OUTLINES

OF

MEDICO-CHIRURGICAL SCIENCE.

OUTLINES
OF
Medico-Chirurgical Science;

CONTAINING

REMARKS ON MEDICAL EDUCATION,

AND

ILLUSTRATIONS OF THE APPLICATION

OF

Anatomy, Physiology, & Pathology,

TO THE

PRINCIPAL PRACTICAL POINTS

IN

MEDICINE AND SURGERY.

WITH COLOURED PLANS.

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SECOND EDITION.

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The Reader is requested to correct the following ERRATA.

Page 41..Line 19—For Expression, READ Expressions.
55 ...... 22—For Subelavian, READ Subclavian.
136 ...... 25—For Opthalmia, READ Ophthalmia.
171 ...... 11—For Cordyles, READ Condyles.
253 ...... 4—For And finally, READ then.
276 ...... 18—For Gimberrat's, READ Gimbernat's.

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69 ...... 22—For Subclavian, read Subclavius.
120 ...... 26—For Opthalmia, read Ophthalmia.
171 ...... 11—For Condyles, read Condyle.
203 ...... 1—For And finally, read One.
276 ...... 18—For Gimbernat's, read Gimbernati's.

DEDICATION.

TO

Edward Holme, M. D.	William Simmons, Esq.
John Mitchell, M. D.	Gavin Hamilton, Esq.
Henry Hardie, M. D.	John Thorpe, Esq.
Edmund Lyon, M. D.	J. A. Ransome, Esq.
Edward Carbutt, M. D.	James Ainsworth, Esq.
J. L. Bardsley, M. D.	Robert Thorpe, Esq.

Physicians and Surgeons of the Manchester Infirmary, &c.

Gentlemen,

Convinced that those who are attached to a Public Institution, can best appreciate the advantages of a well-grounded professional education, I solicit the honour of your patronage to this volume, in which an attempt is made to facilitate the progress of the Student in Medicine and Surgery.

Be pleased to accept it, too, as a testimony of my respect for the very important stations which you fill, in a Charity, inferior to none in its professional arrangements, and superior to most in the zeal and munificence with which it is supported.

I am,

Gentlemen,

Your Obedient Humble Servant,

THE AUTHOR.

Manchester, 22, *Piccadilly*,
October 26*th*, 1824.

PREFACE TO THE SECOND EDITION.

The favourable reception of the First Edition of these "OUTLINES," has confirmed the Author's opinion, that a work, presenting in a concise form the subjects most worthy attention in the prosecution of Medical Studies, would prove both useful and acceptable to the junior members of the profession.

The call for such a work is founded on the fact, that Students spend a great portion of their time unprofitably; perplexing themselves with individual parts, without considering the relation those parts bear to each other. The usual routine of professional study consists in reading a System of Anatomy; next, a System of Physiology; then one of Medicine; and finally of Surgery. This mode of proceeding cannot be correct. To retain knowledge obtained in this way, requires stronger powers of memory than most men possess; and, if retained, for want of connection and easy comparison, it can scarcely be considered an advantageous acquirement.

Nothing can be called knowledge in a medical sense, unless it can be usefully applied: nothing can long arrest our notice that is not pleasing: and nothing can long please, that does not lead to the fulfilment of some useful object.

In the arrangement of Medical Studies, we should, as far as possible, combine the useful with the agreeable; a plan conformable to that, which has been successfully adopted in our modern systems of Scholastic Education. Experience proves to us, that knowledge is not soon forgotten when gained in this way; and that impressions are easily renewed, when fixed in the mind by interesting associations. To read a dry Anatomical Book, and to commit to memory the hard names which Anatomists have, in some respects, judiciously; but in others, arbitrarily given to the individual parts of organs, is indeed an irksome task; and few young men have such zest for professional lore, (at a period when they know not how to value it) as to embark in an undertaking so devoid of interest. This is one of the reasons why Students are often better informed on Physiological, than Anatomical Subjects. Physiology is without doubt a most pleasing and interesting study; but it must not be believed, that any one can be a good Physiologist without being a good Anatomist, for the two sciences are mutually dependent; it is therefore absolutely necessary, that they should be studied in conjunction.

But the ultimate object of these useful pursuits is not to be attained without combining Pathology with them; for this is the grand focus, in which the enlightening rays which emanate from Anatomy and Physiology converge. Anatomy, alone, is important to the Painter and Sculptor, as it enables them, accurately, to delineate the varieties in the contour of the limbs and trunk, caused by the action or repose of muscles. United to Physiology, it displays the most interesting views to the mind, and tends, in a great degree, to expand the scope of the understanding: but if these were all the uses of Anatomy, the science would not have merited one half of the attention which has been bestowed upon it, by those who have assiduously cultivated it, from the earliest ages of the world. In competition with Pathology, every other application of Anatomy is, comparatively, insignificant; for what earthly possession is there, we value so much as health? Hence, what can be equal to that science which contributes to its duration? The Elements of Anatomy, Physiology, and Pathology, ought then to be studied together. The Medical and Surgical Education must be perfect, according to the intimacy of the union; and imperfect, in proportion to their disunion. By their combination, interest will be excited; the memory less burthened, as one idea will recall others; and thus the acquisition of useful information will be rendered a pleasing amusement instead of a laborious task.

The only work in which an attempt has been made to unite the different branches of Medical Science into a general system, is that of the late Dr. Mason Good, in the execution of which, the author has displayed the most profound erudition; but it will be seen, on examining the "*Study of Medicine*," that its arrangement is very different to the following "*Outlines*;" that it is not an Elementary work; and that for a student to read it with advantage, he must first be well grounded in general principles; afterwards, Cullen's and Mason Good's volumes, which in certain respects may be put in competition with each other, will be appreciated as they deserve, and considered as standards of excellence in Medical Literature.

In presenting this volume to the Student, the author does not mean to detract from the merits of Manuals, written with a view to facilitate the dissector in applying his Anatomical researches to practical points. The works of Bell, Colles, Green, Stanley, Shaw, and others are admirably adapted for such a purpose; but this differs from theirs in many respects; it may be read in the closet; but the precepts which it conveys, must be reduced to practice in the Hospital, in the Dissecting Room, and in the Museum. The above publications, therefore, are not superseded by this, for it has not any claim to so distinguished a precedence.

The volume will not be found to contain any thing particularly new; though the design, to a certain extent, is original. Many of the materials which compose the work, lie scattered in books not within the reach of the generality of Students. Indeed, in most modern publications we seek for novelty in vain; for it would seem to be the prevailing opinion of the day, that to arrange what is already known in order to illustrate important practical points, is much more advantageous to Medical Science, than to attempt the discovery of new facts: in which opinion the author unequivocally coincides. Whatever new ideas he may entertain with respect to obscure Physiological and Pathological questions, he, for the present, abstains from obtruding them on public notice. The object then of this manual is valuable, though its execution may be defective. The author, however, flatters himself, that it has been found acceptable to Students, by aiding them in the classification of their labours; and he presumes to think, that it may occasionally have been consulted with the advantage of renewing impressions in the minds of older men.

The reader will find the language of the volume both plain and familiar, for the author has written it with the wish to be perfectly understood; and he trusts, that in this respect he has succeeded. He was struck with a remark in the Preface to an excellent Practical Work on Dislocations and Fractures of the Joints, by Sir Astley Cooper, who says, "I prefer making use of a pointed expression, to a well turned sentence; as I would rather be seen in a good plain suit, than in the finest embroidered dress." It would be well if Medical and Surgical Writers were always governed by a principle like this. Perspicuity and correctness should be aimed at in all their productions; and they should rather incur the risk of being accused of tautology and barrenness of style, than of ambiguity of expression.

The aim of the author of the following work is to lighten the labours of the Student; but he does not arrogate to himself the credit of being able to do much towards the accomplishment of so desirable an object. However, feeling assured that something might be done, he hazarded the publication of this volume; and if it has only answered to the Student in Medicine and Surgery the same purpose that an Itinerary does to the Traveller, viz.—as *an Index to the objects which have a claim upon his attention*, the reward is commensurate with the toil, and the summit of his ambition is attained.

The author has been led to alter the title of the work, from representations having been made to him, that it did not convey a sufficiently correct idea of the nature of its contents, and he trusts that he has now selected one not liable to the same objection. He has endeavoured to render the work more deserving of patronage by correcting the typographical and other errors, which were overlooked in the former edition; by adding new matter on the importance of studying the arterial anastomoses; and by giving a more complete view of medical education, comprehending the order of studies, and the time to be devoted to each branch; but on this last subject, the rules laid down must be considered as general, since much depends on the quickness of the pupil's mind, and its aptitude for acquiring particular kinds of knowledge.

At the suggestion of a reviewer, he at one time thought of adding references, for further detail, to the most important works on the various branches of Medical Science, and had even made considerable progress in this arduous task; but he was induced to abandon the idea, as it would have greatly increased the price of the volume. The Student, however, has little to regret from this omission, as the deficiency is supplied by Watt's "*Bibliotheca Britannica*,"—Young's "*Medical Literature*,"—Monro's "*Elements of Anatomy*,"—Cooper's "*Surgical Dictionary*,"—Uwin's "*Compendium of Theoretical and Practical Medicine*,"—and a French work by Brunet, entitled "*Manuel du Libraire, et de l' Amateur de Livres*," containing a new bibliographical dictionary, and a table in the form of a catalogue raisonné.

The Author's original intention of introducing more plates, strictly anatomical, was superseded by the appearance of those of Mr. Lizars's, which leave but little to be desired: he is, however, willing to believe, that the plans of reflected membranes have assisted the Student in comprehending a very difficult anatomical subject. Dr. Monro, Professor of Anatomy and Surgery in the University of Edinburgh, has honoured the Author with his permission to state, that he found the Diagram of the Peritoneum so correct and intelligible, as to induce him to adopt it in his class-room.

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REMARKS

ON

MEDICO-CHIRURGICAL EDUCATION.

The wish of a parent to bring up his son to the medical profession, ought to be seconded by a corresponding wish on the part of the son. Family prospects and circumstances may influence a father to recommend to his child a particular pursuit in life; but those considerations should give way to a disinclination, or distaste for the studies connected with it.—Without a fondness for these, the student will never bestow on the acquisition of a knowledge of his profession those exertions, which are indispensable to the accomplishment of the arduous task imposed on him; nor will such a man ever rise above mediocrity in its practice. There is no profession that requires more assiduity and application than the medical; none, where the extent of knowledge necessary for the successful practice of it is so unbounded; none, more interesting when the objects of it are congenial to the temper of the mind; but none, which, in the absence of congeniality, is so calculated to excite disgust.

It is not the author's intention to say much on the education which the young gentleman who is designed for the medical profession, should possess; but it devolves upon him as a duty to enforce the necessity of a few preparatory accomplishments.

He should have a competent knowledge of the Latin and Greek languages, particularly of the former. An acquaintance with the Latin language is indispensable; and as most of the terms employed in medicine, surgery, and the auxiliary sciences are derived from the Greek, this language will give much assistance to the memory in retaining the meaning of scientific terms. But Latin and Greek are not the only tongues with which he should be familiar. From the labours of our continental brethren we gain much useful information; hence it will be advantageous to the student to read their works, particularly those which emanate from the French school. There are also other branches of knowledge that should not be overlooked, amongst these we may class mathematics, and the elements of natural philosophy. How, and where, all these studies can be followed, are questions which do not come within the author's design; fortunately many of our public seminaries are so conducted as to furnish facilities for those purposes, without the necessity of incurring the expence attendant on a College education. In brief, the future medical practitioner must be liberally educated, and must be taught not to disregard any branch of useful knowledge, though the relation it may hold to the medical profession may not be more immediate, than it does to other pursuits in life.—Every kind of information in literature, science, and the arts, may be turned to a valuable purpose; for independently of other advantages which are sure to accrue from miscellaneous studies, they serve to enlarge the scope of the mind, and to destroy that pedantry, stiffness, and repulsive gravity, which are too often associated with the medical character. Our profession has its *real* dignity, and the power to command respect; but it has no claim to those qualities unless the members of it have such acquirements as will enable them to perform all the duties of their important calling. "Dignity in physic," as Dr. Gregory properly observes, "is not to be supported by a narrow and selfish spirit—by self-importance—by a formality in dress and manners—or by an affectation of mystery;—but by the superior learning and abilities of those who practice it, —by the liberal manner of gentlemen, and by that openness and candour which disdain all artifice, which invite a free inquiry, and thus boldly bid defiance to all that illiberal ridicule and abuse, to which medicine has been so much and so long exposed." When a determination has been made as to the nature of the youth's pursuit, the parent should recommend that plan of education to be adopted, which is best fitted for the attainment of the objects of that pursuit; so that his son may cultivate an early acquaintance with those branches of knowledge, the most essential to the sphere of life in which he is intended to move.

We are to presume then, that when a young gentleman begins his professional career, he has had the necessary classical education, and other instruction; and that he is now prepared to devote his time exclusively to the subjects of the profession he has chosen. In the study of medicine, where so much is to be learnt, it is highly desirable that we should facilitate labour. In the early period of a youth's apprenticeship, every thing is drudgery, because he cannot adapt the means to the ends; it is therefore of great importance to conduct him in the right way, and to show that his early labours will be crowned with an abundant harvest.

His first studies should embrace the sciences of chemistry and botany, which are the key-stones to pharmacy and materia medica. Pharmacy without chemistry would be productive of more harm than good, as an ignorance of chemical laws would lead us to bring together incompatible substances, the connexion of which might render their operation inert, or convert them into dangerous compounds. After learning the nature and properties of drugs, the student must know how to apply them to practical purposes, and the basis of this knowledge is the study of the structures and functions of the human body, and the systems on which medicinal substances exert their influence. The anatomy and physiology of parts in a state of health must precede his attempts to investigate the phenomena of disease, and the effects produced by morbid causes.

Anatomy is the science of Organization; the means of learning it are Dissection and Observation; and these must go hand in hand. If our knowledge of man were limited to his exterior, the healing art would experience almost as little improvement from the study, as if we viewed an automaton, to which motion and gesture were given by concealed mechanical contrivances. It is the province of Dissection to develope the secret springs of action, and to discover the organs which support life, it is therefore the foundation of Physiology; and as an acquaintance with the natural structure, arrangement of structure, and the functions of structure, is necessary to enable us to detect diseased structure, and diseased functions of structure, it must follow, that Anatomy and Physiology are the basis of Pathology. How incongruous and absurd would it be to suppose, that a man could discover an inaccuracy in the movements of a watch without knowing the proper arrangement of parts in that interesting piece of mechanism; or that he could rectify the impaired machinery of a steam-engine, if ignorant of the adaptation of the parts on which the operations of that master-piece of human ingenuity depend. Not more so than either, would it be to believe, that the Physician or Surgeon could repair the morbid conditions of the body, without a previous knowledge of the circumstances by which the healthy state of its functions is maintained.

It is an opinion far too prevalent, that Anatomy is much more useful to the Surgeon than it is to the Physician, and that the minute study of it is requisite to the one, but not indispensably so to the other; to this opinion, however, the author cannot reconcile himself to become a convert, and Bichat's Doctrine of the Tissues must convince us of its want of cogency. If Anatomy teaches us the intimate structure of Organs, the information which it gives cannot be over-rated, because it furnishes us with the only means of detecting the existence and nature of diseases; and but for the valuable facts which have been elucidated by *post mortem* examinations, the errors of Theoretical Medicine would have still prevailed, to the great retardation of true science, and the injury of society. Such researches to be profitable, must presuppose an acquaintance with the appearance of parts in a healthy and natural state, without which, morbid changes cannot be detected. We must not draw an inference in favour of the inutility of Anatomy to the Physician, from observing that some men practice with great success, although possessed only of a scanty share of this kind of knowledge, for there are very few indeed of this description; and if the argument were valid, similar instances are not wanting in the field of Surgery, for there are Empirics in both professions; every neighbourhood has its pretenders to effect what can only be safely attempted by the hand of Science; and if the extent of opportunity, and the cures *reported* to have been performed were just criteria for judging of ability and skill, very few can cope with the advertising Empirics of large towns. But well-founded Medical and Surgical Science must, by and by, vanquish the vaunted success of Quackery. The human mind is not now intimidated by threats and superstition; it is not enslaved, as it was during the dark ages, by the influence of astrology, and such like chimeras. Diseases are not now attributed to the malignant aspect of the stars; nor are the salutary virtues of remedies drawn from the vegetable kingdom, ascribed to the power of the planet under whose ascendancy they were collected. Men, in general, make it a part of their duty to inquire into the state of Medicine and Surgery, and the relative merits of the Professors of the healing art; and it is not anticipating too much to expect, that ere long, they will hesitate as much in consigning their lives to the care of a person whose skill they suspect, as merchants do in trusting their property to the charge of a mariner who is ignorant of nautical tactics; the one is more important than the other, in the same ratio as the value of life exceeds that of property.

The utility of Physiology no one can dispute; for that science which informs us of the living action of individual parts, and the united offices of the system in a state of health, must be duly appreciated, as a comparison between a natural and morbid function, is the only mode of discriminating between the one and the other; equally necessary is it, therefore, that the Physician and Surgeon should know the former in order to distinguish it from the latter, as it is, that a knowledge of healthy structure should precede the attempt to recognise the effects of disease.

But to understand certain functions, the student must be acquainted with other branches of science. Without the assistance of mechanics, he would be unable to determine the principles of muscular motion; —without pneumatics, he could not comprehend the beautiful process of respiration, and the physiological results of this function;—without optics, he could not explain the operation of the humours of the eye on the rays of light in their transmission through them;— and without acoustics he would be ignorant of the manner in which sound is conveyed to the sensible expansion of the auditory nerve; thus mechanics, pneumatics, optics, acoustics, and other branches of natural philosophy are the auxiliary sciences to the study of medicine, inasmuch as they elucidate certain natural and morbid phenomena in the animal economy.

The question now to be answered relates to the time when these different studies should be pursued.

It is presumed that every young gentleman, who is bound an apprentice to a surgeon, a surgeon and apothecary, or to an apothecary, is indentured for a period of five years. To pass the College of Surgeons, a young man must produce a certificate of his having been engaged six years at least in the acquisition of professional knowledge: to qualify him for examination at Apothecaries' Hall, he must testify by the production of his indenture, his having served an apprenticeship of five years: what ought to be done then is to apportion his time, and to show how it can most profitably be spent in professional acquirement.

When he is first bound an apprentice, it is not safe for the practitioner to trust him with the dispensing department, from his ignorance of the chemical nature and properties of drugs. It is therefore the interest, as well as duty, of the master, to afford his pupil an opportunity of acquiring the necessary knowledge by attending lectures, which are so arranged as to give a condensed view of the most useful points. By this method, and by diligent reading, he will soon become deserving of confidence, and may be entrusted with the important duty in question.—The pupil then should, as early as possible, be allowed to attend lectures on pharmaceutical chemistry, and botany. During the second winter he should be permitted to enter to the lectures on natural philosophy: and in the remaining part of his apprenticeship, human and comparative anatomy, and the application of these studies to medicine, surgery, and midwifery, should be the objects of his researches. He will thus be qualified to extend his views, and to avail himself of future opportunities of improvement, with the best possible chance of benefit.

Unless the student be well grounded in elementary knowledge, he will not profit much from the lectures which he hears in London, or Edinburgh, or any of the established schools; for the lectures delivered there are not purely rudimental. Every Professor, in these places, presumes that he is addressing young men who are not Tyros in the profession; but who have profited by the comparative leisure of their apprenticeship. It is a notorious, though melancholy fact, that many students from the country, who, neglecting to pay early attention to professional acquirement, have failed to derive that improvement which such lectures are calculated to afford; and being discouraged by difficulties which appeared insurmountable, they have actually given up their profession in despair. I would, in a friendly way then, warn the medical student against the delusion which has ruined many, viz.—*that the period of his apprenticeship is of no great value.* It is a gross error to suppose that the schools of London, or elsewhere, can store his brain with sufficient practical lore, without a preparation for its reception: and if he harbours this opinion, he will discover the absurdity of it, when it will be too late to rectify the consequences of so palpable a mistake. It is a truth confirmed by experience, that the love of science increases in the same ratio as our advancement in it; and it is not less true, that our advancement is always in proportion to the labour we bestow in the acquisition of fundamental principles. These remarks will, I hope, serve to stimulate the student to commence his exertions early, to make a diligent use of that time which is valuable *principally* to himself; and to profit from the leisure that is not likely to be interrupted by those miscellaneous occurrences to which he will be subjected in after life. He must use his own efforts, when the means of facilitating labour are given to him. Industry in acquiring knowledge will lead to fame and fortune; but the neglect of this virtue will plant a sting in his bosom, whose poignancy he will deeply feel, when the period of reflection tells him, that he has mispent the most valuable portion of his life.

ON THE

PHENOMENA OF LIFE.

In Nature, we find materials which differ in their properties, and in the laws which govern them. Some are passive and inorganic, regulated only by the general laws of the Universe, whilst others are active and organized, possessing that principle which we call Life, having a power of growth, and a period beyond which they cannot exist. Inorganic substances may be divided into Simple and Compound;—Organic substances, into Vegetable and Animal.

Between Vegetables and Animals, there are some coincidences, but many striking differences. They are both endowed with *Life;* but the vital properties of the former are inferior to those of the latter. Vegetable Life enjoys the faculties of nutrition, absorption, secretion, and re-production; Animal Life has, superadded to these, many more, of which Vegetables are wholly destitute.

But the nature of that principle which we call *Life*, has been a source of perplexity to the Physiologists of all ages; and up to the present day, they have only determined on its *properties*. The ingenious French Physiologist, Bichat, seems to have done more in this respect, than any one who lived before, or since his time; but it cannot be said, that his theory is free from objections in all its bearings; yet, as affording the fundamental distinctions of Physiology, it is regarded as the most perfect system of the schools. After observing that Life is "*L' ensemble des fonctions qui résistent a la Mort*," which cannot be considered as a definition of the thing itself, Bichat points out two remarkable modifications of this principle;—one common both to Vegetables and Animals,—the other, peculiar to Animals. Upon these distinctions he founds a classification of our functions; those which we have in common with Vegetables, he calls the functions of *Automatic* or *Organic Life*, from being common to all organised matter. Those, on the other hand, which are proper to Animals, he names the functions of *Animal Life*. By the organic functions only, an existence could be supported, because they are sufficient for vital purposes, from being subservient to nutrition and secretion; but the relation which Animals have to external objects, renders it necessary that they should have the functions of Animal Life, such as Seeing, Hearing, Smelling, Tasting, and Touching, the power to reflect, to judge, and to will. It is true, Bichat gives us no real information on the *principle* of Life, nor does any other Physiologist; but that has not proved a barrier to the investigation of its laws. Buchan, the author of "Bionomia," remarks,—"the cause of gravitation remains unknown, but ignorance of that cause has been found no bar to the improvement of Physical Astronomy, which, founded upon the acknowledged universal operation of the principle of gravity, forms the most correct, and useful, as well as beautiful department of science, hitherto explored by the powers of the human understanding." With the laws of Life, we are as well acquainted, as with the laws of Gravity; but we are totally ignorant of the *principle* of either, and most probably ever shall remain so. We will now trace some of the phenomena of Human Life.

Before the stimulus of impregnation is given, Life may be said to be in a latent state; but when given, an excitation is created in the ovum, and the changes necessary to the formation of a new being, proceed in a gradual and regular manner, unless interrupted by preternatural circumstances; then Life is arrested in its course; the developing mass dies, and must be cast off from the nidus which lodged it, as pernicious and useless. The impregnated ovum is the primordium of the new Animal, roused to the action of developement; it is contained within two membranes, named chorion and amnion; and in this condition of parts, the ovum escapes from the ovarium, and is conveyed by the fallopian tube into the cavity of the uterus. But it is not only in one, or other of the appendages of the uterus, that a new action is set up; the uterus itself undergoes changes, by which a preparation is made for the reception of the ovum; this preparation consists in the formation of the tunica decidua uteri and the tunica decidua reflexa, the uses of which are,—1st. To retain the ovum in the uterine cavity by entanglement before the os tincæ is sealed up; and—2dly. To secrete, or form, the maternal part of the placenta. The embryo in utero derives its nourishment from the mother; its Life is almost Vegetable, many of its organs being of no use. The eyes, the ears, the nose, and the mouth, are useless. The lungs perform no function, nor do the digestive organs. There is a circulation, but singularities exist in the organs which execute it. The placenta, which is the medium of communication between the parent and her offspring in utero, is composed of two distinct parts, the one named maternal, the other fœtal; and between the two, there is a structure, either vascular or cellular, but whether the one, or the other, or both, is still doubtful. The blood passes from the mother to the placenta by the uterine arteries, and from thence to the navel of the child, by the umbilical vein. Having entered the child's body at the navel, the blood is carried by the umbilical vein towards the liver, where it separates into two currents; one passes into the substance of the liver by the vena portæ, the other goes to the vena cava by the ductus venosus, and eventually both currents arrive at the right auricle of the heart. In the adult subject, the blood is sent from the right auricle into the right ventricle; from the right ventricle to the lungs, by the pulmonary artery; and from the lungs to the left auricle, by the four pulmonary veins; but in the fœtus, the circulation is different. As the child does not breathe, there is no reason why the organs of respiration should be supplied with more blood than is sufficient for their nourishment; on this account there are collateral passages, by which the blood can be transmitted from the right to the left side of the heart, without circulating through the lungs. Opening into the left auricle from the right, is an aperture, named the foramen ovale, by which a certain quantity of blood goes from the right to the left auricle, without entering the right ventricle; and originating at the root of the pulmonary artery, and terminating in the aorta, is a vessel called the ductus arteriosus, by which some of the blood which passed from the right ventricle into the pulmonary artery, is diverted towards the aorta, instead of circulating through the lungs: thus the blood of the right auricle is divided into two streams, and that too of the right ventricle. The blood that is brought to the left auricle by the foramen ovale and pulmonary veins, is driven into the left ventricle, and from thence into the aorta, to be distributed to the different structures of the body. It is then returned by the umbilical arteries, which arise from the internal iliacs, to the placenta, in which organ the blood loses the deteriorating quality which it had acquired in the circulation through the fœtus, and is again rendered fit for nutrient purposes.

At or near the ninth month of pregnancy, the child attains a sufficient degree of vigour to live ex utero, it therefore is emancipated from that cavity, partly by its own efforts, but more particularly by a stimulus exerting those of the mother.

After birth, its economy is changed, and it begins to enjoy the common functions of life. By the application of a ligature to the umbilical cord, the circulation in the umbilical vein and arteries is destroyed; these vessels consequently collapse; their sides grow together, and they become ligaments. When the child is extricated from the uterine cavity, it inspires; this act causes the pulmonary tissue to expand, and freedom is given to the circulation in its vessels. From a greater quantity of blood being thus determined to the lungs, the call for collateral routes is rendered unnecessary, and the foramen ovale, and ductus arteriosus, are by degrees obliterated;—the former by adhesion,—the latter by conversion into ligament, after the manner of the umbilical vessels. Thus, in course of time, all the peculiarities of the fœtal circulating system are destroyed, and the blood takes the same round of movement, as in the adult subject.

If we observe the anatomy of the fœtus at birth, we shall see how different its hard and soft parts are, to what we find them in more advanced age. The bones are imperfectly ossified; the joints are large and loose; the muscles pale and weak; the head disproportionately large; the cranial bones more numerous, and their junction less compact; the chest contracted; the abdomen tumid from the extraordinary magnitude of the liver, and other causes. In the upper and lower extremities, there is nothing remarkable, except the smallness of the latter, in proportion to the other parts of the body.

About the seventh month, dentition usually begins, and this process goes on till the third year, when the twenty milk, or temporary teeth are complete. At or near the twelfth month, the child is able to stand and walk.

At the seventh year, the temporary teeth begin to fall out, and are succeeded by the permanent, which are thirty-two in number, and the set is usually complete about the twelfth year. At the fourteenth or fifteenth year, the signs of puberty appear; and in both sexes, great physical and mental alterations take place; the body changes its form, new functions begin, and the mind evinces more energy and power. About the twenty-first year, the body usually attains its full stature: the bones are fully ossified, the joints are strong, and the muscles firm and powerful. In fact, at this period of life, all the organs perform their offices with the greatest vigour. At the twenty-eighth year, the dentes sapientiæ appear, and the body, after that period, is complete in all its parts. At the forty-fifth or fiftieth year, it usually shows some symptoms of decay; the organs of the senses becoming first impaired. At sixty, the faculties fail, and the body grows feeble. The teeth fall from their sockets, and the hair turns grey; digestion, circulation, and secretion, are less perfectly accomplished, owing to the state of the organs respectively concerned in these functions. At a more advanced age, the bones become brittle, and will break with a slight force, a physical change resulting from a defect of their animal matter; and there will be emaciation and weakness. In fine, Nature's resources are exhausted, and man succumbs to Death without a struggle.

Thus we have traced Life in all its stages, *ab ovo usque ad senectutem.* We recognise its phenomena; but the nature of the principle itself, is involved in impenetrable obscurity.

EXPLANATION

OF THE

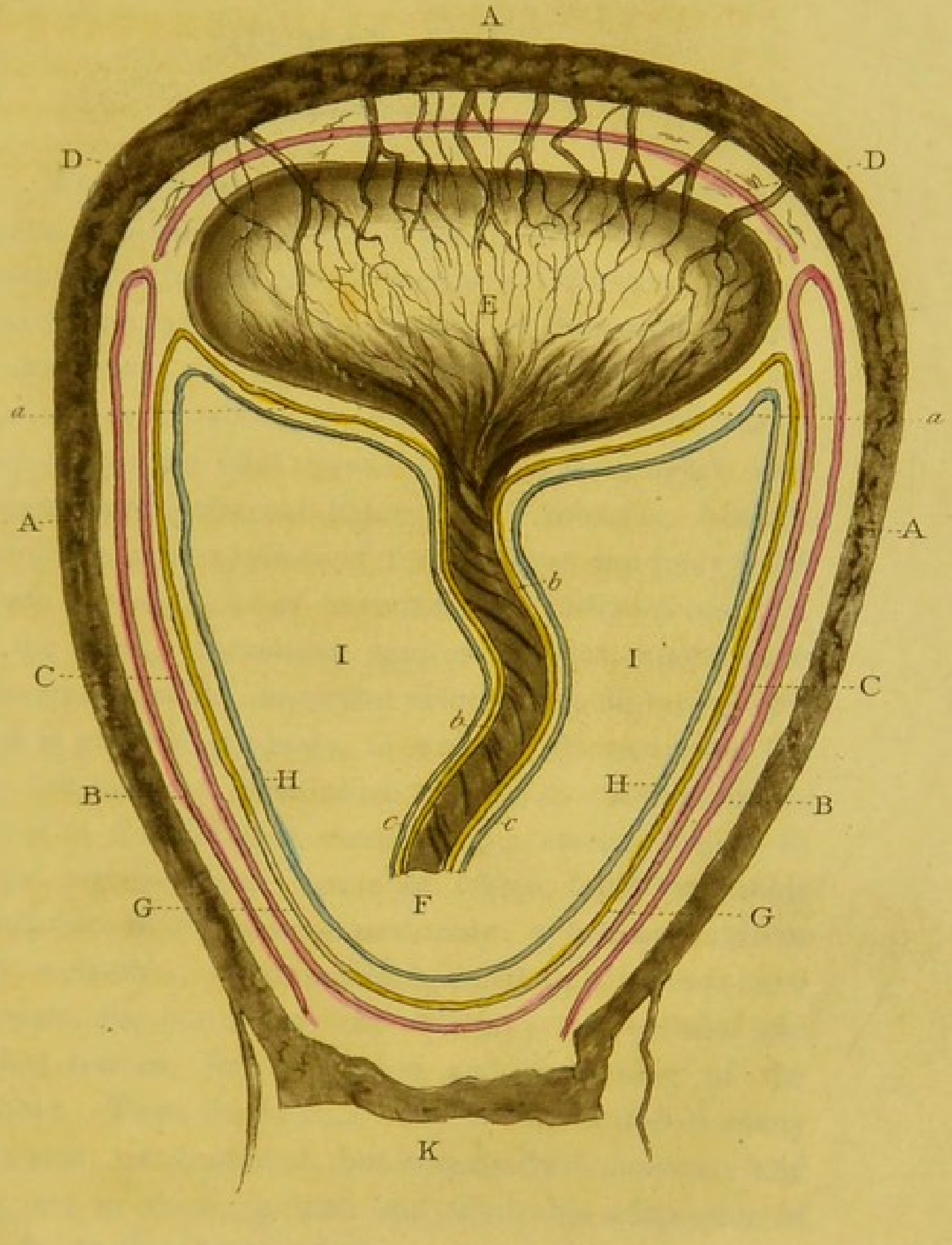
PLAN OF THE FŒTAL MEMBRANES.

THIS Plan represents a perpendicular section of the gravid uterus. The membranes are naturally in close contact; but here, they are arbitrarily separated, for the sake of distinction.

A. A. A.—Are the cut edge of the uterus.
B. B.—The tunica decidua uteri.
C. C.—The tunica decidua reflexa.
D. D.—That portion of the tunica decidua uteri which passes between the uterus and placenta, and is supposed to secrete the maternal part of the placenta.
E.—The placenta.
F.—The funis umbilicalis.
G. G.—The chorion—*a. a.* showing that portion of the membrane which is thought to form the fœtal part of the placenta—*b. b.* denoting the envelope which the chorion gives to the cord.
H. H.—The amnion—*c. c.* its envelope to the cord.
I. I.—Situation of the liquor amnii.
K.—Os tincæ, vel os uteri.

This Plan will give the student a better idea of the fœtal membranes than words can possibly convey.

A PLAN OF THE FŒTAL MEMBRANES.



Engraved by T. Fielding.

ON THE

HUMAN BODY.

THE Human Body is composed of organs, and parts, destined to perform the variety of functions essential to the life which it enjoys. Some are immediately subservient to the faculty of loco-motion, viz. —the bones, cartilages, ligaments, and muscles. In addition to this office, the bones support the soft parts, and defend the vital organs (as the brain, heart, and lungs) from external injury; and muscles, besides being the active agents of transporting the body from place to place, and of executing the different motions of the trunk, extremities, and other parts, operate the movements of the important viscera. A digestive system is given to the body, to prepare the materials for its nutrition; a circulating system to carry nourishment to the different structures; secreting organs to form certain fluids, some of which fulfil important purposes in the animal œconomy; a nervous system for sensation, volition and sympathy; a reproductive system, for continuing the species; and cellular and other tissues, for the union and connexion of the whole. Thus the human body is constituted of many systems, not insulated, but essentially dependent; and we see in them, a wise and admirable adaptation of parts, to their intended uses.

Bone is the hardest and strongest structure in the body, and its functions require that it should be so. We should suspect, from a superficial examination of this substance, and from its resisting for ages the decomposition which dead organic matter usually undergoes, that it is not an organized structure,—that is to say, not possessing arteries, veins, nerves, and absorbents; but injection proves that it is vascular; and the phenomena of disease inform us, that it has nerves and absorbents. But there is superadded to these, and its animal substance, an earthy material, upon the presence of which depends its peculiarity in solidity, weight, and strength. Before mentioning the composition of bone, we will advert to its origin, and the process of its formation, two very interesting physiological inquiries. Its origin is to be sought for in that state of existence, when an impenetrable mystery hangs over all the operations of nature, and when human scrutiny cannot detect the secret changes which are taking place in organizing matter. In the early period of conception, all the systems of the body are, to our observation, homogeneous; the bones, the muscles, and the other organs, are all apparently of the same nature; and until the formative faculty gives to each part its peculiar character, we are at a loss how to distinguish them. We may call the first condition of the fœtus, mucous; therefore, bone, at its origin, may be said to be in a mucous, or gelatinous state. A degree of firmness, which it soon acquires, enables us to detect it from surrounding parts, as it changes from a mucous to a cartilaginous state; and cartilage is the nidus in which the calcareous, or earthy material is deposited; the bones of the head excepted, where the nidus is membrane. The process of ossification now begins to be cognisable to the senses, and may be watched in its progress, to its full completion. The commencement of the third, or osseous state, is manifested by some changes which the cartilage or membrane undergoes. Vessels carrying red blood are seen running towards the ossifying points; the cartilage assumes a yellowish hue; and bony fibres may be seen shooting in a longitudinal, or radiated course, according to the kind of bone in which the process is observed. In flat bones (as those of the cranium), there are two points of ossification, viz.—the centre, and the edge; the fibres from the centre shoot off in a divergent manner, to meet those which proceed in a convergent direction, from the circumference of the bone. The late Mr. Gibson, of Manchester, was the first to describe, satisfactorily, the ossifying process in the bones of the cranium, and he published an ingenious paper on this subject, in the Memoirs of the Literary and Philosophical Society of Manchester.

In the long, or cylindrical bones (as those of the limbs), there are three ossifying points, viz.—the body of the bone, and the two extremities; the latter are called epiphyses. In the spherical bones (as those of the carpus, and tarsus), there is only one point of ossification; but in the irregular bones (as the vertebræ), there are several.

If we examine a child at birth, the osseous system will be found extremely imperfect. The bones of the head are more numerous than in the adult subject, and very loosely united by means of membrane. When we carry our observation from the head of the child to the other bones, we see how incompletely they are ossified. The vertebræ are, in a great degree, cartilaginous; only here and there are spots of ossific matter visible. The sternum is made up of pieces of bone, deposited in, and surrounded by cartilage. The edges of the bones of the pelvis are tipped with cartilage. The three bones of each os innominatum, and the different pieces of the sacrum, are separated by intervening cartilages. The cylindrical bones are incomplete; their ends are cartilaginous, and all their processes the same. Thus the osseous system at birth is very imperfect; although some of the bones are almost completely formed, seven, fourteen, twenty-one, and even twenty-eight years will elapse, 'ere all the bones of the body attain their ultimate formation. At the twenty-first year, they are said to have finished their longitudinal growth; hence at this age, man arrives at his full stature; but the bones increase laterally from that period up to the twenty-eighth or thirtieth year, when not only the bones, but all the other structures of the body are supposed to arrive at their acmé of symmetry and perfection.

We have marked the beautiful work of nature, in forming original bone, and therefore are prepared to understand her operations, in the reparation of the injuries to which bone is liable, for the process of re-union, in fractures, is governed by the same laws. The Surgeon is only an instrument in the hands of nature; he assists her in her efforts, but on her we must rely, as the principal agent. All that art can do, is to reduce the bone if displaced; to retain the fragments in contact; and to prevent the supervention of circumstances, which would frustrate the ends of nature, or retard the fulfilment of them. When this is done, the restorative faculty of living matter completes the work.

If we mark the changes which occur in a bone that has been broken, we shall find them to be these:— The injury inflicted, causes a greater determination of blood to the part injured, and this determination is necessary to the incipient process of repair; for a new matter is to be secreted, and the quantity of it will be in proportion to the supply of blood, the source from which all secretions are derived. But only a *certain* determination is necessary; when too great, it is prejudicial, and the opposite extreme is equally so; too much, or too little inflammation must be guarded against; and this is the foundation of the judicious practice of depletion, when circumstances demand it, and the injudiciousness of it when the excitement is inconsiderable; the previous habits of the patient, the state of health, and the extent of injury, are the grounds which expose the propriety, or impropriety of Surgical interference. Much then is left to the Practitioner, in the after treatment of fractures. Nature, now and then, requires to be controuled, or excited; she may be too active, or not active enough in her operations; and it is the province of good Surgery to be sedulously on the watch, in order to weaken her inordinate efforts, or to augment them when inefficient. The first thing, then, which indicates a disposition to repair a mischief, is an increased determination of blood to the injured part; and this is salutary and necessary, so long as it is moderate. From this blood, the vessels secrete a mucous, or gelatinous substance; in a little time, this gradually increases in consistence, and takes on the true cartilaginous character; and in the cartilage, the earthy particles are deposited; thus, what was mucous, at the commencement of the re-union, becomes, by a series of changes, true bone. Here then, as in the original formation, we note three states,—mucous, cartilaginous, and osseous; the changes from the first to the last are, are in a similar way, progressive; and the circumstances which produce them, depend upon the same influence and actions. These facts prove a coincidence between Physiology in health, and Physiology in disease.

Having considered the process of ossification, it is in natural order, next to inquire into the composition of bone. If a bone be sawn through, it will be found to consist of an external, and compact structure, which is called the shell of the bone, and of an internal, and cellular structure, named cancelli. Bone is not inorganized, as the facts already stated must convince us, for it is susceptible of injury, and has, within itself, the means of reparation, which is not a property of inorganic matter. Like to other structures, it has blood-vessels, nerves, and absorbents; but, in addition to these, it has an animal and earthy matter; the former consisting of what chemists call gelatine, the latter, principally of carbonate and phosphate of lime, which are secretions, and regularly deposited in the form of fibres; it is in the first substance, that the blood-vessels are found. Experiments and disease show, that an animal matter is a component part of bone; by chemical means, we can remove the earthy, without interfering much with the animal substance. After subjecting a bone to the action of muriatic acid, diluted with water, it is rendered flexible, and can easily be twisted into any shape; this is owing to a chemical decomposition, the earthy part of the bone quitting the animal, in consequence of its greater affinity for the acid, by which the solidity of the bone is destroyed. In the disease called mollities ossium, a similar change takes place. In this extraordinary affection, all the calcareous matter is, from some unknown cause, absorbed; and from the secreting vessels ceasing to renew the supply, the bones lose their solidity and strength, yield to the superincumbent weight, and even to the pressure of surrounding parts. A partial existence of this disease gives rise to distortions, often of vital importance to the female sex.

We have a proof of the presence of earthy matter by the foregoing experiments; but another circumstance will corroborate the fact. If we examine a bone after it has been submitted to the process of calcination, its brittleness will clearly evince that the earthy material alone remains. An alteration, analogous to this, occurs in the disease, called fragilitas ossium; here, the bone is rendered fragile, in consequence of the animal and saline substances not existing in their due and natural proportion. In neither of the experiments, whether to show the earthy or animal material, is the shape of the bone altered; thus we see how intimately the two substances are blended; how essential is their accurate combination; and how useless the one is without the other. Anatomy, Physiology, and Pathology, in these instances, as in others, reciprocally assist in the elucidation of healthy and morbid phenomena.

All the bones of the body are covered with a membranous structure, named periosteum, which is in immediate contact with their external surface: like other membranes, it is separable into laminæ. During the periods of ossification, and reparation of injuries in bone, this membrane is crowded with blood-vessels; but in a natural state, it is not vascular, and all the vessels which injection shows in it, are not for its nourishment, as some of them go to supply the bone which it invests; and it is principally by means of vessels that the periosteum adheres to the bone. It has absorbents and nerves; but unless under the influence of disease, this structure is not endowed with a great share of sensibility.

The periosteum serves two important uses, viz.—to give firm attachment to the muscles; and to sustain the branches of blood-vessels going to the bone.

The cavities, or cancellated structure of bones are lined by a membrane called the membrana medullaris. It is exceedingly vascular, and secretes the marrow, which is said to be of the same use to the bone, as the fat is to the soft parts.

Formerly, the diseases of bone were regarded as of a peculiar kind, in very few respects resembling those of the soft parts, an error resulting from the ignorance of the Ancients, with regard to the true structure of this substance. Observation and chemistry have, however, removed this obstacle to improvement in Pathology. Seeing that bone is furnished with blood-vessels, absorbents, and nerves, we cannot be surprised at its liability to inflammation, and its consequences, viz.—increased exhalation, or effusion; suppuration; ulceration; and mortification. Seeing too, that an animal and earthy material enter into its composition, and that for the due and healthy office of bone, they must exist in certain proportions; and knowing that there are vessels which can diminish or increase the one or the other, in quantity; we cannot be astonished at the occurrence of preternatural hardness or softness. Thus, the diseases of bone may be attributed to the states of the vascular system, as those of the softer textures of the body. An increased action of the blood-vessels will constitute *inflammation.* An increased secretion will produce the effusion of a fluid, which, in time, will be converted into bone, causing *exostosis.* A change in the action of the vessels, by which they secrete pus, will give rise to *suppuration.* An increased action of the absorbents, with the preceding condition of the blood-vessels, will occasion *ulceration.* The extinction of the vital principle, *mortification.* And a loss of balance between the secreting and absorbing systems will cause *rachitis, mollities ossium,* and *fragilitas ossium.* Considering the subject in this way, the general Pathology of the osseous system is simplified, and found much to resemble that of soft parts,—differing only in the slowness of the morbid action, and the tardy progress of reparation; two circumstances arising from the quantity of inorganic matter, which peculiarly characterizes the structure of bone.

Bones may be divided into four classes, viz.—the flat, or those of the head;—the cylindrical, or those of the extremities;—the spherical, or those of the carpus and tarsus; and the irregular, or those of the spine. This classification is adopted, not on account of their form entirely, but from the manner in which ossification proceeds in the different bones.

The study of the bones should be commenced with those of the cranium and face; and then, in succession, we should examine those of the spine, thorax, pelvis, upper extremities, and lower extremities.—Their situation, connexion, figure, processes, foramina, general character, and uses, are the points to which the attention should be directed. But to consider the bones individually, (though necessary at first) is not of so much real importance to the Surgeon, as to study them relatively, and combined; for we must seek for the parts formed by their union, and affording lodgment to soft organs. It is obvious, that very little importance can be attached to our knowing the bones of the head and face in their isolated state; but when joined together, they form elevations, and depressions, that must be attended to. If we join two or three vertebræ, we shall have no correct idea of the extent of motion, which the spine enjoys; because, between any two of the bones, little or no movement is allowed; but the whole, when joined, are capable of extensive motion. To explain the mechanism of the chest, we must examine it in its totality; and the same obtains, with regard to the functions of other parts of the osseous system. The Physiology of the skeleton requires, that we should not limit our examination to separate, or individual parts, but extend it to the great whole in connexion; I repeat, however, that parts must be understood, before any other thing be attempted.

The bones of the CRANIUM are eight in number, six of which are proper to the cranium, viz.—the os frontis, two ossa parietalia, two ossa temporalia, and the os occipitis; and two common to the cranium and face, viz.—the os sphenoides, and os ethmoides. These bones are joined together by irregular lines, called sutures, which are variously named. The suture connecting the os frontis with the ossa parietalia, is called the coronal suture.—The one which unites the ossa parietalia, the sagittal suture.—The sutures joining the os temporale on each side to the os parietale, os occipitis, os sphenoides, and os malæ, are named the squamous or temporal; the additamentum suturæ lambdoidalis; sphenoid; and zygomatic. Those uniting the occipital bone to the parietal bones, temporal bone on either side, and sphenoid bone, are called the lambdoidal, the additamentum suturæ lambdoidalis, and sphenoid sutures. The sphenoid bone is connected with surrounding bones by the sphenoid suture; and the ethmoid by the ethmoid suture.

The bones of the FACE are fourteen in number; twelve of them are in pairs, the remaining two are single. The pairs are, the ossa malarum, ossa unguis, ossa nasi, ossa maxillaria superiora, the ossa spongiosa inferiora, and the ossa palati. The single ones are, the vomer, and maxilla inferior. The bones of the face are united to those of the cranium, by the transverse, sphenoid, ethmoid, and zygomatic sutures; and to each other by sutures, named after their situation, and by concretions of substances, the lower jaw excepted, which has a moveable articulation.

The student is much puzzled by a multiplication of the names of the sutures, in the way that some anatomists have adopted. I have endeavoured to simplify the study of them as much as possible; taking care at the same time not to waive any important point.

The TRUNK of the skeleton is composed of three parts; the spine, thorax, and pelvis.

The SPINE is a column of small bones, twenty-four in number; and called vertebræ, from the Latin word, verto. They are divided into three classes, named cervical, dorsal, and lumbar. In the first class, there are seven bones; in the second, twelve; and in the third, five. The increase in size of these bones is gradual, from the first cervical to the last lumbar vertebra.

The spinal column is articulated above, with the condyles of the os occipitis; and below, with the base of the sacrum. Its form is curved; in the neck, it projects forward; in its descent through the thorax, the curvature is backward; and in the loins, forward again: thus its figure has been compared to the italic *ſ*.

Between the cervical, dorsal, and lumbar vertebræ, and even amongst the vertebræ of each class, there are differences, or peculiarities, which must not be overlooked. The first cervical is called the atlas, and is nothing more than a bony ring. The second is named the dentata, from its having a toothlike process. The third, fourth, fifth, and sixth, resemble one another. The seventh is like a dorsal vertebra. The transverse processes of the seven vertebræ of the neck are perforated with a hole; the holes of the six superior transmit the vertebral arteries to the brain; that in each transverse process of the seventh is for the transmission of a vein. The student will readily discover the peculiarities in the rest; and will find no difficulty in accounting for their effects on the degrees of motion in the different parts of the spine. The movements of the spinal column are freest in the neck; next, in the loins; and lastly, in the dorsal vertebræ. The articulation of the vertebræ to the ribs laterally, and the locking together of their spinous processes, are the causes why they are least moveable in the back.

The dorsal vertebræ form the back part of the THORAX, and passing forwards from them are the twenty-four ribs, twelve on each side. The seven uppermost proceed to the STERNUM, a bone composed of two portions, and the cartilago ensiformis, and from being joined to this bone by means of cartilages they are called true ribs. The five inferior on each side, do not reach the sternum, and on that account are named false, or floating ribs. The dorsal vertebræ, behind; the sternum, before; and the ribs, laterally; constitute the conical cavity, called THORAX, which contains the heart, lungs, and other important parts.

There are differences to be observed amongst the RIBS. Some are more curved than others; their diminution in curvature being gradual, from the first to the last. From the first to the seventh, the ribs increase in length; and from the seventh to the twelfth, they decrease. The first rib is articulated only with the first vertebra of the back. The eleventh and twelfth have no tubercles, and the last, no fossa for the intercostal vessels and nerve.

The PELVIS is a cavity, formed of bone; posteriorly is the sacrum; at its apex, the os coccygis; and on the sides, and in front, are the ossa innominata. Above, it is expanded; below that, contracted; then expanded again, to form the cavity; and this last terminates in an inferior opening, called the outlet. The pelvis contains the bladder, rectum, and other organs.

Each UPPER EXTREMITY is composed of the shoulder, arm, fore-arm, and hand.

The shoulder consists of the clavicula, and scapula. The arm, of the os humeri. The fore-arm, of the radius, and ulna. The hand of the bones of the carpus, meta-carpus, and fingers.

Each Lower Extremity is composed of the thigh, leg, and foot. The thigh has one bone, the femur; the leg, two bones, the tibia and fibula, with an appendage to the former, called patella; and the bones of the foot are those of the tarsus, metatarsus, and toes.

Having learnt the individual bones, their processes, and remarkable points, it behoves the student to observe them in their united state, as forming the skeleton. The head, trunk, and extremities, must be examined anatomically, and physiologically.

The differences to be observed in skeletons of different ages, prior to the period when ossification is complete, depend on the stage of the ossifying process. When complete, we remark peculiarities in the male and female skeleton. The male skeleton is larger, in a general way, than the female, and the bones are fuller, and more substantial; but the most striking circumstances between the two, are presented in the breadth of the shoulders in the one; and the expanded and capacious state of the pelvis, in the other.

Amongst the purposes to which the skeleton is subservient, the following are the most important.

1st.—It is the basis of the soft parts, and the frame-work of the body.

2dly.—It is a fulcrum for the action of the muscles; hence, an essential part of the organs of loco-motion.

3dly.—The bones protect from accident, the vital organs, which are contained in the cavities which they form.

The bones which compose the skeleton, are joined together, for the most part, by ligaments; but the junctions vary from one another in many respects; and the variations have given rise to a division of the joints into genera, and the genera are subdivided into species.

The parts which enter into the composition of a joint, capable of free motion, are, ligaments, synovial membrane, synovia, and cartilage; in some of the joints, there are ligaments, as well within, as without the cavity of the joint. With a few of the articulations, there are connected some tendons: *e. g.* the shoulder, hip, and others; but tendons ought not to be enumerated amongst the component parts, since their principal use is to strengthen the articulation.

