines, the use of antiphlogistic remedies, and a most strict observance of a low diet and regimen, are as indispensably requisite after such operation as before: the perforation sets the membrane free from pressure, and gives vent to collected matter, but nothing more; the inflamed state of the parts under the skull, and all the necessary consequences of such inflammation, call for all our attention, full as much afterward as before; and although the patient must have perished without the use of the trephine, yet the merely having used it will not preserve him without every other caution and care."—(*Pott.*)

In relation to this subject, a remark made by Sir Astley Cooper merits notice: when pus lies between the dura mater and skull, the application of the trephine, he acknowledges, is a successful practice; but, according to his experience, this situation of the purulent matter is comparatively rare, as it generally collects between the pia mater and surface of the brain, *for which case an operation will be useless.*—(*Lectures, &c. vol.* 1, *p.* 325.) It is stated by Mr. Brodie, that in hospital practice, suppuration between the dura mater and the bone, in consequence of fracture, is also less common at the present period than when Mr. Pott wrote; a change which he refers to the stricter antiphlogistic plan adopted by modern surgeons, whether the early symptoms be or be not of a dangerous description.—(See *Med. Chir. Trans. vol.* 14, *p.* 411.)

I think it not improper to recommend again the practice of applying cold wet cloths to the head for the prevention and relief of inflammation of the dura mater; a plan to which, as already explained, Schmucker ascribed a good deal of the success with which he treated injuries of the head. It is favourably mentioned by Dr. Hennen, and has received the recommendation of another modern writer, whose opinion must have great weight: "In the inflammation which succeeds slowly to injuries of the head, a species of inflammation not more insidious in its approach than dangerous in its consequences, cold is by far the most efficacious remedy that has yet been discovered."—(See *Thomson's Lectures on Inflammation*, *p.* 181.)

Both tables of the skull sometimes exfoliate in consequence of external violence. The dead bone must be removed, as soon as loose; and, if necessary, the scalp divided for the purpose.

3. *Fissures and Fractures of the Cranium, without Depression.*

Fractures of the cranium are divisible into "those in which the broken parts keep their proper level or equality of surface with the rest of the skull, and those in which they do not; or in other words, fractures without depression and fractures with.

These two distinctions are all which are really necessary to be made, and will be found to comprehend every violent division of the parts of the skull (not made by a cutting instrument), from the finest capillary fissure, up to the most complicated fracture."—(*Pott.*) In most instances, the fracture takes place in the upper part of the cranium; and it is also correctly noticed by Mr. Brodie, that fractures of its basis are always the consequence of very great violence, and re-

coveries from them comparatively rare.—(*Med. Chir. Trans. vol.* 14, *p.* 328.) Sometimes the fracture does not occur at the point to which the violence has been directly applied, but elsewhere, as the effect of what the French term a *contre-coup*. Various explanations of the fact have been offered. Mr. Earle has never known it happen, except when the occiput seemed to have been forcibly impelled against the atlas.—(*Brodie, in Med. Chir. Trans. vol.* 14, *p.* 329.) An ingenious attempt to account for the circumstance may be found in the writings of Mr. C. Bell; though certain cases on record will not conform to any principles yet offered in explanation of them. The disjunction of the sutures is much more rare than fractures of the cranium, and can only happen in young subjects, in whom the sutures are not yet consolidated. They are accidents implying the operation of great violence, and in this point of view may be viewed as dangerous.—(See *Brodie, in Med. Chir. Trans. vol.* 14, *p.* 332.)

No truth in surgery is now better understood and established, than that the bad symptoms very frequently accompanying a broken skull are not produced by the breach made in the bone, nor indicate such breach to have been made. As Sir Astley Cooper remarks, the danger of fractures of the skull depends upon their being united with concussion or extravasation; there is also a remote danger from inflammation. —(*Lectures, &c. p.* 289.) This was the doctrine so well explained by Pott, who observes "the sickness, giddiness, vomiting, and loss of sense and motion can only be the consequence of an affection of the brain, as the common sensorium. They may be produced by its having been violently shaken, by a derangement of its medullary structure, or by unnatural pressure made by a fluid extravasated on its surface, or within its ventricles; but never can be caused by the mere division of the bone (considered abstractedly); which division, in a simple fracture, can neither press on nor derange the structure of the parts within the cranium.

If the solution of continuity in the bone be either produced by such a degree of violence as hath caused a considerable disturbance in the medullary parts of the brain, or has disturbed any of the functions of the nerves going off from it; or has occasioned a breach of any vessel or vessels, whether sanguine or lymphatic, and that hath been followed by an extravasation or lodgement of fluid; the symptoms necessarily consequent upon such derangement, or such pressure, will follow: but they do not follow because the bone is broken; their causes are superadded to the fracture, and although produced by the same external violence, are yet perfectly and absolutely independent of it; so much so that they are frequently found where no fracture is.

The operation of the trepan is frequently performed in the case of simple fractures, and that very judiciously and properly; but it is not performed because the bone is broken or cracked. A mere fracture or fissure of the skull can never require perforation, or that the dura mater under it be laid bare; the reason for doing this springs from other causes than the fracture, and those really independent of it: they spring from the nature of the mischief which the parts within the cranium have sustained, and not from the accidental division of the bone. From these arise the threatening symptoms; from these all the hazard; and from these the necessity and vindication of performing the operation of the trepan.

If a simple fracture of the cranium was unattended in present with any of the before-mentioned symptoms, and there was no reason for apprehending any other evil in future, that is, if the solution of continuity in the bone was the whole disease, it could not possibly indicate any other curative intention but the general one in all fractures, viz. the union of the divided parts." Even fractures of the basis of the skull, which are most frequently fatal, prove so, not because this part of the cranium is broken (the fracture itself being here not more dangerous than elsewhere), but "because it is almost invariably complicated with extensive injury of other and more important parts."—(*Brodie, in Med. Chir. Trans. vol.* 14, *p.* 328.) The post mortem examinations which I have attended, lead me to believe that most of these cases are complicated with extravasation.

I could relate numerous examples to the point, if it were any longer necessary, in the present state of surgical knowledge, to cite facts in proof of the important truth, that the mere undepressed fissure or fracture of the skull itself cannot be the source of the immediate bad symptoms, but that in these cases the whole of the sudden peril arises from the manner in which the brain and its membranes have been hurt by the same violence which caused the injury of the bone. Professor Thomson had opportunities of witnessing in the Netherlands several instances, which can leave no doubt upon this subject. "In some of the wounds (says he) in which the head had been struck obliquely by the sabre, portions of the cranium had been removed, without the brain appearing to have sustained much injury. In one case of this kind, where a considerable portion of the upper part of the occipital bone, *along with the dura mater*, had been removed, a tendency to protrusion of the brain took place during an attack of inflammation; a slight degree of stupor with loss of memory occurred; but on the inflammatory state having been subdued, the brain sunk to its former level, the stupor went off, and the memory returned:"—and in another remarkable sabre-cut, more than an inch in breadth of the left lobe of the cerebellum was exposed, and *was seen pulsating for a period of eight weeks*, yet the injury was unaccompanied with any particular constitutional symptoms.—(See *Obs. made in the Military Hospitals of Belgium, p.* 50, 51.)

In many cases of simple undepressed fractures of the cranium, it is true that trephining is necessary; but the reasons for the operation in these instances are, first, the immediate relief of present symptoms, arising from the pressure of extravasated fluid; and, secondly, the discharge of matter, formed between the skull and dura mater, in consequence of inflammation. The operation of trephining was also recommended by Pott, as a *preventive* of ill consequences; a practice, however, which is now never adopted; and many writers of the highest reputation, especially Desault, Dease, Mr. John Bell, and Mr. Abernethy, have strongly remonstrated against it.

The latter remarks, "In the accounts which we have of the former practice in France, it is related, that surgeons made numerous perforations along the whole track of a fracture of the cranium; and, as far as I am able to judge, without any clear design. Mr. Pott also advises such an operation, with a view to prevent the inflammation and suppuration of the dura mater, which he so much apprehended. But many cases have occurred of late, where, even in fractures with depression, the patients have done well without an operation."

Mr. Abernethy next relates several cases of fracture of the cranium with depression, which terminated favourably, although no operation was performed. This judicious surgeon thinks that these cases, as well as a great many others on record, prove that at all events a slight degree of pressure may not derange the functions of the brain, for a limited time after its application, and in this circumstance probably never; for all those patients whom he had an opportunity of knowing for any length of time after the accident, continued as well as if nothing of the kind had happened to them. In Mr. Hill's *Cases in Surgery*, two instances of this sort are related, and Mr. Hill knew both the patients for many years afterward: yet no inconvenience arose. Indeed, it is not easy to conceive that the pressure, which caused no ill effects at a time when the contents of the cranium filled its cavity completely, should afterward prove injurious, when they have adapted themselves to its altered size and shape. Severe illness, it is true, often intervenes between the receipt of the injury, and the time of its recovery; and many surgeons might be inclined to attribute this to pressure; but it equally occurs when the depressed portion is elevated. If a surgeon, prepossessed with the opinion that elevation of the bone is necessary in every instance of depressed cranium, should have acted upon this opinion in several of the cases which Mr. Abernethy has related, and afterward have employed proper evacuations, his patients would probably have had no bad symptoms, and he would naturally have attributed their well-doing to the mode of treatment which he had pursued: yet these cases did equally well without an operation.—(See *Abernethy's Surgical Works, vol.* 2, *p.* 4, *&c.* 8*vo. Lond.* 1811.)

Depressed fractures of the skull not being our immediate consideration, we need not expatiate upon them; but it seemed right to make the preceding remarks, in order to show how unnecessary it must be to trephine a patient, merely because there is a fracture in the cranium, and with a view of *preventing* bad consequences. Even when the fracture is depressed, it is not neces-

sary, unless there are evident signs that the degree of pressure thus produced on the brain is the cause of existing bad symptoms.

The inflammation and suppuration of the parts beneath the skull, which Mr. Pott wished so much to prevent by trephining early, do not arise from the occurrence of a breach in the cranium, but are the consequences of the same violence which was the occasion of the fracture. Hence it is obvious, that removing a portion of the bone cannot in the least prevent the inflammation and suppuration, which must result from the external violence which was first applied to the head; but, on the contrary, such a removal, being an additional violence, must have a tendency to increase the inevitable inflammatory mischief.

From what has been said, it is not to be inferred, however, that trephining is never proper, when there is a simple undepressed fracture of the skull. Such injury may be joined with an extravasation of blood on the dura mater; or it may be followed by the formation of matter between this membrane and the cranium; in both which circumstances, the operation is essential to the preservation of the patient, immediately, but not before the symptoms indicative of the existence of dangerous pressure on the brain begin to show themselves. —(See *Trephine*.)

A fracture of the skull, unattended with urgent symptoms, and not brought into the surgeon's view by any accidental wound of the integuments, often remains for ever undiscovered; and as no benefit could arise from laying it bare by an incision, such practice should never be adopted. The surgeon ought only to be officious in this way, when he can accomplish by it some better object than the mere gratification of his own curiosity. And as we shall find from the perusal of this article, and the one entitled *Trephine*, that in these cases, the removal of pressure off the surface of the brain is the only possible reason for ever perforating the cranium with this instrument; and as dividing the scalp is only a useful measure when it is preparatory to such operation; neither the one nor the other should ever be practised, unless there exist unequivocal symptoms that there is a dangerous degree of pressure operating on the brain, and caused either by matter, extravasated blood, or a depressed portion of the skull. If any exceptions can be made to this observation, these are cases in which it is advisable to remove loose splinters and fragments of bone, or balls, plainly felt under the scalp.

The true mode of *preventing* the bad effects, frequently following, but not arising from, simple fractures of the skull, is not to trephine, but to put in practice all kinds of antiphlogistic means. For this purpose, let the patient be repeatedly and copiously bled, both from the arm and temporal arteries; let him be properly purged; give him antimonials; keep him on the lowest diet; let him remain in the most quiet situation possible; and if, notwithstanding such steps, the symptoms of inflammation of the brain continue to increase, let a large blister be applied to the scalp. If the scalp be wounded, it is to be healed as speedily as possible. Bloodletting and purgatives (as Sir Astley Cooper remarks) will sometimes remove the symptoms of concussion and extravasation, when they accompany the fracture, and a few hours will often show that the trephine, which was at first thought indispensable, is unnecessary. Irreparable mischief might arise from your making an incision, and converting a simple into a compound fracture. "If you act prudently (he adds), you will try bleeding and purgatives before you operate; and the depletion will prove of the greatest possible advantage in preventing inflammation."—(*Lectures, vol.* 1, *p.* 299.) These are the cases, also, in which the topical application of cold water to the shaved and naked head, by means of cloths kept constantly wet, is an eligible, though in this country a much-neglected practice. Numerous instances, however, in favour of the method are recorded by the experienced Schmucker (*Chir. Wahrnehmungen, b.* 1, *Berlin*, 1774), and the trials which I have seen made of it, give me a high opinion of its superior efficacy. When, in spite of all these measures, matter forms under the cranium, attended with symptoms of pressure, a puffy tumour of the injured part of the scalp, or those changes of the wound, if there is one, which Mr. Pott has so excellently described; not a moment should be lost in delaying to perforate the bone with the trephine, and giving vent to the confined matter.

Experience teaches that fractures at the basis of the skull are extremely dangerous, because they are generally attended with extravasation, or followed by inflammation of the brain, in consequence of the violence of the injury. According to Sir Astley Cooper, they are produced by falls from a great height on the summit of the head. The whole weight of the body is received on the foramen magnum, and cuneiform process of the os occipitis, and, in many instances, the consequence is a transverse fracture through the foramen magnum, the cuneiform process, and part of the temporal bone. A discharge of blood into each meatus auditorius accompanies the accident. It is supposed, also, that the deafness, which sometimes remains during life, in rare instances of recovery, is the result of this kind of injury. —(*Lectures, &c. vol.* 1, *p.* 289.)

A fracture within the orbit is sometimes occasioned by the forcible introduction of a stick, weapon, or pointed instrument, and is generally a fatal case, from the pressure and irritation of the depressed splinters of bone, and the simultaneous wound of the brain. The symptoms in the beginning, however, are frequently mild and deceitful, and it is not till inflammation and suppuration ensue, that the patient's condition is always such as to create immediate alarm. A case, exemplifying this fact, is reported by Sir A. Cooper. —(*Vol. cit. p.* 295.) The same eminent surgeon mentions the occasional production of a circular fracture of the entire cranium, by a blow on the vertex; also the emphysema of the forehead, or the escape of the air, if there be a wound, caused when the nose is blown, in the case of a fracture extending into the frontal sinuses; the complete detachment, sometimes met with, of the fragments, instead of their depression. His observations confirm the fact, that fractures of the skull, if unaccompanied with concussion or compression, become united like those of other bones; but, he adds, that it is more slowly, and that where the interspace is wide, it will not be filled up with bony matter.—(*P.* 297, 298.)

4. *Fractures of the Cranium with Depression.*

In simple fractures of the skull, or those in which the parts of the broken bone are not depressed from their situation, Mr. Pott remarks, that "the chirurgical intention and requisite treatment are the same in each, viz. to procure a discharge for any fluid which may be extravasated in present (*provided the pressure of such extravasation produces urgent symptoms, a condition which should here be added*), and to guard against the formation or confinement of matter." The prevention of suppuration will, as we have already remarked, be best accomplished, not by perforating the cranium, as Mr. Pott advised, but by copious bleeding, evacuations, cold washes to the head, blisters, and a rigorous antiphlogistic regimen. However, the confinement of matter, producing symptoms of pressure on the brain, certainly indicates the immediate use of the trephine.

"But (says the author) in fractures attended with depression there are other intentions. In these the depressed parts are to be elevated, and such as are so separated as to be incapable of reunion, or of being brought to lie properly, and without pressing on the brain, are to be totally removed. These circumstances are peculiar to a depressed fracture; but although they are peculiar, they must not be considered as sole, but as additional to those which have been mentioned at large under the head of simple fracture; commotion, extravasation, inflammation, suppuration, and every ill which can attend on or be found in the latter, are to be met with in the former, and will require the same method of treatment." That loose splintered pieces of the cranium, when quite detached, and already in view, in consequence of the scalp being wounded, ought to be taken away, no one will be inclined to question. That they ought also to be exposed by an incision, even when the scalp is unwounded, and then taken away whenever they cause symptoms of irritation or pressure, I believe will be universally allowed. But the reader will already understand, from what has been said in the preceding section, that several excellent surgeons do not coincide with Pott in believing that every depressed fracture of the skull necessarily demands the application of the trephine.

"There certainly are (says Mr. Abernethy) degrees of this injury, which it would be highly imprudent to treat in this manner. Whenever the patient retains his senses perfectly, I should think it improper to trephine

him, unless symptoms arose that indicated the necessity of it."—(*P.* 21.)

It is extraordinary and unaccountable, but it is not less true, that no calculation of the bad effects can be made by the degree in which a part of the skull is depressed. This is a fact which has been long known. It has also been particularly adverted to by an eminent modern writer. "Various instances also presented themselves, in which, though a considerable degree of compression must have been occasioned, sometimes by the depression of both tables, and at other times by the depression of the inner table only of the skull, yet neither stupor, paralysis, nor loss of memory was produced. In one of these cases the middle of the right parietal bone was fractured, and considerably depressed by a ball, which was extracted on the 20th day. In this case, neither stupor nor paralysis appeared. In another, a musket-ball had struck the right parietal bone, fractured it, and was flattened and lodged between the tables of the skull. The inner table was much depressed, yet no bad symptoms supervened."—(See *Thomson's Observations made in the Military Hospitals in Belgium*, *p.* 59, 60.) The same author also saw a singular case, in which a ball, entering behind the right temple, and passing backwards and downwards, had fractured the bones in its passage, and lodged in the surface of the brain, over the tentorium, from which place it was extracted on the seventeenth day after the injury. No bad symptom had manifested itself previously to the operation, and the man recovered, under the strictest antiphlogistic regimen, with little or no constitutional derangement. Dr. Hennen has recorded two cases, fully proving the correctness of Mr. Abernethy's opinions about the impropriety of using the trephine in cases of depression unattended with urgent symptoms: in one of these instances, the upper and posterior angle of the parietal, which had been struck by a musket-ball, was depressed exactly *an inch and a quarter from the surface of the scalp, yet no bad symptoms followed*, and with the aid of bleeding and other antiphlogistic remedies, the soldier recovered perfectly in a few weeks. "In a similar case, where the man survived thirteen years, with no other inconvenience than occasional determination of blood to the head on hard drinking, *a funnel-like depression to the depth of an inch and a half* was formed in the vertex."—(See *Hennen's Military Surgery*, *p.* 287, *ed.* 2.)

If then the violence of the symptoms is not always in proportion to the compression, but is sometimes considerable when the pressure is slight, every surgeon cannot be too fully impressed with the following truth, that *existing symptoms of dangerous pressure on the brain*, which symptoms will be presently related, *can alone form a true reason for perforating the cranium.*

Although the doctrines of Sir Astley Cooper, generally speaking, coincide very much with the preceding maxim, which I regard as a very important one; there is an exception to it in his advice, in relation to compound fractures of the skull, as will be understood from the following passage. "The old practice used to be, the moment an injury of the brain was suspected, and the least depression of the bone appeared, to make an incision into the scalp. This is putting the patient to considerable hazard; for the simple fracture would by the incision be rendered compound. In simple fracture, then, when it is attended with symptoms of injury of the brain, deplete before you trephine; and when it is unattended with such symptoms, deplete merely, and do not divide the scalp, &c. If the fracture be compound, the treatment must be very different; because a compound fracture is very generally followed by inflammation of the brain; and it will be of little use to trephine, when inflammation is once produced. If the inflammation come on, the patient will generally die, whether you trephine or not," and it is added, that the operation will even be likely to increase the inflammation, which has been excited by a depressed portion of the skull. "The rule (says Sir Astley) which I always follow, is this: when I am called to a compound fracture with depression, which is exposed to view, whether symptoms of injured brain exist or not, I generally use an elevator, and very rarely the trephine. I put the elevator under the bone, raise it, and if it has been comminuted, remove the small portions of bone."—(*Lectures, &c. vol.* 1, *p.* 304. 308.) Of the propriety of using the elevator in such cases, and also of taking away loose fragments, there cannot be a doubt; but many surgeons object (and I confess myself one of the number) to saw out a portion of the skull while the patient is free from urgent symptoms. I believe, also, that the inflammation, when it does arise, is mostly the effect of the violence itself, not of the depression of the bone, and, therefore, more likely to be increased than prevented by the application of the trephine. I think a better reason for elevating the bone, when it is exposed, and there are no bad symptoms, is the fact that many patients, after their recovery from the imminent danger of the accident, become subject, whenever the circulation is hurried, to insanity, epilepsy, &c. Yet, here it is to be considered, that it may be quite time enough to trephine, when such ills follow the continuance of the depression, and that, perhaps, the operation would then be in itself less dangerous, inasmuch as the tendency to inflammation, arising from the first violence, must now have subsided.

In children a portion of the skull is sometimes depressed or indented by a blow, but in a few days regains its natural level without the aid of the surgeon. In such examples, it is conceived by Mr. Brodie, that the earthy part of the bone gives way, while the animal part remains entire, so that there is not an actual solution of continuity, and he supposes that the restoration of the bone to its proper level is brought about by the constant pulsations of the brain against its inner surface.—(See *Med. Chir. Trans. vol.* 14, *p.* 332.)

