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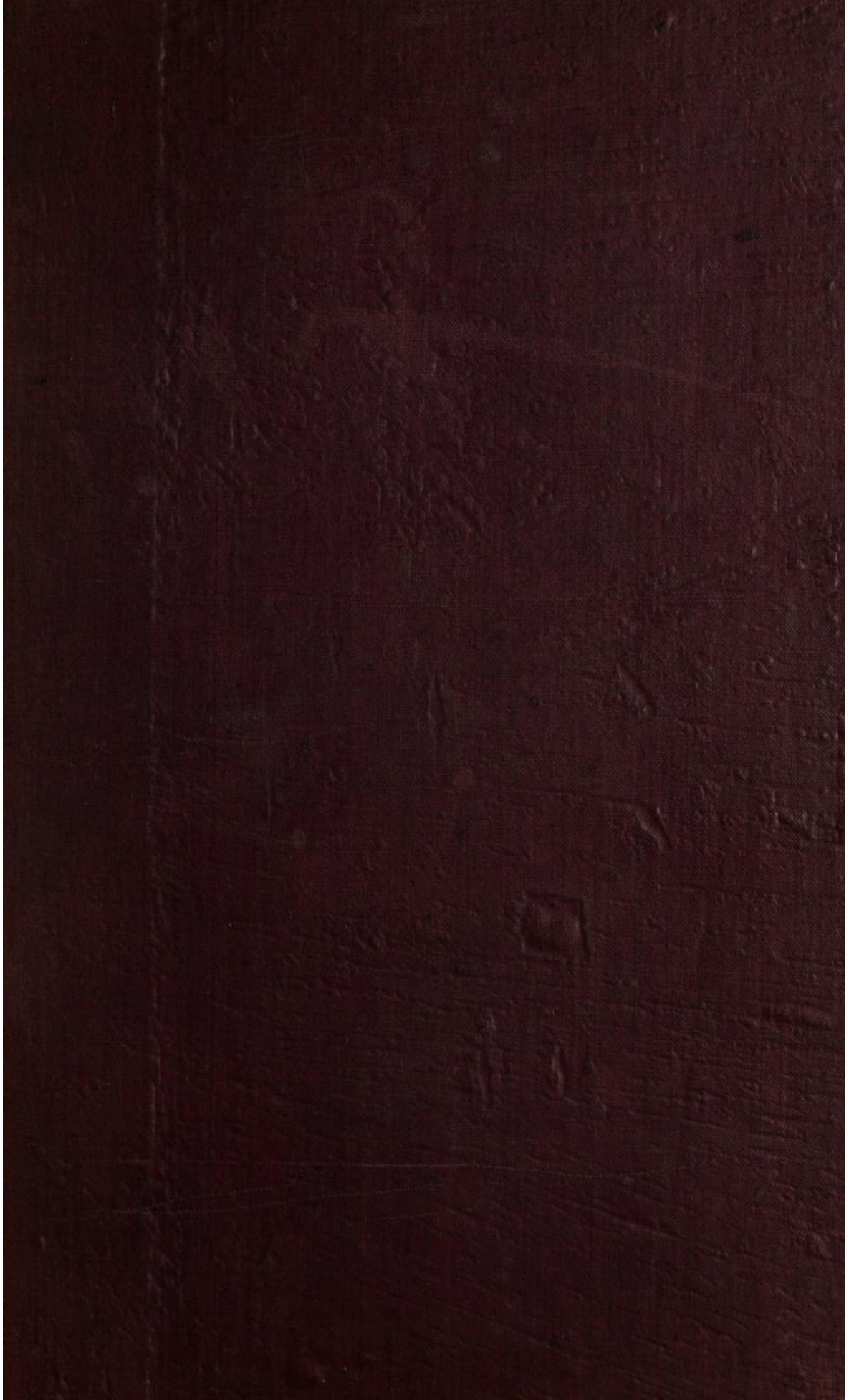https://wellcomecollection.org/works/bemjmdnn

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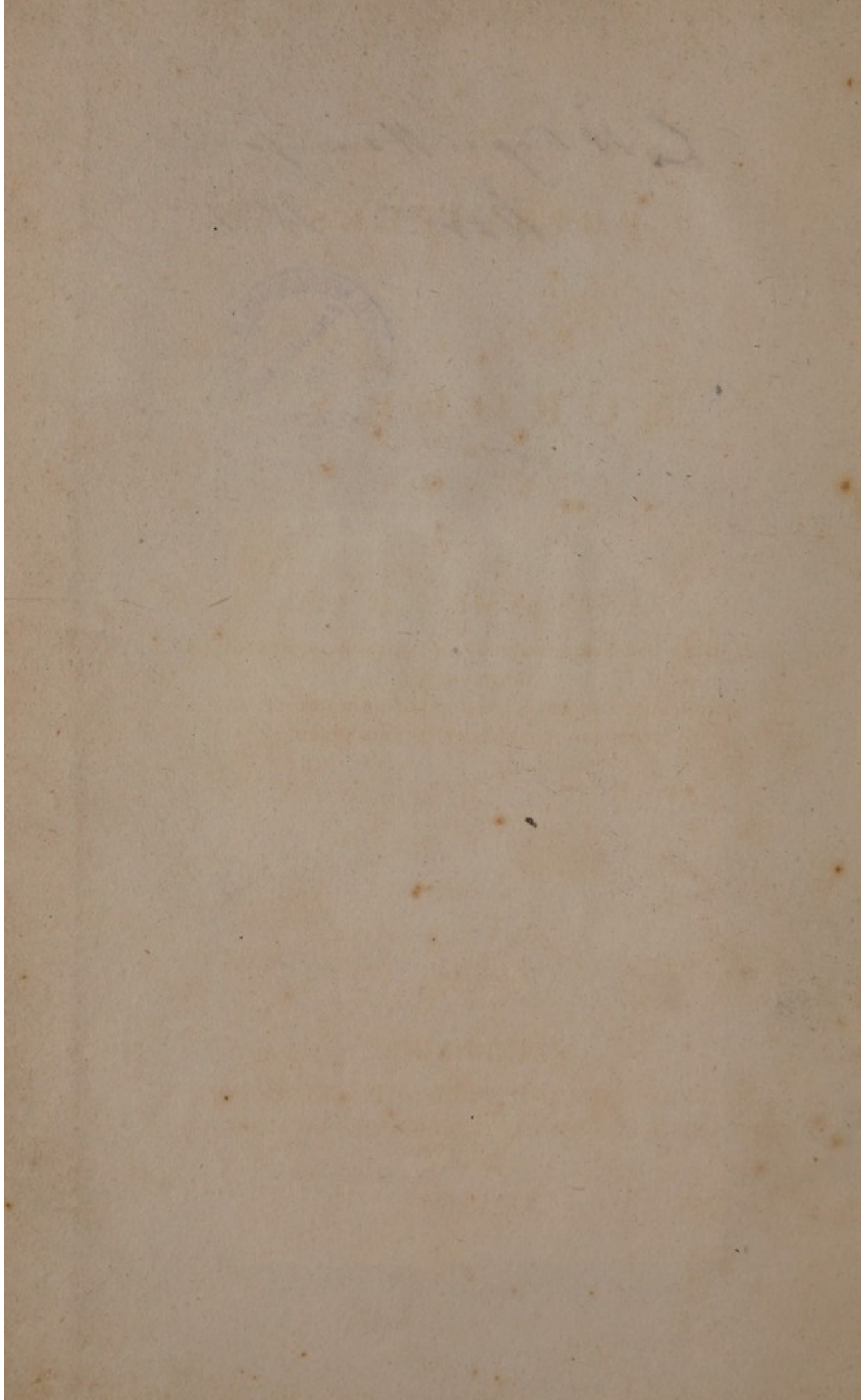
PRINCIPLES

OF

SURGERY.

BY

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PREFACE.

THE English language, though extremely rich in treatises on particular subjects of Surgery, possesses very few works which embrace the whole Science. Of these the most extensive is the system of Benjamin Bell; but it has long been antiquated, and different attempts made to supply its place, though possessing various points of excellence, have proved either so incomplete or so objectionable on other grounds, that they cannot well be employed as text-books for Surgical Lectures. The Author's pupils have urged him to write one for their use. It was on many accounts not in his power to enter very minutely into the various subjects treated

of; but this did not seem necessary, as the excellent compilation of Mr Samuel Cooper's Surgical Dictionary, and the numerous treatises already alluded to, afford ample opportunity of obtaining particular information to all who are well grounded in the principles of the profession. What appeared to be most required was a statement of the leading facts and opinions which constitute the science of modern Surgery, concisely expressed, and systematically arranged, so as to guide the steps of students, and assist in directing the views of practitioners. The Author ventures to hope that the work now offered to the public will in some measure supply this want, and prove useful not only to students of Surgery, but also to gentlemen engaged in practice, whose experience will afford the requisite illustrations for explaining the doctrines which it contains.

The materials of the work have been arranged in an order which the experience of a good many years has proved to be convenient for conducting a Course of Lectures on Surgery,

and which seems to be not ill suited for the purpose of written instruction on the same subject. The Syllabus which has hitherto been used by the Author's pupils is prefixed, to show what part of the undertaking remains to be completed, and the plan that will be followed in its execution. It was much desired that the work should not appear previously to its completion, but as this would have required the delay of another year, and as the half now submitted to the profession contains the general principles of practice, the publication has been proceeded with.

In mitigation of criticism on the literary merits of the work, the Author begs to observe, that the extensive field embraced by it has prohibited any attempt at embellishment with the ornaments of copious language, or the interest of particular details. Having remarked that in many surgical writings, what profess to be general descriptions are really minute relations of individual cases, and regarding this practice as not only unscientific, but

calculated to occasion much uncertainty, he has endeavoured to make a selection of symptoms as well as to use a strictness of expression more becoming the subject, and flatters himself that the portraits of disease which he has drawn, though not on so large a scale, nor so highly coloured as those of some other writers, will lead no less readily to the recognition of what they are intended to represent.

SYLLABUS OF LECTURES.

PLAN OF THE COURSE.

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PRINCIPLES OF SURGERY.

CHAPTER I.

INFLAMMATION.

INTRODUCTION.

WITH the exception of the cuticle and its appendages, which are destitute of vessels, and incapable of performing any vital action, all the solid part of the human body is composed of vascular tissues, which consist of blood-vessels and nerves interwoven together through a basis of cellular substance. These tissues are every where permeated by the blood, which supplies them with nourishment, for their growth and renovation. Some of them seem to perform no living action, but the due appropriation of the nutritious matter thus afforded, so as to preserve their structure in a healthy or perfect state, which is named their nutritive action. Other tissues, in addition to this power of nutrition, possess various remarkable vital properties, which are named their Functions.

A

Both the nutritive and functional actions of the tissues are subject to disorder. When the former are perverted, alteration of the structure necessarily results, but the latter may be disturbed without any obvious change of this kind, though derangement of function is no doubt most frequently connected with alteration of structure, and is very apt to lead to it. Disordered action, whether of function or nutrition, constitutes disease, to remedy which is the object of Medicine.

In Surgical diseases, if we except those depending on the presence of foreign substances, secretions and concretions in the cavities and canals of the body,— there is always alteration of structure, which may be owing either to morbid nutrition, or to external violence. In both cases, reparation is to be effected, not by mechanical art, but by the action of the nutrient vessels ; and all that the surgeon can do, is to remove obstacles out of the way of their salutary operation. It is therefore necessary, in entering upon the study of surgery, to become acquainted with the various actions of these vessels, whether tending to the injury or reparation of structure.

Symptoms of Inflammation.

By Inflammation is generally understood that condition of a part in which it is red, swelled, hot, and painful, along with more or less fever, or constitutional disturbance. But there is still another part of this morbid state, which, though it has not been so much noticed, is really the most important of the whole; that is, perversion of the vital action, which

is truly essential, and never-failing,—while the other symptoms are extremely variable, both in their degree and existence.

Redness.—This symptom is owing to distension of the vessels which convey blood; to this fluid being admitted into those which usually receive only the colourless part of it; and also to bloody effusion into the interstices of the structure concerned.

The redness varies considerably in shade. It is generally bright and florid, like that of arterial blood, but it often has a yellow hue, and still more frequently is dark, or almost purple. The yellow tinge is most frequently observed along with derangement of the biliary secretion; but the dark colour depends on different circumstances, the discrimination of which is of great importance in practice. It was formerly thought a certain indication of putrid tendency, or proneness to die from weakness,—and an unquestionable indication for administering wine, bark, and cordials. It is now observed to depend frequently on obstruction of the respiratory function, preventing the blood from undergoing its proper change. It is seen also when the venous circulation of an inflamed part is impeded; and it almost always appears when the intensity of the inflammation is excessive, in proportion to the strength of action possessed by the part affected.

Swelling.—This symptom depends partly on the enlargement of the vessels, but chiefly on effusion of the serous or albuminous parts of the blood, or the blood itself, into the cellular texture. It consequently

varies with the vascularity and laxity of the tissue concerned.

Heat.—This is a very characteristic symptom of inflammation, and, together with the redness, has no doubt led to the choice of a title for expressing it, since in all languages the term used for this purpose denotes burning. Like the last mentioned symptom, the heat varies with the part affected. It is most remarkable in the skin, and some parts of the mucous membrane.

It was formerly believed that the patient's feeling of heat depended always on a real and proportionate elevation of temperature ; but the application of a thermometer at once proves this opinion to be incorrect. John Hunter investigated the subject with his usual accuracy, and came to the following conclusions : 1. That the heat of an inflamed part is not commensurate with the patient's feelings. 2. That it does not exceed the standard or central heat of the individual. 3. That the greatest increase of temperature takes place in those parts which are farthest from the centre, and naturally coldest. *

Pain.—This is one of the most constant symptoms of inflammation. It is generally proportioned to the violence of the disorder and the sensibility of the part affected ; but there are many exceptions to the latter part of this rule ; and some tissues which are not at all sensible in their healthy state, occasion the most acute suffering when inflamed. The sensibility of every part in the body is increased by inflamma-

* Hunter on Inflammation, p. 296.—*4to Ed.*

tion; and if this has ever been denied, it must have been so from confounding insensibility to those stimuli which require for making an impression that the organ to which they are applied should perform a functional action for their reception, with insensibility to chemical and mechanical stimuli, which always excite more sensation when applied to an inflamed part, than to one in a healthy state. The pain of inflammation varies in kind as well as in degree; being sometimes hot and burning, at other times sharp and cutting, or dull and aching.

It is impossible, in the present state of our knowledge, to account for these varieties in the pain, or even for the existence of pain at all. It is usually ascribed to the swelling that accompanies inflammation causing pressure on the extremities of the nerves, whence it is said the most compact tissue occasions the severest pain; but this explanation is not satisfactory, as many organs which possess the softest and most yielding structure excite excruciating pain when they are inflamed.

The pain is not always felt at the part affected, but often at a distance from it. We are sometimes able to account partly for this by the nervous communications, but more frequently it is quite inexplicable, though highly deserving of attention in a practical point of view.

Derangement of Functional Action.—This symptom of inflammation cannot, of course, attend the inflammation of every tissue; and must be confined to those which possess some vital property in addition

to that of mere nutrition. It is sometimes, however, the only symptom present, or at least the only one that can be recognized; as when the organ affected is contained in an internal cavity. When the function of the organ is to receive the impression of some external stimulus, it either does so imperfectly or not at all; and hence, as already observed, some have been led into the error of supposing, that the common sensibility of parts is occasionally diminished during inflammation.

Derangement of Nutritive Action.—In addition to the serous and bloody effusion into the cellular texture which always takes place to more or less extent, the most frequent indication of a change in the action of the nutritive apparatus is softening of the tissue concerned. In some cases this alteration is so remarkable, that it has lately been thought necessary to designate it by a peculiar expression, viz. *ramollissement.* This effect of inflammation is, on many occasions, of great importance, but at present deserves attention chiefly as affording evidence that the nutritious process is not performed in its usual manner. Another fact which leads to the same conclusion is the rapidity with which putrefaction proceeds after death, in parts where inflammation has previously existed. It may be said that the more than usual proportion of fluid congested by the diseased action may account for this speedy decomposition, without supposing that the constituent particles are altered by it in their relation to each other. But, in such a view of the matter, we ought to observe the same putrefactive ten-

dency equally strong in parts where blood has been simply effused into their texture, which is not the case.

Constitutional Disturbance.—The disturbance of the system, or fever, as it is called, which accompanies inflammation, consists of an alteration in the performance of all the functions of the body. The phenomena which are in consequence exhibited, vary very much, according to peculiarities of the patient's constitution, and the part which is inflamed. Generally, the pulse is more hard and frequent, beating from 80 to 120, and in children much faster,—the respiration is hurried,—the face is flushed,—the eyes are suffused,—the tongue is white and crusted,—there is no appetite,—inordinate thirst,—headach,—constipation, —scanty urine,—dryness of the skin,—weakness of mind or delirium,—and prostration of strength in the voluntary muscles. This state of general disturbance, which is named inflammatory or symptomatic fever, does not always accompany inflammation, and is usually proportioned to the violence of the local symptoms. Its type or character also varies, as already mentioned, according to the part or patient affected. The pulse may be small, feeble, and irregular,—the tongue brown, smooth, and glazed,—the countenance dark-coloured, contracted and anxious, &c. These varieties in the symptoms of fever demand great attention, as indications for directing the remedial measures. The state of the blood, also, in this condition, requires particular consideration.

When blood is taken from one labouring under in-

flammatory fever, instead of coagulating as usual into a homogeneous red tremulous mass, it throws up to the surface a clear transparent portion, which coagulates into an opaque buff-coloured, tough, membranous-looking crust, which is named the buffy coat. It is usually about a quarter of an inch thick, and presents a concave surface, owing apparently to its preserving the original extent, while the subjacent part of the blood contracts during the separation of the serum. Whatever hastens the coagulation of the blood tends to prevent the formation of the buffy coat. Thus weakness of the individual,—the small quantity of blood abstracted,—the exposure of it to an extensive surface of dead matter,—its being abstracted in a small stream or by drops, all oppose the appearance in question. The formation of the buffy coat has therefore been supposed to depend merely upon slowness of coagulation, allowing the red particles to descend, and leave the fibrinous portion pure; but there is certainly something more than this concerned in the process, since the tough yellow crust under consideration differs materially from the fibrinous mass which is obtained by washing away the colouring matter of healthy coagulated blood, and when the disposition to its production is strong, it takes place notwithstanding the most rapid coagulation; while blood drawn from an animal in health may be retained for a long time fluid, without showing any trace of it. The buffy coat, though very constantly, is not invariably, observed during inflammatory fever; and it also appears occasionally,

though no inflammation exists. Pregnancy, and violent agitation, whether of body or mind, are apt to cause its formation.

Nature of Inflammation.

The heat, redness, and swelling which attend inflammation, naturally suggest the idea that the blood of the part is increased in quantity and moving force. Before the circulation of the blood was discovered, and it was supposed that this fluid moved from the liver, then regarded as the source of its formation, to all parts of the body, inflammation was referred to a preternatural flow, or determination of it in some particular direction. After the great discovery of Harvey, that the blood incessantly performs a double circulatory movement, the heart being regarded as the great or rather sole cause of its motion, it was readily concluded, that inflammation must be owing to some obstruction, which checked the progress of the blood forwards, while the *vis a tergo,* viz. the contraction of the heart, continued in operation. This obstruction it was thought might proceed from one or more of the following sources ; morbid lentor of the blood— *error loci* of the globules—and spasm of the extreme vessels. The two first of these were the doctrines of Boerhaave, the last that of Hoffman, but better known in this country as advocated by Cullen. The morbid lentor or thick state of the blood was inferred to exist from the apparent redundance of fibrine as shown by the buffy coat ; and it was thought that

the small vessels, being unable to transmit their contents, thus more viscid than usual, might occasion the obstruction in question. The same effect seemed likely to result from an *error loci*, or entrance of globules into vessels not fitted for their reception. This opinion rested on the belief that the structure of the globules was very complicated, each red one consisting of six serous, and each serous of six lymphatic globules, for the conveyance of which vessels of three different sorts and sizes were provided as channels of communication between the arteries and veins. In this view of the case it seemed probable that a globule getting into a wrong vessel might obstruct all those behind it. The third doctrine of obstruction referred it to inordinate contraction of the orifices of the capillary vessels.