On laying open one of the joints of the extremities, the fine vascular synovial membrane appears, bedewed with its synovia, or secretion; it is classed amongst the most vascular structures of the body, for by coloured size injection, it can be rendered uniformly red. The arteries which are distributed to it, terminate in two ways, viz.—in veins, and exhalents; the former to return the superfluous quantity of blood, the latter for the synovial secretion. The use of the synovia is to lubricate the articulating surfaces, for facilitating their motion upon each other. Besides the synovial membrane, we find the cartilages which tip the extremities of the bones of the joint; they are smooth, white, and extremely elastic; not very vascular, hence endowed only with a weak living principle. Within the knee-joint, there are ligaments, connecting the heads of the bones; but the knee and hip are the only articulations which are furnished with internal ligaments. Without, or on the exterior of the joint, however, there is always one, or more ligaments; when only one (a capsular), the deficiency is made up for, by means, which additionally strengthen this ligament; thus, in the shoulder, and hip-joints, the expanded tendons of muscles contribute much to increase the strength of the capsular ligament; but in the latter, we find the ligamentum teres, in addition to that circumstance; and in the former, the tendon of the long head of the biceps muscle runs through the cavity of the joint.

The ligaments, like the cartilages, are but sparingly organised.

Having given a brief description of the structures of the joints in general, it is easy to understand some of the pathological circumstances attendant on them. With the exception of the synovial membrane, all the parts are little vascular, and little sensible; hence joints are slow in taking on morbid action, and as in bone, that action, when once begun, is with difficulty subdued. This will teach us too, why a wound, which communicates with the cavity of a moveable articulation, is much to be dreaded; for a small puncture exposes to disease a very extensive surface, and the organisation and function of a joint are such as to interfere much with the curative process. The effects of a wound, whether punctured or incised, are, first, an escape of synovial fluid; and secondly, the exposure of the whole cavity of the joint. When called to a patient suffering under an accident of this kind, the indications of treatment must be founded on the effects produced; our object must be to close the wound, and so effectually too, as to prevent the oozing of synovia. We wish to promote adhesion of its sides, and this cannot be done, unless the synovial secretion is confined within the cavity of the joint; great attention and care in dressing the wound, are the means best adapted to do this; but with all the attention that can possibly be bestowed, our attempts are often frustrated. If adhesion cannot be effected at first, it cannot be effected afterwards; for there succeeds to the adhesive inflammation a suppurative one, and granulation must be the process of cure; for there are only two modes of reparation in the body, viz.—adhesion, and granulation. What then have we to expect? A tedious case; the cartilaginous surfaces must first become absorbed, because they are almost incapable of granulating, in consequence of their feeble living powers; and whilst this is going on, the constitutional irritation is often excessive. Sometimes an apparently trifling injury is followed by the most serious consequences; frequently such as endanger the limb, and not unfrequently, the life of the patient, unless amputation is timely resorted to; thus we are convinced of the necessity, imperatively called for, of not neglecting at the onset, wounds of joints. We must employ such means as are most likely to bring about an adhesion of the divided surfaces, and to keep down inflammation; for if these indications be neglected, the second mode of reparation will be attempted, at the expence of great local, and constitutional distress. These remarks I have deemed useful, as illustrative of the association between the Anatomy, Physiology, and Pathology, of the articulating system.

No further observations can be required on the morbid phenomena of joints; because, a right understanding of what we have already stated, will be the key to an explanation of inflammation, and its consequences from most causes; and of the danger resulting from fractures extending into, and compound dislocations of, joints. But in order to be profited by Anatomy, in learning the dislocations, it is necessary to know the peculiarities of the individual articulations; the student must therefore examine them; for they explain why one joint is more susceptible of luxation than another; why the head of a bone is thrown in one direction more easily than another; and why some kinds are more difficult to reduce than others; this last generally depends on muscular obstacles; and muscles, as the agents of dislocation, and the opposing powers to reduction, will be considered in another division of the work.

The bones and joints are the passive organs of loco-motion; the MUSCLES are the active organs, and by their influence, all the animal and organic movements are performed. It is by muscular agency, that we go from place to place; and that the heart, and all hollow viscera, contract upon their contents.

The human passions are expressed by the eyes; the eye-brows; the eye-lids; the lips; and certain appearances of the face; and the expression given to these different parts, are caused by muscles. These expressions constitute the language of gesture, which opens a path to this most interesting inquiry, how the emotions of joy, grief, melancholy, anger, &c. which depend on cerebral operations, are transmitted to, and characterised by muscular organisation. An inquiry replete with interest; but discouraging, from the difficulty there is in determining the preliminary step, viz.—the seats of the passions.

The functions of vision; hearing; speech; mastication; deglutition; the circulation of the blood; respiration; the faculties of standing; sitting; kneeling; walking; running; climbing; pushing; grasping; &c. are all dependent, more or less, on muscular power. Some of the muscles concerned in these purposes, are minute and delicate; as those of the eyes, ears, tongue, soft palate, and larynx; the rest, in a general way, are more bulky, because the actions to be performed by them, are of a more powerful and substantial kind. This outline of the uses of muscles may be filled up, by classifying the different muscles, according to their respective and combined actions; I adopt such an arrangement in my public lectures, as being the best mode of conveying useful instruction in this branch of Anatomy.

The structures which enter into the composition of a muscle are, bundles of fibres, which have a contractile power; cellular membrane, which unites the fibres together; arteries; veins; absorbents; and nerves; and every muscle, the sphincters excepted, terminates in a glistening structure, called a tendon. The Ancients supposed that tendon was nothing more than muscle hardened by pressure; but they possess nothing in common with each other, save the fibrous character, and the fibres are ligamentous, not muscular. Muscle is abundantly furnished with blood-vessels; tendon, on the contrary, has little, or no vascularity; hence its weak living principle, and its tendency to slough, or mortify, on being wounded, punctured, or otherwise injured. Muscles are exquisitely sensible; tendons, on the other hand, are almost devoid of this faculty; they may be cut, or torn, without the animal expressing the slightest degree of pain. Muscle, and tendon, therefore, are not the same, but very different structures.

The principle of muscular motion is *irritability*, of the nature of which, we know as little as we do of life; but there are certain laws of this principle, which we may consider as established; thus, experiments, and observation, fully prove that a muscle cannot long remain in a state of action; therefore, firstly, a state of rest must succeed a state of action. Secondly; every irritable part loses a portion of its irritability by action. Thirdly; by repose, it regains the portion which it lost. Fourthly; all irritable parts are not endowed with the same share of irritability. The heart is the most irritable of all animal structures; next, the intestines; the stomach; the urinary bladder; the muscles of respiration; the voluntary muscles; the arteries; the veins; and lastly, the absorbents. Fifthly; the degree of action produced by a stimulus, is (cæteris paribus) in proportion to the power of the stimulus. And Sixthly; the action of every stimulus is in an inverse ratio to the frequency of its application. There are other confirmed laws of this extraordinary principle; bnt the six above mentioned, are most familiar to us; as facts, illustrative of them, are in the possession of all men. To the student, a thorough knowledge of these laws may lead to deductions of great practical importance.

The muscular system is as little liable to disease as any system of parts in the body; but it furnishes us with many signs of disorder in other organs.

In vigorous and healthy persons, the muscles are firm; but in weak persons, they are soft and flabby. Their power is, in a general way, in proportion to their bulk; but a remarkable fact is observable in certain cases of lunacy, where the power of muscles seems to be extraordinarily increased. In fevers of low type, the power is much diminished; and in paralysis, it is altogether destroyed.

Cramp consists in a spasmodic contraction of one or several muscles; this painful affection, when attendant on labour, is to be referred to the pressure of the child's head on the nerves distributed to the muscles of the thigh. There is a species of cramp called tetanus, which is exceedingly dangerous. Tetanus is an involuntary and almost constant contraction of all, or some of the muscles of the body, while the senses are unaffected. It may be either idiopathic, or symptomatic. In most instances, it succeeds to punctured, and lacerated wounds, especially when tendons and nerves are involved in the injury, and in these cases, the disease is often fatal.

From the constant actions, consequent on organisation and life, and from the continual losses thereby sustained, the body would soon operate its own destruction, if it were not provided with an apparatus to receive the aliment, and to convert the same into a substance capable of repairing the wastes, and of supporting the functions necessary to life. The organs concerned in this important office are called the DIGESTIVE ORGANS; they are, the teeth, salivary glands, œsophagus, stomach, intestines, liver, pancreas, spleen, lacteals, mesenteric glands, and thoracic duct.

The TEETH are the organs of mastication, and, in the adult, thirty-two in number. They are usually divided into four classes, viz.—the incisores, four in each jaw; the canini, two in each jaw; the bicuspidati, four in each jaw; and the molares, six in each jaw.

Each tooth consists of a base, body, cervix, and one or more fangs; the body is covered over with enamel, a white, vitreous-like, and insensible substance; so hard and indestructible, as to resist the effects of time and circumstances, which destroy every other part of the tooth. It is believed that the enamel is not an organised structure, but a crystallised secretion; for, by feeding an animal with madder, the osseous part of the tooth can be rendered quite red; but the enamel remains unchanged: it is, therefore, supposed not to be subject to the laws of life, and circulation. At the extremity of the fang, or fangs of a tooth, a small hole may be perceived, which leads to a cavity, in which is lodged the pulp, consisting of a gelatinous substance, which supports the vessels and nerves of the tooth. The teeth are confined in their alveoli, or sockets, by means of their periosteum, and the gums.

The SALIVARY GLANDS are the parotid, submaxillary, and sublingual; their ducts terminate in the mouth, where their secretion mixes with the food, to facilitate mastication and deglutition.

The ŒSOPHAGUS is the tube which conveys the masticated food into the stomach. It begins at the pharynx, and ends at the cardiac orifice of the stomach; and is a muscular canal, lined by a mucous membrane. Soon after the food has entered the stomach, it loses the character of a masticated substance, and assumes that of an uniform mass. The portion nearest the pylorus is most altered in appearance; for it has taken on the character of chyme: the change having been produced by the gastric juice, which is a powerful solvent.

The STOMACH is a muscular, and membranous bag; not inaptly compared in its figure, to a bag-pipe. It has two orifices, two extremities, two curvatures, and two surfaces. Its coats are three, viz.—a peritoneal, muscular, and villous; the gastric juice is secreted by the vessels of the villous coat.

The muscular tunic has two sets of fibres; a longitudinal, and a circular; by the former set, the cardiac extremity can be brought to approach the pyloric; and by the latter, the circumference of the organ can be contracted; it is by these powers, that the food is propelled from the stomach, into the first portion of the intestinal canal.

The Intestinal Canal is divided into the small, and large intestines; the small are subdivided into duodenum, jejunum, and ilium; the large, into cœcum, colon, and rectum. Like the stomach, the intestinal canal has three coats; but some parts of it have merely a partial investment from the peritoneum.

The auxiliary organs of digestion are, the Liver, Pancreas, and Spleen. The first of these is the largest gland in the body; the peculiarities of its structure will be mentioned in another place. The pancreas very much resembles the salivary glands, and its secreted fluid is similar in composition, and properties, to the saliva. The spleen is a spongy organ, composed of cells, in which the arteries terminate; it is supposed to be accessary to digestion, but nothing positive is known respecting it.

When the food has been partially digested in the stomach, it is carried by the peristaltic action of that organ into the duodenum, where a further change takes place. Into the duodenum open the ducts of the liver, and pancreas; by which the bile, and pancreatic juice are discharged from their respective organs. There can be no doubt that these fluids are the agents of chylification; although it has been disputed by some Physiologists, whether the former has any thing to do with the chylifiant process. The celebrated Blumenbach thinks that the bile separates itself into two portions, a serous, and resinous; and that the former probably mixes with the chyle, and is carried back to the blood, whilst the latter combines with the fæces, and acts as a stimulus to the peristaltic motion of the intestines. The ingenious, and industrious French Physiologist, Richerand, entertains a similar opinion. After speaking of the combined pancreatic and biliary fluids, as serving to penetrate the chyme, to render it fluid, to animalize it, to separate the chylous from the excrementitious part, and to precipitate whatever is not nutritious; he says,—" in bringing about this separation, the bile itself seems to be divided into two parts; its oily, coloured, and bitter portion passes along with the excrements, sheathes them, and imparts to them the stimulating qualities necessary to excite the action of the digestive tube. Its albuminous and saline particles combine with the chyle, become incorporated to it, are absorbed along with it, and return into the circulation." How the separation is effected, Richerand confesses his ignorance. He thinks that this act of the Animal Œconomy is as mysterious and inexplicable as the action of the brain, in producing thought; a phenomenon, which many Physiologists have considered, as exceeding the power of matter. The experiments recently made by Mr. Brodie, and published in Brande's, and other Journals, are capable of settling the point of dispute, respecting the effects of the bile in the process of digestion. Mr. B. was disposed to think, that the bile is intended to convert the chyme into chyle, by a chemical change: but to ascertain whether he was right in this, he completely obstructed the flow of bile into the duodenum, by a ligature on the ductus choledochus. The ligature, and the consequent want of bile, completely, and invariably, prevented the changing of a single particle of chyme into chyle; a process which takes place at the entrance of the duodenum, and never higher than the pylorus. No chyle could be traced in the intestines, or in the lacteals; but both of these were filled with a fluid like the chyme, which became thicker as it proceeded, and at the termination of the ilium, it was quite solid, though not like fæces. The office then of the bile is to convert chyme into chyle; and to act as the natural stimulus to the peristaltic action of the intestines.

When the process of chylification is completed, two functions are set up in the intestinal canal; the one is, absorption of the nutritious part of the food; the other, dejection, or the evacuation of the residuum, or excrementitious portion per anum: the former is accomplished by the lacteals; the latter, by the vermicular motion of the intestines.

The LACTEALS arise from the inner surface of the small intestines by orifices, not visible to the naked eye in the human subject; and from their origin they pass to the MESENTERIC GLANDS. The lacteal vessels which enter the glands, are named vasa lactea primi generis; those passing out of the glands are called, vasa lactea secundi generis. What change the chyle undergoes in these glands is not exactly known; but they are supposed to add a secreted fluid, by which it is more assimilated to the blood. From the mesenteric glands, the lacteals go to the thoracic duct, in which they terminate. This duct begins at, or near the first lumbar vertebra; then ascends on the left side of the spine; and ends in the left subclavian vein, at the place where it is joined by the internal jugular.

Thus, the organs which consitute the digestive system are subservient to various purposes; and on the due performance of each of them depend the nutrition, health, and energy, of the body.

The chyle, or product of the aliment after it has undergone digestion, is found, on analysis, to be composed of water, albumen, fibrine, and saline particles; but there are some differences in the constituent parts and properties of this fluid, as abstracted from animal, and vegetable substances. Animal chyle contains more solid materials, hence, is more nutritious; but vegetable chyle is less putrescent, hence, vegetable food is more proper than animal, for patients labouring under putrid, and some other diseases.

If healthy, and wholesome articles of food be taken, every morbid condition of the chyle must be owing to an undue action of the organs concerned in preparing it. We must, therefore, look to the digestive organs, and rectify their functions, 'ere the chyle can be improved in its properties.

The next system, which is most intimately allied, in a physiological point of view, to the digestive, is the ABSORBENT SYSTEM, which is composed of the absorbent vessels, and their appendages, called glands. The vessels are divided into lacteals and lymphatics; the former take their origin from the inner surface of the small intestines, as we have already stated: the latter arise from almost every surface, substance, and cavity of the body. The two sets of vessels pass through their respective glands, and at length unite to form trunks, which convey the chyle, and lymph, into the circulating mass of blood. The absorbents are supposed to have three coats, like the arteries and veins; but the delicacy of their structure defies an accurate demonstration of them. They are named, elastic, muscular, and membranous. An absorbent vessel will not retain a cylindrical form when cut across; hence, the elastic coat must be weak. The existence of a muscular tunic is to be inferred from their functions. There are two facts in favour of the muscularity of these vessels; first, the power which they have, of accepting, or rejecting the fluids which are offered to them; proving that their action is not dependent on mere capillary attraction; and secondly, the increased energy of their function, on the application of such stimuli as excite the activity of muscular parts in general. The inner, or third coat is the strongest; and to it, is owing the superior strength of the absorbent vessels, in comparison with the strength of veins; the former being able to bear a column of mercury, under which, the latter would immediately burst.

The three tunics are furnished with arteries, veins, absorbents, and nerves. By coloured size injection, the arteries may be shown; besides which, disease proves to us their existence; for when an absorbent is inflamed, we see a red line indicating its course, and resulting from a turgid state of its parietal vessels. The presence of absorbents is more conjectural; but that of nerves is manifested by the acuteness of the sensibility of these vessels, when in an inflamed state.

Absorbents have valves, like veins; but in the former, the valves are universal; in the latter, they are limited to the veins of the extremities, and to parts where pressure may interfere, with the circulation of the blood. The valves are directed towards the thoracic ducts; hence, they will permit a free passage to the fluid which circulates towards the ducts; but offer an effectual opposition to a retrogade movement.

The origins, course, terminations, and peculiarities, of the absorbents and their glands, should be well understood; for otherwise, the functions, and morbid phenomena of the absorbent system cannot be explained.

The absorbent vessels have three grand functions to perform, viz.—to carry the nutritious matter into the mass of blood; to prevent effusions in the circumscribed cavities; and to model the growth of the body by removing superfluous parts.

It is a law in nature, that all living bodies are constantly undergoing renovation, and decay; the blood-vessels are perpetually depositing new materials; and the absorbents are as perpetually engaged in removing the old. No solid, or fluid, can exist a great length of time, without a change: this is the state of living parts, whilst the operations of the system are under the influence of healthy action; but what takes place if the equilibrium, or balance between the function of renovation, and that of removal, be destroyed? If the transmission of nourishment be prevented, and the absorbents continue to act, emaciation must follow. If the blood-vessels perform their functions of deposit, and the lymphatics cease to absorb, an excessive growth, and a tendency to effusion, will be induced. When the exhalations in the different circumscribed cavities, and cellular membrane, are greater than the power of the lymphatics can overcome, dropsical accumulations must take place; producing, in the head, hydrocephalus; in the chest, hydrothorax; in the abdomen, ascites; and in the cellular membrane, anasarca. The preceding remarks will serve to illustrate the uses of the absorbent system, in preventing a preternatural increase of solids, or fluids; thereby in averting disease, and modelling the growth of the body.

But the absorbent system is an efficient means, in the hands of the Physician, and Surgeon, as it can be made subservient to the cure of disease. The lacteals are the most limited part of this system; their use is, to transmit the chyle from the intestines to the thoracic duct. The lymphatics, constituting the major part, arise from three sources, viz.—the external surface of the body, and cellular membrane under the skin; from the different cavities, as the head, thorax, abdomen, and pelvis; and from the surfaces and substance of all the organs of the body. We know the property, which mercury, and some other medicines, possess, of augmenting the action of the internal absorbents; hence, we employ these remedies in many diseases; but we can best excite the energy of the lymphatics, by administering medicine through the medium of cutaneous friction. The surface of the body is covered with a dense inorganic substance, called cuticle; the use of which, is to blunt the acuteness of external impressions, which would otherwise prove painful to the sensible cutis. The cuticle is spread over the orifices of the absorbent vessels, and thereby prevents absorption. Friction, however, raises the cuticle, and thereby exposes the orifices of the absorbent vessels. When the skin is denuded, we remove the sole obstacle to cutaneous absorption. When we wish to introduce mercury into the system, in a more speedy manner than we can do by giving it internally, it is usual to apply a blister, and to dress the raw surface with mercurial ointment; a salivation will thus be often produced in a few hours. When we vaccinate, we insert the virus carefully under the cuticle; by doing so, we present the vaccine lymph to the mouths of the absorbent vessels. Thus we have a great controul over the lymphatics; and can, by proper management, render them powerful auxiliaries to the cure of disease.

We have said, that the absorbent vessels pass through glands, in their route to the subclavian veins. It is of great consequence that the Surgeon should know the situation of these glands, and the absorbents which enter them; in order to trace the effects of irritation, and absorbed poisons. In the face, and neck, there are many absorbent glands in the course of the blood-vessels. In the upper extremity, there are two, three, or more glands, near the inner condyle, and through which, the trunks of the lymphatic vessels pass in their route to the axilla. If there be an irritable wound in either of the fingers, a swelling is likely to take place in one, or more of these glands. A tumour below the elbow is not glandular; because absorbent glands are never found below the joint; but between the elbow, and axillary glands, a few are to be met with, in the course of the brachial vessels.

The glands of the axilla are numerous; being sometimes as many as ten or twelve, in number. Their relative situations, with respect to surrounding parts, should be observed. Along the edge of the pectoral muscle, there is a chain of glands; in the depth of the axilla, are others; and there are others along the edge of the latissimus dorsi muscle, which bounds the axillary space posteriorly. Either of these sets of glands may be affected by an absorption of virus, from a cancerous breast; but, from proximity, the anterior chain is more likely to be first diseased. The extirpation of glandular tumours from the axilla, is a very delicate operation; and when the disease is cancerous, it is seldom effectual; for if the breast, and superficial glands, be removed, it is probable, that some of the deeper seated, as those of the chest, are affected; and as we cannot reach them, we cannot arrest the progress of the disease.

Cancer may, for the most part, be regarded as a fatal malady; in most cases, the operation does little more than prolong the patient's existence; I mean, when the complaint is of a *true* scirrhous character. With regard to the lower extremities, no absorbent glands exist below the ham; nor are there any between the ham, and the lower row of inguinal glands; therefore, no swellings in the intermediate situations can be glandular. Any irritation of the foot may occasion a tumefaction of the inguinal glands, in which the absorbents, which accompany the great saphenous vein, terminate. Bubo, from the absorption of the syphilitic virus, is seated in the upper row of the inguinal glands; this distinction is of practical importance. When the testes are attacked by a malignant disease, the malignancy is communicated to the glands of the loins. In cancer of the uterus, the iliac, or lumbar glands, or both, will become affected. The state of the mesenteric glands, in the disease called tabes mesenterica, and the symptoms attending it, are explained elsewhere.

We have thus followed the routes which poisons take, to enter into the mass of blood; and have elucidated many of the healthy and morbid phenomena of the absorbent system.

Having traced the chyle and lymph to the circulating mass of blood, we are naturally induced to speak next of the SANGUIFEROUS SYSTEM; including a set of organs, by which the nourishment is conveyed to the different structures of the body. The sanguiferous, or circulating system, consists of the heart, arteries, and veins; to which we shall add the lungs; because circulation and respiration are closely allied functions.

The HEART is of a conical figure, and lies obliquely in the thorax, inclining to the left side. Its form justifies a division into base, body, and apex. From the base goes off the aorta, or principal trunk of the arterial system.

This organ has four cavities: an auricle, and ventricle, on the right side; and an auricle, and ventricle, on the left; and with these, large vessels communicate. Into the right auricle, the vena cava descendens, vena cava ascendens, and coronary vein open; and there is an aperture of communication with the right ventricle. In the right ventricle are two openings; one from the auricle; the other into the pulmonary artery. In the left auricle, we observe the entrances of the four pulmonary veins, and a hole into the ventricle; and in the left ventricle, we find the opening just spoken of, and another, leading to the aorta.

The structure of the heart is muscular; but its substance is not uniform in thickness; the reason of which is obvious. It seems to be a law in nature, that no part of the Animal Œconomy shall be endowed with more energy than is necessary for the due and regular execution of its function; hence, a difference is made in the thickness of the parietes of the different cavities of the heart. The right, and left auricles have thin muscular walls; but they possess a sufficient degree of power for the purpose required, viz. —that of sending the blood into the right and left ventricles, which are close at hand. The parietes of the right ventricle are more slender than those of the left; because less force of contractility is demanded, to transmit the blood through the lungs than to propel it, (as the left ventricle does in great measure), throughout the arterial system. Within the cavities of the heart, the student should observe the carneæ columnæ, and chordæ tendineæ.

An examination of the structures of the cavities of this organ, will assist us in explaining how the sides of each of them are approximated; how the blood is expelled; and how a retrogade course of this fluid is guarded against. The course of the blood is determined by the mechanism of the valves; the valves being flood-gates, which permit the passage of the blood in one direction only. They are thus named: the valve between the vena cava inferior, and the right auricle, is called, the valvula Eustachii; that, at the termination of the coronary vein, the valvula semilunaris; that, between the right auricle, and right ventricle, the tricuspid valve. The three valves at the root of the pulmonary artery, are named, from their figure, the valvulæ semilunares. Between the pulmonary veins, and the left auricle, there are no valves. Between the left auricle, and left ventricle, we find the mitral valve; and between the left ventricle, and root of the aorta, are the three valvulæ semilunares. The mechanism of these membranous structures bespeaks a beautiful adaptation of means, to the fulfilment of an end which could not be dispensed with. They sometimes become ossified, which destroys their function, and, in time, proves fatal to the individual, who is the subject of this morbid change.

The heart is admirably constructed in all its parts, and so clear are the uses of its structural arrangements, as to tell at once the purposes of this important organ. It will appear extraordinary, then, to all who know its anatomy, that the circulation of the blood remained undiscovered so long as it did; but the astonishment must cease, when we reflect, that the *true* anatomy of the heart was not accurately known, and that the discovery of its function was almost contemporaneous, with that of its real mechanism, and structure.

The assistance which Anatomy lends to Physiology, is strikingly illustrated by the important fruit of Harvey's industry, and observation. One of the principal circumstances which led him to detect the course of the current of blood, was an examination of the manner in which the valves are disposed. Other Anatomists, before him, shewed an imperfect knowledge of some of the facts, which he afterwards elucidated, therefore Harvey derived assistance from the labours of his predecessors; but to him are we indebted, for correct and scientific views of the subject; and consequently, to him is due the honour of a discovery, far more interesting, and useful, than any other that has been deposited in the archives of medical literature. His doctrine, however, did not escape the animadversions, which new doctrines generally experience; by some, it was scoffed at; by others, it was disbelieved; but truth is sure to overcome all opposition, and before his death, Harvey had the satisfaction to prove it; for his opinions were embraced, credited, and taught by all. Those who dared dispute them, were regarded as aliens to a sound mind; or, as influenced by prejudice which destroys the ability to deduce fair inferences, even from admitted data.

The mechanical arrangement of the different parts of the heart positively shows, that the blood can only circulate in a direction determined by that particular arrangement. It must go from the right auricle, into the right ventricle; from the ventricle, through the lungs; from the lungs, to the left auricle; from the left auricle, to the left ventricle; from the ventricle to the aorta; and from the aorta, throughout the arterial and venous systems, back again to the right side of the heart. This is the grand round of circulation; which we may divide into a pulmonic, and systemic: the parts connected with the former, are, the right cavities of the heart; the pulmonary artery and its ramifications; and the radicles and trunks of the pulmonary veins: those connected with the latter are, the left auricle, and ventricle; the arteries; and the veins.

The ARTERIES are the vessels, which convey the blood from the heart, to the different structures of the body. They originate in two main trunks, viz.—the pulmonary artery, and aorta; the pulmonary artery arises from the right ventricle of the heart, and is distributed to the lungs; the aorta springs from the left ventricle, divides, and subdivides, into branches, which go to all the other organized parts of the body. After its origin, the aorta gives off the coronary arteries, and then forms a curvature, or arch, from which part, vessels pass off to the neck, head, and upper extremities. It then descends on the left of the spine; and whilst in the chest, sends off the intercostal, œsophageal, and bronchial branches. After emerging from the thorax, it begins to supply the abdominal viscera; some of its branches are azygous, or single; others are in pairs. The single branches are, the cæliac, the superior and inferior mesenteric, which are distributed to the stomach, liver, spleen, pancreas, and intestines. The double branches are, the diaphragmatic, the renal, the spermatic, and the lumbar. At the fourth, or fifth lumbar vertebra, the aorta bifurcates into the common iliac arteries. Each common iliac divides into an internal and external branch;

the internal principally supplies the pelvic viscera; the external passes under Poupart's ligament, to the lower extremity. This is a general idea of the distribution of the arterial system. The arteries terminate in six ways, viz.—in anastomosing with other branches; in veins; in the excretory ducts of glands; in exhalent vessels; in cells; and in colourless, or serous branches. In their course, from their origin to their terminations, some branches pass off from the trunks, at acute angles; others more obtusely. After making their angles, and flexions, they run, for the most part, in a straight direction; with the exception of such arteries as supply parts which are subject to be stretched, or where a contrivance is necessary, in order to break the force of circulation; thus, in the lips, uterus, and brain, they take a tortuous, or serpentine course.

An artery is a tube composed of coats; which coats have vasa vasorum, lymphatics, and nerves. They are three in number, and named, the cellular, or elastic, the muscular, and the membranous. It is to the first coat, that an artery owes its ability to retain a cylindrical form, when cut across.

The VEINS are those vessels which return the blood of the arteries back again to the heart. They arise from two sources, viz.—from the extremities of arteries, and from cells; and terminate in the auricles of the heart. The veins of the head, neck, and upper extremities, end in the vena cava superior; those of the lower extremities, abdomen, and thorax, in the vena cava inferior; those of the heart, in the coronary veins; and those of the lungs, in the four pulmonary veins, which terminate in the left auricle of the heart. The veins may be divided into two sets: the cutaneous, and deep; the latter set, for the most part, accompanies the arteries. Between the two sets, there are very free communications; a fact well demonstrated by the effect of grasping, at the time of bleeding from the arm; when the blood does not flow from the orifice with freedom, it is usual to direct the patient to clench his fist, or move his fingers; on doing which, the blood issues freely. The explanation of this is, that when the muscles are in action, their bellies swell, and compress the deep seated veins; by which, the blood is driven into the superficial ones.

The veins, like the arteries, have three coats; but they are all much thinner; hence, the difference in the thickness of the walls of the two orders of vessels. But the veins of the extremities differ from arteries, in having valves, which serve to support the column of blood; this, if allowed to gravitate, would be an almost insuperable obstacle to the circulation in the extreme veins, which is principally of a vis a tergo kind. When the valves do not perform their functions well, that knotted appearance of the veins, known by the name of varix, takes place, and is productive often of serious inconvenience.

The arteries, and veins, are subject to inflammation, obliteration, ulceration, suppuration, mortification, and to the deposition of calcareous matter in their coats.

The heart is the principal agent in the circulation of the blood; its muscular structure giving it a power superior to that of any other agent. Its actions are two, viz.—a diastole, or dilatation; and a systole, or contraction. The right auricle derives its blood from the veins, and contracts upon it; and whilst this auricle is receiving blood from the general system, the left auricle is deriving blood from the lungs; thus, the actions of the auricles are synchronous, they dilate, and contract at the same moment of time, and the ventricles do the same. The arteries contribute a share of power to the systemic circulation, for if they did not, the blood could not arrive at its ultimate destination; the vis a tergo influence not being sufficient to accomplish it. Some Physiologists, however, deny that these vessels are endowed with any other power than that of elasticity; and they say, that this is the only auxiliary agent which they lend to the circulation of the blood. Berzelius is of this opinion, and many moderns believe it to be true; but I would, in addition to the evidences of the inherent action of vessels afforded by local inflammation, and the phenomena of blushing, mention the variety of circulation observed in cold blooded animals. In fishes, the heart, as in the frog, consists of a single auricle and ventricle; the ventricle opens into a bulb, or pedicle, from which the branchial, or artery of the gills, takes its origin. The blood, after circulating through the minute vessels of the gills, arrives at the aorta; and by this main trunk and its branches, it is sent to the different parts of the body; here, therefore, it is *scarcely* possible for the heart to communicate its impulse to the general arterial system. It is in the muscular and elastic coats of arteries, that the power resides, which assists in propelling the blood onwards. The veins, too, have an inherent principle of action; less in degree, however, than that of the arteries; but as the blood in them is supported by valves, less suffices. In the arteries, and veins, there is always a column of blood, which is forced forwards by the action of the heart, aided by that of the arteries, and veins. The capacity of this column is sometimes small and sometimes great; the diminution and increase corresponding with the diastole and systole of the left ventricle, from which circumstances are chiefly derived the phenomena of the pulse.

The Pulse is the effect of the action of the heart upon the blood; which action causes an elongation, as well as a dilatation of the artery in which the pulse is felt. The pulsations at the wrist do not take place at the same moment of time, as those of the carotid, and other arteries near the heart; the interval is long, or short, in proportion to the distance of the vessel from the heart; the reason of which is obvious. At the adult age, in a state of health, the pulse is equal, regular, and has a moderate degree of power; but age, temperament, stature, and disease, occasion varieties in it.

At birth, the number of pulsations in a minute, are about 140.—At the age of twelve months, 120.—At the age of two years, 110.—At the age of three years, 96.—At the age of seven years, 86.—At puberty, about 80.—At the adult period, 75.—And at sixty years of age, about 60.

Persons of a sanguine temperament have generally a quick pulse. Those of a melancholic temperament, a slow one. Women have usually a quicker pulse than men; and dwarfish than tall persons.

In disease, the pulse is often much affected. The pulsations may be frequent, or slow; weak, or strong; full, or small; regular, or irregular; or intermittent.

A *frequent* pulse is characterised by the pulsations being more numerous than they ought to be, in a given time. A *slow* pulse is the reverse of this. In certain inflammatory diseases, and in those attended with much constitutional irritation, the pulse is frequent. In nervous fevers, and diseases of debility, the pulse is generally slow.

A *feeble* pulse is indicated by the vessel striking the fingers feebly, and being easily obliterated by pressure. The reverse of this is a *strong* pulse.

The pulse is *full*, or *small*, according to the diameter of the artery.

A *hard* pulse is a resisting pulse. When tense and resisting, the pulse is *wiry*; so called from the impression of the artery on the fingers. This description of pulse usually accompanies the phlegmasiæ, and active hæmorrhages. A *soft* pulse is an indication of debility.

The pulse is *regular*, when the same interval of time takes place between the pulsations, and when the pulsations maintain the same character. An *irregular* pulse is the reverse of this.

The pulse is *intermittent*, when some pulsations are wanting; and when the pulsations themselves vary in strength, and character.

These are the most important varieties of the pulse. Some authors have enumerated many more; and Galen has described thirty-six different kinds. Our judgment in the treatment of disease is often founded on the state of the pulse; it is one of our most certain guides; but it must be admitted by the Pathologist, that it now and then deceives him.

The LUNGS, (an essential appendage to the circulating system,) are situated in the thorax, one on each side the heart; the left lung is composed of two lobes; the right, of three; and the inclination of the heart to the left side, is the reason assigned for the difference in the number of lobes. The structures which enter into the composition of these organs are, the bronchiæ, or ramifications of the trachea; air cells of great minuteness; two sets of arteries, the pulmonary and bronchial; two sets of veins, corresponding with the arteries; absorbents; and nerves; these different parts are united together by a fine reticular texture; and the whole is surrounded by the pleuritic membrane.

The lungs are quite free in the thorax, except at the lower, and posterior parts; where they are confined, in some measure, by the pleura; and their figure is conical; like the cavity in which they are contained. By forcible inflation, we can distend these organs to a very great extent; but this will give us no just conception of their state in natural inspiration; and they are never completely collapsed; for it is impossible to deprive them of all the air which they contain.

The lungs perform the important function of respiration; the effects of which are, a change of colour in the blood, and the production of animal heat. They are, too, accessary to the formation of the voice; and coughing, sneezing, sighing, yawning, hiccup, and laughing, are sympathetic affections of these organs.

In speaking of the circulation, we said, that the blood passed from the venæ cavæ into the right auricle; from the right auricle into the right ventricle; and from thence to the lungs by the pulmonary artery. The ultimate branches of the pulmonary artery ramify on the parietes of the air cells; anastomose freely with each other; and terminate in the radicles of the pulmonary veins. The pulmonary veins unite, and form at length four considerable trunks, which empty themselves into the left auricle of the heart. Seeing, then, that the blood circulates through the lungs 'ere it goes from the venous to the arterial system, it is reasonable to inquire into the necessity for this.

If we observe the blood in the right cavities of the heart, and compare it with that in the left, we shall find a great difference in the colour and properties of the two. That in the former is what we call venous blood, or blood that has circulated throughout the body, and lost, from that circumstance, a part of its old properties, and acquired new ones. It is of a very dark crimson colour, in consequence of having absorbed a quantity of carbon. That in the latter is arterial blood, or blood deprived of its carbonaceous qualities; hence, of a lighter, and more florid colour. Knowing that the change takes place in the lungs, we must, of course, ascribe it to respiration, and this is reducible to matter of fact; but to render it intelligible, I must first speak of the nature and composition of atmospheric air.

The air of the atmosphere which surrounds us, is composed of three gases, besides heterogeneous matters. The gases are, oxygen, nitrogen, or azote, and carbonic acid; and in one hundred parts, they are usually found in the following proportions; of oxygen, about 22 parts; of nitrogen, 77; and of carbonic acid, about one; but Mr. Dalton thinks that there is not one per cent. of carbonic acid gas. This is the air we inspire, But on analysing the air expired, instead of one of carbonic acid gas in 100 parts, we find much more; and the oxygen proportionally diminished. Dr. Henry observes in his "ELEMENTS OF EXPERIMENTAL CHEMISTRY," that when the state of the expired air is examined, a quantity of oxygen is found to have disappeared, equal to the carbonic acid gas which has been formed. Now, as carbonic acid has been proved to contain its own bulk of oxygen gas, it follows, that all the oxygen which disappears in respiration, must have been expended in forming this acid. A chemical change, therefore, has been effected; and to that change may be attributed the alteration in the colour of the blood. It would appear, that the atmospheric air in the lungs becomes decomposed, on the principle of chemical affinity: that when the carbonised or venous blood is exposed to its action in the lungs, a portion of the oxygen is resolved into its constituent parts, which are a base and caloric, or the matter of heart; the base, or acidifying principle of the oxygen, unites with the carbon of the blood, and forms carbonic acid gas, which passes off in expiration; thus explaining, why more carbon is present in expired, than in inspired air. From being deprived of its carbonaceous principle, the blood changes to a florid red colour, in which state we find it in the left cavities of the heart and arterial system. But another purpose is fulfilled by this chemical decomposition of the oxygen of the atmospheric air, viz.—the production of animal heat.

The natural heat of the body is about 99° of Farenheit, and this obtains equally, whether man inhabits the climate where mercury freezes, or where the sun has almost a scorching power; climate, therefore, does not affect the *internal* temperature of our bodies, which arises from the lungs performing a regular and uninterrupted operation upon the oxyen inspired. We have already spoken of the way in which the base of the oxygen is disposed of, viz.—in combining with the carbon to form carbonic acid gas; the other part, or caloric goes over to the arterial blood in a latent state; but in the circulation it becomes sensible, and maintains an equal temperature of the body. The meaning of latent, and sensible heat, requires further elucidation.

There are two opinions concerning the nature of heat; according to one, it is the *property* of matter;

according to the other, it is *matter itself;* to the latter opinion, most philosophers of the present day incline; they designate it, therefore, *caloric, or the matter of heat.*

When we speak of heat, in common language, we intend to convey the idea of any thing, which, on coming in contact with the hand, or any part of the body, imparts the sensation of warmth; this is temperature, or *sensible heat;* but there is another state, in which caloric may exist, and as the presence of it cannot be detected by the sense of touch, or the thermometer, chemists have applied to it the name of *latent heat;* but for further information on this subject, I shall refer the student to Works on Chemistry.

The caloric, then, which is set at liberty from the oxygen, is in a latent form; but it is disengaged in a sensible state, in the circulation, owing to the blood, on becoming venous, having a less capacity for heat, than when it was arterial. Animal heat, therefore, according to this theory, is the result of a chemical process; but some Physiologists contend, that the nervous system is concerned in its production: thus Mr. Brodie states, that if the brain be destroyed, the power of generating heat is destroyed; and Dr. Wilson Phillips has shown that the temperature of animals is considerably influenced by the spinal marrow.

It will appear from the preceding observations, that the oxygen of the atmospheric air is diminished in quantity by respiration, and that the carbonic acid gas is increased. In Blumenbach's Physiology, there is a note, giving the results of some experiments, made with a view to determine how long an animal can breathe the same air without dying. For these experiments, three dogs were obtained, of equal size and strength. To the trachea of the first dog, a bladder was tied by means of a tube, and this bladder contained about twenty cubic inches of oxygen gas; the animal died in fourteen minutes. In the second case, the bladder was filled with atmospheric air; the animal died in six minutes. In the third, the carbonised air, expired by the second dog, was employed; and the animal died in four minutes. On examining the air of the bladder, after each experiment, it gave the common signs of carbonic acid gas, viz.—it extinguished flame, and precipitated lime from lime-water. Finding, then, that carbon is emitted from the lungs, and oxygen consumed, it is certain that we cannot remain any great length of time in a confined place, without suffering inconvenience, and even death, if the stay be protracted beyond a certain period; because the atmosphere is deteriorated, by being surcharged with a gas, which is destructive of animal life. It is natural, then, to ask, how the air is again purified? From what sources the oxygen is obtained? and by what process the carbonic acid gas is destroyed? We may briefly answer these questions, by stating, that the salutary renovation is principally owing to the vegetation of plants. Priestley proved by his experiments, and the fact has been confirmed by after experimenters, that vegetables act in an opposite manner on the atmosphere to what we do; instead of absorbing oxygen, and emitting carbon, they emit oxygen, and absorb carbon; thus, the animal and vegetable kingdoms are subservient to the well-doing of each other.

To illustrate further the wise provision furnished by nature, I shall extract a passage from Dr. Curry's Observations on Apparent Death: "To Dr. Priestley," he says, "we owe that beautiful discovery of the mutual support which the animal and vegetable creation afford to each other, viz.—that animals, whilst dissolving, and putrifying after death, set loose in the atmosphere, a great quantity of nitrogen gas, which, if augmented beyond its due proportion, would tend to destroy those that still live; but that this gas is greedily absorbed by growing vegetables, which retain and fix its basis as a part of their substance, whilst they give out, in exchange, a quantity of vital air, which, in its turn, is necessary to the maintenance of respiration, and animal life."

We have seen that the constituent parts of atmospheric air, are oxygen, nitrogen, and carbonic acid gas, besides adventitious materials; the proportions in which they are combined, are nearly thus—22—77—and one; although some chemists have given different results; but not, however, widely different.

Oxygen is called vital air; it being the only one of the three that can support animal life; but when alone, it is so stimulating in its effects, as to cause a rapid expenditure of the vital principle. Nitrogen gas is quite incapable of supporting life; and carbonic acid, the same; but for the dilution of the too active properties of the oxygen, their addition is essential in atmospheric air. Monsieur Orfila mentions, in his valuable work on Poisons, that Nysten proved, by experiments, that guinea-pigs, plunged into nitrogen, or azotic gas, are asphyxied at the end of five minutes, and in three minutes and a half, if the experiment be begun by emptying the lungs of the air that may be contained in them. At the moment of immersion into an atmosphere of azote pure, or almost pure; the animal experiences a difficulty in respiration, which becomes great, elevated, and more rapid than ordinary; it grows gradually weak, but without any lesion of the nervous functions; after death, the arterial system is found filled with black blood. This asphyxia takes place through a defect of oxygen, as young animals can be easily restored to life by exposing them to pure air.

Carbonic acid, or that gas which is disengaged from fermenting liquors and lime-kilns, more speedily kills than the preceding. It will destroy life in a few minutes.

The noxious principle, which is given out during the combustion of charcoal, is not the pure carbonic acid gas; it is formed of the gaseous oxyde of carbon, and carbonated hydrogen; it is proved, however, that they both destroy life in the same way, viz.—by obstructing the chemical phenomena of respiration. There are other gases highly destructive; such as the nitrous acid gas, the sulphureous acid gas, &c.; but their action on the body is different; they seem to kill by irritating the lungs; therefore, deleterious *per se*, a property not residing in the azotic, and carbonic acid gases.

We might here extend our inquiry into the causes of death, in asphyxia, from drowning, and hanging; but we shall merely remark, with regard to them, that death results in these cases, from the blood ceasing to be re-supplied with oxygen from the atmosphere; it, therefore, becomes super-carbonised, and on that account is incapable of supporting the functions necessary to animal existence. A knowledge of the cause of death, in asphyxia from gases, submersion, and suspension, will be the best clue to the mode of treatment in suspended animation, proceeding from such like causes.

Besides the functions mentioned, the lungs are accessary to the formation of the voice. The passage which leads from the mouth to the lungs, is called the trachea, or wind-pipe. In its descent in the neck, it is situated before the œsophagus, or canal leading to the stomach; and at or near the third vertebra of the back it divides into the two bronchi; one bronchus goes to the right, the other to the left lung. At the upper part of this tube is the larynx, or organ of the voice.

The *Larynx* is composed of cartilages, ligaments, muscles, &c. The cartilages, are five in number, and named, the thyroid, cricoid, two arytenoid, and epiglottis.

The ligaments of the voice are four. A ligamentous cord passes from the fore part of each arytenoid cartilage to the anterior angle of the thyroid. By these ligaments, an opening is left, which is called the rima glottidis. Under the cords just mentioned, we find two others, taking their origin from the bases of the arytenoid cartilages, and running, like the former ligaments, to be inserted into the thyroid cartilage. Between the superior and inferior ligaments, we see, on each side, a pouch, named, the ventricles of the larynx.

The muscles are small, but numerous; by them, the cartilages and ligaments are acted upon, so as to effect their straightening and expansion, for the modulation of the voice.

The voice is formed by the air, in its exit from the lungs, causing a tremor of the cartilages, and ligaments of the larynx. The strength of it is in proportion to the quantity of air expired, and the size of the glottis. When the rima glottidis is narrow, the tone emitted is acute; when expanded, the tone is grave; and when the air passes through, without producing a tremor of the parts, the result is a whisper. The larynx is the organ of the voice; but the instruments of speech, are the soft palate, the tongue, the lips, and other parts connected with the mouth and nose. But of all these, the tongue is the principal organ; for without it, we could not articulate any of the vowels or consonants distinctly. The great number of small muscles, which compose the tongue, give to it a great variety, and great celerity of motion; and in the act of utterance it rapidly, and readily, applies itself to the different parts of the mouth.

The sympathetic functions of the lungs are, coughing, sneezing, sighing, yawning, hiccup, and laughing.

Coughing may be occasioned by any cause, which irritates the sensible membrane which lines the trachea and larynx. It consists in a violent expiration, accompanied by a contraction of the trachea, and glottis, by which the air is expelled from the lungs, through the wind-pipe, with a great force. A cough is, generally speaking, symptomatic of some morbid affection of the respiratory organs; but it is not necessarily so, for it is often an attendant upon diseases of other viscera, and, therefore, merely sympathetic. A cough is not unusual in dyspepsia, and almost always present in hepatic disorders.

Sneezing is a similar function, in a great degree, to coughing; but as the velum pendulum palati is drawn down, the air rushes through the nostrils instead of passing through the mouth. It is almost invariably a forerunner of an attack of measles, and this is the only pathological fact of importance connected with this affection.

Sighing is a deep inspiration, determined by a preternatural accumulation of blood in the lungs, and right cavities of the heart; any cause which partially suspends the functions of the heart and lungs will produce a sigh, in other words a deep inspiration; this relieves the distended state of the lung, and right cavities of the heart, by expanding the pulmonary tissue, thereby giving freedom to the circulation of the blood.

Yawning is nothing more than a deep sigh.

Hiccup results from a sudden and involuntary contraction of the diaphragm, which gives rise to a sonorous inspiration. It is sometimes sympathetic of functional derangement of the stomach. In strangulated herniæ, and inflammatory affections of the abdominal viscera, it is a very alarming symptom.

Laughing is a succession of short expirations, very frequently repeated. It often accompanies Hysteria.

Having gone through with the circulating and respiratory organs, we will next, in conformity with physiological order, consider the nature and properties of the blood.

The Blood is that fluid which circulates in the cavities of the heart, arteries, and veins. In man, it is of a red colour; but in some animals, it is completely colourless. Whilst circulating, and immediately after being drawn from an artery, or a vein, it appears an homogeneous mass; but when removed from the vessel, it soon loses its uniform consistence, and resolves itself into two parts,—serum and crassamentum.

By exposing the serum to a temperature of 150 or 160 degrees, it assumes a solid form; this substance, in chemical language, is albumen; and by slicing, and squeezing it, a small quantity of fluid may be expressed, called the serosity of the blood. According to Dr. Marcet's Analysis of Human Serum, a thousand parts contain, of

Water	900 . 00
Albumen	86 . 80
Muriates of potassa, and soda	6 . 60
Muco-extractive matter	4 . 00
Subcarbonate of soda	1 . 65
Sulphate of potassa	0 . 35
Earthy phosphates	0 . 60
	1000

Berzelius's Analysis is nearly similar. Serum differs from chyle, in having no white particles.

The crassamentum is composed of two substances; fibrin, and red globules. The nature of fibrin is well known; but that of the red globules, or colouring matter of the blood, is still a contested point amongst chemists. It was believed that the red colour depended on the iron which the blood contains; but the opinion has been rendered questionable by the experiments of Mr. Brande. From them, it is to be inferred that the colouring principle is an animal substance of a peculiar nature; susceptible, like the colouring matter of vegetables, of uniting with bases, and admitting, probably, of important use in the art of dyeing. The blood drawn in inflammatory diseases shows a division of the two component parts of the crassamentum. What we call the "buffy coat" is pure fibrin, which is separated from the red particles, in consequence of a subsidence of the latter, whose specific gravity exceeds that of any other material of the blood. In inflammation, the blood is attenuated, and coagulates slowly; therefore, time is given for the red globules to sink below the fibrin, and this is the explanation of the phenomenon.

The blood is the material used in the formation of new parts, and in the reparation of those injured by accident and disease. During the continuance of life, the solids and fluids of the body are constantly undergoing changes: there is no durability in either, for each solid and fluid is continually acquiring new matter, and losing a part of that which is old and useless; the sources of addition are the chyle and blood; and those of abstraction, the excretions.

If a part sustains an injury by a cutting instrument, and the divided surfaces of the wound be placed in contact, adhesive matter will be effused; and this will be the uniting medium. But if there be a loss of substance, lymph is secreted by the vessels of the part, the neighbouring arteries &c. will shoot into it; the lymph will thus be endowed with life, the void filled up, and at length the injury repaired; these are illustrations of the processes by which all structures are restored, that are restorable, viz.—adhesion, and granulation; and blood is the source from whence these modes of reparation are derived.

The condition of this fluid depends, in great measure, on the energy of the powers of digestion; but it may be altered in its properties, by disease.

The alterations which the blood undergoes by disease, is an inquiry well deserving the attention of the Pathologist, and Chemist. Amongst other things worthy of notice, is the colour of this fluid immediately on abstraction from the vessel. The colour is red, in inflammatory disorders; of a dark appearance, in adynamic affections; almost black, in scurvy; and very pale, in diseases of debility. There is a work yet left for the Chemist to accomplish; which is, to ascertain, by analysis, the changes which different diseases effect in the *properties* of this fluid.

We have seen that there are two orders of blood-vessels in the body, viz.—arteries, and veins. They differ from each other in the density of their structure, and in the rapidity with which the blood circulates in them. The movement of the blood in the arteries, is much quicker than that in the veins; because the heart gives a much stronger impulse to it in the former vessels; and this is one of the sources of greater danger from wounds of arteries. When called to a person who is suffering from hæmorrhage, we should first ascertain whether the bleeding proceeds from a wounded artery, or a wounded vein; observation on the colour of the blood, and the manner in which it flows, will soon enable us to determine this point. Arterial blood is scarlet; venous blood is quite dark; blood from an artery issues per saltum, but that from a vein rushes in an even, unbroken stream. The importance of discrimination is great; for if an artery, and vein of the same size were wounded, the one would require a ligature, but the bleeding in the other might be commanded by means of pressure. If a wound be inflicted in a small vessel, nature sets up a process, by which the flow of blood is soon suppressed; this process consists in the formation of a coagulum, which fills up the opening, and acts mechanically, on the principle of a plug; lymph, in a little time, is effused, the wound closed, and the coagulum is absorbed. If an artery of the size of the temporal should be *partially* cut, nature might not be able to stop the bleeding; but if divided *completely across*, she will be likely to succeed without any assistance: for, when *completely* cut, the extremities of the vessel retract within the cellular membrane, which entangles the effused blood, and thus lays the foundation of a coagulum, which, as in the former case, temporarily shut the bleeding vessel. Although, now and then, nature alone can suppress a hæmorrhage, the aid of surgical means is often called for, particularly if it be of an arterial kind. The common principles in the treatment of hæmorrhages, whether internal, or external, is to diminish the force of circulation, by rest, cold, and the production of syncope; but in external hæmorrhages, we may employ other means; such as astringents, styptics, escharotics, sponge, compression, and the ligature.