Sometimes a considerable depression of the bone arises from the external table being driven into the diploe, while the inner table is entire. To trephine, therefore, merely because there is a depression of the bone, would be completely erroneous, and the only safe principle is that which I have just now specified. The depression of the outer table in the foregoing manner I have never seen myself; Sir Astley Cooper, however, mentions it as a frequent occurrence; but that it is confined to persons of middle age, as in very young and very old persons the skull is thin and without diploe.—(*Lectures, vol.* 1, *p.* 302.) Another sort of depression, I believe, is more frequent; at least, I have seen several examples of the case; it consists in a fracture and depression of the internal table, while the external one continues unbroken. A case of this kind, attended with urgent symptoms of compression, I trephined at Brussels; a large splinter of the inner table was driven more than an inch into the brain, and on its extraction the patient's senses and power of voluntary motion instantly returned. Part of the skull to which the trephine was applied, of course, did not indicate externally any depression, and it was selected because the appearance of the scalp showed, that there the external violence had operated. I rather expected to find extravasated blood, than a depression of the inner table of the skull.—(See also *Saucerotte, in Mém. pour le Prix de l'Acad. de Chir. t.* 4, *éd.* 1819, *p.* 322. *Hennen's Military Surgery*, *p.* 323, *ed.* 2; *and B. C. Brodie, in Med. Chir. Trans. vol.* 14, *p.* 331.)

In military surgery particular cases present themselves, which scarcely admit of being comprehended within the tenor of any general rules and principles. Thus, it sometimes happens, that a ball breaks the os frontis, and the whole or a part of it lodges in the frontal sinus, with or without fracture of the inner boundary of this cavity. In cases of this description, Baron Larrey recommends exposing the course of the fracture by a free incision, and the use of the trephine for the removal of the extraneous body. When the inner side of the sinus was found broken and depressed, he next perforated that part of the cavity with a small conical trephine, took away such pieces of bone as required removal, and let out any extravasated blood. Sometimes, however, the front of the sinus is so splintered, that the fragments, when taken away with the forceps, leave the cavity sufficiently opened, not only for the extraction of the ball, but for the application of the trephine to the inside of the sinus as we find exemplified in one of the two cases of this nature which Larrey met with in the Egyptian campaign.—(*Mém de Chir. Militaire, t.* 2, *p.* 138.) After the battle of Witepsk, in 1812, he was called to two Russian soldiers, whose cases were remarkable; one of them had been struck above the right eyebrow with a grape-shot, which, after breaking and penetrating the frontal bone, entered the cavity of the cranium, so as to lodge upon the anterior right lobe of the brain, and the orbitar process and internal crista of the os frontis. Notwith-

standing the large size of the ball, little of it could be seen externally, and the aperture through which it had passed was not more than three or four lines broad; every attempt to extract it, therefore, was in vain. The patient experienced a painful sense of oppression and weight in the head, and, whenever he inclined it backwards, was seized with syncope. He kept himself constantly in a sitting posture with his head on his knees. Larrey adds, that every symptom of compression of the brain also prevailed, though this account is rather difficult to comprehend, considering that the patient could sit up, and choose his posture. As for any description given by himself of his sufferings, that is another circumstance on which I should not be inclined to dwell, because in all probability the baron was not able to converse in the Russian language, and the inferences respecting the man's feelings were made in some other way. But whatever might be the real state of the symptoms (and in a case of this kind a correct account of them would have been interesting), the ball was plainly ascertained, by means of a probe, to be of iron, and of much larger diameter than the opening through which it had entered; and that for the purpose of extracting it the application of the trepan was urgently necessary. The fracture was fairly brought into view by suitable incisions; three perforations were made with a small trephine at its upper part, and after the removal of the angles of the bone between these perforations, the ball, which weighed seven French ounces, was readily extracted with the aid of a strong pair of forceps and an elevator. A considerable quantity of coagulated blood was also removed, under which the brain was found with a depression of three or four lines deep. As soon as some splinters of the bone had been taken away, the part was dressed with a bit of fine linen dipped in warm wine, sweetened with sugar, over which were placed charpie, several compresses, and a bandage. With respect to the application of warm wine and other stimulants to the surface of the brain, in wounds exposing or interesting that organ, it seems to be an invariable practice with Larrey, as well as Schmucker, and the older surgeons. On what principle the custom is still kept up, and whether it is truly right and useful, are questions which may be rationally put. In whatever way experience may hereafter decide these matters, suffice it to add, that the patient was relieved by the treatment, and fell into a quiet sleep for two hours; but in the evening he became feverish, and the wound acutely painful. A considerable quantity of blood was taken from the vena saphena (and why bleeding was not practised at first, seems extraordinary). The dressings, which, according to my ideas, were highly objectionable, were removed, and a large emollient poultice applied. Cooling beverages, containing a small quantity of tartarized antimony, and antispasmodic anodyne medicines were prescribed. The following day the patient's state appeared satisfactory, without the slightest disturbance of the senses, and in due time he perfectly recovered.

The other soldier had been wounded in the left temple with a leaden ball, five days before Larrey saw him. One half of the ball had gone into the cranium, through a very narrow breach; the other had burrowed under the temporal muscle, and lodged near the mastoid process. The right side of the body was paralytic, the senses were annihilated, and the man was in a state of incessant agitation. After dilating the wound in the temple, and exposing the fracture, Larrey discovered the track of the piece of lead, which had gone towards the mastoid process, and which he immediately extracted by a counter-opening. At the lower part of the temporal wound, he applied a trepan very near the spot where the other portion of the ball was lodged. This, with some fragments of the bone, and a quantity of extravasated blood, was easily extracted. The patient, however, was not saved; a circumstance ascribed by Larrey to the operation having been done too late.

In another case, one of the imperial guards, wounded at the battle of the Moskowa, died with symptoms of compression, and, after death, a quarter of a bullet, and a fragment of bone were found under the skull, attended with an ulcerated or wounded state of the adjacent portion of the brain. Larrey very properly expresses his opinion, that this soldier would have had a chance of being saved, had the trepan been used.—(See *Mém. de Chir. Mil. t.* 4, *p.* 183, *&c.*) The practice of trephining for the removal of balls, situated near a fracture of the skull, within this bony cavity, or lodged among the fragments, or between the two tables forced asunder (see *Engel's case, in Vermischte Chir. Schriften von J. L. Schmucker, b.* 1, *p.* 242), is not peculiar to Larrey, for it has been done by many other surgeons (see *Schmucker's Wahrnehmungen, b.* 1, *p.* 298); but I do not know that he has been anticipated in his bold practice of making a counter-opening in the skull, when the ball is lodged at such a distance from the fracture, that it cannot be extracted through any perforation made in the vicinity of the original injury; for it is a principle which he ventures to lay down, that *when a ball has entered the cranium, without quitting the roof of this cavity, the case is one requiring the application of the trepan.*—(*Mém. de Chir. Mil. t.* 4, *p.* 180.) In the 2d vol. of this work (*p.* 139), the reader will find the account of a soldier, who was struck on the middle of the forehead with a ball which penetrated the os frontis, and then passed obliquely backwards, between the skull and the dura mater, in the course of the longitudinal sinus, as far as the lambdoidal suture, where it stopped. Larrey traced the situation of the ball, by the introduction of an elastic gum catheter into the opening; and measuring the distance between the fracture and the place where he felt the ball, he cut down upon that part of the skull, beneath which he concluded that the ball was lodged. The bone was then perforated with a large trepan; *a good deal of pus was discharged*; the ball was extracted, and the patient recovered. One thing here merits the attention of surgeons: Larrey tells us, that a good deal of pus issued as soon as an opening was made in the skull: there must then have been suppuration under the bone, and inflammation and detachment of the dura mater; circumstances always indicated, according to Pott, by a corresponding separation of the pericranium, and a puffy tumour of the scalp. Did these symptoms take place in the foregoing case, so as to be of any assistance to Larrey, in judging of the place where the ball was lodged? and has the mention of them been omitted only by accident? or are we to infer that suppuration may happen between the cranium and dura mater, without any detachment of the pericranium and puffy tumour of the scalp? a thing which Bichat asserts is proved by daily experience in the Hôtel-Dieu, at Paris.—(See *Œuvres Chir. de Desault, t.* 2, *p.* 29.) Larrey, in his 3d vol. (*p.* 82), gives us another case, in which a ball pierced the left parietal bone, and lodged near the lambdoidal suture. Its situation was detected with the aid of an elastic gum catheter, and partly in consequence of there being a slight ecchymosis over the part. Here a crucial incision was made through the scalp, and a small fissure discovered. As the symptoms of compression increased, the trepan was applied, so as to include the fissure. A half of the ball flattened was found directly under the perforation, and a good deal of blood was voided from the two openings in the cranium. For a fortnight the case went on favourably, but the patient was then attacked with what Larrey terms hospital fever, but which in all probability was inflammation and suppuration of the membranes of the brain, and died.

The records of surgery furnish numerous instances in which the patients lived a considerable time with balls lodged in the cavity of the cranium. Thus, one is related by Paroisse, where the patient soon recovered his senses after the injury, and at the end of six months felt no inconvenience, except a difficulty of opening the mouth.—(*Opuscules de Chir. Obs.* 1, 8*vo. Paris*, 1806.) Ramdohr has published another case, where a soldier was shot through the frontal sinus, and the ball was found after death in the medullary substance of the left hemisphere of the brain, half an inch above the ventricle; yet this patient lived four months after the injury, and soon recovered his senses after its occurrence. For a considerable part of this time he was also free from any bad symptoms. At last he was affected with a kind of stupor, and an inability to open his left eye, and fell into a lethargic and convulsed state.—(*Schmucker, Vermischte Chir. Schriften, b.* 1, *p.* 277.) A French soldier, at the battle of Waterloo, was wounded with a musket-ball, which entered at the anterior portion of the squamous suture, lodged in the substance of the brain, and on the fifth day after an enlargement of the wound, and the removal of seve-

ral fragments of bone, was extracted from the posterior lobe of the right hemisphere of the brain, where it was found resting on the tentorium. Yet, during the several previous days, the man, with the exception of a slight headache, and partial deafness of the right ear, seemed to enjoy perfect health. The case ended well.—(See *Hennen's Mil. Surg. p.* 289, *ed.* 2.) Still more remarkable instances of the duration of life, and even of the absence of very serious symptoms, after great and serious wounds of the brain, and the lodgement of balls, might here be cited; but it will suffice to refer to the instructive Essay of M. Quesnay on the subject, in vol. 1, of the *Mém. de l'Acad. de Chir. 4to.*, and to the account of twenty-two French soldiers, whose vertices, with more or less of the brain, were cut off by sabre-strokes. All these men ultimately died; but at first had not a single bad symptom, and performed a journey of thirty leagues after being wounded, and one-half of this distance on foot.—(See *Paroisse, Opuscules de Chir. p.* 41, *&c.*)

5. *Extravasation under the Cranium, Symptoms of Pressure on the Brain, &c.*

Mr. Pott remarks, "the shock which the head sometimes receives by falls from on high, or by strokes from ponderous bodies, does not unfrequently cause a breach in some of the vessels either of the brain or its meninges, and thereby occasions extravasation of the fluid which should circulate through them. This extravasation may be the only complaint produced by the accident; or it may be joined with, or added to, a fracture of the skull. But this is not all; for it may be produced not only when the cranium is unhurt by the blow, but even when no violence of any kind has been offered to or received by the head."

The effused blood may lie between the cranium and dura mater; between the latter membrane and the arachnoides; on the surface of the pia mater, or under this membrane, on the surface, in the substance, or cavities of the brain. The first species of extravasation, which is observed to be always more or less circumscribed, may occur at any part of the skull, but when situated at its base, is generally fatal. In the second, which is the most common species of extravasation within the dura mater (see *Brodie, in Med. Chir. Trans. vol.* 14, *p.* 333), the blood is widely scattered about between the dura mater and arachnoides, and on this account, unless its quantity be very considerable, it does not cause any great degree of pressure. In the third example, if the blood be situated in the convolutions, it is also widely diffused, but if it be within the substance or ventricles of the brain, which is rare (*Brodie, vol. cit.*), it is circumscribed.—(*Œuvres Chir. de Desault, t.* 2, *p.* 23.) Sometimes in cases of great violence, as Mr. Pott has justly observed, the blood is found at the same time in all these different parts.

According to Mr. Brodie's experience, which confirms the observations of Mr. Abernethy, there is never such hemorrhage from a rupture of the blood-vessels, by which the dura mater is connected to the bone, as will produce dangerous pressure on the brain, except when the middle meningeal artery has been lacerated, from which vessel the bleeding is sometimes very copious. Mr. Brodie has never seen this artery lacerated, except in the combination with a fracture running across the bony canal in which it is situated; but he adverts to other cases, recorded by Mr. Latta and Mr. Abernethy, in which no such fracture accompanied the rupture of the vessel.—(See *Med. Chir. Trans. vol.* 14, *p.* 333.)

Another observation made by Mr. Brodie is, that large extravasations are sometimes found upon the upper surface of the brain, but more frequently at its basis, where they are usually the consequence of a rupture of the substance of the brain. The same surgeon has never seen an instance, in which the blood from a wounded sinus collected between the dura mater and the skull, or between that membrane and the brain, in sufficient quantity to interfere with the functions of the latter organ.

When the blood is extravasated beneath the skull, the violence which produces the rupture of the vessel usually stuns the patient, from which state, provided the quantity and pressure of the blood and the force of the concussion be not too great, he gradually recovers and regains his senses. If the first extravasation be trivial, the patient, after regaining his senses, may only feel a little drowsiness and go to bed. The bleeding from the ruptured vessel continuing, and the pressure on the brain increasing, he becomes more and more insensible, and begins to breathe in a slow, interrupted, stertorous manner. In cases of compression, whether from blood or a depressed portion of the skull, there is a general insensibility; the eyes are half open; the pupils dilated and motionless, even before the vivid light of a candle; the retina is insensible; the limbs relaxed; the breathing stertorous; the pulse slow, and, according to Mr. Abernethy, less subject to intermission, than in cases of concussion. The absence of stertor, however, as this gentleman admits, must not be relied upon as a proof of their being no compression; for Morgagni relates dissections of apoplectic persons, in whom the effusion was considerable, yet no stertor had occurred.

In a case of wound of the posterior part of the skull, with depression, seen by Dr. J. Thomson, the pulse at one time sunk as low as 36 strokes in a minute. This eminent professor, however, is at variance with Mr. Abernethy upon one point, by stating that irregularity of the pulse is a frequent attendant upon compressed brain.—(*Report of Obs. &c. p.* 54, 55.)

Mr. Brodie does not give any positive opinion on the statement made by Mr. Abernethy, that intermission of the pulse is less frequent in compression than concussion; but he expresses his belief, that pressure on the brain for the most part affects the action of the heart; *not by producing actual interruption, but by causing its contractions to be either less frequent, or less forcible than natural.*—(*Med. Chir. Trans. vol.* 14, *p.* 355.) In the cases referred to in Dr. Thomson's report, convulsions sometimes arose from the pressure of portions of the skull, forced inwards upon the brain. This is a very dangerous symptom; but Dr. Thomson saw it cease in a few examples, after the depressed piece of bone had been elevated, and the antiphlogistic regimen adopted.—(*P.* 60.) Convulsions I am disposed to regard, with Bichat, rather as a symptom of injury of the brain, than of compression.—(*Œuvres Chir. de Desault, t.* 2, *p.* 27.)

Mr. Brodie, seemingly unaware of the corresponding remark published in the foregoing work, considers it questionable, whether convulsive twitches of the muscles ought to be regarded as the consequence of simple pressure on the brain? We find them occur, says he, in cases of punctured and wounded brain, where there is no pressure; and whenever he has noticed them as attendant on depression of the skull or extravasated blood, and has afterward had the opportunity of ascertaining the exact nature of the injury, the *pressure has always been found to be complicated with wound or laceration of the substance of the brain.* The convulsive twitches to which Mr. Brodie alludes, he particularly describes as slight and partial, and different from the more violent and general convulsions.—(See *Med. Chir. Trans. vol.* 14, *p.* 352.)

Indeed, the difficulty of the diagnosis of many cases may be well conceived by what Dr. Hennen remarked in his practice; viz. that in some instances the pupils were contracted, in others dilated, where the injury was nearly of a similar nature and degree; while sometimes, in the same patient, one pupil was dilated and the other much contracted. He saw, also, paralysis occur on one side, and convulsions on the other, when the blow had been on the forehead, and the same when it had been on the occiput.—(*Op. cit. p.* 300, 301.)

Mr. Brodie has seen the pupils dilate with the absence, and contract with the presence of light, although the patient lay in a state of complete insensibility, and did not seem to be at all conscious of the impressions made on the retina. He admits, however, that this is a rare occurrence, and that, when the other symptoms of pressure are present, the *pupils are generally insensible and motionless, and mostly dilated*, though sometimes contracted. Every surgeon of experience must be aware of another circumstance mentioned by the same surgeon; namely, that it is not uncommon for the pupils to remain for a time in a state of dilatation, then to become suddenly contracted, and after remaining so for a longer or shorter time, to become again dilated; these changes taking place independently of light and darkness. When the pupils have been dilated, Mr. Brodie has frequently known them to become contracted after the abstraction of blood; the dilatation

returning as soon as the immediate effect of the blood-letting had ceased. He adverts to a curious case, reported by Dr. Hennen, in which blood was extravasated between the membranes of the brain, and the pupils sometimes dilated in an increased light, and contracted in a diminution of it.—(See *Med. Chir. Tyans. vol.* 14, *p.* 352.) Another observation made by Mr. Brodie is, an occasional insensibility of one iris, dilatation of the pupil, and aptosis, continuing after the subsidence of the general insensibility of the body, and even unattended with loss of vision.—(*Vol. cit. p.* 354.)

The patient is hardly ever sick when the pressure on the brain and the general insensibility are considerable; for the very action of vomiting betrays sensibility in the stomach and œsophagus. The truth of this statement, which agrees with Mr. Abernethy's experience, is strikingly confirmed by an observation made by Mr. Brodie; namely, that when he has had occasion to apply the trephine on account of a fracture and depression, and no sickness existed previously, he has sometimes known the patient become sick and vomit immediately the depressed bone was elevated.—(See *Med. Chir. Trans. vol.* 14, p. 356.) These symptoms are not peculiar to pressure from blood, but arise also from that of many depressed fractures of the skull and of suppuration under this part. They are all attributable to the unnatural pressure made on the brain and nerves, and have too often been mistaken as indications of an injury, which, considered abstractedly, can never cause them; I allude to a simple undepressed fracture of the cranium, which may be accompanied with them but cannot cause them. They differ in degree, according to the quantity, kind, and situation of the pressing fluid. The hemorrhage from the nose and ears, which often follows violence applied to the head, is generally conceived to lead to no particular or useful inference: we cannot even calculate, by this sign, that the force has exceeded a certain degree; for such bleedings take place from much slighter causes in some persons than others.

Mr. Brodie's observations on this point merit attention: "There is often a considerable effusion of blood from the ear, especially in cases of fracture of the basis of the cranium. This may, as far as I know, sometimes arise from other sources; but it seems probable that it must in most instances arise from the laceration of the lateral sinus, where it extends downwards behind the petrous process of the temporal bone and the external meatus; and in one instance I ascertained it to have been so by the examination of the body after death. In another case which fell under my observation, there was hemorrhage both from the ear and the nostrils. The patient, a boy, died shortly after the accident; and it was found, on dissection, that there was a fracture of the base of the cranium, with laceration of the cavernous sinus, and that the hemorrhage had taken place from this sinus."—(See *Med. Chir. Trans. vol.* 14, *p.* 334.) According to my experience, bleedings from the ear and nose from injuries of the head are particularly frequent in children, and often manifestly consist of arterial blood.

Paralysis is a symptom which generally attends hurtful pressure on the brain. The particular circumstances, however, which determine its degree, extent, and situation, are not well understood. "In some instances of paralysis from sabre-wounds, as well as in those made by gun-shot (says Dr. J. Thomson), paralysis was confined to the upper, and in others to the lower extremity. *In every instance in which it distinctly appeared that the injury existed on one side of the head, the paralysis uniformly manifested itself upon the other;* but we were unable to perceive any other fixed relation between the part of the brain which had been injured and the part of the body affected with palsy. A wound of the right parietal bone by a musket-ball was followed by palsy of the left arm and leg. In another case, a wound penetrating the upper part of the right parietal bone was accompanied with a slight paralytic affection of the left side of the mouth, and complete palsy of the left leg. In a third case, a sabre-wound of the same bone, followed by extensive exfoliations, gave rise to a complete palsy of the left side."—(*Obs. made in the Military Hospitals in Belgium, p.* 52, 53.)

When the destruction of sensibility is complete, the voluntary muscles are entirely paralyzed. The patient lies motionless in any position in which he happens to be placed. The bladder, incapable of contraction, becomes preternaturally distended with urine; and the relaxation of the sphincter ani allows the involuntary discharge of feces from the rectum. Afterward the muscles of respiration become affected also; the patient breathes with stertor, as in a most profound sleep; and the diaphragm contracts at longer and longer intervals, until respiration altogether ceases. It is this paralysis of the muscles of respiration which in ordinary cases of pressure on the brain is the immediate cause of death. When the loss of sense is imperfect, there are often no marks of paralysis whatever. At other times, there is hemiplegia, which, however, is much more rarely the consequence of accidental violence than of apoplexy. Mr. Brodie conceives that this difference is referrible to the different situation of the pressure. In apoplexy, the extravasation is mostly situated in one of the ventricles, or in the substance of the brain; but after a blow on the head, the cause of pressure commonly operates upon the surface.—(*Med. Chir. Trans. vol.* 14, *p.* 349, 350.)

With respect to paralysis, it is unquestionably one of the common symptoms of pressure on the brain; but, according to Bichat, it may also be caused by concussion; and we know that it may arise in cases of inflammation and suppuration within the skull. The above statement respecting the paralysis being always on the side of the body opposite that on which the brain is compressed, agrees with what is generally remarked by other surgical writers.—(See *Larrey's Mém. de Chir. Mil. t.* 4, *p.* 180; *Hennen's Principles*, p. 301, *ed.* 2, *&c.*) Yet, at the Hôtel-Dieu, at Paris, extravasation has very often been noticed both on the side affected with paralysis and on the opposite one; or else the blood was generally diffused, while the paralysis was local.—(*Œuvres Chir. de Desault, t.* 2, *p.* 27.)