It will be shown below that mere obstruction is not sufficient to account for the symptoms of inflammation, but the hypothetical causes which have been mentioned are inadequate to produce even this effect. The blood, so far from being more thick and viscid during inflammation, is now ascertained to coagulate more slowly, and to allow the red globules to subside more readily than usual. The free communication which exists between neighbouring vessels through means of the anastomoses of their branches would surely prevent any inconvenience from being caused by *error loci*, granting the possibility of such an occurrence; and the doctrine of spasm is objectionable, to say nothing of other grounds, on the very se-

rious one, that the alleged mouths of the vessels are found not to exist.

A different explanation of inflammation was given by Vacca.* He thought that the first step in the process was debility of the capillary vessels, which allowed them to be distended by the current of blood passing through them. The blood thus accumulated would cause heat, swelling, redness, and pain, and the action of the heart consequently becoming affected, the blood would be driven with more force into the arteries, which again would contract with violence proportioned to the extent of their dilatation.

Vacca rested this doctrine chiefly on its satisfactorily explaining the phenomena of inflammation, and also agreeing with circumstances frequently observed in the cause and cure of this morbid state. But his followers have called into their assistance, and indeed considered as their strongest argument, the appearances which are observed in the capillary vessels of inflamed parts when they are surveyed through a microscope. Their statement is, that, as inflammation commences and proceeds, the globules move more and more slowly, and at last cease to do so at all, while the vessels become greatly enlarged and distended.

These observations, though regarded by many as conclusive in favour of the doctrine of debility, seem, upon a more careful consideration, rather opposed to it ; for relaxation of the vessels ought to favour the transmission of their contents, and the delay that might be expected from their increased capacity ought

* Vacca de Inflammationis Natura, &c. 1765.

to be extremely inconsiderable. But it has always been remarked, that the globules begin to move slowly *before* the vessels dilate, * and that the dilatation increases in proportion to the slowness of their motion. It may be farther observed, that if the blood of an inflamed part were stagnated, the colour of it ought to be dark like that of venous blood, while, on the contrary, we know that, unless in particular circumstances, when the difference can be accounted for, it is always bright and florid ; and also, that if the enlargement of vessels necessarily implies debility, then blushing, the turgescence of glands, and the erection of the penis must be considered the effects or indications of debility.

John Hunter, in defining inflammation, said it was simply an increased action of the vessels ; † wisely observing that dilatation was as much an indication of power as contraction. This definition, however, is plainly open to objection, for the symptoms which have been mentioned above clearly show that the natural actions during inflammation are not merely increased but altered. And here it may be noticed, that a great mistake has almost invariably been committed in constructing theories of inflammation, by limiting them to the explanation of the least important though certainly the most obvious symptoms, viz. the redness and swelling, while the heat, pain, and disturbance of the vital action, whether nutritive or functional, have been treated with total neglect.

* Wilson Philip, Med. Chirurg. Trans. Vol. xii. p. 407.
† P. 278.

As the secretory and various other important actions which suffer derangement during inflammation depend in their healthy state upon the nervous energy, or power of life, and as all our efforts have proved insufficient to approach the truth more nearly in their explanation than by referring them to this source, we must be satisfied with doing the same in regard to their derangements ; and being thus obliged to admit, as the essence of inflammation, disturbance in the nervous energy of the part, we may employ it also to account for the changes observed in the circulation, which have never been satisfactorily explained otherwise.

The various local determinations or flows of blood so constantly occurring in blushing, secretion, the turgescence of the erectile tissue, the growth of tumours, the formation of the fœtus, &c. plainly prove that the motion of the blood is not entirely owing to, or under the control of the heart. When physiologists began to recover from the first dazzling effect of Harvey's brilliant discovery, they saw the necessity of taking into account some other motive power besides that of the heart, and much dispute has since existed as to the respective shares of it which ought to be assigned to the arteries, and their capillary terminations. It would be easy to show that any supposed conditions of these vessels as to enlargement or contraction, however energetic or alternated, are inadequate to account for the phenomena in question, and that we must therefore infer the operation of some other power in them than that of muscular contractility. But

this is unnecessary, as there are some vessels in the system which beyond all dispute possess such a power. The vessels of the fœtus, and those which absorb the chyle, can perform their office only by exerting an attractive force on the fluids exterior to them, similar to what must be exercised by the roots of vegetables. And if we admit the operation of such a power in some parts of the vascular system, we may not unreasonably suppose it to exist wherever similar effects are produced. The absorbing property, which is now acknowledged to belong to the veins, can hardly be explained in any other way—and then we have only to go a single step farther to grant it to the venous capillaries which communicate with those of the arteries. One will be more apt to adopt this opinion in examining the capillaries of a frog's foot after the heart of the animal has been cut out. It will then be seen that the globules continue in motion for half-an-hour or more, running sometimes one way, sometimes another, but always fastest in the smallest vessels, which, as measured by the globules, distinctly preserve their capacity without the slightest change, so that they appear as if made of glass, or some such rigid and transparent material.

Vacca seems to have perceived the necessity of attributing an attractive power to the capillary vessels, if we may judge from the following passage of his work above quoted : " Ergo vis sanguinis, quae canales sanguineos distrahere, et distendere nititur, contra eadem oscula, quoque agit, ipsaque aperire tentat. Verum oscula illa in salubri corporis statu vigore

eidem impetui proportionali semper resistunt, et idcirco tam angusta conservantur, ut ipsa ingredi minime possit nisi conveniens secernendus liquor non ex mechanica impellante vi, *sed ex attractionis virtute.*" * To which he adds the following note,—" Attractionis leges inter terrestrium corporum materias nondum detectæ sunt; attractionis vero existentia evidentissime est demonstrata." Vacca had the more merit for forming and thus confidently expressing this opinion, as the curious discovery of Reuss of Moscow, which has been so much extended by M. Dutrochet, that galvanism, a power so much resembling the nervous energy in many other respects, exercises a locomotive effect on fluids, was not made till long after the time he wrote. †

If we allow that the motion of the blood through the capillaries is influenced by the vital power of the vessels, the explanation of all the symptoms of inflammation becomes equally easy and obvious. It has already been found necessary to suppose that there is a disturbance of the nervous energy, in order to account for the various alterations of vital action; and the same power which is thus disturbed being regarded as controlling the capillary circulation, a corresponding derangement of it ought to be expected. Whether the blood passes more quickly or slowly through the inflamed part seems to be of comparatively little consequence; but the florid colour,

* Op. Cit. p. 20.

† Reuss de Electricitatis voltanæ potestate hydragoga—Moscow Transactions, Vol. ii. p. 307.—De viribus sanguinem moventibus, ib. p. 327—Dutrochet sur l'agent immediat du mouvement vital, 1826.

violent throbbing of the arteries, and distension of
the veins, certainly tend to support the former of these
opinions.

Inflammation may therefore be defined to be,—
*a perverted action of the capillary system, generally
attended with heat, pain, redness, and swelling.*

Inflammation terminates in various ways. Some-
times all the symptoms disappear, and the part re-
sumes its natural condition, when it is said to termi-
nate in Resolution. At other times it ends by de-
stroying the life of the part ; and is then said to ter-
minate in Mortification. It also terminates in various
actions, producing alteration of the structure, or the
separation of matters from the blood, differing in
quantity or quality from those naturally secreted by
it.   Of these the most remarkable are the following :
—The formation of a peculiar fluid named pus, which
is called Suppuration,—the effusion of serum, or lymph,
i. e. the fibrin, in a state resembling the buffy coat,
—the removal of solid or fluid parts of the body,
which is named Absorption,—and the production of
some solid structure, differing in quantity or quality
from that naturally existing, which may be designated
Diseased Nutrition.

Inflammation has been variously divided and nam-
ed, according to its termination,—the predominant
local, and constitutional symptoms,—the degree of its
violence,—and the part affected. Most of these dis-
tinctions, so far from simplifying the subject, have
tended greatly to obscure and perplex it.   Instead of
making inflammation be regarded as a morbid action,
always of the same nature, and merely modified in its

symptoms and termination, according to the part and constitution affected, they have made it appear a group of dissimilar processes, arranged under one title, but widely and essentially different from each other.

Inflammation of particular organs and tissues is expressed in modern nomenclature by adding the termination *itis* to the anatomical title of the part affected. For some parts the old and peculiar appellations are still retained,—as Erysipelas for inflammation of the skin, Ophthalmia for that of the eye.

The severity of the symptoms also requires to be distinguished ; for which purpose the terms Acute and Chronic are employed to denote the two extremes of violence, while the intermediate degrees are indicated by qualifying epithets. Acute inflammation frequently passes into the chronic ; but the latter often exists independently and originally. When the inflammation is acute, it terminates one way or another in a few days at farthest, and sometimes even in a few hours ; but when chronic, it may exist for weeks or months with little change. With acute inflammation there is almost always symptomatic fever ; with chronic hardly any.

Causes of Inflammation.

The causes of inflammation, or circumstances which give rise to this morbid state, are very numerous and various. They may be divided into those which act directly on the part affected, and those which do so through the medium of the system.

The direct causes of inflammation, or local irritations

B

as they are usually called, comprehend all the natural stimuli of action when excessive in degree or continuance, various animal, vegetable, and mineral matters, which are named irritants from their effects ; and every sort of violence, whether chemical or mechanical, which alters the structure of the body.

The effect of these causes varies with the irritability or tendency to excited action of the part or patient. Parts are generally irritable in proportion to their vascularity and sensibility ; but there are many exceptions to this rule ; and particular tissues are most under the influence of particular irritations. Parts occasionally become more irritable than usual. The circumstance of having been previously irritated sometimes renders them so. Weakness, or diminished power of action, also, as from interruption of either the nerves or blood-vessels, or any other cause, contrary to what one might expect, produces the same effect. Habit, or the continued exposure to an irritation, lessens its effect.

The differences observed in constitutional irritability are very striking and important. Sometimes they seem to depend on original or congenital peculiarities of the system ; but very frequently proceed from the injurious effect of deviations from propriety in diet or exercise. They are also often connected with mental irritation, which has a powerful control over irritability of the body. In these different states of the system, the same local irritation produces the most opposite effects ; and while one individual may have his limb lacerated and the bone shattered without suf-

3

fering so much inflammation as to occasion sympto-
matic fever, another dies from the intense action ex-
cited by the prick of a pin.

A most important fact in relation to the effect of
irritation is, that it always proves inconsiderable when
another which had been previously in existence, and
exciting disturbance, is removed by its means. The
success of operations frequently depends on this prin-
ciple.

The indirect causes of irritation, or those which
act through the medium of the system, constitute a
difficult, but very interesting and highly necessary
subject of study. One of the most remarkable dif-
ferences between animals and vegetables is the mu-
tual dependence of the component parts of the for-
mer. Though each part is induced to act by par-
ticular stimuli, and produces peculiar effects, the
whole are so connected together that one can hardly
be affected without causing more or less disturbance
of others. Sometimes the whole system suffers, and
then fever results ; at other times the consequent
disorder is confined to a part merely. This fellow-
suffering, whether partial or general, is usually ex-
pressed by the term Sympathy. Various explana-
tions have been offered to account for it, of which the
following are most deserving of notice : 1. The anas-
tomosis of Blood-vessels ; 2. Continuity of Texture ;
3. Nervous Communication ; 4. The Medium of Sen-
sation ; and 5. Participation in the same function.
None of these explanations admit of general applica-
tion in accounting for sympathy ; and many cases of

it are not explicable by any of them. But though the cause of sympathy is at present, and probably ever will be, beyond the reach of human understanding, the facts which are generally observed in regard to its manifestations are fair subjects of inquiry, and of the utmost importance in practice. Of these the five following, or what may be called the laws of sympathetic action, deserve especial attention.

1. Disturbance of action in one part occasions disturbance in others.

In a healthy state of the system all the organs perform certain actions with a certain degree of vigour, and whenever any one of them has its activity either excited or diminished, more or less change ensues in the action of others, the whole of which may thus become disordered or only one. The effect of excited action in causing sympathetic derangement is well known ; but the consequences of diminished action are more apt to be overlooked, though not less frequent, or less productive of serious disease. The most extensive and frequent derangement which occurs in this way proceeds from interruption of the mucous secretion of the intestinal canal. All attentive practitioners have remarked, that, when the bowels become costive, various diseases are apt to break out in distant parts of the body. This has been attributed to the irritation caused by retention of the feces,[*] but may be more correctly referred to interruption of the usual secretion. [†]

* Dr Hamilton on Purgative Medicines.
† Abernethy on the Constitutional Origin of Local Diseases.

Next in order as a source of derangement from diminution of usual action ought to be reckoned the skin. The effects of checked perspiration, or mere chilling of the skin, in occasioning general fever and local inflammation, are constantly presented to our attention ; and it is surprising that some writers on inflammation should have attributed to cold a power of causing direct irritation, from the evidence afforded by cases in which it plainly operated indirectly through the medium of the system, by diminishing action in the part to which it was applied.*

Whenever an accustomed secretion or action of any kind is suppressed, though there may not ensue indications of actual disturbance, there is always a strong disposition to it ; and therefore all operations, even of the most trivial kind, ought to be abstained from in such circumstances, as the direct irritation proceeding from them, together with the indirect inducement to derangement already present, might probably occasion violent local and general disorder.

2. A diseased action may, from long continuance, become as it were adopted by the system, so as to occasion disturbance by its suppression.

This fact is well known to the vulgar, who have in consequence the greatest dread of interfering with local complaints of long-standing, especially such of them as are attended with discharges. This prejudice is no doubt generally carried too far ; but it should be carefully recollected, that excited and disordered action of a part, which has ceased to irritate the sys-

* Thomson on Inflammation, p. 57.

tem, cannot be suddenly removed without the risk of causing general derangement.

3. All parts of the body do not sympathize with equal readiness,—but seem to be influenced by continuity of texture, contiguity of situation, and participation in the same function.

4. Excited action of one part may take the place of that in another, the system seeming inadequate to the support of both.

This translation of disease from one part to another is named Metastasis, and constitutes a most important principle of practice, as being the foundation of what is called counter-irritation, or the excitement of artificial disease for the relief of others more inconvenient or dangerous.

5. Pain, hemorrhage, inflammation, increased nutrition, and excited secretion, take the place of each other, so that they may be regarded as equivalents of action.

It must be observed, however, that the exchange is more ready between some of these than others, which must be attended to in the use of counter-irritation.

6. General disturbance or fever, however induced, is apt to terminate in some local affection, a part being, as it were, sacrificed for the whole.

Most people have what may be called their weak part, which gives way on such occasions, and in many acts like a safety valve, by protecting organs of more importance. This proneness to particular local diseases may be either congenital or the result of habit. In the former case it leads to what is called heredi-

tary disease, and in both occasions what are called constitutional affections.

Treatment of Inflammation.

The great object in treating inflammation is to make it terminate in resolution,—that is, to subside and disappear without leaving any change of the structure or actions of the part. The most obvious indication in the first instance with this view is removal of the cause which excited the disease, should it still continue in operation. When the cause is direct, this can generally be accomplished speedily and perfectly, though sometimes not without the performance of important surgical operations to be described hereafter. But when it is of an indirect kind, the process for removing it is generally tedious and difficult, requiring the careful administration of medicine and strict attention to regimen. When the cause cannot be remedied at once, or when the inflammation continues after its cause has ceased to operate, the morbid action requires the use of means for its suppression.

The symptoms of inflammation naturally suggest the abstraction of blood,—and this has accordingly always been regarded as its grand antidote, though it is perhaps much less often required than is generally believed. Blood may be withdrawn locally from the inflamed part or its neighbourhood, and generally from the larger veins or smaller arteries. The veins are almost always preferred for this purpose, from being more superficial than the arteries, whence they are more easily opened, and from being more easily clos-

ed. Those at the bend of the arm, the external jugu-
lar, and the veins of the hand and foot, are chosen for
venesection.

Venesection.—The patient should be placed in a
reclining posture, unless the peculiar circumstances
of his case should render some other more conve-
nient ; a bandage is then to be put twice round the
arm about an inch above where it is proposed to open
the vessel, and tied with sufficient force to obstruct
the veins without impeding the current of the arteries.
The surgeon now chooses the largest vein, which is
generally the median basilic—puts the limb into such
a position as may be preserved while the blood is flow-
ing, and presses the thumb of one hand upon the ves-
sel immediately below where he proposes to puncture
it, in order to prevent it from rolling, and the blood
from escaping, until he is ready to receive it ; then
holding the lancet with the other hand, he introduces it
into the vein at an angle of 45, in respect both to the
surface of the skin and longitudinal direction of the
vessel. When the blood appears, he ceases to push the
instrument deeper, but carries it a little farther for-
ward, in order to enlarge the opening of the vein ; and
lastly, elevates the point, so as to make the external
wound of sufficient size, which varies from a quarter
to three-eighths of an inch, according to the thickness
of the subcutaneous fat.   The pressure of the thumb
is then removed, and the blood is allowed to flow as
long as seems proper. The surgeon, when a suffi-
cient quantity has been abstracted, slackens the ban-
dage,—places his thumb upon the orifice,—cleanses
the arm from blood,—lays a small compress of folded

caddis on the wound,—and applies with moderate firm-ness a single turn of a bandage in the figure of 8.

It frequently happens, from the operator making too small a wound, or the opening of the vein ceasing to correspond with that of the skin, that the blood en-ters the cellular substance, and constitutes a tumour, which is named Thrombus. It produces no inconve-nience farther than arresting the flow of blood ; and if from this, or any other cause, the quantity desired cannot be obtained, it is better to open another vein at once, than to run the risk of exciting inflammation in the one already wounded, by introducing probes, or using any other contrivances for assisting the blood to escape. When the patient is fat, or the vessel small, the surgeon not being able to see the veins, must feel for them ; and then the one already mentioned, the median basilic, is generally recognized most easily, both from its large size and regular situation, on the inner side of the tendinous attachment of the biceps to the fascia of the fore-arm. The humeral artery lies under the vein at this point, but runs no danger of being wounded, unless the lancet is used with un-due force. The only artery that can be injured in a natural distribution of the vessels is the humeral ; but the arteries of the fore-arm frequently take a super-ficial course, which makes them assume the appear-ance of veins ; whence it is always proper to ascertain before introducing the lancet that the vessel is really a vein by its want of pulsation. The cutaneous nerves are so small and intimately connected with the veins, that they cannot be avoided by any precaution ; and

there is reason to believe, from the acute pain occasionally complained of, that they are not unfrequently divided; but bad consequences seldom if ever result, either from this source or the alleged pricking of tendons, which was formerly much dreaded.* When any local inconvenience results from the operation, it is now allowed to depend upon inflammation of the skin, cellular substance, or vein, owing to peculiar irritability of the patient's constitution, or the coarse manner in which the surgeon has inflicted or dressed the wound. These accidents will be best avoided by performing the operation as has been described above; and when they do occur, ought to be treated according to the principles which will be explained hereafter.

The external jugular may be rendered sufficiently tense for being opened, by pressing on it with the thumb a little above the clavicle. The lancet may then be introduced precisely as has been recommended; and if the incision is made in the direction of the sterno-mastoid muscle, it will not only ensure the division of the superjacent fibres of the *platysma myoides,* but also have the proper degree of obliquity in respect to the coats of the vein. The edge of the cup which is to receive the blood being held tightly below the aperture will determine the blood to flow through it, and when a sufficient quantity has been obtained, its farther escape will be easily prevented by applying a small compress of caddis, which should be retained by two crossing slips of adhesive plaster, rather than a bandage encircling the neck, as this might reinduce the bleeding.

* Benjamin Bell's System of Surgery.—Vol. iii. p. 184.—7th Ed.

The *vena saphena* may be readily opened where it passes over the inner ankle ; and in order to promote the flow of blood it is usual to place the foot in warm water, the discoloration of which is held to indicate the quantity of blood abstracted ; but as this measure is apt to mislead, it is better merely to suspend the limb in the steam, and place a vessel below it to receive the blood.

Some timorous patients will not allow themselves to be bled except from the superficial veins on the back of the hand, and the operation may be performed there very easily though not very effectually.