How these means act, is sufficiently evident, and I shall only observe, with respect to the ligature, that its immediate effect, (as proved by Dr. Jones' experiments), is the division of the internal, and muscular coats of the artery, and the approximation of the divided surfaces. In a little time, the surfaces adhere through the medium of effused lymph, and the calibre of the vessel is obliterated to the collateral branches, above and below the part on which the ligature was applied. When the artery is sealed, the thread is disengaged from its connections with the vessel, by ulcerating through the external coat.

Dr. Jones considers the division of the internal, and middle coats, by the ligature, as an essential part in the operation; and that without it, the vessel could not be obliterated. This, however, has been contradicted by that excellent Surgeon, the late Mr. Allan Burns, of Glasgow; and Mr. Charles Bell combats the opinion of Dr. Jones on this subject, in his "System of Dissections," published in 1809.

It is certain, that the immediate effect of a round ligature, is the division of the muscular, and membranous tunics of the vessels; but that this is *essential* to obliteration, may, I think, be justly doubted; for we know, that a degree of pressure, which prevents the flow of blood through the artery, is sufficient to excite that adhesive inflammation which will end in an obliteration of its calibre; but that the obliteration is expedited by the injury which the ligature inflicts, there can be no question.

In passing a ligature, we should take care to exclude every thing but the vessel; and to use as small a one as is compatible with safety; a large ligature is too great a source of irritation, and a very small one will incur the risk of secondary hæmorrhage, by cutting through the vessel 'ere the sealing process is completed.

As a general rule, we may say, all arteries inferior in size to the temporal, may safely, in case of wound, be trusted to compression, which is the next most powerful means to the ligature; but when the vessel is of a larger size, one, if not two ligatures will be necessary.

From the blood, certain fluids are separated by Glands, or SECRETING ORGANS. No part of Physiology is more obscure than this process of secretion. Our knowledge of it is so limited, that we can only say, certain structures have the ability, from a peculiar arrangement of their parts, to form particular kinds of fluids from the blood, which are either accessary to the performance of certain animal functions; or necessary, in order to rid the system of materials, which, if retained, would prove injurious to its œconomy.

There are three kinds of secreting organs in the body; the membranous, the follicular, and the ductiform, or complex.

Of the first kind, are the dura mater, pleura, peritoneum, tunica vaginalis, and other serous membranes. In these organs, the arrangement of the secreting apparatus is simple. The arteries terminate in two ways; in pores, and veins. The fluid secreted by the capillary vessels, exudes through the pores; and the veins return the superfluous quantity of blood.

Of the second kind, are those small glandular bodies contained within the mucous membrane of the different passages; and we may class with them the sebaceous follicles; here the secretory apparatus is less simple. Between the terminations of the arteries, and the commencement of the veins, there is an arrangement of parts, more nearly approaching to that of complex glands.

Of the third kind, are those glands which constitute some of the important organs of the body; as the salivary glands, the liver, the pancreas, the kidnies, the testes, and the mammæ. In these organs, the parenchyma is peculiarly complicated; because the fluids which they secrete, are of a compound nature, and some of them differing essentially from the blood.

The screted fluids of the body may thus be classed, in conformity with the organs to which they respectively belong:

A.—The fluids of the organs of loco-motion.

B.—The fluids of the serous membranes of the three grand cavities.

C.—The fluids of the digestive organs.

D.—The fluids of the sanguiferous and respiratory organs.

E.—The fluids of the urinary organs.

F.—The fluids of the brain, spinal marrow, and nerves.

G.—The fluids of the organs of the five senses.

H.—The fluids of the organs of re-production.

I.—The fluids of the connecting media.

A.—The organs of loco-motion are the bones, joints, and muscles.

In the bones, we find an oily substance, which is called *marrow;* it is secreted by the membrana medullaris, or that vascular membrane which lines the cancellated structure of bone. On analysis, it is found to consist of pure marrow, albumen, gelatin, a peculiar extractive matter, and water.

In the moveable articulations, we find the capsular ligament lined by a very delicate membrane of extreme vascularity, and called the synovial membrane. It secretes the *synovia*, which lubricates the articulatory surfaces. Synovia is composed of albumen, gelatin, mucilage, water, and a small quantity of the muriate of soda.

With the tendons of certain muscles, there are connected *bursæ mucosæ.* They are furnished with a synovial membrane for secreting a fluid, similar in its properties and uses, to the synovia of the joints.

The membrane lining the interior of the bones, is liable to inflammation from common and specific causes. When it terminates in the formation of matter, the disease is called " spina ventosa." The synovial membrane too may be affected, with inflammation from common, and specific causes.

B.—The *fluids of the lining membranes of the three grand cavities* of the body, are the second class of fluids.

The cranium is lined by a membrane, called dura mater, which, too, is the external envelope of the brain. Under it, are the tunica arachnoidea, and pia mater. The outer surface of the dura mater is in intimate attachment with the bones of the skull. Their adhesion is so close, as to leave no intervening space. Between the inner surface of the dura mater, and the outer surface of the tunica arachnoidea, however, there is an interspace, and this is continued down the spine. It is here that we find a lubricating serous fluid, to prevent the membranes from adhering. It is secreted by the vessels of the dura mater; and a preternatural collection of it constitutes the disease called, hydrops membranarum, vel hydrocephalus externus. In the thorax, we find a lining and reflected membrane, called the pleura, which is of a serous kind. It exhales a fluid, which, in the living subject, is in the form of a halitus; but in the dead, it is found condensed into a small quantity of moisture. But for the presence of this secretion, the pleura costalis, and the pleura pulmonalis, would adhere together, being always in contact; as well in expiration, as in inspiration. Adhesions of the pleuræ are very commonly met with, in post mortem examinations; and, when considerable, they cause dyspnœa, or difficulty of breathing.

The peritoneum is similar in structure, and function, to the pleura.

C.—The fluids concerned in the process of digestion, are, the saliva, the gastric juice, the enteric juice, the bile, the pancreatic juice, and the mucus of the alimentary passages.

The *saliva* is secreted by the parotid, submaxillary, and sublingual glands. It is mixed with the aliment in the mouth; and by partially dissolving it, facilitates mastication and digestion. It contains water, mucus, albumen, muriate of soda, phosphate of soda, phosphate of lime, and phosphate of ammonia.

The *gastric juice* is the principal agent in the digestion of the food; it is secreted by the villous coat of the stomach, and possesses very remarkable properties. The exact nature of this fluid is not known;

because there is considerable difficulty in procuring it unmixed with the other fluids. Its operation would seem to be chemical, since it acts upon dead animal fibre, as well as aliments. The conjectures on the manner in which the functions of digestion is performed, have been very numerous. In the days of mechanical philosophy, the stomach was supposed to triturate the food like a pair of mill-stones; but this hypothesis, together with those of concoction, of fermentation, and of putrefaction, have all, in their turn, given place to another view, founded on science and experiments. It is admitted now by all, that the gastric juice is the agent of digestion. Reaumur first stated, that digestion depended on chemical solution; and future experiments have confirmed the statement.

Throughout the whole course of the large and small intestines, we find a *limpid fluid*, which is secreted by the follicles of the intestines. Its uses are to assist in chylification, and to facilitate the course of the alimentary, and stercoraceous matters, in the intestinal canal.

Bile is the peculiar secretion of the liver, which is the largest gland in the body, and situated in the upper part of the abdominal cavity. The arrangement of the secretory apparatus in the liver is similar to that of other complex glands; there are arteries carrying the blood, from which the secretion takes place; veins returning the superabundant quantity to the heart; and tubuli for conveying the secreted fluid to its main excretory duct. But in the blood-vessels of the liver, there is this peculiarity; whilst other glands are supplied with arterial blood *only*, this organ receives, in addition to it, a large quantity of venous blood, through the medium of the vena portæ, a considerable vessel formed by the union of those veins which return the blood from the other chylopoietic viscera.

It is supposed by many Physiologists, that the blood carried to the liver by the hepatic artery, is intended merely for the nourishment of the gland, and that the blood of the vena portæ is only for the biliary secretion; but a case related by Mr. Abernethy, in the "PHILOSOPHICAL TRANSACTIONS," proves that the blood of the artery is subservient to both functions. The subject of the case referred to, was a child, in whom the vena portæ terminated at once in the vena cava inferior, without approaching the liver; yet the child was well nourished; and, on examination after death, bile was found both in the gall-bladder and intestines.

The bile is carried from the liver by the hepatic duct; to the gall-bladder, by the cystic duct; and to the intestines, by the ductus communis choledochus. The uses of this fluid are to assist in the chyliferous process, and to excite the peristaltic action of the intestines. It is found to consist of a resinous matter, albumen, salts of soda, lime, and oxide of iron.

Very many serious diseases owe their existence to a deranged state of the biliary secretion. It may be in a deficient quantity, when the functions of digestion and defæcation will suffer; or may be in excess, as in yellow fever, and in that fatal disease called, cholera morbus; but in these disorders, it is acrid in property, as well as redundant in quantity.

The bile may be prevented from passing into the intestines, in which case it will become absorbed, and by entering into the mass of blood, produce jaundice. The obstruction may be temporary, from the pressure on the ducts by surrounding viscera, as in jaundice from pregnancy; but it is more lasting often in cases of obstruction from a biliary calculus. Biliary calculi are not unfrequently found in the gall-bladder, without giving any signs of their existence during life; but if one, or more, should pass into the ducts, very painful and dangerous consequences may follow.

Biliary concretions are proposed to be arranged under four classes.

In the first class, is that kind of gall-stone which has a white colour, and a chrystallized, shining, laminated structure; it is soluble in oil of turpentine, and pure alkalies; and of an oval form.

2dly.—That kind which is polygonal, or round in its formation, and of a light greyish brown colour.

It has an external covering of concentric layers, and within, it is composed of a matter, either chrystallized, or having the appearance of coagulated honey.

3dly.—That species compounded of the preceding two.

4thly.—A species differing from the others in being neither soluble in alcohol, nor oil of turpentine.

Dr. Monro, jun. has, in his "OUTLINES OF ANATOMY," described a fifth, but very rare kind of biliary calculus, which, as far as he knows, has never been mentioned. It is of a jet black colour; of a shining appearance; seldom attains a large size, and is very irregular on the surface.

In the treatment of biliary disorders, our attention must be principally directed to the state of the liver; a derangement of which being, in the majority of cases, the primary cause of a morbid secretion of bile.

The *pancreatic juice* is secreted by a long glandular body, called the pancreas, lying in the epigastric region, behind the stomach. Like the salivary glands, to which the pancreas is very analogous in structure, it is composed of lobes, which are connected by cellular tissue, and the arteries terminate in two ways, viz.—in the radicles of the excretory ducts, and veins. The excretory duct terminates in the duodenum, sometimes in common with the duct of the liver and gall-bladder; and sometimes by an independent orifice. In composition, the pancreatic juice is very similar to the saliva; and its use is to assist in the formation of chyle.

In the mouth, œsophagus, stomach, and whole tract of the intestines, very many mucous glands exist.

D.—The fluids of the circulating and respiratory organs, are in the fourth class.

The heart is contained in a bag, called the pericardium, which is, in fact, a reflected membrane, like the pleura, peritoneum, and tunica vaginalis testis. It gives a close, and afterwards a loose covering to the heart. The internal surface is a secreting organ; it secretes a serous fluid named, *liquor pericardii*, which prevents the close and loose portions of the membrane from adhering together. An accumulation of this fluid constitutes hydrops pericardii.

The lining membrane of the cavities of the heart, arteries, and veins, furnishes a *serous secretion*, which is useful in facilitating the circulation of the blood.

In the trachea, bronchiæ, and pulmonary cells, there is a *mucus*, for the lubrication of their surfaces.

E.—The peculiar secretion of the kidnies is the *urine;* but to defend the parts from this acrid fluid, all the urinary passages are provided with mucus, furnished by the ordinary source of that secretion.

The kidnies are two imperfectly oval glands, situated in the lumbar region. They are behind the peritoneum; therefore, have only an anterior covering from that membrane. In the kidney, we observe two distinct substances; the external is called the cortical, or secerning; the internal, the tubular part. In the centre is a cavity, named, the pelvis of the kidney; and from it, goes off the ureter, or excretory duct, which terminates in the bladder, by an oblique valvular entry between its coats.

The bladder is the reservoir in which the urine collects; and on being distended to a certain point, the stimulus of distention induces a disposition in the bladder to contract; which contraction, assisted by the abdominal muscles, and diaphragm, effects the evacuation of its contents.

The *urine* is more abundant in quantity than any secretion in the body; and it is more affected by what we eat and drink, than any other.

Dr. Henry says, in his "ELEMENTS OF EXPERIMENTAL CHEMISTRY," Ninth Edition, that the following substances appear to him, to have been satisfactorily proved to exist in healthy urine, viz.—water; free phosphoric acid; phosphate of lime; phosphate of magnesia; fluoric acid; uric acid; benzoic acid; lactic acid; urea; gelatine; albumen; lactate of ammonia; sulphate of potassa; sulphate of soda; fluate of lime; muriate of soda; phosphate of soda; phosphate of ammonia; sulphur; silica; making twenty ingredients.

Berzelius, in his Analysis of Urine, speaks of its containing seventeen different ingredients, viz.—water; urea; sulphate of potash; sulphate of soda; phosphate of soda; phosphate of ammonia; muriate of soda; muriate of ammonia; animal matter, soluble in alcohol, and usually accompanying the lactates; animal matter, insoluble in alcohol; urea, not separable from the preceding; earthy phosphate, with a trace of fluate of lime; uric acid; mucus of the bladder, and silex; but the composition of the urine must vary, according to the age, constitution, state of health, and the nature of the ingesta.

There are no diseases that have more engaged the attention than those connected with the urinary system; and, generally speaking, there are none more painful, and distressing.

From inflammation, and other causes, the secretion may be suppressed; or the reverse of this may happen, as in diabetes.

By disease, it is often altered in its appearance; in bilious fevers, it is of a yellow colour; in inflammatory disease, it is red, &c. Innumerable, almost, are the appearances which it assumes, under different circumstances; and, taken alone, the urine will often furnish the most satisfactory diagnosis of disease.

The impediments to the discharge of urine from the bladder, are amongst the most formidable of all surgical diseases. They may reside in the bladder itself; in the prostate gland; or in the urethra. When the bladder loses its tone, from over distension, the catheter, and other means, will be necessary. When the prostate gland is enlarged, as it usually is in old age, there is often a mechanical obstruction to the flow of urine; and the catheter is the only method of giving relief. When stricture in the urethra is the cause of retention, we must aim at removing the stricture by bougies; but for temporary purposes, we must introduce the catheter; and if this be not practicable, there are two resources left; the one is, to make an opening into the urethra, behind the stricture; the other is, to puncture the bladder.

Of late years, some of the most eminent Chemists have turned their attention to the examination of *urinary calculi.* Dr. Woolaston, Mr. Brande, Dr. Marcet, Dr. Henry, and Professor Vauquelin, have done much for this department of science. The materials usually met with in these concretions, are, uric acid;

triple phosphate, or ammoniaco magnesian phosphate; and oxalate of lime. Those composed of uric acid, are known by their being laminated, and having the appearance of box-wood. Those composed of the triple phosphate, are white and friable; breaking between the fingers with the greatest ease. And those of the oxalate of lime, have an irregular surface; from which circumstance, they are named the mulberry calculi.

But there are some calculi composed principally of the phosphate of lime; and others, of the carbonate of lime; hence, Dr. Henry has adopted the following classification, which seems to him, sufficient for every purpose of arrangement.

1st.—Calculi which are chiefly composed of uric acid, or urate of ammonia.

2dly.—Calculi principally composed of the ammoniaco magnesian phosphate.

3dly.—Calculi consisting, for the most part, of phosphate of lime.

4thy.—Calculi containing, principally, carbonate of lime.

5thly.—Calculi which derive their characteristic property from oxalate of lime.

6thly.—Calculi composed of the substance discovered by Dr. Woolaston, and called by him, *cystic oxide*.

If any addition were made to the above classes, Dr. Henry proposes to add the two following:

Calculi containing several of the foregoing ingredients, in such a state of admixture, as not to be distinguishable without chemical analysis; and

Those, in which the different substances are disposed in distinct layers, or in concentric strata.

When a calculus forms in the bladder, no solvent can reach it; therefore, if too large to be voided per urethram, the operation of lithotomy is demanded. To perform it with safety, the anatomy of the perineum, urethra, and pelvic viscera, must be perfectly understood. For this, I shall refer the reader to that part of the volume which treats on Relative Position.

F.—The *fluids of the nervous system* are in the sixth class.

In the ventricles of the brain, we find a serous fluid, secreted principally by that net-work of vessels in each ventricle, called, the choroid plexus. Its utility, in all probability, is not so limited as common opinion supposes, viz.—to prevent the sides of the ventricles from falling together. When collected in large quantity, it forms hydrocephalus internus.

In the sheaths of the nerves, there is an aqueous humour, which serves to keep the nervous fibrils moist, &c.

G.—We may divide the *fluids of the eye*, into those of the appendages, and those situated in the interior of the organ. The tears, and meibomian fluid, are secretions of the first division; the aqueous humour, the lens, the vitreous humour, and the pigmentum nigrum, of the second.

The *tears* are formed by the lachrymal glands; one in each eye. The gland occupies a depression in the upper, and outer part of the orbit. There proceed from it, six or seven small ducts, which open on the inner side of the upper eye-lid. After being diffused over the surface of the eye, to moisten it, and to obviate the effects of attrition from the motion of the eye-lids, the tears are conveyed to the puncta lachrymalia into the lachrymal sac, and from thence to the nose. The tears contain, mucus, water, and a small quantity of saline matter.

Between the tarsi, and lining membrane of the eye-lids, the meibomian follicles are seen. The secretion from them is of an oily nature, and prevents the accretion of the eyelids during sleep.

The *aqueous humour* occupies the chambers of the eye, or that space situated between the cornea before, and the capsule of the crystalline lens behind. The vessels of the iris are supposed to secrete it. This fluid is a very powerful solvent; but chemical analysis goes no way towards explaining the reason of it; since it is nothing more than albumen, gelatin, water, and a little common salt.

The *crystalline lens* is a solid substance; but we are in the habit of classing it amongst the humours of the eye. A fluid, however, is contained in its capsule. The lens refracts, and transmits the rays of light to the vitreous humour.

The *vitreous humour* forms the greatest part of the eye; the crystalline lens is received into a depression on its anterior surface; and posteriorly, and laterally, the retina is expanded on it. It is composed of a watery fluid enclosed in cells; and the whole is surrounded by a membrane, called tunica hyaloidea, vitrea, vel aranea. The vitreous humour refracts the rays of light, in their transmission to the retina.

The *pigmentum nigrum* is secreted by the vessels of the choroid coat. Its use is to absorb the rays, which, if admitted to the retina in superfluous quantity, would cause confusion in vision.

Between the skin and cartilages of the ear, there are very many small bodies called ceruminous glands, which secrete the *wax*.

In the internal ear, we have the *water of the labyrinth*, which is supposed to be secreted by the membrane which lines the vestibule, cochlea, and semicircular canals. It serves as a medium for transmitting the rays of sound from the membranes of the foramen ovale, to the sensible expanded pulp of the auditory nerve.

A deficiency of either of the above secretions will affect, more or less, the auditory function.

There is a *mucous secretion in the nostrils*, formed by the mucous glands. Its use is to defend the papillæ of the olfactory nerves. In catarrh, the secretion is increased.

All the cavities which communicate with the nostrils are lined by a membrane, furnished with the same secretory apparatus as the pituitary membrane of the nose.

The *fluids of the mouth* are the saliva, and mucus; the former has been already mentioned; the latter is secreted by the tonsils, and other mucous glands.

The fluid of the skin is the *matter of perspiration* which is exhaled by the cutaneous vessels. It keeps the skin moist; and supports the equal temperature of the body.

Monsieur Thenard, a well-known French Chemist, gives the following analysis of this fluid; water; free acetic acid; muriate of soda; a small quantity of phosphate of lime; oxide of iron; and a gelatinous animal matter.

H.—By the internal surface of the tunica vaginalis, a *halitus* is secreted; similar, in every respect, to that of the dura mater, pleura, and peritoneum; it is to prevent adhesion between the close and reflected tunics of the testis. When the fluid is preternatural in quantity, the disease is called hydrocele.

The *semen* is secreted by the testes. According to the French Chemist Vauquelin, it is composed of water, animal mucilage, phosphate of lime, and soda.

The prostate gland is a body situated at the neck of the bladder. It secretes a milky fluid, which is said to be useful as a vehicle for the semen.

The mucus of the urethra is secreted by the mucous glands of the passage, for the purpose of shielding the lining membrane of the urethra, from the acrid quality of the urine.

Near the corona glandis, there are follicles which form a *sebaceous fluid* to lubricate the glands, and to render the prepuce capable of being drawn forwards, or retracted, without injury to the sensible glans.

The *fluids of the female organs* are principally of a mucous kind, for the defence of the passages.

There is a serous fluid in the cavity of the uterus, exhaled by the extremities of the arteries, and it is probable that the menstrual fluid is derived from the same vessels.

I.—The *reticulated membrane* is naturally bedewed with a moisture; but this is very inconsiderable in a healthy state of the body. The *adipose membrane* consists of distinct cells, which are filled with an oily fluid.

These are the secreted fluids; and their quantity, united to that of the chyle, and blood, is supposed to exceed in weight, the solids of the body.

With respect to the Pathology of secreting organs, we may remark, that when they are attacked with inflammation, their function is affected. The effect of a slight degree of inflammatory action, is an increase of their secreted fluid; but a higher degree is attended with suppressed secretion; thus, when the eye is triflingly inflamed, there is a constant running of tears; but when the opthalmia is very acute, the surface of the eye is dry, and exceedingly painful. In mild hepatitis, there is an augmented secretion of bile; in a very acute attack, the formation of bile is suspended; and the stools are white, or clay coloured. The same happens with regard to the urine, in nephritis, &c. These effects of different degrees of inflammation, all secreting organs experience; the remarks here emitted, will, therefore, allow of extensive application, and will serve to simplify the nature of certain dropsies, and the treatment which they require.

The NERVOUS SYSTEM, which is next to be considered, exercises an absolute controul over all the functions which we have hitherto described. The muscles, which are the active organs of loco-motion, are subordinate to it. The stomach cannot digest; the heart cannot beat; and the secreting organs cannot separate their fluids from the blood without it; indeed, it has the supreme dominion over all the functions of animal life, and its existence is the most striking distinguishing character between animal and vegetable substances.

The nervous system includes the brain; the spinal marrow; and the nerves.

The spinal marrow, and nerves, communicate with the brain; and are the media of connection betwixt the body, and the mind. Without this communication, they could not perform the functions which nature has assigned to them, viz.—volition, and sensation. We may will to move the arm; but if the nerves going to the muscles, be divided, or paralised by pressure, the will cannot manifest itself; for it is through the nerves, that the mental desire to will, is transmitted to the moving organs.

The physical constitution of the coats, and humours of the eye, may be perfect; light may be admitted, and properly refracted, in its passage through them; but if the optic nerve be intercepted in its course to the brain, the mind cannot be sensible to the impression of the rays of light; in which case, there will be no vision; and the same obtains with regard to hearing, smelling, tasting, and touching.

But the question agitated amongst Physiologists is, on what principle does nervous energy depend? We cannot answer; and, with humility, must confess that it is a blank in human knowledge.

A recent attempt has been made to substitute another method of dissecting the brain, for the *mechanical* one which has long been pursued in anatomical schools. The reformers in this branch of Anatomy, are Gall and Spurzeim; and in some particulars, the peculiarities of their researches, are entitled to our attention. Instead of slicing the brain, in order to give certain appearances, and to expose remarkable prominent or depressed points, these Anatomists have had in view, the demonstration of minute structure; by which they profess to have gained a more satisfactory clue to the functions of the cerebral organ. They have shown that the brain is fibrous, a circumstance lost sight of in the ordinary method of dissecting it; and for the same reason, that the fibrous structure of an apple cannot be observed, when smoothly cut. There is one fact which deserves notice, because it is corroborative of Gall and Spurzeim's opinion on the real structure of the brain, and the connection between its structure, and its functions; a fact which defies proof by the common mode of dissection. It has been confirmed, by examining bodies, after death, that when hemiplegia is the result of cerebral lesion, the paralysis is on the opposite side of the body to the seat of disease in the brain. In following the fibres of the medulla oblongata, Gall and Spurzheim discovered a decussation of them; that is to say, the fibres of the right side of the brain passed to the left side of the body, and vice versâ; and this affords an easy solution of the pathological fact alluded to. It would appear then, that the fibres transmit the nervous influence; and if so, it is more scientific to trace them from their source to their destination, than to dissect the brain, with the intention of exposing eminences and depressions in its cavities and substance; I shall say nothing, however, on their physiological theory, with regard to the individual functions, of individual portions of the brain.

Gall and Spurzeim's anatomical researches have induced them to come to the following conclusions; that the cineriteous and medullary substances of the brain, are inseparable, the one from the other; that the former is the matrix of the latter; that the medulla is composed of white fibres, which converge towards certain points, named, commissures; and that these commissures are the media of communication of the fibres of the opposite sides of the brain; in all this, I see no inconsistency, and nothing but what we may suppose to be true; but the doctrine is in its infancy, and if not well founded, will be sure to experience the fate of other anatomical opinions, equally plausible at the period of their birth; but found untenable by the searchers after truth.

We have stated, that Gall and Spurzeim believe that the cortical part of the brain is the matrix of the medullary; and consequently, of the nerves. Professor Tiedemann, who has made many interesting researches in the Anatomy of the brain, is opposed to this opinion. He says, that the cortical matter is formed after the medullary; and that the origin of the spinal and cerebral nerves, are visible before the least trace of the former can be observed. There are many other points, in which Anatomists disagree; we should therefore, as yet, be very cautious in inclining our minds to any particular doctrine.

The brain is usually divided into three parts, cerebrum, cerebellum, and medulla oblongata; these parts are covered by membranes, called, dura mater, tunica arachnoidea, and pia mater.

The CEREBRUM consists of two hemispheres, which are separated by the falx major. The hemispheres are divided into lobes, and subdivided into convolutions.

The CEREBELLUM is situated in the posterior fossæ of the cranium; it has two lobes, formed by a process of the dura mater, named, falx minor; and the cerebellum is separated from the cerebrum, by means of another process of the same membrane, called, tentorium.

The last part of the brain, is the MEDULLA OBLONGATA, which lies upon the basilar process of the os occipitis.

The appearances worthy of notice in the cerebral mass, are, the corpus callosum; the cortical and medullary substances; the lateral ventricles; the cornua; the thalami nervorum opticorum; the corpora striata; the septum lucidum; the fornix; the plexus choroides; the foramen Mouroinum; the third ventricle; the commissures of the third ventricle; the iter a tertio ad quartum ventriculum; the iter ad infundibulum; the tubercula quadrigemina; the infundibulum; the pituitary gland; the corpora albicantia;

the pons Varolii; the crura cerebri; the crura cerebelli; the fourth ventricle: the corpora olivaria; the corpora pyramidalia; and by a vertical section of the cerebellum, we produce an appearance, which is called the arbor vitæ. I shall refer the student to works professedly anatomical, for the more minute anatomy of the brain.

Of the uses of the individual prominences of the cerebral organ, we cannot, as yet, boast of any positive knowledge. From the optic nerves taking their origin, in great measure, from the thalami nervorum opticorum, these bodies have been considered, by Physiologists, as particularly subservient to the visual function; but, in the "Archives Génerales de Médécine," for June, 1823, there is a Paper, by M. M. Foville and Pinel-Grandchamps, in which, the authors assign another function to them. At a Meeting of the "Académie Royale de Médécine," they related the case of a female, who had laboured for several years under a complete paralysis of the upper and lower extremities of the left side. An old extravasation was found in the right hemisphere of the brain, in the medullary space, outwardly, between the thalami optici, and corpora striata; and equally affecting these two parts. M. M. Foville and Pinel-Grandchamps presented this fact to the Academy, as confirming their previous observations, that the seat of motion in the upper extremities, is placed in the thalami, and that of motion in the lower, in the corpora striata.

This is a too hasty opinion; and until more facts are brought forward in support of it, we are not justified in adopting it.

The Spinal Marrow is said, by most Anatomists, to be a continuation of the brain; Gall and Spurzeim, however, think differently. They say, that they are connected; not continuous. In its course down the vertebral canal, it sends off the spinal nerves, which are thirty-one pairs; and on reaching the first or second lumbar vertebra, it terminates in a bushy extremity, called, cauda equina, from its resemblance to the tail of a horse. Its coverings are the same, as those of the brain.

The Nerves are whitish cords, composed of fibres, which are united together by fine membrane, and enclosed in a cellular sheath. They are furnished with blood-vessels, &c., like other organised parts.

The nerves, like the arteries and veins, pass into the different structures of the body, and are often seen in company with them; but there are textures, in which arteries and veins can be easily demonstrated, but where no vestige of nerves can be detected; and, according to the experiments of Haller, Portal, and other Physiologists, these parts do not evince the least degree of feeling. Are we to infer from this that they do not possess nerves?

I believe that there is no organized part of the human body completely destitute of nerves; by organized part, I mean, no living part. The cuticle, the nails, the hairs, have not any; but these are not living structures; they are merely secretions, and excrescences from living structures. The bones, periosteum, cartilages, tendons, and membranes, commonly ranked amongst parts devoid of sensibility, are not wanting nerves; we cannot trace them in either of these substances; but disease proves their existence. In inflammation of bone, periosteum, the dura mater, pleura, and peritoneum, there would be no pain if there were no nerves; as it is, no diseases are accompanied with more agonizing pain than pleuritis, peritonitis, &c. hence nerves must be present, although minute anatomy cannot show them. It may be laid down as positive, that no organized part is without nerves; but in some structures, they are more numerous than in others; hence, their different degrees of sensibility.

How nerves terminate is a matter of conjecture in many cases; but we well know how a few are disposed of. Thus, the olfactory nerves spread on the pituitary membrane of the nose, to give us the sense of smell; the optic expand to form the retinæ; the auditory nerves line the walls of the labyrinth of the ears, for the sense of hearing; but how the nerves entering the viscera, muscles, &c. end, we cannot positively determine.

The nerves take their origin from two sources; the brain, and spinal marrow. Those from the former are called, the cerebral nerves; and those from the latter, the spinal nerves, which are divided into cervical, lumbar, dorsal, and sacral.

The *cerebral nerves* are,

1—Olfactorii,
2—Optici,
3—Motores oculorum,
4—Pathetici,
5—Trigemini,
6—Abducentes,
7—Auditorii,
8—Faciales,
9—Glosso Pharyngei,
10—Pneumo-Gastrici,
11—Linguales.

The name given to each of the above pairs, with with the exception of two or three, will lead us to infer their respective distribution and uses. They supply the organs and parts connected with the head and face. the pneumo-gastrici excepted.

The nerves which supply the organs of the thorax, abdomen, and pelvis, are the pneumo-gastrici before-mentioned, and the nervi sympathetici.

Each *nervus pneumo-gastricus* arises from the side of the crus cerebelli, and from a fissure observed between it, and the corpus olivare. It leaves the cranium through the foramen lacerum posterius, and appears at the upper part of the neck, in company with the accessory nerve of Willis, and the glosso pharyngeal. It descends in the neck between the jugular vein, and the carotid artery, and enclosed in the same common sheath; afterwards it is continued through the chest into the abdomen, where it ends.

Its principal branches are,

1—Nervus Pharyngeus,
2— —— Laryngeus,
3—Rami Cardiaci,
4—Nervus Recurrens,
5—Rami Pulmonales,
6— —— Œsophagei,
7— —— Coronarii.

The *sympathetic nerves* may be regarded as a separate system; they have been distinguished by the names, systema gangliorum, and systema vitæ automaticæ; the former, from their consisting of a number of ganglia; the latter, from their subserviency to the functions of automatic life. On each side, it is seen coming out of the base of the skull, and may be followed downwards through the neck, chest, and abdomen to the os coccygis, where it terminates.

In its course, it forms the following ganglia,

1—*Cervical Ganglia*, consisting of

a.—Superior cervical Ganglion.
b.—Middle Cervical Ganglion.
c.—Inferior Cervical Ganglion.

2—*Thoracic Ganglia*, from which the splanchnic branches arise.
3—*Lumbar Ganglia.*
4—*Sacral Ganglia.*

In the abdomen, near the trunk of the cœliac artery, we see the semilunar ganglion. Between the cœliac and superior mesenteric arteries, are several small ganglia, named the cœliac ganglia. Near this part, we find numerous nervous filaments, crossing and re-crossing each other, and forming a complicated net work, which has been called the solar plexus; from this point, branches go off to the principal viscera of the abdomen and pelvis, and each set of branches is termed a plexus; thus, we have the hepatic plexus; the splenic plexus; the superior mesenteric plexus; the renal, or emulgent plexus; the spermatic plexus; the inferior mesenteric plexus; and the hypogastric plexus.

There is scarcely a part in the body, that may not be drawn into a sympathetic consent with this diffused and beautiful system of nerves. Its junctions, by means of ganglia, with the cerebral, and spinal nerves, offer an easy solution of this fact.

The *nerves which go off from the spinal marrow*, are thirty-one pairs, and divided into nine cervical;

twelve dorsal; five lumbar; and five sacral. The cervical nerves are,

1—Nervus Accessorius Willisii,
2— ——— Suboccipitalis,
3— ——— Cervicalis Primus,
4— ——— ——— Secundus,
5— ——— ——— Tertius.

The above nerves are chiefly distributed to muscles.

The fourth, third, and sometimes the second cervical nerves, send off filaments to form the phrenic, or diaphragmatic nerves.

The sixth, seventh, eighth, and ninth cervical, and first dorsal, which are much larger than the preceding spinal nerves, unite to form the axillary plexus.

From the *axillary plexus*, arise the nerves that supply the upper extremity, viz.—

1—Thoracici,
2—Scapularis,
3—Articularis,
4—Cutaneus Internus,
5— ——— ——— Minor,
6— ——— Externus, vel Musculo Cutaneus,
7—Spiralis,
8—Medianus,
9—Ulnaris.

There are twelve pairs of *dorsal nerves;* the first has already been disposed of. The remaining eleven make their exit from the canal, through the vertebral foramina; and after forming ganglia with the sympathetic, each nerve divides into an anterior, and posterior branch, to supply the muscles and integuments of the parietes of the chest and spine.

The anterior branches of the lumbar, and sacral nerves, form the *Crural Plexus.*

The principal branches sent off from this plexus, are,

1—Nervus Spermaticus Externus,
2———— Cutaneus Superior,
3———— Glutæus Superior,
4—————— Inferior,
5———— Pudicus Communis,
6———— Obturatorius,
7———— Cruralis,
8———— Sciaticus.

The sciatic nerve divides, about half-way down the thigh, into

1—Nervus Fibularis,
2———— Tibialis,

which are distributed to the leg and foot.

By showing the situation, and course of the nerves of the pelvis, and lower extremity, we may explain some of the painful sensations which women experience in the progress of parturition.

The nerves are the auxiliary instruments of sensation, and voluntary motion; but the manner in which these functions are performed is still doubtful. An interesting theory has recently been advanced by Mr. C. Bell, upon the functions of nerves; I shall present it in brief to the reader. The common opinion entertained is, that the nerves are a series of tubes, which transmit to the different structures of the body, a power, which is secreted by the brain; but as Anatomy cannot demonstrate the nerves as tubular, Mr. Bell thinks, that the theory is not compatible with our real knowledge of the structural arrangement of nerves. Many parts are more abundantly supplied with nerves than others, and it has been supposed that this was necessary, because they stood in need of a more bountiful provision of nervous energy; but Mr. Bell is of opinion, that the hypothesis is fallacious. He says, however perfect the enjoyment of any sense, or however exquisite the function of any part may be, one nerve is sufficient to bestow the power; that, for one purpose, no more than one nerve is required; and that the accumulation of many nerves to augment the power, or improve the function, is as untrue in fact, as it is unphilosophical in theory. When a part is supplied with many nerves, it is for the purpose (Mr. Bell thinks) of enabling the organ to perform many offices, or to connect it with different operations of the economy, and not to augment what has been vaguely called the nervous power. For the illustrations of Mr. Bell's theory, I shall refer the reader to his Papers, published in the "*Journal of Science and Arts*," the "*Philosophical Transactions of the Royal Society*," and elsewhere. On the whole, we must consider the theory as ingenious; and the investigations which Mr. Bell and Mr. Shaw are engaged in, as likely to lead to an extension of our knowledge of the functions of the nervous system. Additional evidence in favour of their opinion, has been afforded by some experiments made by S. D. Brougton, Esq. and of which an account is given in the "*Medical and Physical Journal*," for June, 1823.

The brain, the spinal marrow, and the nerves, are the organs of sensation in general, sensation being a generic term; but the species of this faculty require particular organs in order to convey to the mind, the different impressions which external objects are capable of making; thus, the eye is necessary to impress an idea of distance, and colour; the ear, to distinguish sounds; the nose, to detect the presence of odours; the tongue, to ascertain the savour of bodies; and the papillæ of the cutis vera, to discover the qualities of hardness, softness, smoothness, roughness, heat, and cold. The sensations may be reduced to five kinds, viz.—seeing, hearing, smelling, tasting, and touch; but the organs of these sensations are mere instruments to receive and collect impressions;

their function being dependent on the communication which exists between their nerves and the brain.

The organ of vision is the EYE, consisting of parts which admit of being divided into appendages, and globe; the former are accessary to the function of the eye; the latter is composed of coats, and humours, which serve to refract the rays of light, and other purposes.

The appendages of the eye are the supercilia, or eye-brows; the palpebræ, or lids; the cilia, or lashes; the tarsi, or cartilaginous edges of the lids; the meibomian glands; the tunica conjunctiva; the lachrymal apparatus; and muscles. The eye-brows moderate light, which, if intense, confuses vision. The lids are subservient to the same use, and, by the motion of the palpebra superior, the tears are diffused over the surface of the eye. The lashes guard the eye in some measure, against the entrance of foreign bodies; but they likewise lessen the intensity of the light; and Morgagni believed, that persons with black eye-lashes have greater strength of sight, than those with white. The tarsi, when the lids are closed, form a canal, by which the tears are conducted to the puncta lachrymalia. The meibomian glands, which are very conspicuous in the ox, and large animals, secrete a yellow fluid, which moistens the lashes, and prevents the agglutination of the lids during sleep. The tunica conjunctiva gives a covering to the anterior surface of the eye, and connects the appendages with the globe. The lachrymal apparatus consists of the gland, puncta, caruncle, sac, and ductus ad nasum. The gland, which is situated in a depression behind the external angular process of the os frontis, secretes the tears, which are carried from it by means of several small ducts, which open on the surface of the tunica conjunctiva. The tears, after moistening the surface of the eye, are directed by the caruncle, or that small red body seen at the inner corner, into the puncta lachrymalia, which terminate in the lachrymal sac; and from this sac they are conveyed into the nose. Although the lachrymal gland is allowed by all Physiologists, to be one source of this fluid, which lubricates the eye, Portal thinks that it is not the only one; for he believes that the arterial extremities of the tunica conjunctiva exhale a part of it. He says, in his Anatomy, "*Nous ne nierons pas qu' une partie de la liqueur lachrymale, ne provienne du corps, ou de la glande lachrymale; nous dirons cependant que c'est de la conjonctive que decoule la plus quantité de cette humeur: elle s'exhale des extremités artérielles, et est reprise en partie par les vaisseaux lymphatiques, ou absorbans: le reste coule dans les points lachrymaux, d' ou elle parvient dans le nez.*" That the tunica conjunctiva is an absorbing and secreting membrane, is very probable; but that the fluid which it secretes, is analogous to that of the lachrymal gland, we have no proof. If M. Portal means to offer as such, that " an increased sensibility of the conjunctiva augments the secretion of tears; but if that sensibility is too great, the secretion diminishes and ceases;" we cannot receive it as evidence, for we know that all the structures of the eye sympathize with each other, and that this cause, or an extension of the morbid sensibility to the lachrymal gland, will be quite sufficient to occasion an augmented secretion of tears. We have already stated the effects of inflammation, when it attacks a glandular structure; and in a subsequent part of the volume, shall illustrate them in a more particular manner. We conceive then, that when the tunica conjunctiva is slightly inflamed, either sympathy, or a spreading of the inflammation to the lachrymal gland, is the cause of increased secretion; and that a greater degree of inflammatory action operating, mediately or immediately, on the same organ, is the cause of its suspension. The direct, and only source of the tears, seems to be the lachrymal gland; for we cannot see the necessity of there being any other provision.

The last of the appendages of the eye are the muscles. The orbicular muscle surrounds the eyelids, and, by contracting, shuts them. They are opened by the relaxation of this muscle, and by the action of the levator palpebræ superioris. From the bottom of the orbit, there arise muscles, which are inserted in the sclerotica, and act on the ball of the eye. The adductor oculi directs the ball towards the nose; the abductor oculi carries it outwards; the levator raises it; the depressor directs it towards the ground; and to give degrees of obliquity to it, there are two oblique muscles. The four first of these muscles are, by some Anatomists, called the "recti;" when they act in succession, the eye is rolled in its socket; but when all are in action at the same time, the globe is fixed.

Mr. C. Bell communicated to the "Royal Society," in 1823, a Paper on certain motions of the eye, which have hitherto been undescribed. Thus, every time the eye-lids are brought together, to cover the globe, the eye turns upwards; without which motion, it would not be properly moistened, nor the particles of dust removed from its surface. During sleep, the ball is turned upwards, so as to lodge under the superior lid. These movements are rapid and involuntary, while others are under the government of the will; and for the purpose of directing the eye to different objects. Hitherto, both the oblique, and the straight muscles, have been regarded as voluntary; but Mr. Bell maintains, that the oblique are for the performance of the insensible motions; and the recti, for those under the command of volition. That the functions of these muscles are inseparably connected with the retina, and cease to act when it becomes insensible, while the oblique muscles come into play, and draw the pupil upwards, beneath the upper eye-lid. Hence that turning of the eye-ball which we witness in sleep, in fainting, or in death, is but the indication of insensibility.

The power which the eye has, of adapting itself to distances, is, by some Physiologists, ascribed to the recti muscles compressing the ball of the eye, and changing its conformation. To view objects placed at different distances, either the whole, or some part of this organ, must have the ability to undergo changes, in order to adjust the focal point; for the rays of light which reach the eye from a near, and those from a distant object, could not converge at the retina, the seat of vision, without some alteration; either in the length of the axis; in the form of the cornea; in the position of the other refracting media; or in the situation of the retina itself. If we suppose that the four straight muscles can compress the sclerotic coat sufficiently to alter the axis, or to push forwards the humours, and thereby to increase in a material degree, the convexity of the cornea, we need not seek for other means of accounting for the adjustment of the eye to distances; but it is far from being certain that the muscles have this compressing effect, to the adequate extent, even in the human eye; and certainly not in such animals as have the tunica sclerotica of considerable thickness. The axis of the eye, or the form of the cornea, then, are not likely to be much altered by the action of the four recti muscles; but comparative Anatomy furnishes us with a fact, which proves that the cornea may be one of the instruments of adaptation; for Mr. Crampton informs us, in the "*Annals of Philosophy*," that he has demonstrated the existence of a muscle in birds, capable of changing its form, and which he considers as the organ employed to alter the convexity of the eye. Where, however, there is no such direct provision as this, we must look for an auxiliary power of adjustment, and the weight of reasoning seems to be in favour of its being seated in the iris, which, from its capability of contracting, and expanding the aperture of the pupil, excludes certain rays of light, and admits such only as are necessary for distinct vision. This phenomenon of vision is one of much interest; and Physiologists are by no means agreed in their explanation of it. In the number of the "*Transactions of the Royal Society of Edinburgh*," which appeared in the spring of the present year, there is a Paper by Dr. Knox, on the comparative Anatomy of the eye, in which the author states, that that part of the organ called the ciliary ligament, is not ligamentous, but muscular in structure; and that it is on this, that depends the ability which the eye has of adapting itself to distance.

These are amongst the facts which Dr. Knox brings forward, in support of his opinion,—

1.—The developement of the ciliary muscle follows the ratio of the strength of vision; or rather the accommodating powers of the eye, in the various classes of animals.

2.—When examined by the microscope, it puts on the same appearance as the iris, and presents the same arrangement of particles.

3.—In most birds, and in many of the mammalia, as in the quadrumanous and canine animals, numerous nerves can readily be demonstrated proceeding to the ciliary muscle, and distributed throughout its substance. Ligaments, on the contrary, are very sparingly supplied with nerves.

If the ciliary ligament be really muscular, it may be accessary to such a function, by changing the situation of the crystalline lens.

The globe of the eye is made up of coats and humours, and certain appendages to each. It is nearly spherical in form; indeed, would be exactly so, if the sphere were not interrupted by the greater convexity of the transparent cornea.

The humours, and the other delicate parts of the eye, are enclosed in a dense membrane, called, the tunica sclerotica; anteriorly, it receives the cornea, which is transparent, and may, by maceration, be separated from the sclerotic coat; posteriorly, it is pierced by the optic nerve, which enters at the inner part of the optic axis; this axis being defined by drawing a central line from the anterior to the posterior surface of the eye.

Under the sclerotic, we find a black coat, which is named the tunica choroides. It is seen to commence at the optic nerve, and to end at the ligamentum ciliare, which, with true deference to Dr. Knox, seems to me to be nothing more than compact cellular tissue. The choroid tunic was supposed by Ruysch to consist of two laminæ; but modern minute Anatomists have exposed this mistake, by discovering that the laminated appearance arises from a difference in the direction of the external and internal vessels of this membrane; those which are situated externally, run vorticosely; but those internally, have a disposition parallel to each other. The tunica choroides is a secreting membrane; its secretion is a black fluid, named, pigmentum nigrum, which absorbs the superfluous rays of light. In the race of men, called, Albinos, this pigment is wanting; and so it is in the owl, and some animals; in which cases the eyes appear red, in consequence of the blood-vessels being visible; and such men and animals can see better in a weak, than in a strong light.

To the ligamentum ciliare is attached the iris, which floats in the aqueous humour, and divides the eye into two chambers; the anterior chamber is bounded by the cornea before, and the iris behind; the posterior chamber has the iris on the fore part, and the crystalline lens posteriorly. The anterior surface of this curtain-like membrane, is of different colours, in different individuals; and sometimes not of the same in both eyes. In the Eighty-sixth number of the "*Medical Repository*," there is a case related by Dr. Andrew Smith, shewing the remarkable effect of disease, in changing the colour of the iris. While examining the eyes of the soldiers in the garrrison, Isle of Wight, an individual presented himself with the iris of the right eye of a grey, and that of the left, of a light green colour. Upon inquiring into the history of this unusual appearance, Dr. Smith found that the left had only changed to a green colour within the last seventeen months, from the consequences, it was supposed, of a severe blow.

The posterior surface of the iris is dark, and radiated; the radii are named the ciliary processes. Sir Everard Home, in his "*Croonian Lecture on the Anatomical Structure of the Eye*," mentions, that he has ascertained, by the microscope, the radii to be eighty in number; and that in the interstices between them are bundles of muscular fibres, which pass from the capsule of the vitreous humour, to the capsule of the lens.

In the centre of the iris, is an opening, called, the pupil, which is round in the human subject; horizontal, in grazing animals; and vertical, in those of the cat kind.

Physiologists do not agree as to the structure of the iris; but from the pupil being susceptible of contraction and dilatation, the most prevalent, and probable opinion is, that it is in part, if not wholly muscular. Some have supposed, that the diminution and expansion may be explained by the changes which the vascular structure of the iris experiences from sanguineous determination; thus, when the retina is impressed with a too vivid light, blood is determined to the iris in an increased quantity, by which the vessels are distended, and the aperture of the pupil encroached on; but when the stimulus is withdrawn, the blood recedes, and the pupil resumes its original size. Blumenbach thinks, that the dilatation and contraction neither depend on muscularity, nor vascularity, but on a "vita propria;" to which term it is not easy to attach a precise meaning. Analogy, and the circumstances which affect the pupil, must incline us to the opinion, that the iris is muscular; after death, it, like all the muscles of the body, is in a state of relaxation, the pupil is consequently dilated; and when, from other causes, muscular action is suspended, or weakened, we find the state of the iris to correspond.

Under the choroid coat, is the third tunic, which is called the retina, it embraces, as it were, the vitreous humour. To say, that the retina is the expansion of the optic nerve, is not anatomically correct; for minute researches have shown, that the nervous pulp is situated between two tunics; the external one, named, tunica Jacobi, in honour of the discoverer; the internal, the tunica vasculosa; there are then, other parts composing the retina, besides the pulpy expansion of the nerve.

The tunica sclerotica, the tunica choroides, and the retina, are the three perfect coats of the eye. The sclerotica is considered by some writers, to be a continuation of the dura mater, a thick membrane which lies immediately under the skull; and the choroides, a continuation of the pia mater, a fine thin membrane, which adheres closely to the brain. Galen, and all the old Anatomists, believed that the tunica sclerotica was a continuation of the dura mater; but most modern Anatomists do not think so; nor do they believe that the tunica choroides is the product of the pia mater. The sclerotic coat is very much thicker and stronger than the dura mater, and there is nothing but the extreme vascularity of the two membranes, that can identify the tunica choroides with the pia mater.

The humours of the eye are three, viz.—the aqueous, the crystalline, and the vitreous.

The aqueous humour occupies the chambers of the eye; its source is the vessels of the iris.

The chrystalline lens, although commonly called a humour, is a solid double convex substance. Its anterior surface, however, is more flattened than its posterior, which is received into a depression of the vitreous humour. The lens is confined in its situation by a capsule, which is most probably derived from that of the vitreous humour.

The third humour of the eye, is the vitreous, which forms the principal bulk of the globe; its consistence is gelatinous, from its being made up of cells and water, which are surrounded by a capsule, named, the tunica hyaloidea, vel aranea.

At the edge of the crystalline lens, this tunic is said to divide into two laminæ; one lamina gives an anterior covering to the lens; and the other passes behind it. By this separation of the membrane, a canal is formed, called the Petitian canal, which may be inflated by means of a blow-pipe.

These are the principal facts, connected with the coats and humours of the eye.

The arteries of the appendages of this organ are the internal angular, or nasal; the rami lachrymales; and muscular branches; those of the tunics, are the arteria centralis retinæ, and the ciliary branches. The arteries terminate in veins, and some of them in exhalent orifices.

The nerves are, the motor oculi; the nervus patheticus; the ophthalmic branch of the nervus trigeminus; the abducens; and the optic, which expands into the retina.

All the nerves, with the exception of the optic, are nerves of motion and feeling; the optic is the nerve of sense. It arises principally from a prominence in the ventricle of the brain, called the thalamus nervi optici, forms a long medullary tract, and enters the orbit through the foramen opticum. There is a difference of opinion amongst Anatomists, as to whether the optic nerve passes to the eye on the same side as its origin; whether the nerves decussate, or cross, and pass to the opposite sides; or whether there is an intermixture of fibres. Dr. Woolaston has recently published an interesting Paper on the subject, in which he states that there is a *semi-decussation* of the nerves; he came to this conclusion from reasoning on certain ocular phenomena which occurred in his own person.

Before the student can understand the mechanism, and phenomena of vision, he must acquire a knowledge of the leading laws in optics; and above all, he must inform himself on the changes in the direction of the rays of light produced by their passing through different media.