The preceding class of symptoms only informs us, that the brain is suffering compression; and leaves us quite in the dark respecting several other very important circumstances. "We not only have no *certain infallible* rule, whereby to distinguish what the pressing fluid is, or where it is situated, but we are, in many instances, absolutely incapable of knowing whether the symptoms be occasioned by any fluid at all; *for a fragment of bone broken off from the internal table of the cranium, and making an equal degree of pressure, will produce exactly the same complaints.*"—(*Pott.*) In detailing the symptoms of pressure from blood, I took particular notice of the patient being at first generally stunned by the blow, of his gradually regaining his senses, and of his afterward relapsing into a state of insensibility again. *The interval of sense* which thus occurs, was pointed out by Petit as a circumstance of the greatest consequence in elucidation of the nature of the case.

"A concussion and an extravasation (as Mr. Pott observes) are very distinct causes of mischief, though not always very distinguishable.

M. Le Dran, and others of the modern French writers, have made a very sensible and just distinction between that kind and degree of loss of sense which arises from a mere commotion of the brain, and that which is caused by a mere extravasation, in those instances in which the time of the attack or appearance of such symptoms are different or distinct. The loss of sense which immediately follows the violence, say they, is most probably owing to a commotion; but that which comes on after an interval of time has passed is most probably caused by extravasation.

This distinction is certainly just and good as far as it will go. That degree of abolition or diminution of sense which immediately attends or follows the blow or fall, and goes off again without the assistance of art, is in all probability occasioned by the sudden shake or temporary derangement of the contents of the head: and the same kind of symptoms recurring again some time after they had ceased, or not coming on until some time has passed from the receipt of the violence, do most probably proceed from the breach of a vessel within or upon the brain. But, unluckily, we have it not very often in our power to make this exact distinction. An extravasation is often made so immediately, and so largely, at the instant of the accident, that all sense and motion are instantaneously lost, and never again return. And it also sometimes happens, that although an extravasation may possibly not have been made at the moment of the accident, and the first complaints may have been owing to commotion merely, yet

a quantity of fluid having been shed from its proper vessels very soon after the accident, and producing its proper symptoms, before those caused by the commotion have had time to go off, the similarity of the effects of each of these different causes is such, as to deprive us of all power of distinguishing between the one and the other, or of determining, with any tolerable precision, to which of them such symptoms as remain are really owing."

A man meets with a fall; a slight concussion of the brain is the consequence, and the patient is instantly stunned. The effects of concussion gradually subside, but an extravasation takes place, and the loss of the senses continues, though from a different cause. Here, according to the principles of Petit, the case would be set down as concussion; yet, things are quite the contrary, the extravasation now keeping up the symptom which was only temporarily produced by concussion. In many instances, also, the effects of concussion and extravasation exist together, and then how is a surgeon to judge of the nature of the case?—(See *Œuvres Chir. de Desault*, *t.* 2, *p.* 25.)

"When an extravasation of any kind is made either upon or within the brain, if it be in such quantity, or so situated, as to disorder the economy of the animal, it always produces such disorder by making an unnatural pressure on the parts where it lies. The nature and degree of the symptoms hereby produced are various and different in different persons, according to the kind, quantity, and situation of the pressing fluid. Sometimes it is merely fluid blood, sometimes blood in a state of coagulation; sometimes it is a clear lymph, and at others blood and water are found mixed together: each of these is found either simple or mixed in different situations, that is, between the skull and dura mater, between the dura and pia mater, or in the natural cavities of the brain called its ventricles, and sometimes, in cases of great violence, they are found at the same time in all these different parts. Sometimes a considerable quantity is shed instantly at the time of the accident; and sometimes the breach by which the effusion is made is so circumstanced, both as to nature and situation, that it is at first very small, and increases by faster or slower degrees. In the former, the symptoms are generally immediate and urgent, and the extravasation is of the bloody kind; in the latter, they are frequently slight at first, appear after some little interval of time, increase gradually till they become urgent or fatal, and are in such case generally occasioned by extravasated lymph. So that although the immediate appearance of bad symptoms does most certainly imply mischief of some kind or other, yet, on the other hand, no man ought to suppose his patient free from hazard, either because such symptoms do not show themselves at first, or because they appear to be but slight; those which come on late, or, appearing slight at first, increase gradually, being full as much to be dreaded, as to consequence, as the more immediately alarming ones; with this material difference between them, that the one *may* be the consequence of a mere concussion of the brain, and may by means of quietude and evacuation go quite off; whereas, the other being most frequently owing to an extravasation of lymph (though sometimes of blood also) within the substance of the brain, are very seldom removed by art."—(*Pott.*)

The case of extravasation between the cranium and dura mater is almost the only one which admits of relief from trephining. Mr. Abernethy informs us, that in the cases which he has seen of blood extravasated between the dura and pia mater, on a division of the former membrane being made for its discharge, only the serous part of it could be evacuated; for the coagulum was spread over the hemisphere of the brain, and had descended as low as possible towards its inferior part, so that very little relief was obtained by the operation.—(*Surgical Works, vol.* 2, *p.* 46.) This statement is confirmed by that of Bichat, and the practice inculcated agrees with what Sir Astley Cooper also directs, as will be presently noticed.

Fractures of the cranium which take place across the lower and front angle of the parietal bone, and the rest of the track of the trunk, and large branches of the spinous artery of the dura mater, are cases very apt to be attended with a copious extravasation. This vessel, and others more deeply seated, however, may be ruptured, pour out a considerable quantity of blood, and induce urgent symptoms of pressure on the brain, not only without the co-existence of a fracture, but even of any external mark of violence on the scalp.

The effused blood is frequently situated below the part on which the violence has operated, and hence, when such part is pointed out by a wound or discoloration of the scalp, or a fracture, and the symptoms of pressure are considerable, I should have no hesitation about immediately trephining in the situation of the external injury. I have seen many cases in which such practice was justified by the result, and even when no extravasation exists, this plan will sometimes detect a depression of the inner table of the skull, and be the means of saving life, as happened in one very remarkable case, which I trephined at Brussels after the battle of Waterloo. At the same time, it would be wrong to hold out the expectation, that by acting on this principle, the surgeon will always find blood immediately under the part of the cranium which he perforates. With respect to a fracture also, as a guide to the place for the application of the trephine in cases of extravasation, Desault regards it as very fallacious, dissections proving that numerous fractures of the skull are unattended with any effusion of blood immediately under them; and his experience taught him that the most frequent cases were those in which there was either extravasation without fracture, or a fracture with blood effused in a part of the head remote from the injury of the bone.—(*Œuvres Chir. t.* 2, *p.* 130.) Even when blood is seen issuing from the fissure, he regards it as no proof of the dura mater being detached, as such blood may proceed from the vessels of the diploe.—(*P.* 31.) But what is to be done when dangerous symptoms of pressure prevail, without any external mark to denote what part of the head has received the blow, or whether any at all? for a general concussion of the head may produce an effusion of blood within the cranium. Under these circumstances, Mr. Pott was against the operation, and says, that "the only chance of relief is from phlebotomy and an open belly; by which we may hope so to lessen the quantity of the circulating fluids as to assist nature in the dissipation or absorption of what has been extravasated. This is an effect which, although not highly improbable in itself, yet is not to be expected from a slight or trifling application of the means proposed. The use of them must be proportioned to the hazard of the case. Blood must be drawn off freely and repeatedly, and from different veins; the belly must be kept constantly open, the body quiet, and the strictest regularity of general regimen must be rigidly observed. By these means, very alarming symptoms have now and then been removed, and people in seemingly very hazardous circumstances have been recovered." Desault also promulgated the same advice, and blamed the doctrine formerly in vogue, that it was better to apply the trephine many times uselessly than to let a single extravasation remain undetected; for he was firmly convinced that the trephine, when used on this principle, was a source of greater mischief than the effused blood itself.—(*Œuvres Chir. t.* 2, *p.* 34.) The same doctrine is espoused by Sir Astley Cooper (*Lectures, &c. vol.* 1, *p.* 288), and, I believe, by all the best modern surgeons.

But should the mode of judging whether blood lies immediately under the skull, suggested by Mr. Abernethy, prove invariably correct, the question whether the trephine should be applied or not, may in future be more easily determined. Even when the injured scalp shows where the violence has operated, the criterion about to be noticed may inform us whether we should perforate the bone or not; for though the extravasation is sometimes found immediately under the external mark, yet it often is not so, but is in a part distant from that mark, to which situation we have nothing to lead us, and to which, indeed, if we knew it, we could not reach. Mr. Abernethy has observed, "that unless one of the large arteries of the dura mater be wounded, the quantity of blood poured out will probably be inconsiderable; and the slight compression of the brain, which this occasions, may not be attended with any peculiar symptoms, or perhaps it may occasion some stupor, or excite an irritation, disposing the subjacent parts to become inflamed. It is indeed highly probable, that in many cases which have done well without an operation, such an extravasation has existed. But if there be so much blood on the dura mater as materially to derange the functions of the brain, the bone, to a

certain extent, will no longer receive blood from within, and by the operation performed for its exposure, the pericranium must have been separated from its outside. I believe that a *bone so circumstanced will not be found to bleed;* and I am at least certain it cannot with the same freedom and celerity as it does when the dura mater remains connected with it internally."—(See *Abernethy's Surgical Works, vol.* 2, *p.* 47.) In some cases related by this gentleman, there was no hemorrhage; twice he was able, by attending to this circumstance, to tell how far the detachment of the dura mater extended; and often, when symptoms seemed to demand a perforation of the skull, he has seen the operation contra-indicated by the hemorrhage from the bone, and, as the event showed, with accuracy. Mr. Abernethy admits, however, that in aged persons, and in those in whom the circulation has been rendered languid by the accident, the mode of distinction which he has pointed out will be less conclusive.

Pott remarks, that "if the extravasation be of blood, and that blood be in a fluid state, small in quantity, and lying between the skull and dura mater, immediately under or near to the place perforated, it may happily be all discharged by such perforation, and the patient's life may thereby be saved; of which many instances are producible. But if the event does not prove so fortunate, if the extravasation be so large or so situated that the operation proves insufficient, yet the symptoms having been urgent, general evacuation having been used ineffectually, and a wound or bruise of the scalp having pointed out the part which most probably received the blow, although the removal of that part of the scalp (a simple incision ought to have been said) should not detect any injury done to the bone, yet the symptoms still subsisting, I cannot help thinking that perforation of the cranium is in these circumstances so fully warranted, that the omission of it may truly be called a neglect of having done that which might have proved serviceable, and, *rebus sic stantibus*, can do no harm. It is very true, that no man can beforehand tell whether such operation will prove beneficial or not, because he cannot know the precise nature, degree, or situation of the mischief; but this uncertainty, properly considered, is so far from being a dissuasive from the attempt, that it is really a strong incitement to make it; it being fully as impossible to know that the extravasated fluid does *not* lie between the skull and dura mater, and that under the part stricken, as that it *does;* and if the latter should be the case, and the operation be not performed, one, and most probably the only, means of relief will have been omitted."

On some of the foregoing points, Mr. Brodie's advice coincides very much with the precepts of Mr. Abernethy, and with the doctrines which have been for many years inculcated in this work. Blood, he observes, is seldom poured out in any considerable quantity between the dura mater and the bone, except in consequence of a laceration of the middle meningeal artery, or one of its principal branches. If, therefore, we find the patient lying in a state of stupor, and discover a fracture with or without depression, extending in the direction of the middle meningeal artery, Mr. Brodie is an advocate for the trephine. When no fracture is discoverable, but there is other evidence of the injury having fallen on that part of the cranium under which the middle meningeal artery is situated, the trephine, he says, may be employed on speculation, rather than that the patient should be left to die without any attempt being made for his preservation.—(See *Med. Chir. Trans. vol.* 14, *p.* 385.)

When there is no interval of sense between the blow and the coming on of perilous symptoms, it is frequently impossible to determine whether the mischief be owing to the largeness and suddenness of the extravasation, to the violence of the shock which the brain has received, or to both these causes at once, which, unfortunately, is too often the case. In this latter complication, indeed, trephining will frequently be of no avail, even though it serve for the entire removal of all pressure off the brain; for the patient cannot recover from the violence of the concussion, and never regains his senses. This is no reason, however, why the chance of the operation doing good should not be taken when there are evident symptoms of pressure. Let us, in these darkened cases, call to mind the sentiments of Pott, who says, "No man who is at all acquainted with this subject will ever venture to pronounce or promise success from the use of the trephine, even in the most apparently slight cases: he knows that honestly he cannot: it is enough that it has often been successful where and when every other means has failed. The true and just consideration is this: does the operation of perforating the cranium in such case add at all to that degree of hazard which the patient is in before it is performed? or can he in many instances do well without it? If it does add to the patient's hazard, that is certainly a very good reason for laying it aside, or for using it very cautiously; but if it does not, and the only objection made to it is, that it frequently fails of being successful, surely it cannot be right to disuse that which has often been, not only salutary, but the *causa sine qua non* of preservation, merely because it is also often unsuccessful, that is, because it is not infallible."

Giving vent to the confined blood "may produce a cure, or it may prove only a temporary relief, according to the different circumstances of different cases. The disappearance and even the alleviation of the most pressing symptoms, is undoubtedly a favourable circumstance, but is not to be depended upon as absolutely portending a good event. Either a bloody or limpid extravasation may be formed or forming between the meninges, or upon or within the brain, and may prove as certainly pernicious in future, as the more external effusion would have done had it not been discharged; or the dura mater may have been so damaged by the violence of the blow as to inflame and suppurate, and thereby destroy the patient.

If the disease lies between the dura and pia mater, mere perforation of the skull can do nothing; and, therefore, if the symptoms are pressing, there is no remedy but division of the outer of these membranes. The division of the dura mater is an operation which I have several times seen done by others, and have often done myself; I have seen it, and found it now and then successful; and, from those instances of success, am satisfied of the propriety and necessity of its being sometimes done." He next states, however, his sentiment, that wounding the dura mater is itself attended with dangerous consequences. Mr. Abernethy's opinion of such operation has already been given. It is also disapproved of by Sir Astley Cooper, who says, that if blood be not found between the dura mater and skull, do not puncture the dura mater to seek for it; which would be of no use, as the blood is coagulated, and could not escape, being seated under the pia mater, or in the brain itself.—(*Lectures, &c. p.* 289.)

If, after the removal of a portion of bone, the dura mater should present itself of a blue colour, be lifted up by blood underneath it, and bulge, as it were, into the aperture, Mr. Brodie approves of a puncture being made in that membrane; and, though he joins Pott in regarding a wound of the dura mater as a dangerous measure itself, he considers it here justified by circumstances, and supports his advice by a reference to a case in which Mr. Chevalier thus discharged a considerable quantity of blood, and the patient recovered. —(See *Med. and Physical Journ. vol.* 8, *p.* 505.) He has also adduced another instance of the success of the practice, in the hands of my friend and neighbour Mr. Ogle.

Upon the removal of a piece of bone by means of the trephine; if the operation has been performed over the part where the disease is situated, and the extravasation be of the fluid kind, and between the cranium and dura mater; such fluid, whether it be blood, water, or both, is immediately seen, and is partly discharged by such opening: if, on the other hand, the extravasation be of blood in a coagulated or grumous state, it is either loose or in some degree adherent to the dura mater; if the former of these be the case, it is either totally or partially discharged at the time of, or soon after, the operation, according to the quantity or extent of the mischief; if the latter, the perforation discovers, but does not immediately discharge it." Mr. Pott then lays it down as a rule, that a large extravasation must necessarily require a more free removal of bone than a small one; and a grumous or coagulated extravasation a still more free use of the instrument.

In applying the trephine, on account of a fracture with depression, Mr. Brodie deems the removal of a small portion of bone generally sufficient; but when

blood is extravasated on the surface of the dura mater, he recommends the bone to be more freely taken away. He founds this advice on the circumstances of a case which he has recorded, where a more limited opening did not give a sufficiently ready outlet to the suppuration that ensued, and the patient died.—(See *Med. Chir. Trans. vol.* 14, *p.* 386.)

In the treatment of pressure from extravasation, Sir Astley Cooper joins the generality of surgeons in recommending free depletion, in order to prevent inflammation; the bowels, he says, are to be opened, and the patient kept very quiet. "If there be a bruise, indicating the spot at which the injury has been sustained, you may trephine *after every other means has been tried ineffectually*. If a fracture exists, and the symptoms do not yield to depletion, you will trephine to seek the extravasation."—(*Lectures, p.* 288.)

All cases of pressure on the brain are attended with hazard of inflammation of this organ and its membranes. The danger must be averted as much as possible, by applying cold washes to the head, and employing free and repeated bleeding, leeches, antimonials, saline purgatives, and other antiphlogistic means. After the depleting method has been continued some time, blisters may be applied to the head, and the cold wash omitted.

CONCUSSION OR COMMOTION OF THE BRAIN.

It is observed by Mr. Pott, that "very alarming symptoms, followed sometimes by the most fatal consequences, are found to attend great violence offered to the head; and, upon the strictest examination both of the living and the dead, neither fissure, fracture, nor extravasation of any kind can be discovered. The same symptoms, and the same event, are met with, when the head has received no injury at all *ab externo*, but has only been violently shaken; nay, when only the body or general frame has seemed to have sustained the whole violence." And he afterward remarks, that "the symptoms attending a concussion are generally in proportion to the degree of violence which the brain itself has sustained, and which, indeed, is cognizable only by the symptoms. If the concussion be very great, all sense and power of motion are immediately abolished, and death follows soon; but between this degree and that slight confusion (or stunning as it is called) which attends most violences done to the head, there are many stages." But besides the foregoing description of concussion, which seems rather to consist in a lesion of function than in any visible disorganization, Sir Astley Cooper has found the more violent degrees of it attended with laceration of the brain, and slight extravasation.—(*Lectures, &c. p.* 262.) The latter, however, are rather to be considered as compound cases than as instances of pure concussion. Mr. Brodie has observed, that the symptoms of concussion do not depend upon any such derangement of the organization of the brain as admits of being disclosed to us by dissection; yet he thinks the inference not justified, that there is really no organic change. It is difficult, he says, to conceive in what other manner concussion of the brain can operate so as to produce the effects which it is known to produce; and if we consider that the ultimate structure of the brain is on so minute a scale that our senses are incapable of detecting it, it is evident that there may be changes and alterations of structure which our senses are also incapable of detecting.—(*Brodie in Med. Chir. Trans. vol.* 14, *p.* 337.)

Mr. Abernethy, I think, has removed a good deal of the perplexity of this subject by dividing concussion into three stages. In fact, without discriminating them, the various descriptions of the symptoms, as given by different writers, cannot be at all reconciled.

"The *first* is, that state of insensibility and derangement of the bodily powers which immediately succeeds the accident. While it lasts, the patient scarcely feels any injury that may be inflicted on him. His breathing is difficult, but in general without stertor; his pulse intermits, and his extremities are cold. But such a state cannot last long; it goes off gradually, and is succeeded by another, which I consider as the *second* stage of concussion. In this, the pulse and respiration become better, and though not regularly performed, are sufficient to maintain life, and to diffuse warmth over the extreme parts of the body. The feeling of the patient is now so far restored, that he is sensible if his skin be pinched; but he lies stupid and inattentive to slight external impressions. As the effects of concussion diminish, he becomes capable of replying to questions put to him in a loud tone of voice, especially when they refer to his chief suffering at the time, as pain in the head, &c.; otherwise he answers incoherently, and as if his attention was occupied by something else. As long as the stupor remains, the inflammation of the brain seems to be moderate; but as the former abates, the latter seldom fails to increase; and this constitutes the *third* stage, which is the most important of the series of effects proceeding from concussion.

These several stages vary considerably in their degree and duration; but more or less of each will be found to take place in every instance where the brain has been violently shaken. Whether they bear any certain proportion to each other or not, I do not know. Indeed, this will depend upon such a variety of circumstances in the constitution, the injury, and the after-treatment, that it must be difficult to determine.

With regard to the treatment of concussion, it would appear that in the first stage very little can be done; and, perhaps, what little is done had better be omitted, as the brain and nerves are probably insensible to any stimulants that can be employed. From a loose and, I think, fallacious analogy between the insensibility in fainting and that which occurs in concussion, the more powerful stimulants, such as wine, brandy, and volatile alkali, are commonly had recourse to, as soon as the patient can be got to swallow. The same reasoning which led to the employment of these remedies in the *first* stage, in order to recall sensibility, has given a kind of sanction to their repetition in the *second* with a view to continue and increase it.

But here the practice becomes more pernicious and less defensible. The circumstance of the brain having so far recovered its powers as to carry on the animal functions in a degree sufficient to maintain life, is surely a strong argument that it will continue to do so, without the aid of means which probably tend to exhaust parts already weakened by the violent action they induce.

And it seems probable that these stimulating liquors will aggravate that inflammation which must sooner or later ensue."—(*Essay on Injuries of the Head, p.* 59.)