Arteriotomy.—The only artery now ever opened intentionally for the abstraction of blood is the temporal. Either its anterior or middle branch may be selected, but the former is the most convenient ; and the best part of its course for the purpose is just where it begins to be covered by the hairs of the head, a few of which ought to be shaved off previous to the operation. The artery is sometimes so large and superficial that it may be opened in the same way as a vein ; but in general this method would not succeed, as the small size and depth of the vessel render it extremely difficult to avoid either cutting its coats entirely across or pricking them slightly, in both of which cases the blood does not flow freely. Many plans have been proposed to obviate this difficulty, but the simplest and surest one is to place the point of the fore and middle fingers over the artery so as to ascertain and mark its course—then to make an oblique incision about half an inch long with a lancet

through the integuments over the vessel where it lies between the fingers—and lastly, to introduce the instrument gently again and again until the blood springs out. The operation may also be rendered more certain by using a small cupping-glass having an oval aperture fitted to the shape of the temporal region; even if the artery should have been completely divided this means will induce the blood to flow from it. To stop the hemorrhage a firm compress of caddis should be placed on the wound, and then a bandage a yard or two long, and an inch broad, rolled up at each of its extremities, being applied first to the opposite side of the head, should be brought round and crossed over the artery, after which its ends are to be carried back again in the opposite direction, and this repeated until sufficient pressure is effected.

Effects of Bleeding.—The first effect noticed is a diminution in the force and rapidity of the circulation, which is manifested by the pulse becoming slower and softer. By-and-bye the motion of the heart is so much weakened that it no longer propels the blood with sufficient force to support the functions of the brain. The individual becomes pale—he complains of weakness and nausea, which sometimes proceeds to vomiting, but more frequently, the functions of the brain becoming more and more completely suspended, he loses all power of sensation and voluntary motion—he is no longer able to stand or sit—there are frequently slight tremors of the muscles, and in some rare cases violent convulsive contractions of them— he makes some deep inspirations and expirations— looks wildly about him, and falls into a state closely

resembling death, which is named Syncope. Syncope occurs most readily when the patient is in an erect posture, and a very large quantity of blood may be withdrawn without inducing it if he lies horizontally. The most effectual method of recovering one from this state is consequently to lay him on his back. The quantity of blood which must be abstracted to induce syncope in ordinary circumstances is extremely variable. Sometimes several pounds may be withdrawn before its symptoms appear, and at other times a few ounces are sufficient for the purpose; the patient's mental alarm has a considerable share in producing the effect, but in general sixteen or twenty ounces are required.

When the patient is very weak, or very largely depleted, the syncope either passes directly into death, or is succeeded by an intermediate state, named Sinking. In this condition the pulse is small, feeble, and intermittent; the countenance is deadly pale, and bedewed with clammy moisture; the extremities are cold, and the patient has a distressing sensation of weakness. He lies in a dozing state; and when roused from it takes some time to recollect his situation, often at first expressing himself incoherently. His breathing is uneasy, being performed with dilatation of the nostrils, and is frequently attended with slight crepitation, or mucous rattle in the chest. This state, after continuing for hours, or it may be even for days, terminates in death, which is usually preceded by hiccup and vomiting.

When the quantity of blood abstracted is not too

great, in proportion to the strength of the patient, there
is a recovery or reaction of the system. After an ordi-
nary syncope, the symptoms go off in the inverse order
of their approach ; and when the patient has complete-
ly regained his faculties, it is generally observed that
the actions which were suspended are performed with
a slight degree of excitement. This is most observ-
able with regard to the pulse, which is rather more
sharp and frequent for some time afterwards than it
was before, provided the patient did not labour under
any febrile disturbance.

This excess of reaction is observed to be propor-
tioned in degree to the strength of the patient and
the quantity of blood withdrawn, provided it is not
so large as at once to induce sinking or death. Ex-
cessive reaction closely simulates the symptoms of in-
flammatory fever. The pulse is extremely frequent,
and has a peculiar jarring or jerking sort of charac-
ter—the respiration is hurried—the face is flushed—
the eyes are red and suffused—the patient complains
of intense headach, and distracting noises in his ears
—and when blood is drawn it exhibits the buffy coat,
though hardly the cupped surface which is seen dur-
ing inflammation. The local symptoms of inflam-
mation are not wanting ; and the brain, with its
membranes, is the part which, out of all proportion,
most frequently suffers ; but the viscera of the tho-
rax and abdomen are not exempt from risk.

This curious state, for pointing out which we are
much indebted to Dr Marshall Hall,* may be indu-

* Med. Chirurg. Trans. Vol. xiii. p. 127.

ced either by one or two very large bleedings, or by
a great number of small ones, causing a continued
drain on the system for days, weeks, or months ; and
accordingly, as it occurs in one or other of these
ways, the symptoms vary in the degree of their vio-
lence or acuteness. It may terminate in fatal effusion
on the brain, or some other important organ, in sink-
ing, or in a return to health. Bleeding, as might be
expected, though it affords temporary relief, always
increases the evil, either by making the state of ex-
citement more quickly terminate in sinking, or by in-
creasing the violence of its symptoms. Perfect rest,
both of body and mind ; cold applications to the
head ; gentle opiates ; and the gradual operation of
time, ought to be trusted to as the means of relief.

The discrimination between the symptoms of ex-
cessive reaction and those of inflammation, is of the
utmost importance in practice ; and the following ob-
servations as to the circumstances which modify the
effects of hemorrhage are deserving of much attention.

In young subjects, that is to say children and in-
fants, the power of reaction is feeble, and the risk of
sinking consequently great ; but if the immediate dan-
ger be surmounted, recovery is accomplished quickly
and perfectly.

In adult subjects who are weak from age or any
other cause, there is also small power of reaction ; but
their danger of sinking is not merely in the first in-
stance, and continues for a much longer time after-
wards, as the restoration to health is slow and imper-
fect.

In the healthy and robust individual there is always excessive reaction, unless the bleeding be so small as not to affect the system sufficiently, or so profuse as to cause sinking or death in the first instance.

Pain, fear, and the exhaustion produced by protracted fever, or the discharge of matter, increase the risk of sinking.

Local Bleeding.—Blood may be abstracted locally by scarifying, leeching, and cupping.

The first method can be employed only when the part inflamed is superficial. In such cases incisions are often useful, not only by allowing blood to escape, but by relieving tension.

Leeches should be dried before they are used, and the part to which they are applied ought to be carefully washed with warm water. When they are wished to fasten at a particular point, they should be inclosed in a small cone of paper or linen, which allows merely the head to project. After they fall off, the bleeding is to be encouraged by fomentations or a poultice, unless it proves excessive, as sometimes happens, particularly in children, when a small piece of caddis ought to be pressed firmly on the wound. If this means should fail, which it seldom does, the nitrate of silver may be applied, or the wound may be transfixed by a small needle or pin, and tied with a thread. The quantity of blood obtained by cupping depends greatly on the part which is chosen for the purpose. The skin should be well fomented before the operation, and carefully protected from the influence of cold during its performance. The glasses should have wide mouths, and be frequently emptied, to prevent the blood from

coagulating over the wounds, which opposes its flow, unless they be made of such a shape as to prevent this.

Purgatives.—These are substances that, when introduced into the intestinal canal, produce more or less irritation; the effect of which is a more vigorous secretion from the mucous membrane, and increased contraction of the muscular fibres. In consequence of this double operation, the dejections are more frequent and copious than usual; and the patient is not only relieved in the way of metastasis, that is, from having an action excited at a distance from the diseased one, but also has those secretions restored, the suppression of which is frequently the indirect cause of inflammation.

Many different purgatives are employed in medicine; but the most useful in subduing inflammation are calomel, jalap, and sulphate of magnesia. The saline purgatives induce a very copious secretion from the whole surface of the intestines, while calomel is thought to act more particularly on the liver, by restoring or promoting its secretion. The blue pill and rhubarb are very beneficial in gradually restoring these actions to a state of health when their disturbance has occasioned chronic inflammation.

Purgative agents are often introduced into the rectum with the view of hastening the effect of those administered by the mouth, or superseding the necessity of their use, when from any circumstance their employment happens to be inconvenient. The grand essential of these injections, clysters, or enemata, as they are named, is bulk or size sufficient to distend

the rectum, since this is the proper stimulus of that gut. From one to two pounds of gruel, or simply tepid water, should be used, and made more or less irritating, according to circumstances, by the addition of common salt, olive oil, castor oil, sulphate of magnesia, or oil of turpentine, &c. Various apparatuses have been employed for the purpose of injection; but the simple and efficient contrivance of Read has superseded all the others.

Diaphoretics.—These are remedies which, in the effect they produce, bear the same relation to the skin that purgatives do to the mucous membrane of the intestines. They increase the action of the skin, and are thus beneficial either in the way of metastasis, or in removing the cause of the inflammation, by restoring the secretion which has been suppressed.

The salts of ammonia have a diaphoretic effect; but being of a stimulating nature, are questionable remedies for subduing excited action of the system. Ipecacuan is less objectionable in this respect, and the combination of it with opium, constituting Dover's powder, is often extremely useful. By far the best diaphoretic, however, for subduing inflammatory action, is the tartrate of antimony, given in small and frequently repeated doses, so as to maintain a slight nausea, or even occasional vomiting. The warm bath is a powerful diaphoretic, and would often be very advantageous if it could be procured; but the difficulties which attend its employment in most families are so great as almost to proscribe it. The vapour-bath is more readily administered, and may perhaps

come into more general use. Much benefit is frequently derived from the semi-cupium or hip-bath, and the pediluvium or foot-bath; and still more, local baths are of great service in the form of fomentations and poultices. Heat is sometimes applied locally without moisture, but is then found to be not so efficacious.

Narcotics.—These are medicines which, without causing any real diminution in the power of the system, produce a temporary indisposition for action. Of these the most useful are opium, tobacco, hyoscyamus, and belladonna.

Astringents.—These are remedies somewhat similar in effect to those last mentioned. Cold, acetate of lead, and nitrate of silver, are the best means of this kind. Cold is more efficient in preventing than curing inflammation. It is of no use unless it can be applied either to the part affected or in its immediate neighbourhood; and then only when the diseased action proceeds from direct irritation. The acetate of lead is used externally in solution, either alone or along with opium, and has great effect in allaying pain.

Stimulants.—These means seem at first sight directly opposed to the object in view, but they are often beneficial when the part or system is disposed to overact by the weakness of its power.

Pressure.—In the defective condition which has just been mentioned, pressure may often be exercised advantageously by bandaging.

Counter-irritants.—The means of removing inflammation which are included under this title act on the

principle of metastasis, and excite irritation of various degrees as to intensity and duration. The most gentle in their effect are named rubefacients, of which may be mentioned mustard, oil of turpentine, ammonia, gum ammoniac, camphor, and some of the mineral acids. Blisters or vesicatories, are applications which, as the name implies, occasion blisters of the skin or elevations of the cuticle, by fluid effused under it in consequence of their irritation. The plaster of cantharides is most frequently employed for this purpose, but when the effect is wished to be strong and immediate, recourse may be had to boiling water.

So soon as the blisters caused in either of these ways have risen, they ought to be cut, so as to allow the serous fluid which they contain to escape, after which the surface is to be dressed with some simple ointment. In order to prolong the irritation of blisters, it used to be customary to dress the raw part with an ointment containing savine leaves, or the powder of cantharides, which prevented it from healing, and maintained a discharge of matter. When continued irritation is required, it is now more frequently effected by the tartrate of antimony, which, when applied to the skin either in solution or ointment, occasions a pustular eruption, that may be regulated as to extent and duration by the same means.

Another mode of causing permanent counter-irritation, is to institute a discharge of matter from a breach in the continuity of the skin. The introduction of a seton used to be, and still is, with many people a favourite way of effecting this. The operation is most

easily done with a seton-needle, an instrument shaped
like a lancet, about three inches long, three-eighths of
an inch broad, slightly curved, and having an eye in the
handle. A fold of skin being held up, the needle is push-
ed through, and by its means a thread, to which a skein
of silk or cotton sufficient to fill the aperture can then be
introduced. In a few days, when the discharge of mat-
ter commences, a new seton may be passed by drawing
it through the loop of the old one,—and this may then
be repeated daily. Issues are now more frequently em-
ployed with this view. They are merely breaches in
the surface caused by the knife, caustic, or the actual
cautery; that is, red hot iron. When the knife is used,
it should be pushed through a fold of the skin, and
then some peas, or other foreign bodies, must be placed
in the wound to prevent it from healing. The caus-
tics employed for opening issues are the nitrate of sil-
ver, pure potass, and potass fused with lime, of which
the last is on the whole the best. It may either be ap-
plied for three or four hours made into a paste with
soap or bread, and limited in its operation by a de-
fence of adhesive plaster, having an aperture cut in
it of the requisite size, or simply rubbed in substance
upon the skin until the alteration of colour and con-
sistence indicates that its effect is sufficient. In either
case, after the action of the caustic is completed, a
poultice ought to be applied until the portion of skin
that has been destroyed separates, when some foreign
substances, such as those already mentioned, must be
introduced to prevent the opening from closing. The
actual cautery is the best method of the whole, since

the breach which it occasions requires no means for keeping it open, and does not heal until after many weeks or months, or healing applications are employed. The pain is severe but almost momentary, and, on the whole, much less than that of the caustic, and the counter-irritating effect is found to be greater than that of any of the other means. The iron should have a sharp edge, not more than the eighth of an inch broad, in order to burn the skin deeply, or rather through its whole thickness, since, unless this be done, in adults at least, the effect is very inconsiderable and of short duration. It should be used as hot as possible.

Counter-irritation is frequently effected by moxa. This consists in burning small cones of the down of the Artemisia, or what answers equally well, provided the combustion be maintained by a blow-pipe or bellows, raw cotton made into cylinders from one to two inches wide and three quarters of an inch thick. Every degree of irritation may be thus effected, from the slightest reddening to the most complete burning— but it is difficult to regulate the effect, and there seems to be no advantage in attempting to do so, as the other means which have been mentioned are more under command, and at least equally efficacious.

Acupuncturation.—This remedy for inflammation must stand by itself. It consists in the introduction of slender needles from one to three inches in length into the inflamed part by a gentle rotatory motion. No respect is paid in doing this to the importance of the organs, and the heart, stomach, arteries, and

nerves are all transfixed without any ceremony. No pain or other symptoms of irritation are produced, and, on the contrary, a diminution of the inflammatory indications is alleged to be frequently observed. This practice is of ancient origin, and held in much esteem in eastern countries, where, as in China and Japan, its employment is said to constitute a distinct department of the surgical profession. Some years ago it was tried pretty extensively in France and also in this country, but it now seems to be going or rather to have already gone into disrepute.

Choice and Combination of the means which have been mentioned in treating Inflammation.

General bleeding is of no use as a preventive of inflammation, unless it removes some derangement of the system, or counteracts its tendency to excite inflammation. It has most effect at the commencement of inflammation, and is most beneficial when there is great power of action. It is better to take a large quantity of blood at first, so as to produce some decisive effect, than to bleed frequently by small portions. When it is found necessary to take away a large quantity of blood, an opiate given immediately afterwards is useful, by diminishing the tendency to reaction, and a small bleeding of a few ounces is often serviceable, with the same view, if practised soon after the first one, just when the symptoms of returning action appear.

After the force of the disease has been broken by bleeding, purgatives and diaphoretics are proper. It

is usual to premise the mercurial and follow them up with the saline ones. The tartrate of antimony is the best diaphoretic, and, by powerfully diminishing the tendency to violent action, in a great measure supersedes the necessity of bleeding, except at the commencement of the attack. Local bleeding is of most service in treating acute inflammation, as an adjunct to the measures of a general kind. Blistering is useful both in acute and chronic inflammation, but ought not to be employed for the former, if fever exists, until by bleeding, or some other means, the power of action in the system has been lessened. All the other modes of counter-irritating are most advantageous in, or rather entirely restricted to, chronic inflammation.

Opiates and astringents are most beneficial, both externally and internally, when there is much irritability, or tendency to act more than in proportion to the strength of the part or system.

Stimulants do good when the tendency to diseased action depends on weakness.

Resolution.—When the symptoms of inflammation subside they do not leave the part affected altogether in its natural state. It generally remains for a time somewhat swelled, tender, and unfit for the performance of its duty, whence it requires rest, mechanical support, and gentle stimulation.

CHAPTER II.

MORTIFICATION.

Symptoms of Mortification.

WHEN inflammation, instead of terminating in a return to the natural action, goes on to the destruction of the part concerned, it is said to terminate in Mortification. In this case the part is not only deprived of sensation and voluntary motion, but is completely divested of all vital properties, so that no opposition being any longer offered to the exercise of chemical attraction, putrefactive decomposition at once commences. The appearance of a mortified part varies with its structure, just as happens in putrefaction. The soft juicy tissues suffer most alteration, and the hard fibrous ones least. The former are reduced at once to the state of a dark fetid pulp, while the latter retain their distinctive characters for a much longer time. Another circumstance that affects the appearance of a mortified part, is the degree of action which has preceded its death, since the softness and fetor will of course be greater if much fluid has been accumulated previously. This has led to a division of mortification into dry and moist, which is quite arbitrary, altogether useless, and very perplexing.

The symptoms of mortification may be divided into those which precede its accomplishment, those exhibited by the mortified part, and those of the system which attend the local changes.

The symptoms that precede mortification are, generally speaking, those indicative of intense inflammation. The redness is dark and fiery, the pain hot and burning, and the swelling hard. As mortification approaches, the swelling, though it may rather increase in extent, becomes less tense, and pits on pressure. The skin acquires a yellowish hue, and exhibits dark mottled spots or broad lines over its surface. The temperature of the part becomes lower, and vesicles, containing a thin serous fluid of a yellow green or purple colour, which are named phlyctenæ, make their appearance. This state is called gangrene or gangrenous inflammation. The part is not dead, but threatening to die, and while more or less of it usually does perish, the greater portion generally recovers. When the vital power is completely extinguished, the part ceases to be painful, it shrinks in proportion to its previous distension, becomes black, brown, ash-grey, or buff-coloured, and emits a peculiar and most characteristic fetor, which is nearly the same whatever be the tissue concerned. It is then said to be sphacelated, or to constitute a slough.

The symptoms presented by the system while these local changes are taking place, deserve great attention. They are nearly those which have been already described as attending sinking from excessive hemorrhage. The countenance is pale, cold, and moist;

the features seem small and contracted; and the ap-
pearance exhibits that ill-omened aspect which has
been designated the *facies Hippocratica*; the pulse is
quick, feeble, and irregular; the tongue is brown;
and the lips frequently display small dark-coloured ve-
sications. The patient lies on his back completely
collapsed, or, as it were, sunk down into his bed; he
has frequent coffee-coloured vomiting, and suffers from
almost incessant hiccup. His body emits a peculiar
odour, somewhat like that of moist earth. He some-
times retains his mental faculties entire; but more
frequently falls into a dozing state, alternated with
low muttering delirium. The breathing becomes ob-
structed by mucous effusion, and death closes the
scene.

It is not easy to account for these constitutional
symptoms. They have been attributed to the spha-
celated part acting like a poison. But where slough-
ing is induced directly by chemical or mechanical
means, even to a great extent, it is not attended with
the effects in question. They have been also referred
to the general exhaustion of power which the system
suffers from the intense overaction that precedes the
mortification. But this opinion is irreconcilable with
the fact, that removal of the sphacelated part alleviates
and sometimes completely arrests the constitutional
symptoms. They have, therefore, as the only other
explanation, been accounted for by supposing that the
gangrenous or dying action extends itself over the sys-
tem. Whatever be the true reason of the constitu-
tional effect, there can be no doubt that it bears di-

rect proportion to the importance of the part affected, and the violence of the action which has preceded the destruction of its vitality.

Causes of Mortification.

The causes of mortification, or circumstances which induce inflammation to terminate in this way, may be referred to weakness, or defective powers of action; —excessive irritability, or disposition to act;—and excessive irritation, or excitement to act.

Weakness.—The different tissues possess different powers of action. The tendons and shafts of the bones are very apt to die when inflamed—the cellular substance is less so—the skin still less—and the coats of the arteries least of all. The weakness which predisposes to mortification may also depend on general debility of the system. In the advanced stage of fevers the slightest irritations are apt to occasion sloughing. In weakly children, exhausted still farther by disease, this effect is of course more certainly produced. Bad or defective food, and especially the use of unsound rye, which is subject to a morbid condition named Ergot, causes such an unhealthy state of the system, that the slightest local irritation, or even inflammation occurring spontaneously, leads to extensive sloughing of the extremities.