Every one knows, that if a beam of light traverses a vacuum, the course of the rays which constitute that beam is not changed; nor is it, if they pass through a medium of uniform density; but if, in their passage, they meet a body, the rays are either absorbed, reflected, or refracted; absorbed, if the body be opaque; reflected, if it has a polished surface; and refracted, if the body is transparent, and possesses a different degree of density to that through which they had previously passed. In the eye, we have more especially to do with the laws of refraction, and the following most appertain to our present enquiry. When rays of light go from a rarer to a denser medium (as from air to water), they are refracted to the perpendicular line, and e contrario. When they go from the perpendicular, the rays are said to diverge; when to the perpendicular, to converge; and the point, where the converging rays meet, is named, the focus. These are the principal laws connected with the function of the eye, which is constituted of parts capable of refracting the luminous rays, and of bringing them to converge at the retina; they there impinge, and produce an impression, which is transmitted by the optic nerve to the brain.

For accurate vision, it is necessary that the rays do not meet before they reach the retina, and that they do not go beyond that point; thus, the eye must have a power of adapting itself to the circumstances of the nearness and distance of objects. We believe, as we have before observed, that this power resides, in part, in the lateral pressure of muscles, either lengthening the axis of the eye, or producing a greater convexity of the cornea; and, in part, to the action of the iris on the aperture of the pupil; but these powers, when conjoined, are not sufficient to overcome the consequences of certain defects in the conformation of this organ. Some people are short-sighted; this arises from the cornea, or crystalline lens being too convex, which circumstance will have the effect of collecting the rays of light to a point, before they arrive at the retina. Others again, particularly aged persons, are long-sighted; this results from a too great flatness of the eye, occasioned by an absorption of a part of the humours; in which case, the rays do not converge at the retina. It is easy to prescribe the means of remedying these defects when the causes are known; in the former case, we wish to give a greater divergency to the rays, which is done by a concave glass; and a greater convergency, which is required in the latter case, is produced by a convex one: thus, a knowledge of the causes of short and long-sightedness, and an acquaintance with the effects of concave and convex lenses, lead us to the adaptation of remedies proper for each of these cases.

It will be evident, from the sketch which we have given of the Physiology of the eye, that every thing which obstructs the entry of the rays of light, must interfere, more or less, with the function of this organ. The cornea transparens may become opaque from acute opthalmia, by which a dense lymph is often extravasated on its surface, or between its laminæ; or from a cicatrix, left by an ulcer, or wound; or from staphyloma. By these causes, the rays of light will be partially, or wholly prevented from entering the eye. The cornea may be in a natural and healthy condition, and capable of transmitting the rays; but, from hypopium, or an accumulation of coagulated lymph, in the aqueous humour, in consequence of an acute inflammation of the iris, the rays will not be able to go beyond the cornea. The cornea, and aqueous humour may be natural, but the pupil may be obliterated; in which case, the light would not pass beyond the anterior chamber. The pupil may exist; but there may be a deposition of lymph behind the capsule of the lens, or an opacity of the lens itself, constituting cataract. The crystalline lens may preserve its transparency; but the retina, or optic nerve, may, from pressure on the nerve, or disease of the brain, lose its sensibility, and amaurosis be the event; hence, the causes of blindess are various; but, fortunately, from the improved state of the opthalmic art, we can now remove many of the affections of the eye, which were formerly classed amongst incurable diseases.

Opacity of the cornea, from extravasated lymph, is to be treated on the principles of promoting absorption. Opacity, from the cicatrization of an ulcer, or wound, will often continue for life. Opacity from staphyloma is incurable. An accumulation of lymph in the aqueous humour is to be removed by exciting the action of the absorbents after the inflammation of the iris has been subdued. An obliteration of the pupil is to be remedied by the formation of an artificial one, by the method of Cheselden, Scarpa, Gibson, Adams, or Ware. Opacity of the lens, from effused lymph behind the capsule, must be treated by introducing a needle, and puncturing the capsule, so as to allow the aqueous humour to have access to the lymph, by which it will be dissolved, and subsequently absorbed. The aqueous humour has a powerful solvent property; on a knowledge of which is founded the treatment of soft and milky cataract, and the late method recommended by Sir William Adams, of treating hard cataracts, viz.—by cutting the lens into small portions, and placing them in the anterior chamber of the eye.

Analysis teaches us nothing on what the solvent property of the aqueous humour depends; for the most active ingredient which it contains, is muriate of soda; but that it is endued with this power in an extraordinary degree, is proved by a circumstance which occurred to Mr. Cline, senr. He was operating for cataract, a spasm seized the eye after the needle was introduced, and a portion of it snapped off. Bad consequences were apprehended; but, to the great gratification and astonishment of the Surgeon, the fragment of the needle was dissolved, and afterwards absorbed. This interesting fact is mentioned by Sir Astley Cooper in his Anatomical Lectures.

Besides Sir William Adams' operation, which is not, I believe, very extensively practised in hard cataracts, there are two other methods, viz.—depression, and extraction; but to the latter, most Surgeons give the preference.

With respect to gutta serena, or amaurosis, we may pronounce the disease, in many cases, to be incurable; the seat of the cause being beyond the scope of investigation; but there are some cases, as those dependent on plethora; and paralysis, that occasionally admit of cure. The celebrated Baron Larrey, the Surgeon-in-Chief of the French army, recommends the use of the moxa, as a remedy capable of producing good effects. In his "*Surgical Memoirs*," he relates cases to prove it. The subject of one, was the son of an English corporal, where the blindness had suddenly supervened, after he had travelled, bare-foot, from Corunna to Valladolid, in a severe winter. No doubt was entertained of the existence of amaurosis, yet the irides retained their sensibility. The moxa was applied over the course of the facial nerve, behind the angle of the jaw, and camphor liniment applied to the head. At the second application of the moxa, the child perceived light; at the fourth, he distinguished objects, and colours; and at the seventh, the functions of vision were completely restored. The treatment of amaurosis must be regulated by the cause of the disease, so far as we know, or suspect it. If it be local plethora, which, according to Mr. Stevenson, and other writers, is very generally concerned in the production of amaurosis, the moxa, as a counterirritant, may do good; but more reliance may, in most cases, be placed in local blood-letting, and the subsequent application of blisters.

The second of the five senses, is the sense of hearing; the organ is the Ear, which is divided into external, and internal parts. Hearing is a sense of great importance, as it warns us of the approach of danger, and enables us to communicate with each other; but still it is less important than that of sight.

The external ear is composed of elastic cartilages, and the meatus auditorius externus, which is a canal, partly cartilaginous, and partly bony; the cartilages are covered with common integument, and the canal is lined with the same structure, which terminates in a cul de sac, at the membrana tympani, and under which are the ceruminous glands, or the small bodies which secrete the wax of the ear. The external ear has scarcely any motion in the human subject; but in animals, it is extensively mobile. To the eminences, and depressions, formed by the external cartilages, different names are given, as helix; antihelix; tragus; antitragus; fossa innominata; scapha; and concha; by these, the sound is collected, and transmitted to the membrana tympani, which is the septum between the external and internal parts of the auditory apparatus. The membrana tympani is situated at the bottom of the meatus auditorius, which in the fœtus is a mere bony ring, but in the adult a spiral canal; the membrane is oval in figure, and oblique in its direction, in order to prevent the reflection of sound. By some Anatomists, it is supposed to be muscular; Sir Everard Home is of this opinion, and thinks that the fibres run from the circumference to the centre, where they are attached to the malleus, or first of the chain of bones, and that the use of this structure is to enable the membrane to vary its degree of tension, to receive quickly the vibrations conveyed to it by the sonorous rays, and thereby to give us more accurate perceptions of sound. Sir Everard may be right, but there is another circumstance which can vary the degree of tension of the membrana tympani sufficiently for these purposes, viz.—the small muscles which act on the bones in the cavity of the tympanum; and as the first of these (the malleus) is attached to the membrane of the drum, and the last (the stapes) to the membrane of the foramen ovale; the movement of the bones must influence the state of both these membranes.

Analogy is in favour of Sir Everard Home's opinion, as muscular fibres exist in the elephant, and some other animals; but Physiology does not seem peremptorily to require them in the human ear.

The membrana tympani, we have said, separates the external from the internal parts of the ear, and naturally the separation is complete. Cheseldon says, however, that the membrane does not entirely close the passage; but has, on one side, a small aperture, covered with a valve; but this is not generally admitted. Although an aperture is not natural, an unentire state is not incompatible with the function of the membrana tympani; provided there be sufficient of it left to retain the chain of bones in their situation; but if these be displaced, deafness follows; because the vibration cannot be continued.

Behind the membrana tympani is a cavity, called, the drum of the ear; across which, from the posterior surface of the membrane just mentioned to the membrane of the fenestra ovalis, is extended a chain of small bones, named, malleus, incus, os orbiculare, and stapes; with these, small muscles are connected, by whose action the bones are moved, and the membranes, with which they are in contact, rendered tense, or lax. M. Majendie considers these muscles as the instruments which tighten and relax the membrana tympani; but in a Paper, published in the "*Journal de Physiologie Experimentale*," on this subject, he shows, that muscular contraction may be replaced by elasticity. He found, on examining the organization of the ear, from the monkey downwards, that the muscles disappear, and are substituted by irregular spherical bodies, of which one is comparatively large, belonging to the malleus, and the other much smaller, connected with the stapes. These bodies, Majendie has denominated, from their properties, "*corps élastiques*;" they are considered as acting by elasticity, in keeping the membrane of the tympanum, and that of the fenestra ovalis, in a state of tension.

In the tympanum, there are four openings; one leads to the throat, and is called the Eustachian tube; another communicates with the mastoid cells; a third, the fenestra ovalis, leads to the vestibule; and a fourth, the fenestra rotunda, opens into the cochlea of the labyrinth. There is no aperture of communication between the tympanum and the semi-circular canals; but between them and the vestibule, openings exist. Besides the bones, muscles, and foramina, a nerve is seen, called, the chorda tympani, and there are two or more irregular elevations.

The next part of the internal ear is the labyrinth; which is divided into vestibule, cochlea, and semi-circular canals. These windings, and sinuosities, are filled with water, and on their parietes, is spread the pulp of the auditory nerve.

This is the arrangement of the parts which enter into the composition of the ear; but to understand the Physiology of this organ, the student must have a general knowledge of the principles of Acoustics.

Sound is an effect produced by the concussion of elastic bodies; the common medium of it is air; but there are two other media of conveyance, viz.—solid bodies, and water. In the ear, we have an example of each of them; thus, air conveys the sonorous rays to the membrana tympani; the chain of bones carries them across the cavity of the drum; and water conducts them to the pulpy expansion of the auditory nerve.

Sound, like light, may be collected to a point, and thus its audibility is increased; on this principle, whispering galleries are constructed; and this property of sound suggested the invention of the "*stéthoscope*" of Monsieur Laennec, an instrument employed for exploring the nature of thoracic diseases, and which has recently been proposed by Lisfranc, as a useful method of distinguishing the seats of fractures. We shall allude to this instrument in a future part of the volume.

Sound like light, too, may be reflected; of which an echo is an illustration. The above circumstances connected with sound, viz.—its media of conveyance; its concentration; and its capability of reflection, are all, more or less, concerned in the Physiology of the ear.

The trumpet-like opening of the auricle, is well calculated to receive the sonorous rays; and by its irregularities, they are directed on the principle of reflection, to the meatus auditorius externus, by which they are amassed into a narrow compass, and therefore, strike with force on the membrana tympani, which they set in motion. But to produce the necessary oscillation of this membrane, there must be a current of air behind, as well as before it; and this is admitted by the Eustachian tube. The vibratory movement of the membrana tympani is imparted to the malleus, which is in contact with it; the malleus communicates it to the incus; the incus to the os orbiculare, and stapes; and the stapes to the membrane which covers the fenestra ovalis. It is then sent by means of the water in the labyrinth, to the expanded auditory nerve, and the impression made, is, by it, transmitted to the brain.

Mr. Swan, of Lincoln, has communicated to the Medico-Chirurgical Society of London, a very interesting Paper, "*On the Physiology of the Ear*," which has been published in Part II. of the Eleventh Volume of their Transactions. Mr. Swan had advanced in a former Paper, that sounds can be conveyed to the organs of hearing, by impressions made upon the facial nerves, and that people born deaf and dumb, from imperfect mechanism of the ear, without any defect in the auditory nerves, might be made to hear through the medium of the facial nerves. In the Paper now published, he mentions the case of a woman, who was born with the meatus externi imperforate. "She did not begin to talk intelligibly till she was seven years old, and did not talk tolerably well till she was about twelve. She can hear perfectly well, when a person addresses her at the distance of six or seven yards; but not nearly so well, when the person speaking is behind her. When a linen-cloth, and a piece of flannel, were put over her face, she heard distinctly;

but when a large woollen-cloth was put over these, she could not hear any of the same questions uttered in the same tone. On repeating the same experiment, it was found that she heard more faintly, according to the extent of the covering put on her face. The same was the case with tunes played on the piano-forte. When the face was covered, the sounds were fainter; but when she placed her hand over the piano, she heard much better; but not so well, when a silk handkerchief was tied round her arm."

Mr. Swan thinks, that in instructing the deaf and dumb, the attention is too exclusively devoted to signs; and that the faculty of hearing, in dumb people, where the auditory nerves are perfect, might be much improved, if the whole, or the greatest part of their attention were directed to the proper exercise of these nerves.

As we find that the sensibility of the nerves concerned in the production of the senses, is increased by proper use, it is reasonable to suppose, that in dumb people, the facial nerves would have more power of receiving and conveying impressions of sounds, if they were properly exercised.

The remarks of Mr. Swan are certainly deserving the attention of those who devote their atttention to the instruction of the Deaf and Dumb; for the most minute dissection in these cases, has never developed any unnatural appearance in the structure of the auditory nerves.

There are no diseases more obscure than those of the internal ear, which is owing to their being beyond the scope of inspection; but many affections of the external ear are curable. The causes which occasion partial, or complete deafness, may be of two kinds: those arising from original organic, or functional defect; and those arising from neglect, accident, and disease.

Deafness, from diseases of the external ear, will, in a general way, admit of relief, if not of entire removal; but when the cause is seated in the internal, it is less seldom cured.

It is desirable to have the means of determining the seat of disease in cases of deafness. It may be in the external ear, that is, without the membrana tympani; it may be in the internal ear, or within the membrana tympani; or it may be occasioned by an obstruction in the Eustachian tube. In the first case, the person must, generally speaking, be insensible to impressions conveyed through the air; but Mr. Cooper, in his "*Surgical Dictionary*," relates the case of a boy, where no vestiges of the meatus auditorii could be seen, and where the natural situations of these openings were completely covered with the common integuments; yet, the child could hear a great deal, though the sense was certainly dull and imperfect.

Such a case, however, if the internal ear be sound, and perfectly formed, is not insensible to impressions conveyed through solid bodies, held between the teeth; even this was not necessary in Mr. Swan's patient. I read not long since, an account of a merchant of Cleves, who became almost totally deaf; one day he happened to be sitting near a harpsichord, while some one was playing, and having a tobacco-pipe in his mouth, the bowl of which rested accidentally against the body of the instrument, he was agreeably and unexpectedly surprized to hear all the notes in the most distinct manner. By reflection and practice, he made a valuable use of this discovery, for he soon learned, by means of hard wood, one end of which he placed against his teeth, to keep up a conversation, and to be able to understand the softest whisper. His son made this the subject of his *Inaugural Dissertation*, which was published in 1754.

In the above case, of course, the internal ear, and Eustachian tube were perfect, and the disease was seated in the external ear. We learn from it, the means of determining where the defect lies; and in deafness from a dubious cause, the Surgeon may employ it as a diagnostic test.

When a solid substance is applied to the teeth, the sound is conveyed to the tympanum, by the Eustachian tube, which opens behind the soft palate; but still that sound can only be conveyed when the substance is put in contact with the teeth, which are good conductors. This is proved by the experiment of M. Itard, a celebrated French Aurist, which is, that when we apply a watch to the teeth, the ticking can be distinctly heard; but when the watch is put on the back part of the tongue, remote from the teeth, and the mouth closed, the sound cannot be heard at all; notwithstanding, in this case, the watch is placed much nearer the orifice of the Eustachian tube.

We may finally state, with respect to the Pathology of the ear, that the difficulty of cure is in proportion to the depth of the malady; if superficial, it may be relieved, or removed; if deep, the chances are very much against our being able to do any good by either medical or surgical means.

For the treatment of diseases of the ear, the student should consult the works of Mr. Saunders, and Mr. Curtis, on the affections of this organ.

The third of the five senses, is the sense of smell; the acuteness of which is in proportion to the developement of the nostrils. The basis of the soft parts of the Nose, is bone, and cartilage, which are covered, and lined, by common skin; but internally, the skin is more vascular, and called, the pituitary membrane. The nose is divided into two nostrils, by the septum narium; and in each nostril are elevations, formed by the spongy, or turbinated bones, which afford an extensive surface for the expansion of the lining membrane.

This membrane is supplied with the first pair of nerves, which take their origin from the anterior lobes of the brain. They are called the olfactory, and their numerous filaments are sent through the cribriform plate of the ethmoid bone to be distributed to the pituitary membrane, which is the seat of the sense of smell, and the source of the mucus of the nostrils.

The Physiology of smell is more simple than that of seeing, and hearing. From certain bodies, are constantly escaping small particles, whose motion is influenced by the air. This, in passing through the nostrils to the lungs, applies the odorous effluvia to the pituitary membrane; and the impression thus made, is transmitted by the olfactory nerves to the brain.

This sense is an important one, and contributes much to the gratifications, and pleasures of life.

The fourth of the senses, is the sense of taste, a faculty which resides in the papillæ of the tongue.

The TONGUE is divided by Anatomists, into base, body, and apex; the base is fixed to the os hyoides; but the apex is moveable. The substance of this organ is muscular, and the covering of it is the continuation of the lining membrane of the mouth. On the surface of the tongue are seen numerous small eminences, which are called papillæ; some of them are much larger than others. They are divided into three classes; those near the base are named, the papillæ capitatæ; those in the centre, the papillæ mediæ; and those at the apex, the papillæ minimæ; they appear to be the terminations of the nerves; the first class excepted, which are supposed to be merely mucous glands.

In the tongue, there are three sets of nerves, viz.—the lingual, the glosso pharyngeal, and the gustatory. The lingual is believed to be the nerve of motion; the glosso pharyngeal, the nerve of secretion; and the gustatory, the nerve of taste; there is, however, a considerable intermixture between the sets. The arteries, veins, and nerves, of one side of the tongue, are separated from those of the other, by the longitudinal line, called, the Raphé linguæ.

The sense of taste resides in the papillæ mediæ, et minimæ. How sapid bodies act on these eminences, is a question which Physiologists cannot satisfactorily answer. Some consider that their action is chemical; others think, that it is mechanical; but as it is necessary to the perfection of this function, that the substance to be tasted, be either in a state of solution, when taken into the mouth, or dissolved afterwards, by the saliva and mucus of this cavity, the process would appear to be strictly chemical.

The appearances of the tongue, furnish us with important diagnostic, and prognostic signs; its dryness, and its colour, are circumstances which the Practitioner must attend to, in forming his judgment of disease. Dryness indicates fever; moistness, succeeding to dryness, presages a favourable termination; dryness and blackness denote a putrid tendency; and great redness is often an attendant on visceral inflammatory diseases, particularly on gastritis, enteritis, and hepatitis. In jaundice, and bilious fevers, the tongue is generallly covered with a yellow, viscid mucus.

The indications of disorder, furnished by the tongue, are less likely to mislead the Practitioner than those of the pulse; but no one set of symptoms ought to be regarded as sufficient to found an opinion upon. The tongue, the pulse, the state of the secretions generally, the colour of the skin, the attitude of the body, and the general aspect of the patient, must be examined, and attentively observed; for an opinion, supported by a solitary fact, may be erroneous; but it hardly can be so, when grounded on a concatenation of circumstances agreeing in all their points.

The last of the five senses, is the sense of touch;

a property residing in the Cutis Vera, which is abundantly supplied with blood-vessels, absorbents, and nerves; the extremities of the fingers and toes, however, have a more exquisite sense, than other parts.

The cutis vera is one of the three tunics which cover the body. On the surface, is the dense inorganized cuticle; and intervening, between it and the cutis, is the rete mucosum. The integuments of the body are reflected inwards, so as to line certain passages, as the nostrils, mouth, œsophagus, trachea, urethra, vagina, and a part of the rectum. The cuticle and rete mucosum, are believed to be secretions of the cutis vera. This last is an exceedingly vascular membrane; it is also plentifully supplied with absorbents; as shown by quicksilver injections.

The cutis is a very sensible structure; and but for the cuticle and rete mucosum, the impressions of tactile bodies, could scarcely be endured; this is proved by the acute pain experienced, when these external coverings are removed.

But the sense of touch, is not the only function of the cutis; it is also a secretive organ, and supposed by some Physiologists, to effect the same changes on the atmosphere, as the lungs; but there is a doubt about this point. The eminent Chemists, Allen and Pepys, made some experiments, with a view to determine it; but they found so many obstacles to the enquiry, as to be prevented from coming to any positive conclusion. It is, however, the source of the perspirable fluid, which is secreted by the cutaneous vessels. In addition to these functions, the skin is an extensive sympathizing organ, and often influences the state of the lungs, stomach, intestines, and kidnies. When the cutaneous secretion is checked by cold; the lungs, alimentary canal, and urinary organs, frequently become disordered. Catarrh, and pneumonia, often arise from this cause. The bowel-complaint of the Spring and Autumn, are generally to be traced to suppressed perspiration, from the frequent vicissitudes of the weather at these seasons of the year; and every body knows how sparingly the urine is secreted when we perspire freely, and vice versa. I am convinced, from observation, that the enteric affections of the Spring and Autumn, are of an inflammatory character, and almost in every instance produced by the sudden application of cold to the skin. The effect of this is, to impel the blood from the surface; and from the intimate sympathy between the chylo-poietic viscera and skin, it is not surprizing, that the former should be more liable to suffer, than other organs.

In these complaints, when the inflammatory action is in a moderate degree, the alvine evacuations are mucous, and profuse; but when the inflammation runs high, the secretion is diminished, and costiveness prevails. That the suppression of the secretory function is caused by active inflammation, is verified by what we find after the inflammation is diminished by depletion, viz.—the bowels, which before resisted the operation of purgative medicines, soon begin to be acted upon; and the event is a copious exhalation from their mucous surface.

The nails and hairs are the appendices to the skin; and like the cuticle, are inorganized, and insensible substances; the former are secreted by a glandular structure; the latter grow from roots or bulbs, situated in the cellular membrane, under the skin.

According to the experiments of Mr. Hatchett, hair consists of gelatine, and coagulated albumen; besides which it is said to contain oils, iron, oxide of manganese, lime, silica, and sulphur.

We have now considered the five species of sensations, which convey information to the mind, viz.—seeing, hearing, smelling, tasting, and touching. The two first of these senses are produced by media, which modify the impressing agents; but for the three last, it is required, that the object be brought into contact with the organ to be impressed; thus the odorous particles must be applied to the pituitary membrane, in order to be smelt; sapid bodies must come in contact with the tongue, in order to be tasted; and tactile bodies, with the skin, in order to be felt.

We have examined all the organs necessary to the support of life; but as death is the certain consequence of life, the human species would soon become extinct, if there were not organs and functions subservient to its continuance.

There are few persons who attain the age of three score years and ten, because there are many causes which have a tendency to curtail the thread of human existence. The desire of longevity (as Willich observes) seems to be inherent in all animated nature; and particularly in the human race. It is intimately cherished by us throughout the whole of our life, and is frequently supported and strengthened, not only by justifiable means, but also by various species of collusion; but, in spite of the desire, how few there are who live to be old; partly from causes of our own creation, partly from casualities, and partly from diseases to which the different periods of life peculiarly predispose us. In infancy, the convulsions attendant on dentition, hydrocephalus, hooping-cough, the measles, scarlet-fever, and small-pox, commit great havoc; thus, it has been computed that one-half of the children born in London, die under the age of two years and three quarters; and in Manchester, under five: but the mortality of the infantile period of life has been greatly diminished by the discovery of vaccination.

In the middle stages of life, inflammatory diseases prevail, and destroy great numbers. In advanced age, organic affections, and diseases of debility. Thus, from the moment of our birth, we have to anticipate a series of bodily calamities, which threaten an abridgment of life; therefore few comparatively arrive even at the grand climacteric. The human species, then, would soon become extinct, if nature had not provided for its continuance.

THE ORGANS OF RE-PRODUCTION IN THE MALE SUBJECT are the testes, and their connections, and the penis, and its connections.

The testes, or glands, which secrete the semen are contained in a bag, called the scrotum. Each testis has two envelopes, a close, and reflected, and both are derived from the peritoneum.

On laying open the loose tunic, we observe the gland and its epididymis; the latter being obliquely placed on the outer, and back part, of the former. The testis is made up of arteries, veins, absorbents, nerves, the tubuli seminiferi, and the connecting medium of these parts; and the whole is encompassed by the tunica propria. Passing off from the testis is seen the spermatic cord, which is composed of the parts going to, and from the gland, and surrounded by peritoneum, the same as the tunica vaginalis reflexa, but here called the tunica vaginalis of the spermatic cord. Upon its outer surface are cellular membrane, and the fibres of the cremaster muscle. From the testis the cord ascends; passes through the external abdominal ring; traverses the inguinal canal, or that oblique space between the two rings; and enters the abdomen through the foramen, in the fascia transversalis. On arriving at this point, the different component parts of the cord are seen to separate; the vas deferens descends to the neck of the bladder, and the artery, veins, &c. pass upwards. The excretory duct of each testis, is named the vas deferens, it descends to the vesicula seminalis, a convoluted body lying at the under and lateral part of the urinary bladder; and terminates with the duct of the vesicula seminalis, in the urethra, at a process of the lining membrane, called caput gallinaginis, vel verumontanum. The vesiculæ seminales are the reservoirs of the semen; but some Physiologists have assigned to them other purposes.

The penis is composed of three bodies; the two corpora cavernosa above, and the corpus spongiosum below; in this last body is the urethra, or outlet for the urine, and semen.

The corpora cavernosa, and corpus spongiosum are covered by a continuation of the common skin, which forms anteriorly a loose fold, called, the præputium. These parts are plentifully supplied with arteries, veins, absorbents, and nerves.

Each corpus cavernosum arises from the ramus pubis, ascends, and meets the opposite body; the two bodies then unite, and pass to the glans penis, to which their extremities are applied. By their junction a groove is left above, for the arteria dorsalis, and vena magna ipsius penis; and below, is another furrow for the corpus spongiosum.

Between the two corpora cavernosa there is a partition, called the septum penis, but it is perforated, so that the cells in one corpus freely communicate with those of the other.

The corpus spongiosum begins at the bulb of the urethra, and terminates in the expansion called glans. The prominent ring at the commencement of the glans is named the corona glandis, and the contracted part behind is the cervix. About the corona and cervix there are many small follicles, which secrete a sebaceous matter to defend the glans, and to facilitate the motion of the prepuce backwards and forwards. The three corpora of the penis are cellular in structure, as inflation proves, but the cells of the corpus spongiosum are more delicate than those of the corpora cavernosa.

The Organs of Re-production in the Female are divided into external and internal.

The external are, the mons Veneris, labia, pudendum, clitoris, nymphæ, orificium vaginæ, and carunculæ myrtifornes.

The internal are, the vagina, uterus, fallopian tubes, ovaria, and ligaments. The fallopian tubes, ovaria, and ligaments are the appendages to the womb.

To the organs of re-production, we must add the mammæ, which are composed of small glandular bodies, the lactiferous ducts, adeps, arteries, veins, lymphatics, and nerves.

The function of these organs is to form the fluid for the nourishment of the offspring; which fluid, in the human subject, differs from that of the cow, in containing more saccharine matter, and less curd.

It is not requisite for me to comment on the Anatomy of these parts; and the Anatomico-pathological views of most consequence will be found under the head, Relative Position.

We have very little to say on the Physiology of the organs of re-production in the male, more than that the secretion which the testes furnish is the stimulus to impregnation.

The womb, in the unimpregnated state, has only one function to perform, viz.—menstruation; the use of which is to render the organ fit for the purposes of conception. The fluid which is discharged at the menstrual periods is not blood, but a secretion from the blood; it is incoagulable, therefore contains no fibrine. The period when this new function of the uterus begins, is very different in different climates. In hot countries it appears as early as the ninth or tenth year, but in very cold regions not until the nineteenth or twentieth year. After once appearing, it recurs monthly, (in some constitutions oftener) to the age of 45 or 50, unless temporarily suspended by pregnancy, lactation, and disease.

Of the changes which the uterus, and its appendages, undergo from impregnation, we have already given a full description in the section which treats "*On the Phenomena of Life.*" In the female, we find the ovum which contains the rudiments of the new animal, and the nidus for the developement of its different parts; but conception, from involving the nature of life, and the state of existence of the animal in ovo, is one of the most obscure and intricate subjects in Physiological science. If we trace propagation from its most simple form, as in gemmiparous animals, to its most complex, as in viviparous, we meet with phenomena as replete with mystery, as they are with interest.

Finally, to complete the human body, all the organs, and parts, that we have mentioned, must be connected; and the medium of connection is CELLULAR MEMBRANE.

This structure may be divided into two kinds; reticular and adipose. The reticular is found in situations where a considerable degree of motion is necessary; the adipose occupies parts where the motion is limited. The great distinction between the two is this: betwixt the cells of the former, there is a free communication, as observed in œdematous, and emphysematous swellings; but the cells of the latter do not at all communicate; each cell is a distinct glandular part, and like to other secreting organs, exceedingly vascular.

Thus, we have the human body complete in all its parts. A mind provided with all the instruments which are wanted by man for his individual purposes, and for holding converse with the objects that are around him. He has a superior animal organization, united to an intellectual endowment, which qualifies him to exercise that authority delegated to him by his Maker, and to which every thing in nature is subservient. Man is at the head of all created beings; he is, as Bacon styles him, "the final cause of all things; for if man were removed from the world, creation would appear to be without a purpose."

ON

RELATIVE POSITION;

OR

MEDICO-CHIRURGICAL VIEWS

OF THE

HUMAN BODY.

After the general description of the human body, which has been given in strict physiological order, it is proper to consider the grouping together of parts; and thus to describe their support and connexions. This constitutes the study of *Relative Position;* a knowledge which enables us to detect the seat of disease, and which has an influence on all the steps that are taken, in the planning and performance of the different operations of surgery.

We have seen that there are different systems of parts in the human body; but to study them separately, is only admissible, as introductory to other important points; afterwards, the student must observe the relations which they have to each other, and the manner in which they are linked together; for it is principally by observation on them in their united state, that he will acquire a competency to practice his profession with success and safety.

An acquaintance with the relative position of organs and parts assists the Physician and Surgeon, in forming their diagnosis of diseases, and suggests the remedies most likely to act upon them. Ignorance in this respect on the part of the Surgeon, may be very serious in its consequences; for called upon, as he is, to use the knife, fatal mischief might ensue from his not knowing the part on which he has to operate.

It is not difficult to perform an operation on a subject in the dissecting-room; but we should consider under what different circumstances we act on the dead, to what we do on the living body. When an incision is made into a part deprived of life, no blood appears, and there is nothing to obscure the view, or embarrass the operator; but when a wound is inflicted on living structure, blood streams out, and the incised soft parts are in some measure concealed. In the dead subject, the muscles are in a passive state; in the living, they retract on being irritated by the knife; and these anatomical differences produce changes which should be anticipated. But there are moral circumstances, too, which can cause embarrassment, viz.—the cries of the patient, and the watchful eyes of censorious by-standers; and these will induce confusion, unless the Surgeon's whole feelings and mind are concentrated in his work, a degree of abstraction which cannot always be commanded: but the confidence which Anatomy gives, and a sense of duty, which is paramount to every other consideration, will, in time, perhaps, overcome all these difficulties.

Anatomy contributes to inspire confidence; but it is practice, or experience only, that can enable a Surgeon to perform a capital operation with almost stoical indifference. But neither Anatomy nor experience can, in all cases, divest the mind of a too anxious feeling. Haller (than whom, a better Anatomist and Physiologist never lived) expressly tells us, in his "*Bibliotheca Chirurgica*," that he was never able to perform an operation on the living subject; although he had given instructions in surgery, for seventeen years, and had frequently shown, on the dead body, the most difficult operations in surgery.

It is said, that Cheselden, to the last, was generally affected with diarrhœa, in contemplating a serious operation. At first, all men feel more or less anxiety, however great their anatomical knowledge may be; and often, this continues throughout their professional life. I shall here give what Richerand, a distinguished operative Surgeon of the French School says, on this subject, and as the passage comprehends what I wish to impress on the mind of the student, viz.—how confidence is most likely to be acquired, I shall, with his words, conclude these introductory remarks. After speaking of the necessary qualifications of the Surgeon, he continues "*Deux choses contribuent encore à inspirer cette confiance nécessaire au succès; d'abord* *la connoissance parfaite de la partie sur la quelle on opère, et de la maladie pour laquelle on pratique l' opération, puis l' habitude de son exécution sur le cadavre, lors qu'il s'agit d'un cas où l'on se conduit d'après des règles décrites. Cependant, si j'en juge par ma propre expérience, il est difficile qu' à la première opération, la vue, peutêtre même l'odeur du sang, les cris du patient, la nouveauté du spectacle, ne vous causent une émotion qui n'est pas sans quelqüe analogie avec celle qu' éprouve le guerrier par le tumulte d'un combat, et l'aspect du carnage."*

ON

THE HEAD.

The Head is divided into the Cranium and Face.

CRANIUM.

In a former part of the volume, mention is made of the bones of the skull, and the manner in which they are united, by means of sutures; but before the student can understand the attachments, and other circumstances, of the minute soft parts which are connected with the cranium and face, he must study well the elevations, depressions, foramina, and other remarkable points in the bones of the head. The united bones present a front, a lateral, a posterior, an upper, and an under surface.

In the *front view*, the parts worthy of notice are, the prominences indicating the situation of the frontal sinuses; the two orbits; the seven portions of bone which enter into the composition of each orbit, and especially the os unguis, on account of its connexion with the lachrymal sac; the seat of the lachrymal gland in a depression behind the external angular process of the frontal bone; the fissure at the bottom of the orbit; the foramen opticum; the foramen supra-orbitarium; and foramen infra-orbitarium.

The bony parts of the nostrils are next to be observed, and the terminations of the frontal sphenoidal, and ethmoidal cells, the ductus ad nasum, and the opening of the antrum Highmorianum. The bones of the mouth, &c. come next; and of the teeth, the anterior molar of the upper jaw, which communicate with the floor of the antrum, should be studied; this being a practical point.

In the *side view,* we observe a part of the os frontis; the lateral part of the os parietale; the os temporale; the zygomatic arch; the styloid process; the entrance to the organ of hearing; the mastoid process; and a part of the os occipitis. The situation of the anterior inferior angle of the temporal bone should be marked in its relative position to the temporal root of the zygoma, which is prominent, and can be felt through the soft parts which cover it; because the angle shows the seat of the artery of the dura mater. The posterior inferior angle must also be noticed, because it corresponds to the corner of the lateral sinus. In this view, in most crania, some irregular portions of bone are seen between the parietal, temporal, and occipital bones; they are called ossa triquetra, and have been mistaken for depressed fragments; the student, therefore, should be aware of their situation, in order to avoid such a dangerons error.

The *posterior view* is chiefly occupied by the os occipitis, of which the ridges and tuber are remarkable points; the latter indicates the place where the cerebrum ends, and the cerebellum begins; also where the longitudinal sinus of the dura mater bifuscates, or divides into the two lateral sinuses.

In the *superior surface*, we see a part of the os frontis; the parietal bones; and the sagittal suture, running in the same line as the longitudinal sinus.

In the *inferior surface*, we remark the basis of the lower jaw; the palatum durum, and its foramina; the under part of the zygomatic processes; the cavities which receive the cordyles of the inferior maxilla; the depressions anterior to them, where the condyles lie in dislocation of this bone; the pterygoid processes of the sphœnoid bone; the mastoid, and styloid processes of the temporal bones; the cuneiform process of the os occipitis; the condyloid process of the same bone; the foramen magnum for transmitting the spinal marrow, and other parts; and behind this, are depressions, and ridges in the os occipitis, for the attachment of muscles.

A great number of foramina, and pits, may be remarked in this view; the former, for the passage of blood-vessels, and nerves, to and from the brain; the latter, for lodging soft parts.

The foramina to be seen in the inferior surface are, the foramina lacera orbitalia superiora; foramina pterygoidea; foramina spinosa; foramina carotida; iter a palato ad aurem; foramina lacera in basi cranii; foramina stylo-mastoidea; foramina condyloidea anteriora; foramina condyloidea posteriora; foramen magnum; and often the foramina mastoidea.

The foramina to be seen in the internal basis are, the foramina optica; foramina lacera orbitalia superiora; foramina rotunda; foramina ovalia; foraminaspinosa; foramina carotida; foramina auditiva; foramina lacera in basi cranii; foramina condyloidea anteriora; foramen magnum; and the foramina mastoidea.

Besides these foramina of the internal basis, we see cavities for the lobes of the cerebrum and cerebellum. The crista galli, and cribriform plate of the ethmoid bone are seen on the fore part; behind these, the sella turcica, and clinoid processes; the petrous portions of the temporal bones; the basilar process of the os occipitis, hollowed out for the medulla oblongata of the brain; the fossæ, for the lateral sinuses, must be particularly attended to; the deep depressions for the cerebellum; the crucial spine, &c. In the corresponding internal surfaces of the lateral and upper parts of the cranium, there is nothing remarkable, save the sulci of the dura matral arteries, and the groove for the longitudinal sinus.

The cranium is separated from the face by the transverse suture. It is covered by the common integument, which is here called, the scalp; but though common integument, as Pott observes, 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; a circumstance arising from its connections with important parts. Growing from the scalp, are, the capilli, or hairs of the head, which, like the other hairs of the body, are inorganized structures, that is to say, not alive; but they proceed from bulbs which possess life, and a power of secretion. Having reflected the scalp, we find on its porterior surface the tendon of the occipito frontalis muscle, that muscle which produces the transverse wrinkles of the forehead; and immediately covering the bones of the cranium is the membrane called pericranium, but which in other situations is named periosteum. The pericranium firmly adheres to the cranium, by means of blood-vessels passing from the one to the other, and by insinuating itself into the sutures, and there meeting with corresponding insinuations of the dura mater, or external membrane of the brain. These communications between the external and internal parts of the head, explain pathological facts of not unfrequent occurrence, viz.—how slight injuries, or erysipelas, of the scalp, and pericranium, terminate fatally, by producing inflammation of the brain. It is on this account, that we would prohibit the application of a blister to the scalp in phrenitis.

On observing the manner in which the bones of the cranium are protected from external injury, by soft parts, we find that in the frontal part of the head, above the superciliary ridges, there is nothing more than common integument, the tendon of the occipito frontalis muscle, and the pericranium On the summit of the head, and on the upper and lateral parts of it, the protection is similar. At the lower and lateral parts we find the temporal muscles covered with a dense fascia; *posteriorly*, above the upper transverse ridge of the os occipitis, the soft parts are the same as on the forehead; but below the occipital ridge, are the thick muscles of the neck. Bearing in mind the relative thickness, and strength of the bones of the cranium, and the means of protection furnished by the soft parts, inferences should be drawn as to the comparative liability of the different bones to suffer fracture from external force.

Of all the bones of the cranium, the parietal are most frequently broken, because they are larger, weaker, and less protected, the temporal excepted, which, at their squamous portion, are somewhat thinner. The os frontis is quite as much exposed to accident; but it is stronger, and thicker, than the parietal. The force to fracture either of the temporal bones, must be of a pointed or penetrating kind; for the massy temporal muscle shields it. A very little of the occipital bone appears above the fleshy muscles attached to the upper transverse ridge; hence, a very little of the bone is exposed to violence. Bu the ossa parietalia are only defended by the scalp, tendon of the occipito frontalis, and pericranium; and, in comparison with the other bones (a portion of the temporal excepted) they are thinner, and therefore not capable of resisting any violent injury.

Whether the faculties of the mind reside in a part, or in the whole of the cerebral organ, is a question which the present state of Physiology cannot determine; but that they have their seat within the cranium, seems to be proved by the effects of injuries, and diseases of the brain. A man receives a blow on the head, the concussion of the brain suspends its functions; the man falls, and loses all sense, and voluntary power. The same happens in a fit of apoplexy; but here, the cause is compression, not concussion. The effects of a blow on the head are not always severe in proportion to the violence with which the blow was struck. A slight blow will sometimes kill; and other cases occur where a severe one has occasioned merely a temporary stun; the difference arises, in a general way, from the seat of injury; some parts of the head being better defended than others, as we have already shown. For a blow on the head to kill, it is not necessary that the brain should immediately suffer. A simple wound of the scalp may terminate fatally, in the way we have mentioned; the chance of this fatal termination is considerably enhanced by mal-treatment of the wound; thus, ligatures should be avoided; and notwithstanding that excellent Surgeon, Mr. Pott, assents to their employment, for uniting certain lacerated wounds of the scalp, most surgeons of the present day object to them; on account of their being both dangerous, and unnecessary. Three years ago, I saw an extensive laceration of the integuments of the forehead; in which case, the Surgeon was induced to retain the edges of the wound in contact, by sutures. On the day after the accident, the patient complained of considerable pain in the head; the edges of the wound were swollen, and much inflamed; an evaporative lotion, and leeches were applied to the temples; but in spite of these means, the inflammation of the scalp extended. The Surgeon prudently withdrew the ligatures; after which, the inflammation subsided, the pain of the head left, and the patient's convalescence was progressive.

When we are called to a patient in an insensible state; and, on enquiry, find that he has received a violent blow on the head, we try to ascertain, by means of a probe (if there be an external wound) whether the bone has suffered. We succeed, perhaps, in finding a fissure; but we are not to conclude, that the fissure has caused the symptoms, if they be those of concussion only; but if we discover that a portion of bone has been depressed, and symptoms of compression exist, then it is quite fair to suppose that the depressed fragment of bone is the cause of those symptoms; even if the depressed portion be small.

The symptoms of concussion, which accompany a fissure, or fracture of the head, are not caused by that fissure, or fracture; for, as Mr. Bell observes, " they originate from the injury which the brain received at the same time that the bone was hurt;" the fracture and concussion are, therefore, conjoint effects.

The sources of symptoms, furnished by injuries, or violence applied to the cranium, are two, viz.—concussion, and compression. By concussion, is meant a shock given to the brain by a blow; by which the functions of that organ are temporarily suspended, or permanently destroyed. The symptoms which denote a slight degree of concussion, are giddiness, tremor, paleness, nausea, and momentary insensibility. When the concussion is violent, there is a complete loss of sensibility and voluntary power; the skin is pallid and cold, and there is sickness, and a feebleness of pulse; this state of depression nearly resembles a state of syncope; but if the patient survives, sensibility and volition, in some measure, return, the countenance becomes natural, the skin assumes its ordinary warmth, and the pulse rises; this is what is called a re-action; we are now to apprehend inflammation, and our treatment must be directed to the prevention of it by the appropriate means. Should depletory measures not succeed in preventing it, the patient dies from inflammation of the brain, or from the symptoms of concussion giving place to those of compression, in consequence of a rupture of blood-vessels, effusion, or suppuration.

The symptoms of compression are very similar to those of concussion, with these exceptions; the pupils of the eye are usually more affected, the pulse is slow and labouring, and the breathing stertorous. Compression may arise from any cause which produces an encroachment on the brain, as depression of bone, extravasation of blood, effusion of lymph, or the formation of matter; but these causes do not necessarily give birth to symptoms of compression.

The summary of the practice, in the different injuries of the head, is as follows:—

In case of concussion, with, or without fracture, depletion, with the common auxiliary means, must be had recourse to, after the depressed state of the system, immediately consequent on the violence, has gone off.

In case of compression, from *simple* fracture, with depression of bone, full bleeding must be employed; should the symptoms not yield, the fragment must be raised.

In case of compression, from *compound* fracture, with depression of bone, we are advised immediately to trephine.

In compression, from the rupture of a blood-vessel, the turgid state of the vessels of the brain, is to be relieved by the abstraction of blood; and we are then to trust to the action of the absorbents for the removal of the coagulum. When from effusion it is to be treated on the same principle as other hydropic affections.

Lastly, in compression from the formation of matter, it is warrantable to operate, provided the seat of matter can positively be ascertained.

In the present day, the trephine is not so often used as formerly, Hey's saw, from being a more manageable instrument, having nearly superseded its employment; but the following remarks will be useful, whether the one or the other be preferred. When it is determined upon to remove a portion of bone, the Surgeon is to recall to mind what he knows of the relation which the internal parts of the head bear to the external; he will then remember the most objectionable places to the application of the trepan. There is no part of the cranium, where the trephine, or Hey's saw, may not be applied; but still there are some parts, where little, or no danger need be apprehended; and others, where the operation must be conducted with the greatest care and caution. These places I shall enumerate.

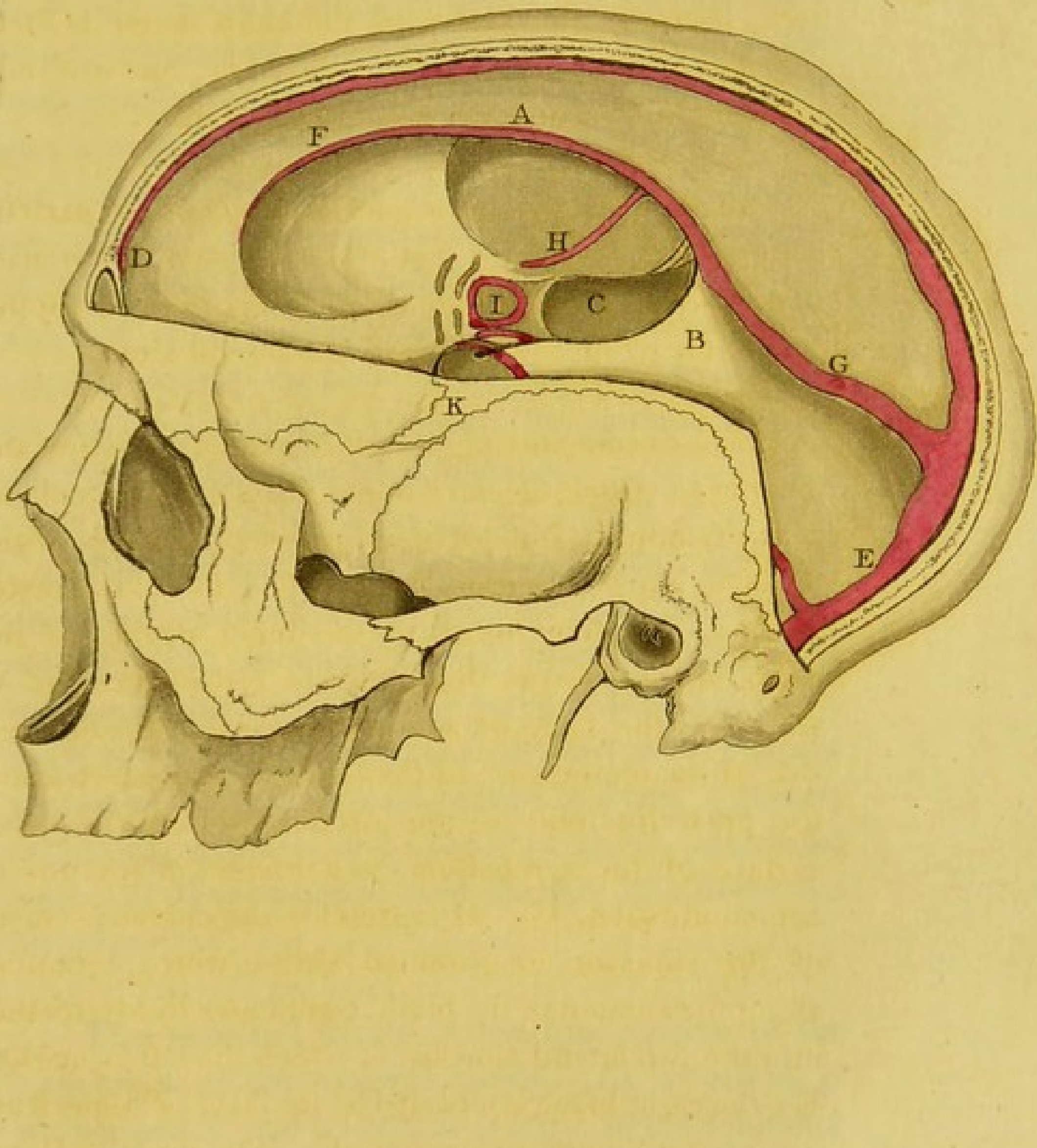
1.—In a line drawn from the nose, along the summit of the head, to the tuberosity of the os occipitis; because, just above the nose are the frontal sinuses, and the continued line indicates the course of the longitudinal sinus of the brain.

2d.—At the anterior inferior angle of the parietal bone, situated about two inches above the zygomatic arch; because the artery of the dura mater is here embedded in a deep sulcus in the bone, and a wound of it might occasion a serious hæmorrhage.

3d.—At the posterior inferior angle of the parietal bone, which is situated just above the root of the mastoid process of the temporal bone; because it is opposite to a part of the course of the lateral sinus.

The accompanying sketch is intended to show the manner in which the dura mater envelopes the contents of the cranium; and the relations of the sinuses of the brain to the exterior of the skull. The dura mater gives a complete lining to the inner surface of the cranium, and forms the processes represented by A, which is the falx, or septum cerebri. B—The left side of the tentorium; or that process which separates the posterior lobes of the cerebrum, from the upper surface of the cerebellum, and leaves an aperture of communication, C. D represents the commencement of the superior longitudinal sinus, which, running along the summit of the brain, terminates by bifurcating into the two lateral sinuses, of which the left is marked E; the right being concealed by the falx. F represents the inferior longitudinal sinus. G—The torcular Herophili. H—The petrous sinus. I—The cavernous sinus; and K—The anterior inferior angle of the parietal bone.

Plate 2



The blood brought to the brain, and its membranes, by the carotid, and vertebral arteries, is by these sinuses, or veins, returned again to the heart.

The superior longitudinal and lateral sinuses, are, however, the only vessels of importance in their relation to external parts. By observing their course, the student will learn to appreciate the observations made on the most objectionable places to the application of the trephine. Besides the situations where the sinuses are concerned, we mentioned the anterior inferior angle of the parietal bone; behind which, in the view annexed, is the left dura matral, or spinal artery. To impress on the memory of the student, the relation of that vessel to the zygoma, the anterior inferior angle of the bone has been retained.

The principal arteries of the scalp are, the occipital, and temporal, which come off from the external carotid. The occipital branch, after escaping from its connections with the deep parts, a little below the angle of the jaw, is seen just at the root of the mastoid process of the os temporale, where it forms a sulcus, or groove, which is to be observed in the macerated bone; it then ascends, and divides into numerous branches.

The temporal artery is the continuation of the main trunk of the external carotid. At its origin, it is deep seated, and buried, as it were, in the substance of the parotid gland; but it soon becomes more superficial, and its course can be easily followed. This is the vessel in which arteriotomy is performed, and in executing this operation, Mr. Allan Burns recommends that the Surgeon should make firm pressure with the fore finger of the left hand, on the artery, a little higher than the point, where he intends to open it, and with the thumb of the same hand, a little lower. In this way the canal of the vessel is kept distended, by intercepting a quantity of blood. Then with a scalpel the surgeon is to make an incision about half an inch in length, down to the artery, which he next punctures longitudinally, with a lancet. Having removed the pressure made with the thumb, the blood flows. To check the flow, when sufficient has been obtained, a compress, retained by a proper bandage, will commonly be found sufficient; should, this not succeed, the vessel is to be divided across, this acts by enabling the extremities to draw themselves within the cellular membrane, which, by entangling the blood, facilitates the formation of a coagulum. The editor of the last edition of Burn's "*Anatomy of the head and neck*," recommends tying the artery, in preference to either of the above plans; for security, this practice may now and then be necessary, but it cannot be so in all cases.

The temporal artery is occasionally affected with aneurism; a case of this kind was admitted in March last, under the care of Mr. Tyrrell, Surgeon of St.