In most cases of concussion, the patient vomits after the accident. According to Mr. Brodie, sickness and vomiting are generally early symptoms, and seldom continue after the patient has recovered from the first shock of the accident.—(*Med. Chir. Trans. vol.* 14, *p.* 339.) In the beginning, a torpor exists in the intestinal canal, and considerable difficulty in procuring an evacuation; but afterward the feces are sometimes involuntarily discharged; and the bladder becomes distended, so as to require the catheter; but after a time, the urine also comes away involuntarily. There is sometimes bleeding at the nose, and a part of the blood which drops into the throat is vomited up. The pupils of the eyes are generally natural; but if changed, both are a little dilated, or sometimes only one. The state of the pupils, however, is differently represented by different writers, and my experience has taught me that it is subject to much variety. In that stage in which the sensibility of the patient is impaired, but not annihilated, "the pupils contract on exposure to light, and are sometimes more contracted than under ordinary circumstances."—(*Brodie, vol. cit. p.* 338.) According to Sir Astley Cooper, the pulse, although natural when the patient is undisturbed, scarcely ever fails to be quickened by any exertion made by the patient: and the carotids sometimes pulsate with great force; but the latter symptom is generally not noticed till after a few hours. The state of the pulse is very different, according to the stage of the disorder. In severe cases, the pulse is at first intermitting, irregular, feeble, perhaps scarcely perceptible, and the patient in a condition approaching that of syncope. Such may be his situation for several hours after the accident. When concussion proves fatal, the cause of death is imputed by Mr. Brodie to this disturbance of the action of the heart. "In general, when the patient has lain for some time in the state which has been described, a reaction of the circulating system takes place, and the pulse beats with greater strength in proportion as the failure of it was greater in the first instance. But where the shock has been unusually severe, there is no such

reaction. The pulse becomes more and more feeble, more irregular and intermittent; the extremities grow cold, and at last the action of the heart being altogether suspended, the patient expires. In some cases, even after reaction has begun to take place, it seems as if the constitution were unequal to the effort: there is another failure of the circulation, the result of which is the same as if the patient had never rallied from the beginning."—(*Brodie, in Med. Chir. Trans. vol.* 14, *p.* 341.) The mind, as Sir Astley Cooper remarks, is variously affected, according to the degree of injury which the patient has sustained. In some cases, there is a total loss of mental power; in others, the patient is capable, though with difficulty, of being roused to make a rational answer, but immediately sinks again into coma. Sometimes the memory is lost; while in other instances, it is only partially impaired. A total forgetfulness of any foreign language is a common effect of concussion. It frequently happens that the patient, when roused, will be perfectly sensible and answer questions rationally; but if left undisturbed, the mind appears to be occupied by some particular circumstance (often an incoherent one), of which he is constantly talking. Patients recollect nothing about the mode in which their accidents took place. If the injury has been occasioned by a fall from a horse, they can only remember mounting and riding to some distance, but not that the animal ran away or threw them; nor, however perfectly they may recover in other respects, do they ever have any recollection of the kind of accident. The change produced by injuries of the brain is remarked to be somewhat similar to the effects of age; the patient loses impressions of a recent date, and is sensible of those which he received in his earlier years. But, as Sir Astley correctly explains, the degree of injury sustained by the brain varies considerably in different cases. Some patients are only stunned, or deprived of sense for a moment; others recover in a few hours; some remain in a great degree insensible for fifteen or twenty days. Some recover entirely; others have afterward an imperfect memory. A partial loss of sense will be produced in the function of one eye, or deafness in one ear; and so of volition, the squinting caused by an injury of the brain being sometimes permanent. In some cases a degree of fatuity; in some, great irritability; in others, vertigo, and tendency to severe headache from the slightest excitement, will remain. In one example seen by Sir Astley Cooper, a remarkable irritability of the stomach and disposition to vomit were the permanent consequences of a concussion of the brain. In particular instances, the faculty of readily uttering the proper words for expressing ideas is lost and never regained, and wrong terms are used. Often the judgment remains enfeebled.—(*Lectures, vol.* 1, *p.* 254, *&c.*) Many of the observations in the foregoing statement coincide with the accounts given of the subject in the writings of Bichat and Desault.

The following passage, extracted from a writer who has already been of material assistance in this article, cannot be too deeply impressed on the memory of every surgical practitioner.

"To distinguish between an extravasation and commotion by the symptoms only, is frequently a very difficult matter, sometimes an impossible one. The similarity of the effects in some cases, and the very small space of time which may intervene between the going off of the one and accession of the other, render this a very nice exercise of the judgment. The first stunning or deprivation of sense, whether total or partial, may be from either, and no man can tell from which; but when these first symptoms have been removed, or have spontaneously disappeared, if such patient is again oppressed with drowsiness or stupidity, or a total or partial loss of sense, it then becomes most probable, that the first complaints were from commotion, and that the latter are from extravasation; and the greater the distance of time between the two, the greater is the probability not only that an extravasation is the cause, but that the extravasation is of the limpid kind, made gradatim, and within the brain.

When there is no reason to apprehend any other injury, and commotion seems to be the sole disease, plentiful evacuation by phlebotomy and lenient cathartics, a dark room, the most perfect quietude, and a very low regimen, are the only means in our power; and are sometimes successful."—(*Pott.*) When the patient is at all sensible, every thing likely to irritate the mind is to be avoided.—(*A. Cooper, Lectures, &c. p.* 279, *vol.* 1.)

With these means should also be associated the constant application to the head of cloths dipped in very cold water, or Schmucker's frigorific lotion. When the effects of the violence are not necessarily fatal in a very short time after the accident, the great danger which is to be guarded against is certainly inflammation of the brain. Hence the necessity of freely employing the lancet and antiphlogistic means. The discrimination which Mr. Abernethy introduced into the views of the present subject, by his division of concussion into three stages, has led also to more rational and successful practice. For, though bleeding is now generally allowed to be the great means of relief in concussion, it is not rashly practised at the beginning of many cases, when the pulse can hardly be felt, when the circulation scarcely goes on, and every action in the system is nearly annihilated. But the state of the pulse and circulation is closely watched, and the surgeon bleeds in sufficient time and quantity, to prevent in many instances that immoderate frequency and hardness which the pulse always has a tendency in these cases to assume, immediately the first shock of the accident begins to abate. "Bleeding," as Sir Astley Cooper correctly notices, "may be carried to excess. You must, in the repetition of bleeding, regulate your conduct by the symptoms; observe whether there be any hardness in your patient's pulse, and whether he complains of pain in the head, if he have still the power of complaining. Watch your patient with the greatest possible anxiety; visit him at least three times a day: and if you find any hardness of the pulse supervening after the first copious bleeding, take away a tea-cupful of blood; but do not go on bleeding him largely; for you would, by this means, reduce the strength too much, and prevent the reparative process of nature." Sir Astley admits, however, that it is frequently necessary to take away blood after the first bleeding; but he directs this to be generally done in small quantities. He acknowledges, also, that it is sometimes necessary to take away large quantities by repeated bleedings.—(*P.* 271.) The recovery of many cases which have fallen under my own observation, I have imputed to the frequent and even copious abstraction of blood, by means of the lancet, leeches, and cupping; at the same time, I know that this practice is often carried beyond all moderation, without due attention to those circumstances which I have mentioned as the proper guide.

I believe, with Mr. Abernethy and Mr. Brodie, that in the very first stage of concussion, when all the powers of life are depressed, cordials and stimulants can rarely be employed with advantage. The latter gentleman has lately offered some considerations against the method which merit attention. There are, he observes, sufficient reasons why we should regard that condition of the system which approaches to syncope, as being mostly conducive to the patient's welfare, and why we should wish to prolong rather than abridge the period of its duration. The same blow which gives rise to symptoms of concussion, he remarks, frequently occasions the rupture of some small vessels within the cranium. The same state of the system which produces an enfeebled action of the heart, is calculated to prevent the ruptured vessels from pouring out their contents; and the longer it continues, the less is the danger of internal hemorrhage. If we excite the action of the heart with wine and ammonia, we may bring on symptoms of pressure on the brain. If, on the contrary, we watch the gradual restoration of the pulse, and bleed at the proper moment in quantity sufficient to keep down the action of the heart, we may often check extravasation. Mr. Brodie also argues, that as the state of depression is followed by one of excitement, it is another strong consideration in favour of avoiding stimuli, and having recourse to bleeding in time to prevent the action of the heart from becoming too vehement.—(See *Med. Chir. Trans. vol.* 14, *p.* 377.)

With respect to emetics, I have no confidence myself in their usefulness in cases of concussion, and much doubt even their safety, especially when the disorder is complicated with extravasation (*A. Cooper, Lectures, &c. vol.* 1, *p.* 276), a point often incapable of positive decision.

Purgative an antimonial medicines should be prescribed, and a low regimen enjoined. After bleeding has been freely practised and the bowels emptied, blisters on the scalp and nape of the neck are frequently very useful in preventing or lessening the tendency to inflammation of the brain and its membranes.

As bleeding from the arm cannot be employed in young children, Sir A. Cooper recommends the exhibition of calomel, with acescent drinks, so as to purge them; and leeches, or opening the jugular vein.

For the relief of certain symptoms, frequently remaining after concussion, as pain in the head, giddiness, diminution of sight, and deafness, Sir A. Cooper directs the head to be washed with spirit of wine and water, or the use of the shower-bath. Sometimes he orders the ung. canthar. to be rubbed on the head, and pil. hydrarg. and extr. colocynth. to be given. In cases of nervous debility of an organ, electricity is sometimes useful; and occasionally, in long-continued pains of the head, he forms an issue in the scalp, benefit sometimes resulting even from slight exfoliations.—(*Lectures, vol.* 1, *p.* 280.) These measures are infinitely more prudent than the old custom of trephining.

I cannot conclude this article without adverting to the great propensity to relapse, after patients have long appeared out of every danger from wounds of the head, the bad symptoms sometimes coming on again, and proving fatal many years after the original injury, as is strongly exemplified in a case related in a work of high character.—(See *Schmucker's Vermischte Schriften, b.* 1, *p.* 247.)

[In the third number of the *Amer. Jour. of the Med. and Phys. Sciences*, Professor Sewall, of Washington city, has reported two cases of fracture of the cranium, with *loss of a portion of the substance of the brain.* The wound in one of them was inflicted with a spade, which penetrated through the dura mater and into the medullary portion of the brain. The antiphlogistic treatment was relied upon from the commencement, and during the suppuration which followed: the brain itself protruded and sloughed away, and subsequently portions of it were removed by the spatula. This patient, nevertheless, recovered entirely in six weeks after the accident.

Professor Dudley has also written a valuable paper on injuries of the head, which may be found in the first number of the *Transylvania Journal of Medicine.* He reports a number of cases of epilepsy occurring after injuries of the cranium, which he has cured by trephining. In confirmation of his views I may here refer to a case published in the 5th vol. of the *N. Y. Med. and Phys. Journal*, in which epilepsy, originating from depression of bone, was cured by trephining, by Dr. David L. Rogers, of this city.—*Reese.*]

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HEMERALOPIA. According to M. Dujardin, this term is derived from ἡμέρα, the day, ἀλαὸς, blind, and ὤψ, the eye, and its right signification is therefore inferred to be *diurna cæcitudo*, or *day-blindness.*—(See *Journal de Méd. t.* 19, *p.* 348.) In the same sense, Dr. Hillary (*Obs. on the Diseases of Barbadoes, p.* 298, *edit.* 2) and Dr. Heberden (*Med. Trans. vol.* 1, *art.* 5) have employed the term.

Hemeralopia, then, which is of very rare occurrence, stands in opposition to the *nyctalopia* of the ancients, or *night-blindness.* Numerous modern writers, however, have used these terms in the contrary sense; considering the hemeralopia as denoting sight during the day, and blindness in the night; and nyctalopia as expressing night-seeing, owl-sight, as the French call it, and blindness during the daytime.

Hemeralopia, in the meaning of day-blindness, is a very uncommon affection. Dr. Hillary never met with but two examples. He mentions a report, however, that there are a people in Siam, in the East Indies, and also in Africa, who are subject to the disease of being blind in the daytime, and seeing well by night.—(*Mod. Univ. Hist. vol.* 7.)

According to Sauvages, hemeralopia (in his nomenclature called *amblyopia crepuscularis*) was in some degree epidemic in the neighbourhood of Montpellier, in the villages in damp situations, adjoining rivers, and it particularly affected the soldiers, who slept in the open damp air. They were cured, he says, by blistering, together with emetics and cathartics, and other evacuants.—(*Nosol. Method. class* 6, *gen.* 3, *spec.* 1.)

See some ingenious observations on the subject in *Dr. Rees's Cyclopædia, art. Hemeralopia*, and by Mr. Bampfield, in *Med. Chir. Trans. vol.* 5, *p.* 34, *&c.*

Scarpa, with the generality of modern writers, has considered hemeralopia as an affection, in which the patient sees very well in the day, but not in the nighttime.

The abolition of eyesight by night (observes Mr. Bampfield) has occurred in all ages, and is a common disease of seamen in the East and West Indies, Mediterranean, and in all hot and tropical countries and latitudes, and affects more or less the natives likewise of those regions of the globe. It also occurs frequently among soldiers in the East and West Indies; but he has been informed that it is by no means so prevalent among them as sailors. It is not an uncommon complaint of the Lascars employed in the East India Company's ships trading between India and Europe. It has very rarely indeed affected the officers of his Majesty's or of the East India Company's ships. Celsus has remarked, that women and virgins, whose menstrual returns are regular, are exempt from this disease (*lib.* 6, *cap.* 6); and it may be observed, that the inhabitants of cold latitudes are less subject to hemeralopia in their own climate, than the natives of tropical countries are in theirs; but more so, when they visit the tropics.—(*Med. Chir. Trans. vol.* 5, *p.* 38.)

"*Hemeralopia*, or *nocturnal blindness* (says Scarpa), is properly nothing but a kind of imperfect periodical amaurosis, most commonly sympathetic with the stomach. Its paroxysms come on towards the evening, and

disappear in the morning. The disease is endemic in some countries, and epidemic at certain seasons of the year in others.

At sunset, objects appear to persons affected with the complaint, as if covered with an ash-coloured veil, which gradually changes into a dense cloud, which intervenes between the eyes and surrounding objects. Patients with hemeralopia have the pupil, both in the day and night-time, more dilated and less moveable than it usually is in healthy eyes. The majority of them, however, have the pupil more or less moveable in the daytime, and always expanded and motionless at night. When brought into a room faintly lighted by a candle, where all the bystanders can see tolerably well, they cannot discern at all, or in a very feeble manner, scarcely any one object: or they only find themselves able to distinguish light from darkness: and at moonlight their sight is still worse. At daybreak they recover their sight, which continues perfect all the rest of the day till sunset."—(*Cap.* 19, *p.* 322, *ed.* 8*vo.*)

According to Mr. Bampfield, the disease always affects both eyes at the same time. "In general (says this gentleman), the nocturnal blindness is at first partial, the patient is enabled to see objects a short time after sunset, and perhaps will be able to see a little by clear moonlight. At this period of the complaint, he is capable of seeing distinctly by bright candlelight. The nocturnal sight, however, becomes daily more impaired and imperfect; and, after a few days, the patient is unable to discriminate the largest objects after sunset, or by moonlight, &c.; and finally, after a longer lapse of time, he cannot perceive any object distinctly by the brightest candlelight. If the patient is permitted to remain in this state of disease, the sight will become weak by daylight, the rays of the sun will be too powerful to be endured, whether they are direct or reflected; lippitude is sometimes induced; myopism, or shortness of sight succeeds; and in progress of time vision becomes so impaired and imperfect, that apprehensions of a total loss of sight are entertained; and this dreadful consequence has been known to ensue, where the complaint has been totally neglected, or left to nature, or where ineffectual remedies have been employed."—(*Bontius*, *p.* 73.)

"It has been remarked by some, that the patients are capable of seeing distinctly, at all periods of the complaint, with the aid of a strong artificial light; but in *bad* cases of hemeralopia, in my practice, the patients positively denied the existence of the sense of distinct sight by very clear candlelight."—(*Bampfield, in Medico-Chir. Trans. vol.* 5, *p.* 39, 40.)

The duration of the disease, when left to itself, is generally from two weeks to three or six months. Experience has not proved that the disposition to the complaint depends upon any particular colour of the iris, as several writers have conjectured; nor upon the largeness of the eyes, as alleged by Hippocrates.—(*Lib.* 6, *sec.* 7.)

In idiopathic cases, the health does not in general suffer, and, except in the worst stage, the eye is not altered in appearance. But in cases of long duration the pupil, according to Mr. Bampfield, "is often contracted, and the eyes and actions of the patient evince marks of painful irritation, if the eyes are exposed to a vivid light, or if he looks upwards. But if they meet the direct rays of the sun, which in the tropics are always powerful, or a strong glaring reflection of them, pain and temporary blindness are induced, from which the patient recovers by closing his eyelids for a time to exclude the rays of light, and retiring to the shade. The pupil of the eye is considerably dilated both by day and night, in the proportion of about one case in twelve, and at night the pupil is often dilated, and does not perform its expansions and contractions when exposed to the moon or artificial light. The cases attended with dilated pupil were generally those of long duration, &c.

"Europeans, who have been once affected with hemeralopia in tropical climates, are particularly liable to a recurrence of this disease as long as they remain in them."—(*Bampfield, op. cit. p.* 42, 43.)

In two examples, described by Dr. Andrew Smith, the pupils were observed to contract and dilate regularly in the daytime, according to the quantity of light; but after sunset they seemed a little more dilated than natural, and contracted but sluggishly upon exposure to light, while the eyes themselves seemed devoid of their usual energy and vivacity.—(See *Edinb. Med. and Surgical Journ. No.* 74, *p.* 22.)

The remote causes of idiopathic hemeralopia are not well ascertained. Sleeping with the face exposed to the brilliancy of daylight, the vivid reflection of the sun's rays from the sandy shores of hot countries, and bright moonlight, have been enumerated as causes. Dr. Pye thinks the disorder intermittent.—(*Med. Obs. and Inquiries*, *vol.* 1, *art.* 13.) But, as Mr. Bampfield properly observes, though the complaint is certainly periodical, there is nothing in its character tending to prove that it is influenced by the same causes as intermittent fever. The latter gentleman conjectures, "that too much light suddenly transmitted to the retina, or for a long period acting on it, may afterward render it unsusceptible of being stimulated to action by the weaker or smaller quantities of light transmitted to it by night."—(*P.* 44.) The same sentiment is adopted by Dr. Smith.—(*Edinb. Med. Journ. No.* 74, *p.* 23.) Among other objections to this explanation, however, it might be remarked, that the patients do not always see, though the light be good; and Mr. Bampfield's own "patients positively denied the existence of distinct sight by very clear candlelight." Besides, if the disease were entirely caused by the sudden or long operation of vivid light, one would conclude that all persons subjected to that cause ought to have the effect produced, which is far from being the case.

When the tongue is white, and the patient has headache and bilious complaints, M. Lassus thinks the cause of the disease is in the stomach and primæ viæ. The same author likewise states, that hemeralopia attacks debilitated persons subject to catarrhal affections, residing in damp situations, and living on indigestible food. From the combination of such causes (says he) the disorder was epidemic in the vicinity of Montpellier (*Sauvage, Nosolog. Méthod. t.* 2, *p.* 732); at Belle-Isle sur Mer. (*Recueil d'Observ. de Médecine des Hôpitaux Militaires, par Richard, t.* 2, *p.* 573); and hence it is endemic in watery situations where the nights are cold and damp. They who expose themselves to this humidity (says M. Lassus), or who navigate along the eastern coasts of Africa, who traverse the Mozambique channel, or sail along the coasts of Malabar and Coromandel, are sometimes attacked by it.—(See *Pathologie Chir. t.* 2, *p.* 542, 543.) Hemeralopia sometimes occurs as a symptom of the scurvy. This fact was noticed by Mr. Telford, in Sir G. Blane's *Treatise on Diseases of Seamen*, and it is likewise confirmed by Mr. Bampfield, who remarks that hemeralopia should be referred to the same causes as scurvy, "when the subject of it has for a long period subsisted on a salted diet at sea, &c., and if any other scorbutic symptom be present, such as spongy gums, ecchymoses, saline smell of the secretions, ulcers, with liver-like fungus, &c."—(*Medico-Chir. Trans. vol.* 5, *p.* 45.)

This disease, according to Scarpa, may commonly be completely cured, and oftentimes in a very short time, by treating it on the same plan by which the imperfect amaurosis is remedied (see *Amaurosis*); viz. by employing emetics, the resolvent powders and pills, and a blister on the nape of the neck; and topically, the vapours of ammonia; lastly, by prescribing towards the end of the treatment bark conjoined with valerian. In cases in which the disease has been preceded by plethora and suppressed perspiration, bleeding and sudorifics are also indicated.—(*Cap.* 19, *p.* 322. 333.)

Scarpa supports this statement by the relation of three cases in which he cured the disease by such treatment. These patients were all unhealthy, and evidently labouring under disorder of the gastric organs.

One hundred cases, however, of idiopathic, and two hundred of symptomatic hemeralopia, occurred in the practice of Mr. Bampfield in different parts of the globe, but chiefly in the East Indies. All these cases perpectly recovered: and hence we may infer that under proper treatment a favourable prognosis may always be given.

Celsus has stated that persons who have been for some time affected with amaurosis, have regained their sight on being attacked by a diarrhœa. This seems to Scarpa to be corroborated by the case related by Dr. Pye.—(*Med. Obs. and Inq. vol.* 1.) Scarpa entertains no doubt that many similar facts, showing the influence of what he terms morbific gastric stimuli over the organ of sight, might be found in the records of medicine, and proving the great utility of a spontaneous

looseness of the bowels in the cure of imperfect amaurosis.

But, says Scarpa, even if such examples of incomplete amaurosis being dissipated in consequence of spontaneous vomiting or copious evacuations from the bowels, produced entirely by nature, were rare, and noticed by few, we now have many cases evincing the successful cure of this disease by means of such evacuations artificially produced by emetics and purgative medicines. Of this the accurate observations of Schmucker and Richter furnish us with numerous satisfactory proofs, and it is added, that our confidence in the above method of curing the imperfect and periodical amaurosis must increase when we take notice that the most respectable practitioners of past times have, in the majority of cases, cured this disease only by means of emetics and opening medicines, though in their writings they may have imputed the success of the treatment to other causes, or the efficacy of other remedies which were also prescribed.

Scarpa, after several valuable remarks on amaurosis in general, refers to the *Mercure de France*, for February, 1756, where there is an account of the cures performed by Fournier, by means of bleeding and emetics.