A part merely of the body may be rendered weaker than usual, so as to be more prone to mortification, and this in various ways. When the principal artery of a limb is tied, there is no longer sufficient strength for carrying on the usual actions—the weakened part

seems to make an effort to recover—heat, pain, swelling, with the other symptoms of inflammation, supervene, and, if they are the least excited by external circumstances, soon wear out the diminished power that remains. This effect of impeding the supply of blood is sometimes produced intentionally to destroy morbid growths inaccessible to the ordinary means of removal. The arteries occasionally become obstructed spontaneously, and this probably gives rise to the mortification of the toes which not unfrequently happens in old men.

Nearly the same effect is produced when the blood is prevented from returning through the veins by pressure or closure of them from other causes.

Defect of nervous energy also predisposes to mortification. People who are paralytic in the inferior extremities, are apt to have sloughing induced by slight bruises. When the principal nerve of a limb is cut or otherwise interrupted, a tendency to mortification is frequently observed at the extremity.

Irritability or excessive disposition to act.—Weak parts are always irritable; and hence this cause of mortification is to a certain extent comprehended in the former one. But, independently of weakness, and in the most opposite state of parts or constitutions, there is frequently an excessive disposition to over-action. People who exceed in eating or drinking, or who do not take exercise in proportion to their food, are liable to this morbid disposition, which is also sometimes met with as a peculiarity of original constitution.

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Excessive irritation or excitement to act.—Gene-
rally speaking, while other things are equal, the vio-
lence of inflammation is directly in proportion to the
irritation.   Whence it follows, that severe injuries,
or other great and continued irritations, are apt to
occasion mortification.

Treatment of Mortification.

The prevention of mortification requires the use of
means proper for obviating the predisposing causes. If
there is general weakness of the system from the use
of improper food, or any other cause, it must be reme-
died by a more wholesome regimen, and, if necessary,
supported in the meantime by the administration of
wine, spirits, and other stimuli of speedy operation. If
any cause of local weakness exist in operation, it ought
if possible to be removed ; and the part which is weak-
ened should be protected from all excitement. If there
is great irritability depending on strong power of ac-
tion, it ought to be lessened by bleeding, purging, tar-
trate of antimony, and tobacco injections. And if the
irritability is connected with or proceeding from weak-
ness, calomel and opium, general and local warm bath-
ing, anodynes, and astringents, ought to be admini-
stered conjunctly or severally, according to circum-
stances.

When the mortification is completed, the slough
should be cut away so far as is practicable, without en-
croaching on the living parts, in order to diminish the
fetor ; barm poultices are sometimes used with this
view, but they generally occasion uneasiness.   The

chlorurets of lime or soda in solution, diluted nitrous acid, or the *unguentum resinosum* with an equal quantity of oil of turpentine, are less objectionable applications.

The extreme prostration of strength that accompanies mortification, peremptorily demands diligent support from wine and spirits. Bark used to be thought a sort of specific for supporting the system under this trial, but it is now less trusted, and if given at all, the sulphate of quina is the preparation of it which ought to be preferred.

When the mortification does not cease to extend, it comes to be a question whether or not the surgeon ought to interfere with the knife. The objection to doing so is, that, though the constitutional symptoms may be alleviated, or altogether removed for a time after the amputation, the patient is soon reduced to the same state by sloughing of the cut surface. The most prudent course seems to be a middle one; to abstain from amputation when the mortification depends upon an internal cause, or one that cannot be removed, and to operate when the cause is external or within reach. It does not follow from this rule that amputation should always be performed when mortification of a limb ensues from external irritation, since the most trivial injury is sufficient to induce it in an unhealthy subject. It is only when the violence of the action is fairly referable to the local cause that the operation can be practised with propriety.

CHAPTER III.

EFFUSION.

Effusion of Serum.

THE action or process which is denoted by the expression Effusion, consists in the separation of the serous or fibrinous portion of the blood and its discharge into some part of the body.

Effusion is not necessarily preceded by inflammation, but is very frequently a consequence of it. It has already been remarked, that a slight degree of effusion almost always attends inflammation.

Serous effusion takes place chiefly into the interstices of the subcutaneous cellular texture, and into the cavities which are lined with serous membranes. In the former situation, it occasions a swelling of the part affected, which is smooth, colourless, unless inflammation exists, and pits on pressure. This is œdema or anasarca. It occupies those parts which are most dependent, and changes its place with the position of the body. In the serous sacs it constitutes collections of fluid, which are named dropsies.

The fluid, both of œdema and dropsy, generally

bears a close resemblance to, or rather seems identical with, the serum of the blood. Sometimes it is more limpid and colourless, tinged with blood or bile, more watery, or loaded with a larger proportion of albumen.

Serous effusion is induced in the cellular texture and serous sacs by various circumstances. It is often observed distinctly as a consequence of inflammation, but in this case the serous sacs are chiefly concerned. It very frequently results from the venous circulation being impeded either by the mere posture of the body or obstruction of the vessels; in which case the cellular texture mostly receives it. It also by no means rarely occurs without previous excitement of the part that can be observed, and seems rather to depend on weakness in the power of the vessels. This is equally apt to happen in both the situations.

The indication for preventing serous effusion is, of course, to obviate as far as possible the circumstances which occasion it. Inflammation should be treated on the principles which have been explained to make it terminate in resolution. If the circulation of the veins is not free, the impeding cause ought to be removed. If weakness threatens to occasion the effusion, it must be remedied by means suited to the case.

The cure of effusion is sometimes accomplished by simply puncturing the skin or sac containing the fluid, and allowing it to run out. But very generally the vessels from which the effusion has proceeded continue their action, so as to renew and maintain it after such evacuation. It is therefore necessary to change the action of the vessels, and this is done by various means.

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Mere external pressure sometimes suffices, and is more powerful when preceded by the application of blisters or stimulating ointments and lotions to the neighbouring skin. When signs of excited action continue along with the effusion, general and local bleeding may be indicated; and on the principle of counter-irritation or metastasis, diuretics, diaphoretics, and purgatives are administered. It is generally observed that the effused fluid is more readily absorbed when it is seated in the cellular substance than when it occupies a serous bag, provided the exciting cause has been removed. When the dropsical effusion is of small extent and superficially situated, particular operations are occasionally performed for its radical cure, as will be explained hereafter.

Effusion of Fibrine.

When fibrine is effused, it takes precisely the appearance of the buffy coat, and is named coagulable lymph. This effusion happens most frequently in the same situations as the serous one, but also occurs on the mucous surfaces, and in the interstices of every tissue.

When the lymph is thrown out upon a surface, it takes the form of a crust or membrane,—and if not disturbed, is apt to become organized by extension of the neighbouring blood-vessels, so as to constitute a permanent structure. Adhesions are thus often effected between adjacent surfaces. When lymph is effused on a serous surface, there is generally more or less serum also, which in this case is not limpid and colour-

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less, but turbid, with flakes of lymph floating in it. If the patient survives so as to afford sufficient time for the purpose, the lymph and serum become quite distinct and separate; the former is organized into dense membranous structures, and the latter exhibits the usual appearance of a dropsical fluid.

Effusion of lymph on a natural surface occurs almost always as a consequence of inflammation. It is also occasionally produced by two surfaces of the same kind being pressed together. The means of prevention consist in subduing the inflammation that precedes; and it may farther be stated, that the constitutional disturbance produced by mercury seems much opposed to the action which occasions it.

Lymph, like serum, is effused into the cellular interstices also, but in this case is not confined to the subcutaneous texture, and occurs with equal readiness in the constituent as in the connecting cellular substance of organs. In this situation too, it becomes organized, so as to cause thickening and hardening of the part concerned.

This effusion may occur as a consequence of inflammation, but much more frequently takes its rise from the immediate effect of local irritation, such as that produced by the lodgement of foreign matters within the substance of the body, when it is not sufficient to occasion inflammation. This process is generally rather beneficial than injurious, as it limits the influence of the irritation, and prevents it from exciting a more violent or injurious action. Its effects generally disappear as soon as the cause that led to them is removed; if they

do not, the same means which promote the dispersion of œdema are required, namely, pressure, with blistering, and stimulating ointments.

Lymph is also effused on the surfaces of wounds, and sometimes unites them, so as to remedy at once the solution of continuity. This process is named Union by the first intention. The steps by which it is accomplished, and the circumstances that oppose and favour its completion, are extremely important.

Every wound is attended with more or less bleeding ; and as it gradually ceases, an exudation of serum takes place, which is readily recognized by the faint-coloured stain it makes on the dressing. From eight to twelve hours after the wound is inflicted, less or more, according to its extent, all this discharge ceases, when lymph is effused from the cut surfaces, and if they are in contact, or nearly so, glues them together—becoming gradually organized, and completing the union from forty-eight to seventy-two hours after the injury has been sustained. The union, though now perfect, so far as regards appearance and feeling, does not possess much mechanical strength ; and if the lips of the wound be torn asunder, they are found to exhibit a coating of coagulable lymph on each of the respective surfaces, precisely similar to that which is effused upon serous membranes as a consequence of inflammation. Inflammation, therefore, used to be—and, until very lately was—considered essential to this mode of union, which was said to be effected by adhesive inflammation. It is now ascertained that

inflammation, so far from being essential to the pro-
cess, is completely subversive of it. A certain degree
of excitement is not incompatible ; but whenever it
goes so far as to occasion pain, or much swelling and
redness, union by the first intention is frustrated—
and the way is led to another process of reparation
hereafter to be described, viz. Granulation.

Inflammation being certainly preventive of pri-
mary union, and the interposition of any foreign
substance, or the separation of the cut surfaces, be-
yond the extent to which they can be glued toge-
ther by the thin layer of lymph effused from each,
being of course no less adverse to the process, it
follows that the plan usually followed in dressing
wounds must be equally injudicious and injurious.
It consists in closing them immediately, or soon after
their infliction, and retaining their lips in accurate
contact by adhesive plaster, or other means. Pled-
gets of ointment and bandages are then applied—
and no change is made in the dressing till the fourth
day. The consequences are, that the blood and serum
being confined, the edges of the wound are separated
from each other ; and the stimulus of necessity, as
John Hunter called it, or irritation produced by the
continuance of a breach in the structure of the body,
which, if primary union had occurred, would have
ceased to exist, causes inflammation as the first step
to the other mode of reparation already mentioned.
Three insuperable obstacles, any one of which would
be sufficient for the purpose, are thus placed in the
way of direct adhesion ; and when the wound is at

length undressed, instead of being united it is found
distended into a cavity filled with matter.

It is much more consonant with reason, and will
be found much more successful in practice, to close the
lips of the wound only partially until all bloody or se-
rous oozing has ceased, and then to place them in the
most exact possible contact. *

* In the year 1825 I published an essay in the Edinburgh Medical
and Surgical Journal, recommending this mode of treating wounds,
and am happy to observe that it is gradually coming into use, even
with those who at first most strenuously opposed it.

CHAPTER IV.

ABSORPTION.

Effects of Absorption.

By absorption is understood an excess in the action of removal over that of deposition in the nutrient vessels. The effect of this is necessarily a diminution in the bulk of the part concerned, which may be either of the surface or the substance. Absorption, therefore, is distinguished into superficial or ulcerative, and interstitial.

It may occur in both situations as a consequence of inflammation merely, without reference to the exciting cause; but much more frequently it depends upon some peculiarity of local irritation, which either occasions it directly or indirectly, through the intervention of inflammation.

The most common exciting causes of absorption are pressure, and the presence of something not naturally existing in the body. It frequently removes fluids effused into the interstices and cavities, and, when inadequate to effect this, generally opens a passage for their escape externally, by removing the parietes containing them to such extent as is necessary for effecting an aperture. Foreign bodies which excite more

irritation than what is sufficient for causing the effusion and organization of lymph around them, very frequently obtain their discharge by a similar process of interstitial absorption. It is curious that, though the pressure or irritation excited by the foreign matter one would suppose must be equal on all sides,—the absorbing action always takes place in the direction of the nearest external surface, unless an internal one should be very near, when the process proceeds towards it. It is by ulcerative absorption of the surrounding living tissue that sloughs are detached.

The means which may be employed for inducing absorption, are pressure, stimulating lotions, such as those containing vinegar, spirits, and muriate of ammonia, blistering ointments, and liniments containing mercury and iodine,—also the internal use of the two last mentioned medicines, and the tincture of cantharides.

CHAPTER V.

GRANULATION.

Effects of the Granulating Action.

THE term granulation is applied to an action which repairs breaches in the continuity of the surface that are not healed by primary union. Such breaches may be caused either by violence or absorption, and in both cases are named ulcers. An ulcer may be defined to be a solution of continuity in a natural surface, secreting matter.

When a wound does not heal by the first intention, it begins about twenty-four hours after the injury has been sustained to be painful, and attended with the other symptoms of inflammation. A thin serous discharge oozes out from it, and by-and-bye the surface acquires a uniform appearance, whatever be the tissue which composes it, owing to an effusion of lymph that seals up the interstices of the cellular substance, and forms a thin superficial covering. About the third day, sooner or later, according to the activity of action, the incrustation of lymph becomes organized,—it acquires a red colour, bleeds when touched, and before many days have elapsed, shoots up into small granular projections, whence the process is named. These granu-

lations are small, pointed, firm, and vascular,—they are covered with a firm pellicle, and constantly secrete a peculiar thick straw-coloured fluid named Pus, the properties of which will be more particularly described hereafter.

The wound is now, properly speaking, an ulcer, and the subsequent process of healing is the same as in ulcers caused by absorption. The inequality of surface, if any existed, gradually disappears, the bottom of the ulcer becomes regularly concave, and at length there ceases to be any difference of level between it and the surrounding parts. While these changes are taking place, the extent of the breach is daily diminishing, by a general contraction of its surface. Then a fine blue pellicle is observed at the edge, which increases in breadth, and at last covers the small remnant of the ulcer that is not closed by the contraction just mentioned. This new-formed skin is named the cicatrix; it is, of course, always much smaller in extent than the original breach of continuity, and diminishes still farther in the course of time. At first it is blue or purple, and very vascular, but afterwards it ceases to be so, and becomes dense, white, and bloodless, at the same time contracting still farther.

Nature of the Granulating Action.

It is generally believed that the granulations grow up above each other by the effusion and organization of lymph in successive layers until the cavity is filled to the proper level. That then the thin pellicle on the surface begins to be thickened and formed in-

to skin at the circumference of the ulcer, while the granulations below shrink, owing to absorption of their constituent substance, and draw the edges of the breach together. *   There can be no doubt, however, that this opinion rests on inaccurate observation, and is quite incorrect.   The subject was carefully investigated by the French Academy of Surgery ; and the essays of Messrs Louis, Fabre, Pibrac, &c. † leave hardly any thing to be desired for its elucidation. They showed that there is never any real reproduction of lost parts, with the exception of bone, which in some circumstances is regenerated.   The skin also ought perhaps to be excepted ; but the difference as to appearance and properties between the substance that constitutes a cicatrix, and the ordinary integument of the body, would rather lead us to regard this structure as a new formation.   In all other cases it will be invariably found, that when the cure is completed there either remains a depression corresponding to the loss of substance, or such contraction of the neighbouring parts as compensates for the absolute want.

The first step in the healing of an ulcer seems to be disgorgement or subsidence of the surrounding swelling if any exists ; and then a gradual emaciation ensues, chiefly of the fatty, but also of the other tissues concerned, so as to render the skin more lax and easily drawn together.   Hence it is that the cicatrix when first formed appears to be on a level with the neighbouring surface, though there may have been a

* Sir A. Cooper's Lectures, by Tyrrel, Vol. i. p. 160.
† Mém. de l'Academie de Chirurgie, T. iv. and v. 4to ed.

loss of substance to a considerable depth. After the cure is completed, the usual plumpness sometimes returns, and in such circumstances the cicatrix will always be found deeply depressed. Ulcers being thus healed by contraction, and not by any new production except what forms the cicatrix, the reason appears why their cure is accomplished more readily in parts which are lax, than in those which are comparatively fixed from adhering to the subjacent bones.

When an ulcer is dissected, the cellular substance lying under and around its base is found more or less infiltrated and condensed with lymph, but the granular covering is very thin, being limited to the crust effused in the first instance, and subsequently organized. The texture under the thin pellicle of the granulations is liable to be distended with blood or serum, which occasions a state similar to œdema, and elevates the surface of the ulcer so as to present the appearance which is commonly named *proud flesh*. Morbid nutrition may occur in the same situation, and then growths of various size, form, and appearance spring up; but these, so far from having any share in the process of cure, tend to delay or entirely prevent it. It may be asked, why should not the natural structures be regenerated, if diseased ones are thus formed? But it should be recollected, that all we know of the laws of nature is learned from her decisions; and mere analogy, in opposition to well-ascertained facts, affords no reason to expect any reproduction of lost parts in the human subject. There are other circumstances under which regeneration takes place more readily

—that is, when the parts concerned do not communicate with a breach in the surface of the body. An interstitial process then goes forwards, consisting of the effusion and organization of lymph, which frequently forms a substitute, nearly or altogether similar to the original texture. The nerves, tendons, periosteum, bones, and ligaments, are thus frequently restored, after suffering more or less extensive destruction.

Treatment of Ulcers tending to heal.

So long as the granulating process proceeds, as has been described, it requires no local treatment, except what is necessary to prevent it from being disturbed by external irritation. Great attention to cleanliness ought to be observed with regard to the parts surrounding the sore, which should be frequently washed and shaved, if there are any hairs upon them. There is no use or propriety in scrubbing the surface of the ulcer itself, as is frequently done, since the pus affords a natural covering to protect it, and would be sufficient for the purpose, if it was not that the risk of injury from contact with external bodies, and the unseemliness of an ulcer exposed to view, require some artificial covering. Old linen, lint, or charpie, may be employed for this purpose; and perhaps the last-mentioned article is the best, as, being more porous, it allows the pus to pass readily through its interstices, while the others must have small holes cut in them in order to do so. Whatever be the covering employed, it should be spread with some

unctuous matter, at least where it lies upon the edges of the ulcer, to which it is otherwise apt to adhere, and consequently injure them when removed. The ulcer requires to be dressed frequently, in proportion to the quantity of discharge. Once in the twenty-four hours is generally sufficient, but twice is often necessary—and sometimes the interval may be extended to two days or more.

One granulating surface may unite with another, when they are placed in contact, and retained together. The cure is thus sometimes greatly abridged, and at other times very troublesome adhesions result.

Treatment of Contractions caused by Cicatrization.

When the ulcerated surface is extensive, and the integuments surrounding it are easily drawn together, great deformity and inconvenience are frequently occasioned by the contracting effect of the granulating action, rendering the cicatrix so small as to keep the parts about it permanently displaced and immoveable. Mere division of the contraction is hardly ever sufficient to remedy the evil, as the firmness of the cicatrix prevents the edge of the cut from being separated much, and any relaxation thus gained is almost always lost during the subsequent cicatrization. An ingenious method of treatment was proposed by Mr Earle,*—namely, to cut out the cicatrix entirely, and then unite the edges of the wound laterally, if possible, by the first intention, but, at all events, so as to prevent contraction in the longitudinal direction. In

* Medico-Chirurg. Trans. Vol. v.

favourable circumstances for its performance, this operation answers extremely well, but these are unfortunately seldom met with, and it is obvious, that if the cicatrix be broad or of much extent in proportion to the size of the part affected, no benefit could be derived from its excision.

Treatment of Ulcers not tending to heal.

Ulcers are prevented from healing by many different circumstances, which have led to a variety of complicated classifications for their arrangement. As the effect of these has invariably been to perplex instead of simplifying the subject, it seems better to adopt an easier system; and the three following heads will be found to comprehend the whole.

1. Ulcers which are prevented from healing by defect of action.

2. Ulcers which are prevented from healing by excess of action.

3. Ulcers which are prevented from healing by peculiarity of action.

The circumstance which has occasioned the ulcer, the part of the body in which it is situated, or the peculiarities of the patient's system, sometimes at once indicate its nature; but in general this can be learned only by carefully examining the distinctive features that are presented in respect to the surface of the ulcer, the shape of its edges, the quantity or quality of its discharge, the kind and degree of the pain proceeding from it, the condition of the surrounding and subjacent parts, and the mode of its cicatrization.

Ulcers prevented from healing by Defect of Action.