Thomas's Hospital; the temporal artery was supposed to have supplied the sac, and therefore it was thought sufficient to tie the vessel. After doing this, it was discovered that the aneurismal tumour still pulsated; Mr. Tyrrell was then obliged to open the sac, and apply four ligatures on the extremities of arteries, which terminated in it. This is not a case of common occurrence; it is seldom necessary to do more than to place a ligature above, and one below the sac. We cannot be much surprised that the pulsation should have continued after the application of one ligature, as the tumour in an ordinary case would be likely to have been fed by anastomosing branches. But it was quite right, that Mr. Tyrrell should first try the effect of *one* ligature.

FACE.

Anatomically speaking, the face is that part which is comprehended between the root of the nose, and the orbitar plates of the frontal bone above; the basis of the inferior jaw below; and the ears laterally; in which space we observe, the cheeks; the eyes; the nose; and the mouth.

The cheeks are formed of bones, muscles, and fat; externally, they are covered by common integument, and they are lined internally by the membrane of the mouth.

The muscles of the face, (the masseters excepted), are connected with the appendages of the eyes, with the alæ of the nose, with the upper and lower lips, and the angles of the mouth. Under natural circumstances, the mouth is in a transverse line, this is owing to the muscles on one side of the face being equally antagonized by those of the other; but if any thing happens to give greater power to those on one side, than to those on the other, the mouth is rendered awry, or oblique. Pain in the face, from an affection of the facial nerve, or from the irritation of a diseased tooth, will often cause a preternatural irritability of the muscles on the affected side, and during the paroxysm of pain, a convulsive motion will be observed, which, from habit, will sometimes continue, after the pain has subsided.

The deformity which frequently occurs in the mouth, after an attack of hemiplegia, is attributable to the muscles not being antagonized. A person receives an injury on the right side of the head, which throws him half paralytic; we find, in this case, a drawing upwards of the left angle of the mouth; and the left arm and leg paralyzed. How are these symptoms to be explained? The injury exists on the right side of the brain. The left corner of the mouth is drawn upwards, because the muscles on the right side of the face, are palsied. The arm and leg, on the opposite side to the injury of the brain, are paralyzed, in consequence of the nervous fibres decussating each other in the medulla oblongata; thus, the fibres of the right side of the brain go to the left of the body, and e contrario. The student will learn from these remarks, 1st.—That the side on which the angle of the mouth is deformed, is not the diseased side; the muscles draw the corner upwards, from not being antagonized, or opposed; and 2dly.—That when there is a loss of muscular power, in the left arm and leg, the cause may be suspected to occupy the opposite side of the brain.

There is no law in Pathology more general, than that the paralysis of the parts below the neck, is situated on the side opposite to that of disease in the brain; but still some exceptions to it have been mentioned. M. Bayle, an eminent French Physician, has re-published the cases of Morgagni, and others, where paralysis occurred on the same side as the cerebral lesion. He attempts to explain these cases, by saying, that some fibres are found *not* to decussate, but to continue from the brain to the spinal marrow, or from the spinal marrow to the brain. This fact, so amply proved and demonstrated by Gall, offers, he thinks, the only rational solution which we yet possess of the exceptions to the general rule in question.

Having carefully dissected the muscles, the student will observe their connections with other parts; particularly with the parotid duct and nerves.

The parotid duct will be found, on carefully removing the fat, which is usually deposited between the masseter and buccinator muscles. It will be seen passing over the belly of the former muscle, and penetrating the latter, to enter the mouth, just opposite to the space between the second and third molares of the upper jaw. He may trace the duct to the parotid gland, an exensive body situated before the ear, and the principal salivary gland. Its connections with blood-vessels and nerves, are exceedingly important, and should be well studied. Another point of practice is the knowledge that one or more conglobate glands are usually found situated near the parotid, and that a disease of them may be confounded with a disease of the parotid itself.

The duct of the parotid is formed by numerous twigs, which arise from the granules of the gland; it tends forwards from its origin, and its course across the cheek is defined by a line drawn from the junction of the lobe and pinna of the ear, to a little above the angle of the mouth. The duct is embedded in fat, and absorbent glands; on removing which, the student will expose some small twigs of the portio dura nerve, and the transversalis faciei artery. It is of great consequence, that the course of the parotid duct should be known; because mischief will arise from an injury of it, either in the removal of tumours from the face, or in wounds from other causes. The mischief to be apprehended, is the formation of a salivary fistula.

We have followed the parotid duct (called ductus

Stenonis) across the body of the masseter muscle, a situation where it is much exposed to injury. A wound in the face may give rise to a sore which cannot be made to heal, if the ductus Stenonis be wounded; as there will be a continual discharge of saliva; and this disease will last for life, without some aid from surgery. It does not follow as a matter of course, that a salivary fistula should succeed to an external wound of the duct, if the injury be, in the first place, properly treated; but if we allow the period to pass, when there is a chance of promoting an adhesion between the edges of the wound, the evil we have spoken of may be anticipated. When called to a person who has just received a cut in the face, by which the duct has been divided, the wound must be cleaned from coagula, and foreign substances; the edges approximated, and retained by means of a twisted suture, and adhesive plaster; and further pressed on, and secured, by a linen compress, and roller. Pressure is absolutely necessary to prevent the oozing of the salivary secretion; without it, our aim would assuredly be frustrated. If, in spite of this careful treatment, a salivary fistula should form, something else must be done. We have said, that the external effusion of saliva is the cause of the mischief which ensues, if adhesion be not accomplished; hence, reason suggests, that if we can divert the course of that fluid into the mouth, instead of allowing it to be discharged outwardly, the wound will as soon cicatrize, as in any other part of the body, and the disease be cured. On this suggestion, are founded many proposals; but the seton is oftener used than any other means. The student must consult Works on Surgery, for the particular treatment of this disease.

We may here remark, with regard to wounds and ulcers of the parotid gland, that the oozing of saliva will prevent the healing process, unless firm and constant pressure is employed.

In the dissection of the face, the student should pay particular attention to the nerves. Those of practical importance are the supra-orbitar; the infra-orbitar; the facial, already alluded to; and the dental branches.

The supra-orbitar is a branch of the first branch of the fifth pair, and called the ophthalmic. It emerges from the foramen supra-orbitarium to be distributed to the skin and muscles of the forehead. The pain in the forehead, of which persons labouring under acute ophthalmia frequently complain, is principally owing to a sympathetic affection of this nerve.

The infra-orbitar is a branch of the superior maxillary nerve. It is seen passing out at the foramen infra-orbitarium, under the levater labii superioris, alæque nasi muscle; and after appearing, it divides into many branches upon the muscles and skin of the cheek.

This nerve is frequently affected with the painful disease called tic douloureux; but this affection may depend on a disease of one or more of the branches of the portio dura, or facial nerve. This nerve is seen within the cranium, in company with the portio mollis. It enters the bony cavity of the ear, through the foramen auditivum internum, and in the canal of Fallopius it receives the recurrent or superficial branch of the vidian. The trunk of the nerve leaves the ear through the foramen stylo-mastoideum; and is seen on raising the parotid gland. Soon after emerging from this hole, it divides into branches to the temple, face, and throat; and the appearance thus produced, is named by anatomists, the pes anserinus.

It is obvious, when we observe the distribution of this nerve, and that of the infra-orbitar, that it is not easy to determine in which of the two sets of branches the morbid affection is seated. But the infra-orbitar branches are oftener found to be the seat of disease, than the facial. In a case of tic douloureux of the facial nerve, it would be difficult if not dangerous to attempt the division of its trunk, the only place indeed where it can be reached with safety, is at the anterior edge of the mastoid process of the temporal bone; but an incision down upon it, in this situation, would in some cases endanger a wound of the occipital artery.

The fourth nerve of the face is the dental, the remains of which are seen coming through the foramen mentale, to spread upon the soft parts of the chin.

Either of the four nerves mentioned may be affected with tic douloureux, or neuralgia, hence we speak of four species of this complaint, as occurring in the face.

1st.—The frontal neuralgia, which is seated in the supra-orbitar branches. 2d.—The sub-orbitar neuralgia, in the infra-orbitar. 3d —The facial neuralgia, in the facial. And 4th.—The maxillary neuralgia, when the dental branches are affected.

For the cure of neuralgia, or tic douloureux many remedies have been proposed, the carbonate of iron is recommended by Mr. Hutchinson, and its use has been highly extolled by some practitioners who have tried it; but there is nothing so much entitled to our confidence, as the division of the trunk of the affected nerve, even this has frequently failed to do more than to give temporary relief, because the divided extremities re-unite, and the nerve resumes its function. The re-union has been disputed by some Physiologists, but that it really happens, is fully proved by the results of Dr. Haighton's interesting experiments on the par vagum, an account of which may be seen in the Eighty-fifth Volume of the "*Phi-*

losophical Transactions." Mr. Allan Burns says, to prevent re-union, a portion of the trunk of the nerve must be cut out, and this he thinks, is the only way to insure success.

The arteries of the face are not large; and therefore not of much practical importance; but the student should know the course of the principal branches.

The common carotid artery ascends by the side of the trachea, accompanied by important parts; at another time to be introduced to the notice of the student. A little below a line, drawn transversely from the corner of the os hyoides, this main trunk divides into the external and internal carotid branches. The arteries of the face arise from the external carotid, and are the facial, or external maxillary; a branch of the temporal, named, the transversalis faciei; and some of the branches of the internal maxillary artery. The facial is the third branch given off by the external carotid. It mounts over the submaxillary gland and jaw-bone; and just at the anterior edge of the masseter muscle, the pulsation of the vessel can be felt; in this situation, it could be compressed so as to command hœmorrhage from either of its branches; but in order to succeed effectually, both facial arteries must be pressed on, as their branches freely communicate. After passing over the jaw, the vessel is found under the depressor anguli oris muscle, in its course to the angle of the mouth; and at the angle, it gives off the coronary artery of the lips: the trunk then ascends by the side of the nose, and gradually expends itself on it, and the neighbouring parts.

The second artery of the face is the transversalis faciei, a branch of the temporal, which we have already alluded to, when speaking of the parotid duct.

By the internal maxillary artery, the face is supplied with a few small branches; thus, the inferior dental, after supplying the teeth, emerges by the mental hole to be distributed on the chin; and the trunk ends in the infra-orbitary branch, which ramifies on the cheek and side of the nose. Neither of the arteries of the face, however, are of much consequence in a surgical point of view, and their venæ comites are still more unimportant.

The student should examine the muscles which elevate the jaw, viz.—the temporal, and masseters. The depressors are situated in the neck. The articulation of the lower jaw is such as to admit of movement in every direction. The condyloid processes occupy the glenoid cavities of the temporal bones; but, like the sterno-clavicular, and one or two other joints of the body, there is an inter-articular cartilage, which divides the joint into two distinct cavities, each of which is lined by a synovial membrane. It is to the presence of these cartilages, that the inferior maxilla owes its rotatory or grinding power. The ligaments of the lower jaw are the capsular, external lateral, and internal lateral. The movements of which it is susceptible in the human body, are downwards, upwards, forwards, backwards, and laterally inwards, and outwards.

When the lower jaw is closed, the glenoid cavities are observed to be accurately filled by the condyloid processes. When slightly depressed, the latter will be seen to quit the former in a partial manner, and to be in contact with the small elevated points on the fore part of the cavities. If still more depressed, they will mount over the elevations alluded to, and slip under the zygomatic arches. This will illustrate how dislocation happens from yawning, or violent laughing, in which acts, the condyles are easily dislocated, when a spasmodic action seizes the muscles connected with the jaw.

As organs connected with the face, we shall now describe the Practical Anatomy of the eyes, nose, and mouth.

Eye.—In a former part of the volume, we mentioned the structures which enter into the composition of the eye, and the changes which this organ undergoes by disease. In this place, we shall explain the surgical Anatomy of the appendages, particularly of the lachrymal apparatus.

The principal appendages of the eye are situated superficially; they are the eye-brows, eye-lids, eye-lashes, the tunica conjunctiva, caruncula lachrymalis, and the apparatus concerned in the secretion and discharge of the tears. Some of these parts are visible, and can be demonstrated without the aid of dissection; but there are others that cannot be. The knife is required to display the lachrymal gland and sac; and to show the ductus ad nasum, we must break through bone; the commencement, course, and termination of the duct may, however, be shown without this trouble.

The reflection of the tunica conjunctiva is a point of Anatomy well deserving of attention. The student will find, by everting the upper and under eye-lids, that this membrane does not merely give a covering to the surface of the eye, but after running a little backwards, it is reflected so as to line the lids; thus, it connects the globe of the eye with the lids, and prevents extraneous matters from passing beyond a certain point. It often happens, that the eye is much pained by the presence of dust, or gritty matter; but as on superficial examination, the source of irritation cannot be detected, the eye is pronounced inflamed, although the inflammation obstinately resists the common treatment. I have seen very distressing cases of this kind; and one of them, which occurred when I was a pupil, made a strong impression on my mind. In this case, the cause was not suspected; the eye assumed the usual appearance of inflammation, and the usual remedies were employed; but the symptoms grew daily more and more alarming; at length the cornea became opaque, and the eye would have been irretrievably lost, had not the upper lid been everted, and a speck of dust, which was sticking firmly, been removed. The eversion was not made from a suspicion that any extraneous matter would be discovered, but to ascertain whether the irritation did not proceed from an irregular granulated state of the tunica conjunctiva; it being conjectured that this was probable, from the patient not complaining of pain when the eye-lids were closed.

Nothing is more easy than to evert the eye-lid; it is to be done by means of a probe, which is pressed upon the upper surface of the lid, whilst the Surgeon, laying hold of the eye-lashes with his finger and thumb, draws them upwards.

The next part of the appendages of practical importance, is the lachrymal apparatus, which we have described in a former part of the volume. The situation of the sac, and duct must be well studied. The lachrymal sac, lodged on one half of the os unguis, is bounded above, by the tendon of the orbicularis muscle, and below, by the edge of the orbit.

The lachrymal duct is a bony canal, formed by the os unguis above, the superior maxillary bone on the outer side, and the inferior spongy bone on the inner; it is lined by a vascular and secreting membrane, and terminates under the inferior spongy bone. The introduction of a probe into it, to examine the nature of obstructions, is an operation which the student should practice.

There is a complaint, the nature of which we should be at a loss to define, if we did not know the route which the tears take in escaping from the surface of the eye. The disease is called, "fistula lachrymalis," and is caused by an obstruction in the ductus ad nasum, either from viscid mucus, or a thickening of its lining membrane. The first symptom which denotes it, is a trickling of tears over the cheek. If the proper treatment be neglected in this stage, an inflammation will supervene, and the probability is, that matter will form, and a *true* fistula be established. There are, then, three stages; the first consists of simple obstruction; the second, of inflammation of the lining membrane of the sac, and duct; and the third, of suppuration, and ulceration: this last stage constitutes the true fistula lachrymalis. The treatment depends on the stage of the disease; but a passage for the tears into the nose must eventually be made; and if the natural one cannot be restored, in consequence of its contracted state, we must make an opening into the nose through the os unguis, which, in neglected cases, Nature herself will often effect, by the ulcerative process. For much valuable information on fistula lachrymalis, the reader may consult Pott's

Treatise on the subject, Scarpa's Work, and Ware, "On the Epiphora," &c.

As the student will not be able properly to examine the structures of the globe of the eye, in a subject on the dissecting table, I have introduced remarks on the Anatomy, Physiology, and Pathology, of this organ, in another part of the volume.

Nose, and Nasal Cavities.—The external figure of the nose is pyramidal; its divisions are into radix, dorsum, alæ, and apex. Internally, we find two cavities, called, the nostrils; one nostril is separated from the other by the septum narium, and in each are observed eminences and depressions. The Anatomy and Physiology of this organ are described elsewhere; but we have to consider certain relations which it has to other parts.

If a probe be passed along the floor of either nostril, the instrument will appear behind the soft palate; thus, a communication exists between the nose, and the fauces. This knowledge involves important points of practice, viz.—the introduction of a tube into the trachea, for the purpose of inflating the lungs in cases of suspended animation, or into the œsophagus, for injecting fluids into the stomach, or drawing fluids from it, or into the Eustachian tube, to clear it from obstruction. To these points of practise, we shall recur presently. The probe (or whatever other instrument be passed along the floor of the nostril) will be thus situated with regard to surrounding parts. Below are the palatine processes of the superior maxillary bones, and the ossa palati, by which the cavity of the nose is separated from that of the mouth; on the inner side is the septum narium; on the outer side, are the processes of the bones which form the floor; above, is the projection of the inferior spongy bone, which presents to the probe its concave surface; the space thus bounded, is the inferior division of the nostril, and it is here (below the inferior spongy bone) that the ductus ad nasum terminates.

Above the inferior spongy bone, we find another space which is the middle division of the nostril. It is bounded below, by the convex surface of the lower spongy bone; on the outer side, by the superior maxillary, and the os planum of the ethmoid bone; on the inner side, by the septum; and above, by the superior spongy bone; this middle space is more contracted than the inferior. Into it open the frontal, the sphœnoidal, and some of the ethmoidal sinuses; also the maxillary sinus, called, the antrum Highmorianum. Above the superior spongy bone, is the upper division of the nostril; here we find the cribriform plate of the ethmoid bone above; the superior spongy bone on the outer side; the septum on the inner; and below, there is a continued fissure to the floor of the nostril. Into this upper space open some of the ethmoidal cells.

The projections formed by the ossa spongiosa and all the boundaries of the nostrils are lined by the vascular pituitary membrane, which insinuates itself into all the cavities which communicate with the nostrils; thus the lining membrane of the frontal, sphenoidal, ethmoidal, and maxillary sinuses, and the ductus ad nasum, would seem to be productions of it.

There are two circumstances connected with the pituitary membrane, to which it will be well to advert, viz—its disposition greater than that of other mucous membranes, to give growth to polypous tumours, and to bleed. There are three common kinds of polypi of the nose, viz.—the fleshy polypus, the malignant polypus, and a third kind, which is merely an elongation or prolapsus of the mucous membrane. The first and second are morbid productions; the third is a mere relaxation of the membrane.

Epistaxis, or hœmorrhage from the nose, is often a salutary effort made by nature, to relieve an over-distended state of the vessels of the brain; in this case, when the bleeding is within moderate limits, it is clear that it is better to encourage, than to suppress it. But hœmorrhage from the nose, is sometimes consequent on general relaxation; when, of course, it is prudent to check it at once, and to prevent its recurrence by improving the general health. With the mode of plugging the nostrils, (an operation required when common means fail,) every student is familiar.

The principle is to close not only the anterior, but the posterior opening.

To plug up the posterior narine aperture, a catheter, bougie, or probe with a piece of string attached to its extremity, must be passed along the floor of the nostril, until it appears in the fauces behind the curtain of the palate. The string is then to be laid hold of by means of a long dressing forceps, and drawn out of the mouth. A dossil of lint or sponge is to be tied to it, and by withdrawing the bougie from the nostril, the plug will be carried to the posterior aperture; this will prevent the escape of blood backwards. The anterior opening is then to be well closed; and thus the blood, confined in the nostril between the two plugs, coagulates, and mechanically obstructs the bleeding vessels.

The pituitary membrane of the nose is also called Schneiderian membrane, because Schneider first accurately described it. The ancients believed that the membrane was perforated in different places, in order to give exit to the mucus of the nose, which they erroneously thought wss secreted by the glandular-like body which occupies the sella turcica of the sphenoid bone, and in conformity to that supposition, they named it "Glandula Pituitaria," a name still retained; but the fact is, that there is no direct communication by any such apertures, for the small body mentioned has nothing to do with the mucus of the nose, it being a secretion from the membrane itself. It is true that on looking up the nostrils of a basis cranii, which has been macerated and dried, we observe light through the cribriform plate of the ethmoid bone; but it is to be remembered, that in the living subject, these small apertures are filled with fibrils of the olfactory nerve, and that the pituitary membrane is in direct contact with the inferior, and the dura mater, with the upper surface of the cribriform plate. The impression, however, of any volatile, or acrid essence, can easily be transmitted from the nose to the brain; it being by far the *most* direct passage. This fact exposes the danger of introducing very acrid substances into the nostrils. In my manuscript notes, taken at Sir Astley Cooper's Anatomical Lectures, I find mention made of a case, where phrenitis and death were brought on in a gentleman, by the Surgeon making use of a highly stimulant application, for the cure of ozœna.

I cannot conclude the surgical Anatomy of the nose, without making a few additional observations on the antrum maxillare, vel Highmorianum, a large cavity in the upper jaw-bone. On examining the antrum in the dry bone, we find that the palate plate of the os maxillare superius forms its floor, and that the first, second, and third molar teeth usually penetrate into the cavity; or that if they do not, a thin plate of bone only is intervening. The roof of the antrum is formed by the orbitar plate of the bone; the outer, or molar wall is thick; the inner, or nasal, is exceedingly thin. We have already said, that the antrum, as well as the other sinuses of the bones of the head, is lined by a membrane similar to the pituitary; the office of which is to secrete a mucous fluid to bedew their surfaces. Should this fluid be secreted in too great abundance, by the reflection of the membrane which covers the frontal, the sphenoidal, and the ethmoidal sinuses, or the nostrils, we can easily conceive how the superabundance is got rid off, as it can be evacuated by the nose; but when the secretion is in excess in the antrum, the mode of escape is not so easy. True it is, that a communication exists with the nose; but the opening is small, and its mechanism such, as to offer a valvular obstruction. Mr. Burns says, " Urine might as readily regurgitate from the bladder along the ureter, as fluid pass from the antrum into the nose;" but, perhaps, the analogy is here carried too far; yet it is certain, that when by disease, or accident, the membrane becomes swollen, or thickened, the obstruction is complete.

When there is a preternatural accumulation of fluid, whether mucus, or pus, in this cavity, we are not to expect that that mucus, or pus, will find an exit by the nose; how then is it to be discharged? It is to be done by forming a new passage, by extracting one of the grinding teeth, and perforating from its socket into the antrum. After the matter is thus discharged, the disease of the membrane, if it be of a common kind, may be cured by appropriate injections.

On the Mouth.—In the anatomy of the mouth, I shall comprehend the space situated before, and that situated behind the curtain of the palate; the former cavity is the mouth, commonly so called; the latter is usually named the fauces, or top of the throat. I shall call them anterior, and posterior cavities of the mouth.

The boundaries of the anterior cavity when the jaw-bones are closed, are these; the roof is formed by the palatum durum; the floor by the tongue, and its connections; the anterior and lateral parts, by the alveolar processes, teeth, and gums; and the posterior part by the velum pendulum palati, vel palatum molle. All these parts (the alveolar processes and teeth excepted) are covered by the lining membrane of the mouth, which is similar in structure to the common integument; this is proved by its being occasionally affected with the same specific eruptions as the skin.

In order to gain a distinct view of the anterior cavity of the mouth, the student should make an incision from each angle of the lips, towards the articulations of the lower jaw, then by separating the two jaws; the tongue and its connections, and the soft palate will be fully exposed.

The tongue will be seen attached by its basis to the os hyoides, and the apex free and moveable. The upper part or dorsum is covered over with the small eminences called papillæ; the venter is partially confined by a doubling of the lining membrane, named the frænum linguæ, the relation of which, to the blood-vessels of the tongue should be observed, as they are in danger of being cut, in carelessly clipping it in tongue-tied children; near the frænum will be found the terminations of the submaxillary and sublingual ducts, an obstruction of which is the cause of ranula.

The anterior cavity of the mouth is separated from the posterior, by the velum pendulum palati. It is a muscular curtain consisting of two arches, with a thick pendulous body in the centre, named the uvula. Laterally each arch has two pillars, between which is the amygdala or tonsil gland, which secretes a mucus.

Inflammation of the tonsil gland is named cynanche tonsillaris, but often the inflammatory action is extended to the neighbouring parts. The termination of this disease may be either in resolution, suppuration, or chronic enlargement.

When the tonsil gland is severely inflamed, it swells so much as to render deglutition, and respiration, difficult and painful; thus, a vigorous treatment is demanded for it; and should suppuration take place, we are not to relax our exertions; but the indication of treatment is changed. An abscess in the throat is dangerous, as it may spontaneously burst, the matter escape into the trachea, and the patient be suffocated. Many fatal cases of this accident are recorded; the progress of suppuration, therefore, must be watched, and as soon as matter forms, it must be discharged by puncture. But here, a word of caution is necessary, from the proximity of the tonsil to the carotid artery, and I shall give it in the language of Mr. Burns. He says, "When we have resolved on opening an abscess in the tonsil, some caution is required; it is to be remembered, that this gland, naturally, is very near to the carotid artery, and that by enlargement, it is brought still more closely in connection with it. Hence, this vessel may, by passing the cutting instrument too deep, and inclining it too much towards the angle of the jaw, be injured. In this country, I have been informed, that a Surgeon, in opening a tonsillitic abscess, actually did plunge the knife into the carotid; I scarcely need add, that he lost his patient before he could suppress the bleeding. In Portal's Work, a case may also be read, where, in opening an abscess in the tonsil, with a '*pharyngotome*,' a skilful Surgeon of Montpelier, had the misfortune to open a large artery, and to see his patient die from violent hœmorrhage, which could not be checked." From the passage which Burns has quoted from Portal, and which he gives in French, but which I have taken the liberty of translating, we should infer that the carotid artery was wounded; but on referring to Portal's "*Cours d' Anatomie Médicale*," I find the case related in a note Vol. III. Page 183; (Burn's extract being taken from Vol. IV. Page 509.) The Professor's words are, "*Un conseiller de la cour des aides fut atteint d'une violente esquinancie par l'inflammation des amygdales; on crut reconnoitre un abcès dans l'une d'elles. Un chirurgien habile voulut à cet effet, l'ouvrir avec le pharyngotome; mais il le dirigea si mal, ou l'artère* tonsillaire *étoit si grosse, qu'ayant été ouverte, il survint une hémorrhagie qui fut bientôt mortelle.*" Thus it would appear, that we have not merely to apprehend the danger of opening the carotid, but that the tonsil artery when wounded, may (if enlarged) give rise to fatal hœmorrhage. In the generality of cases, however, we need have no dread of that extent of bleeding from the tonsil arteries, which the actual cautery cannot suppress; but it is of vital importance that the operator should carefully avoid the carotid; this he may do by not directing the point of the bistoury in the line of the angle of the jaw, but to pierce the tumour in front, and carry the instrument directly backwards.

But in opening a tonsillitic abscess, transfixing the blood-vessels is not the only ground of fear; another is suffocation from the discharge of its contents into the trachea; this has happened under the management of eminent Surgeons, who, for praiseworthy motives, have given publicity to the direful catastrophe which they witnessed. The natural inference, which we should be induced to draw is, that such an accident is occasionally unavoidable.

Inflammation of the tonsil gland sometimes terminates in chronic enlargement; I have seen several cases of this sort. I have also frequently seen too, an enlarged and indurated state of the gland to succeed to suppuration. This disease often yields to blisters; but from the unpleasant, and even painful sensation which the patient complains of as attending it, a removal of the whole, or a part of the tumour, by caustic, the actual cautery, ligature, or excision, is sometimes obliged to be resorted to. With regard to the caustic, I believe it to be, in the majority of cases, totally inefficacious. The actual cautery, carefully conducted to the tumour, promises success. Excision is often attended with the loss of so much blood as to excite alarm; I have been present at two operations by excision; in one, the bleeding was inconsiderable; in the other, performed by Baron Larrey, the blood flowed so freely, that the operator was induced to apply the actual cautery, in order to restrain it. With respect to strangulating the tumour, by passing a ligature about it, this is certainly the safest operation; and managed as Mr. Grainger, the father of the Lecturer, of the Borough, has pointed out in his "*Medical and Surgical Remarks*," published in 1815, an operation not difficult to perform. After mentioning the different methods which have been proposed by Want, Cheselden, Sharpe, Walker, Chevalier, and the opinion of some Medical Men, that the disease is constitutional, and therefore, that the removal of the enlarged gland is doing nothing, Mr. Grainger states the method of operating which he has adopted, and used in a great number of cases with invariable success. The instrument which he employs, is a double silver tube, about three or four inches long, according to the age of the patient from whose throat the tonsil is to be removed; through this, a well annealed silver wire is to be drawn so as to leave a noose at one end, of such a size as to enable the Surgeon to pass it easily over the enlarged tonsil; and the wire is to be tightened daily, until the tumour falls off by strangulation. But it would appear by note D, in the Appendix to Mr. Pattison's Edition of Burns' Work, that there is no necessity for allowing the wire to remain about the neck of the tumour, until the period of separation; and this is certainly true, as a few hours must be sufficient to destroy its life. Mr. Pattison mentions Dr. Physick's plan of removing the tonsil, which is the same as Mr. Grainger's, with two exceptions, viz.—his using soft pure iron wire instead of silver, and removing the instrument twenty-four hours after its application. The mode of disengaging the wire is simple, nothing more being necessary than to push a portion of it back through the canula, until the noose is so much enlarged as to slip over the tonsil.

Having given as full a description of the surgical

Anatomy of the septum between the anterior and posterior cavity of the mouth, as is compatible with the design of this volume, I shall next describe the posterior cavity, or fauces, and the ducts, or passages opening into, and proceeding from it. The parts which bound the space behind the velum pendulum palati, are the following: on the fore part, above, we find the internal openings of the nostrils, and the irregularities in them formed by the spongy bones; below, are the velum pendulum palati, the aperture of communication between the anterior and posterior cavities, and the base of the tongue; the view of these parts can only be obtained by separating the cervical vertebræ from the back part of the throat; but this the student should defer doing until he has examined the other boundaries of the fauces. The posterior part is bounded by the bodies of the cervical vertebræ. The superior part by the basilar process of the os occipitis, and a part of the sphenoid bone. On each side, immediately behind the posterior openings of the nostrils, we observe the trumpet-like orifice of the Eustachian tube; below, the fauces terminate in the larynx before, and the pharynx behind; thus, the air, in entering the lungs, and the food, in its route to the stomach, must pass through this cavity. The space thus bounded has many muscles connected with it, and it is lined by a continuation of the common membrane of the mouth.

In a former part of the volume, I alluded to the manner in which the nostrils communicate with the fauces, and of the practicability of passing a properly curved bougie, or hollow flexible tube, into the larynx, and pharynx, from the nose; this knowledge is of greater importance, as it respects the former, than the latter operation, because in a case of suspended animation it supersedes the necessity of laryngotomy, or tracheotomy ; as a tube cannot be made to enter the larynx from the mouth, but may, under all circumstances, be introduced with facility from the mouth into the œsophagus. But to perform these operations, the Surgeon must be well acquainted with the mechanism of the parts concerned in deglutition. After a portion of food has been masticated, it is formed into a bolus, and placed on the dorsum of the tongue; in swallowing that morsel, the tongue recedes in the mouth, the effect of which is to press the epiglottis down upon the opening of the glottis, and thus to prevent the food from entering the trachea. The tongue then is the preventive agent, and of this we can readily convince ourselves, by carrying it backwards, and forwards: in the former case, the epiglottis falls flat on the rima glottidis; and if we draw the tongue from the mouth, the epiglottis is raised, and the orifice of the glottis exposed. When it is our wish to pass a tube from the right nostril into the trachea to inflate the lungs, our first aim must be to open the larynx, this is done by pulling the tongue from the mouth; but if we want to pass a tube from the nose, or mouth, into the pharynx, we should push the tongue back to prevent the possibility of its entering the larynx: these observations must be remembered.

To distend the lungs from the nostrils, it is not absolutely necessary that the tube should be insinuated into the aperture of the larynx. We may not always have a proper instrument at hand, and as what is to be done in suspended animation, must be done quickly, another method of operating must be employed. If we were to introduce a tube, or the nozzle of a pair of bellows into one of the nostrils, and blow; it is evident that the air would not pass into the trachea, as the epiglottis closes the opening into it, and that some would escape through the mouth, some through the nostril, and some pass into the stomach; to prevent these causes of failure, a finger must be put into the mouth, and the tongue drawn forwards, by this the epiglottis will be raised, and by approximating the lips around the finger, the air will be prevented from escaping per os; the opposite nostril to that occupied by the tube must be closed; and the fingers of an assistant must press back the thyroid cartilage upon the œsophagus, so that air may not pass into the stomach; there is now only one passage for the air, and that is into the lungs. Respiration is partly a mechanical process; the parietes of the chest dilate, and the lungs become distended by the pressure of the atmosphere; this is inspiration: the parietes then fall, and by pressing the lungs, the air is expelled; this is expiration. These operations by the natural powers, are suspended in the cases now under consideration; we are therefore to imitate them by artificial means. Having distended the lungs in the way described, we imitate inspiration; we imitate expiration by compressing the chest, and allowing the nostrils and mouth to re-open. The distension and expulsion are thus alternated, until all hope is extinct, or resuscitation crowns our efforts with success. When the patient is in the passive state attendant on suspended animation, the above methods of inflating the lungs are adequate substitutes for laryngotomy, or tracheotomy; but when a foreign body is lodged in the larynx, or windpipe, an opening must be made for its extraction, or discharge.

A knowledge of the relative position of parts shows the possibility of passing a probe, with a proper curvature, through the nostril into the Eustachian tube to clear it from obstructions; and it explains how an enlargement of the tonsil gland may so close the orifice of the tube, as to exclude air from the cavity of the tympanum, and thereby produce a partial or complete deafness.

ON

THE TRUNK.

The Trunk is that part of the body which is situated between the head, and the lower part of the pelvis; and to which the upper and lower extremities are attached. It consists of the spine; neck; thorax; abdomen; and pelvis.

SPINE.

Prior to the student attempting to display the intricate masses of muscles, which occupy the lateral parts of the vertebral column, he should have taken an opportunity of making himself perfectly acquainted with the processes of the vertebræ, with the natural curvatures of the spine, with the joints, with the ligaments, and with the inter-vertebral substance. Observation on the manner in which the bones are joined together, will impress him with an idea of the strong and beautiful structure of the spine, and how well the arrangement of its parts is adapted to fulfil the functions of giving support to the head, and of keeping the body erect. The spine would assuredly sink under the weight which it has to sustain, if it were not for the advantages which its form and mechanism afford. Observation on the mode of junction will explain too why the vertebræ are seldom fractured, and still seldomer dislocated. In these accidents, the danger is in proportion to the concussion or compression which the spinal marrow suffers.

A case of fracture of the processus dentatus is mentioned in Sir Astley Cooper's Work on Fractures and Dislocations. A woman, in the venereal ward of St. Thomas' Hospital, while sitting in bed, eating her dinner, was observed to fall suddenly forwards, and, upon the patients running to her, she was found dead. On examination, it was discovered that the dentiform process had been broken off; and the head, in falling forwards, had forced the root of the process back upon the spinal marrow, which had occasioned her instant dissolution. A dislocation from rupture of the transverse ligament (if the dislocation were complete) would prove fatal in the same way. Luxation from any other cause is scarcely possible, but should it occur, the effects would be according to the seat of accident. If the second vertebra were dislocated from the third, death would almost immediately ensue, if the pressure on the spinal marrow were considerable, for the phrenic nerves would become paralyzed, and respiration thereby stopt; but if below the fourth cervical vertebra, it is possible for the patient to survive; the parts below the injury would, however, lose sensation and voluntary motion.

Fractures of the vertebræ are, fortunately, very rare occurrences; and, unfortunately, when extensive, they seldom admit of any relief.

There is no part of Anatomy more neglected by students, than that of the muscles of the spine; but as the attention of the Profession has recently been much attracted to it by some improvements in the treatment of curvatures, founded on anatomical and physiological knowledge, it will, we doubt not, now receive that share of investigation to which it is entitled.

Incurvations of the vertebral column have, at all times, much engaged the thoughts of practitioners, and numerous works have been written upon the subject; of late, they have multiplied fast upon us; but I agree with a modern reviewer, that our knowledge of the causes, and remedies, has not increased in the same ratio as the authors; still we must admit, that there appears the dawn of probability, that the treatment of diseased conditions of the spine is more likely than ever, to be placed on a scientific basis, and for this we are indebted to the judicious application of Anatomy and Physiology to the science of Pathology.

On observing the attachments of the muscles of the spine, the student will learn, that their conjoint actions are, to maintain the equilibrium of the trunk, and thus perpendicularly to support the superincumbent weight; and that when the muscles on one side act independently of those of the other, the flexure of the spine must be in a lateral direction. When the spinal pillar is carried forwards, or laterally, there is but a trifling degree of motion between any two bones; the curve is gentle, and regular, so that the medulla spinalis readily accommodates itself to every change of posture.

Under the integuments of the posterior part of the trunk, we find expanded muscles, which pass from it to the upper extremities; these muscles, under certain circumstances, must modify the motions of the trunk. When the muscles which form this superficial stratum are reflected towards their insertions, we come to those which have a direct influence on the head and spine. At the nucha, or nape of the neck, there are some muscles which act upon the head, in antagonizing those on the fore part, or in turning the head backwards, or obliquely to one side; but throughout the remaining portion of the spine, we find the muscles which are appropriated to retain the spine erect, to bend it backwards, and to move it directly, or obliquely sideways.

Distortions of the vertebral column may be produced by various causes. The cause may be a disease of the body, of one or more of the vertebræ, as caries from local injury. It may depend on an affection of the vertebral joints, or on some disease of the intervertebral substance, to which cause Dr. Jarrold has lately directed the attention of the Profession, in his "*Enquiry into the Causes of Curvatures of the Spine.*" Besides the causes above enumerated, there are others; thus, the vertebræ, the vertebral joints, and inter-vertebral substance, or one, or the whole of these structures may become secondarily affected from muscular debility; or either of the preceding causes separately, or the whole, conjointly, may be the effects of constitutional disease.

To detect the real cause of distortion then, is often extremely difficult; since different causes produce nearly similar effects. We cannot agree with Pott that the primary and sole cause of the curvature outwards, is a distempered state of the parts composing, or in immediate connection with the spine, tending to, and most frequently ending in, a caries of the body, or bodies, of one or more of the vertebræ; that from this proceeds all the mischief, whether general or local, apparent or concealed; and that this causes the ill health of the patient, and in time the curvature. Nor can we simplify the question as Mr. Wilson, the late Lecturer on Anatomy, has done, by saying, " Incurvations of the vertebral column are of two kinds; one arising from rickets, in this, the bend is usually to the sides; the other from caries of the bodies of the vertebræ, the bend in which is forwards;" nor can we, with Dr. Jarrold, content ourselves by referring lateral curvature to a specific disease of the inter-vertebral substance.

Mr. Shaw has recently published a Work on Distortions of the Spine, which is illustrated with a splendid set of plates. The volume contains a good deal of valuable information. It would occupy too much space to notice the Author's opinions on the nature of the diseases he treats; but there are some points so relevant to the subject of the muscles, that I cannot refrain from giving them a place in this volume. Amongst other causes, he mentions debility of the muscles as one of the most frequent forerunners of distortion; he says "the muscles, whose office it is to support the vertebræ, may be so weakened by want of exercise, as to become incapable of performing their functions. When this takes place, the vertebræ, and the ligaments which bind them together, yield to the superincumbent weight, for they are affected in a secondary manner, by the same causes that have produced debility in the muscles."

I cannot make up my mind to think that muscular or general debility, is sufficient to produce a lateral curvature of the spine, unless conjoined to an indulgence in certain malpositions of the trunk; this alone, as Mr. Shaw admits in another part of the Volume, may occasion distortion, even though the person were at the time in good health, but they would operate in an increased degree in ill health: or in the weak condition that generally follows fever or measles. When we exercise certain muscles, we increase the power of those muscles; when then we indulge in inclining the body to one side, I can easily conceive that the acting muscles would in time gain such an ascendancy of power, as to be inefficiently antagonized by the muscles on the opposite side of the vertebral column; and that the spine would thus be laterally curved, and remain so until means are employed to equalize muscular action.

By Physiology we are taught, that the spine is kept erect by the equal and regular action of the muscles, situated on each side of the vertebræ; if then the spine is bent laterally, the action of the muscles cannot be equal, and that to render them so, must be one of the indications of cure.

Mr. Grant of Bath, communicated to the late Mr. Wilson, that he had proposed to remove the lateral incurvation of the spine, by placing a weight on the head of the patient, on the principle of causing a regular and equal action of the vertebral muscles. The practice struck Mr. Wilson as founded on just physiological principles, and he soon made a trial of it with a success which exceeded his most sanguine expectations. Mr. Wilson tried the plan in many instances during the last sixteen years of his life, and in no one instance, where it was properly persevered in, did he find it to fail in preventing the further progress of the disease; and in many it effected a perfect cure, at least so perfect, that no deformity was perceived, nor inconvenience in other respects suffered.

The weight to be carried, must of course, be regulated by the age and strength of the patient.

As adjuvants to this mode of treatment. We should advise friction, a recumbent posture during many hours of the day, and attention to the regular functions of the chylo-poietic viscera.

Mr. Shaw and Mr. Ward allude to the action of muscles, as capable of restoring the spine to its natural situation, and recommend certain mechanical contrivances, in order to effect this indication; but it must be specifically understood that no practice of this kind is applicable in all cases of distortion; that the remedy can only be prescribed with safety by the medical practitioner; and that to do good, it must be employed in the early stage of the disease. When there is inflammation of the ligaments, and vertebral joints, or caries of the corpora vertebrarum, such like means may be productive of irreparable mischief.

NECK.

The complicated Anatomy of the Neck, and the serious operations which are occasionally performed on this part, render it imperative that the student should pay particular attention to it. He must accurately observe the coverings, the fascia, the muscles, the blood-vessels, nerves, and glands. The cutaneous muscles, veins, and fascia, must be traced; the muscles must be examined in their relation to the arteries; the arteries, veins, and nerves, in relation to the muscles, and to each other; and the absorbent and salivary glands in their relation to the trunk, and branches of the carotid.

Before beginning the dissection of the neck, he should examine the prominent parts of the throat through their natural covering; and by drawing lines, should familiarize himself with the relation of the muscles to the important blood-vessels and nerves. In studying the relative Anatomy of the neck, a great thing to be attended to is the position of the head. When the head is placed parallel to the horizon, all the hard parts are more distinct, and the distance between the chin and sternum is, of course, less than when the head is turned back. In either position, however, the os hyoides, the thyroid cartilage, the cricoid cartilage, and the trachea may be felt. The most important circumstances in the Anatomy of the neck, are the course and connections of the carotid arteries. We know, that in the operation of tying the common carotid, our guide to the seat of the vessel, is the inner edge of the sterno cleido mastoideus. A knowledge of the place where the sterno cleido and omo hyoideus muscles meet, which is to be ascertained by drawing two lines, one from the anterior part of the mastoid process of the temporal bone, to the centre of the upper bone of the sternum; the other from the cornu of the os hyoides to the clavicle, about an inch and a half from its junction with the sternum; will almost infallibly lead us to the seat of the carotid artery, where it can be most easily secured by ligature. This relation of the external parts to the carotid, applies equally to the nervus descendens noni, the internal jugular vein, and par vagum, for the descendens noni lies upon the sheath; and the internal jugular vein, and par vagum, are contained in the same common cellular envelope as the artery; but how placed with regard to it, is a point hereafter to be described.

The fore part of the neck having been rendered tense, the following circumstances must be attended to in the dissection. The first incision is to be made through the skin, in the direction of the fibres of the thin layer of muscle called the platysma myoides, which in some subjects is so pale and indistinct as not to be easily recognized as muscular. The fibres run from the base of the jaw obliquely outwards, and downwards over the neck, clavicle, and upper part of the thorax.

The student must next observe the external jugular vein, which is formed by the union of the branches from the temple, face, and neck; and descends behind the platysma myoides, to the subclavian vein. At or near the angle of the jaw, this vessel anastomoses by means of two or more branches with the internal jugular; one of the vessels which return the blood from the brain. The external jugular is frequently opened for the purpose of abstracting blood, and with more advantage in diseases of the head, and in ophthalmia than a vein in the arm; indeed it is probable, with more advantage even than the temporal artery, as the depletion is more local and more immediate in its effects.

When we draw blood from a vein of the arm, the flow affects the head, in common with the other parts of the body. When we deplete from the temporal artery, we take away that blood which was destined to supply the integuments of the head; and although between the vessels of the scalp and pericranium, and those of the dura mater, there are vascular communications, they are only few in number. But the blood drawn from the external jugular vein is derived directly from the exterior of the head, and indirectly from the brain, through the medium of the inosculations between the external and internal jugulars, near the angle of the jaw; and besides, from the discharge of blood being sudden, syncope is more speedily induced; and this is a great desideratum in certain affections of the brain. When the jugular vein is to be opened, the incision is to be made in the direction of the fibres of the platysma myoides muscle, and at the part where it passes over the body of the sterno cleido mastoideus; the current of blood towards the heart being, of course, intercepted by means of pressure.

Having reflected the platysma myoides muscle towards the jaw, (in doing which, the student must avoid the twigs of nerves which come off from the second, and third cervical branches,) the dissector will find underneath it much cellular structure, in which are embedded numerous absorbent glands. This structure insinuates itself between the muscles, vessels, and nerves of the neck. In a natural state, it is tolerably dense and strong; but by compressing causes, as the enlargement of glands, abscess, and aneurism, it takes on a very considerable thickness. Yet, in the neck, the cellular fascia is not so compact, either under natural or diseased circumstances, as it is in some other parts of the body.

The student will now proceed with the dissection of the deeper seated parts. He will first expose the sterno cleido mastoideus muscle throughout its whole course; then the omo hyoideus, the sterno hyoideus, and sterno thyroideus. If the sterno cleido mastoideus be drawn to the outer side, and the omo hyoideus pulled towards the trachea, the sheath of the vessels will be exposed; exterior to it, will be seen the nervus descendens noni, which is a branch of the lingual; and on laying open the sheath, the carotid artery, and internal jugular vein, will come into view; and between them, or rather concealed by them, is the par vagum. The artery is on the inner side of the vein. The sheath in which these parts are included, will be found, on examination, to have a septum, or division, between the artery and vein; so that in the operation of tying the carotid, that part only of the sheath must be opened, which lies immmediately over the artery.

Let the student now observe the artery, vein, and nerve, as situated with regard to the neighbouring parts. Below the point where the sterno cleido, and omo hyoideus muscles cross each other, he will find the sheath, concealed by the sterno cleido, omo, and sterno hyoideus muscles; above the point of decussation, it is covered by the skin, platysma myoides, and fascia only. On the inner side, are the larynx, thyroid gland, trachea, and œsophagus. On the outer side, in the middle of the neck, is the sterno cleido mastoideus muscle; and behind it without the sheath, are the great sympathetic nerve, the inferior thyroideal artery, the longus colli, and rectus capitis major muscles; and these are the soft parts in the vicinity of the vessels and par vagum.

For a great part of its course, the carotid artery is accompanied by small absorbent glands, which, from forming one connected chain, are called glandulæ concatenatæ. Should one of these glands take on a diseased action, and enlarge in size, it might be mistaken for aneurism. Mr. Burns mentions the case of a woman who had a tumour of the magnitude of a walnut on the side of the neck, which had a strong pulsation, owing to the action of the carotid underneath; several who saw it, and who satisfied themselves with a superficial examination, firmly believed it to be aneurism, but it proved to be nothing more than an enlarged gland. Mr. Burns thinks that some of the reputed cases of aneurism in which spontaneous recovery took place, had been merely glandular tumours placed over the course of a large artery, and receiving an impulse from the vessel beneath; an opinion which I believe to be true in many instances.

It is not only in the neck, however, that an enlarged gland in the course of an artery, may lead to error in diagnosis; therefore we should carefully examine the swelling before speaking positively as to its nature. The pulsation may arise not only from the gland being situated over a large artery, but from a branch of an artery passing over the tumour. To discriminate between aneurism and the former case, the tumour should be pulled forwards, so as to be removed from the sphere of action of the artery; on doing this, all pulsation will cease if the tumour be merely glandular. To decide between aneurism and the latter case; if aneurism, the pulsation is general; if a glandular tumour, the pulsation is only partial, or confined to a particular part of the swelling.

It is not requisite that I should point out the cases in which the ligature of the carotid artery may be required; for information on that subject, I cannot refer the student to a better work, than Mr. Hodgson's "*Treatise on the Diseases of Arteries and Veins*;" nor need I enter on the minute history of the operation, as Cooper's "*Surgical Dictionary*," a work which is, or ought to be, in the possession of every student, gives it in detail; but on the disease which oftener calls for its performance than any other, viz:—aneurism, I shall make a few general observations, which will apply to this disease in all situations.

The arteries are organized like the other structures of the body, hence are liable to the same morbid changes. They may inflame; thicken; become obliterated by adhesion, as the sequela of inflammation; suppurate; ulcerate; and die. But besides these diseases, arteries are more than other structures subject to an osseous deposit in their coats, by which their function is interfered with; and aneurism is peculiar to them, unless the dilatation of veins in varix, may be regarded as a similar disease.

An aneurism may be briefly defined a pulsating tumour, having a communication with the interior of an artery; how it is formed, however, is a matter of controversy amongst Pathologists. In some cases, it no doubt consists merely in a preternatural yielding of the coats of the vessel; whilst in others, one, two, or the whole of the coats give way by ulceration; and in these cases, the coat, or coats remaining entire, and the soft parts near them, or the soft parts only, when all the coats yield, form the boundaries of the sac.

An aneurism, at its commencement, is accompanied by a symptom which clearly denotes the nature of the affection; that symptom is pulsation; but in a more advanced period of the disease, it is more obscure; and in the last stage, not to be felt. The progress of the disease is sometimes slow, and sometimes exceedingly rapid; a spontaneous cure of it seldom happens; therefore, if it were not for the interference of art, the disease would almost invariably terminate in the bursting of the sac, and death.

The treatment of aneurism may be divided into medical and surgical. On the former, much reliance cannot be placed; but digitalis, and low diet may, by moderating vascular action, retard the fatal issue of the disease. The only mean, independent of the operation, that can be employed with probable advantage, is compression, not partial, but general; that is to say, not to the tumour only, but to the whole member, for it is in aneurism of the arteries of the members alone, that compression can be used. There are cases on record, in which, it is said, compression has effected a cure, but it is in certain stages only of aneurism, that it can be advantageously, nay safely applied. If there be the least degree of inflammation of the aneurismal tumour, a circumstance indicated by pain on pressure, it would be rash and dangerous to employ it. The cure, in this way, must at all times be an exceedingly tardy and wearisome process; but it is justifiable in certain cases to try its effect. When acting in a proper manner, it gives no pain, and cures by diverting the current of the circulation from the aneurismal sac.

Prior to the year 1785, (a period which should be kept in remembrance from having given birth to a most important improvement in operative surgery) the operation for aneurism was pregnant with difficulty and danger, so that Mr. Pott and others declared, that until a better mode of treating the disease was discovered, amputation was the only resource in popliteal aneurism. The operation consisted in cutting open the tumour, cleaning it of its contents, and tying the artery at each extremity of the sac. We are told that this method was first adopted by Severinus and Trullus, about the year 1646, in a case of aneurism in the thigh; and subsequently to them by many surgeons in France, Germany, and Italy. The first operation of the kind performed in this country, at least the first on record, occurred to Mr. Burchall, at the Manchester Infirmary, in 1757; an account of which, will be found in the third volume of "*Medical Observations and Inquiries.*" The frequent failure caused it to fall into disuse, and amputation of the limb was substituted, until John Hunter's improvement superseded the necessity of so desperate an expedient.

The new operation for aneurism was first performed by Mr. Hunter, in 1785, on a patient in St. George's Hospital. It consisted in tying the main trunk of the artery above the seat of disease; the points to be gained by this were, to obliterate the calibre of the vessel communicating with the aneurismal sac; to cut off the supply of blood to the tumour, and thereby to allow the diseased mass to be removed by absorption. Since Hunter's time, the method of operating has been improved and simplified, and may now be said to have arrived at its ultimate perfection.

After the main artery of a limb has been secured by a ligature, the blood finds its way to the parts below the obliterated point, by means of the anastomoses, or communications which exist between the final ramifications of arteries. The passage of the blood by these collateral routes is at first difficult; but eventually becomes free, by a gradual dilatation of the anastomosing branches.