Night-blindness is sometimes congenital, and therefore constitutional, and altogether beyond the reach of any curative measure. It is said sometimes to be hereditary, and the writer of the article *Nyctalopia* in Dr. Rees's Cyclopædia was acquainted with an instance in which it occurred to two children of the same family. A case of congenital nyctalopia, which had continued many years without change, and independently of any disease, is related by Dr. Parham.—(See *Med. Obs. and Inquiries*, *vol.* 1, *p.* 122, *note.*)

Pellier (*Recueil de Mém. et Obs. sur l'Œil, obs.* 132) cured hemeralopia by repeated doses of tartar-emetic, a seton in the nape of the neck, and cooling, aperient beverages.

The method of treatment which Mr. Bampfield adopted is certainly quite simple. "A succession of blisters to the temples (says he), of the size of a crown or half-crown piece, applied tolerably close to the external canthus of the eye, has succeeded in every case of idiopathic hemeralopia which I have seen, &c. The first application of blisters commonly enables the patient to see dimly by candlelight, or perceive objects without the power of discriminating what they are. In some slight cases which admitted of easy cure, the first application succeeded perfectly. The second application of blisters commonly enables the patient to see by candlelight distinctly, perhaps, by bright moonlight, and even half an hour after sunset, or the sight is restored for short periods during the night, and is again abolished. The second application very often effects a perfect recovery. The third, fourth, or fifth applications in succession generally produce a complete recovery where the first or second have failed; but some rare instances of very obstinate hemeralopia have required even ten successive blisters to each temple; or instead of using them in succession, a perpetual vesicatory has been formed on each temple, and maintained until a cure has been accomplished, an event which has generally followed in a fortnight."—(*Bampfield in Medico-Chir. Trans. vol.* 5, *p.* 47, 48.) In some cases, shades over the eyes were worn during the treatment, and a certain time after the cure. The patients were also often directed to bathe their eyes with cold water two or three times a day.

Mr. Bampfield knew of some instances in which electricity was successfully employed as a topical stimulus to the eye. He also informs us that a spontaneous cure sometimes followed the eruption of biles on the head or face, or the formation of abscesses on these parts, or in the ears.

Although blisters will generally effect a cure, there were particular cases in which Mr. Bampfield administered cathartics, such as calomel and the neutral salts. In these examples the patient had bilious complaints, indicated by a yellow state of the tongue and skin, headache, and pain about the præcordia, or symptoms of indigestion; white tongue, loss of appetite, pain and flatulence of the stomach, &c. With blisters and aperient medicines Mr. Lawrence sometimes combines cupping on the temples or nape of the neck.

The patients treated by Dr. Smith were put into a ward moderately lighted, and their bowels emptied by a gentle cathartic. A blister was then applied to each temple, and kept open with savin cerate. A little of a solution of the oxymuriate of mercury, in the proportion of two grains to an ounce of water, was dropped into the eyes twice a day. The purgatives were repeated on the third day, and the quantity of light to which the patients were exposed was afterward gradually increased.—(See *Edinb. Med. Journ. No.* 74, *p.* 24.)

In the scorbutic hemeralopia, the application of blisters is to be deferred, until the state of the constitution is amended by giving lemon and lime-juice, and fresh animal and vegetable food; because the hemeralopia often gradually ceases as the scurvy is cured; and before this last event the blister might produce a scorbutic ulcer. Mr. Bampfield estimates that about one-third of the cases of scorbutic hemeralopia resist the efficacy of the antiscorbutic regimen and medicines; and consequently must ultimately be treated as idiopathic cases.

The frequent recurrence of this disease, during the patient's continuance in a tropical or hot climate, naturally suggests the propriety of recommending him to return to his native climate, by which change the tendency to a relapse is in general completely removed.—(*Bampfield, in Medico-Chir. Trans. vol.* 5, *p.* 53.)

Consult *Celsus de Re Medicâ, cap.* 6, *lib.* 6. *Galeni Op. Lib. de Oculis, pars* 4, *cap.* 11. 22. *Ætii Sermo Septimus, cap.* 48, *&c. Paul. Æginæ, lib.* 3, *cap.* 48. *Actuarius, De Method. Med. lib.* 4, *cap.* 11. *Rhases, De Ægritud. Ocul. cap.* 4. *Avicenna, lib.* 3, *fen.* 3, *tractat.* 4. *Frabricii Hildani centur.* 1, *obs.* 24; *centur.* 5, *obs.* 13. *Platner, Praxis Med. C. A. Bergen et J. C. Weise, De Nyctalopia seu Cœcitate Nocturna; Haller, Disp. ad Morb. &c.* 359. *Journal de Médecine et de Chirurgie, an* 1756, *t.* 4. *Medical Observations and Inquiries, vol.* 1. *Recueil d'Observations de Médecine des Hôpitaux Militaires, par Richard, t.* 2. *Duport, Mémoire sur la Goutte Sereine Nocturne épidémique, ou Nyctalopie. Observations on Tropical Nyctalopia, by Mr. J. Forbes, in Edinb. Medical and Surgical Journal, No.* 28, *p.* 417, *et seq. Richter's Anfangsgrunde der Wundarzneykunst, b.* 3, *p.* 483, *et seq. Schmucker's Chirurgische Schriften, band* 2. *Saggio di Osservazioni e d'Esperienze sulle Principali Malattie degli Occhi di Antonio Scarpa, p.* 322, *et seq. edit.* 8*vo. Venezia*, 1802. *Lassus, Pathologie Chirurgicale, t.* 2, *p.* 539, *edit.* 2. *Rees's Cyclopædia, art. Nyctalopia. A Practical Essay on Hemeralopia, or Night-blindness, commonly called Nyctalopia, by R. W. Bampfield, in Medico-Chirurgical Trans. vol.* 5, *p.* 32, *et seq. A. Simpson on Hemeralopia*, 8*vo. Glasgow*, 1819. *C. H. Weller, A Manual of the Diseases of the Eye, transl. by D. Monteath, vol.* 2, *p.* 142, 8*vo. Glasgow*, 1821. *Good's Study of Medicine, vol.* 4, *p.* 203, *edit.* 3, 1829. *Lawrence's Lectures on the Diseases of the Eye, published in the Lancet. Dr. A. Smith, in Edinb. Med. and Surgical Journ. No.* 74.

HEMIOPIA. (From ἡμισυς, half, and ὠψ, the eye.) A certain disorder of the eye, in which the patient cannot see the whole of any object which he is looking at, but only a part of it. Sometimes he sees the middle, but not the circumference; sometimes the circumference, but not the centre; while on other occasions, it is only the upper or lower half which is discerned. Sometimes objects are seen thus imperfectly, whether distant or near; sometimes only when they are near, and not at a great distance.

The causes of hemiopia are divided by Richter into four kinds.

To the first belong opacities of the cornea and crystalline lens, especially such as destroy the transparency of only a certain portion of these parts.

The cure of this species of hemiopia depends upon the removal of the partial opacity from which it originates.—(See *Cataract*, and *Cornea, Opacities of.*)

Under certain circumstances, persons whose upper eyelids cannot be properly raised, are affected with hemiopia. They can only discern the lower half of an object which is near and of large size, unless they go farther from it, draw their heads backwards, or turn their eyes downwards. The pupil, in particular instances, becomes drawn away from the middle of the iris. This may also be a cause of hemiopia: it is a case that does not admit of a cure. The affection may likewise proceed from a separation of the iris from the margin of the cornea by external violence or other causes. Here the cure is equally impracticable.

The foregoing species of hemiopia are merely effects

of other diseases. The fourth and last kind is the most important, being generally regarded as an independent disorder. Sometimes it appears rather to be the effect of a sudden and transient irritation, producing a morbid sensibility in the optic nerve.

The causes of this sort of case, if we can credit Richter, are mostly seated in the abdominal viscera. When the affection is more durable, forming what has been termed *amaurosis dimidiata*, the same treatment is indicated as in *Amaurosis*, in which, indeed, it often terminates.—(*Richter, Anfangsgr. der Wundarzn. b.* 3, *kap.* 17.)

HEMORRHAGE. (From αἷμα, blood, and ῥήγνυμι, to break out.) *Bleeding.*

This is doubtless one of the most important subjects in surgery. The fear of hemorrhage retarded the improvement of our profession for ages: the ancients, ignorant how to stop bleeding, were afraid to cut out the most trivial tumour, or they did so with terror. They generally performed slowly and imperfectly, by means of burning irons or ligatures, the same operations which the moderns execute quickly and safely with a knife. If the old surgeons ventured to amputate a limb, they only did so after it had mortified, by dividing the dead parts; and so great was their apprehension of hemorrhage, that they only dared to cut parts which could no longer bleed.—(*John Bell's Principles of Surgery, vol.* 1, *p.* 142.) But not only as a consequence of surgery is hemorrhage to be feared; it is also one of the most alarming accidents which surgery is called upon to relieve. "*Un sentiment naturel attache a l'idée de perdre son sang; un terreur machinale, dont l'enfant qui commence à parler, et l'homme le plus décide, sont également susceptibles. On ne peut point dire, que cette peur soit chimerique. Si l'on comptoit ceux, qui perdent la vie dans une bataille, on verroit, que les trois quarts ont péri par quelque hemorrhagie; et dans les grandes operations de chirurgie cet accident est presque toujours le plus formidable.*"—(*Morand, Mém. de l'Acad. Royale de Chirurgie, vol.* 5, 8*vo.*)

As the blood circulates in the arteries with much greater impetus and rapidity than in the veins, it necessarily follows, that their wounds are generally attended with much more hemorrhage than those of the latter vessels, and that such hemorrhage is more difficult to suppress. However, as the blood also flows through veins of great magnitude with much velocity, bleedings from them are frequently highly dangerous, and sometimes unavoidably fatal. When an artery is wounded the blood is of a bright scarlet colour, and gushes from the vessel *per saltum*, in a very rapid manner. The blood issues from a vein in an even, unbroken stream, and is of a dark purple red colour. It is of great practical use to remember these distinguishing differences between arterial and venous hemorrhage, because, though in both cases the oozing of blood may be equal in quantity, yet, in the latter instance, the surgeon is often justified in bringing the sides of a wound together, without taking farther means to suppress the bleeding, while it would not be proper to adopt the same conduct were there an equal discharge of arterial blood.

Dr. Jones has favoured the world with a matchless work on the present subject; and as one grand object of this Dictionary is to present a careful account of the principal modern improvements in surgical science, I shall first endeavour to make the reader acquainted with the more accurate doctrines first promulgated by this gentleman relative to the subject of hemorrhage. Afterward, the surgical means to be practised in different cases will be considered.

The sides of the arteries are divisible into three coats. The *internal one* is extremely thin and smooth. It is elastic and firm (considering its delicate structure) in the longitudinal direction, *but so weak in the circular as to be very easily torn by the slightest force applied in that direction.* Its diseases show that it is vascular, and it is also probably sensible.

The *middle coat* is the thickest and is composed of muscular fibres all arranged in a circular manner; they differ, however, from common muscular fibres in being more elastic, by which they tend to keep a dead artery open, and of a cylindrical form. As this middle coat has no longitudinal fibres, *the circular fibres are held together by a slender connexion, which yields readily to any force applied in the circumference of the artery.*

The *external coat* is remarkable for its whiteness, density, and great elasticity. *When an artery is surrounded with a tight ligature, its middle and internal coats are as completely divided by it as they could be by a knife, while the external coat remains entire.*

Besides these proper coats, all the arteries in their natural situations are connected by means of fine cellular substance, with surrounding membranous sheaths. *If an artery be divided, the divided parts, owing to their elasticity, recede from each other, and the length of the cellular substance connecting the artery with the sheath admits of its retracting a certain way within the sheath.*

Another important fact is: *that when an artery is divided, its truncated extremities contract in a greater or less degree, and the contraction is generally, if not always, permanent.*

Arteries are furnished with arteries, veins, absorbents and nerves; *a structure which makes them susceptible of every change to which living parts are subjected in common; enables them to inflame when injured, and to pour out coagulable lymph, by which the injury is repaired or the tube permanently closed.*—(See *Jones on Hemorrhage.*)

Petit the surgeon, in 1731, first endeavoured to explain the means which nature employs for the suppression of hemorrhage. He thought that bleeding from a divided artery is stopped by the formation of a coagulum of blood, which is situated partly *within* and partly *without* the vessel. The clot, he says, afterward adheres to the inside of the artery, to its orifice, and to the surrounding parts; and he adds, that when hemorrhage is stopped by a ligature, a coagulum is formed above the ligature, which only differs in shape from the one which takes place when no ligature is employed. His theory leads him to recommend compression for the support of the coagulum.

In 1736, Morand published additional interesting remarks. He allowed, that a coagulum had some effect in stopping hemorrhage, but contended that a corrugation, or plaiting of the circular fibres of the artery which diminish its canal, and a shortening and consequent thickening of its *longitudinal ones*, which nearly rendered it impervious, had some share in the process. He thought that the cavity of an artery might be obliterated, by the puckering or corrugation, when *circular pressure like that of a ligature was made.*

Morand erred chiefly in his mode of explanation, and in his belief in the existence of longitudinal fibres, which no modern anatomists admit; for the *contraction* and *retraction* of divided arteries are indisputable facts, and as Dr. Jones remarks, this does not affect the truth of his general conclusion, *that the change produced on a divided artery, contributes with the coagulum to stop the flow of blood.*

Mr. S. Sharp (*2d edit. of Operations of Surgery*, 1739) supported the same doctrine. "The blood-vessels, immediately upon their division, bleed freely, and continue bleeding till they are either stopped by art, or at length contracting and withdrawing themselves into the wound, their extremities are shut up by coagulated blood."

Pouteau (*Mélanges de Chirurgie*, 1760) denied that a coagulum is always found after an artery is divided; and when it is, he thought it only a feeble subsidiary means towards the suppression of hemorrhage. He contended that the retraction of the artery had not been demonstrated, and could not be more effectual than a coagulum. His theory was, that the swelling of the cellular membrane at the circumference of the cut extremity of the artery forms the principal impediment to the flow of blood; and that a ligature is useful in promoting a more immediate and extensive induration of the cellular substance.

Gooch, White, Aikin, and Kirkland, all oppose Petit's doctrine of coagulum. The first blends some of Pouteau's theory with his own, by observing, that "when a small artery is totally divided, its retraction may bring it under the surrounding parts, and with the natural contraction of the diameter of its mouth, assisted by the compressive power of those parts, increased by their growing tumid, the efflux of blood may be stopped."

White was convinced, from what Gooch had suggested and Kirkland confirmed, that the arteries, by their natural contraction, coalesce as far as their first ramification.

Dr. Jones admits, that an artery contracts after it has been divided, and his experiments authorize him to say, that the contraction of an artery is an important means, but certainly not the only nor even the chief means, by which hemorrhage is stopped. When the artery is above a certain size, the impetuous flow of blood through the wound of the artery would resist the contraction of the vessel in such a degree, that the consequences would be fatal in almost every instance, were it not for the formation of coagulum.

Mr. J. Bell thinks, that when hemorrhage stops of its own accord, it is neither from the retraction of an artery, nor the constriction of its fibres, nor the formation of clots, but by the cellular substance which surrounds the artery being injected with blood.

We must refer the reader to Dr. Jones's work for a complete exposure of the inconsistencies and absurdities in Mr. Bell's account of his own theory.—(See *p.* 25, *&c.*)

Dr. Jones concludes his criticisms on Mr. Bell with observing, that if this gentleman really mean to confine his doctrine of the natural mean of suppressing hemorrhage to the injection of the cellular substance round the artery with blood, he dwells improperly on one of the attendant circumstances, to the exclusion of the retraction and contraction of an artery, and the formation of a distinct clot, all primary parts of the process.

The blood, besides filling the cellular substance round the artery, also fills the cellular substance at the mouth of the artery in a particular manner; for the divided vessel, by its retraction within its cellular sheath, leaves a space of a determinate form, which, when all the circumstances necessary for the suppression of hemorrhage operate, is gradually filled up by a distinct clot.—(*Jones.*)

MEANS OF NATURE IN STOPPING BLEEDING FROM DIVIDED ARTERIES.

Dr. Jones has given a faithful and accurate detail of a series of experiments on animals, which demonstrate "that the blood, the action, and even the structure of the arteries, their sheath, and the cellular substance connecting them with it," are concerned in stopping bleeding from a divided artery of moderate size in the following manner: "An impetuous flow of blood, a sudden and forcible retraction of the artery within its sheath, and a slight contraction of its extremity, are the immediate and almost simultaneous effects of its division. The natural impulse, however, with which the blood is driven on in some measure counteracts the retraction, and resists the contraction of the artery. The blood is effused into the cellular substance, between the artery and its sheath, and passing through that canal of the sheath, which had been formed by the retraction of the artery, flows freely externally, or is extravasated into the surrounding cellular membrane, in proportion to the open or confined state of the wound. The retracting artery leaves the internal surface of the sheath uneven, by lacerating or stretching the cellular fibres that connected them. These fibres entangle the blood as it flows, and thus the foundation is laid for the formation of a coagulum at the mouth of the artery, and which appears to be completed by the blood as it passes through this canal of the sheath, gradually adhering and coagulating around its internal surface, till it completely fills it up from the circumference to the centre.—(*Jones, p.* 53.)

The effusion of blood into the surrounding cellular membrane, and between the artery and its sheath; but in particular the diminished force of the circulation from loss of blood, and the speedy coagulation of this fluid under these circumstances, most essentially contribute, says Dr. Jones, to the desirable effect.

It appears then, that a coagulum, which Dr. Jones calls the *external* one, situated at the mouth of the artery and within its sheath, forms the first complete obstacle to the continuance of bleeding; and though it seems externally like a continuation of the artery, yet, on slitting open this vessel, its termination can be plainly observed, with the coagulum shutting up its mouth, and contained in its sheath.

No collateral branch being very near the impervious mouth of the artery, the blood just within it is at rest, and usually forms a slender conical coagulum, which neither fills up the canal of the artery nor adheres to its sides, except by a small portion of the circumference of its base near the extremity of the vessel. This coagulum is distinct from the former, and what Dr. Jones calls the *internal* one.

The cut end of the artery next inflames, and the vasa vasorum pour out lymph, which fills up the extremity of the artery, is situated between the internal and external coagula, and is somewhat intermingled with them, or adheres to them, and is firmly united all round to the internal coat of the vessel. Dr. Jones farther states, that the permanent suppression of hemorrhage chiefly depends on this coagulum of lymph; but that the end of the artery is also secured by a gradual contraction which it undergoes, and by an effusion of lymph between its tunics, and into the surrounding cellular substance; whereby these parts become thickened, and so incorporated with each other, that one cannot be discerned from the other. Should the wound in the integuments not heal by the first intention, the coagulating lymph, soon effused, attaches the artery firmly to the subjacent and lateral parts, gives it a new covering, and entirely excludes it from the outward wound.

The same circumstances are also remarkable in the portion of the vessel most remote from the heart. Its orifice, however, is usually more contracted, and its external coagulum smaller, than the one which attaches itself to the other cut end of the artery.—(*Jones on Hemorrhage, p.* 56.)

The impervious extremity of the artery no longer allowing blood to circulate through it, the portion which lies between it and the first lateral branch gradually contracts, till its cavity is completely obliterated and its tunics assume a ligamentous appearance. In a few days the external coagulum, which in the first instance stopped the hemorrhage, is absorbed, and the coagulating lymph effused around it, and by which the parts were thickened, is gradually removed, so that they resume again their cellular texture.

At a still later period the ligamentous portion is reduced to a filamentous state, so that the artery is, as it were, completely annihilated from its cut end to the first lateral branch; but long before this final change is accomplished, the inosculating branches have become considerably enlarged, so as to establish a free communication between the disunited parts of the main artery.

When an artery has been divided *at some distance from a lateral branch*, three coagula are formed; one of blood externally, which shuts up its mouth; one of lymph, just within the extremity of its canal; and one of blood within its cavity and contiguous to that of lymph. But *when the artery has been divided near a lateral branch, no internal coagulum of blood is formed.* —(*Jones, p.* 63.)

The external coagulum is always formed when the divided artery is left to nature; not so, however, if art interfere, for under the application of the ligature it can never form. If agaric, lycoperdon, or sponge be used, its formation is doubtful, depending entirely upon the degree of pressure that is used; but the internal coagulum of blood will be equally formed, whether the treatment be left to art or nature, if no collateral branch be near the truncated extremity of the artery; and lastly, effused lymph, which, when in sufficient quantity, forms a distinct coagulum just at the mouth of the artery, will be always found, if the hemorrhage be permanently suppressed.—(*Jones, p.* 74.)

MEANS WHICH NATURE EMPLOYS FOR SUPPRESSING THE HEMORRHAGE FROM PUNCTURED OR PARTIALLY DIVIDED ARTERIES.

The suppression of hemorrhage by the natural means is sometimes more easily accomplished when an artery is completely divided, than when merely punctured or partially divided. Completely dividing a wounded artery was one means practised by the ancients for the stoppage of hemorrhage: the moderns frequently do the same thing when bleeding from the temporal artery proves troublesome.

Dr. Jones has related many experiments highly worthy of perusal, and which were undertaken to investigate the present part of the subject of hemorrhage. He candidly acknowledges, however, that in regard to the temporary means by which the bleeding from a punctured artery is stopped, he has but little to add to what Petit has explained in his third publication on hemorrhage.—(*Mém de l'Acad. des Sciences*, 1735.) The blood is effused into the cellular substance, between the artery and its sheath, for some distance both

above and below the wounded part; and when the parts are examined a short time after the hemorrhage has completely stopped, we find a stratum of coagulated blood between the artery and its sheath, extending from a few inches below the wounded part to two or three inches above it, and somewhat thicker or more prominent over the wounded part than elsewhere.