The defect of action seems to depend sometimes upon a real want of power, and at others upon a want of disposition to exert the power that exists. The ulcers, accordingly, exhibit different characters, and require different treatment, whence they are divided into weak, and indolent or callous.

In weak ulcers the surface is generally higher than that of the surrounding skin, and exhibits large flabby granulations, which are either of a dark colour, like that of venous blood, or pale and œdematous looking. The edge is smooth and rounded; the discharge thin, watery, and generally profuse; the pain usually inconsiderable or altogether absent. The parts surrounding and subjacent, constituting what is called the stool of the ulcer, are soft and free from any indurating effusion. The cicatrix forms round the margin, and is at first generally elevated above the proper level, to which it usually descends afterwards, owing to the contraction that takes place subsequently to its completion.

This kind of ulcer occurs in parts which possess weak powers of action, either on their own account or on that of the system. The local weakness may depend on obstruction of the blood or nervous energy, the cause which occasioned the ulcer, or simply on the duration of the healing process. The general weakness is most frequently observed in children; but may be induced at any age, by deficient nourishment, an unwholesome atmosphere, &c. The most important sources of local weakness are the causes that

produced the ulcer, and the duration of its existence. With regard to the former, it may be stated, that wherever the solution of continuity is effected by means which injure the remaining parts, as by lacerating, bruising, or burning them, it displays the character of a weak ulcer; and as to the latter, it is sufficient to observe, that every ulcer tends to become defective in action during the process of cure; so that, if considerable in size, it is seen to display sooner or later the features indicative of this condition.

The treatment of weak ulcers consists in employing pressure, together with stimulating and astringent applications locally; and, if necessary, strengthening the system by the administration of wine, bark, bitters, and nourishing diet. The *Tinctura lyttæ* is often very useful in such cases when administered internally. Of the local applications, ointments used to be most employed, but the preference is now generally given to various metallic solutions, such as those of the sulphate of zinc, acetate of lead, sulphate of copper, in the proportion of from one to three grains to the ounce. These washes, as they are called, ought to be varied occasionally, as habit lessens their effects; and with the same view a poultice ought to be applied from time to time. Pressure is always useful, and ought to be exerted by proper bandages. Several folds of caddis moistened with the wash should be laid over the sore; and thin sheet-lead cut to the size of it is also very advantageous. Between the caddis and bandage it is proper to interpose a piece of oiled silk, to prevent the lotion from soaking away, and leaving the sore dry.

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The indolent or callous ulcer is distinguished by a smooth surface, generally depressed, and having no appearance of granulations, of various colours, brown, grey, or white, and looking as if varnished; a viscid tenacious fetid discharge; a circular or oval figure, with little irregularity; and thick white edges, seeming as if composed of accumulated cuticle. There is no particular hardness in the immediate neighbourhood of the ulcer; but there is almost always considerable swelling of the limb in which it is seated. The swelling is not soft and yielding like that of common œdema, but firm and incompressible. The pain is very variable. There is no appearance of cicatrix, so long as the sore retains its indolent character.

Ulcers of this description are confined almost exclusively to the legs of people advanced beyond middle age, and constitute a very troublesome subject of surgical practice, as they are very apt to recur after being healed. Some people, partly from the fear of injuring the system by suppressing a long-continued discharge, and partly from despairing of effecting a permanent cure, bestow little care on the treatment of these complaints; but this is wrong, since the most unpromising cases, under proper management, are often remedied; and there is hardly any disease which interferes more seriously with the patient's comfort, or unfits him more for the active duties of life.

The treatment which has been found most useful, is rest in the horizontal posture, conjoined with pressure. The merit of fully establishing the advantage of pressure, is due to Messrs Whately and Baynton,

the former of whom recommended a calico or flannel bandage, to be tightly applied from the toes upwards to the knees; and the latter, in addition to this means, insisted upon more effectual compression being exercised, by slips of adhesive plaster, an inch or two broad, and long enough not only to encircle the limb, but to cross each other far enough to obtain a firm hold when drawn round the leg, and across the sore. It is this practice which is generally regarded as the best, and has taken the place of all the others previously in use. The limb having been shaved, a slip of plaster is applied an inch or two below the sore; then another a little farther up, so as to leave a third of the former one exposed; then another in the same way; and so on, until not only the ulcer, but an inch of the skin above it is covered. Then a cotton roller, three inches broad, and five yards long, is applied from the toes upwards. Pledgets of caddis, covered with simple ointment, or compresses of tow, are often interposed between the plasters and bandage; but this is unnecessary. If the patient complains of pain, the dressing may be soaked with cold water. Unless the discharge is profuse, the sore need not be dressed oftener than once in two days. Under this treatment the swelling of the limb subsides,—the callous edges speedily disappear,—the surface of the ulcer granulates, discharges a purulent secretion, and cicatrizes as an ordinary healing sore.

I have found that the application of a large blister greatly hastens the cure, and frequently proves sufficient for its completion. The immediate effect of this

practice is a removal of the swelling,—the high callous edges disappear,—the surface of the ulcer comes at once to be on a level with the surrounding skin—granulates, and cicatrizes. *

Ulcers prevented from healing by Excess of Action.

These ulcers have an angry or irritable look, owing to redness of their own surface and that of the surrounding skin. They are deep, of a brownish-red colour, and show no granulations—they are irregular in shape—their edges are abrupt and ragged—their discharge is thin, serous, and often tinged with blood—the pain attending them is always acute. They form no cicatrix so long as they retain the irritable character. Irritable or overacting ulcers are met with in full over-fed subjects, who possess strong powers of action, and in weak irritable individuals. They may also occur in any one as the effect of continued irritation, whether direct or indirect.

The treatment consists in removing all sources of irritation, and using those local applications which have a soothing tendency. Of these, heat and moisture, as afforded by fomentations and poultices, are the best; and their effects may be increased by using decoctions of poppy heads, solution of acetate of lead with opium, &c. Scarification of the edges of the ulcer, or leeches, may also be employed if the symptoms are severe, but it is very seldom necessary to do so. Bleeding, purging, calomel and opium must also

* Second Report of the Edinburgh Surgical Hospital.—*Med. and Surg. Journal*, No. 102.

be resorted to according to the state of the system, so as to reduce excessive power of action and allay inordinate irritability. In relieving the ulcer from irritation it should be recollected, that motion has a powerful effect in causing or increasing it, and rest therefore ought to be strictly enforced.

When the over-action runs so high as to destroy the life of the part, it constitutes what is called a sloughing ulcer. The patients in crowded ill-ventilated hospitals sometimes suffer from sloughing of their sores, attended with great destruction of the parts, and frequently fatal effects on the system. This Hospital Gangrene, as it is named, no doubt depends on the unwholesome atmosphere exciting preternatural irritability, and the treatment, therefore, essentially requires removal from the sphere of this deleterious influence. Other means will hardly be required if this be afforded, while the most careful administration of dressings and medicines will be of little avail so long as the grand desideratum is withheld. The age, strength, and previous circumstances of the patient may render it proper to vary the subordinate treatment by bleeding or stimulating, fomenting or cauterizing. The hospital gangrene, as described by military surgeons, is not met with in civil hospitals, but a degree of the same effect, proceeding from a similar cause, is of frequent occurrence, and demands similar measures for its remedy.

When the action of irritable ulcers is not so intense as to destroy the life of the part directly, it sometimes occasions removal of the tissues concerned by absorp-

tion, and then constitutes phagedenic or eating ulcers as they are called. Soothing applications to the part, and the internal use of opium, ipecacuan, and calomel, generally have most effect in checking the progress of the disease ; but bleeding, both local and general, is sometimes requisite. The condition of the part or system which has occasioned the inordinate action in any case, will indicate the proper course.

Ulcers prevented from Healing by Peculiarity of Action.

It was formerly thought that all the ulcers which resisted the local means of increasing and diminishing action owed their obstinacy to peculiarity of disposition, whence they were named specific sores. It is now well ascertained that a very large proportion of these so called specific ulcers depend on some irritation direct or indirect, after the removal of which they readily heal. * The most common cause of irritation in such cases is that which proceeds from suppression of the secretions, especially those of the digestive organs, the remedy of which consists in correcting the patient's errors in regimen, and in subjecting him to an alterative course of medicine. The local treatment must be regulated by the condition of the ulcer as to excess or defect of action, but, generally speaking, lotions answer best, and of these the black wash, which is formed by decomposing calomel with lime water in the proportion of eight or ten grains to the ounce, is the most useful.

Ulcers depending on the suppression of other ha-

* Abernethy on the Constitutional Origin of Local Complaints.

bitual discharges should be treated on the same prin-
ciple, the particular means employed being varied ac-
cording to the circumstances of the case.

When an ulcer continues to exist without any local
or constitutional irritation to account for its doing so,
the obstinacy may then be fairly referred to peculiarity
of action. This morbid disposition is either confined
to the ulcer, or exists generally throughout the system.
Specific ulcers may accordingly be divided into consti-
tutional and local.

Specific ulcers are generally distinguished by the
hardness of their base and edges, the total want of gra-
nulations, and their mode of cicatrization. Their co-
lour is usually grey, yellow, or purple; their surface
sometimes deeply excavated, at other times elevated
into fungous growths, presenting a sort of cauliflower
appearance. Their discharge exhibits every variety as
to colour, consistence, and quantity. The pain at-
tending them is very variable. Their cicatrix exhibits
various odd peculiarities in the mode of its formation,
often commencing in the centre or at one side, and
shooting over the remainder of the area—going on at
one part while the ulcer extends at another—and being
in general considerably depressed below the surround-
ing surface, but not unfrequently elevated into projec-
tions high above it.

The treatment varies with the nature of the general
or local disposition which maintains the ulcer. It is
for the most part proper, in the first instance, to de-
stroy the surface with caustic, which may be either the
caustic potass, nitrate of silver, or *potassa cum calce*,

then to apply black wash, and subject the patient to an alterative course of regimen and medicine. When these means fail, strong preparations of mercury and arsenic are sometimes employed to destroy the diseased action, such as the arseniate of potass, the white oxide of arsenic or arsenious acid, the red and grey oxides of mercury applied in substance or ointment, or the oxymuriate of mercury. In using these poisonous agents it should be recollected, that an ulcerated surface possesses strong powers of absorption, especially when it is of old standing, so that proper caution must be observed in order to prevent them from producing disagreeable or fatal effects on the system.

When the ulcer resists every means employed to induce a healing action, it is generally named a Cancer, the only remedy for which is extirpation. This may be effected by caustic and cautery, the ligature, and the knife. The first mentioned means are proper where the sore is of no great depth, or of much extent; the second where hemorrhage might be profuse, and could not be easily restrained ; the third, or excision, is the easiest, least painful, and most certain method in the great majority of cases.

The different morbid dispositions which have now been considered may exist together, so as to complicate the appearance and treatment of ulcers. An indolent ulcer of the leg, by intemperate living and the excitement of motion, frequently, in addition to its own character, presents some of those which depend on irritation, such as redness and pain. These subside under the influence of poultices and rest, so as to leave

the indolent characters alone. Specific ulcers show
every variety of under-acting and over-acting charac-
ters, according to their particular circumstances, and
consequently require a variety of treatment besides
that which their peculiar nature demands.

CHAPTER VI.

SUPPURATION.

Pus.

SUPPURATION consists in the formation of a peculiar fluid which possesses the following characters : It has nearly the consistence of cream ; it has a pale yellow or straw colour ; it occasions no smell while cold ; but when heated to the temperature of the body emits a faint odour ; it is opaque, and when examined by the microscope appears to be composed of globules suspended in a transparent fluid ; it sinks in water ; it is coagulated by muriate of ammonia ; and sometimes has its fluidity diminished, merely by removal from the body, so far as to become consistent.

It was formerly believed that pus originated from putrefaction or degeneration of the blood and other fluid or solid parts ; and a loss of substance or breach in the continuity of the solids was thought essential to its formation. It is now ascertained that pus is produced by a peculiar secreting action of the capillary vessels, which may occur without any solution of continuity. The mucous membranes, after being inflamed, frequently take on the suppurative action ; and the purulent secretion of the granulations may be quot-

ed as another instance, since the pus is discharged here at once from the vessels. A granulating surface in several respects bears much resemblance to a mucous membrane, and may be regarded as a temporary covering instead of the skin. Pus varies very much in consistence, colour, and other properties.

Suppuration may be divided into superficial and interstitial.

Superficial Suppuration.

Superficial suppuration is that which takes place from the surface of the mucous membranes. It was not admitted by the older surgeons, who accounted for the discharge in such cases either by calling it mucous, or by referring it to some solution of continuity out of sight.

Purulent discharge from a surface, or a running, as it is generally named, is in the first instance accompanied with symptoms of the inflammatory action which preceded it, particularly heat and redness, which require measures of a soothing kind, such as bleeding, purging, warm fomentations, &c. By-and-bye these subside, and the discharge alone continues, when the treatment must be altered to the use of stimulating and astringent applications, such as metallic washes, ointments, &c.

Interstitial Suppuration.

When suppuration takes place within the texture of the body, there results a collection of pus, which is named an Abscess. The matter sometimes is diffus-

ed through the interstices of the cellular texture ; but
more frequently is contained in a circumscribed cavi-
ty, which is limited by the effusion of lymph.

When inflammation terminates in the formation of
an abscess, the pain loses its intensity, and occasions
a throbbing sensation. The tension also diminishes,
but the swelling does not subside ; on the contrary,
it rather becomes more prominent; and when pressed
between the fingers, conveys the sensation of a fluid
contained in a bag, which is called fluctuation. The
particles of a fluid being equally moveable in all direc-
tions, it happens that when pressure is made at one
part, an impulse is communicated over the whole sur-
face; and if the fingers be placed at different points,
the extent of it may be ascertained. When the col-
lection of matter is small, or thickly covered, a very
nice and practised sense of touch, the *tactus eruditus,*
is requisite for this purpose. If the abscess, on the
other hand, be very large, simple percussion at one
point is sufficient to detect it. When the suppuration
is extensive, or seated in any important region of the
body, its commencement and progress are usually at-
tended with rigors of various degrees and duration.

It has been questioned whether or not suppuration
can occur without being preceded by inflammation.
There can be no doubt that the symptoms of over-ac-
tion previously, are often very slight, and they pro-
bably ought not to be regarded as essential ; but in
the great majority of cases, suppuration certainly is a
consequence of inflammation.

The contents of an abscess may be removed by the

powers of the system in two ways. They are some-
times simply absorbed into the mass of circulating
fluids, from which they were formerly believed to re-
main distinct, and be thrown out in some other part
of the body,—as by the kidnies, intestinal canal, &c. ;
but this opinion is now abandoned, and the belief
in purulent urine or diarrhœa, as a consequence of
metastasis of pus, no longer exists. Much more fre-
quently the pressure of the matter causes absorption
of the surrounding parts, and, in conformity with the
general law that those yield to it most readily which
lie nearest the surface, the covering of the abscess be-
comes thinner and thinner, so that the skin alone re-
maining, it projects from the distension of the fluid, and
becomes so thin as to allow the colour of the pus to
be perceived through it. The abscess is then said to
point, and soon afterwards, the absorption still con-
tinuing, an aperture takes place, which allows the
contents to escape. A discharge of matter issues
from the opening for some time afterwards, but gra-
dually becomes thinner and diminishes in quantity
until a cicatrix is formed.

It is generally stated that this process of cure de-
pends on a growth of granulations from the whole sur-
face of the cavity which is thus gradually filled up. But if
this were the case, it is plain that there ought to be a per-
manent solid enlargement of the part concerned. For
pus does not proceed from the breaking down or soft-
ening of the natural tissues, as was formerly supposed,
and is merely secreted by the vessels into the inter-
stices between them. It separates the muscles, con-

denses the cellular texture, and elevates the skin, so as to obtain room for its reception, but so soon as vent is afforded for its escape, all the parts that have been pressed aside resume their natural situation; the cavity of the abscess is thus at once greatly diminished, and the contracting effect of the granulating action which ensues upon its surface completes its obliteration.

Instead of waiting for the natural evacuation of abscesses, it is usual to make an artificial opening, in order to hasten the cure. This ought not to be done in general until the fluctuation is distinct, especially if the abscess be seated in a glandular structure, as the process of reparation is otherwise apt to be rendered slow and imperfect. On the other hand, if the abscess is left entirely to itself, the skin frequently becomes so thin and impoverished at the part where it points, that it does not possess sufficient power of action for uniting with the subjacent surface; the matter also may extend over a greater space; and the patient suffers much more pain than he would have done if the abscess had been opened. When the patient is in great distress; when there is reason to believe that the matter is forming under some thick fascia, or other covering that resists its progress to the surface; or when the matter continues to be diffused in the cellular substance, it is improper to wait for pointing, and it is impossible to make an opening too early. When the suppuration takes place in a gland, or any morbid structure, it is proper to let the abscess either open naturally, or at all events be most

completely formed before interfering with it. In other cases, so soon as the fluctuation can be distinctly perceived, and the abscess points, the opening should be effected.

After the matter begins to form, and before it is evacuated, poultices and fomentations are applied, as they are believed to hasten the process of suppuration.

Abscesses may be opened either by the knife or caustic. The former is infinitely less painful and more certain. The best instrument for the purpose is represented by Fig. 1, Plate I. It is readily introduced into the cavity, and then carried to what extent, or in what direction, may seem proper. It is always right to make a large opening; and, as a measure for determining its size, the breadth of the part that points may be taken, if it does not exceed an inch and a half or two inches. After the matter escapes, so far as it is induced to do so by the contraction of the parts containing it, a piece of lint should be placed between the lips of the wound to prevent them from uniting by the first intention; but care must be taken that it is not so thick or forcibly introduced as to confine the discharge, and consequently oppose the obliteration of the cavity. A poultice may be applied for a few days to promote the escape of matter secreted by the surface of the abscess, and then simple ointment, or a slightly stimulating wash, supported with a proper bandage, should be employed until the cure is completed.

When caustic is used it should be applied as if for making an issue; and in case it does not extend its

effect through the whole parietes of the cavity, a knife may be pushed into the eschar or slough caused by its operation. Patients who could not bear the idea of having their sound skins cut, have comparatively little objection to this.

Some practitioners prefer caustic for opening abscesses, on the ground that while making the aperture it hastens the suppurative process. But if means for this purpose are required, there are others which can be used with more effect, and leave the opening to be made by the more eligible method of the knife.

When, owing to peculiarity of the part or patient, it is desirable to avoid making a breach in the surface, means should be used to promote removal of the matter by absorption. The best of these are blisters, followed by pressure. The cases in which they can be used with effect are chiefly those of slow suppuration in the glands, and under the periosteum.

Abscesses are said to be chronic or cold when the symptoms of inflammation which precede them are mild or not at all observable. In such cases the collection generally forms slowly and insidiously, so as not to attract attention until it attains a large size. Owing to the want of action that attends its origin there is little effusion of lymph, and consequently little resistance to the extension of the matter, whence the swelling is often of an irregular figure, and readily changes its place according to the tendency of gravity. When the matter passes from one part to another, it constitutes what is called a congestive abscess. The contents of chronic abscesses are generally thin,

and bear no small resemblance to whey, especially as they usually have flakes of curdy-looking matter floating in them. The superjacent skin is generally not altered in colour.

These abscesses have little disposition to evacuate themselves spontaneously, as the matter readily extends itself, and thus does not occasion sufficient pressure to induce absorption of the external parietes. It is hence the more necessary to make an artificial opening, but this cannot be done without some danger when the collection is large. The surface of the cavity, which not unfrequently is capacious enough to contain several pounds of fluid, sometimes inflames, and produces such violent constitutional disturbance as proves fatal in a few days. More frequently the bad consequence consists in a profuse and long-continued discharge from the morbid surface, by which the patient's strength is gradually exhausted, and hectic fever, as it is called, is excited. In this condition the patient becomes excessively weak and emaciated; the countenance is extremely pale, with the exception of a red patch on the cheeks, which contrasts remarkably with the whiteness of the other parts of the face, and especially of the eyes; the pulse is quick and weak; he complains of burning heat in the palms of his hands and soles of his feet; his skin is dry and hot; and he suffers from nocturnal sweats, often together with colliquative diarrhœa.