Before then an operation for the cure of aneurism be decided on, it is, of course, necessary to be assured, that there is a sufficient communication between the branches passing off above, and those passing off below, the part to which the ligature is to be applied; for the life of the limb cannot be preserved unless there is. One of the carotid arteries may be tied with perfect safety; but it is doubtful whether both can be. The subclavian may be secured, but the success is here more doubtful, than when one of the carotids is tied, and the reason will by and by be explained. The brachial, and its branches; the internal iliac; the external iliac; the femoral, and its divisions, may be operated on with safety; but whether the arteria innominata, and the aorta, can be tied with impunity, is questionable. Modern surgery, however, seems to be so aspiring, as to stand at nothing; and what can tend better to prove this assertion, than the bold operation undertaken by Sir Astley Cooper, in 1817? This Surgeon dared even to pass a ligature about the aorta three-fourths of an inch above its bifurcation; but the urgent circumstances of the case fully justified so desperate a measure. Dr. Mott, in America, has also distinguished himself by passing a ligature on the arteria innominata, for a case of aneurism of the subclavian artery, where the whole vessel was found so diseased, that the Surgeon had no alternative, but to tie the common trunk. This was a bold operation, and the performance of it evinced, on the part of the Surgeon, great confidence in the resources of nature; but the confidence was warrantable, and why?

Mr. Burns tied the arteria innominata, on the dead subject, with two ligatures, and cut across the vessel in the space between them, without hurting any of the surrounding vessels. Afterwards, even coarse injections, impelled into the aorta, passed freely by the anastomosing branches into the arteries of the right arm; filling them and all the vessels of the head completely. Mr. Burns mentions a case, in which he and others were induced to hint, that the arteria innominata might be tied; but the boldness of the operation, and the deficiency of data whereupon to estimate the probability of its issue, forbade them to urge the proposition.

We shall now enumerate the parts which are concerned in tying the common carotid artery; they are, the common integument; platysma myoides; fascia; sterno cleido mastoideus; omo hyoideus; nervus descendens noni; sheath of the vessels; internal jugular vein; and par vagum. The nervus sympatheticus is situated without and behind the sheath, therefore not at all endangered in the operation.

An examination of the course and parts in connection with the artery, must fully convince us that the situation where it is most easily reached, is just above the decussation of the sterno cleido, and omo hyoideus muscles; but the aneurismal tumour may be so low down, as to require the ligature to be placed on the vessel below this spot; here the operation is more difficult, as the artery is deeper, and to expose it, the sternal head of the sterno cleido muscle must be raised.

The right carotid artery is one of the branches into which the arteria innominata divides; the left carotid arises from the arch of the aorta, and at the lower part of the neck this vessel lies close to the œsophagus

It is no longer problematical whether the carotid artery can be safely tied; that injurious effects on the functions of the brain would supervene, was an apprehension which the result of very many cases has fully proved to be totally unfounded. Putting a ligature about the carotid is almost an every day operation, in large hospitals. The Anatomy of the blood-vessels shows, that the arteries which furnish blood to one side of the neck, face, scalp, and brain, freely anastomose with those of the other; hence one of the carotid arteries may be obliterated without danger. If both carotids were secured, the only resources left, are, the vertebral, inferior thyroideal, and superficial, and deep cervical arteries, which are branches of the subclavian, and not adequate I think, to furnish the necessary supply of blood.

In passing the ligature, care must be taken that neither the par vagum, nor jugular vein, is included in the ligature, for to tie either would be fatal. This is to be received as certain, with regard to the nerve, and nearly equally so with respect to the vein; for the dangerous effects of a ligature on a vein, has caused the operation of tying the vena saphena for varix of the lower extremity, to be abandoned as unsafe. The head being still more bent back than it has been for the dissection of the carotid, and its connections in the lower and middle regions of the neck, the student will pursue the course of the artery towards the angle of the jaw, where it usually divides into two considerable branches, the internal, and external carotids; the internal enters the foramen carotidum, to supply the anterior part of the brain; the external furnishes branches to the neck, face, and scalp.

With respect to the place where the division of the common carotid takes place, it now and then varies, but generally it is said to divide opposite to the upper margin of the thyroid cartilage, a transverse line then drawn from this point, will be our guide to the seat of bifurcation.

Before tracing the external carotid, and the branches which arise from it, the following parts of the basis of the jaw must be sought for: the inferior portion of the parotid gland; the digastricus, and the muscles which take their origin from the styloid process of the temporal bone; the submaxillary gland; absorbent glands; the mylo hyoideus; the hyoglossus, and the other muscles of the tongue; the sublingual gland; and the ducts of the salivary glands. The student is next to follow the nerves of this part, viz.—the glosso pharyngeal, the lingual, the nervus accessorius Willisii, &c.; and deeper seated, he will find the par vagum, and great sympathetic emerging from the cranium. The relative position of the external and internal carotids, with regard to each other, and to the parts mentioned, must be observed: it will be found that the internal carotid is deeper seated than the external, and separated from it by the styloid process of the temporal bone; that the external runs close to the tonsil gland; and that there is an intricate arrangement of structures about the angle of the jaw.

The internal carotid artery sends off no branch until it enters the skull; but the external begins immediately to supply the neighbouring parts. The place of origin of its branches frequently varies; but the following are usually found to arise from it:—The superior thyroideal; the lingual; the facial, or external maxillary; the ascending pharyngeal; the occipital; the temporal; and internal maxillary. These different branches must be followed, and their relations accurately noted. The parts about the basis, and angle of the jaw, cannot be well described; it is by dissection only, that a knowledge of them can be obtained. The student will then learn, how the structures of this portion of Anatomy are intermixed; and that to remove a tumour from this part, is a serious operation, unless conducted with care, and anatomical skill.

The student is now to go to the central portion of the neck, including the trachea, œsophagus, and their connections. Above the trachea is the os hyoides, to which the muscles of the tongue are attached; below the os hyoides is the thyroid cartilage; still lower the cricoid; and then the rings of the trachea. A little below the cricoid cartilage we find the thyroid gland, consisting of two lobes; it is supplied by four considerable vessels, two of which originate from the subclavian, and two from the external carotid arteries.

When the thyroid gland is of its natural size, it lies a little below the cricoid cartilage; but when augmented in bulk, by bronchocele, or the Derbyshire disease, so called from its being endemic in the County of Derby, it extends upwards, so as to cover the thyroid cartilage; laterally, so as to derange the natural position of parts; and downwards, so as to encroach upon the large vessels which arise from the arch of the aorta.

When we observe the relation of the lobes of the thyroid gland to the carotid arteries, we should suppose, and in the majority of cases our supposition would be correct, that the vessels would be situated behind the tumour; but an instance has occurred in my practice lately; where, in an aged female, the carotid arteries were thrown considerably out of their course. When I first saw the tumour, I observed on each side, at the extreme point of its lateral region, a movement of the integuments; and on applying my finger to the part, I found a strong pulsation; the vessel was superficial, and the dimension of it was nearly equal to the size of my little finger.

Since the last edition of this work, a post mortem examination has enabled me to verify the correctness of the above statement; as the carotid arteries and the contents of the sheaths occupied the situation I suspected.

The nature of bronchocele is not involved in much obscurity; as on cutting into it the natural cells of the gland are found increased in size, but the structure does not appear changed in any other respect. The inhabitants of the Alps are very subject to this disease, which has by some writers been attributed to the use of snow water: but in Derbyshire, it is considered a more common disorder than in any other county of England, and there, such a cause does not operate. I agree with Dr. Thomas, the author of the "*Modern Practice of Physic*," that a predisposition to the disease is frequently entailed on the children, by the parent; and that where we meet with bronchocele in particular districts, it is rather owing to the inhabitants intermarrying among each other, thereby entailing the predisposition to it, on their offspring; than to any peculiarity in the articles used for diet.

Various remedies have been recommended for the cure of this disease, amongst which, the burnt sponge has long maintained the character of being the most efficacious. From chemistry having shown, that the basis of the spongia usta is subcarbonate of soda, this alkaline preparation has of late been used as a succedaneum, and with equal success. Iodine has recently been extolled, especially by the continental writers, as almost a specific in this disease. It is applied externally in the form of ointment, composed of half a drachm of the hydriodate of potash, rubbed up with an ounce of lard or spermaceti cerate; and ten or twelve drops of the tincture are given internally twice or three times a day. My own experience has not induced me to attribute very striking effects to the use of this medicine, but it is fair to state, I have been informed, that some cases of bronchocele have been treated in the Manchester Infirmary, by the internal administration of a solution of the hydriodate of potash, and with marked success.

The practicability of extirpating the thyroid gland, when so enlarged as to interfere with respiration, and deglutition, is a point to which much consideration has been given. The use of the knife has been deprecated by some Surgeons, on account of the terrible hæmorrhage which would succeed, and certain it is, that without precautionary measures, this circumstance would offer an insuperable objection.

We know, however, the sources from whence the arterial hæmorrhage would proceed, viz:—the two superior, and two inferior thyroideal arteries; these therefore must be secured immediately after the flaps of integument have been raised, and before the body of the tumour is detached.

The venous hœmorrhage may be commanded by pressure. But after the four thyroideal arteries have been tied, it is not prudent to use the scalpel in order to separate the swelling from surrounding parts: the best operating Surgeons advise, that in the removal of all tumours from parts where important structures are interwoven with each other, as in the neck, at the angle of the jaw, and in the axilla, it is better, after cutting through the integuments, that the knife should be laid aside, and that the fingers, assisted occasionally by a blunt instrument, should be substituted in order to detach the swelling from contiguous parts.

If these circumstances be attended to, the operation is practicable, and may be performed in cases of extreme emergency; the emergency however is not to be estimated by the magnitude of the tumour, but by its mechanical effects on the trachea, and œsophagus.

Every enlargement of the thyroid gland is not bronchocele. It is liable to increase in size from other causes; as suppuration, dropsy, fungus, cancer, &c. It is well to bear this knowledge in mind, in coming to a decision on the nature of the affections of this organ.

In another place, we mentioned that an enlarged absorbent gland before the carotid, has been mistaken for aneurism; if then, the student observes how the artery is likely to be situated, with regard to the corresponding lobe of the thyroid gland, if one lobe only be bronchocelic, he may easily conceive that such a mistake in this case is possible; for the tumour would receive an impulse from the pulsation of the artery which it covers.

Having observed the cartilages of the larynx, the trachea, and the soft parts about them, the student will consider the operations of laryngotomy, tracheotomy, and œsophagotomy. Neither cutting into the larynx, nor trachea, can, in a general way, be necessary, when the object is merely to inflate the lungs, as a tube may be introduced from the nostril; but one or other of these operations, may be required for the purpose of extracting foreign bodies, which have slipped into the aërial passage.

When any hard substance, as a bit of bone, or a pea, has got into the wind-pipe, it would be desirable to know its exact seat, for this would determine our choice of situation where an opening might best reach it. The feelings of the patient may deceive us; for if the foreign body is not firmly fixed, the current of air will move it up and down in the trachea, and the person will refer his painful sensations sometimes to one part, and sometimes to another; but the distress attendant on an accident of this kind, is often so great, as to disable the patient from giving any satisfactory clue to the exact seat of irritation.

It is obvious I think, that to extract a body sticking in the rima glottidis, the most convenient operation for reaching it, would be that recommended by Mr. Coleman; not, however, for the purpose we are now considering, but for artificial respiration. It is, to divide the thyroid cartilage by a longitudinal incision; an union of which, afterwards, is said to be as completely effected, as if the trachea itself were cut; this operation is called laryngotomy.

If the body had freely passed into the wind-pipe, and from being of a rounded form was capable of being carried up and down in that passage by the air, I think tracheotomy would be preferable to laryngotomy, and my ground of preference is founded on the experiment of Favier, related by Burns, which is, that when a pea was fairly put into the trachea of a dog, and an opening made into the wind-pipe below the thyroid gland, the pea was raised by the force of the air expelled from the lungs, and thrown out by the wound; and this took place as often as the foreign substance was put into the wind-pipe. This might happen from the proximity of the opening to the bronchi; but the pea would not, I presume, have so readily made its exit through an aperture in the larynx, as the edges would not be so far separable without danger, as the divided rings of the trachea are; and independent of this circumstance, the body would be more likely to escape during a forcible expiration, as it would meet with no obstruction until it arrived at the rima glottidis.

Mr. Burns applies the result of Favier's experiment to disprove the opinion, that when a foreign body has unquestionably slipped into the larynx, bronchotomy, or tracheotomy, can only be useful, where the substance is situated *above* the point where the perforation is to be made; and he fully proves the opinion to be erroneous, by observation on a female patient of his own, in whom a plum-stone got into the trachea, and where, by careful examination, the foreign substance was ascertained to ascend, and descend, with great rapidity, during the acts of expiration, and inspiration.

Additional testimony of the facts mentioned by Favier and Burns, is furnished by a case which occurred to M. Boyer, a French Surgeon of acknowledged eminence, and published in the "*Nouveau Journal de Médécine*," for February, 1820.

The operations of tracheotomy, and laryngo-tracheotomy of M. Boyer, are not so simple as laryngotomy, as more caution is necessary, owing to varieties which not unfrequently occur in the distribution of arteries about the neck. Should both carotids arise from the arteria innominata, the left branch must cross the trachea, and thus would be endangered in tracheotomy. Mr. Burns makes mention of a preparation in the excellent museum of Dr. Barclay, Lecturer on Anatomy, at Edinburgh, where the two inferior thyroideal arteries arise by a common trunk from the right subclavian artery. The vessel creeps up the side of the trachea, lower than the gland, and when it has reached the front of the wind-pipe, it divides into two branches. It is well to bear the possibility of these maldistributions of the arteries in mind, as it enforces the necessity of care, and that in the operation of tracheotomy, it is safer to lay down the knife after the crucial incision has been made, and to expose the rings of the trachea with the fingers, than to run the risk of being annoyed by an unexpected hœmorrhage. If a vessel be wounded, of course it must be secured by ligature, before an opening be made into the wind-pipe.

The presence of foreign bodies in the trachea, is not the only case which may require either of these operations. In the Third Volume of the "*Transactions of the Association of Fellows and Licentiates of the King's, and Queen's College of Physicians in Ireland*," there is an account of a case of cynanche laryngea, by R. Carmichael, Esq. in which tracheotomy was performed with success; and in the Seventy-seventh Number of the "*Edinburgh Medical and Surgical Journal*," there are two instances related by Mr. Liston, in which the same operation was required, and fully succeeded. One was a case of œdema glottidis, a disease described by Bayle; the other, a case in which the larynx was paralized by a blow, and where suffocation was threatened by a collection of some fluid in the trachea, and its ramifications.

The next point to which the student must attend, is the situation of the œsophagus, behind the wind-pipe, as it will lead him to select the safest place for the operation of œsophagotomy.

The pharynx, or upper part of the gullet, is of a funnel shape, and of a muscular structure; it terminates in the œsophagus, just opposite to the inferior edge of the larynx; thus the œsophagus and trachea may be said to commence opposite to each other. At their commencement, the one is placed immediately behind the other; but as the œsophagus descends, it inclines to the left, and in the lower part of the neck is seen projecting beyond the side of the wind-pipe, and not far distant from the carotid artery. The principal parts connected with the side of the œsophagus are, the branches of the recurrent nerve, and the inferior thyroideal artery, which are situated near the projecting part of the canal.

Substances may lodge in the pharynx or œsophagus, and suffocate by producing spasmodic constriction, or by their pressure on the trachea. The modes of giving relief are, extraction of the substance by the finger, or a curved forceps; pushing it into the stomach by means of a probang; or cutting down upon it through the walls of the gullet. When a person, in the act of deglutition, is thrown into the agony of threatened suffocation, we are not all at once to conclude, that the morsel of food is detained in the pharynx from being too large to pass into the contracted œsophagus; it is possible, from the epiglottis not having performed its office duly, that the morsel, or a portion of it, has entered the rima glottidis. I was present at the inspection of the body of a female, who struggled, and died, at St. Peter's Hospital, Bristol, whilst in the act of eating her dinner. Suffocation was suspected by the by-standers, but they were incompetent to give any assistance, and before the Surgeon reached the ward, the patient was a corpse. On examining the throat, a large morsel of meat was found firmly impacted in the upper part of the larynx.

Our first attempt, in all cases of suffocation, should be to introduce the fingers, and endeavour to extract the substance; if not within reach of the fingers, a curved forceps, or probang, must be used; but perhaps neither are at hand; in this extremity, a bougie, a piece of whalebone, well guarded at its point, or any flexible substance, must be employed; there is no time to be lost; for what is to be done, must be done quickly. In the introduction of an instrument, the student must recall to mind what has been already said on the influence of the movements of the tongue on the epiglottis. But it may not be adviseable to push the foreign body into the stomach; or if adviseable, it may not be practicable to do so: in the former case, we must endeavour to draw it out; and in the latter, the operation of œsophagotomy affords the only chance of saving life.

If the relation of parts in the space bounded by the trachea and œsophagus on the inner side, and the inner edge of the sterno cleido on the outer, be recollected by the student, he will have no difficulty in stating what are the parts to be avoided by the knife; the carotid artery, internal jugular vein, and par vagum, are shielded by the condensed cellular sheath which surrounds them. There are two arteries in danger of being wounded, viz.—the inferior thyroideal, which is a branch of the subclavian; and the superior thyroideal, which is sent off from the external carotid. The first of these arteries bends behind the sheath of the vessels, and passes in an oblique direction upwards, towards the inferior portion of the thyroid gland, on which it ramifies; the course of the superior thyroideal artery has an equal degree of obliquity downwards, but it is more tortuous than the inferior; it expends itself on the upper portion of the thyroid gland; but neither of these vessels need be interfered with, for the one is below, and the other above the place of the incision; besides further safety is given by our discontinuing to use the cutting edge of the knife after the deeper seated parts have been exposed, and separating with the finger, or the handle of the scalpel, all the structures contiguous to the place where the œsophagus is to be opened, which is determinable by the situation of the foreign body.

In the performance of all operations, we wish as much as possible to avoid an effusion of blood, as its presence obscures the parts to be divided by the knife; hœmorrhage is one source of that intimidation which every young operator feels, and of which, experience alone can perfectly divest him.

The student has already seen, that the external jugular vein runs superficially; without care, this vessel, or some of its larger branches, may be cut in making the incision through the integument. The trunk of the vein is not endangered in the majority of subjects, as its course is obliquely outwards; but there is usually a pretty considerable branch, which Fyfe calls, the " anterior jugular," which ascends between the trachea and inner edge of the sterno mastoid muscle, and this ought to be avoided by the knife; but there are frequent varieties in the distribution of venous branches throughout the body; therefore we must try to make them apparent by distension, which is done by pressing on the main trunk, so as to intercept the current of blood towards the heart.

There is another portion of the neck, which the student has to dissect, viz.—the triangular space bounded by the outer edge of the sterno mastoideus muscle on the inner side; the edge of the trapezius muscle on the outer; and the clavicle which constitutes the basis of the triangle; but as the important parts, which it contains, belong principally to the upper extremity, I shall defer the consideration of it, until we enter on a description of that part of the body.

THORAX.

The thorax, whether regarded anatomically, physiologically, or pathologically, is decidedly the most important part of the human body, as it encloses organs, the most essential to our existence. A wound of the head, or abdomen, may destroy life, but a person seldom survives a penetrating wound of the lungs, in consequence of the hœmorrhage which follows; and a wound of the heart is almost instantly fatal. The lungs and heart (strictly speaking) are vital organs; and Nature, all wise in her plans, has taken care to place them in a situation, and to surround them with a wall, well calculated to defend them from external violence.

When we look to the Anatomy of the parietes of the chest, we observe that they are composed of materials well adapted to resist injuries. The muscles of the abdomen oppose the effects of a blow, if not exceedingly violent; but the means are less protective than those of the thorax, as the latter consist chiefly of bone; the necessity for which is founded on the great importance of the thoracic viscera, and the dreadful consequences of a sudden suspension of their function.

The basis of all the bony parts of the chest is the spine; or that portion of it which is included within the last cervical, and first lumbar vertebræ. From this point, the ribs pass forwards on each side, and the principal of them are united anteriorly to the sternum, by means of intervening cartilages.

The student must examine the processes, and remarkable points in the bony parts of the thorax; he must observe how the muscles before and behind are expanded upon the ribs, and the protection thus afforded against fractures, and how they may affect the walls of the chest, when their insertions are fixed. Between the ribs he will find the two layers of inter-costal muscles; and there are other muscles, with the uses of which he must make himself acquainted.

On noticing the ribs in their mode of junction, with the sternum, with the vertebræ, and with each other, it must be evident that in case of fracture, the broken extremities can only be displaced inwards, or outwards; their connection, before and behind, prevents any derangement in length; and the fragments cannot be carried either upwards, or downwards, on account of the intercostal muscular fibres acting equally above, and below the extremities of the broken bone.

The thoracic cavity is shut out from the neck, by the muscles and blood-vessels going to, and returning from the neck, head, and upper extremities; and below, from the abdomen, by the diaphragm. Having raised the sternum and cartilages of the ribs, we obtain a view of the viscera of the chest, invested by their pleuritic membrane. Inclined to the left, from a central line drawn perpendicularly (considering the body erect) we see the pericardium, which contains the heart; and laterally, are the lungs.

The internal figure of the chest is conical; but the basis of the cone is not horizontal; the diaphragm being obliquely placed, so that the posterior part of the chest encroaches more on the abdominal cavity than the anterior; and this muscle is not flat, but convex. This muscular septum will be more particularly described when we speak of the parietes of the abdomen; but the student must, at this time, observe its relations to the thoracic viscera.

On raising the sternum, the student would remark a triangular space, formed by the recession of the pleuræ. When we say *pleuræ*, it is not to be understood to mean, that there are two bags, for there is only one; but the term pleuræ is made use of by some Anatomists to distinguish the pleura of the right side, from that of the left. It is true, the chest is divided into two distinct cavities, but this merely arises from the attachments of the membrane to the sternum, before, and to the vertebræ behind; forming the two spaces, named, the mediastina: but here let me observe, the division between the right and left cavity of the chest is not exactly in the middle; as from before, backwards, the septum passes with a degree of obliquity.

The annexed diagram will point out the course of the pleuritic membrane, which secretes a halitus to lubricate the surface, and thereby to prevent the parts which are in contact, from adhering to each other. It is not only a lining, but reflected membrane; that is to say, it not only lines the walls of the chest, but gives a covering to the lungs and pericardium. The accom panying plan represents a view produced by an horizontal section of the thorax, and its contents; I have thought it necessary to give it, as there is nothing which perplexes students more than the reflection of membranes, and when represented to the eye in the form of a diagram, nothing is more simple.

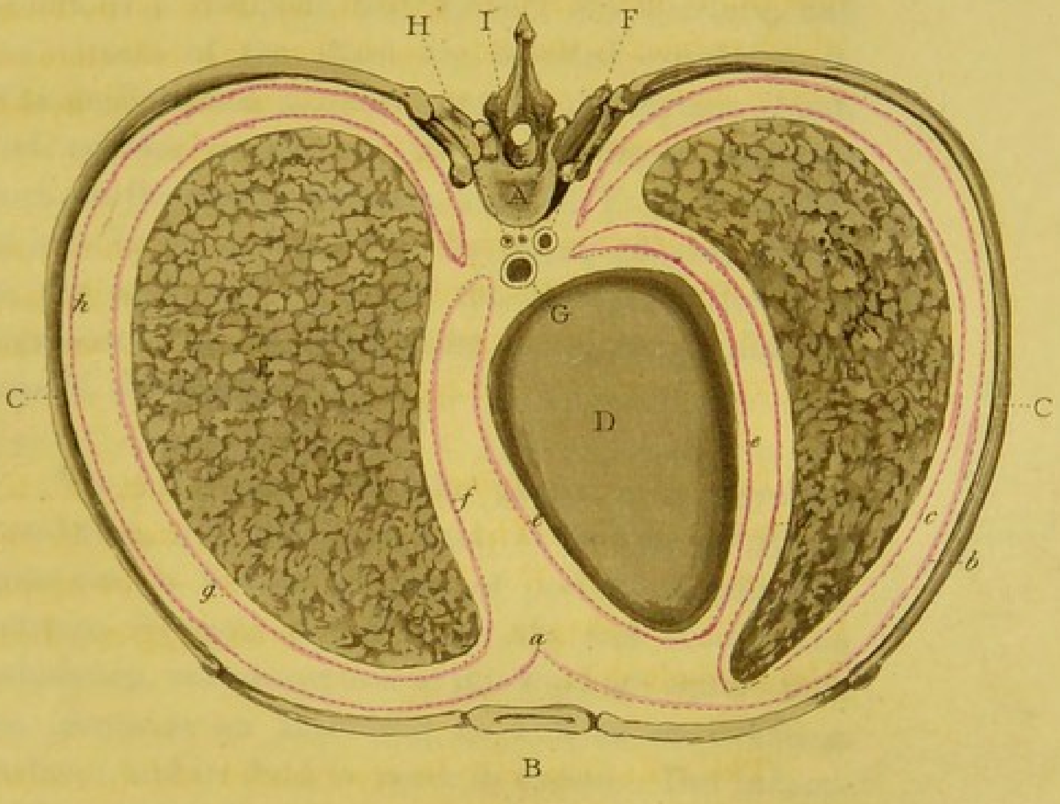
The pleura is a single bag without an opening; to demonstrate its course over the parietes of the thorax, and the viscera, the bag must be broken into, and the rupture is made at the sternum.

A.—marks the spine. B.—The sternum. C. C. —The ribs. D.—The situation of the heart in its pericardium. E. E.—The lungs. F.—The aorta. G.—The œsophagus. H.—The vena azygos. I.—The thoracic duct.

The reflection is to be commenced at (a), behind the sternum. From this point, the pleura goes to line the inner surface of the ribs on the left side (b), forming the pleura costalis. Having reached the spine, it is to be traced over the outer surface of the lung (c), forming the pleura pulmonalis. It then returns to

A DIAGRAM

of the REFLECTION of the PLEURA.



Engraved by T. Fielding.

the spine on the internal surface of the lung (d), adapting itself to the irregularities of the lobes. It then passes over the pericardium (e e); afterwards on the internal surface of the right lung (f); and finally, on the external face of the same lung (g); and finally, on the right wall of the chest (h), to terminate behind the sternum where the reflection was begun. Thus the pleura is a complete bag without any aperture, and the viscera of the chest are situated exterior to it. The mediastinum anterius contains the thymus gland, and cellular membrane; the mediastinum posterius encloses the important parts, marked F. G. H. and I. It is to be remembered that the pleura adheres closely to the walls and organs of the chest, and that it is represented as separated from them, merely for the sake of clearness.

We have said, that the pleura is a secreting membrane, and that the fluid, or halitus, which it gives out, is for the purpose of preventing adhesion between its surfaces. During life and health, the exhalation, and absorption of this fluid are equal; thus the pleura is an absorbing as well as an exhaling surface; and its fluid is never in excess. But inflammation materially affects the secretion; when excessive, the secretive function is suspended, and then the surfaces of the pleura costalis, and pleura pulmonalis adhere; but when the inflammation is mild, the secretion is increased, and this is one of the causes of hydro-thorax.

The proximate causes assigned for dropsies in the different parts of the body, are, increased secretion, and diminished absorption. When more fluid is poured out by the exhalent vessels of the pleura than natural, although the absorbents may be as active as in health, it is obvious that fluid would accumulate, from the balance of exhalation and absorption being destroyed. On the other hand, should the exhalation be in its due quantity, and absorption by any cause be diminished, it is equally obvious that the result would be similar. This is the view which Pathologists have taken of the nature of dropsies. But some modern experiments on the mechanism of absorption, by the ingenious French Physiologist Magendie, may tend, by their result, to overthrow this kind of reasoning on the proximate causes. From a series of well-conducted experiments, he has been led to infer, that the veins and arteries, both large and small, are endowed with an absorbent power; that absorption depends on the capillary attraction of the vascular walls; that the more numerous the vessels, the more rapid is the absorption; and that distension, or plethora, weakens the absorbing power, and if considerable, entirely suspends it.

The results of the experiments, which will be found detailed in the First Number of the "*Journal de Physiologie Experimentale,*" are exceedingly interesting; and prove, either that the blood-vessels are endowed with an absorbent power, and that that power is weakened, or destroyed, by over-distension; or that the action of the lymphatics is much under the influence of the circulation; to whichever conclusion we come, the practical inferences are not materially different, so far as dropsies are concerned.

Such information as this, and coming too from so respectable an authority, will have the effect of altering our views with regard to effusions. We can no longer refer them to either increased secretion, or diminished absorption operating independently of each other. In dropsy from active causes, there is not only an increased secretion, but also diminished absorption; and to cure in this case, we must bleed. Bleeding has recently been highly extolled, as a remedy in effusions; but it is in effusions from the above causes *only*, that it can do good: when they are of a passive nature, as in cases where there is a want of energy, it must do harm. In dropsies from debility, an opposite indication is necessary; and if we succeed in fulfilling it, the accumulated fluid will soon become absorbed; the equilibrium of exhalation and absorption be restored; and the parts again resume their healthy function; but this happy termination can only be expected, *when there is no organic disease.*

Serum is not the only fluid which may lodge in the chest; pus, and blood, have been discovered in many cases. The presence of pus most commonly results from the bursting of an abscess of the lungs;

but Dr. Baillie mentions, that the pleura may be so inflamed as to form it. In his valuable Work on "*Morbid Anatomy*," he states, that empyema may be distinguished with a good deal of certainty, after inflammation of the pleura, or lungs, by rigors having taken place, by a remission of the pain, by the cough and difficulty of breathing continuing; and by the person being able to lie more easily upon the diseased side, than the other. It is not always, however, that there are notable signs of the presence of matter in the chest: Portal speaks of a patient who had an attack of peripneumonia, which left a slight difficulty of breathing, and a little debility, but there was no cough, no œdema of the lower extremities, and no fever; yet on examining the body after death, the right cavity of the chest was found almost filled with pus.

Blood in the thorax must proceed either from the rupture of a blood-vessel, or vessels; from the transudation of this fluid through the relaxed coats of the arteries, or veins; or from the exhalent extremities. If the extravasation be considerable, we must apprehend danger; but if not great, the coagula may become absorbed, and therefore be productive only of temporary inconvenience.

When water, or pus, is actually known to be present in the right, or left cavity of the chest, is it safe to puncture the parietes for its discharge? This question involves two considerations; the safety, and expediency of the operation. When we have two evils to contend with, viz.—the imminent danger, in which a person labouring under hydro-thorax is placed, and the possibility of exciting inflammation in the pleura, by inflicting a wound in it; there can be no doubt of the justifiability of hazarding an operation. We have only to fear two things, viz—a wound of the intercostal artery, and inflammation; the first may, in a general way, be avoided, by dividing the intercostal muscles at the *upper edge* of the seventh rib; for the artery, vein, and nerve, occupy the lower margin: there are, however, some exceptions. I have seen the vessels running intermediately between the ribs; but certainly never near the upper edge. With regard to the inflammation which may ensue, if great, we can commonly check it by depletion; if trifling, it may have a beneficial effect in effusion from chronic inflammation, by changing the action of the vessels; for instances are not wanting to show, that an acute disease will often cure a chronic one, and it is this law in Pathology, upon which, injection for the radical cure of hydrocele is founded.

With regard to the expediency of the operation, this is more difficult to determine. Could we positively ascertain that the water, or pus, arose from a disease of the pleura only, no Surgeon would hesitate to operate, for many instances of cure are recorded; but when there is organic disease in the heart, no good is likely to result from the operation, and therefore it would not be prudent to perform it; when in the lungs, the propriety is rendered less questionable, by the theory of Dr. Carson, to which we shall presently advert.

Having inquired into the natural, and most common morbid conditions of the pleura, we shall now notice the relative position of the organs of the thorax; and the effects of respiration on the walls and contents of the chest. The heart is observed not to be in the median line, but inclining to the left side. To show how the lungs lie, they should be inflated, when it will be seen how perfectly they adapt themselves to the figure of the cavities, so as to leave between their surface and the parietes, no vacuity; this is the state in which they are during life and health. Respiration is their function; and consists of two parts, inspiration, and expiration.

In inspiration, the chest is expanded on all sides, in consequence of an elevation of the ribs, and a descent of the diaphragm, produced by the contraction of the intercostales, levatores costarum, and diaphragm; assisted occasionally by the sterno mastoidei, subclavii, serrati, pectorales, and latissimi dorsi muscles; but in order that the three last sets of muscles act, the shoulders must be fixed.

In expiration, the chest is contracted in all its dimensions; the contraction is caused by the depression of the ribs, and the ascent of the diaphragm; the ribs fall in consequence of the intercostales ceasing to act, and by the contraction of the sterno costales, and the five pairs of muscles of the abdomen, aided occasionally by the longissimi dorsi, sacro-lumbales, and quadrati lumborum muscles. It is to be remembered that the diaphragm is the principal agent in both parts of respiration, when the function is executed in a natural manner. In ordinary breathing, it is but feebly assisted, even by the intercostales; and it is only when respiration is exceedingly laborious, that the other muscles attached to the ribs are called into action.

The lungs are accurately fitted to the cavity in which they lie, as well in expiration, as inspiration; this results from the elastic property of these organs. They are kept distended by the pressure of the atmosphere; but on puncturing the chest, air will rush into the cavity, and then by the pressure on one side being counter-balanced by pressure on the other, the lungs collapse, because the elastic power can now act without resistance. A practical deduction has lately been drawn from this knowledge by Dr. Carson, of Liverpool, and he has applied it to the treatment of the most fatal of all diseases, consumption of the lungs.

In an advanced state of phthisis, vomicæ, or abscesses; ulcerations, and other morbid appearances, are found in the substance of the lungs.

Abscesses are seldom known to heal when situated in these organs, and one of the reasons of this would seem to be, that the parts cannot be kept in a state of rest. If an abscess of the lungs were to burst, and the matter were to discharge itself by the trachea, the sides of the abscess would fall together, granulations would arise, adhesions form, and in time the sac would become obliterated in the same way as abscesses of other parts. But the function of the lungs renders this almost impossible, because the parts cannot be kept in that quiescent state, which is necessary to the reparative process we have described. The deduction is, that if the lungs can be kept quiet, abscesses may heal in them as in other structures; hence it has been proposed to puncture the chest with a view to cause a collapse of the lungs, by admitting air into the cavity of the thorax. The operation has been performed, at the recommendation of Dr. Carson, on a gentleman of Liverpool; but it was unsuccessful. In the Thirty-first Number of the "*Medical Intelligencer*," the editors mention, that they saw it inadvertently tried, and that the effect was remarkably satisfactory, for the patient felt comparatively well for a short time after the operation.

Dr. Carson's suggestion is plausible; but it cannot succeed where adhesions exist to a great extent, and where there are constitutional circumstances to contend with.

Phthisis pulmonalis is a general term, and implies that condition of the lungs in which matter has formed as the sequela of inflammation. In an advanced state of the disease, there is general emaciation, and hectic fever, as the consequences of the morbid state of the lungs. Phthisis may result from *common* or *specific causes;* amongst the former, is pneumonia from cold; amongst the latter, are hereditary diathesis, and defective organization. Between these causes, a distinction should be made in practice, as the chance of cure in the one case, is far greater than that in the other. If a man, having no specific tendency to the disease, should happen to be attacked with inflammation of the lungs, and in spite of depletion, and a rigid adherence to an antiphlogistic regimen, matter should form, either in the right or left lung, and be discharged per tracheam, the abscess would heal, if it were not for the unfavourable circumstances, under which the disease is placed; which circumstances have already been alluded to. In such a case, the operation might be successful, because the disease may be considered as local; but without an operation, the morbid action will continue; the general system will be brought to sympathize with the local derangement; all the symptoms characteristic of advanced phthisis will ensue; and the patient will sink under them; these observations illustrate the origin, progress, and termination of phthisis, from a common cause if there be no interference from art.

But in phthisis from a specific cause, the case is quite different; the disease is dependant on inherent defects, and without eradicating these, all attempts at cure will be inefficient; in such a case, it is obvious, the operation can do no good.

The distinctions established are, in a practical point of view, of extreme importance; and expose, I think, in a striking manner, the probable efficiency, and inefficiency, of Dr. Carson's proposal.

The lungs are closely applied to the inner surface of the ribs, and this will lead the student to reflect on the dangerous effects of wounds of the chest, and the consequences of fractures of the costæ. If a sharp instrument be thrust through the intervals of the ribs, it must, almost of necessity, wound the lungs, and the probability is, that the person will die from hœmorrhage. The blood will not flow through the aperture which has been made in the parietes, but into the cavity of the thorax; for on air being admitted, the lungs will recede.

If a rib be fractured in a pointed manner, and the sharp fragment be forcibly driven inwards, it may tear through the pleura pulmonalis, and penetrate the lung; a lacerated wound of this kind is not commonly succeeded by much hœmorrhage, but there will be another effect, which is almost constant, viz.—emphysema, which is a swelling produced by air diffusing itself in the cellular membrane under the skin. Sometimes the diffusion is partial; but it may extend over the whole surface of the body. If the fracture of the rib were compound, (an accident which seldom occurs), emphysema would not be likely to take place, because if the lung were torn by the ragged extremity of the bone pushed inwards, the air would have a free exit by the external opening. It sometimes succeeds to wounds; but it is principally in gun-shot; because, as Mr. John Bell observes, the orifice in the skin inflames and swells, while the wound is wider within.

On emphysema it is not necessary that I should dwell; I have explained the cause of this affection, and for the treatment, shall refer the reader to Works on Surgery.

The student will now expose the heart by making a longitudinal incision in the pericardium.

The pericardium is a perfect bag, like the pleura; and after giving a close covering to the heart, it is reflected, so as to form the loose portion, which is composed of two layers, the pleuritic and pericardiac. Its inner surface is a secreting surface, like the pleura; the secreted fluid is called, liquor pericardii, and prevents the pericardium from adhering to the heart; inflammation, and other diseases affect this membrane in a similar way to the pleura. A preternatural collection of the serum of this bag, gives rise to the disease called, hydrops pericardii: M. Skielderup, of Copenhagen, proposes, in cases of this kind, to remove by a trephine, a portion of the sternum, between the fifth and sixth ribs, and to let out the fluid by puncture.

The student will find the heart lying obliquely to the left side in this bag; the base of it is placed backwards, the apex forwards; and if the apex be accurately noticed, with regard to the part of the parietes to which it corresponds, it will be found that it is a little below the nipple of the left breast. Some of the ancients supposed that the heart lay perpendicularly in the thorax; that is, in a line with the sternum; an error induced by their observations being confined to the Anatomy of brutes.

The incision in the pericardium is to be continued upwards, so as to make the great vessels at the basis of the heart conspicuous, and the student must observe the situation of the right and left cavities of this organ, and the veins which terminate in, and the arteries which proceed from them.

The left ventricle gives origin to the main trunk of the arterial system, which vessel, named, the aorta, ascends, forms a curvature, and then descends in the mediastinum posterius; and in the chest, it gives off the intercostal, œsophageal, and bronchial branches.

From the arch of the aorta arise three considerable vessels, viz.—the arteria innominata, the left carotid, and the left subclavian. The left subclavian vein crosses the roots of the vessels, but more especially those of the left carotid, and the arteria innominata. The trachea lies between the two carotid arteries, and behind the arteria innominata.

The student should pay particular attention to the situation of the arch of the aorta, and the vessels which originate from it; for the arch or curvature is a frequent seat of aneurism. When the tumour is large it presses forwards on the upper bone of the sternum, and the extremities of the first ribs, and will frequently cause an absorption of these parts. It presses backwards on the trachea, and œsophagus, hence the difficulty of breathing and deglutition in cases of this kind. There are no positive signs by which incipient aneurism of the arch can be detected, but when the tumour becomes large, it will extend upwards so as to manifest itself by pulsation above the sternum. An aneurismal swelling of the curvature has on this account been mistaken for aneurism of the arteria innominata, and of the left subclavian artery.

The heart is pretty closely in contact with the surface of the pericardium; a penetrating wound in the cardiac region, therefore, could scarcely injure the latter without the former. Wounds of the pericardium and heart are mortal; but not immediately so in all cases, for Portal mentions an instance of a soldier who lived fifteen days after an accident of this kind: but the wound in this case could not have communicated with either of the cavities.

The heart is liable to the same diseases as other organs, but its function peculiarly predisposes it to preternatural dilatation; enlargement therefore is one of the most common morbid conditions of this organ. With the exception of carditis, we are not in possession of any infallible means of forming a diagnosis of the diseases of the heart; that is to say, of distinguishing one disease from another, by the prevailing symptoms; and it is so often sympathetically affected as to perplex the judgment of practitioners. Palpitations, frequent faintings, and irregularity of the pulse, are characteristics of troubled circulation; but whether they arise from a disease of the heart itself, or of the vessels, or of the pericardium, or of the lungs, or of the diaphragm, or of the stomach, or of more distant parts; it is not always easy to determine. No diseases are more liable to be confounded with each other, than those of the heart and lungs; the functional relations which subsist between these organs are such, that one of them cannot be materially deranged in structure, without the other being more or less affected in its office. When the heart is diseased, the function of respiration suffers; and when the lungs are disordered, circulation is embarrassed. How desirable would it be then to possess a test of the actual seat of disease.

Percussion of the thorax may enable us now and then to detect the presence of fluid in the chest; but it can do no more, and even in this, it is often deceptive.

M. Laennec, an ingenious and skilful French Physician, and a pupil of the celebrated Corvisart, has recently proposed a new method of distinguishing the different diseases of the heart and lungs, by means of an acoustic instrument, which he calls the "Stethoscope," of the use of which, a very favourable report has been made, by a committee of the Institute, composed of M. M. Portal, Pelletan, and Percy. The origin of the idea was this; M. Laennec was consulted in 1816, by a young female, who had some general symptoms of a disease of the heart, and in whom the application of the hand, and percussion, gave no satisfactory results, on account of her embonpoint; recollecting the well-known acoustic phenomenon, that if the ear be applied to the end of a beam, one hears distinctly the scratch of a pin at the other end; he imagined, that a useful hint might be drawn from this property of bodies. He took a sheet of paper, and formed a roll of it well secured, of which he applied one end to the region of the præcordia, and placing the ear at the other end, he was as much surprized as gratified in hearing the heart beat more clearly and distinctly than he had ever done, by the immediate application of the ear. This discovery led him to make a series of experiments at the Hospital

Necker, the results of which, he has published in two volumes, under the title "*De l' Auscultation Médiate, ou Traité du Diagnostic des Maladies des Poumons, et du cœur, Fondé principalement sur ce noveau Moyen de l' Exploration,*" which has been translated by Dr. Forbes.

M. Laennec gives ample directions for using the stethoscope in exploring the voice, the state of the lungs, &c. &c., but I must refer the student to the work itself, which is well worth perusal; as it contains much valuable matter on morbid anatomy.

There are some important nerves in the chest, to which the student must attend; they are the par vagum, grand sympathetic, phrenic, and intercostals.

The par vagum, sympathetic, and phrenic nerves, are more or less connected by filaments; hence the extreme sympathy, which exists between the heart, lungs, diaphragm, and stomach, in health and disease.

The par vagum are nerves of very considerable importance, and have more engaged the attention of Physiologists than any other pair. The experiments made upon them by Haighton, Dupuytren, Le Gallois, Philips, Brodie, and other modern Physiologists, are highly interesting. These nerves contribute to supply the pharynx, larynx, heart, lungs, œsophagus, and stomach, with nervous energy; we may, therefore, infer what mischief would accrue from their continuity being destroyed. It has been proved, in a satisfactory manner, that if one of these nerves be cut across in the neck, the injury is not always mortal, but that the animal soon dies after the division of both; that if one nerve only be divided, the lungs and stomach are impaired in their functions, but they soon recover them: that the section of both nerves, affects the larynx, the heart, the lungs, and stomach; and the animal dies asphyxied. Different explanations have, however, been given by different Physiologists, of the cause of death, after dividing the par vagum; but the post mortem appearances incline us to the opinion that asphyxia is the proximate cause.

To prove the influence of the phrenic nerves on the action of the diaphragm, it is only necessary to watch the effects of pricking, irritating, and dividing them. By pricking them with a pin, or scalpel, or irritating them by means of some acrid fluid, the muscle contracts. If the nerves be divided, the diaphragm is paralyzed.

The diaphragm, as we have said, is the principal agent in respiration; the other organs are the intercostal muscles, the abdominal muscles, &c. All these parts are provided with nerves from the spinal marrow. If the spinal marrow be divided above the third cervical vertebra, the respiratory function is put a stop to. If the division be made low in the neck, the intercostal and abdominal muscles will be paralyzed; but the diaphragm will continue its actions. This fact was known to Galen; for amongst other curious experiments, he mentions, that if the spinal marrow be cut at the sixth cervical vertebra, all the parts below the section fall into a state of paralysis, excepting the diaphragm, which moves and supports respiration. These phenomena are easily explained.

We have given the most practical and interesting points in the Anatomy, Physiology, and Pathology, of the structures of the thorax. The student may now remove the viscera for more minute dissection; but as he will, by and by, have to attend to the surgical Anatomy of the subclavian arteries, he must, in taking away the heart and lungs, leave the arch of the aorta, and its vessels; the vena cava superior; the trachea, from a little above its bifurcation into the bronchi; and be careful not to injure the diaphragm, as the particular demonstration of, and practical allusions to this muscle, remain yet to be given.

ABDOMEN.

The abdomen consists of two parts; the abdomen, properly so called, and the pelvis. It is a cavity formed, above, by the diaphragm; below, by the soft parts of the outlet of the pelvis; on the fore part, and laterally, by the abdominal muscles; and behind by the lumbar vertebræ, vertebral muscles, and sacrum.

The viscera, which the cavity contains, are, the stomach, intestines, liver, pancreas, spleen, kidnies, urinary bladder, some of the organs of generation, and certain appendages; all these parts are enveloped wholly, or partially, by a serous membrane, called, the peritoneum, which also lines the walls of the abdomen.

For the sake of pointing out the situations which the different organs of the belly respectively occupy, Anatomists have divided, and subdivided its parietes into regions.

If a line be drawn transversely, about two fingers' breadth above the umbilicus, we define the upper division, which is subdivided into three, by drawing a line on each side, corresponding with the edges of the cartilages of the ribs. The middle of these subdivisions is named, the regio epigastrica vel scrobiculus cordis; in which space we find the greater portion of the stomach, a part of the left lobe of the liver, the pancreas, the duodenum, a part of the omentum minus, the abdominal aorta, the cæliac artery, the vena cava, the vena portæ, and hepatic ducts. The right lateral subdivision is called, the hypochondrium dextrum. It contains the right lobe of the liver, and the gall-bladder. The left lateral, or hypochondrium sinistrum, contains a portion of the stomach, and the spleen.

The middle division of the abdomen is defined, above, by the transverse line already drawn; and below, by another line, which is to be made about three fingers' breadth below the navel. If then a perpendicular line be drawn on each side, from one transverse line to the other, commencing about an inch on the inner side of each anterior superior spinous process of the ilium; we have the three regions of this middle division. The central region is named, regio umbilicalis, and contains the omentum majus, or the principal portion of it, the arch of the colon, the small intestines, a part of the aorta, and vena cava. The lateral spaces, extending to the vertebræ, may be named, the lumbar regions; in the regio lumbalis dextra, we find the ascending colon, the right kidney, and right capsula renalis; in the regio lumbalis sinistra, the descending colon, the left kidney, and left renal capsule.

The remaining part of the abdomen must be divided into six regions, if we wish to fix the relation of the internal to the external parts; these regions are the hypogastric, the two iliac, the pubic, and two inguinal; but the regio pubica, and regiones inguinales, we shall mention elsewhere.

The regio hypogastrica contains the urachus, the remains of the umbilical arteries, the inferior portion of the omentum, part of the intestinum ilium, the termination of the aorta, the common iliac arteries, the vena cava, the common iliac veins, and a part of the ureters. In the regio iliaca dextra, the space corresponding to the centre of the right ilium, are a portion of the intestinum ilium, and the cæcum; and in the female, the right appendages of the womb. In the regio iliaca sinistra, we find the sigmoid flexure of the colon, in lieu of the cæcum; but the other contents are similar to those on the right side.

These divisions and subdivisions of the walls of the abdomen, are of extreme importance, as they enable us to determine what organs are likely to be injured by wounds and blows.

We have here spoken of the relative position of parts, when the body is laid horizontally; but as the viscera change in some measure their situation, when the body is erect, we may be deceived in our opinion as to the organ injured, unless we make an allowance for this circumstance. In the vertical position, the liver gravitates and causes the stomach and intestines to descend; hence the inferior part of the belly is more prominent when we stand, sit, or kneel, than when we repose on the back. Portal alludes to the change of situation which the kidnies undergo, when the body is laid on the belly; in this case, they are at a greater distance from the surface, a fact very essential to be known in the treatment of wounds and ulcers of these organs. To convince himself of this point, he has several times made punctures into the lumbar region, and although he thrust the instrument to the depth of near three inches, the kidnies were not injured; this explains the account given by Douglas, of his having in consequence of the excessive depth of the kidney, attempted in vain to perform the operation of nephrotomy. Stones have been extracted through fistulous sores in the loins, but there is not on record a well authenticated instance where a cut was made through the healthy skin into the kidney, for the purpose of removing calculi from this organ.

Position of body, however, is not the only circumstance which influences the relation of the abdominal viscera, to each other, and to the walls which enclose them. At an early age we observe a remarkable deviation in this respect. In infancy the abdomen is longer and larger in all its dimensions, than at the adult period of life. The diaphragm is less concave towards the belly, and the pelvis smaller; thus the hypochondriac regions, and the regions of the pelvis, are more contracted: the viscera therefore are more in the middle division of the abdomen. The stomach of the child is not transversely, but perpendicularly placed, its pyloric extremity reaching to the umbilicus.

The liver is, proportionately, much larger in the child than in the grown up person: in the former it is situated in the middle division of the belly; in the latter, it occupies the hypochondriac regions. The position of the urinary bladder too is different; its elongated form causing it, when distended with urine, to rise considerably out of the pelvic cavity; but all these variations gradually disappear in the progress of age.

Having premised thus much on relative position, I shall now proceed with a description of the parietes of the abdomen; the disposition of the fibres of the five pairs of muscles, and the parts formed by their aponeuroses, as lineæ, ligaments, &c.

There are five pairs of muscles on the anterior and lateral parts of the abdominal cavity, which are named according to the direction of their fibres. A line, drawn from the ensiform cartilage to the symphysis pubis, in the course of what is called the linea alba, denotes the line of demarcation between the muscles of the opposite sides.

To begin the dissection, an incision should be made through the integument, from the cartilago ensiformis to the junction of the pubes, and then another from the umbilicus obliquely upwards and outwards, over the cartilages of the ribs; this last incision is in the direction of the fibres of the obliquus externus abdominis. This last muscle is to be carefully dissected in the course of its fibres, and the student will find that they run inwards and downwards to terminate in an expanded tendon, or aponeurosis, the attachments of which towards the iliac, and pubic regions, must be particularly attended to. The first attachment to be noticed, is that of the aponeurosis to the anterior superior spinous process of the ilium; from this point, the tendon is extended to the inner extremity of the pubis of the same side, and to that of the opposite bone, forming Poupart's ligament; and here, the tendinous fibres separate, so as to leave a triangular aperture, which is called the external abdominal ring. The other implantation of this muscle, which forms Gimberrat's ligament, will be mentioned when we enter on the particular anatomy of herniæ. We have said, that the muscles of one side of the abdomen meet those on the other, at the linea alba; this line, therefore, is another point into which the external oblique muscle is inserted.

Having reflected the integumens, and exposed the whole of the obliquus externus, the student must observe the umbilicus, the linea alba, the lineæ semilunares, and lineæ transversales. The umbilicus, now and then, yields so as to cause visceral protrusion. The linea alba is formed by the interlacement of the aponeuroses of the opposite muscles; it is, therefore, the general point of insertion. The lineæ semilunares are formed by the union of the aponeurosis of the obliquus externus, to the aponeuroses of the obliquus internus and transversalis. The lineæ transversales are three or four lines, which intersect the recti muscles, and not to be distinctly seen until the anterior part of the sheath of these muscles has been laid open.