Hence, rather than say that the hemorrhage is stopped by a coagulum, it is more correct to say, that it is stopped by a thick lamina of coagulated blood, which, though somewhat thicker at the wounded part, is perfectly continuous with the coagulated blood lying between the artery and its sheath.—(*Jones, p.* 113.)

When an artery is punctured, the immediate hemorrhage, by filling up the space between the artery and its sheath with blood, and consequently distending the sheath, alters the relative situation of the puncture in the sheath to that in the artery, so that they are not exactly opposite to each other; and by this means a layer of blood is confined by the sheath over the puncture in the artery, and by coagulating there prevents any farther effusion of blood.

But this coagulated blood, like the external coagulum of a divided artery, affords only a temporary barrier to the hemorrhage: its permanent suppression is effected by a process of reparation or of obliteration.

Dr. Jones's experiments prove, that an artery, if wounded only to a moderate extent, is capable of reuniting and healing so completely, that after a certain time the cicatrization cannot be discovered, either on its internal or external surface; and that even oblique and transverse wounds (which gape most), when they do not open the artery to a greater extent than one-fourth of its circumference, are also filled up and healed by an effusion of coagulating lymph from their inflamed lips, so as to occasion but little or no obstruction to the canal of the artery. The utmost magnitude of a wound, which will still allow the continuity of the canal to be preserved, is difficult to be learned; for when the wound is large, but yet capable of being united, such a quantity of coagulating lymph is poured out, that the canal of the vessel at the wounded part is more or less filled up by it. And when the wound is still larger, the vessel soon becomes either torn or ulcerated completely across, by which its complete division is accomplished.

Beclard made a series of experiments upon dogs, whose arteries are said not to differ much from those of man, though *the impulse of the heart is not so strong, and the blood is more coagulable*; two circumstances which should be duly considered in applying any of the inferences drawn from such experiments to the human subject. "In his first experiment he pricked the femoral artery wth a needle; the blood flowed, but soon stopped. On removing the coagulum it again flowed, but in a smaller stream; it gradually ceased to bleed, and finally stopped, though the coagulum was again scraped off. On examination of the artery no trace of the cicatrix was found. Several similar experiments had the same result. In experiment 4, he denuded the femoral artery, and made a longitudinal cut in it from two to three lines. The lips of the wound were seen in contact during the diastole of the ventricle, and to be separated by a jet of blood during the systole. The blood was stopped by a coagulum; this was removed twice, and each time the blood flowed in a diminished stream, but the animal died. In experiment 6, he made the same incision, but did not detach the sheath from the artery, and the wound was left to nature. The hemorrhage was not great; there was an infiltration of blood into the sheath, the size of an almond, which at the end of some days began to diminish, and disappeared in two or three weeks. On the limb being examined, fifteen days afterward, a little white ridge was found adhering firmly to the artery and to the sheath, and completely closing the wound. In the interior, there was a depressed longitudinal cicatrix of the breadth of the fifth of a line. *The canal was regular and pervious* through its whole extent.

In experiments 7, 8, 9, he made transverse incisions of $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ of the circumference of the femoral artery *separated from its sheath:* all the animals died. In experiment 10, he made a transverse incision through $\frac{1}{4}$ of the circumference, *without disturbing the sheath.* The bleeding was stopped by a coagulum, but on the animal moving it again flowed, and the dog died. But in the next experiment of the same kind the blood was stopped by a coagulum, and the artery was closed by nearly the same process as in the 6th experiment. So completely was the cure at the end of six weeks that the external part of the artery did not show any mark of a wound, and the cicatrix was scarcely observable on the interior surface. In his 12th experiment he cut one-half of the circumference: the animal died; and so did it in several similar experiments. In experiment 13, he cut $\frac{3}{4}$ of the circumference: after the animal was much reduced the bleeding ceased, and the artery was closed in the same manner that it is when the section is complete.

From these experiments he concludes wounds of the arteries of dogs are cured by nature when they are only occasioned by a puncture, or a longitudinal incision, whether the artery be denuded or not; but when arising from transverse incisions they are always mortal if the artery be laid bare. If the artery retain its sheath, and the wound be $\frac{1}{4}$ or $\frac{3}{4}$ of the circumference, it may be cured by the efforts of nature; but it is always fatal if $\frac{1}{2}$ of it be cut through.—(See *Quarterly Journ. of Foreign Medicine and Surgery, vol.* 1, *p.* 26.) The inferences respecting the curability of a wound extending through $\frac{3}{4}$ of the circumference, and the incurability of one that affects only $\frac{1}{2}$ of the circumference of the vessel, I should presume must require farther examination, notwithstanding an accidental faintness produced by the sudden loss of blood in the first instance may have been the means of saving one or two of the animals on which Beclard made his experiments.

This author thinks it probable that a puncture, or longitudinal incision, in the artery of a man may be cured by nature; but that a transverse wound never cicatrizes properly, as the clot becomes displaced, or, if a cicatrix be formed, it will be distended and torn.

One fact made out by the same professor is, that when an artery is deprived of its sheath for an extent greater than its distance of retraction, the hemorrhage is mortal. I have not yet had time to look over the original paper; but it appears to me, that it would be desirable to know precisely to what sized arteries the author is referring, when he is making some of the above inferences. The size and condition of each animal, the subject of experiment, should also be particularly specified; as experiments made on the femoral artery of a lady's lapdog would surely not have the same results as those performed on the same artery of a large terrier, setter, or Newfoundland dog.

According to Dr. Jones, the lymph which fills up the wound of an artery is poured out very freely both from the vessel and the surrounding parts, and it accumulates around the artery, particularly over the wound, where it forms a more distinct tumour. The exposed surrounding parts at the same time inflame, and pour out coagulating lymph, with which the whole surface of the wound becomes covered, and which completely excludes the artery from the external wound. This lymph granulates, and the wound is filled up and healed in the usual manner.—(See *Jones on Hemorrhage, p.* 113, *&c.*)

SURGICAL MEANS OF SUPPRESSING HEMORRHAGE.

It must be plain to every one who understands the course of the circulation, that pressure, made on that portion of a wounded artery which adjoins the wound towards the heart, must check the effusion of blood. The current of blood in the veins, running in the opposite direction, requires the pressure to be applied to that side of the wound which is most remote from the heart. However, on account of the freedom and facility with which the blood is transmitted through the anastomoses, from the portion of the artery above the point of pressure into the lower continuation of the artery, such pressure will often only check, and not effectually stop the bleeding, unless the part of the vessel directly below the wound be also compressed or secured. As pressure is the most rational means of impeding hemorrhage, so it is the most effectual; and almost all the plans, employed for this purpose, are only modifications of it. The tourniquet, the ligature, the application of a roller and compresses, even agaric itself, only become useful in the suppression of hemorrhage, on the principle of pressure: the cautery, caustics, and stypics, however, have a different mode of operation.

In order to prevent a wounded person from dying of hemorrhage, Celsus advised the wound to be filled with dry lint, over which was laid a sponge dipped in cold water, and pressed on the part with the hand. If, not

withstanding these means, the hemorrhage should continue, he recommends repeatedly applying fresh lint, wet with vinegar; but he is against the use of corroding escharotic applications, on account of the inflammation which they produce; or only sanctions the employment of the mildest ones. When the hemorrhage resists these methods, *he advises two ligatures to be applied to the wounded part of the vessel, and then dividing the portion situated between them:* "*Quod si illa quoque profluvio vincuntur, venæ, quæ sanguinem fundunt, apprehendendæ, circaque id, quod ictum est, duobus locis deligandæ, intercidendæque sunt, ut et in se ipsæ coeant, et nihilominus ora præclusa habeant.*" —(*Lib.* 5, *cap.* 26.) When the ligature was impracticable, the wound bled dangerously, and no large nerves nor muscles were situated in the bleeding part Celsus proposed the actual cautery.

Galen also mentions tying the vessels for the purpose of stopping hemorrhage; and there are some traces of the same information in other authors, who lived before him, as Archigenes and Rufus. Probably, however, the ligature was little used at these early periods, as may be inferred from the multitude of astringents, caustics, and other applications, which were advised for stopping bleeding, and in which less confidence would have been put, had the use of the ligature been familiarly known. No one can doubt, that if the old surgeons had had many opportunities of seeing the advantages of the ligature, they would soon have used it after amputations; but so far were they from adopting such practice, that Albucasis, a long while afterward, refused to amputate at the wrist, lest he should see his patient bleed to death.

Paré is considered as the first who regularly employed the ligature after amputation. His method having been attacked, he modestly defends it in the part of his works entitled *Apologie*, where he takes great care to impute the origin of it to the ancients, and cites many of them who have made mention of it. However, he thinks its utility in amputations of such consequence, that he ascribes his first adoption of this practice to inspiration of the Deity.

The method in which the ancients placed most confidence for stopping hemorrhage after the amputation of a limb, was the cauterization of the cut vessel, and surrounding flesh. The parts thus affected by the heat formed an eschar, of greater or less thickness, which blocked up the opening of the vessel, and hindered the blood from escaping. The separation of the eschar, however, which frequently took place too soon, occasioned a return of hemorrhage, and rendered it the more dangerous, as its suppression was now more difficult than before the cautery had been applied. Sometimes the instrument, being too much heated, immediately brought away with it the eschar. At the present time, the cautery is never employed as a means of suppressing hemorrhage, or, at most, only in a few very unusual cases, in which neither compression nor the ligature can be made use of. In Great Britain, the cautery may be said to be entirely exploded; but in France, the best hospital surgeons now and then employ it to stop bleedings from the antrum and the mouth.

The old surgeons also very commonly applied to bleeding parts pledgets, dipped in boiling turpentine—a practice that has long been most justly abandoned.

ASTRINGENTS, STYPTICS, &c.

Le Dran, in his Treatise on the Operations of Surgery, says that a button of vitriol, or alum, applied and properly confined on the extremity of the vessel, is sufficient to stop the hemorrhage in amputations. Heister recommends the application of vitriol, in preference to the ligature, in the amputation of the forearm. Great praises have also been conferred on agaric, and sponge, for their styptic properties. Solutions of iron, and all the mineral acids in various forms, have been recommended to the public, as remedies of the same kind, and possessing great efficacy. The ancients, centuries ago, left no application of this nature untried, and the pretended discoveries of new and more effectual styptics in later times may almost all be met with in their writings. This fact merits particular notice, because the little success attending their practice, especially when bleeding from a considerable artery was to be suppressed, clearly proves what little reliance ought to be placed on means of this description.—(*Encyclopédie Méthodique, partie Chir.*) The most which styptics can do is to stop hemorrhages from small arteries; but they ought never to be trusted when large vessels are concerned.

There is no doubt, that cold air has a styptic property; by which expression I mean, that it promotes the contraction of the vessels; for no styptics can contribute to make the blood coagulate, though such an erroneous idea is not uncommon. We frequently tie, on the surface of a wound, every artery that betrays the least disposition to bleed, as long as the wound continues exposed to the air. We bring the opposite sides of this wound into contact, and put the patient to bed. Not an hour elapses before the renewal of hemorrhage compels us to remove the dressings. The wound is again exposed to the air, and again the bleeding ceases. This often happens in the scrotum, after the removal of a testicle, and on the chest, after the removal of a breast. The proper conduct in such cases, is not to open the wound unnecessarily, but to apply pressure, or else wet linen to the part, so as to produce such an evaporation from its surface, as shall create a sufficient degree of cold to stop the bleeding. As all styptics are more or less irritating, no judicious practitioners apply them to recent wounds. However, for the suppression of hemorrhage from diseased surfaces, where the vessels seem to have lost their natural disposition to contract, these applications are sometimes indicated.

COMPRESSION.

We have already remarked that all the best means of checking hemorrhage operate on the principle of pressure; the actual and potential cautery, and some styptics excepted: the first two of which operate by forming a slough, which stops up the mouths of the vessels; while the latter operate by promoting their contraction. Let us next consider the various modifications of pressure.

In a dissertation on the manner of stopping hemorrhage, printed in the *Mém. de l'Acad. des Sciences, année* 1731, Petit endeavoured to prove, that different articles, praised as infallible specifics, would seldom or never have succeeded without compression. Even when caustics were employed, it was usual to bind compresses tightly on the part, so as to resist the impulse of the blood in the artery, and the premature separation of the eschar. Had this precaution not been taken, Petit believes hemorrhage would almost invariably have followed, and indeed, notwithstanding the pains taken to avert it by suitable compression, it did too frequently take place on the detachment of the eschar. Petit has noticed that the end of a finger, gently compressing the mouth of a vessel, is a sufficient means of stopping hemorrhage from it, and that nothing else would be necessary, if the finger and stump could always be kept in this posture. Hence he endeavoured to obviate these difficulties by inventing a machine which securely and incessantly executed the office of the finger. The instrument was a double tourniquet, which, when applied, compressed at once both the extremity of the divided artery and its trunk above the wound. The compression on the end of the vessel was permanent; that on the trunk was made only at the time of dressing the wound, or when it was necessary to relax the other. An engraving and particular description of the instrument are to be found in Petit's memoir.

Surgeons formerly filled the cavities of wounds with lint or charpie, and then made pressure on the bleeding vessels, by applying compresses and a tight roller over the part. The practitioners of the present day are too well acquainted with the advantages of not allowing any extraneous substance to intervene between the opposite surfaces of a recent wound, to persist in the above plan. They know that the sides of the wound may be brought into contact, and that compression may yet be adopted, so as both to restrain particular hemorrhages, and rather promote than retard the union of the wound.

When the blood does not issue from any particular vessel, but from numerous small ones, compression is preferable to the ligature. In the employment of the latter, it would be necessary to tie the whole surface of the wound. The sides of the wound are to be brought accurately together, and compresses are then to be placed over the part, and a roller to be applied with sufficient tightness to make effectual pressure, but not so forcibly as to produce any chance of the circulation in the limb being completely stopped.

If, in bleedings from large arteries, compression can ever be prudently tried, it is when these vessels lie immediately over a bone. Bleedings from the radial and temporal arteries are generally cited as cases of this kind, though from the many instances of failure which I have seen happen where the first of these vessels is concerned, I should be reluctant either to advise or make such an attempt. Compression is sometimes tried, when the brachial artery is wounded in phlebotomy. Here it is occasionally tried, in preference to the ligature, because the latter cannot be employed without an operation to expose the artery.

When there is a small wound in a large artery, the following plan may be tried: a tourniquet is to be applied, so as to command the flow of blood into the vessel. The edges of the external wound are next to be brought into contact. Then a compress, shaped like a blunt cone, and which is best formed of a series of compresses, gradually increasing in size, is to be placed with its apex exactly on the situation of the wound in the artery. This *graduated compress*, as it is termed, is then to be bound on the part with a roller.

In this manner, I once healed a wound of the superficial palmar arch, in a young lady in Great Pulteney-street. The outward wound was very small, and though the hemorrhage was profuse, I conceived that it might be permanently stopped, if compression could be so made as to keep the external wound incessantly and firmly covered for the space of a day or two. At first, I tried a compress of lint, bound on the part with a roller; but this proving ineffectual, I took some pieces of money, from the size of a farthing to that of a half-crown, and, wrapping them up in linen, put the smallest one accurately over the wound, so as completely to cover it. Then the others were arranged, and all of them were firmly confined with a roller, and the arm kept as quiet as possible in a sling. They were taken off after three days, and no hemorrhage ensued.

It is to be observed, that the palmar fascia, in this instance, would prevent the compression from operating on the vessel; but the case shows that this artery, when wounded, is capable of healing, if the blood be completely prevented from getting out of the external wound by the proper application of compression. Were the outer wound too large to admit of this plan, it would probably be the safest practice to cut down, at once, to the ulnar artery, and put a ligature round it, though, as this would only certainly stop the bleeding from one end of the vessel in the hand, pressure on the wound would yet be necessary. I have never seen a surgeon succeed in taking up the artery in the hand.

Besides compressing the wounded part of the artery, some surgeons also apply a longitudinal compress over the track of the vessel above the wound, with a view of weakening the flow of blood into it. Whatever good effect it may have in this way, is more than counterbalanced by the difficulty which it must create to the circulation in the arm. If the graduated compress be properly arranged, an effusion of blood cannot possibly happen, and pressure along the course of the artery must at all events be unnecessary. After relaxing the tourniquet, if no blood escape from the artery, the surgeon (supposing it to be the brachial artery wounded) should feel the pulse at the wrist, in order to ascertain that the compression employed is not so powerful as entirely to impede the circulation in the forearm and hand. The arm is to be kept quietly in a sling, and, in forty-eight hours, if no bleeding take place, there will be great reason to expect that the case will do well. In another work, I have given an engraving and description of an instrument invented by Plenck, for making pressure on the wounded brachial artery, at the bend of the arm, without pressing upon the whole circumference of the limb, and consequently without stopping the circulation. No one, however, would prefer compression when large arteries are injured, except in the kind of cases to which we have just now adverted, or in those in which the wounded vessel can be firmly compressed against a subjacent bone. Sometimes the compresses slip off, or the bandages become slack, and a fatal hemorrhage may arise; and a still greater risk is that of mortification from the constricted state of the limb. When the method is tried, the tourniquet should always be left loosely round the limb, ready to be tightened in an instant. Sometimes the external wound heals, while the opening in the artery remains unclosed, and a false aneurism is the consequence.

TOURNIQUET.

When hemorrhage takes place from a large artery in one of the limbs, where the vessel can be conveniently compressed above the wound in it, a tourniquet, judiciously applied, never fails to put an immediate stop to the bleeding.

Before the invention of this instrument, which did not take place till the latter part of the 17th century, surgery was really a very defective art. No important operation could be undertaken on the extremities, without placing the patient in the most imminent peril; and many wounds were mortal, which, with the aid of this simple contrivance, would not have been attended with the least danger.

The first invention of the tourniquet has been claimed by different surgeons, and even different nations. But, whoever was the inventor, it was first presented to the public in a form exceedingly simple; so much so, indeed, that it seems extraordinary that its invention did not happen sooner. A small pad being placed on the principal artery of a limb, a band was applied over it, so as to encircle the limb twice. Then a stick was introduced between the two circles of the band, which was twisted: thus the pad was made completely to stop the flow of blood into the lower part of the vessel.

Although in the *Armamentarium Chirurgicum* of Scultetus there is a plate of a machine invented by this author for compressing the radial artery by means of a screw, J. L. Petit is universally allowed to be the first who brought the tourniquet to perfection, by combining the circular band with a screw, so that the greatest pressure may operate on the principal artery.

The advantages of the modern tourniquet are, that its pressure can be regulated with the utmost exactness; that it operates chiefly on the point where the pad is placed, and where the main artery lies; that it does not require the aid of an assistant to keep it tense; that it completely commands the flow of blood into a limb; that it can be relaxed or tightened in a moment; and that, when there is reason to fear a sudden renewal of hemorrhage, it can be left slackly round the limb, and, in case of need, tightened in an instant. Its utility, however, is confined to the limbs, and as the pressure necessary to stop the flow of blood through the principal artery completely prevents the return of blood through the veins, its application cannot be made very long without inducing mortification. It is only of use also in putting a sudden stop to profuse hemorrhages for a time, that is, until the surgeon has put in practice some means, the effect of which is more permanent.

LIGATURE.

The ancients were quite unacquainted with the use of the tourniquet, and though some of their writers have made mention of the ligature, they do not seem to have known how to make proper use of it, nor to have possessed any other certain means of suppressing hemorrhage from wounds. In modern times, it is easily comprehensible, that when any great operation was undertaken, while surgery was so imperfect, there was more likelihood of the patient's life being shortened than lengthened, by what was attempted. Under these circumstances, it is not surprising that the old practitioners should have taken immense pains to invent a great many topical astringents. But now that the ligature is known to be a means which is safer and less painful than former methods, no longer search need be made for specifics against hemorrhage.

It may, indeed, be set down as a rule in surgery, that whenever large arteries are wounded, no styptic application should ever be employed, but immediate recourse had to the ligature, as being, when properly applied, the most simple and safe of all methods.

In order to qualify the reader to judge of the best mode of applying ligatures to arteries, I shall first explain to him their effect on these vessels, as related by Dr. Jones.

This gentleman learned from Dr. J. Thomson, of Edinburgh, that in every instance in which a ligature is applied around an artery, without including the surrounding parts, the internal coat of the vessel is torn through by it; and that this fact had been originally

noticed by Desault. Dr. Thomson even demonstrated to Dr. Jones, on a portion of artery taken from the human subject, that the internal and middle coats are divided by the ligature.—(*Jones*, *p.* 126.)

This led Dr. Jones to make some experiments on the arteries of dogs and horses, tending to the conclusion, that *when several ligatures are applied round an artery* with sufficient tightness to cut through its internal and middle coats, although the cords be immediately afterward removed, the vessel will always become impervious at the part which was tied, as far as the first collateral branches above and below the obstructed part. Dr. Jones thinks it reasonable to expect that the obstruction produced in the arteries of dogs and horses, in the manner he has related, "might be effected by the same treatment in the arteries of the human subject; and, if it should prove successful, it might be employed in some of the most important cases in surgery. The success of the late important improvements which have been introduced in the operation for aneurism, may perhaps appear to most surgeons to have rendered that operation sufficiently simple and safe; but if it be possible to produce obstruction in the canal of an artery of the human subject in the above-mentioned manner, may it not be advantageously employed in the cure of aneurism; inasmuch as nothing need be done to prevent the immediate union of the external wound?" Dr. Jones next questions whether this mode of obstructing the passage of blood through the arteries may not also be advantageously practised in cases of bronchocele?—(*P.* 136.)