This kind of disturbance is the usual result of continued irritation operating on a weak subject, and one of its most common causes is the discharge that follows the

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opening of a chronic abscess.   It used to be supposed
that the matter occasioned the fever by being absorb-
ed into the mass of circulating fluids, but this opinion is
now abandoned, and the effects on the system are attri-
buted to the irritation which attends its secretion.
Though the expression Hectic Fever is sanctioned by
long use and universal acceptation, there appears to be
good reason for laying it aside, since it leads directly and
unavoidably to erroneous ideas of the condition which
it is employed to denote.   Fever implies disturbance of
all the corporeal functions; but in the hectic state those
of the stomach, brain, and many other parts remain un-
affected ; and it will be found on examination, that all
this morbid condition amounts to, is irritation, usually
attended with increased action of one or more *parts* of
the system, in conformity with the first law of sympa-
thetic action, (p. 20.) The effect of the primary and se-
condary local irritations is to weaken the system more
and more; at length fever is really induced—the patient
shivers—his tongue becomes foul—he loses his appe-
tite—and speedily sinks under the disease.   Instead
of Hectic Fever therefore, which, if used at all, ought
to be restricted to denote this last mentioned state, it
would perhaps be better to use the expression of Hectic
Irritation.

A great improvement in the treatment of chronic
abscesses was introduced by Mr Abernethy.   It con-
sisted in drawing off at first, only part of the contents
by means of a trocar, allowing the wound to heal by
the first intention, and then repeating the puncture
two or three times, with the interval of a week or

two, until the collection was so reduced in size, that the cavity could be safely laid open and healed from the bottom as an ordinary abscess. If the abscess is large, the patient should be confined to bed, and kept quiet for some days previously and subsequently to the operation; for if these precautions be disregarded, even though the wound should heal by the first intention, there will be a risk of inflammation. Care should be taken to prevent the entrance of air, not because it possesses any power of direct irritation, but because it promotes putrefaction of the remaining matter, and in that way gives rise to the most violent disturbance. If there is reason to suppose that the abscess is connected with any incurable disease in the bones or elsewhere, it ought not to be opened, since doing so could only accelerate the patient's fate, and bring surgery into discredit. Such abscesses often exist for years without suffering apparently any change, or giving the patient much inconvenience, but upon being opened prove speedily fatal.

Sinus and Fistula.

When an abscess is seated in parts, the action of which is defective owing to local or general causes, the cavity that remains after its evacuation does not contract completely and close, but continues to secrete a discharge, which is generally thin and copious, then constituting what is called a Sinus. The surface, in course of time, becomes condensed and smooth, so as to resemble a mucous membrane rather

than the granulated covering of an ulcer—and if the discharge be copious, or any source of irritation exist, lymph is effused around the cavity so as to thicken its walls and render them almost of cartilaginous hardness. In such a confirmed state the sinus is named a Fistula, but this term is usually confined in its application to sinuses connected with the natural excretory canals, the contents of which, by passing through the preternatural channel, prevent it from closing, and cause thickening of its walls. This hardening or callosity was formerly thought to depend on morbid disposition of the part, and to require extirpation as an essential step to the patient's recovery. The operations practised on this principle were extremely severe, and one of the great improvements derived from the more enlightened pathology of modern surgery is their entire disuse. It is now found to be sufficient for remedying the induration to remove the cause of irritation that induced it, the methods of doing which will be explained hereafter, in connection with the different regions of the body which are apt to become the seat of fistula.

In treating sinuses the indications are to promote granulating action on their surface, and to lay their sides together. They are not healed by *filling up* any more than the original cavity of the abscess, but contract until they become obliterated, or close more directly by union of the opposite surfaces.

Stimulating injections, such as those applied to weak ulcers, should be thrown in, pressure ought to be used externally, and the patient, by means of nour-

ishing food, together with all the other adjuvants to
the recovery of general health, should remedy, if pos-
sible, weakness of action in the system if there seems
to be any fault in this respect. The *Tinctura Lyttæ*
is often serviceable in exciting more energetic action,
before this can be effected by strengthening the sys-
tem. Great care must be taken to avoid confining
the discharge of the sinus, since, if prevented from es-
caping, it must distend the sides of the cavity ; and,
on the same principle, it is proper always to afford
the matter a dependent opening for its escape, either
by enlarging the one already existing, or making a
new one. The most effectual method of proceeding
is to lay the canal open by the knife ; and it is not
unfrequently necessary to resort to this practice when
mild measures have failed, or the result of experience
in similar cases authorizes the surgeon to dispense
with their trial.

CHAPTER VII.

DISEASED NUTRITION.

Tumours.

By diseased nutrition is understood an action of the capillary vessels, which, instead of preserving the tissue concerned in a natural condition, increases its size or alters its texture. The morbid growths thus resulting, constitute the principal division of a most important class of surgical diseases, which are named Tumours. The term tumour implies enlargement of a part of the body beyond its natural dimensions, which may be owing to the effusion or accumulation of fluids, the displacement of organs, or morbid growths.

Morbid growths include simple enlargements of the natural tissues, and also diseased conversions of them into textures foreign to the healthy constitution of the body. Mr Abernethy used the term tumour as synonymous with morbid growth, and restricted its application " to such swellings as arise from some new production, which made no part of the original composition of the body." * As this would exclude many important enlargements of natural tissues which con-

* Abernethy on Tumours, p. 6.

stitute tumours very deserving of attention, the more comprehensive definition that has just been stated seems to be preferable.

Morbid growths occur in almost every part of the body, but the glands and subcutaneous tissue are their most frequent seats. They are very variable in the rapidity and extent of their increase; 'but, generally speaking, grow quickly in proportion to their size; and, other things being equal, usually enlarge most vigorously when their situation is dependent. Any thing that irritates, or tends to inflame them, promotes their increase; and opposite circumstances are attended with opposite effects; rest, low diet, cold applications, and leeches, lessen the activity of their enlargement.

When inflammation attacks a morbid growth, it of course either terminates in resolution or mortification; or leads the way to some of the actions which have been described. But, whatever the action may be, it almost invariably proceeds in a depraved malignant sort of manner, so as to prevent a cure, or any satisfactory termination. Morbid growths deserve great attention, not only on account of the distressing consequences which thus ensue, but also in regard to the deformity and inconvenience which they occasion directly by their presence. They may be removed in three ways, viz. by absorption, mortification, and excision. In order to determine on the choice of these means, and execute them properly, it is necessary to be acquainted more particularly with the different kinds of morbid growths.

Mr Abernethy's arrangement and nomenclature of tumours are generally adopted.   He divided them into Sarcomatous and Encysted ; the former being solid ; the latter composed of a cyst containing matters of variable consistence.

Vascular Sarcoma.

Of all morbid growths, the simplest and apparently most akin to the natural structure, is that which has been named Simple or Vascular Sarcoma.   It possesses a firm solid consistence, and generally a fibrous struc-ture.   It is freely supplied with blood, and has usually small deposits of glairy fluid irregularly interspersed through its substance.   It seems to be chiefly com-posed of accumulated cellular tissue and blood-vessels. It sometimes exists as an independent tumour ; but more frequently constitutes what are called simple en-largements of natural parts, especially the glands.   It produces little inconvenience, except what proceeds from its size ; and is recognized by negative charac-ters ; that is, by not manifesting the peculiarities which distinguish the other kinds of morbid growth.

Of all tumours, this is the one which yields most readily to means that promote absorption ; and this, accordingly, is the method followed in its treatment. Blisters applied locally, and the internal use of can-tharides, with a small quantity of mercury, so as hardly to affect the mouth, ought to be used in the first place, and then the ointment of hydriodate of po-tass, in the proportion of a drachm of the salt to an ounce of axunge, should be applied either alone or to-

gether, with a third part of camphorated mercurial ointment; after which, the tumour is if possible to be subjected to the pressure of a bandage. If the tumour during the treatment ever becomes red or pain-ful, a few leeches should be applied; and the utmost care is to be taken throughout, that the patient's se-cretions are duly performed. In this way chronic enlargements of the glands, and simple sarcomatous growths existing independently, may often be dispersed. Should they prove obstinate, and occasion much in-convenience or deformity, the best method of remov-ing them is excision, if the circumstances of the case, as to the situation and connection of the tumour, do not forbid it. Some attempts have been made to arrest the morbid nutritive action, or cause sloughing of the mass proceeding from it, by tying one or more of the nutrient arteries; but experience on this subject has hitherto been very limited and unsatisfactory.

Fibro-Cartilaginous Sarcoma.

There is a kind of tumour not unfrequently met with about the head, neck, axilla, and region of the mamma, which possesses very nearly the structure named Fibro-cartilage by anatomists; and I have there-fore taken the liberty of applying this title to it, as there is no other under which it can be properly ar-ranged, though every practical surgeon must be per-fectly familiar with it.

This tumour has always a nodulated, or what mi-neralogists would call a botryoidal surface. It pos-sesses a compact homogeneous consistence, with the

exception of small cells, variable in their size and number ; it is of a yellowish or grey colour ; it is inclosed in a capsule, which separates it from the surrounding parts. It often occurs in the vicinity of the parotid and mammary glands, which it compresses, and then causes them to be diminished by absorption, so much as at last to occupy their place, and appear to superficial observers a morbid degeneration of the glands themselves. It is not attended with any inconvenience except what its size occasions ; is not prone to any other action but that of its own nutrition ; and after attaining a certain magnitude, generally ceases to grow larger.

The only efficient treatment is removal by the knife, and this in general may be easily done. If the deep situation, or important connections of the tumour, should render the operation dangerous, or productive of any permanent inconvenience, it ought not to be undertaken, unless the swelling seriously incommodes the patient, or is rapidly increasing.

Adipose Sarcoma.

One of the most common solid tumours is that which has very properly been named the Adipose or Fatty Growth. The appearance of its structure is precisely what the title indicates, and bears the closest resemblance to that of the ordinary subcutaneous fat. It is generally of a somewhat darker yellow colour, and not so granular ; it is surrounded by a thin capsule, which keeps it distinct from the neighbouring parts, unless they happen to be pressed together, when ad-

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hesions occur between them ; it is generally of a very irregular figure, and sends out long processes in various directions. The skin covering such tumours is not discoloured, but usually shows some inequalities of surface, corresponding with the lobules of the growth. The adipose sarcoma occurs in every part of the body, and at all periods of life, but is most frequently met with under the integuments of the trunk in young females, and middle-aged people of both sexes. There is frequently more than one tumour in the same person. It tends to increase according to the principles already explained, and occasionally attains a monstrous size, so as to weigh ten, fourteen, or even twenty-seven pounds, which was the weight of one removed from the parietes of the abdomen by Sir A. Cooper.* It generally occasions no inconvenience except what is caused by its bulk, but sometimes becomes the seat of uneasy sensations, and weakens the voluntary action of the neighbouring muscles. It is not prone to any morbid action or degeneration, but has in some cases been found altered in this way.

In treating adipose sarcoma, it is found that the means which promote absorption have little or no effect, and that excision is the only mode of affording the patient relief, unless the tumour happens to have a very narrow neck, when the ligature may be employed, but not so advantageously as the knife. The capsule which surrounds the growth hardly adheres to it, except in the circumstances above-mentioned, so

* Med. Chirurg. Trans. Vol. xi.

that the dissection is extremely easy and readily performed.

Cystic Sarcoma.

Tumours are occasionally met with, which when dissected, exhibit a cellular structure, the compartments being extremely variable in their relative as well as absolute size, and in the nature of their contents. Sometimes they are perfectly fluid, at other times viscid or glairy, and their colour is of every kind, though most frequently yellow or purple. Different cells of the same tumour often have dissimilar contents.

This Cystic Sarcoma, as it is called, tends to increase, and does not appear to have any limits to the size which it may attain. It is not prone to degeneration, and does not occasion any uneasiness, except by its bulk, causing deformity, impeding the motion of the patient, or pressing injuriously on important organs. It occurs most frequently in glandular structures, especially the ovaries, testicles, and mamma, but is also occasionally observed under the integuments of the trunk, more particularly the upper part of it, and rarely on the limbs. It is recognized by its imperfect fluctuation and colour.

The only treatment that this growth admits of with advantage is excision, which is effected with very different degrees of facility, according to circumstances. If the tumour be seated in a texture of limited extent, such as the testicle, it may be very readily removed. But if it commences simply in the cellular texture, it is apt to spread so widely, and contract

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such adhesions, as to render an effectual operation very difficult, or even impracticable. In such situations, it is therefore the duty of the surgeon to press upon the patient the propriety of early extirpation.

Muco-Cutaneous Sarcoma.

It again seems necessary to introduce a new designation, in order to include a sort of tumour, the varieties of which, though numerous, and of extremely frequent occurrence, have not received any distinctive appellation, except those by which they are known to the vulgar.

Both the mucous membrane and skin are frequently expanded into excrescences, which in the former case constitute what is called Polypus, in the latter Warts. The thin integument which, at the outlets of the body intervenes between the external and internal covering of it, is also often extended into tumours, which hold a middle place, in all respects, between polypus and wart.

The structure of all these growths is essentially the same, appearing to consist in little else than an extension of the natural tissue. Polypus is a substance soft, smooth, easily torn, of a light yellowish or grey colour, not possessed of much sensibility, and bleeding but little when injured. It is not prone to other morbid actions, and occasions no great inconvenience except by its pressure. It generally has a narrow neck, and a figure regulated by the shape of the cavity in which it grows. Warts are of more compact and firm consistence. They are very sensible, and

bleed freely when cut or torn. They seldom attain a large size ; and after a time usually remain stationary or disappear. They cause deformity, and sometimes impede the use of the part in which they are seated. The excrescences which originate from the margins of the outlets of the body are of all sizes, from that of the smallest wart to that of an egg or orange. They are usually also of a consistence and vascularity intermediate between those of polypus and wart.

The treatment of polypus consists in removal, which may be effected either by scissors or ligature, or if the situation of the tumour does not permit these means to be employed, by evulsion, that is, pulling away with forceps. Warts may be cut off or destroyed by ligature ; but these violent measures are seldom required, as they usually either disappear spontaneously, or yield to some stimulating application, which promotes absorption, such as the acetic acid. The excrescences of intermediate nature, when small, may be readily dispersed by the last-mentioned means ; but when of any considerable size, are most easily, quickly, and satisfactorily removed by the knife or scissors.

Carcinomatous Sarcoma.

The morbid structure which is designated Carcinoma, is distinguished by its great firmness, and almost cartilaginous hardness, whence it used to be, and still is, occasionally called scirrhus. The dense texture which characterizes carcinoma does not constitute a uniform homogeneous mass, but has numerous interstices which

are filled with a yellow or brownish-grey friable sub-
stance, and it is generally extended in the form of diverg-
ing bands which spread into the neighbourhood. When
the disease occurs in an organ of limited extent, as a
lymphatic gland, or the testicle, it does not tend to dif-
fuse itself beyond the confines of the part concerned,
the structure of which it affects more uniformly than
when seated in a tissue less distinctly bounded. As
the disease proceeds however, it at last breaks through
this obstacle, and then spreads as has been already de-
scribed. The carcinomatous action extends itself in a
different way also, namely, along the absorbent vessels
and glands of the part originally affected. It would
seem in general to take this course more readily than
to pass directly from one tissue to another. As to the
mode in which the morbid action is transmitted along
the absorbents, there exists a difference of opinion,
some thinking that matter must be conveyed through
the vessels, others that the mere irritation of the disease
is sufficient to account for the sympathetic affection of
the parts in question. The fact is certain, that glands
in the course of the absorbents leading from a carcino-
matous tumour, are often thoroughly tainted, though
the original mass remains solid, and contains no fluid
matter in its interstices.

Carcinoma occurs most frequently in glandular or
secreting structures, and the mamma, skin, tongue, sto-
mach, and uterus, may be mentioned as its most com-
mon seats. It seldom commences in people below mid-
dle age, and from forty to fifty may be mentioned as
its favourite time of attack, but it is occasionally ob-

served in persons much younger than this, as those who are not more than thirty or even twenty. I am not aware of its having been ever met with before puberty. The predisposition of parts to carcinomatous action seems to be increased by their suffering chronic enlargement and induration; and the disease is generally called into existence by some irritation either direct or indirect. Of the former, blows and bruises may be mentioned as those most frequently concerned, and of the latter, suppression of habitual secretions. The cessation of the menstrual discharge, though a natural event, almost always occasions more or less disturbance of the system, and this occurring at a period of life when, other things being equal, the tendency to carcinomatous action seems to be strongest, there appears good reason for the fact, that in the great majority of cases, the disease commences at this season. The disposition to the morbid action is sometimes so strong, that it begins without any local cause, and is then apt to occur in more parts of the body than one. In such cases the patient usually betrays the unhealthy tendency by a peculiar greenish-yellow complexion, and anxious expression of countenance.

The characteristic symptoms of carcinoma are hardness and pain. The hardness exceeds that of any natural texture, except bone and cartilage. The pain is usually of a lancinating or darting kind, not constant, but attacking the patient by fits. Sometimes it is described as hot or burning, and is then usually more fixed.

Carcinoma tends to inflame and ulcerate. If the skin

is affected either primarily or secondarily, this takes place on the surface, in which a breach opens, and gradually extends. If the disease be more deeply seated, an abscess is formed within it, which discharges its contents, and leaves a cavity ready to take on the same sort of action as the ulcer which is established in the other way. In both cases the ulcer makes no advance towards reparation, but proves truly specific and incorrigible, and is named a Cancer. The process is occasionally reversed, the morbid formation taking place round a sore, which, in the first instance, does not possess any malignant characters. The edges of cancer are of course extremely hard, since the excavation is formed in a carcinomatous mass. The ulcer is very irregular in the shape of its margin and surface; sometimes it is deep, and as if scooped out of the part; at other times, cauliflower-looking excrescences rise from it, and hang over the edge. The discharge is generally profuse, bloody, and fetid. The pain is incessant, and of various kinds. The patient loses appetite and sleep; complains of wandering pains and weakness of the limbs; becomes gradually exhausted; and at last dies, in general rather suddenly, before the period which might have been expected from the progress of the disease. The rapidity of its course varies greatly, a month or two being sometimes sufficient for its reaching a fatal termination; while in other cases it exists for many years with little change, or even remains stationary altogether.

The treatment of carcinoma in its different stages, has engaged more attention than perhaps any other

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surgical disease ; and it has been repeatedly believed that means of correcting the morbid action were discovered.   More careful observation has uniformly proved these expectations to be fallacious ; and it must be admitted, that so far as we know at present, there is no cure for carcinoma except extirpation. Much may perhaps be done in the way of prevention, by protecting those parts of the body most subject to the disease from the influence of irritation, at that period of life when the disposition to it exists most strongly; and leeching, with fomentation, in most cases, not only alleviates the severity of the symptoms, but retards the advance of the malady.   Tranquillity of body and mind, regularity in the secretions, and moderate diet, conduce to the same effect.   The pain of cancer may be soothed by opiates, used both externally and internally.   Hemlock poultices, lotions and ointments of acetate of lead, carbonate of iron, various preparations of arsenic, pressure, and an endless catalogue of applications might be mentioned, as having been more or less confided in for correcting the diseased action, and instituting a healing one.   They sometimes afford temporary relief, but *never* effect any permanent alteration to the better.   The only proceeding that deserves at all to be considered a remedy for carcinoma, is removal of the morbid structure.

This may be done sometimes by the actual or potential cautery ; but these means are very apt to destroy the disease partially, and consequently, do no good, but on the contrary harm by exciting greater

activity in the portion that remains. The knife or scissors effect the extirpation most easily and securely ; and the ligature should be reserved for those cases where excision might be attended with irrepressible hemorrhage. It would be subjecting the patient to useless pain, and bringing surgery into discredit, to attempt extirpation in cases where the extent or connections of the disease prevented its complete removal ; and in this view, it is incumbent on the surgeon to search very carefully for any glands, in the course of the absorbents, that may have become affected, previous to performing his operation, so as either to insure their removal, or, if that appears impracticable, to abstain from cutting at all. And it may be here remarked, that the result of operations for carcinoma, when the glands are affected, is almost invariably unsatisfactory, however perfectly they may seem to be taken away. In performing this operation, it is not sufficient to take away the mere indurated mass, as the surrounding parts are always more or less vitiated. If the disease is seated in a distinct organ, the whole of it ought always to be removed, however small the part of it which is actually affected may be ; and when the tissue concerned is not in this way circumscribed, the knife should be carried as wide as possible from the tumour.