The student is now to reflect the external oblique muscle towards the linea alba, and underneath he will find the obliquus internus vel ascendens. Some of the fibres of this muscle take an oblique course upwards, others proceed almost transversely across the abdomen, and others descend obliquely towards the pubis. The muscle is inserted fleshy into some of the ribs, and tendinous into other parts; but the expanded aponeurosis in front has this peculiarity; when it reaches the linea semilunaris, it splits into two laminæ; one lamina goes before the rectus muscle, and under the aponeurosis of the external oblique, to the linea alba; the other layer passes to the linea alba, behind the rectus, excepting at the inferior portion of this muscle, where the whole of the tendon is found on the anterior part of the sheath.

Under the obliquus internus, the student will find the fibres of the transversalis passing from the internal surfaces of the cartilages of the inferior ribs, the transverse processes of the lumbar vertebræ, the crest of the ilium, and Poupart's ligament, to their tendinous expansion, which, with the exception of the inferior part, goes to the linea alba, behind the rectus. From the internal oblique and transversalis, some pale fibres go to the spermatic cord, constituting the cremaster muscle.

How then is the sheath of the rectus muscle formed? is the question which the student will ask himself; the answer is easy. Dividing the recti muscles into fourths, the upper three-fourths of their sheaths will have the aponeurosis of the external oblique, and the anterior layer of the internal oblique on their fore part, and the posterior layer of the internal oblique, and the aponeurosis of the transversalis behind. At the inferior fourth, all the aponeuroses pass before the sheath, hence at this part the peritoneum only lines the posterior surface of the recti muscles.

The recti muscles are now to be dissected, by turning back the fore part of their sheath; the lineæ transversales will then be fully exposed; and in front of the recti, in the same sheath will be seen the fifth pair of muscles called, from their figure, the pyramidales. If one of the recti muscles be now divided across, and the two extremities reflected, the student will be able to observe the peculiar disposal of the aponeuroses, by which the muscle is surrounded. It is only from knowing the direction which the fibres take, that any idea can be obtained of the purposes to which the abdominal muscles are subservient; they all concur in diminishing the capacity of the chest by pulling down the ribs, as in expiration, and therefore are in respiration the antagonists to the diaphragm; they are the auxiliary flexors of the trunk, in which action they antagonise the vertebral muscles; and they all contribute to compress the viscera of the abdomen, which compression is necessary to the due performance of their respective functions.

The organs are constantly compressed, from the walls of the belly having the power of adapting themselves to the parts which they enclose; to talk therefore of the *cavity* of the belly, whilst the viscera are contained within it, is anatomically incorrect. A pointed instrument, entering the parietes of the abdomen, would be as liable to wound one or other of the viscera, as an instrument pushed into the chest would be to wound the lungs. When by any cause an atrophy attacks any of the organs of the abdomen, the muscular parietes contract in proportion to the diminution of size, which the organ has undergone. When, on the other hand, the viscera augment in bulk by disease or other causes, the walls yield so as to accommodate the increase. The abdomen can thus become extremely capacious by collections of fluid, air, &c.

Behind the abdominal muscles, is a polished serous membrane, named peritoneum, which lines the walls, and furnishes a complete or partial envelope to the abdominal organs.

To demonstrate the reflection of the peritoneum, we must describe it as consisting of two bags, which sometimes communicate with each other, by means of the foramen of Winslow; but it is no more possible to say, where this membrane begins, and where it ends, than it is to determine the points of commencement and termination in a circle; but we may imagine such points.

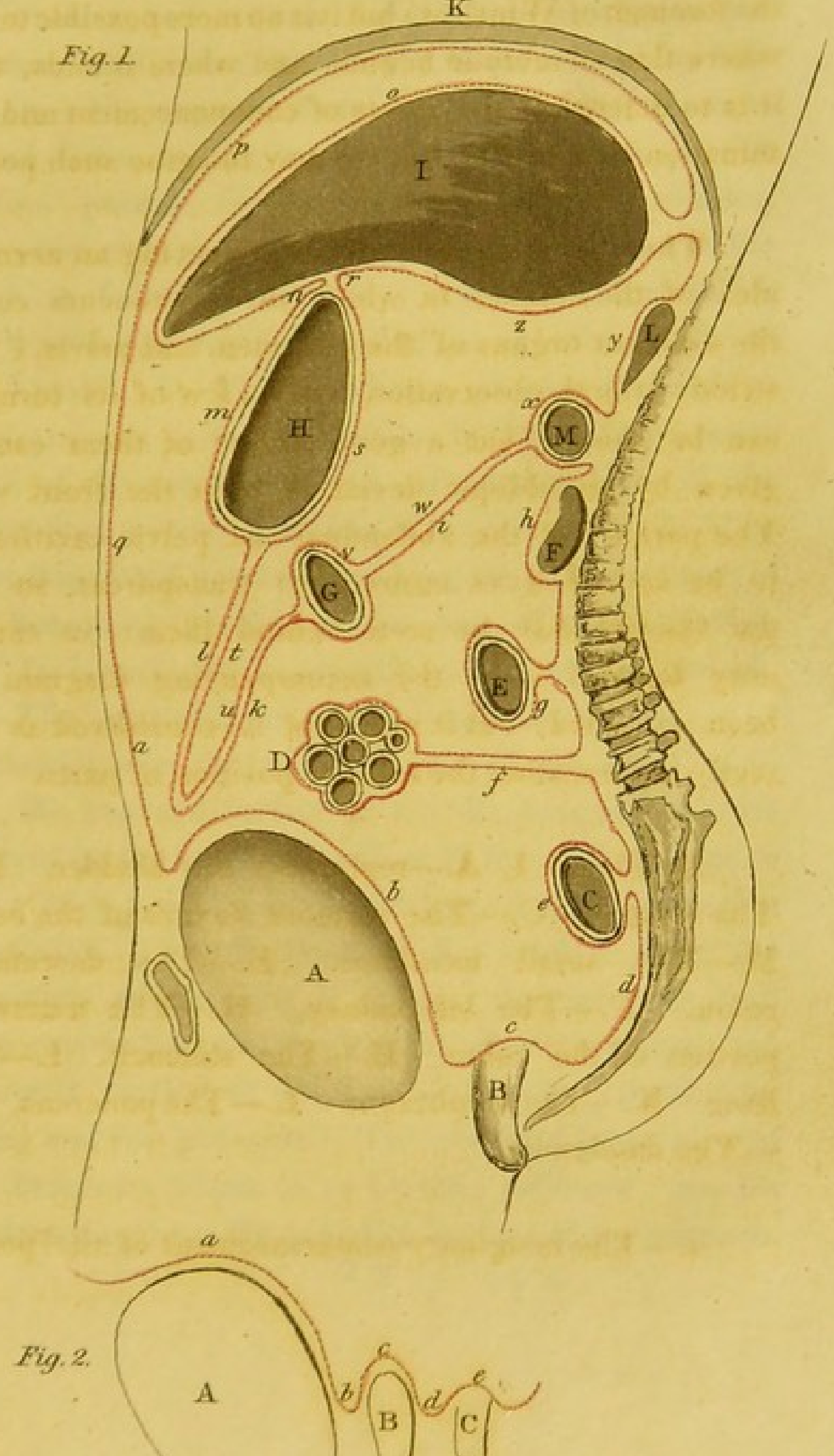
There is much difficulty in conveying an accurate idea of the manner in which the peritoneum covers the different organs of the abdomen and pelvis. In a strictly lateral observation, only a few of its turnings can be shown; but a good notion of them can be given by an oblique deviation from the front view. The parietes of the abdominal and pelvic cavities are to be imagined as entire, but transparent, so that the viscera may be seen behind them: in conformity to this idea, the accompanying diagram has been executed; but it must not be considered as correctly representing the relative position of parts.

In Figure 1, A.—represents the bladder. B.—The rectum. C.—The sigmoid flexure of the colon. D.—The small intestines. E.—The descending colon. F.—The left kidney. G.—The transverse portion of the colon. H.—The stomach. I.—The liver. K.—The diaphragm. L.—The pancreas. M.—The duodenum.

a.—The imaginary commencement of the perito-

A DIAGRAM

of the REFLECTION of the PERITONEUM.



Engraved by T. Fielding

neum, at the posterior surface of the recti muscles. *b.*—Its reflection over the fundus of the bladder. *c.*—Its ascent on the rectum, leaving a pouch between the bladder and rectum. *d.*—Connexion with the sacrum, and reflection on the walls of the pelvis. *e.*—Over the sigmoid flexure of the colon, which is bound down to the venter of the left ilium. *f.*—A portion passing forwards over the small intestines, and after giving a covering to them, returning to the spine to form the mesentery. *g.*—Its reflection on the descending colon. *h.*—On the anterior surface of the kidney. *i.*—The membrane running forwards to the transverse arch of the colon, to form the posterior layer of the meso-colon. *k.*—Posterior layer of the descending portion of the bag of the omentum. *l.*—The same continued upwards, making the anterior layer of the ascending portion of the bag of the omentum. *m.*—Its covering to the anterior surface of the stomach. *n.*—The anterior layer of the omentum minus. *o.*—Reflection over the convex surface of the liver. *p.*—On the concave surface of the diaphragm. *q.*—Its descent on the posterior surface of the recti mnscles to meet at *(a)*, where the larger bag of the peritoneum terminates. To demonstrate the smaller bag, the omentum minus must be broken through, we shall then expose the posterior surface of the stomach, the posterior surface of the arch of the colon, the duodenum, and the pancreas. The posterior layer—*r.*—of the omentum minus is to be thus followed. *s.*—Its continuation over the posterior surface of the stomach.

t.—The posterior layer of the anterior portion of the bag of the omentum, or epiploon. *u.*—It ascends to form the anterior layer of the posterior portion of the bag of the omentum. *v.*—The membrane continued to cover the anterior surface of the arch of the colon. *w.*—Ascending portion making the anterior layer of the meso-colon. *x.*—Continuation over the anterior surface of the duodenum. *y.*—Over the anterior surface of the pancreas. *z.*—Membrane passing on the inferior concave surface of the liver to its imaginary termination at the omentum minus.

Figure 2 represents the reflection of the peritoneum over the pelvic viscera in the female; the difference from figure 1, is caused by the uterus and its appendages being interposed between the bladder and rectum. A.—The bladder. B.—The uterus. C.—The rectum.

a.—Peritoneum covering the fundus and posterior part of the bladder. *b.*—A pouch between the bladder and uterus. *c.*—Reflection over the fundus and appendages of the uterus. *d.*—A pouch between the uterus and rectum. *e.*—Reflection on the rectum. In every other respect the reflection is the same as in the male subject.

The viscera of the abdomen not seen in the diagram are, the cœcum, ascending colon, right kidney, and spleen. Corresponding to the sigmoid flexure of the colon, in the venter of the right ilium, we find the cœcum covered anteriorly, and bound down by peritoneum, like the sigmoid flexure of the colon; the ascending portion of the colon is covered like the descending; and the right kidney, like the left.

The spleen is connected with the left extremity of the stomach, by that portion of peritoneum which goes over its anterior surface, and marked *m* in the diagram, which portion on the right side passes towards the concavity of the liver, to form the anterior lamina of the omentum minus, and on the left side after covering the spleen, it goes to the diaphragm, to connect the spleen and stomach to that muscle.

After breaking through the omentum minus to show the smaller sac of peritoneum, it will be seen that the spleen is loosely joined to the pancreas by that portion of the membrane which gives an anterior covering to the pancreas and duodenum, thus it is wholly encircled by peritoneum.

These views of this reflected membrane teach us, that some of the organs of the abdomen are only partially, whilst others are completely invested by it. The bladder, rectum, cœcum, kidnies, duodenum, and pancreas are only partially covered, all the rest are wholly so.

Some anatomical writers have described this membrane as consisting of three parts, a middle, an inferior, and a superior; but this view is objectionable, as it does not give us an exact idea of its continuity.

The peritoneum answers two important uses, viz.—to retain the viscera in their situation, and to secrete a serous fluid to lubricate the surfaces of the organs, and to prevent their adhesion to each other. The secretive function of this membrane may be affected by the same causes as those which affect the pleura. A morbid collection of its fluid is called ascites, and may arise from inflammation, debility, or organic disease. The operation of paracentesis is justified when the accumulation is so excessive as to occasion urgent symptoms by its pressure, but it has only a palliative effect when the dropsy results from visceral disease.

The student will now examine the relative position of the abdominal organs; he will observe the form, the transverse position, the surfaces, the curvatures, and the extremities of the stomach; the extremity in which the œsophagus terminates, is called the cardia; that from which the intestines proceed, is named the pylorus. He will then follow the course of the intestinal canal, consisting of the duodenum, jejunum, and ilium, or the small; and the cœcum, colon and rectum, or large intestines. The duodenum is in great measure concealed until it emerges from the mesocolon, where it ends. The jejunum and ilium are much alike in their external appearance. The cœcum is remarkable from having an appendage named appendix vermiformis, and a valve which prevents the retrogade movement of the fæces. The colon consists of the ascending, transverse, descending, and sigmoid portions; and this gut nearly surrounds the small intestines. The rectum occupies the venter of the sacrum to which it is attached by peritoneum.

In the liver, the students will observe the ligaments, and four lobes, viz.—the right lobe, the left lobe, the lobulus Spigelii, and the lobulus quadratus; also the situation of the gall-bladder and the porta; he will expose the parts contained in Glisson's capsule, viz.—the hepatic artery, the vena portæ, the ductus hepaticus, the ductus cysticus, the ductus communis choledochus and nerves; and afterwards he will cut into the substance of the liver, in order to observe its parenchyma.

The pancreas is next to be noticed; the duct will be found in its centre, and if a probe be introduced into it, the instrument will pass into the duodenum, by the orifice common to it, and the ductus communis choledochus, or by a distinct aperture.

The spleen is the remaining chylo-poietic organ, and is situated at the left extremity of the stomach.

Having examined the structure of the stomach, intestinal canal, liver, pancreas, and spleen, the student will acquaint himself with the situation of the kidnies, ureters, and urinary bladder. This last organ is situated in the pelvis, where it is connected with the rectum in the male, and with the uterus, and its appendages, in the female.

All the abdominal organs derive their arterial blood from arteries coming off from the aorta. The cæliac supplies the stomach, liver, pancreas, and spleen; the superior and inferior mesenteric arteries supply the small and large intestines; and the renal, or emulgent, furnish blood to the kidnies.

The nerves are derived from the par vagum, and grand sympathetic. Plexuses are found near the origins of the arteries, and from these the nerves pass off to the different organs.

All the viscera of the abdomen are liable to inflammation, and its consequences, but some of them are subject to particular morbid changes.

Inflammation may be occasioned by a variety of causes, but some organs are exposed to it from situation, and function. The stomach, for example, from being the receptacle of what we eat and drink, is more susceptible of being abused than any other organ; and with truth it may be asserted, that it is the nursery of more diseases than any other viscus.

If we have studied the characteristics of inflammation in general, we shall seldom be at a loss in detecting its presence; but inflammation of certain organs offers varieties which must be understood.

The state of the pulse is in most cases a criterion; but there are exceptions to this rule. In gastritis and enteritis the pulse is unlike to that in hepatitis; in the two first, it is small and frequent; in the last, tense and strong; but in both these cases, copious depletion is indicated. The pain too varies according to the seat of inflammation, particularly in such organs as the liver, and lungs. When the investing membrane is affected, the pain is much more acute, than when the parenchyma, or substance of the organ, is the seat of disease; the unyielding and compact nature of membranous structure is probably the cause of this fact. In parenchymatous inflammation the pain is dull and heavy, and this is the symptom which marks the difference between it, and inflammation of the enveloping membrane.

A change of structure in the mesenteric glands, accompanied by obstruction, is productive of a morbid phenomenon, of much importance to be known. We have said, in another part of the volume, that the lacteals, in their course from the small intestines to the thoracic duct, pass through these bodies; it is obvious then, that if they should be disorganized, and obstructed by disease, the nourishing product of the aliment cannot be transmitted to the blood, and miras-mus, or emaciation, must ensue, because the system cannot be supplied with its due and proper support. This explains the common characteristics of tabes mesenterica.

Before the student removes the chylo-poietic viscera for more minute examination, he should reflect on the relations of the liver, stomach, and spleen, to the diaphragm; and how the organs of the chest and abdomen may thus be reciprocally affected.

In inspiration, the diaphragm descends, so as to enlarge the capacity of the thorax; this descent produces a change in the situation of the liver, stomach, and spleen, but more especially of the right lobe of the liver. This organ, we have said, also descends by its own weight, when the body is erect, or in the sitting posture. In exploring its diseases then, we should bear these facts in mind, and make the examination when the patient is sitting, or standing; allowances being given for that encroachment of the liver on the abdomen, which position and inspiration occasion.

When the liver, or spleen is much enlarged, it prevents, in some measure, the descent of the diaphragm and difficulty of breathing, is the result. On the other hand, the diaphragm may be pressed downwards, and prevented from ascending by a collection of water in the chest; in this case, the liver would be projected, and be more distinct to the touch, than in its natural state. These circumstances, which mechanically alter the position of the organs in connection with the diaphragm are of great importance.

Having taken away the abdominal viscera, (the urinary organs, and rectum excepted,) the student will dissect the diaphragm. After stripping off the peritoneum which covers it, he will find the muscular fibres radiating to a tendinous centre, this is the larger muscle; the smaller lies on the sides of the bodies of the last dorsal, and the three or four lumbar vertebræ, and passing towards the same centre as the larger muscle, form, what are called the crura, or pillars of the diaphragm.

The diaphragm is pierced with three openings, viz.—one opening for the passage of the aorta; another on the right side for the vena cava; and a third for the œsophagus.

The arteries of this muscle are the phrenic, which are branches of the aorta; the nerves we have already considered.

The pectoral surfaee of the diaphragm is intimately united to the pericardium, and the pleura, by which it is separated from the heart and lungs. Its abdominal part is connected, more or less, with the liver, stomach, spleen, pancreas, duodenum, and kidnies. Its physiological relations are exceedingly numerous; it is the principal agent in respiration; it assists circulation, digestion, absorption, and other functions; and possesses exquisite sensibility, and sympathy. Its pathological reports are not less numerous or less important: many of these reports have been already spoken of.

How essential the regular and uninterrupted functions of the diaphragm are to the health of the body, may be inferred from the exalted character which it held amongst the ancients, who considered this muscle, the heart and brain, as the triumvirate of human life.

The student will now turn his attention to the PELVIS, its contents, and parts in connection with them, for in their practical references they are in many respects distinct from the viscera of the abdomen.

The bony structure of the pelvis must first be studied; it is a point of necessity which cannot be too urgently enforced. If midwifery be the object of inquiry, a knowledge of the bones of the pelvis, and of the dimensions of its different parts, is the introduction to that science. In the performance of one of the most serious operations in surgery, the prominent points about the outlet of this cavity, serve as guides. In cutting for the stone, we feel for the arch of the pubes, begin the incision just below it, and extend it downwards midway between the anus and tuberosity of the ischium; the arch of the pubes, and tuber ischii are fixed points, and easily felt under their soft covering, and in a general way the Surgeon cannot do wrong, if he governs his first incision by them.

The bony pelvis has an articulatory surface above, for the last lumbar vertebra, and two hollows or sockets below, for receiving the heads of the thigh bones. There is an expansion formed by the ilia; below that a contraction called the brim; then a cavity; and lastly the outlet. In the adult, the pelvis is composed of four bones, viz.—the sacrum, os coccygis, and two ossa innominata. In the young subject, each os innominatum consists of three distinct portions of bone, the iliac, ischiatic, and pubic; but by age the three portions become one.

The connection of the bones of the pelvis to the spine, and to each other, is rendered firm by strong ligaments. The junction of the sacrum to the ilium on each side, is called the sacro-iliac symphysis; that of the pubes on the fore part, the symphysis pubis. The bones are so firmly bound together, as to preclude almost the possibility of dislocation. A weight (as the wheel of a loaded carriage) might separate the junction between the sacrum and ossa innominata, and flatten the bones; but a fracture would be likely to occur at the same time. The danger of this accident would be in proportion to the injury, which the pelvic viscera sustained by the crush.

After the student has made himself acquainted with the prominent parts of the pelvis, he must observe its axis with regard to the trunk, and that of its brim, cavity, and outlet with respect to each other, for the viscera partake of the same bearing as the cavity in which they lie. He must then notice the changes which take place in its axis, in the different positions of the body, as when the body is erect; when the thighs are partially bent; and when approximated to the abdomen as in the position of the patient for lithotomy; it will be found that these different postures vary the position of parts in a notable degree. When the Surgeon ties the legs of his patient, and bends them towards the abdomen, the axis of the pelvis, and that of the trunk, are brought nearly to correspond: every deviation from this position causes a change of axis; and when the thighs and legs are extended, the pelvis is placed at a considerable angle.

The soft parts which line the pelvic cavity, are the next subject of inquiry; some of them can be shown without interfering with the viscera; but those of the outlet must be examined in another stage of the dissection.

The fossæ of the ilia are occupied by the iliaci interni muscles; and each iliacus tendon passes over the fore part of the pelvis, to be implanted into the trochanter minor of the thigh-bone. On the inner side of this muscle, is seen the psoas magnus, which arises from the sides and transverse processes of the last dorsal and four first lumbar vertebræ, and descends to be inserted into the trochanter minor. The iliacus internus, and psoas magnus, are covered by a thin aponeurotic membrane, named, the fascia iliaca, which will be spoken of at another time, as contributing to form the sheath of the femoral vessels; and over this membrane, we find the peritoneum. In addition to the use which these muscles have in bending the thigh on the trunk, they afford a cushion-like support to the intestines, and the gravid uterus in the female.

Certain arteries, veins, and nerves, must now be noticed. The common iliac artery and vein are seen at the inner edge of the psoas muscle; they soon divide into the internal and external iliac branches.

The student should observe the situation of the common iliac, which has been tied by Dr. Stevens. This operation might be rendered necessary by aneurism of either of the branches of the internal iliac, or of the trunk of the external iliac, when the tumour extends to the origin of the vessel.

On the iliacus internus, and psoas magnus, are some twigs of nerves, which pass out under Poupart's ligament to supply the upper part of the thigh; they are principally cutaneous branches. The anterior crural nerve must be next exposed, and its course followed. The dissection of the obturator nerves, and others, must be deferred until the pelvic organs have been examined; they ought then to be looked for, as a knowledge of their origin, course, and distribution, assists us in explaining the numbness, pain, and cramp, in the thighs and legs, during the progress of parturition, and why, in the different stages of labour, the painful sensations are referred to different situations.

In the male subject, the cavity of the pelvis is less capacious than in the female, as it contains fewer organs. Anteriorly is seen the urinary bladder, which is attached to the pubes before, and situated in the pubic region. When empty, the fundus, or upper part of this organ, is nearly on a level with the upper edge of the ossa pubes; when distended, it rises in the pelvis; and at its utmost distension, it reaches nearly to the umbilicus. Behind the bladder is the rectum, which takes the curve of the hollow of the sacrum; and between the bladder and rectum, is a pouch, formed by peritoneum. The student knows, from the view which we have before given of this membrane, that after leaving the recti muscles, it passes over the fundus, and posterior surface of the bladder, to near its cervix; it then ascends over the fore part of the rectum, and attaches this portion of intestine to the venter sacri, by a process called meso-rectum. The neck of the bladder, then, and inferior part of the rectum, are not covered with peritoneum; there is left a triangular space, the apex of which is formed by the prostate gland, and the sides by the vesiculæ seminales; it is in this space that we puncture the bladder from the rectum, in retention of urine, where less formidable means have been had recourse to without effect. The opening is made in a dependent situation, and without the risk of wounding the peritoneum.

The perinæum is now to be dissected. In reflecting the integuments, the student must pay attention to the dense fascia of this part, which is the cause of the distressing consequences of a suppuration in perinæo, and explains why abscesses, in this situation, are so much disposed to become fistulous. When matter forms, it cannot easily determine itself to the surface, on account of the great thickness of the anterior wall of the abscess; the pus, therefore, burrows amongst the loose cellular membrane, and gives rise to extensive mischief. To obviate this effect, it is required that we should make an early opening with a lancet.

Having exposed the muscles of the perinæum, the arteries, the bulb of the urethra, the membranous portion of the canal, the prostate gland, and the connection of all these parts to the rectum; the student must apply his Anatomy to surgical purposes. He must reflect on the infiltration of urine in the cellular membrane of the perinæum, as being not an unfrequent cause of death after lithotomy; he must consider the parts to be cut in the lateral operation for stone, and the stages of the process; the new proposal, by M. Sanson, of cutting from the rectum into the bladder, which operation he calls the "recto vesical"; the operation of puncturing the bladder, from the rectum, for the discharge of urine in case of unmanageable obstruction in the natural passage; the nature of fistula, in perinæo; fistula in ano; diseases of the rectum; and the treatment which they respectively require.

Another examination of the pelvic viscera may now be made, by separating the left os innominatum at the sacro iliac junction, and sawing through the pubis, at a little distance from the symphysis; by thus removing one side of the pony pelvis, we obtain a lateral view.

When the bladder is partially inflated from the ureter, and the rectum stuffed with hair or tow, the relation of these parts to others, will be more clearly seen. The ureter will be observed descending to the bladder; the vesicula seminalis lying near its cervix; the vas deferens passing downwards; the prostate gland surrounding the neck of the bladder; the membranous part of the urethra beyond it; and the turnings of the peritoneum can now be easily traced over the bladder and rectum.

Let the student now examine the urinary and genital organs in a particular manner. He should observe the form and structure of the bladder, the termination of the ureters obliquely between its coats, the internal orifice of the urethra, the prostate gland, and the structure and appearances of the urethra throughout its whole course.

The urethra extends from the neck of the bladder to the extremity of the penis; not in a straight, but curved line. From its commencement, it proceeds downwards and forwards through the prostate gland, and under the symphysis pubis. It afterwards passes through the spongy body to the extremity of the penis. In the first place, it is in the prostate gland; then in the membranous part; and lastly, in the corpus spongiosum. The prostatic portion of the canal is about one inch in length; the membranous the same; and the spongy, about seven inches; nine inches being the usual length of the urethra. The canal is not of the same size throughout its whole extent. It is dilated near the bladder; contracted in the prostate; still more contracted in the membranous portion; dilated in the glans; and contracted again at the orificium urethræ.

On slitting up the urethra, we find it lined with a mucous membrane, and we expose the large lacunæ, near the glans, which furnish the morbid secretion discharged in gonorrhœa; and the verumontanum, near which, the ducts of the vesiculæ seminales, vasa deferentia, and prostate gland open. It is necessary that the curvatures of the urethra should be known; also the situation of the dilated and contracted parts of it: the curvatures, in order that we may give to a catheter the proper bend; the dilatations and contractions, in order to avoid mistaking a natural for a morbid straightening of the passage, an error which has occasionally happened. We might with propriety make, in this place, some observations on the introduction of the catheter, sound, and bougie; but in a general way, the operation only requires a knowledge of the Anatomy of the urethra, to ensure its easy accomplishment.

If a comparison be made between the pelvis of the male, and that of the female, obvious differences will be seen, both in capacity and form. The ilia are more expanded in the latter, the brim is more oval, the cavity more capacious, and the outlet larger; but the depth of the pelvis is less in the female subject than in the male. In an obstetric point of view, it is necessary to bear in mind the depth of the pelvic cavity in its different parts; behind, it measures in the standard pelvis, from five to six inches; anteriorly, about two inches; and laterally, from three inches and a half to four inches.

In the dimensions given of the brim, cavity, and outlet, the student should consider whether it is understood that they are taken *without*, or *with* the soft parts of the pelvis. At Lectures on Midwifery, the measurements are usually demonstrated on the dry bones, and the Lecturer states what they are in that condition of parts; but it is to be remembered, that if the pelvis measures from the top of the sacrum to the symphysis pubis, four inches and a half, or four and three quarters, in the dried state, the presence of the soft parts would reduce the dimensions one inch, or more. The standard pelvis measures at the brim, from sacrum to pubes, about four inches and a half without the soft parts, and about three inches and a half with them. From one linea ileo-pectinea to the other, about five inches and a quarter without, but not more than four with the soft parts; the longest diameter of the brim then, is from side to side: in the outlet it is reversed, for the shortest diameter is from one tuberosity of the ischium to the other; the distance being about four inches and a half without, and four with the soft parts. From the extremity of the os coccygis to the under edge of the symphysis pubis, we have full five inches and a half in the dry bones, and about five in the recent subject; but we may consider this distance as capable of being increased in young females, in consequence of the mobility of the coccyx.

The dimensions of the fœtal head at the full period of utero gestation, are, in a general way, as follow:

The longest line is from the vertex, or crown of the head to the chin, which is from five inches, to five and a quarter. A line drawn from the forehead to the upper part of the occiput, will measure about four inches and a half. The shortest line is from the protuberance of one parietal bone to the other, which is not more than three inches.

It will be obvious by this comparison of the admeasurements of the pelvis, and the child's head, that there is ample room for the latter to pass through the apertures of the former, without the least compression of the bones; but how is the delivery accomplished when the pelvis measures, from sacrum to pubis, very much less than natural?

Dr. Merriman tells us, in his "*Synopsis of Difficult Parturition,*" that Dr. Osborne, who took great pains in investigating the best method of procedure in cases of distorted pelvis, considers that a fœtus, at full maturity, cannot pass alive, if the dimensions of the pelvis from the pubes to the projection of the sacrum, be only two inches and three quarters; and Dr. Clarke, of Dublin, says, that three inches and a quarter, from the pubis to the sacrum, is the least diameter through which he has known a full-grown fœtus to pass *entire;* but as it has been ascertained by Dr. Hamilton, that children have been born living, through a pelvis in which this diameter was "manifestly under three inches," it is necessary that practitioners of midwifery should be very much upon their guard against being deceived in their estimate of the actual dimensions. Let, however, *three inches* be the space through which a fœtal head *can* pass, and we shall be able to form a pretty good idea of the pressure which the bones of the cranium must experience, and of the diminution in size which the whole head must undergo, in order to be propelled through the apertures of the pelvis. We may infer, from these facts, how desirable it is, that we should possess the means of judging whether there is sufficient space in the pelvis for the head to pass, without that artificial assistance which is incompatible with the life of the child: instruments, called pelvimeters, have been invented for the purpose, but they are uncertain, and therefore seldom used in this country; we must subscribe to the opinion of the able Accoucheurs, Haighton and Burns, that the hand is the best pelvimeter; the size of the pelvis being determinable with tolerable accuracy, by the number of fingers that can be passed into its different parts.

The female pelvis is a subject which might lead us to extend our remarks; but the reader must consult Works exclusively devoted to the obstetric art.

I must here recall to the student's recollection, the observations which we made on the soft parts bounding the pelvic cavity; they apply equally to the female as to the male subject; but in the viscera there is a difference. The organs of the pelvis in the female are, the urinary bladder, the uterus and its appendages, and the rectum.

The bladder is situated in the fore part; the rectum, in the back part; and the internal organs of generation, between the two; and this intervention of the vagina, uterus, and its appendages, constitutes the principal difference between the pelvic viscera of the male, and those of the female. The reflection of the peritoneum may be followed over the bladder, as in the male subject. When it reaches the inferior part of that organ, it ascends over the anterior face of the vagina and uterus, leaving a sort of pouch between the bladder and the womb; it then expands, to form the ligamenta lata, in which the fallopian tubes and ovaria are involved; and afterwards it gives the posterior face of the uterus and vagina a covering. The membrane then ascends upon the anterior face of the rectum, and spreads into two lateral folds. Between the uterus and rectum, a pouch is formed, similar to that between the bladder and womb, but it is much more distinct.

The student will now understand a difficulty occasionally occurring to the passing of the catheter, viz.—a diversion of the urethra from its natural course. From the attachments between the viscera of the pelvis, by peritoneum, it is plain, that any thing which could cause a change in the natural position of the womb, would also tend to alter more or less the position of the bladder. When the uterus, during gestation, rises in the abdomen, the bladder is carried upwards, and forwards; hence the urethra, instead of being nearly horizontal, becomes preternaturally curved. On the contrary, the uterus, instead of rising, sometimes falls, as in prolapsus and inversio uteri, in which cases the urethra is dragged in a direction downwards.

Other circumstances may occasion a distortion of the urethra, as malformed pelvis, extreme corpulency, &c.; the cause must lead us to suspect the course which the urethra has taken, and the introduction of the catheter performed accordingly.

A side view of the pelvic viscera in the female is to be obtained in the same way as in the male; the urinary bladder is to be inflated, and the vagina and rectum stuffed with hair, or tow. The student will observe the ureter on the left side; the bladder, behind the pubes; the uterus, its appendages, and vagina, behind the bladder; and the rectum, posterior to the whole. In this view of parts, the remarkable inflections of the peritoneum will be very apparent.

The urethra will be observed to be about one inch in length, and in its course under the arch of the pubes, to describe a slight curvature, the concavity of which is upwards. The meatus urinarius, or external opening, is situated just under the symphysis pubis, and a little above the orificium vaginæ. At its extremity, it has a button-like projection, which, in the the living subject, is perceptible to the touch; but in the dead, more flaccid and indistinct. This is the opportunity for the student to practice catheterism in the female, a most delicate operation, and in which the tactus eruditus is the only guide permitted us.

Lithotomy in the female consisted, formerly, in cutting the urethra by means of a probe-pointed bistoury directed on a staff, previously introduced into the bladder; but this operation is likely to be superseded by that of dilatation; the urethra having been found susceptible of considerable extension, by pressure exerted on its side. An ingenious instrument for the purpose has been invented by Mr. Weiss, in the Strand, at the suggestion of Sir Astley Cooper; and in the Twelfth Volume of the "*Medico-Chirurgical Transactions*," a Paper will be found, by Sir Astley, giving an account of operations in which the dilator was successfully employed.

As the student has examined the parietes of the abdomen, and the relative position of the contents, he will be induced to consider the nature and consequences of wounds.

On the abdomen receiving a stab with a sharp instrument, what are the circumstances which should lead the Surgeon to form a judgment on the mischief which has been produced, and the probable issue of the case? The first thing to be considered, is the depth of the wound; if it be superficial, that is, if confined to the walls of the abdomen merely, we have less to fear than if the instrument had penetrated the cavity; for in this case the peritoneum would be injured, and most probably some of the viscera; but we are not too hastily to pronounce a favourable prognosis, even in wounds not communicating with the cavity. If the integument only be incised, or punctured, the accident is trivial, and need not excite any alarm; but when the aponeuroses of the abdominal muscles suffer, the case is alarming, as we know that injuries of tendinous structures are not easily repaired. The issue may be inflammation, suppuration, and sloughing; if matter forms, it will burrow behind the aponeuroses, and we can now easily predict the consequences unless an exit is given to it by an artificial opening. The structure then of the anterior part of the parietes of the belly, renders the event of wounds of this part more dangerous than superficial wounds of the chest, and of almost equal danger with those of the coverings of the cranium.

If the instrument has pierced the peritoneum, (and the viscera, by good fortune, have escaped injury), we have to apprehend, in addition to the preceding effects, that the peritoneum will inflame; and that the inflammation will spread from the lining to the reflected portions of this membrane: we have here very formidable circumstances to combat; but these circumstances are still more serious, when complicated with visceral wounds, for they may give rise to extravasation of blood in the abdominal cavity, or other fluids, as chyme, chyle, fæces, bile, or urine, according to the natural contents of the wounded organ.

I shall not enter on the symptoms which characterize wounds of the different abdominal viscera; but the student must make himself acquainted with them, and the most approved methods of treatment

ON THE

UPPER EXTREMITIES.

In order thoroughly to understand the relative situation of the soft parts of the upper extremity, certain preparatory information is necessary, and this I shall, in a brief way, put the student in possession of.

The soft parts are more or less connected with hard ones, and the muscles act upon the bones through the medium of joints; a knowledge of the bones and joints should therefore precede any other inquiry.

Two bones enter into the composition of the shoulder, viz.—the clavicle, and scapula; the clavicle is attached at one extremity to the sternum and first rib; at the other, to the acromion scapulæ; and it forms an arch over the nerves and vessels going to the axilla. The scapula is confined to the trunk, posteriorly, by means of muscles only. The clavicle, and edges of the shoulder-blade, are to be felt through their coverings, so too are the spine, coracoid process, and acromion of the latter bone; thus, a derangement from fracture or dislocation is easily recognised.

The shoulder-joint is formed by the scapula and os humeri.

It is of the orbicular, in other words, of the ball and socket kind. The glenoid cavity of the scapula is shallow, the head of the os humeri large; hence they are not so closely fitted to each other, as the caput femoris is to the acetabulum. It is this circumstance, in a great measure, which gives to the shoulder-joint its great extent of motion, and to it is owing its liability to dislocation; for great freedom, and great strength of articulation are not compatible with each other. The shoulder-joint has a capsular ligament only; this, however, is strengthened by the aponeurotic expansions of the muscles of the scapula. The tendons of the supra spinatus, infra spinatus, subscapularis, and teres minor muscles, are spread upon the capsular ligament; and but for this, the os humeri would be much more frequently dislocated than it is. What serves additionally to prevent this accident, is the tendon of the long head of the biceps muscle, which passes through the joint on its fore part.

In the dry bone the glenoid cavity is very superficial, but in the recent subject it will be observed to be less so; for around the edge of the cavity a ligamento-cartilaginous substance projects, by which the socket is deepened the eighth of an inch or more.

It is contended by some Surgeons, that the os humeri may be completely dislocated in four directions, viz.—upwards, downwards, forwards, and backwards, but Sir Astley Cooper mentions the three last only; if the first, or dislocation upwards should happen, it must undoubtedly be complicated with fracture of the acromion process of the scapula, seeing that that process advances considerably over the upper part of the joint.

The arm consists of one bone, the os humeri, which has a rounded head above; and an irregular extremity below, formed by the projecting condyles, and the articular surface for the ulna, which is between them. The other remarkable points of this bone are supposed to be understood by the student.

The elbow-joint is of the hinge-like description, and capable only of flexion and extension. The humerus terminates in an articulatory surface, on which the ulna plays; and on the outer side of the ulna, is the radius, or other bone of the fore-arm, the head of which is applied to the extreme point of the external condyle of the humerus. The ligaments of the elbow-joint are strong; there is an external lateral, an internal lateral, an oblique, and a capsular; besides these, there are ligaments connecting the radius to the ulna. The movements of the former bone on the latter are called, pronation, and supination; pronation, when the palm of the hand is turned downwards; supination, when turned upwards. The elbow-joint is also strenthened by the tendons of muscles; thus behind, we find the expanded tendon of the triceps, which is attached to the olecranon process of the ulna; and on the fore part is the brachialis internus, which is attached to the coronoid process, and the body of the bone.

Notwithstanding the great strength of the elbow articulation, it is occasionally dislocated. The most common dislocation is backwards. A lateral one, now and then occurs; but a dislocation forwards cannot happen without a fracture of the olecranon ulnæ.

The fore-arm is composed of two bones; the radius, and ulna, which are united together, throughout nearly the whole of their length, by the inter-osseous ligament. The radius must be considered as the only bone of the fore-arm which enters into the composition of the wrist-joint, it is applied to the lunar and scaphoid bones: the joint of the inferior extremity of the ulna is quite distinct from that of the wrist. The ligaments of the carpal-joint are, the two lateral, the anterior, the posterior, and the capsular. Dislocation may take place either backwards, forwards, inwards, or outwards, and either one, or both bones may be displaced.

The carpus has eight bones; the metacarpus, five; the fingers, three; and the thumb only two. Between the first and second row of carpal-bones, there exists a perfect joint, with a capsular and other ligaments. The bones of the carpus are joined to those of the metacarpus by capsular, and interosseal ligaments. The digital joints have a capsular, and lateral ligaments.

About the wrist, there are bursæ mucosæ, connected with the sheaths of tendons; the disease, called *ganglion*, consists in a preternatural accumulation of the natural secretion of the lining membrane of the bursa; and the carpus is a part of the body where this disease more commonly occurs, than any other. We are to be careful not to mistake one of these swellings for aneurism. Mr. Burne has given a case in the Sixty-seventh Number of the "*Edinburgh Medical and Surgical Journal*, where this happened. The tumour was situated precisely in the course of the radial artery, it had an evident and general pulsation, and entirely disappeared on the application of firm pressure; but on the removal of the pressure, it re-assumed its former size. Mr. Burne, and other Medical Men, pronounced it an aneurism. Subsequent examination, however, convinced them that the tumour was a ganglion, and that its gradual enlargement had raised the arteria radialis from its natural situation; the latter being found, on an attentive inspection, to pass over the swelling.

These are the prefatory remarks which I deem essential prior to entering on the muscles, blood-vessels, and nerves. They may appear to the student as premature, as he cannot examine the joints until the muscles are removed; but I would ask, can he understand the actions of muscles without a previous knowledge of the mechanism of the joints? Certainly not; he must therefore avail himself of the means which every dissecting-room affords, to gain the necessary preliminary information.

Before commencing the dissection, the student should familiarize himself with the relation of the hard to the soft parts. He can easily trace the clavicle from its sternal to its scapular extremity. Behind the clavicle, is the first rib, over which the subclavian artery passes; and in a depression under the scapular end of the collar-bone, the artery may be compressed so as to command the circulation of the blood in the arm. The acromion scapulæ is superficial. The head of the os humeri may be felt by the fingers, in the axilla, when the arm is raised. The condyles of the os humeri, and the olecranon ulnæ are prominent points at the elbow-joint, and the styloid processes of the radius and ulna, at the wrist. By knowing the natural situation of these hard parts, the student acquires the means of detecting injuries of joints.

I do not think it necessary to give a description of the origins, insertions, and individual uses of the muscles of the extremities, for it cannot be expected that this volume should supply the place of a Manual of Dissections, for the aim of it is different; but after the student has exposed and dissected them, the following remarks on their conjoint actions must be attended to.

From the manner in which the clavicle and scapula are articulated, it is obvious that they can be raised, or depressed, pulled forwards, or drawn backwards. The muscles which raise them are, the levator scapulæ, and the superior fibres of the trapezius; those which depress them are, the pectoralis minor, subclavius, and serratus magnus; and they serve to pull them forwards. Those which draw the scapula, consequently the clavicle backwards, are, the rhomboidei, and transverse fibres of the trapezius; and by its influence on the os brachii, the latissimus dorsi would contribute rather powerfully to produce this motion. These four actions may be called *direct*, because there are specific muscles to perform them; but there are others of a combined nature; that is to say, requiring for their performance, a combination or alternation of forces; thus, if two opposite muscles act at the same time, the clavicle and scapula would neither be drawn in one direction, nor in the other, but would be intermediately fixed, if the acting muscles be equally antagonized: the conjoint actions of muscles produce what may be called compound movements. If there be an alternate action of muscles, the bones partially revolve upon their axis; the scapula is raised by the upper fibres of the trapezius and levator scapulæ, and depressed by the serratus major anticus; thus, these muscles are rotators of the scapula.

The shoulder-joint has a very extensive degree of motion, from the scapula affording a very superficial lodgement for the head of the os humeri. We can carry the arm forwards, which is called extension; backwards, flexion; from the trunk, abduction; towards the trunk, adduction; and the os humeri may be made to revolve, which is called rotation. When we carry the arm forwards, the pectoralis major, the anterior portion of the deltoides, the coraco brachialis, the subscapularis, and the biceps, are called into action. When in an opposite direction, the posterior fibres of the deltoides, the latissimus dorsi, teres major, teres minor, and triceps, act. Abduction is performed by the deltoides, and the supra and infra spinati muscles. Adduction, by the pectoralis major, and latissimus dorsi. Rotation inwards, by the subscapularis, anterior fibres of the deltoid muscle, latissimus dorsi, and teres major; and rotation outwards, by the posterior fibres of the deltoid muscle, the infra spinatus, and teres minor.

The elbow-joint is hinge-like, and capable only of flexion and extension. The flexors are, the biceps, and brachialis internus. The extensors are, the triceps, and anconeus. But the radius moves upon the ulna, producing the motions called pronation and supination. The pronators are, the pronator teres, pronator quadratus, and flexor carpi radialis. The supinators are, the biceps, supinator radii longus, supinator radii brevis, extensor ossis metacarpi pollicis, and extensor primi et secundi internodii pollicis.

The motions of the wrist are, flexion, extension, abduction, and adduction.

The flexor muscles are on the anterior part of the bones; the extensors, on the posterior part; the abductors, on the radial side; and the adductors, on the ulnar side of the fore-arm.

The thumb can be moved more extensively than the fingers, but not in more directions. The motions of both are, flexion, extension, abduction, and adduction.

The student is now to apply what he has learnt of the actions of muscles to the explanation of those signs of fractures which are furnished by deformity of limb, or displacement.

When the clavicle is broken, we discover the nature of the accident by observation on the form of the shoulder, and by passing the fingers along the body of the bone, which will present an irregularity; this is occasioned by the extremity of the internal fragment projecting above the external one; it is not, however, the inner, but the outer fragment that is displaced, and Anatomy tells us why it is so. Above the inner portion, is the attachment of the sterno cleido mastoideus muscle, and opposite to it, below, is the origin of a part of the pectoralis major. If either the clavicular portion of the sterno cleido, or that of the pectoralis major, were to contract alone, the fragment would be drawn upwards, or downwards, according to the muscle that is in action; but when both act at the same time, the bone is fixed at an intermediate point, in accordance with a well known law in muscular motion; and this is one of the reasons why the inner fragment is stationary; but there is another cause arising from the clavicle being joined to the sternum, and first rib, by means of strong ligaments; hence the security is two-fold. Let the student now carry his observation to the outer fragment, and he will find adequate reasons for its displacement. The clavicle is the chief support of the upper extremity; consequently, when broken, the arm falls, and carries the scapular extremity of the clavicle along with it; the fragment is thus lowered, and it is then drawn inwards by the subclavius muscle; these are amongst the signs which indicate a fractured collar-bone, and there is no difficulty in explaining them, after the ligaments and muscles, connected with the bone, have been properly examined.

When the acromion scapulæ is fractured, the rotundity of the shoulder is lessened, and the form of it changed, because the arm falls, the deltoid muscles, or those fibres which arise from the acromion process, pull the fragment downwards, and the levator scapulæ, and upper portion of the trapezius muscle, elevate the body of the scapula.

To restore the acromion to its natural situation, the deltoid, and the other muscles, must be relaxed.

The sign which denotes a fracture of the coracoid process, is an inclination of the arm forwards, and downwards; the pectoralis minor muscle, which is inserted into the fragment, and the short head of the biceps and coraco brachialis, which take their origin from it, are the agents of displacement.

When the inferior angle of the scapula is broken through, the portion is drawn forwards by the action of the serratus major anticus muscle.

When an oblique fracture happens at the upper part of the os humeri, above the insertions of the pectoralis major and latissimus dorsi muscles, it is easy to conceive what the derangement would be. The muscles just alluded to, from being implanted into the lower fragment, would pull it inwards, and the teres major would draw it a little upwards. Should the bone be broken lower down, the displacement would be much less, owing to the firm attachment of the brachialis internus, both above, and below the fracture on the fore part, and that of the triceps on the back part of the os humeri.

Occasionally, the olecranon ulnæ is snapped off by the spasmodic contraction of the triceps muscle; but it is more frequently fractured by a direct blow.

When this accident occurs, the elbow is thrown into a state of flexion, and the patient is incapable of spontaneously extending the joint; the flexion of the elbow results from the flexor muscles having no antagonists; and the olecranon is detached from the body of the ulna, and pulled upwards, by the action of the triceps muscle.

A fracture of the ulna often occurs at its inferior part, because it is smaller and less defended by soft structures than the upper. One of its diagnostic marks, is a depression on the inside of the fore-arm, which is caused by the pronator radii quadratus muscle drawing the lower fragment towards the radius. The radius, however, is more frequently broken than the ulna, because it is the principal support of the hand. This accident is marked by the hand falling prone; partly from its own weight, but principally from the action of the pronating muscles.

When both bones are fractured, the fragments are pushed together; a longitudinal derangement is rendered almost impossible, by the two bones being united, throughout their whole length, by the inter-osseous ligament.

In the reduction, or what is the more common expression, in the setting of fractures, this grand principle must be borne in mind, viz.—to place the limb in such a position as will relax the most powerful muscles which are likely to act on the broken portions, and which, if not relaxed, will prevent the easy coaptation of the fragments, and the retention of them when coapted; this rule must indubitably be the best in all cases. We cannot put all the muscles in a state of repose, therefore must be content to command the most powerful; and then, by means of splints and bandages, to controul the action of the rest. It is not only required of the Surgeon to set a fracture, but to guard against future derangement, which, in oblique breaches of the bone, is sure to happen without proper management.

Muscles, too, are the agents of displacement in dislocations, and in all cases they offer an obstacle to reduction. The muscles resist, and not the ligaments, for they are generally torn through. In reducing a dislocated bone, we relax the most powerful muscles, and fatigue, by unremitting extension, those which cannot be relaxed. One of the laws of muscular irritability is, that a state of rest must succeed to a state of action; a muscle may be tired, but not if we allow alternate action and repose; hence the injudiciousness of using sudden jerks in the reduction of a dislocated limb, and the necessity of keeping up a steady and continued extension.

The student is now to dissect the arteries, veins, and nerves of the upper extremity, and to observe their relation to the muscles, and to each other. He is to follow the subclavian artery and vein, and the plexus of nerves passing to the axilla; the axillary artery, vein, and nerves sent off from the axillary plexus; the brachial artery, and venæ comites; the artery at the bend of the arm, and the cutaneous veins and other structures of this part; the radial ulnar, and interosseal branches, with their venæ comites, and accompanying nerves; and lastly, the branches which the radial and ulnar arteries send to the fingers. He will then be prepared to consider the detached surgical views which I shall now give him.

When we were engaged in the Anatomy of the neck, we omitted to describe a triangular space, formed, on the inner side, by the outer edge of the sterno cleido mastoideus; on the outer side, by the external edge of the trapezius; and below, by the clavicle; because it was not connected with the vessels of the neck, but with the artery and nerves which supply the upper extremity.

Having reflected a triangular portion of integument, corresponding with the form of this space, the platysma myoides muscle will be exposed; under it, is the cervical fascia, and deeper still, we find much loose cellular structure. This last is to be carefully dissected away, in order to show the subclavian artery, and vein, and the cervical nerves, which go to form the axillary plexus.

The student is to trace the subclavian artery on both sides of the neck, as the difference in origin occasions varieties in the course, and length of the vessels. To obtain a view of its first part, the clavicular portion of the sterno cleido must be raised; the par vagum will then appear before the artery, and just behind the sternal extremity of the clavicle; anterior to the artery, is the subclavian vein; and connected with the vein and artery, are the recurrent nerve, thoracic duct, and other important parts. The artery on the right side arises from the arteria innominata; it is more superficial than the left, shorter by the length of the arteria innominata, and more direct in its course. The left takes its origin from the arch of the aorta, it passes, first vertically upwards, and then suddenly bends outwards; but the course of both arteries is the same, after they have passed between the scalenus anticus, and medius muscles; each artery then begins to descend to the axilla, having the plexus of nerves above and rather behind it, and the subclavian vein before, but separated from the artery by the scalenus anticus muscle. Having emerged from under the clavicle, the subclavian loses its name, and becomes the axillary artery.

Having studied the relations of the subclavian artery, and the branches which are sent off from it, viz.—the internal mammary, the superior intercostal, the vertebral, the inferior thyroideal, the supra scapular, and the cervical, which are very variable in their origin and course; the next points for consideration are, the practicability of passing a ligature about it, and the cases requiring the operation. The safety of cutting down upon the artery, in order to tie it between the heart and scaleni muscles, is to be questioned, on account of the proximity of the vessel to many very important parts; but that it may be tied without much risk, after it has passed the scaleni muscles, many successful cases bear witness.

The external incision is to divide the skin immediately above the clavicle, from the outer edge of the clavicular portion of the sterno cleido muscle, to the margin of the clavicular insertion of the trapezius. On the edges of this incision being separated, the fibres of the platysma myoides will be exposed; these are to be cut through with caution, lest the external jugular vein, which lies immediately under it, should be wounded; the jugular vein is, by means of a blunt hook, to be drawn to the outer side, the cellular membrane carefully separated with the handle of the scalpel, and the artery felt for, which has the cervical nerves of the axillary plexus above, and the subclavian vein below it. The vessel lies deep, and therefore some difficulty has occasionally been experienced in passing a ligature about it; this has induced Desault, Mr. Ramsden, and other Surgeons, to contrive instruments, by which this part of the operation may be facilitated. Not very long ago, Mr. Weiss, an ingenious surgical instrument-maker in the Strand, constructed an instrument, on a principle suggested by Mr. Kirby, an eminent Surgeon in Dublin. An idea of it cannot easily be conveyed in words; therefore, the plate of it, which is given in many Journals, must be consulted. Mr. Travers, and Mr. Brodie, have used it, and found it to obviate the difficulty alluded to; in some recent cases, however, the common aneurismal needle has been found quite sufficient.