Subsequent experimenters have not been equally successful with Dr. Jones in obtaining the obliteration of the cavity of the vessel after this operation. Did this difference depend upon their having tied the vessel only in one place? Mr. Hodgson tried the experiment in two instances upon the carotid arteries of dogs; and in neither of them was the cavity of the vessel obliterated. The same experiment has been repeated by several surgeons upon the arteries of dogs and horses; but in no example, as far as Mr. Hodgson knows, has the complete obliteration of the cavity of the vessel been accomplished. However, as an effusion of lymph is an invariable consequence of the operation, the want of union is owing to the opposite sides of the vessel not being retained in a state of contact, so as to allow of their adhesion.—(See *Observations on the Application of the Ligature to Arteries, &c. by B. Travers, vol.* 4, *Med. Chir. Trans.*) The presence of the ligature, in the common mode of its application, effects this object; and for the success of Dr. Jones's experiment, it appeared only necessary that the opposite sides of the wounded vessel should be retained in contact until their adhesion is sufficiently accomplished to resist the passage of the blood through the tube. This object might probably be effected by compression; but the inconveniences attending such a degree of pressure as shall retain the opposite sides of an artery in contact at the bottom of a recent wound, are too great to permit its employment. It occurred to Mr. Travers, that if a ligature were applied to an artery, and suffered to remain only a few hours, the adhesion of the wounded surfaces would be sufficiently accomplished to ensure the obliteration of the canal; and by the removal of the ligature at this period, the inconveniences attending its stay would be obviated. The danger produced by the continuance of a ligature upon an artery arises from the irritation which, as a foreign body, it produces in its coats. Ulceration has never been observed to commence in less than twenty-four hours after the application of a ligature; while it is an ascertained fact that lymph is in a favourable state for organization in less than six hours, in a wound the sides of which are preserved in contact.—(*Jones*, *chap.* 4, *exp.* 1.) If it be sufficient, therefore, to ensure their adhesion, that the wounded coats of an artery be kept in contact by a ligature only three or four hours, ulceration and sloughing may in a great degree be obviated by promoting the immediate adhesion of the wound. Justified by this reasoning, Mr. Travers performed several experiments, by which he ascertained, that if a ligature be kept six, two hours, or even one hour upon the carotid artery of a horse, and then removed, the adhesion is sufficiently advanced to secure the permanent obliteration of the canal. It appeared probable that the same result would be obtained upon the healthy artery of a human subject.—(*Hodgson on the Diseases of Arteries, &c. p.* 228, *et seq.*) Mr. A. C. Hutchison, in the year 1800, tied the brachial arteries of two dogs, and removed the ligatures immediately after their application. In both instances, the complete obliteration of the canal of the artery was the consequence of the operation.—(See *Practical Observations in Surgery*, *p.* 103.) He has also tried this method, as modified by Mr. Travers, in an operation which he performed for a popliteal aneurism in a sailor, in Nov. 1813. A double ligature was passed under the femoral artery. The ligatures were tied with loops or slip-knots, about a quarter of an inch of the vessel being left undivided between them. All that now remained of the pulsation in the tumour was a slight undulatory motion. Nearly six hours having elapsed from the application of the ligatures, the wound was carefully opened, and the ligatures untied and removed, without the slightest disturbance of the vessel. In less than half a minute afterward the artery became distended with blood, and the pulsations in the tumour were as strong as they had been before the operation. Mr. Hutchison then applied two fresh ligatures; hemorrhage afterward came on; amputation was performed, and the patient died.—(See *Practical Observations in Surgery*, *p.* 102, *&c.*) Now, as Mr. Hutchison chose to apply other ligatures, on finding that the pulsation returned, the above case only proves that the artery was not obliterated in about six hours, and we are left in the dark respecting the grand question, namely, whether the vessel would have become obliterated by the effusion of coagulating lymph and the adhesive inflammation, notwithstanding the return of circulation through it. As for the hemorrhage which occurred, I think it might have been expected, considering the disturbance and irritation which the artery must have sustained in the proceedings absolutely necessary for the application of not less than four ligatures, and the removal of two of them. According to my ideas, only one ligature ought to have been used, and none of the artery detached. We also have no description of the sort of ligatures which were employed; an essential piece of information in forming a judgment of the merits of the preceding method. The application, removal, and reapplication of ligatures are not consistent with the wise principles inculcated by the late Dr. Jones, and have, in more instances than that recorded by my friend Mr. Hutchison, brought on ulceration of the artery and hemorrhage. For farther information on the question concerning the propriety of withdrawing the ligature previously to its detachment, see the article *Aneurism*.

From Dr. Jones's experiments, it appears that the first effects of a ligature upon an artery are, a complete division of its internal and middle coats, the bringing of its wounded surfaces into contact with each other, and an obstruction to the circulation of the blood through its canal. There must be a small quantity of stagnant blood just within the extremity of the artery; but this does not, in every instance, immediately form a coagulum capable of filling up the canal of the artery. In most cases, only a slender coagulum is formed at first, which gradually becomes larger by successive coagulations of the blood; and hence the coagulum is always at first of a tapering form, with its base at the extremity of the artery. But, as Dr. Jones remarks, the formation of this coagulum is not material; for soon after the ligature has been applied, the end of the artery inflames, and the wounded internal surface of its canal being kept in close contact by the ligature, adheres and converts this portion of the artery into an impervious and, at first, slightly conical sac. It is to the effused lymph that the base of the coagulum adheres, when found to be adherent. Lymph is also effused between the coats of the artery, and among the parts surrounding its extremity. In a little time, the ligature makes the part on which it is directly applied ulcerate, and, acting as a tent, a small aperture is formed in the layer of lymph effused over the artery. Through this aperture a small quantity of pus is discharged, as long as the ligature remains; and finally, the ligature itself also escapes, and the little cavity which it has occasioned granulates and fills up, and the external wound heals, leaving the cellular substance a little beyond the end of the artery much thickened and indurated.—(*Jones*, *p.* 159. 161.)

In short, when an artery is properly tied, the following are the effects, as enumerated by Dr. Jones:

1. To cut through the internal and middle coats of the artery, and to bring the wounded surfaces into perfect apposition.

2. To occasion a determination of blood to the collateral branches.

3. To allow the formation of a coagulum of blood just within the artery, provided a collateral branch be not very near the ligature. It merits particular notice, however, that though the nearness of a collateral branch prevents the formation of the coagulum, it cannot always prevent the completion of the adhesive process. In the experiments made on the arteries of horses and dogs by Mr. Travers, the ligature was purposely applied close to large collateral branches, yet the vessels were safely obliterated.—(See *Med. Chir. Trans. vol.* 6, *p.* 658. 660.)

4. To excite inflammation in the internal and middle coats of the artery, by having cut them through, and, consequently, to give rise to an effusion of lymph, by which the wounded surfaces are united, and the canal is rendered impervious; to produce a simultaneous inflammation on the corresponding external surface of the artery, by which it becomes very much thickened with effused lymph; and, at the same time, from the exposure and inevitable wounding of the surrounding parts, to occasion inflammation in them, and an effusion of lymph, which covers the artery, and forms the surface of the wound.

5. To produce ulceration in the part of the artery around which the ligature is immediately applied, viz. its external coat.

6. To produce indirectly a complete obliteration, not only of the canal of the artery, but even of the artery itself, to the collateral branches on both sides of the part which has been tied.

7. To give rise to an enlargement of the collateral branches.—(*Jones, p.* 163, 164.)

Every part of an artery is organized in a similar manner to the other soft parts, and its coats are susceptible of the same process of adhesion, ulceration, &c. as the other parts are. Hence, the precautions taken to secure the adhesion of other parts should be observed for the same purpose with regard to an artery. The vessel is put in a state to admit of adhesion by the ligature, which, when properly applied, cuts through its internal and middle coats, keeps their cut surfaces in contact, and affords them an opportuuity of uniting by the adhesive inflammation, as other cut surfaces do. The immediate stoppage of the bleeding is merely the incipient and temporary part of what the ligature has to accomplish; it has also to effect the adhesion of the internal and middle coats of the artery, which, being the thing on which the permanent suppression of hemorrhage depends, is the most important. The size and form of the ligature, whether completely flat or irregular, have not been, as Dr. Jones remarks, sufficiently attended to; nor is the degree of force employed in tying the artery often considered. Some surgeons, wishing to guard against the ligature slipping off, tie it with very considerable force; while others, apprehensive of cutting through the artery, or of occasioning too early a separation of the ligature, draw it only sufficiently tight just to prevent the escape of blood. A broad, flat ligature is not likely to make such a wound in the internal and middle coats of the artery as is most favourable to adhesion, because it is scarcely possible to tie it smoothly round the vessel, which is very likely to be thrown into folds or puckered by it, and consequently to have an irregular bruised wound made in its middle and internal coats. By covering also a considerable space of the external coat, it may destroy the very vessels which pass on it in their way to the cut surfaces of the inner coats, and thus render them incapable of inflaming. Even supposing the wound to unite, still such a ligature may cover that part of the external coat which is directly over the newly united part, and, consequently, as soon as it has produced ulceration through the external coat, it will cause the same effect on the newly united parts, and, of course, secondary hemorrhage.—(*Jones, p.* 168.)

When a ligature is of an irregular form, it is apt to cut through the internal and middle coats of an artery more completely at some parts than others; but these coats must be perfectly cut through, in order to produce an effusion of lymph from the inside of the vessel, which seems to adhere most securely at its cut surfaces.

Also, when the ligature is not applied with sufficient tightness, the inner coats of the artery will not be properly cut through. Dr. Jones thinks that the ligature, being sometimes put on so as to deviate from a circle, has a tendency to produce secondary hemorrhage.

Dr. Jones conceives that ligatures are best when they are round and very firm; and he adds, that though only a slight force is necessary to cut through the internal and middle coats of an artery, it is better to tie the vessel more tightly than is necessary merely to cut through its inner coats, because the cut surfaces will thus be more certainly kept in contact; the separation of the ligature expedited; and the danger of ulceration spreading to the newly cicatrized part diminished. The external part will never ulcerate through before the inner ones have adhered. The limb, however, should be kept in a perfectly quiet state.

I am sincerely glad to find that so accurate an observer as Dr. Jones has refuted the idea that ligatures occasionally slip off the vessels, in consequence of the violent impulse of the blood. In fact, the blood does not continue to be impelled against the extremity of the artery, with the same impetuosity with which it circulated through the vessel before it was tied. The blood is immediately determined into the collateral branches, nor is there any pulsation for some way above the ligature.

Dr. Jones much more rationally imputes this occasional accident either to the clumsiness of the ligature, which prevents its lying compactly and securely round the artery, or to its not having been applied with sufficient tightness; or to its having that very insecure hold of the vessel which the deviation from the circular application must occasion.—(*P.* 173.)

Dr. Jones is of opinion, that in cases of aneurism, in which the artery has only been tied with one ligature, and left undivided, and in which secondary hemorrhage has arisen, that this has most probably been owing either to a diseased state of the artery; to various contrivances for compressing a large portion of the vessel; to having a loose ligature above the one which is tied; or, lastly, to not tying the artery sufficiently tight to cut through the internal and middle coats, so as to fit them for adhesion. The latter fault can hardly fail to produce a gradual ulceration of those coats, and of course bring on hemorrhage, which returns with greater violence as the ulceration advances.—(*P.* 176.)

These reflections must also obviously explain why Scarpa's practice of using a largish ligature, with the intervention of a piece of cloth between the cord and the vessel, for the express purpose of hindering the inner coats of the vessel from being divided, must be objectionable, because it may be set down as an axiom in all operations where large arteries are to be tied, that the quantity of extraneous substances in the wound, and particularly of such as are in contact with the artery, should be diminished as much as possible. And though I may be disposed to go so far with Scarpa as to believe that the interposition of a piece of cork or wood is worse than that of a cylinder of linen, I cannot accede to the proposition that the latter is free from objection, because it rather acts as a cushion than as a body likely to bruise.—(See *Mem. on the Ligature of Arteries, p.* 44.)

With the differences in the constitutions of man and animals, I know that the results of experiments on the latter can never be looked upon as a positive proof of what would happen from the same experiments performed on the human subject. The stronger or weaker impulse of the heart, the more or less coagulable nature of the blood, the greater or less degree of general and local irritability, the more or less quick tendency to adhesive inflammation and ulceration, are circumstances which must make in different animals the same experiments lead to opposite results. The question whether a small round ligature, or a larger flat one, with a piece of linen between it and the vessel, be best, must therefore, after all, be decided, not by Dr. Jones's experiments, nor those of Scarpa, or Mislet, but by the practice of surgery on the human body; and that the principles defended in this Dictionary are on the whole to be preferred, can hardly be questioned by any man who knows how much less frequent secondary hemorrhage now is in this metropolis than it was formerly, when those principles were neither observed nor comprehended.—(See *Amputation*, *Aneurism*, *Arteries*, and *Ligature*.)

Dr. Jones seems to consider, that the advantage of the retraction of the *divided* artery within the cellular membrane is compensated, in the case of the *undivided* artery, by the speedy and profuse effusion of lymph, which takes place over and round the vessel at the tied part, and even covers the ligature itself. Another cause of secondary hemorrhage is, the including of other parts in the ligature, together with the artery; by doing which the division of the inner coats of the vessel may be prevented.

In the valuable publication of Dr. Jones to which I have so freely adverted, some secondary hemorrhages are also imputed to the hidden separation or laceration of the recently united parts of an artery, by premature and extraordinary exertions of the patient. Hence, he strongly insists on keeping a limb in which a large artery has been tied perfectly at rest.

I shall conclude these remarks on the ligature with a few practical rules.

1. Always tie a large artery as separately as possible, but still let the ligature be applied to a part of the vessel which is close to its natural connexions.

Besides the reasons for this practice already specified, we may observe, that including other substances in the ligature causes immense pain, and a larger part of a wound to remain disunited. The ligature is also apt to become loose, as soon as the substance between it and the artery sloughs or ulcerates. Sometimes the ligature, thus applied, forms a circular furrow in the flesh, and remains a tedious time incapable of a separation.

The blood-vessels being organized like other living parts, the healing of a wounded artery can only take place favourably when that part of the vessel which is immediately contiguous to the ligature continues to receive a due supply of blood through its vasa vasorum, which are ramifications of the collateral arteries. Hence the disadvantage of putting a ligature round the middle of a portion of an artery, which has been separated from its surrounding connexions; and hence the utility of making the knot as closely as possible to that part of the vessel which lies undisturbed among the surrounding flesh.

Small arteries neither allow nor require these minute attentions to the mode of tying them.

2. When a divided artery is large, open-mouthed, and quite visible, it is best to take hold of it, and raise its extremity a little way above the surface of the wound with a pair of forceps. When the vessel is smaller, the tenaculum is the most convenient instrument.

3. While the surgeon holds the vessel in this way, the assistant is to place the noose of the ligature round it, and tie it according to the above directions. In order that the noose may not rise too high, and even above the mouth of the artery, when it is tightened, the ends of the ligature must be drawn as horizontally as possible, which is best done with the thumbs. A knot is next to be made.

4. As ligatures always operate in wounds as extraneous bodies, and one-half of each is sufficient for the removal of the noose when detached, the other should be cut off close to the knot, and taken away.

As we have explained in the article *Amputation*, and as we shall notice again in speaking of the *Ligature*, trials have of late years been made of the practice of cutting off both ends of the ligature close to the knot, with a view of diminishing, as far as possible, the quantity of extraneous substances in the wound. This plan requires the use of very small silk ligatures, in order to be duly judged of.—(See *Mr. Lawrence's Obs. in Medico-Chir. Trans. vol.* 6, *p.* 156, *et seq.*)

5. When a large artery is completely divided, two ligatures, one to the upper, the other to the lower part of the vessel are commonly necessary, in consequence of the anastomosing branches conveying the blood very readily into the part of the artery most remote from the heart, as soon as the first ligature has been applied.

6. When a large artery is only punctured, and compression cannot be judiciously tried, the vessel must be first exposed by an incision, and then a double ligature introduced under it, with the aid of an eye-probe. One ligature is to be tied above, the other below the bleeding orifice; with due attention to the principles explained in this article, and that on *Aneurism*.

7. Ligatures usually come away from the largest artery ever tied in about a fortnight, and from those of moderate size in six or seven days. When they continue attached much beyond the usual period, it is proper to draw them very gently every time the wound is dressed, for the purpose of accelerating their detachment. Great care, however, is requisite in doing this; for, as Dr. Jones remarks, as long as the ligature seems firmly attached, pulling it rather strongly must act more or less on the recently cicatrized extremity of the artery, which is not only contiguous to it, but is still united to that portion of the artery (the external coat) which detains the ligature.—(*Jones*, *p.* 162.)

In particular individuals there appears to be an extraordinary tendency to profuse hemorrhage from very slight injuries. An instance of this kind has been recorded by Mr. Blagden, where a fatal hemorrhage arose from the extraction of a tooth. The patient, who was twenty-seven years of age, had had a tooth extracted when a boy, in consequence of which operation the bleeding continued for twenty-one days from the socket before it ceased. A very slight cut on the head was also followed by an alarming bleeding, which could not be stopped by pressure, styptics, or the ligature, so that it became necessary to apply the kali purum, which succeeded. On his having another carious tooth taken out, a profuse bleeding followed, which resisted the effect of styptics, caustic, and every means adopted to stop up the socket. The actual cautery was tried in vain. The dangerous condition of the patient seemed to leave no other resource, but that of tying the carotid artery, which was done by Mr. Brodie. But even this proceeding failed to suppress the hemorrhage, which proved fatal.—(See *Med. Chir. Trans. vol.* 8, *p.* 224, *Lond.* 1817.) On the mode of stopping hemorrhage from the sockets of the teeth, the reader may find some remarks in the *Edin. Med. and Surg. Journ. No.* 58, *p.* 157.

The hemorrhage from the bites of leeches sometimes proves exceedingly obstinate, and instances of death from this cause have occasionally happened, particularly in children. When common methods fail, the plan has been recently tried of passing a fine sewing needle through the skin on one side of the wound, and then another through the skin on the opposite side, and then twisting some thread round the needles, so as to draw them together, and close the bite. The experiment fully answered.—(See *Lond. Med. Repository, Jan.* 1819, *p.* 23—26.)

For more information respecting hemorrhage, see *Amputation*, *Aneurism*, *Arteries*, *Ligature*, and *Wounds*.

Consult also *Petit's Memoirs, among those of l'Acad. des Sciences for the years* 1731, 1732—1735. *Morand, Sur le Changement qui arrive aux Artères coupées*, 1736. *Pouteau, Mélanges de Chirurgie. Gooch's Chirurgical Works, vol.* 1. *Kirkland's Essay on the Method of suppressing Hemorrhages from Divided Arteries*, 8*vo. Lond.* 1763. *White's Cases in Surgery. J. Bell's Principles of Surgery, vol.* 1. *Partie Chirurgicale de l'Encycl. Méth. Larrey, Mémoires de Chirurgie Militaire, tom.* 2, *p.* 379. *Pelletan, Clinique Chir. t.* 2, *p.* 240, *&c. Mémoire Elémentaire sur les Hemorrhagies. Richerand, Nosographie Chir. t.* 4, *sect. sur les Maladies des Artères, p.* 23, *&c. edit.* 4. *Leveillé, Nouvelle Doctrine Chir. t.* 1, *chap.* 3; *and particularly Jones, On the Process employed by Nature, in suppressing the Hemorrhage from Divided and Punctured Arteries*, 1805. *Many useful remarks on the subject of Hemorrhage will be found in Hodgson's Treatise on the Diseases of Arteries and Veins.* See also, *Observations upon the Ligature of Arteries, and the Causes of Secondary Hemorrhage, &c., by B. Travers, in Med. Chir. Trans. vol.* 4, *p.* 435, *et seq.* Likewise, *Farther Observations on the Ligature of Arteries, by the same, in Med. Chir. Trans. vol.* 6, *p.* 632, *et seq. Lawrence, On a New Method of tying the Arteries in Aneurism, Amputation, &c. in vol.* 6 *of the Med. Chir. Trans. p.* 156, *&c.; and Crampton, in vol.* 7 *of the same work. Langenbeck, Bibl. b.* 1. *Dr. J. Thomson's Lectures on Inflammation, p.* 250, *&c., and Observations made in the Military Hospitals in Belgium, p.* 42—44. *Scarpa, On Aneurism, and particularly his Memoir on the Ligature of Arteries: this is contained in the second edit. of the Transl. by Mr. Wishart. Beclard, Expériences sur les Blessures des Artères. Robt. Harrison, Surgical Anatomy of the Arteries*, 2 *vols. Dublin*, 1824, 1825. *T. Turner, On the Arterial System, &c. and the Surgical Treatment of Hemorrhage*, 8*vo. Lond.* 1825. *Velpeau, Anatom. Chir.* 2

tomes, 8vo. *Paris*, 1825. *John Cross, A Case of Amputation, with some Experiments and Observations on the securing of Arteries with minute silk Ligatures, in Lond. Med. Repository, vol. 7, p. 353. The author relates several experiments for the purpose of ascertaining the utility of tying arteries with such ligatures, and cutting the two ends off close to the knot. They were performed on the carotids of dogs and asses. The conclusions are unfavourable to the practice. After one case of amputation, where the method was tried, the stump healed slowly, and for several months small abscesses repeatedly formed.*

HEMORRHOIDS. (From *αἷμα*, blood, and *ῥέω*, to flow.) *Piles*, divided into such as do not bleed, and termed *blind*, and into others subject to occasional hemorrhage, and distinguished by the epithet *open*. The etymological meaning of the word is evidently only a discharge of blood. Surgeons, however, sanctioned by long custom, have generally implied by the term *hemorrhoids* either a simple bleeding from the veins of the lower part of the rectum, recurring more or less frequently, yet not accompanied with any distinguishable permanent tumours within, or on the outside of the anus; or else swellings formed by a varicose distention and morbid thickening of those vessels, either with or without occasional hemorrhage; or lastly, tumours originally produced by effused blood, but subsequently converted into an organized substance.—(*Abernethy, Surgical Works, vol. 2, p. 234.*)

According to Richter, blind hemorrhoids consist of preternatural cysts or sacs at the lower extremity of the rectum, from the size of a pea to that of an apple. Sometimes they are distended with blood, and very much swelled; and at other periods entirely subside; though, when they have been often considerably swelled, they never quite disappear, but are alternately in a full enlarged state and empty and flaccid. Indeed, the more frequent and considerable the enlargement has been, the greater is their size. It is generally supposed, that these tumours or cysts are varicose expansions of the veins of the rectum; and probably, says Richter, this may sometimes really be the case; but the disease is not always of this nature. In particular instances, and, perhaps, in most cases, they arise from an extravasation of blood under the inner coat of the rectum; and then the cyst is altogether formed by this membrane, and not by the vein. The following circumstances furnish proof of what has been here observed. Hemorrhoids are sometimes as large as a walnut or apple; yet it is scarcely credible, that a mere varix could attain such a size. When cut away, the bleeding is often very slight, even when they are large. Surely, if the tumours were varices, there would always be profuse hemorrhage. Sometimes the cyst is found quite empty; but how can a varix be supposed to be in this state? The shape of hemorrhoids is also remarked to be subject to greater variety than can hardly attend dilatations of veins: thus they are sometimes oblong, sometimes cylindrical, like a finger, &c. Lastly, when cut away, the sac is plainly seen to consist only of a single membrane.—(*Anfangsgr. der Wundarzn. b. 6, p. 395, ed. 2, Gött.* 1802.)