Medullary Sarcoma.

The title of Cerebriform, would perhaps be more correct than that of Medullary, to designate the species of sarcoma which is now to be considered ; but,

as the general acceptation of the latter term has fully sanctioned its use, there would be no advantage in attempting a change.

The medullary growth bears a close resemblance to the substance of brain, not only in appearance, but also in chemical composition. When divided, it seems as if composed of rounded masses, inclosed, and separated from each other more or less completely by thin membranous septa, which become more obvious, after the soft pulpy mass is removed by putrefactive decomposition, or the action of alkalies. The consistence of the tumour, though in general pretty nearly that of the brain, is sometimes much denser ; at other times more approaching fluidity than the natural state of this tissue. Its colour also is subject to much variety, from almost pure white to the darkest red,—the difference in this respect seeming to depend on the quantity of blood which circulates through the growth, or is effused into its interstices. The proportion of blood is sometimes so great, that the tumour when divided resembles a coagulum ; but more frequently it exhibits merely spots or blotches, irregularly interspersed through the substance of the mass.

Medullary sarcoma may occur in any tissue of the body, but originates most frequently in the bones, testicle, mamma, and eye ; next to which the subcutaneous cellular texture, brain, lymphatic glands, and lungs, are the most common seats of its commencement. Like carcinoma, it extends itself both into the neighbouring parts and along the absorbents ; but spreads in the former more readily than in the lat-

ter, which is the reverse, as has been already stated, of what happens in regard to the other disease. It occurs in all ages, but is most frequently met with in infants, and adults between twenty and thirty. It is recognized by its soft semi-fluctuating consistence, which is sometimes very apt to make the swelling be regarded as depending on the presence of a fluid. The superficial veins become very much enlarged ; but as they do so, though hardly to the same extent, in nearly all chronic enlargements, this diagnostic must be considered merely as a corroboration of the more positive evidence which is afforded by the con- sistence, situation, and history of the tumour. The pain that attends it is extremely uncertain, being in some cases very severe, in others hardly perceptible.

This morbid growth, after attaining a certain size, tends to open and protrude the soft substance com- posing it. It does so by sloughing, the formation and evacuation of an abscess, or simply ulceration. In whichever of these ways the bursting, as it is cal- led, takes place, the integuments covering the tumour first become red and adherent, then the breach is established, the substance of the tumour presents it- self to view, and large fungous excrescences shoot out from the cavity. The discharge that ensues is always profuse, and generally very thin, excessively fetid, and bloody. In some cases pure blood is effused from time to time in considerable quantity ; and hence Mr Hey of Leeds, who first gave a general description of the disease, named it *Fungus Hæmatodes*. This term cannot be applied with propriety, and leads to much

confusion, because the fungous protrusions of medullary sarcoma do not always, or even generally bleed, while a bleeding fungus often appears without being preceded by the medullary formation. There is nothing particular in the structure of such bleeding excrescences ; and if the term *fungus hæmatodes* be retained, it should have its use confined to express simply the fact of there being a fungous protrusion from which blood issues.

Medullary sarcoma, in its advanced stage, is attended with a greenish-yellow complexion, and general emaciation. If allowed to proceed, it sooner or later destroys the patient by gradual exhaustion. The rapidity of its course, like that of carcinoma, is extremely variable, and cannot be foretold according to any data with which we are as yet acquainted. The treatment of this disease is, if possible, still less satisfactory than that of the one first mentioned. All local applications and internal remedies are admitted to be totally useless. The only mode of affording relief is excision ; and, owing to the tendency of the morbid action to diffuse itself into the neighbouring parts, whatever be their nature or tissue, the operations for this purpose are very often followed by relapses. Unless, however, the case does not permit complete ablation of the tumour, or there should be indications of the disease existing in other regions of the body, it is the duty of the surgeon to give the patient the benefit of the chance that is thus afforded ; and, of course, the sooner that this is done, the better, after the nature of the malady is ascertained.

Scrofulous Sarcoma.

The morbid formation usually called Scrofula, and which, in systematic arrangement, may be ranked as Scrofulous Sarcoma, presents different appearances, according to the tissue affected. In general, it constitutes rounded masses or tubercles, as they are named, which consist of a greyish-yellow, gritty, semi-organized-looking substance. It sometimes is not condensed and circumscribed in this way, but exists in a diffused state, so as to produce more or less change in the structure concerned. In the bones it is confined to the cancellated texture, the interstices of which it fills. In the synovial membrane it produces a remarkable thickening, softening, and conversion into a sort of gelatinous consistence. In the lungs, lymphatic and mesenteric glands, subcutaneous tissue, brain, and *dura mater*, it occurs in the tubercular form. It is not attended with pain, and hardly produces any inconvenience, except by its bulk causing deformity, or pressing injuriously on important organs.

The morbid formations generally remain stationary for a longer or shorter period after their completion, and then are either absorbed, or, as more frequently happens, suppurate, so as to constitute abscesses, containing thin sero-purulent fluid, with flakes of scrofulous matter floating in it. When the matter is discharged, the restorative process advances slowly and imperfectly ; indolent sinuses or weak ulcers almost always result ; and too frequently, owing to the situa-

tion of the disease, or the nature of the tissues affect-
ed, a cure is never accomplished.

The disposition to scrofulous action exists most
strongly in childhood, from seven to fourteen years of
age ; but traces of its effects are sometimes observed
much earlier, and it would be difficult to prove that
its operation does not occasionally continue in advan-
ced age. The morbid tendency is inherited as a pecu-
liarity of constitution, and is usually associated with
light hair, blue eyes, a fine skin, and florid complex-
ion ; whence scrofulous children appear very healthy
and thriving until they begin to suffer from the effects
of their peculiar disposition. The earliest indications
of its presence, are in general swelling of the upper
lip and *columna nasi*, with tumefaction of the edges
of the eyelids. Many exceptions occur in which all
these signs are wanting, and the patient, though of
dark complexion, and exhibiting in other respects
characters quite the reverse of those just mentioned,
betrays the strongest tendency to the disease.

The scrofulous diathesis or constitution is not al-
ways equally well marked in the parents and their off-
spring; its effects at least are much modified by circum-
stances. Whatever has a weakening influence on the in-
dividual seems to increase the morbid tendency. Youth
or sickliness of the parents—bad nursing—unwhole-
some or deficient food—and especially cold with mois-
ture, may be particularly mentioned as causing or
contributing to this effect ; and some people have gone
so far as to suppose that they may be sufficient to in-
duce scrofulous action without any hereditary taint.

This is not probable, but there can be no doubt that though the tendency in the parents be strong, it may be weak in the children, provided the circumstances which have been mentioned are absent, and *vice versa.* Persons who possess a scrofulous constitution are generally more liable to other diseases, and suffer from them more severely than those whose systems are more healthy in their disposition. It is usual to name all these affections scrofulous when they occur in such circumstances, and hence great confusion continually arises. In order to avoid this it will be better to restrict the use and signification of the term to those diseases which consist in, or proceed directly from, the morbid depositions which have been described as the result of scrofulous action.

In the treatment of scrofula the first object should be to obviate the circumstances which cherish the hereditary disposition. The child should be carefully nursed, warmly clothed, and supplied with a moderate allowance of wholesome nourishing food. If necessary, mild means should be used to correct derangement of the intestinal secretions, but nothing is more injurious than to keep up incessant irritation of the canal by frequently administering purgative medicines, the necessity for which may almost always be advantageously superseded by proper regulation of the diet and exercise. Should the indications which have been mentioned, or the parentage of the patient, lead to the persuasion that the disposition to the disease is very strong, the place of residence, if cold and moist, ought

if possible, to be changed for one that is dry and warm.

When the scrofulous depositions are actually formed, the greatest care must be used to guard against the operation of all direct and indirect irritations which might tend to excite their inflammation or suppuration. The means proper for this purpose, depend on the part of the body affected, and will be explained hereafter; but on all occasions it is right to attend to the climate, the regimen, and the secretions of the patient. Of local applications, iodine seems to have most power in causing absorption of scrofulous tumours. Blisters, muriate of ammonia, camphorated mercurial ointment, pressure, and sea-bathing, are also very useful in conducing to the same effect. But it should be carefully recollected, that the exciting influence through which they prove beneficial, if not duly regulated, may occasion inflammation and suppuration. When the abscess is seated in a part of the body exposed to view, as the neck, it becomes important to determine what mode of treatment will render the resulting cicatrix least observable. Sir A. Cooper strongly recommends a small puncture to be made with a lancet so soon as any matter is formed, and that then the remaining scrofulous substance should be squeezed out. The result of many trials leads me to conclude, that in the great majority of cases it is not possible in this way to effect evacuation completely. And what seems to be the safest practice, is to let the matter be very fully formed before opening the abscess, when a free incision should be made, or to abstain from evacuation altogether, and

trust to absorption. If this should not take place, a
spontaneous aperture will occur, and may be enlarg-
ed if necessary. Various drugs are used empirically
under the specious pretext of producing a gradual
improvement in the patient's constitution. The mu-
riate of lime is one of these ; and there are people weak
enough to believe the assertion, that it sometimes re-
quires several years to effect any salutary change. Such
practice is merely a cloak for quackery, and as such, is
not less useless to the patient, than disgraceful to the
profession. It was formerly believed that a miraculous
power of curing scrofulous diseases, by simply touching
the patient, belonged to the kings of England from Ed-
ward the Confessor downwards, whence the common
name of the disease still in use, viz. the King's Evil.
But it is hardly necessary to say, that in the present en-
lightened days this foolish superstition no longer exists.

Encysted Tumours.

Encysted tumours, or wens, as they are called when
of large size, consist of two parts.—1. A bag or cyst of
variable thickness, whence they have their title ; 2. a
quantity of fluid, semi-fluid, or solid matter forming
its contents. They are distinguished in reference to
the nature of their contents into meliceritous, athero-
matous, and steatomatous, accordingly as they possess
the consistence of honey, putty, or lard ; steatomes
usually contain hairs mixed up with the lardy sub-
stance.

Encysted tumours are of all sizes, but generally be-
tween those of a pea and walnut. They are mostly

seated immediately under the skin or mucous membrane, and chiefly abound in the head and face. It has been supposed that they are mere overgrowths of the natural sebaceous follicles, or crypts which lie in the skin. And Dr Sharpey of this city has made known to me a curious observation which would go to support this opinion, viz. that the fatty substance which may be squeezed out of the follicles in question, contains numerous small hairs, which can be readily seen through a microscope of moderate power. It has been said too, that steatomatous tumours may sometimes be emptied through a small aperture in their centre, but these cases must be regarded as rare exceptions, and their completely subcutaneous position, their occurrence in the ovaries, and elsewhere, not in the neighbourhood of sebaceous follicles, and their usually entire, imperforated cysts afford good reason to regard them as altogether new formations.

Encysted tumours are sometimes but very rarely absorbed, and local irritation, as that of a blow, occasionally excites the action which effects their removal in this way. More frequently they remain stationary after attaining a certain size, or gradually enlarge, adhere to the skin, inflame, suppurate, and open. A foul intractable sore then results, and occasionally the secretion from it takes the form, appearance, and structure of a fibrous horn.

The best remedy for encysted tumours is excision, unless the cyst is so situated or adherent that it cannot be completely taken away, in which case the part that remains must be touched with caustic, and

left to slough off, or be removed by the absorbent action of the vessels. When the tumour is subcutaneous, its cyst generally adheres very loosely, or rather not at all, so that the operation is performed almost instantaneously, and with extreme facility, by running a knife through the long direction of the tumour, so as to divide its sac and superjacent integuments, squeezing out the contents, and then pulling away the bag with forceps. If the tumour is large, and has been subjected to pressure, the skin usually adheres to the sac at its most projecting part; and when this is found to be the case, an elliptical portion must be removed, so as to include the conjoined integument and cyst. When the bag adheres by its whole surface to the surrounding tissue, it must either be regularly dissected out, or if small, punctured, emptied, and touched with caustic.

CHAPTER VIII.

BLOOD-VESSELS.

Arteries.

THE two great arterial trunks, the aorta and pulmonary artery, agree generally in structure and function, but differ remarkably in two respects. The branches of the former unite or anastomose freely with their neighbours, while those of the latter continue unconnected from their separation to their termination ; and the coats of the aorta are prone to morbid action, while those of the pulmonary artery are hardly known ever to suffer from it.   It is the aorta alone which affords subject for surgical practice.

The arterial tube is composed of three coats; 1. The external or cellular ; 2. The middle or fibrous ; and, 3. The internal or serous.   The first of these consists merely of condensed cellular membrane, and is therefore not recognized by some as a distinct tissue, being regarded rather as a modification of the cellular sheath which envelopes other organs of the body.   But the larger arteries and veins, where lying contiguous, have usually a covering of this kind in addition to the one in question, which, from its compactness, strength, and constant existence, ought cer-

tainly to be considered an essential and important part of the vessel. The middle coat is constituted by circular fibres, which, from their appearance, composition and properties, may with most propriety be referred to the elastic tissue. When examined in a large artery of the human body, or in the artery of a large animal as the horse, they are distinctly extensible and resilient, so as to resemble the *ligamentum nuchae* of quadrupeds, and other similar structures. The elastic property of this coat must tend to preserve the vessel of a certain size in opposition to the distending force of the blood, and the effect of any vital contractile power resident in the arterial tissue. That the arteries do possess such a power, cannot be denied, since during life, and even for some time after death, at least after the extinction of respiration and circulation, they contract much beyond the limit determined by their elasticity, whenever they are freed from the distension of their contents. The internal coat is distinguished by its thinness and smoothness ; it is probably lubricated by a secretion from its own surface,—and in most respects resembles the membranes which line the cavities of the body, whence it is named the Serous coat.

All of these coats are vascular, and capable of performing the actions, whether healthy or morbid, which are exercised by the nutritious system of other parts. But the internal one is most subject to disease, and generally seems to be the source of alterations from the healthy structure, when they occur in the other constituent parts of the vessel. The actions which

take place in it most frequently and readily, are effusion of lymph, and diseased nutrition.

Effusion is induced as an immediate effect of various local irritations, such as pressure and wounds; on which circumstance are founded the various methods of obstructing arteries, that have been proposed in the treatment of disease. It is ascertained, from experiments made on dogs and horses, that if an artery be subjected for some hours to the pressure of a tight bandage encircling the limb, the canal of the vessel sometimes becomes impervious. This effect results more surely when the sides of the artery itself are directly compressed; and Dr Jones discovered, that when the internal and middle coats are divided, lymph is effused so copiously that obstruction frequently ensues, though the constriction be not continued after the division is effected. Desault had ingeniously contrived to do this by tying the vessel tightly with a firm round ligature, which, making no impression on the tough external coat, but dividing the soft yielding ones within, could be removed so as to leave the former entire, and the latter completely cut. Various attempts have been made to obliterate the arteries of the human subject by these means. Assalini employed little forceps, the blades of which could be approximated with regulated force, by a screw passing through the handles. Mr Crampton made use of a piece of wood about three inches long, and having an oval extremity, at each end of which there was a hole for receiving a narrow tape after being drawn under the artery, when it was tightened by a simple contrivance

of the handle. * And Mr Travers conjoined pressure with division of the inner coats, by tying a ligature tightly with a slip-knot, and removing it from a few hours to two days afterwards. These scientific and reasonable trials occasionally proved successful, but their results have been very irregular. The obliteration of human arteries, though accomplished by the same process, appears to be not so readily induced or completed as in the lower animals. Such proceedings are therefore now abandoned, and the method invariably followed, consists in tying the vessel firmly with a small round silk ligature, which is left to be detached by the ulcerative absorption instituted through the irritation caused by its presence; the effusion of lymph that directly succeeds its application, seals up the cavity both above and below, so as to prevent hemorrhage during the process of separation.

M. Amussat of Paris has lately contrived another method of obstructing large arteries, which generally succeeds in the lower animals, and has been executed with success at least once on the human subject. It consists in seizing the bare coats of the artery transversely with two pairs of forceps, and then, while the vessel is held very firmly, separating the two instruments from each other, so as to rupture the internal coats, and throw them into folds. The effect of this procedure is interesting in respect to the pathology of the arteries, but will not probably be preferred in practice to that of the ligature.

* Medico-Chirurg. Trans. Vol. vii.

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Lymph is also effused from the arterial coats as a consequence of inflammation; and the spontaneous obstructions which thus ensue deserve much attention. Though probably not very uncommon, they escaped observation until very lately, and are yet far from generally known. The inflammation may be limited to a small part of the vessel, or affect nearly the whole of the arterial system. The circumstances immediately concerned in its production are unknown; but it is observed to be nearly confined to adults at or beyond middle age, having a bad habit of body. According to its extent and violence, the patient feels pain in the region of the vessels concerned, which is aggravated by pressure or motion, and attended with more or less fever. As, from the depth of the vessels, there is no external appearance of disease, these symptoms are referred to rheumatism, and medical aid is not required until inconvenience begins to be experienced from the obstruction that ensues; at least such has been the case in nearly all the instances of this occurrence hitherto recorded. The impoverished limb becomes cold and numb; and if stimulating means be employed to excite the weakened actions, they readily excite inflammation, which speedily runs on to gangrene and mortification. On dissection, the vessels are found contracted, thickened in their coats, and firmly plugged, partly with lymph, partly with firm, brown, fibrinous coagulum. Obstruction of the vessels with coagulum used to be considered a regular consequence of mortification; but it is now ascertained to be by no means a common occurrence;

and when it does happen, ought probably rather to be regarded as a cause than an effect of the mortification. Instead of the disease leading to the death of the part, there is reason to believe that it sometimes terminates in recovery, owing to the blood passing through anastomosing vessels, which gradually enlarge, so as to convey adequate nourishment.

Opportunity is seldom afforded to treat the primary inflammation, and its diagnosis would not be easy. In case of its being discovered sufficiently early, the proper remedies would be local bleeding and fomentations, with calomel and opium given internally. After the obstruction is completed, which may be learned by the coldness, numbness, want of pulsation, and history of the case, the utmost care must be taken to protect the weakened part from depression on the one hand, and excitement on the other. It ought to be warmly clothed, but guarded against external heat, and all other stimulants. Should mortification ensue, amputation ought to be performed above the obstruction, unless a line of demarcation appears lower.

Diseased nutrition of the internal coat is a very common occurrence, especially in advanced age, and unsound constitutions. The consequence of it, is a deposition either of a soft pultaceous substance, which is named its atheromatous degeneration, or of calcareous scales, which constitute what is called ossification of the artery. In both cases this morbid change affects principally the external surface of the inner coat, a slender film of which almost always remains as a lining to the vessel. The two diseased alterations

generally exist together in variable proportion. They affect most frequently the aorta, and arteries of the inferior extremities. They seldom take place extensively before the age of sixty; but are then so common, that they might almost be regarded as natural occurrences. Males are more subject to them than females. When an artery becomes ossified it usually dilates, and thus transmits the blood more readily than might be expected from the thickening which it suffers; but still, owing to the rigidity of the tube, or some other cause, does not seem to do so with the same freedom as in the natural state; and the patient complains of weakness and uncomfortable sensations, with more or less emaciation in the part of the body where the vessel is distributed. Mr Pott described a mortification which sometimes attacks the toes and feet of old men, beginning very insidiously by a small black or brown spot, generally at the edge of one of the nails, or on the instep. The disease proceeds with intense pain, and diffused dusky redness, until the constitutional symptoms are induced, and the patient dies, but seldom before the end of two or three weeks at soonest. This distressing disease has been ascribed to ossification of the arteries, but not very satisfactorily, since, if this cause were sufficient for its production, it ought to be much more frequent than it actually is. In the cases I have had an opportunity of dissecting, the arteries were not only ossified, but completely obstructed with dense coagulum ; and perhaps the weakened limb may be finally destroyed by the altered surface of ts ves-

sels determining coagulation of their contents. Mr
Pott found that nothing afforded so much relief from
the pain, and mitigation of the symptoms in general,
as opium given in large, and frequently repeated
doses. Amputation is, of course, entirely out of the
question.

Wounds of Arteries.