The principal case requiring a ligature on the subclavian, is aneurism of the axillary artery, which may be seated below the clavicle, or be extended to the subclavian artery itself.

When we look to the anastomosing branches of the subclavian and axillary arteries, we find that the chance of success in this operation is less than that of tying many other arteries of the body; for the means of supplying the upper extremity with blood are, principally, limited to the inosculations between the supra scapular artery, which is a branch of the subclavian, and the infra scapular which arises from the axillary artery; and in the occasional variety, where the supra scapular artery springs from the axillary, instead of the subclavian, success is still more doubtful. But the apparent scantiness of the means by which the circulation can be carried on, after the main trunk is obliterated, ought not to deter us from performing the operation, for in many instances the resources of nature have been found adequate to the supply of a sufficient quantity of blood for the support of the limb. A wound of the axillary artery is regarded as an accident which requires a ligature on the subclavian; but no security against hœmorrhage can be fully calculated upon, unless the wounded vessel is cut down upon, and two ligatures passed; one above, and the other below the bleeding point. This remark will lead me to speak of the relations of the axillary artery, and the parts concerned in the operation of tying it.

To gain a view of the axillary vessels, and nerves just below the clavicle, an incision is to be made in a line corresponding with the lower margin of that bone, and another to meet it along the edge of the deltoid muscle; the integument is then to be reflected towards the sternum, in order to bring into view, the clavicular portions of the deltoid and pectoralis major muscles. The origin of the latter muscle from the clavicle is next to be raised, and the cellular membrane underneath to be dissected carefully away. The parts seen after a little dissection are, the cephalic vein terminating in the axillary vein; the humeral thoracic artery winding up to the deltoid muscle; the axillary vein partly covered by the pectoralis minor muscle; the axillary artery partly concealed by the vein; and behind the artery is the axillary plexus of nerves; but in order to expose these parts in the greatest possible degree, the pectoralis major should be relaxed.

In the operation of taking up the axillary artery, the first incision is to be commenced about an inch from the sternal end of the clavicle, and carried towards the coracoid process of the scapula; some of the clavicular fibres of the pectoralis muscle are to be subsequently divided, the cellular membrane underneath pushed aside with the handle of the scalpel, and by the same means the artery exposed.

We have now to consider the connections of the artery, in the depth of the arm pit, a pyramidal cavity occupied by blood vessels, nerves, absorbent glands, much fat, and cellular membrane. In this space, the artery will be seen surrounded by the plexus of nerves, and most difficult to reach, without injury to other parts. In the tying of this vessel, and the extirpation of glands from the axilla, the operations are to be executed with as little use of the blade of the knife as possible, after the incision through the integument has been made.

When the artery has passed the tendons of the pectoralis major, and latissimus dorsi muscles, it takes the name of brachial artery; which vessel descends on the inside of the arm, to the bend of the elbow, where it divides into the ulnar and radial branches. At the upper part of the arm it is covered anteriorly by the coraco brachialis muscle, but during the rest of its course, it lies on the inner edge of the biceps, accompanied by the brachial vein, sometimes veins, and the median nerve, which is situated over the artery, and contained in the same sheath as the vessels. From being directly over the artery, it receives a pulsatory motion from it, and on this account the nerve has been mistaken for the artery, and tied. In the operation of securing this vessel, the edge of the biceps muscle is to guide us to its seat; an incision about two and a half or three inches in length, is to be made through the skin, and fascia, and the margin of the biceps drawn to the outer side. The sheath of the vessels is to be opened, the artery separated from the other contents, and a ligature applied. The circulation is afterwards continued by the communications which exist between the branches of the superior deep humeral, and the recurrent branch of the radial artery; between the inferior deep humeral, and recurrent ulnar, and interosseal branches; besides which there are other muscular, and collateral routes.

The bend of the arm is a very important piece of anatomy, and ought to be well studied. It is composed of common integument, superficial or cutaneous veins, cutaneous nerves, fascia, the insertion of the biceps, brachial artery, brachial vein, or veins, median nerve, and lastly, the tendon of the brachialis internus muscle. In reflecting the skin, the student should take care not to injure the superficial veins, and the cutaneous filaments of nerves. The veins are usually four in number, viz.—the cephalic, basilic, median cephalic, and median basilic; these two last are formed by the bifurcation of the common median vein. On the median cephalic, and median basilic are seen some filaments from the external and internal cutaneous nerves, and under the median basilic lies the brachial artery, but separated from it by an intervening fascia. The artery, vein, and median nerve are on the inner edge of the biceps tendon.

It will be evident to the student after examining the relation of the cutaneous veins to the artery, that there is some danger in opening the median basilic vein without care, because the artery is beneath it; but as varieties are constantly occurring in the branching off of the superficial veins, and in the course of the brachial artery and its division, it is never prudent to bleed in either of the veins without first ascertaining whether any artery is in danger of being wounded. In two of the subjects received into my dissecting-room last winter, there were varieties in the distribution of the arteries of the arm. In one, the brachial artery divided into the radial and ulnar branches a little below the axilla; the radial branch descended behind the median basilic vein, taking the same course that the brachial artery ordinarily does. In the other, the bifurcation took place about the middle of the arm, and the radial branch passed downwards, immediately by the side of the cephalic median, and quite as superficial as the vein. Here a wound of the radial artery would have been endangered in bleeding from what is commonly the safest vein, because it is very distant from the brachial artery, in the relation which that vessel most frequently bears to the cutaneous veins.

The puncture of an artery in bleeding, gives rise to what is called an aneurismal varix, which is to be treated on the principle of wounded arteries. This is one of the most formidable accidents attendant on venæ-sectio; but there are now and then other unpleasant consequences; as inflammation of the vein, abscess, &c.; but I shall refer the student to Works on Surgery, for information on these subjects.

The ulnar, radial, and interosseal arteries, in their course down the arm; their distribution in the hand; and their relation to the venæ comites, and nerves, are next to be studied. The superficial palmar arch is formed by the ulnar artery; the deep arch by the radial. Between the two, there are free inosculations: 1st.—Through a branch called, the superficialis volæ, which is given off by the radial artery, near the wrist, and traversing the palm of the hand, joins the superficial arch. 2dly.—By the radialis indicis, which anastomoses at the tip of the fore-finger, with the ulnaris indicis. 3dly.—By the arteria profunda volæ, which, after distributing branches to the interosseal muscles, and deep parts of the palm, terminates, by communicating with the arteria ulnaris profunda; thus, in whatever part, the ulnar, or radial arteries should be obstructed by ligature, there will remain ample resources for the circulation in the fore-arm, and hand, independent even of the interosseal arteries, which inosculate freely with each other about the wrist, and hand, and with branches of the radial and ulnar vessels. An acquaintance with the distribution of the arteries of the fore-arm, teaches us this practical fact, that in order to suppress, in an effectual manner, a hœmorrhage from a wound of either the ulnar or radial artery, it is necessary to secure both extremities of the vessel, for if a ligature were placed on the upper portion only, bleeding would be sure to continue from the lower.

ON THE

LOWER EXTREMITIES.

Before making insulated views of the groin, inside of the thigh, ham, leg, and foot, I shall give some prefatory remarks on the bones, joints, and muscles of the lower extremity.

The thigh-bone is the longest and largest cylindrical bone in the body. Above, it is received into the acetabulum of the pelvis; below, it is articulated with the tibia, and patella. Its remarkable parts are, the head, neck, great trochanter, little trochanter, linea aspera, and condyles.

The hip-joint is like the shoulder, an orbicular one; but the acetabulum, formed by the ilium, ischium, and pubis, is much deeper than the glenoid cavity of the scapula. The joint has two ligaments, the capsular without, and the ligamentum teres within the joint; and the former is strengthened by the aponeurotic insertions of the muscles of the hip. The articulation lies deep; hence, injuries of it are not easy to detect.

The head of the femur may be dislocated in four directions, viz.—on the dorsum ilii; into the ischiatic notch; downwards, in the foramen ovale; and upwards, on the body of the pubis.

If the head of the bone be placed in the different situations which we have mentioned, the characteristics of the four kinds of dislocations will be easily explained.

In the management of dislocations of the hip-joint, certain relaxant means are necessary, prior to any attempt at reduction; thus, the patient should be bled, put into a hot bath, and nauseated by means of tartar emetic. Having thus prepared him, the apparatus for extension, and counter-extension, are to be applied, and the required force employed for the reduction of the bone. Whilst the extension is going on, the head of the bone is to be forcibly carried towards its natural situation.

Now we are on injuries of the hip-joint, I shall make a few observations on fractures of the cervix femoris, a subject which has excited, of late, much interest amonst the Members of the Profession. It is not, however, with the causes and diagnosis of the accident, that I shall occupy the reader's time, but with the opinion entertained on its prognosis, and treatment.

Until Mr. Earle's "*Practical Observations on Surgery*" appeared, a difference of sentiment as to whether re-union takes place when the fracture is *within* the ligament, had scarcely been expressed amongst the Hospital Surgeons of this country; but the French Surgeons and ourselves have always been at variance on this question. The arguments, however, on this branch of Pathology, are so conflicting, as we shall presently show, as to make us cautious in vindicating, in a positive manner, either of the opposite opinions.

Desault states his full conviction that fractures of the cervix femoris, occurring in a healthy constitution, will unite, on the average, in about forty days, and generally without deformity. In the "*Parisian Chirurgical Journal*," published many years ago by Desault, who was then Principal Surgeon to the Hotel Dieu, we find several cases of this kind, which were successfully treated.

Let us now oppose to this opinion, the observations of Sir Astley Cooper, whose experience has not fallen far short of that, which Desault himself enjoyed.

In his Work "*On Dislocations, &c.*" he points out three species of fracture of the cervix femoris; first, that in which the fracture happens through the neck of the bone, *entirely within* the capsular ligament. Secondly, a fracture through the neck of the thigh-bone, at its junction with the trochanter major, which is *external* to the capsular ligament. And thirdly, that species where the bone is broken through the trochanter major, *beyond* its junction with the cervix femoris. Between the three kinds, he makes this important distinction; in the first, no re-union will take place; but the two last will admit of union, like fractures of other bones. Sir Astley qualifies the opinion that he has given, by saying, that if, in the first place, a bony union ever does happen, it is an extremely rare occurrence, and that he has not yet met with a single example of it. The reasons which he assigns for the absence of ossific union in the transverse fracture *within* the capsular ligament, are these:

1st.—The want of proper apposition of the bones; for if the broken extremities, in any part of the body, be kept much asunder, ossific union is prevented.

2ndly.—The want of pressure of one bone upon the other, even where the length of the limb is preserved. This will operate in preventing union, in cases where the capsular ligament is not torn, in consequence of the secretion of a quantity of fluid into the joint, from increased determination of blood to the capsular ligament; this distends the ligament, and thus entirely prevents the contact of the bones, by pushing the upper end of the thigh-bone, from the acetabulum.

The third, and principal reason assigned by Sir

Astley Cooper, is the absence of ossific action in the head of the thigh-bone, from being separated from its cervix; its life being then solely supported by the ligamentum teres, which has only a few minute vessels ramifying from it to the head of the bone.

May we not, with propriety, add a fourth, viz.—the age of the patient? Fractures of the cervix femoris occur, in eight cases out of ten, in persons far advanced in years, and we know that the little vitality of bone, in old age, often proves a preventive to re-union in any situation.

Sir Astley Cooper's opinion, then, is directly opposed to that of Desault, and other Surgeons; he maintains, that re-union has never happened in his practice, when the fracture is *within* the capsular ligament, and retains no connection with the trochanter major. On the other hand, we find distinctly stated in the sixth case of Desault, that a fracture through the middle of the neck of the thigh-bone, was united, without deformity, on the forty-fourth day.

Sir Astley Cooper believes that re-union can take place in the second and third species, but not in the first. This belief may certainly lead to the error which M. Roux apprehends, viz.—that those supposed to be *within* the ligament will be left to themselves; those *without* it, only, being capable of consolidation.

Now it is to be allowed, that there is no positive mode of determining the exact seat of the fracture, and that the different species may be confounded. Seeing this, all fractures of the cervix should be treated after the same manner.

The treatment should be, to bring the fragments, as much as possible, in coaptation, by extension and counter-extension, and to keep them in that state by retentive means. To fulfil this last indication, we must form an effectual opposition to the motions of the pelvis on the thigh, the thigh on the pelvis, the leg on the thigh, and the foot on the leg, by means of splints properly secured. In the French Hospitals, fractures of the cervix femoris are as attentively treated and watched, as fractures of the body of the femur, from a conviction that the one unites as readily as the other; we must attribute the success of Desault's cases to this attention; and, perhaps, the frequent failures in this country, to the negligent practice which is engendered by our entertaining an opposite opinion.

The thigh-bone terminates in two condyles, which contribute to form the knee-joint, which, like the elbow, is of the hinge-like description, and susceptible of flexion and extension only. The bones which compose it are three, viz.—the femur, tibia, and patella. The ligaments are, the external and internal lateral; the posterior ligament, the capsular and ligamentum patellæ; into this last the rectus, cruræus, and vasti muscles are inserted, which muscles act on the tibia, and produce the extension of the leg upon the thigh. Internally, we find the alar and crucial ligaments, and some transverse ligamentous bands uniting the two semilunar cartilages. As there are no massy soft parts surrounding this articulation, we can readily discover the alterations produced in it, by accident and disease.

The superficial nature of the knee-joint predisposes it much to dislocation, and from being more exposed to violence from falls, than any other articulation, this accident is not of unfrequent occurrence, the patella, however, is oftener displaced from its situation, than the tibia is from the articulatory surfaces of the femur.

The leg consists or two bones, the tibia, and fibula; the tibia is articulated with the femur above, and with the astragalus below. The fibula is articulated above with the tibia, therefore is not at all connected with the knee-joint. At the ankle-joint we find three bones, the tibia, the fibula, and the astragalus. The tarsal bone, called astragalus, has an articulatory surface for each of the bones of the leg. Scarcely any other motions are allowed at the ankle, besides flexion and extension.

Although this articulation is rendered exceedingly strong by capsular and other ligaments, it is, next to the shoulder-joint, the most liable to dislocation; and from being superficial, and projecting at the malleoli; the accident is often compound. The tibia may be thrown in any direction, but the dislocation inwards is most frequent. As the gastrocnemii muscles are inserted into the os calcis; it is necessary, in reducing the tibia, that these muscles be relaxed, by bending the knee.

Between the first and second row of tarsal, as between the first and second row of carpal bones, we find a perfect joint. It is formed, above, by the astragalus, and os calcis; and below, by the os naviculare, and os cuboides: the astragalus is opposed to the os naviculare, the os calcis to the os cuboides, and the articulation between them is nearly in the same transverse line. The tarsal-bones are united to each other by capsular ligaments, and ligaments passing from bone to bone. The metatarsal bones are fixed to the tarsal by capsular, and to each other, by interosseal ligaments. The toes, like the fingers, have capsular, and lateral ligaments.

In the lower extremity, as in the upper, the student must make himself acquainted with the points of bones near the joints, which can be felt through their fleshy covering. He should particularly observe the relative position of the trochanter major, as this will assist him in detecting accidents of the hip-joint.

The student is next to dissect the muscles, which may be classed according to their uses.

The motions of the lower extremity are, those of the femur on the pelvis; of the leg upon the thigh; of the foot upon the leg; and those of the toes.

The hip is a ball and socket joint, like the shoulder; but differs from it in the depth of the socket, and size of the head of the bone. The movements of the thigh-bone on the pelvis are extensive, and in every direction; they are, backwards, (extension); forwards, (flexion); outwards, (abduction); inwards, (adduction); and it can revolve upon its axis inwards, or outwards, (rotation inwards and outwards). The muscles of extension are, the glutæus maximus, part of the glutæus medius, that portion of the biceps which arises from the tuber ischii, that portion of the adductor magnus from the same point, the semi membranosus, the semi tendinosus; besides which, some of the smaller muscles near the posterior part of the hip-joint assist in this action.

The muscles of flexion are, the iliacus internus, the psoas magnus, the tensor vaginæ femoris, the sartorius, the gracilis, the adductores, the rectus, the pectineus, and the obturator externus.

The muscles of abduction are, the three glutæi, the pyriformis, the gemini, the obturator internus, and tensor vaginæ femoris.

The muscles of adduction are, the iliacus internus, psoas magnus, pectineus, gracilis, adductores, obturator externus, and quadratus femoris.

The muscles of rotation inwards are, the anterior portions of the glutæus medius, and glutæus minimus, the tensor vaginæ femoris, sartorius, and gracilis.

The muscles of rotation outwards are, the glutæus maximus, glutæus medius, pyriformis, gemini, obturator externus, quadratus femoris, iliacus internus, psoas magnus, and three adductores.

The knee is like the elbow, a ginglymoid joint; when the leg is a little bent, however, a slight rotatory motion can be performed. The muscles of the anterior part of the thigh (the sartorius excepted) are, the extensors. Those of the posterior part are, the flexors. The rotators inwards are, the muscles which go to be inserted into the tibia. The rotator outwards is, the biceps, which is inserted into the fibula.

The ankle-joint is hinge-like, but in addition to flexion and extension, it can be bent inwards and outwards. The flexors are, the tibialis anticus, and the extensor muscles of the toes. The extensors are, the gastrocnemii, plantaris, tibialis posticus, peronei, and flexors of the toes.

The benders inwards are, the tibialis posticus, the extensor proprius pollicis, and the flexors of the toes.

The benders outwards are, the peronei, and extensor longus digitorum.

The toes, like the fingers, can be bent, extended, abducted, and adducted. The flexors and extensors are named according to the toes which the supply.

The abductors are, the abductor pollicis, abductor minimi digiti, and interossei anteriores.

The adductors are, the adductor pollicis, transversalis pedis, and interossei posteriores.

Let us now see how these muscles produce the signs of fracture, when the solution of continuity in the bones is complete.

When the cervix femoris is broken through, the limb is shortened, because the muscles which take their origin from the pelvis, and are inserted into, or near the trochanter, pull the lower portion of the bone upwards; and the toes are turned outwards, principally from the rotators outwards, being more powerful than the rotators inwards.

When the fracture happens below the trochanters, there are various muscles both above and below the seat of accident. There are some attached to the femur throughout its whole length, and from being connected with both fragments, would not occasion much displacement; but those which arise from the pelvis, and are implanted into the bones of the leg, as the semi-tendinosus, semi-membranosus, and biceps, act on the lower fragment, and give rise to the signs, which mark a fracture of the shaft of the bone.

The patella is liable to be broken from the same causes as the olecranon ulnæ, viz.—the action of muscles, and external force. If the fracture be transverse, the upper portion of the bone is drawn upwards by the action of the rectus femoris muscle.

In fractures of the bones of the leg, the lower fragments are acted upon by the gastrocnemii, and peronei muscles, and carried backwards and outwards.

Seeing that the displacing agents in fractures of the thigh, and leg, are the flexor muscles of the knee, and the extensor muscles of the foot; there can be little doubt as to the position which we should give the limb in fractures of the thigh and leg. In fracture of the shaft of the femur with displacement, we should relax the flexor muscles of the knee, in order to reduce the fragments, and we should preserve the semiflex position afterwards, in order to keep them reduced. In fracture of the bones of the leg, the gastrocnemii must be put in a state of relaxation, and kept so by retentive means, during the whole of the cure. I am aware that this practice is objected to by some Surgeons, particularly by the French, who advise an horizontal posture of the limb; but I saw nothing in the Parisian Hospitals that could induce me to forsake the method adopted by the majority of English Surgeons. It is not Pott's method that we adhere to, further, than in putting the limb in a state of half flexion: to make it rest horizontally, on its outer side, (which was another part of his practice, in fractures of the thigh,) has, for just and proper reasons, been abandoned.

Having dissected the muscles, and applied a knowledge of their action on the bones, and joints, to practical purposes; the student will trace the main arteries, and their branches, the principal veins, the anterior crural, and sacro sciatic nerves, and observe their relative position with respect to the muscles, to the bones, and to each other.

The abdominal aorta terminates at the fourth lumbar vertebra, by dividing into the common iliac arteries. Each common iliac passes obliquely outwards, and downwards, and just at the sacro iliac symphysis, divides into the internal and external iliac branches.

The internal iliac artery is principally distributed to the pelvic viscera; but there are branches, viz.— the obturator, glutæal, and ischiatic, which supply the muscles of the thigh, and are important anastomosing vessels when the external iliac is obliterated.

The external iliac artery descends under Poupart's ligament, to the lower extremity. It sends off the epigastric, and the circumflexa ilii branches. After appearing at the upper part of the thigh, it takes the name of femoral artery; and passes down, obliquely, over the pectinæus, and triceps muscles; lower down, it corresponds with the inner edge of the sartorius muscle. After perforating the tendon of the triceps, it becomes the popliteal artery, which terminates by dividing into the anterior and posterior tibial branches. The anterior tibial perforates the interosseous ligament, and then appears in front of the leg, between the tibialis anticus, and extensor longus digitorum; still lower, it has the extensor proprius pollicis on its outer side; and on the dorsum of the foot, it is situated between the tendon of the extensor proprius pollicis, and the first tendon of the extensor longus digitorum.

The posterior tibial branch descends between the gastrocnemius internus, and the flexor longus digitorum muscles. It passes behind the malleolus internus, and enters the sole of the foot, where it divides into the plantar arteries. The peroneal artery is a branch of the posterior tibial, and ends by anastomosing with branches of the anterior and posterior tibial, near the ankle-joint.

The arteries are accompanied by veins; below the knee, there are two veins to one artery; but above the knee, only one. The venæ saphenæ are cutaneous veins; the vena saphena minor terminates in the vena saphena major, which ends in the femoral vein.

The anterial crural nerve is distributed to the skin, and deep muscles on the fore and inner part of the thigh. The great sciatic nerve supplies the remainder of the thigh and leg, and branches of it accompany the anterior tibial, and posterior tibial arteries.

These general remarks on the distribution of the arteries, veins, and nerves of the lower extremity, will prepare the student for what we are about to say on the grouping together of parts, in detached views of the groin, inside of the thigh, ham, leg, and foot.

The groin is a very important part of the Anatomy of the body, and one of peculiar interest to the Surgeon, from being connected with herniæ, and from being the situation of the main artery of the lower extremity.

Every student who has merely read of the parts concerned in inguinal and crural herniæ, justly thinks the subject difficult and embarrassing, and almost despairs of ever knowing what Lecturers, and Anatomical Writers urge as indispensable. But I will encourage the pupil, by assuring him, that there is no point in surgical Anatomy more simple, and that the perplexity which he feels, arises from his substituting the laboured, and minute descriptions of authors, (and not necessary to the practical understanding of the subject), for the demonstration of the parts, as they really are in nature; and his embarrassment is not a little heightened, by writers on herniæ giving different names to one, and the same structure.

In a former part of the volume, we described the abdominal muscles; but we did not particularize on their connections at the groin. To do this, will be the present object.

If an incision be made from about three inches below the umbilicus, to the anterior superior spinous process of the ilium; and another from the commencement of this incision, perpendicularly to the symphysis pubis; we include a portion of integument, under which, are the parts concerned in inguinal and crural herniæ. To display these parts, another incision in the integument is required, from the centre of the transverse one, directly downwards, to about three inches below the groin; two flaps of skin will thus be formed, and these flaps are to be carefully dissected from the condensed layer of cellular membrane underneath, and reflected; the inner towards the linea alba, and symphysis pubis; the outer towards the spine of the ilium, and the outer part of the thigh. The condensed membrane, which is now seen covering the aponeurosis of the external oblique muscle, Poupart's ligament, the spermatic cord, after emerging from the ring, and the upper part of the thigh, is called the fascia superficialis. It is a structure not confined to the groin; but here, and in other portions of the body, it is thicker, more membranous, and deserving of particular notice, from its relation to herniæ, and suppurating buboes.

The fascia superficialis is to be separated from the aponeurosis which it covers, and reflected in a similar way to the skin; this will expose the glistening tendon, its termination in Poupart's ligament, the upper portion of the fascia lata of the thigh, and the inguinal glands; and the student will easily understand, after observing the situation of the superficial fascia above the inguinal glands, why it is, that abscesses in the groin are long in bursting; for the fascia thickens from pressure, and offers great resistance; and why, if allowed to open spontaneously, a sinuous ulcer is often left, which is troublesome to heal. The common skin, and fascia just described, are then the superficial parts of the inguinal region.

The portion of aponeurosis, which stretches from the superior spinous process of the ilium to the symphysis pubis, is next to be examined. It is called Poupart's ligament, and at its pubic extremity, there is an opening, formed by a separation of the tendinous fibres, and named the external abdominal ring, in contradistinction to another aperture, by and by to be described, which is the internal ring. If the student expected to find the external abdominal ring a distinct opening, he will, in this stage of the dissection, perceive his error. It is occupied by the spermatic cord, and cellular membrane, over which is a thin, delicate fascia, which is called the fascia of the cord, and conceals the site of the ring; on raising this, and breaking down, with the handle of his scalpel, the cellular connections of the cord, he will be able to observe the ring, which, however, is not circular, as its name would seem to imply, but rather of an elliptical form.

The aponeurosis of the external oblique muscle is now to be detached from the internal oblique, which is under it, and turned towards the thigh. The internal oblique is then to be detached from the transversalis, which is under it, and these two muscles observed in their relation to the spermatic cord in its passage from the external ring, to its disappearance at the groin. The student is then to replace the internal oblique and transversalis, and to leave the aponeurosis of the external oblique reflected towards the thigh. By taking hold of the spermatic cord, and gently drawing it, he will see its course behind Poupart's ligament; and will observe, that it is covered with a few pale fibres, called the cremaster muscle, which are derived from the obliquus internus, and transversalis muscles.

If now the internal oblique, and transversalis be carefully cut, and pushed upwards with the handle of the knife, a thin fascia will be seen lining the posterior surface of the latter muscle; it is the fascia transversalis of Cooper. Below, it is firmly attached to Poupart's ligament, and the pubis; and passing upwards, we find it between the posterior surface of the transversalis, and the peritoneum. In this fascia, is the internal abdominal ring, by which the cord leaves the abdomen. The tendons of the internal oblique, and transversalis, are not then perforated for the passage of the cord, for the opening is in the fascia above mentioned, and the tendons of these muscles form, as it were, an arch over the cord. In tracing the cord, the student will observe it, in what is called the inguinal canal, viz.—that space between the two rings; that it is here situated behind the aponeurosis of the external oblique; and that it passes under the edges of the internal oblique, and transversalis muscles. At the internal abdominal ring, (which is not a well defined opening, without breaking down the cellular membrane about it,) the spermatic cord is formed; and behind the ring is the peritoneum, which lines the abdominal cavity; it is important to bear this in mind, as it explains the nature of the hernial sac.

In the dissection, the student must observe the epigastric artery. It arises from the external iliac, and passes upwards, and inwards, towards the rectus muscle; it is situated a little on the inner side of the internal ring, and between the fascia transversalis, and peritoneum.

Thus we have followed the spermatic cord, and its connections in its passage from the external ring to the abdomen; and if we reverse the order of things, we shall have the course of the viscera in oblique inguinal hernia.

We stated, when speaking on the parietes, and contents of the abdomen, that, in health, the abdominal cavity was accurately filled by the viscera; that the muscular walls exerted a constant but mild compression; and that the viscera re-act upon them. It is by this compression, that the organs are supported in their respective situations; but when, by any cause, the uniformity of pressure is disturbed, certain parts of the parietes, which are less resisting than others, may yield, and the viscera be pushed without the abdomen; this is hernia.

I shall not enter into the particular causes of hernia, but shall just remark, that the disease consists in the protrusion of some of the contents of the abdomen through certain apertures, which transmit blood-vessels, or other parts; and that when the protruding viscera appear at the external abdominal ring, the disease is called, inguinal; and when under Poupart's ligament, femoral hernia.

Inguinal herniæ are of three kinds; the oblique, the direct, and the congenital. We have examined the natural parts connected with them, and found them to be, common integument; the fascia superficialis; the fascia of the spermatic cord; Poupart's ligament; the external abdominal ring; the internal oblique and transversalis muscles; the fascia transversalis; the internal abdominal ring; the inguinal canal; the epigastric artery; the spermatic cord; its cremaster tunic; and behind all these, is the peritoneum.

In the female subject, the round ligament occupies the place of the spermatic cord, and the apertures are proportionally small; to which circumstance is attributable the infrequency of inguinal hernia in the female sex.

To know the Anatomy of these parts, in their natural state, is an essential piece of knowledge to the student, but he must not forget that there is often a great difference between the Anatomy of parts in health, and in disease. Every one is aware of the effects of pressure in elongating extensible membranes, thus the peritoneum is carried before the viscera, and constitutes the sac of all herniæ, (congenital excepted), however large they may be. This membrane is not broken, as the Ancients erroneously supposed, hence the term "rupture," but actually pushed before the viscera. Common observation on pregnancy, and dropsy, is sufficient to convince us of the degree of extension which the peritoneum is capable of undergoing. Every body knows, too, the effect of pressure in rendering a thin membrane, a dense and thick fascia; the student must, therefore, expect the coverings of a hernial tumour to be much thicker than in their natural state. Instead of finding the fascia superficialis a layer of cellular membrane, loosely matted together, he will see it in the form of a dense fascia. Instead of the delicate tunic which the cremaster assumes, we find, that the muscle acquires a surprising thickness: and the transparent peritoneum is often, in old and voluminous herniæ, exceedingly changed in its appearance. Besides the alteration in structure, the parts will be more or less altered in position; thus, instead of there being an inch, or more, between the external and internal rings, they are nearly brought together; and there will be differences in the relation of other parts.

An oblique inguinal hernia takes the course of the spermatic cord. The intestine, or epiploon, enters the inguinal canal by the internal abdominal ring, and carries with it that portion of peritoneum, which lined the posterior surface of the ring. Hernia in the inguinal canal will often elude detection, as the dense aponeurosis of the external oblique will not yield; and therefore no tumour can be perceived. Patients have died from strangulation in this case, without the cause being at all suspected. When the hernia is in the canal, the sac is covered by the common integument, the fascia superficialis, and the aponeurosis of the external oblique; and the seat of strangulation is generally at the place where the internal oblique, and transversalis muscles cross the neck of the sac.

When the viscera are protruded through the external ring, a tumour is formed, and the nature of the disease becomes obvious. It is characterized by being returnable into the abdomen; by disappearing when the patient takes an horizontal posture; and by its volume being increased by the efforts of coughing, and sneezing. If the truss be not applied in this stage of the complaint, the tumour will augment in bulk, and will, at last, extend to the scrotum.

The coverings of the hernial sac are the same in number, after passing the ring, whatever progress the swelling may have made. The common skin is the first tunic; the fascia superficialis, the second; the fascia of the spermatic cord, the third; the cremaster tunic, the fourth; and then the sac. Scarpa, however, speaks of a cellular covering over the sac, and between it, and the cremaster. He says, if we dissect with care, a voluminous and old scrotal hernia, (meaning inguinal hernia which has passed into the scrotum), we remark, in the first place, a prolongation, of considerable thickness, of the fascia lata aponeurosis, by which he means the fascia of the cord; (by some called fascia propria,) and under it, the cremaster tunic; these two envelopes are sometimes very compact. Below them, he says, we find a cellular tissue, so much condensed, that it represents a compact and thick membrane, formed of several layers, applied one upon another. After having raised all these layers in succession, we come to the true hernial sac. He states this tunic to be a prolongation of the cellular tissue which covers all the exterior of the peritoneum; and that when the subject is embonpoint, the tunic is charged with fat, like that which unites the peritoneum to the abdominal muscles. The fascia cellularis of Scarpa, then, is another tunic in oblique hernia, and this constitutes the fifth covering of the sac.

The relative position of the spermatic cord, and epigastric artery is thus: the former is placed ordinarily behind the hernial sac, but there are some exceptions to this rule; and the foundation of one exception, viz.—the division of the constituent parts of the cord, is not difficult to explain, when we know that they come from different directions; thus the blood-vessels descend to the internal ring, and the vas deferens ascends from the pelvis; therefore, the component parts of the cord may be split by the force of protruding viscera, and consequently, sometimes the blood-vessels may be found on the anterior, and the vas deferens, on the posterior surface of the sac. The epigastric artery is a little on the inner side of the internal ring; thus in oblique inguinal hernia, it is on the pubic side of the mouth of the hernial sac.

When the oblique species of hernia is strangulated, the seat of stricture may be, the external ring, the internal ring, or the neck of the sac; but the most common seat is the external ring.

The second kind of inguinal hernia is the direct, or ventro-inguinal. In this case, the intestine, or epiploon, or both, do not take the course of the inguinal canal, but pass directly through the external abdominal ring; and in this case, the cremaster muscle does not give a tunic to the sac. The stricture in this species must be either at the external ring, or neck of the sac.

The third species of inguinal hernia is the congenital, so called from its usually appearing soon after birth. To comprehend the manner in which it occurs, the student must be perfectly acquainted with what is named the descent of the testes. It must first be recollected, that these glands are not, from the earliest period of the fœtus, situated in the scrotum; originally they are lodged in the abdomen, immediately below the kidnies, and, like the kidnies, they have an anterior covering from the peritoneum. This is the relative situation of parts 'ere the child attains its seventh month. At, or near that period of uterine existence, the testes begin their descent into the scrotum, to which they are said to be guided by the gubernacula, and at birth their descent is usually completed, but not always.

Without knowing the original seat of the testes; how the peritoneum covers their anterior surface; and how the same membrane sends a process through the internal abdominal ring; it is not possible to understand the manner in which the tunica vaginalis, and tunica vaginalis reflexa are formed.

The student is much perplexed by finding, in different Anatomical Works, different names given to the membranes connected with the testis. Some writers call the close tunic, the tunica albuginea; and the reflected one, the tunica vaginalis. Others regard the tunica albuginea as a distinct structure, and not derived from the peritoneum; that it is the proper covering of the testis; and that the septulæ, or partitions, which we meet with in the body of the gland, between the blood-vessels and seminiferous tubes, are processes of it. I am inclined to admit this as being really the case; therefore the testis may be said to have three tunics; two close, and one reflected; and they may be named, for distinction sake, *tunica propria*, *tunica vaginalis testis*, and *tunica vaginalis reflexa*; and these names, we shall take the liberty of adopting. The testis, then, in abdomine, has a partial investment from the peritoneum, besides its proper coat; the gland descends to the abdominal ring, carrying with it the tunica propria, and tunica vaginalis testis. At the ring, it finds a cul de sac, or pouch of peritoneum, which is protruded, before the testis, into the scrotum, and forms the tunica vaginalis reflexa.

Nothing can be more simple to understand than this, and when understood, it is easy to comprehend the nature of congenital hernia, and hydrocele in children. It is clear, that after the testis has carried with it the peritoneum which was at the ring, a communication will exist between the cavity of the abdomen, and that of the elongated sac, constituting the tunica vaginalis reflexa; but, naturally, this communication does not long remain, for an adhesive process usually takes place, by which the neck of the sac is closed; this, though commonly, is not, however, constantly the case; and a default of this kind gives rise to the diseases before mentioned. Between hernia congenita, and other herniæ, there is this difference; in the former, the tunica vaginalis reflexa forms the hernial sac; in the latter, the sac is produced by a gradual stretching, or elongation of the peritoneum, *from the pressure of the protruded viscera*: and between hydrocele in children, from the above stated cause, and the common hydrocele at a more advanced age, there is this difference; in the former, there is a communication between the cavity of the abdomen, and that of the tunica vaginalis reflexa; but in the latter, the tunica vaginalis reflexa is a bag without an opening. In the hydrocele of childhood, and of adult age, the effused fluid occupies the same situation, viz.—the tunica vaginalis reflexa; and the testis, with its tunica vaginalis testis, is behind the serous collection.

There is a variety of congenital hernia produced, by a partial obliteration of the passage of communication between the abdomen and the scrotum; thus, the obliteration may not commence at the internal ring, but in the inguinal canal, leaving a pouch, into which, intestine, or epiploon, may easily insinuate itself; this pouch is gradually elongated, and in such a hernia, we find another sac, under the tunica vaginalis reflexa. The late Mr. Hey, of Leeds, to whom the Profession is as much indebted as to almost any man, was the first, I believe, who described this variety of hernia; it is not, however, of very frequent occurrence.

We will now give the Anatomy of the parts concerned in femoral, or crural hernia, some of which are the same as those of the inguinal species. This hernia takes the course of the vessels of the thigh; therefore, the fascia superficialis and Poupart's ligament are equally concerned in both inguinal, and crural hernia.

Femoral hernia is a disease which more frequently happens in the female, than in the male sex; because the ligament of Poupart is more extended, owing to the greater breadth of the pelvis. The Anatomy of the parts therefore is better shown in the former, than in the latter.

Before he proceeds farther with the dissection, than he has already done, in showing the Anatomy of inguinal hernia; the student should observe the manner in which the upper part of the thigh is shut out from the abdomen. By turning down the abdominal muscles, and peritoneum, and passing the finger under Poupart's ligament, he will find what is called the crural opening, which gives passage to the artery, and vein of the groin. The opening is not free, except at the inner side of the vein, which is the part at which the protrusion takes place in femoral hernia. The crural opening, or ring, is bounded, above, by Poupart's ligament, which is here called, the crural arch; on the inner, or pubic side, by the ligament of Gimbernat, which presents to the finger, a sharp edge; on the outer, or iliac side, and behind, by the psoas magnus, and the iliacus muscles, and the fascia which covers them.

The artery and vein are inclosed in a funnel-like sheath, which is formed, on the fore part, by the fascia transversalis; and on the back part, by the fascia iliaca, the membrane just mentioned as giving a covering to the psoas magnus, and iliacus internus muscles. The artery is on the iliac, and the vein on the pubic side of the crural ring. In femoral hernia, as in inguinal, the peritoneum forms the sac; of which fact, the student may easily convince himself by separating the peritoneum from the inner surface of the abdominal muscles, and examining the manner in which it passes over the ring: then he will find, that no viscus can enter the crural ring without carrying the peritoneum with it. If this membrane be pushed by the finger between the vein, and pubic side of the sheath, we produce an artificial hernia, and if the sac thus produced be distended with hair, the student may proceed with the dissection below Poupart's ligament, and observe how the hernial protrusion stands in its relation to other parts.

Under the common integument, at the upper part of the thigh, we find the fascia superficialis, which we have already described as covering the inguinal glands; if this fascia be raised, we expose the fascia lata, which uniformly surrounds the muscles of the thigh, below the entrance of the vena saphena into the femoral vein; but above that point, there are irregular appearances in it. The fascia lata is commonly said to consist of two portions; an iliac, and a pubic; the former portion is attached to nearly the whole of Poupart's ligament, and has a crescentic edge, called the falciform process; the latter, which is much thinner in structure, is attached to the anterior edge of the pubis, and covers the muscles of the thigh which arise from that bone, viz.—the pectinæus, and adductores. It is continued behind the femoral vessels, and unites with the outer portion. A little below Poupart's, or Fallopius' ligament, we see an oval opening, where the fascia is defective, it is occupied by cellular membrane and lymphatic glands: on removing these, a part of the femoral vein is brought into view, and at the lower part of the oval space, the vena saphena major is observed, entering the femoral vein.

In Works on Herniæ, the portions of the fascia lata are much dwelt on, and I shall refer the student to them for a more minute description.

The student may now examine the sheath of the vessels, a part of which, is not covered by the fascia lata; he will then dissect the deeper seated parts about the crural ring, and observe its boundaries.

The parts, then, which are concerned in femoral hernia are those which are connected with the passage of the vessels from the abdomen to the groin.

The coverings, which the hernial sac has, are, the common skin, the fascia superficialis, and the fascia propria of Cooper.

The seat of stricture, when strangulated, may be the edge of Poupart's ligament, Gimbernat's ligament, or the mouth of the sac.

I shall only make two or three more observations, which are suggested by the importance of knowing the Anatomy of the parts concerned in hernia, in the application of trusses; in the taxis; and in the operation.

We learn, by the Anatomy of the inguinal species of hernia, the situation where the pad of the truss should be placed, in order to produce a radical cure, viz.—not over the external, but the internal ring; for the mouth of the sac must be kept empty. Before the natural parts of hernia were well understood, the pad was invariably applied on the former situation, a practice which might prove injurious, by compressing the spermatic cord against the pubis.

By the operation of the taxis is meant, the act of returning the protruded viscera into the cavity of the abdomen. To effect which, two things must be attended to, viz.—the position, and direction of force. With respect to the position of the patient, as our aim is to increase the capacity of the abdominal cavity, by relaxing its walls, it is obvious that the head, pelvis, and lower extremities, should be made to approach each other; and as the apertures, through which the hernia has passed, are relaxed, by turning the knee of the extremity of the affected side inwards, this must be done 'ere we attempt reduction.

In inguinal hernia of small size, the force must be directed towards the ilium; but not so much so in large herniæ. In femoral, or crural hernia, the tumour turns upon itself, after it has descended a little way in the thigh; thus, the pressure must first be downwards, and when the tumour is brought to the level of Poupart's ligament, it is to be pushed directly upwards.

With respect to the operation for strangulated hernia, we have to dread a wound of the contents of the sac, and that of the epigastric artery; to avoid the former, the coverings of the hernial tumour, are to be carefully divided; and to avoid the latter, we must bear in mind the common course of the artery, and take care not to cut in the direction of it. But the treatment of herniæ, in its different states, comprehends so many highly important considerations, that I should do harm, if I were to proceed farther; for the student must consult the Treatises which have been written upon the subject. There is no surgical disease upon which more labour has been bestowed, than hernia. To recommend the student, therefore, to read all the Works that treat on it, would be to impose a task on him, which would require almost a long life to accomplish; but he will not do justice to himself, if he neglects the perusal of certain modern Works, as those of the present century; amongst which, we must consider Cooper's, Scarpa's, and Lawrence's, as possessing superior merit.

I have not entered on the diseases with which herniæ may be confounded; the contents of the sac; the nature of the reducible, irreducible, and the strangulated states of herniæ; and the anomalous circumstances which may present themselves; as information on these subjects must be derived from the sources referred to.

There are other herniæ, besides the umbilical, inguinal, and femoral; thus, there is the phrenic hernia; the ventral; the pudendal; the vaginal; the perineal; the thyroideal; the ischiatic; and the mesenteric, and meso-colic herniæ of Cooper. The appellation given to each species, is derived from the situation in which the protrusion takes place.

The most important relation of the Anatomy of the groin to surgery, is, perhaps to be awarded to herniæ; but aneurism of the external iliac artery, or of the femoral, high up, is another subject which demands an intimate knowledge of the parts contained in this region of the body.

In an aneurism of the external iliac artery, it is necessary to pass a ligature about the vessel above the seat of disease. To do this, the Surgeon must know how the artery runs, and how it is relatively placed with regard to other parts. The internal abdominal ring is situated at a point, midway between the anterior superior spinous process of the ilium, and the spinous process of the pubis. Behind this opening, is the external iliac artery; on the inner side of the artery, is the vein; and on the outer side, is the anterior crural nerve. The vessels are contained in a sheath behind the peritoneum.

To reach the artery then, it is clear, that an incision must be made above Poupart's ligament; that the aponeurosis of the external muscle must be raised; that the spermatic cord, and margin of the internal oblique and transversalis muscle, must be pushed upwards, with the handle of the scalpel, and the fingers; that we must take care to avoid the epigastric artery; that we must raise the peritoneum from its attachment to the pubis; that the sheath of the vessels must be scratched through; that the vein be separated from the artery; and that the aneurismal needle be passed under the artery, from within, outwards, in order that the vein be not transfixed.

Mr. Abernethy was the first who tied the external iliac artery, and the event of two of his cases, of those of Messrs. Freer, Tomlinson, and of other Surgeons, which have since occurred, proves, beyond a doubt, that this vessel may be tied with perfect safety.

Some of the French Surgeons, are, however, astonished at the boldness of English Surgery in this respect. Baron Larrey, in his "*Memoires de Chirurgie Militaire, &c.*" a Work abounding in interest, objects to the operation, on the ground of its inutility; in consequence, as he says, of the dissection of almost all the subjects who had undergone the operation, having exhibited all the characters of an aneurismal diathesis.

In aneurism of the femoral artery, high up in the thigh, it will be required to pass a ligature below Poupart's ligament. The remarks which we have made on the Anatomy of the groin, render it superfluous to detail the steps of the operation. The artery bears the same relation to the vein below Poupart's ligament, as it does above it. The crural nerve is so far removed from the artery, as not to be at all in danger.

When the external iliac, or upper portion of the femoral artery is obstructed, the blood passes into the lower extremity, principally, by the following branches. The internal iliac artery gives off the glutæal, which communicates with branches of the femoral and profunda; also, the ischiatic and obturator, which anastomose with the circumflex branches of the profunda femoris; and there are other collateral passages: by these means, the circulation is sufficiently established for present purposes, and becomes free, in time, by the gradual enlargement of the inosculating branches. Sir Astley Cooper has published a minute account of the anastomoses of the arteries at the groin, in the Fourth Volume of the "*Medico-Chirurgical Transactions*."

Popliteal aneurism, or aneurism of the popliteal artery, is treated by the application of a ligature to the femoral artery, about the middle of the thigh, where the sartorius muscle crosses the vessel. The artery is enclosed in a sheath of condensed cellular membrane, accompanied by its vein. The operation of tying the femoral artery, for popliteal aneurism, has been so frequently performed, as to leave no doubt on the mind, as to the efficacy of the treatment, and its freedom from danger. The usual anastomosing vessels are, the profunda and its branches, which communicate with the rami musculares, and other branches of the femoral artery; also, with the articular arteries of the popliteal. When the femoral artery is obliterated to the profunda branch, which is sometimes the case, even when the ligature is applied on the vessel low down, the rami perforantes of the profunda femoris, and the rami articulares of the popliteal, are the channels which the blood takes, to arrive at the lower part of the limb.

In the dissection of the ham, we find, under the skin, much cellular membrane; and then a strong fascia which binds down the vessels and nerves of this part, which are embedded in much fat, and cellular membrane. The nerve first appears; and close to the bone are, the popliteal artery, and vein. The hamstrings are formed by the tendons of the flexor muscles of the leg. The branches of the popliteal artery are, the superior external and internal, and the inferior external and internal articular arteries; and the arteriæ surales, which are spent chiefly on the head of the gastrocnemius externus muscle. The articular arteries freely communicate with each other, and with the recurrent tibial, and by these, the circulation is carried on, after the course of the blood in the main trunk is stopped.

To tie the anterior tibial artery, just after it has perforated the interosseous ligament of the leg, we must dissect through the skin, and fascia, between the tibialis anticus, and the extensor communis muscles. The artery lies on the ligament, in company with the venæ comites and nerve. About a hand's breadth from the ankle, it is situated between the tibialis anticus, and the extensor longus pollicis; and on the anterior part of the foot, between the first tendon of the extensor communis, and the tendon of the extensor longus pollicis. At the space, between the tarsal extremities of the meta-tarsal bone of the great toe, and toe next it, the artery dips into the sole of the foot.

The posterior tibial artery lies deep, but may be reached at any part of its course. Behind the inner ankle, too, the vessel may be tied: in this situation, the artery bears the same relations to the venæ comites, and nerve, as it does higher up.

The peroneal artery, below the middle of the leg, is situated at the posterior surface of the fibula.

When we trace the arteries of the leg and foot, we find free communications of the muscular branches of the trunks. At the ankles, the anterior tibial sends off the rami malleolares externus et internus, which anastomose with branches sent off about the joint by the posterior tibial, and peroneal arteries. The anterior tibial is then continued forwards under the annular ligament, and gives off the arteria metatarsea, which furnishes the interosseal branches. The anastomoticus profundus dips down, to inosculate with one of the plantar arteries of the posterior tibial, to form the arcus plantaris, which supplies the digital branches. It is evident, after this view, that either the anterior tibial, the posterior tibial, or the peroneal artery, may be obliterated, without endangering, in the least, the after circulation in the leg and foot.

When we were on the arteries of the fore-arm and hand, we mentioned that the anastomoses between the branches of the radial, ulnar, and interosseal, were so free, that in case of wound of either of the two first, a ligature was required at each extremity of the wounded vessel. The same remark applies to the treatment of a wound of either of the arteries of the leg and foot. A case has been communicated to me, of the division, by a hatchet, of the anterior tibial artery on the dorsum of the foot. A Surgeon was called, who cut down, and passed a ligature about the trunk, in the middle of the leg. After doing this, the bleeding continued from the wound, and it was found necessary to secure the vessel at the wounded part. The cause of the continuance of the hæmorrhage remained unexplained, until it so happened, that on dissecting an injected limb, a mal-distribution of the arteries of the leg was discovered. The anterior tibial terminated by dividing into numerous branches, which were distributed about the ankle-joints: and the peroneal, instead of being spent about the ankle, was continued over the dorsum of the foot, and supplied the place of the anterior tibial vessel. This discovery induced the surgeon to suppose, that in the case above related, the arteries were mal-distributed in a similar way, and was employed to explain why the bleeding was not checked, when the anterior tibial artery was tied.

In the last edition, I objected to this explanation of the fact, and substituted for it the probability that the inferior part of the vessel was fed by anastomosing branches, as the mal-distribution alluded to was extremely rare, since I could not find a similar anomaly in any anatomical work. A short time ago, however, I perused Dr. Barclay's valuable little work on the Arteries, in which I found mentioned, that the late Mr. Allan Burns, of Glasgow, communicated to the author, an account of his having seen the anterior tibial artery wanting in two subjects, and that the arteria peronea antica supplied its place in the dorsum of the foot. These cases bear an analogy to the instance above cited; but still an opinion, founded on the *possibility* of such an anomaly, cannot be admitted in preference to that, founded on the basis of anatomy.

I might have extended my observations on the importance of studying the Arterial Anastomoses, and the application of this branch of knowledge to the treatment of Aneurism and Hæmorrhage; but it is incompatible with the design of this volume, to enlarge on one point *only* of Surgical Anatomy; and I therefore must beg to refer the student for further detail, to my "*Practical Treatise on the Arterial System.*" Experience has proved, that Hunter's operation in aneurism is the only method that can be relied on: but the inquiring student will not rest satisfied with being told, that placing a ligature on the artery above the aneurismal swelling, will cure the disease; he will ask how it operates? and what are the resources of Nature when the main channel of the blood is thus obstructed? It is not difficult to reply to the first of these questions; and the second may be easily answered, if it be understood that some of the branches of arteries communicate with each other, and that it is by these communications the circulation is continued, when the principal vessel of the limb is rendered impervious by ligature, accident, or disease.

The study of the Anastomoses will moreover teach him, that the apprehension which some entertain, that the inosculating branches, in certain situations, are not sufficient to support the life of the part, is entirely groundless; excepting in one case, viz.—when the aorta is obstructed by ligature at any point of its course between its origin and the passing off of the lumbar branches. 2dly.—That more is to be feared from their being abundant, than from their being few in number. 3dly.—That if the aneurism be of the common kind, it is reasonable to expect that the operation of tying the arterial trunk, at a distance from the disease, sufficient to ensure a sound condition of the vessel, will have the effect of curing the aneurismal swelling. 4thly.—That a failure may arise, either from the circumstance of the sac being fed from *above*, in consequence of some anastomosing branches entering the artery between the ligature and the disease; or from *below*, by the recurrent circulation. And lastly,—it will teach him, with respect to the treatment of hæmorrhage, that when a large vessel is wounded, two ligatures should be applied,—one to the upper, and the other to the lower extremity of the artery; and when a smaller, and difficult to reach, (as either of the palmar and plantar branches), the practice should consist in tying the vessel which supplies the wounded branch, and using firm pressure on the seat of injury.

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