At the same time, it should be recollected that "the blood sometimes coagulates in the dilated vein, and the swelling becomes hard, inflamed, and very painful. The coagulum is subsequently absorbed, but the thickened coats of the vein and the surrounding parts form a tumour which is liable to inflame and afford great distress."—(*Hodgson on Diseases of Arteries, &c. p.* 566.) In short, all surgeons who consider the disease as varices, admit, with Sir E. Home, that in cases of long standing, the contents of hemorrhoidal tumours "coagulate and become solid; their coats increase in thickness, and they resemble pendulous excrescent tumours in other situations in the body.—(*On Ulcers, &c.*) Availing himself of the extensive opportunity afforded by his dissecting-room, Mr. Kirby has taken some pains to ascertain the nature of these tumours; and he observes, "I cannot say, that they seemed to be formed of a varicose distention of the great hemorrhoidal vein, even in a single instance. In every case of external hemorrhoids, the tumour appeared to be composed of a prolongation of the cellular substance in a state of unusual firmness, surrounded by some veins, and covered by the integuments. The veins were branches of the internal iliac. In every case of internal hemorrhoid, the structure was pretty similar; the veins, however, seemed enlarged, and were branches of the hemorrhoidal."—(*On certain severe Forms of Hemorrhoidal Excrescence, p. 40.*)

The opinion that piles are formed of cells filled with blood is also adopted by Dr. Ribes. The distention of the hemorrhoidal veins with blood, he observes, gives rise to varices; but if any of their blood is extravasated in the cellular membrane, at the inferior and internal part of the anus, hemorrhoids are the result. If the inferior mesenteric vein be dissected in hemorrhoidal patients, the ramifications of the vessel are seen terminating in these cysts of blood, and on completely removing the whole, the hemorrhoids appear suspended from the branches of the vein, as grapes from the vine.—(See *Révue Méd. t. 1, 8vo.* 1820.) Montegre, well known as the author of a copious treatise on the present subject, is the only writer who defines a hemorrhoid to be a preternatural determination of blood (*fluxion sanguine*) to the extremity of the rectum, because he conceives that hemorrhage, swelling, &c. are accidental circumstances, not constantly attending the disease.—(See *Dict. des Sciences Méd t. 20, p. 445.*)

Whether the account of some piles being formed of distinct cysts or sacs of blood be correct or not, there is no doubt, that the tumours sometimes consist of a varicose enlargement of the branches of the hemorrhoidal veins. Were this not the fact, how could cases like the following ever take place? "One of my patients (says M. Delatour) had several of these tumours of very large size, and at every contraction of the sphincter ani, the blood issued from them *per saltum*."—(*Hist. Phil. obs.* 212.) Montegre has likewise seen two instances in which the blood spouted out of the tumours in a continued stream.—(*Dict. des Sciences Méd. t. 20, p. 453.*) And Richerand mentions a merchant who lived to the age of eighty-nine, quite free from infirmity, and whose good health was ascribed to periodical bleedings from piles, during fifty years of his life; the evacuation being very regular, and so profuse, that the blood was thrown some distance, as from a vein opened in phlebotomy.—(See *Nosogr. Chir.*) If many piles were not either varices, or cysts in direct communication with the large veins of the rectum, Petit would not have succeeded in taking blood from them by puncture, as he often did in lieu of the ordinary mode of venesection.—(*Mal. Chir. t. 2, p. 134.*)

Hemorrhoids vary in number, size, form, and situation: some being *external*; others *internal*; and some hardly larger than a pea, while others exceed a hen's egg in size. Sometimes they bring on very serious complaints, either by bursting and discharging blood so profusely as dangerously to reduce the patient; or by exciting inflammation of the adjacent parts, and causing abscesses and fistulæ; or, lastly, by becoming strangulated by the contraction of the sphincter ani, so as to occasion severe pain. Piles which bleed but little are not of much consequence; but those which bleed profusely cause violent pain, or which induce inflammation and all its effects, demand the greatest attention. Lieutaud mentions a person who lost three quarts of blood from some piles in the course of a couple of days; and both Arius and the celebrated philosopher Copernicus are said to have bled to death in this manner.

I do not know what credit ought to be given to the extraordinary case cited by Panaroli, in which a Spanish nobleman voided every day, for four years, a pint of blood from some hemorrhoids, and yet enjoyed perfect health!—(See *Obs. Chir. pentec. 2, obs. 46.*) For other curious facts of this nature, see *Dict. des Sciences Méd. t. 20, p. 458.*

As Mr. Howship remarks, hemorrhoidal tumours, when connected with inflammation, are very painful. "The patient can then neither walk, ride, nor sit; the only tolerable state being that of rest in the reclined position. Should he, during the continuance of inflammation, be obliged to pass a motion, the distress is extreme. With these symptoms, there is generally more or less feverish heat and restlessness, now and then delirium."—(*On Diseases of the Lower Intestines, p.* 208, *ed.* 3.)

In general, when piles are situated far up the rectum, they are less painful than when low down, and sometimes the patient is not conscious of having them till he begins to void blood from the rectum. In the former case, the veins or tumours are surrounded by soft and yielding substances, which do not make

any painful pressure on them; but when they are situated towards the anus, they often suffer painful constriction from the action of the sphincter muscle. Mr. Heaviside met with two examples where hemorrhoidal swellings were attacked with inflammation, and so violently strangulated by the spasmodic action of the sphincter ani, that the parts underwent a spontaneous mortification, and a radical cure was the result.—(*J. Howship on Diseases of the Lower Intestines, &c. p.* 210, *ed.* 3.)

With regard to the cause of hemorrhoids, any thing capable of retarding the return of blood through the hemorrhoidal veins may occasion the disease. The pressure of the gravid uterus, costiveness, and the frequent retention of hardened feces in the rectum, are very frequent causes. Persons who lead sedentary lives are often troubled with the complaint. Women are more subject to piles than men.

The pressure of an enlarged liver, or of water accumulated in the cavity of the peritoneum, may occasion piles.

I have adverted to the opinion of Montegre, that hemorrhoids depend upon a determination of blood to the lower part of the rectum; which sentiment is perhaps correct in cases where the disease arises from irritation in that bowel, or the neighbouring parts.

When these tumours are produced by the pressure of the gravid uterus, no cure can be expected till after delivery, when one generally follows spontaneously. Also, when piles are an effect of dropsy, they cannot get well before the pressure of the fluid in the abdomen has been removed by tapping. Gently laxative medicines and a horizontal position of the body commonly alleviate the uneasiness resulting from hemorrhoids. The application of an ointment composed of equal parts of the powder of oak-galls and of elder ointment or hog's lard contributes to the same beneficial effect. The application of warm water by means of a bidet, or semicupium, is also frequently productive of great ease. When piles are constricted by the sphincter ani muscle, the pain may often be at once removed by pushing the swellings up the rectum, and using fomentations or even the warm bath. Mr. Howship, in cases where the disposition to spasm in the sphincter is connected with high irritability in the bowel, recommends the introduction of a metallic bougie for a certain length of time, the size of the instrument and frequency of repetition of the operation being duly regulated.—(*On Diseases of the Lower Intestines, &c. p.* 214, *ed.* 3.) When the disease is in a state of inflammation, leeches applied to the vicinity of the anus, and puncturing the dilated hemorrhoidal vessels with a lancet, for the purpose of taking away blood, and the application of cold lotions, are measures occasionally employed to procure ease. The usefulness of leeches was particularly noticed by Schmucker.—(*Vermischte Chir. Schriften, b.* 1, *p.* 107.) Petit preferred the lancet.

According to Mr. Howship, when there is "frequent hemorrhage from the veins within the sphincter, with perhaps little or no external tumour, one of the best means of relief is the metallic bougie, regulated by the patient's feelings, and also by the promptitude with which inflammation and consolidation take place."—(*On Diseases of the Lower Intestines, &c. p.* 215, *ed.* 3.)

When the number and size of hemorrhoids are so considerable, as materially to obstruct the discharge of the feces; when they are severely painful, and subject to profuse bleedings; when the patient is disabled from following his usual occupations; and when the above means afford insufficient relief, the surgeon should recommend their removal.

The extirpation of piles with the actual cautery and caustics, as practised by the old surgeons, is now altogether relinquished. The only plan ever followed in the present state of surgery is, either to cut the tumours off with a pair of scissors or knife, or to apply a tight ligature round their base, so as to cause them to slough away. If possible, the opportunity of doing either of these operations should always be taken when the disease is in a tolerably quiet state.

When piles are to be cut off, and they are not sufficiently visible, the patient must first strain, as at stool, in order to make the swellings more apparent. With the aid of a pair of directing forceps, the skin covering the hemorrhoids is then to be separated from them with the knife, but not cut away, and the tumours being taken hold of with a tenaculum, are to be removed. Sabatier states, that saving the skin is very essential; for any hemorrhage which may arise can then be more easily suppressed; and when there are several hemorrhoids to be extirpated, the loss of substance about the anus will be less, and, of course, the patient will not be so liable to a contraction of this part, which is sometimes a very great affliction.

Previously to the performance of any operation, Mr. Abernethy endeavours to bring the bowels into a more regular state, and takes care to clear them with any medicine found by experience to answer the purpose without inducing a continuance of irritation and purging. "The bowel being everted to the utmost by the efforts used in evacuating the feces, and the parts cleansed by bathing with tepid water, the piles should be taken hold of with a double hook and removed with a pair of scissors. A protruded and thickened plait of the bowel may be removed in the same way; but I think it is best to use the bistoury in removing it, because the depth to which the scissors may cut is uncertain. The incision made by the knife resembles two curved lines joined at each extremity." The direction of the incision, both for the removal of piles, and that of plaits, he says, should be longitudinal in the direction of the bowel. When there is a transverse fold of the bowel of considerable extent, he prefers taking away two elliptical portions in the long axis of the rectum.—(See *Abernethy's Surgical Works, vol.* 2, *p.* 239.)

As I have explained in the former part of this work (see *Anus, Prolapsus of*), the late Mr. Hey used to remove these extensive diseased folds about the verge of the anus, with great success. J. L. Petit followed the same practice (*Mal. Chir. t.* 2, *p.* 134), and more recently Mr. Kirby.—(*Obs. on the Hemorrhoidal Excrescence, Lond.* 1817.)

The late Mr. Ware published some remarks, the tenor of which is to prove, that when there are several hemorrhoids, the removal of one or two of the most painful of them, with a pair of scissors, will afford effectual relief.

The excision of piles is occasionally followed by dangerous bleeding, as is exemplified in a case related by Petit. A patient had some hemorrhoids, which were supposed to be external, while they were only temporarily protruded. Almost immediately after they had been cut off, the skin which had supported them was drawn inwards. An internal hemorrhage ensued, which could not be suppressed, and proved fatal in less than five hours. The rectum and colon were found full of black, coagulated blood. Sir E. Home speaks also of some instances within his knowledge, where, after the removal of internal piles with the knife, the bleeding endangered life.—(*On Ulcers, p.* 365.)

If the bleeding should be troublesome, and proceed from vessels within the rectum, the best plan would be to distend the gut with a suitable piece of sponge, so as to make pressure on the wound. Cold should also be applied to the sacrum and nates.

The removal of hemorrhoids with a ligature may generally be done with sufficient safety; but still it has its inconveniences, though they are not constant. Petit frequently practised this method without any ill effects. In other instances he had reason to repent of having adopted it. A woman, in whom he had tied three hemorrhoids with narrow pedicles, which were favourably situated for this operation, did not at first experience a great deal of pain. However, five hours afterward he was informed that she suffered violent colic pains, which extended along the colon. She was bled four times without material relief. At last Petit cut the ligatures, which could not be loosened, in consequence of their being concealed so deeply in the substance of the swollen parts. The pain very soon subsided. The ligatures had only been applied four-and-twenty hours, but the piles had become black, and the skin covering their bases was cut through. Petit then removed them without the least effusion of blood.

Petit also relates a case in which a patient, after having had some piles tied, died of symptoms resembling those which take place in cases of strangulated herniæ, notwithstanding the ligatures had been cut, as in the foregoing instance. After these two cases, Petit abandoned the practice of tying hemorrhoids. Mr. Kirby has mentioned two cases proving the ill effects sometimes arising from the ligature of piles: in one of these examples, the patient's life was saved with great difficulty; and in the other the operation was followed by

tetanus and death.—(*Obs. on the Treatment of certain severe Forms of Hemorrhoidal Excrescence*, p. 1—3, 8vo. *Lond.* 1817.)

Mr. Howship, who prefers the use of the ligature, observes, that in performing the operation, it is not necessary to take up all the tumours; but that, if there are five or six, the tying of two or three of the largest will generally produce such a change in the texture of the rest, as will secure the patient from any return of the disease. After the ligatures are detached, he discontinues the fomentations and applies cold lotions.—(*On Diseases of the Lower Intestines, &c. p.* 216, *ed.* 3.)

I believe, on the whole, that it is best to remove hemorrhoids with a knife, except when they are situated high up the rectum, where the veins are of large size and likely to bleed profusely. If a tumour so situated should absolutely require removal, which can rarely happen, a ligature might be put round its base with the aid of a double cannula. When the base of the tumour, however, is large, admits of being brought into view, and the surgeon prefers tying it, he should pass a needle, armed with a strong double ligature, through the root of the hemorrhoid, and tie one part of this ligature firmly over one side of the swelling and the other over the opposite side. When the base of the tumour is narrow, and the ligature is preferred, the part may be tied at once, without passing a double ligature through its middle.

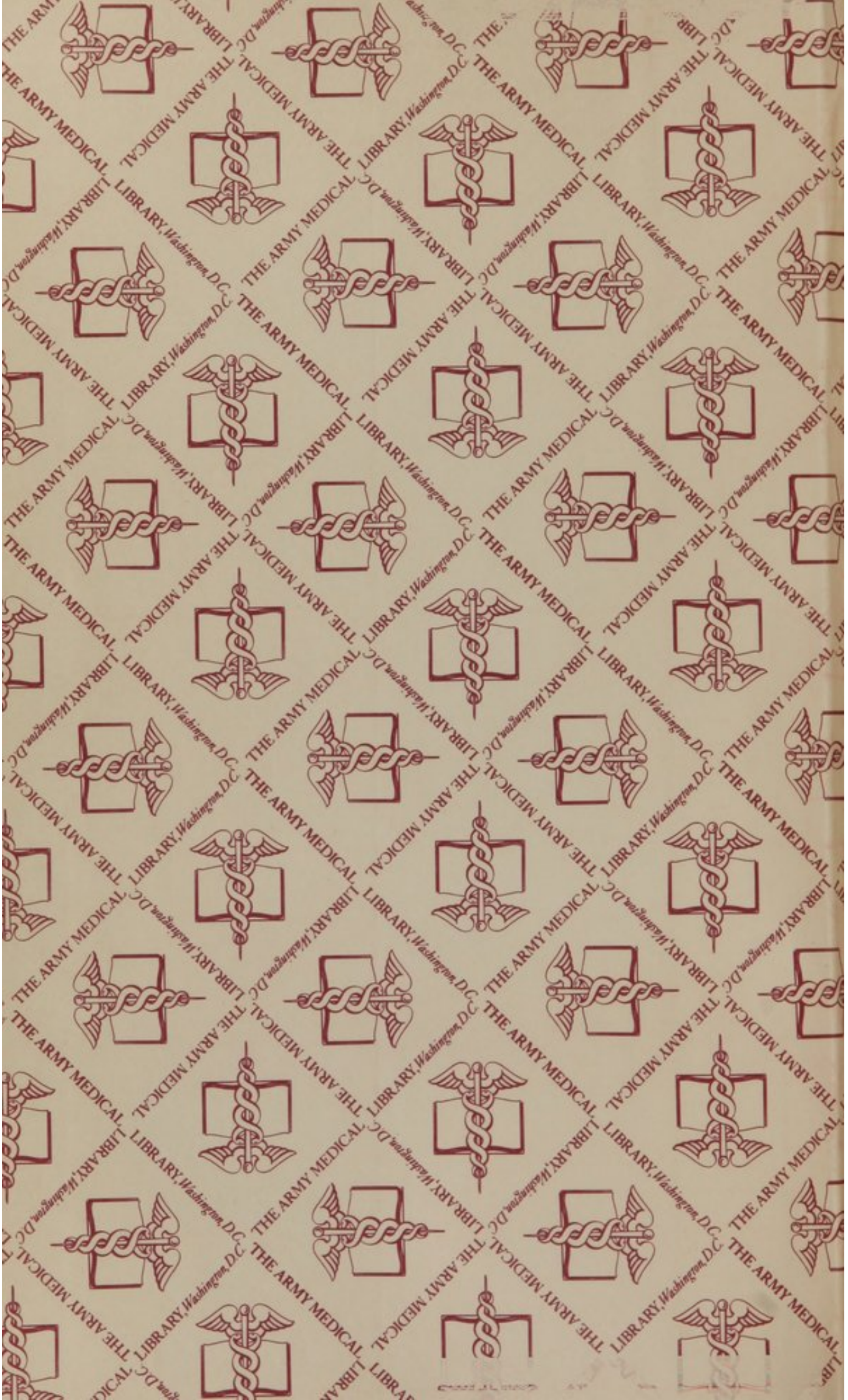
Old hemorrhoids, which have been repeatedly in a state of inflammation, at length acquire a considerable degree of hardness. The internal membrane of the rectum becomes thickened, loses its natural softness, and forms a kind of cyst which prevents the tumour from bursting and bleeding.—(See *Theden, Progrès de la Chirurgie, sect.* 4, *p.* 73.) In the end, it ulcerates and pours out a fetid discharge. Its size cannot now be lessened by the use of emollient applications; and its excision is indispensably necessary.—(See *Lassus, Pathologie Chir. t.* 1, *p.* 336.)

An opinion has commonly prevailed, that the bleeding from piles is of a salutary or critical nature; an evacuation, by which some peccant or morbid matter is thrown off from the body. Hence, many patients have been advised to submit to all the pain and uneasiness which the disease occasions, rather than seek a cure. If the fact, that some patients lose their health after their piles have been cured, be received as sufficient proof of the disease having had a salutary effect, the doctrine must remain fully established. But before this inference should be drawn, it ought to be known whether the frequency of the fact is such as to warrant the conclusion; for it is not to be supposed that the removal of piles places the patient altogether beyond the reach of disease and illness; and no one will deny, that such operation frequently leads to improvement of the health. Were a patient to appear to suffer from the cessation of an habitual bleeding from piles, leeches and even cupping-glasses might be applied.

Consult *Petit, Œuvres Posthumes, t.* 2. *Callisen, Systema Chirurgiæ Hodiernæ, t.* 2, *p.* 105, *ed.* 1800. *Sabatier, De la Medecine Opératoire, t.* 2. *Latta's System of Surgery, vol.* 2. *Ware, on the Treatment of Hemorrhoids. Truka de Krzowitz, Historia Hemorrhoidum,* 3 *vols.* 8vo. *Vindob.* 1794, 1795. *Sir J. Earle, Obs. on Hemorrhoidal Excrescences,* 2*d ed.* 8vo. *Lond.* 1807. *T. Copeland, Obs. on the Principal Diseases of the Rectum and Anus,* 8vo. *Lond.* 1814. *Schreger, Chirurgische Versüche, b.* 1, *p.* 253, *&c. Ueber tuberculöse Excrescenz des Afterdarms,* 8vo. *Nürnberg,* 1811. *John Kirby, Obs. on the Treatment of certain severe Forms of Hemorrhoidal Excrescence,* 8vo. *Lond.* 1817. *Abernethy on Hemorrhoidal Diseases, in his Surgical Works, vol.* 2, *p.* 231, *&c. Lassus, Pathologie Chir. t.* 1, *p.* 331, *ed.* 1809. *Richter von der Blinden Guldnen Ader, in Anfangsgr. der Wundarzneykunst, b.* 6, *p.* 395, *ed.* 1802. *W. Hey, Pract. Obs. in Surgery, p.* 439, *&c. ed.* 2, 8vo. *Lond.* 1810. *Dict. des Sciences Méd. t.* 20, *p.* 441, *&c.* 8vo. *Paris,* 1817. *Montegre, Des Hemorrhoides, ou Traité Analytique de toutes les Affections Hemorrhoidales, nouvelle edit. Paris,* 1819. *W. Whyte, Obs. on Strictures of the Rectum, &c.* 3*d ed. Bath,* 1820. *J. Howship on Diseases of the Lower Intestines and Anus, ed.* 3, 8vo. *Lond.* 1824. *G. Calvert on Hemorrhoids, &c.* 8vo. *London,* 1824.

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