When an artery is wounded, the blood issues from
it with great force in a stream, which is either conti-
nuous, or varied by successive pulsatory jets, according
to the size of the vessel and the aperture made in its
coats; unless the artery concerned be very large, or
particularly circumstanced, as will be explained here-
after, in which case the hemorrhage does not cease un-
til the animal has suffered a fatal depletion,—the flow
of blood gradually diminishes, and after a time ceases,
when the wound heals as it would have done in other
circumstances. Various explanations have been offer-
ed to account for the spontaneous cessation of arterial
hemorrhage. Petit (1730,) referred it to the coagula-
tion of blood, first without and then within the orifice
of the vessel, so as to form a sort of cork or stopper
to it. Morand, (1736,) in addition to coagulation, in-
sisted upon there being also contraction of the mouth
of the artery both as to length and width, so that it
assumed a conical form, which retained the clot. Pou-
teau (1760,) rejected the preceding explanations, and
referred the whole effect to injection of blood into the
cellular substance. Dr Kirkland (1763,) maintained,
to the conviction for a long while of most surgeons in

this country, that the process consisted in shrinking
and obliteration of the wounded vessel up to the first
branch that came off above the injured part. In 1807,
Dr Jones proved, by a full and conclusive course of ex-
periments, that none of these opinions were correct,—
that the process in question was a complicated one,—
and that it consisted of various distinct steps. He as-
certained that, in the first place, the extremity of the
artery contracted somewhat, and withdrew itself by
retraction; that then the blood was injected into the
surrounding cellular substance, especially that of the
sheath, and coagulated there, after which a coagulum
formed first on the outside, then in the interior of the
orifice of the vessel; and then lymph being effused be-
tween these from the cut edges of the arterial coats,
became gradually organized, so as to complete the ob-
struction. In the course of time the artery contracted
up to the first branch, and the clots were absorbed, when
the cure might be considered complete. When the ar-
tery which has been wounded is prevented from re-
tracting by its firm connection with the neighbouring
parts, or by being only partially divided, or when the
surrounding cellular substance is either very dense or
very lax, this process is impeded, and the hemorrhage
proves more obstinate than in ordinary cases. On the
contrary, when an artery is not cut, but torn across,
it seldom bleeds at all, even though of large size, be-
cause the external or cellular coat being the last to give
way during the stretching of the artery, when at last
ruptured, is actually elongated beyond the internal and
middle ones, and instead of resuming its relative situa-

tion with regard to them, collapses into a conical form, so as effectually to close the orifice. This explanation I venture to give on the authority of experiments repeatedly performed, and as affording a more satisfactory explanation of the fact than those hitherto offered to account for it, viz. that arteries retract more when torn,—that the edges of the orifice are killed by the violence, and therefore induce more speedy coagulation of the blood,—and that the internal coats are more extensively ruptured than the external one, so as to form irregular folds or projections into the cavity.

In some constitutions there is a remarkable disposition to bleed, so that the slightest wounds become troublesome, or even dangerous. This hemorrhagic tendency is generally observed most distinctly in children,—is associated with both fair and dark complexions,—is frequently hereditary, and can be discovered only by experience of its effects.

The means employed artificially for conducing to the cessation of hemorrhage, may be referred to the ligature, pressure, and styptics. The use of the ligature was introduced by Ambrose Paré in the latter end of the sixteenth century. He, and still more his successors, applied it injuriously by including a portion of the surrounding tissues to give it a secure hold. Paré employed large broad-bladed forceps called crane-bill from their shape; but the instrument generally preferred was a curved needle, which, being thrust through or around the vessel, together with the parts adjoining, subjected to the ligature a mass not only quite superfluous, but which likewise was apt to occasion

great inconvenience by shrinking subsequently so as
to render the ligature loose, by delaying its separa-
tion, or by exciting inflammation. Mr Bromfield,
(1772,) explained the propriety of tying merely the
coats of the vessel, and introduced into general use
for this purpose the tenaculum, which had been pre-
viously recommended by Cheselden. It consisted of a
sharp, curved, round needle fixed in a handle, and was
employed to transfix and draw out the mouth of the
artery, so as to let the ligature be tied about it. The
common dissecting forceps have now almost supersed-
ed the tenaculum, as rendering the insulation of the
vessel more easy and complete. The best material
for the ligature is *stay silk*, of such strength that
twenty-four yards of it weigh one drachm. It ought
to be waxed previously to being used.

When the artery wounded is of large size, it must
be tied both above and below the opening, as the an-
astomosing branches would otherwise maintain the
hemorrhage from the inferior orifice. If it is neces-
sary, in order to apply the ligatures, to expose the ar-
tery more fully, it should if possible be done by di-
lating the original wound, since there is apt to be
much difficulty in finding the aperture when the sur-
geon cuts down on a different side of the vessel from
that which is punctured.

In tying an artery which has bled long or repeat-
edly, it is necessary to beware of mistaking for the
orifice of the vessel a fibrinous cylindrical extension
of it, the ligature of which could not produce any
permanent or beneficial effect.

Pressure may on many occasions be employed to suppress hemorrhage more conveniently than the ligature, as where the artery is but small, or lies over some unyielding part which can afford good counter-pressure,—or is much branched and freely connected with neighbouring arteries of large size, so that several orifices would require to be tied,—or is situated so deeply that the ligature could not be applied without a serious operation. Lint or sponge may be employed to effect the pressure; but the former is on many accounts preferable. Folded portions of it, successively increased in size, constituting what are called graduated compresses, ought to be applied over the bleeding vessel, and secured by a proper bandage. Unless the first one is placed directly on the orifice of the artery, the subsequent pieces, however firmly compressed, will have little effect. When the hemorrhage takes place into a cavity, the parietes of which are firm and unyielding, it may sometimes be restrained by closing the outlets, so as to make the blood accumulate, and press upon the orifices whence it issues.

Styptics are agents which, independently of any compressing effect, possess a power of checking hemorrhage. Of these may be mentioned the sulphates of copper, zinc, iron, and alumina, and the nitrate of silver; strong spirits, oil of turpentine, and the actual cautery; also soft spongy or powdery substances, such as dried lycoperdon, spiders' webs, and the agaric of the oak or amadou. This last, which is the tinder used in Germany and elsewhere, when prepared without immersion in nitre, constituted the

famous styptic of Brossard, which possessed a very high reputation both in France and in this country towards the conclusion of the last century. Before the proper principles for applying the ligature were ascertained and acknowledged, styptics were regarded as important means for controlling hemorrhage; but they are now very much neglected; and the actual cautery is almost the only one of them still retained in use. It is occasionally, but very rarely, resorted to on account of bleeding in situations inaccessible either to the ligature or to pressure. M. Amussat has lately endeavoured to introduce a fourth mode of suppressing hemorrhage, which consists in twisting the mouths of the vessels. This *torsion* is effected differently, according to the size of the artery. When small it is simply twisted; when large the internal coats are first pushed back by means of another pair of forceps, while the extremity is held tightly by those employed for twisting.

The bleeding after it has been stopped, sometimes returns, when it is called secondary hemorrhage. If it has ceased spontaneously, merely through the natural process aided perhaps by syncope, which favours coagulation, the reaction of the system that ensues within an hour or two is apt to reinduce it. If arrested by pressure, it may return either at this time, or not until two or three days afterwards, when the feverish excitement which is then occasioned by the irritation of the wound, tends to promote it; and if a ligature has been applied, the ulceration by which it is separated, if too rapid or extensive, may cause a
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bleeding from three days to as many weeks after the infliction of the injury. When the hemorrhage, therefore, is considerable, the local means of restraining it ought to be assisted by those which produce a corresponding effect on the system, such as rest, quiet, low diet, cooling purgatives, and whatever else may seem likely to moderate the force of the circulation.

It has of late been proposed to obviate the immediately fatal effect of excessive hemorrhage, by transfusing the blood of another individual into the veins of the patient. The experience hitherto acquired on this subject is very limited, and far from satisfactory. The profuse depletion requisite to sanction such a proceeding is generally either accompanied with some incurable lesion of the system, or happens in circumstances which prevent the preparations for it from being completed soon enough.

The simplest and best mode of performing the operation, is to fasten a bladder to the canula of a small trocar, or a small silver tube made for the purpose, with its extremity rounded and slightly curved, which being introduced into one of the veins of the arm, will transmit the blood received in the bladder, as it flows from the vein of the person who affords it, and descends into that of the patient by its own weight, or the influence of slight pressure exercised on the bag. The various ingenious and complicated apparatus which have been contrived for effecting transfusion, are less manageable than this very simple one, which may always be constructed extemporaneously, and are objectionable on account of the extensive surface of dead

matter to which they expose the blood, besides the risk of injecting air that attends their use.

Aneurism.

By the term aneurism, derived from the Greek verb ανευρυνω to dilate, is understood a sac containing blood fluid, or coagulated, and communicating with the trunk of an artery. There has been much dispute as to the constitution of the aneurismal sac. Sennert, Severinus, Hildanus, Wiseman, &c. supposed that all the coats of the artery were destroyed; and that it was formed by the surrounding cellular substance alone. Forrestus, Ruysch, Diemerbroek, &c. thought that the artery was merely dilated; while Morgagni, Lancisi, Guattani, &c. maintained, that aneurisms might result either from simple dilatation of the vessel, or from expansion of the cellular substance, and therefore divided them into true and false, accordingly as the artery was dilated or ruptured. Scarpa has laboured to prove that the former do not exist, there being always rupture of the internal and middle coats. He has not succeeded in establishing his opinion to the full extent, but certainly ascertained that it is extremely rare to find the artery entire, and forming the sac by its mere expansion.

Aneurisms may be conveniently divided into true and false. The former being those in which one or more of the arterial coats remain entire; the latter, those in which the vessel is completely ruptured, and the sac is formed by the surrounding cellular substance.

True aneurisms may be subdivided into those which consist of simple dilatation of all the coats, and those in which the external one alone remains entire. The former are very rare, and nearly confined to two parts of the arterial system, viz. the aorta, and arteries of the brain. It was formerly supposed from careless observation, that aneurism of the aorta generally depended on dilatation of all the coats, but Scarpa showed that in the great majority of cases, the inner ones at least were ruptured. Exceptions, however, are sometimes met with, in which there can be no doubt as to the integrity of the vessel. In the arteries of the brain, the external coat is very thin, and affords little resistance when the inner ones are destroyed by disease. Aneurism is therefore very rare in this situation, and when it does occur, depends on a general dilatation of the vessel.

The true aneurisms, in which the internal coats are destroyed, and the external one alone remains, are much more common. Their shape is not so regular as that of the last mentioned kind, since the external coat does not dilate uniformly round the circumference of the vessel, but usually expands merely on that side where the internal layers are ruptured, so as to form a sort of bag or pouch which often has only a very narrow communication with the artery. The blood which is received into this cavity being removed as it were from the current of circulation, and exposed to a surface different from that of the healthy vessel, has a double inducement to coagulate, and accordingly does so, not all at once, but by de-

grees, thus forming a succession of concentric fibrin-
ous laminæ, which line the aneurismal sac, and some-
times fill its cavity completely.

The arteries liable to this disease are almost all the
great trunks of the system ; and the parts of their
course most frequently affected are those where they
give off large branches, or are exposed by their situa-
tion to sudden extremes of tension and relaxation.
The aorta at its arch, origin of the cœliac, and its bifur-
cation, the carotid at its division, the axillary, the ex-
ternal iliac at the groin, and the popliteal are the most
common seats of its occurrence. The first step in the
production of this kind of aneurism is no doubt the for-
mation of a breach in the inner coats, through which
the blood, being constantly urged by the force of the
heart, will pass and gradually distend the cellular coat
into a bag. The tumour thus caused must press up-
on the surrounding tissues, and excite by the irritation
of its constantly increasing size, such an effusion of
lymph into their textures as will greatly strengthen
the parietes of the bag. The original breach or crevice
can generally be traced either to a blow, sudden ex-
tension, and such sorts of violence, or to violent im-
pulse of the heart, consequent upon some emotion of
the mind or exertion of the body. It is not likely
that those means could rupture the internal coats of
a sound artery, and if they did so, the speedy effusion
of lymph would, we have reason to believe, not only
repair the injury, but obliterate the vessel. The ar-
tery, therefore, must probably be predisposed to suf-
fer the process that has been described, by undergoing

the morbid degeneration of the internal coat, which renders it soft, easily torn, and unfit for performing the adhesive action. It has been already stated, that the inner and middle coats, though extensively altered in their structure, usually retain a thin membranous film, were it not for which, the frequency of aneurism would doubtless be much greater than it actually is; since in that case there would be no occasion for any force to institute the breach, and it would occur as a certain consequence of the atheromatous alteration. Males are more subject to the disease than females, probably for the double reason that their predisposition to unsoundness of the arterial coats is stronger, and also that they are more exposed to the exciting influence of violent exertion, which may operate in determining the morbid degeneration of the artery concerned, as well as in directly causing the commencement of the aneurism.

In false aneurisms none of the coats remain entire, and the sac is formed, in part of its extent at least, merely by the surrounding cellular substance. They are generally of larger size and more irregular figure than those which retain part of the arterial coats in their composition, whence also their contents are usually more completely coagulated. They are produced in two ways: 1. By the formation at once of a breach through all the coats of the vessel together, which may be effected either by violence or ulcerative absorption; 2. By the sac of a true aneurism giving way, so as to allow its contents to escape, and distend the cellular substance into another bag. They are therefore divided into pri-

mary and secondary ; they occur much more extensive-
ly over the arterial system than the true kind, since
they not only result from these, but may arise from
almost any artery that is wounded, and are frequently
connected with vessels of very inconsiderable size.

The symptoms of aneurism are tumour, subsiding
under pressure, and returning when relieved from it
with a whizzing noise, and thrilling feel ; pulsation, or
rather, violent distending throbbing ; feebleness of pulse ;
coldness, numbness, and weakness of the parts beyond
the disease ; œdematous swelling and pain, owing to the
pressure of the aneurism on the veins and nerves.
When the aneurism is internal, these indications can
hardly be recognized, but there are then generally others
presented by the derangement of function which is
caused by the presence of the tumour. These, however,
are often not distinct, and at the same time apt to be
mistaken for the signs of other affections. The com-
pressibility and pulsation of the tumour are the grand
distinguishing characters of aneurism. They are most
distinct when all the coats remain entire, because then
the contents of the sac generally continue fluid ; they
are usually well marked so long as the external coat
does not give way ; but in false aneurisms, especially
those of old standing, where the cavity is of large size
and irregular figure, they are often very obscure, or
altogether unobservable, owing to the extent of coagu-
lation which is apt to occur in such circumstances. The
pulsatory movement communicated to solid tumours
by large arteries lying under them, is sometimes mis-
taken for the pulsation of an aneurism. This error

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will be avoided by recollecting, that in aneurism there is a general and forcible expansion of the whole sac, which can be perceived as distinctly when the tumour is embraced laterally, as when the hand is placed upon it, while the deceitful impulse communicated by an artery to a tumour seated over it, is merely a faint heaving upwards, which can be felt only when the surgeon presses in the direction of the vessel.

The natural course of aneurism is to grow larger and larger, to change from the constitution of the true into that of the false kind, and then to terminate in one of the following modes. 1. The contents coagulate, and are absorbed with or without obliteration of the vessel; 2. The artery becomes obstructed from coagulation, or the effusion of lymph, and ulcerative absorption of the parietes of the tumour allows its contents to escape; 3. The sac opens by ulceration or sloughing, without previous obstruction of the vessel. The consequence of the two first of these terminations is a natural cure, that of the third a fatal hemorrhage.

The treatment of aneurism consists in the use of means which tend to promote one or other of the two salutary processes just mentioned. The earliest attempts of this kind were directed with a view to the second of them, and their rudeness was equalled by their severity. The sac having been opened by cutting or burning, its contents were turned out, and then the hemorrhage was restrained by repeated applications of the actual cautery, or some other powerful styptic. The introduction of the ligature for closing the mouths of arteries rendered this operation less painful, formi-

I

dable, and uncertain ; but the difficulty and danger attending it continued to be very great, and the instances of recovery were extremely rare. Surgeons therefore turned their attention to the other mode of natural cure, and endeavoured to promote coagulation by lessening the force of the circulation, through the effect of bleeding, low diet, and rest. This plan of treatment is usually distinguished as that of Valsalva, who was its principal supporter. In addition to these means, Guattani recommended tight bandaging of the limb and tumour. Both methods were found to be extremely inefficient and uncertain, so that though productive of less harm, they hardly afforded more benefit than the bloody proceeding which has been already described, and was in those days called the Operation for Aneurism. The good old fashion of performing amputation of the limb affected, was therefore generally followed, until it fortunately occurred to John Hunter, (1785,) and much about the same time to Desault, that an effectual method of causing coagulation would be to obstruct the artery above the tumour, or between it and the heart, so that thus the natural cure by coagulation and absorption might be safely and certainly induced.

The first trials of this new practice were hardly so successful as was anticipated, owing to the vexatious, alarming, and not unfrequently fatal hemorrhage which attended the separation of the ligature applied to effect obstruction of the artery. To obviate this cause of failure various contrivances were employed. The ligatures were sometimes drawn

gently, lest they should cut the coats of the vessel, or a little roll of plaster was interposed with the same view between the knot and artery. Ligatures in the form of tapes were employed; two or three of them were tied at a little distance from each other, so as to compress a considerable extent of the vessel; and ligatures of reserve, as they were called, being introduced under the artery, beyond those which had been tied, were left loose, so that they might be drawn tight if occasion should require. Notwithstanding all these precautions, bleeding still occurred as often as before, and proved, if possible, even more unmanageable. In despair, therefore, of obstructing arteries safely in this way, attempts were made to obliterate them without inducing the ulcerative absorption which was requisite for the separation of the ligature. Simple compression of the vessel, division of its internal coat, and these two means conjoined, were tried for this purpose, but, as has been already stated, however promising they might appear from their results when practised on the lower animals, they were found to operate very uncertainly on the human arteries. Though these experiments thus did not lead directly to any practical improvement, they occasioned such a series of extensive and accurate observations, as had the happy effect of developing the true principles on which the bleeding caused by ligatures depends, and consequently showed how it was to be avoided.

The great source of danger was found to proceed from the ulceration which detaches the ligature going beyond due bounds; and it was ascertained that the

circumstances most conducive to this, were extensive separation of the artery from its neighbouring connections, the interposition of much foreign matter between it and them, or the irregular puckering of the coats by flat or twisted ligatures, also laceration and contusion of the neighbouring tissues, caused by exposing the vessel with the fingers or any blunt pointed instrument, which prevented union by the first intention, and excited inflammation. Such being the case, it naturally followed that the most effectual method of preventing hemorrhage was to use a ligature small, firm, and round, to pass it round the artery with as little disturbance as possible to its connections, and to draw it tightly. It is to British surgeons, especially Messrs Jones, Hodgson, Lawrence, and Travers, that the profession are chiefly indebted for establishing these principles, which render the use of the ligature in the hands of a good operator equally easy and safe. To them, also, and more particularly Cooper and Abernethy, together with Drs Post and Mott in America, is to be ascribed the honour of leading the way by their bold and successful operations, resting on the sound foundation of correct pathology, to the practice of the present day in the treatment of aneurism, which contrasts remarkably by its simplicity and safety with the complexity and danger of the older method.

The ligature should consist of waxed stay silk, and may in every situation be passed round the artery by means of the simple needle represented (Fig. 2, Plate I.) after the sheath of the vessel has been opened merely to

an extent sufficient for the purpose. One ligature only ought to be employed, unless the operator unfortunately denudes the artery too far, when he will diminish the risk of hemorrhage by introducing two threads, and tying them as far from each other as the detachment of the vessel permits, after which he should divide the artery between them. Mr Abernethy recommended this proceeding as proper on all occasions admitting of it, in order to take off the effect of tension, and place the ligature as nearly as possible in the same situation with one applied after amputation, where the chance of bleeding is known to be greatly less. The difference of the two cases in all probability does not depend on tension, and it will therefore be proper to confine the practice to the circumstances which have been mentioned as requiring it.

After the principal artery of the limb is obstructed, the capillary anastomoses of the branches which arise above and below the impervious part, afford a new channel for the conveyance of the blood, and in general so free a one, that little apprehension need be entertained of bad consequences from imperfect circulation. What contributes to this, is the dilatation of the small vessels which occurs before the operation, owing to the natural channel becoming more or less impeded by the disease. It has been thought by Dr Parry of Bath, M. Maunoir of Geneva, &c. that new branches are occasionally formed, after a time, between the obstructed extremities of the artery, leading directly from the one to the other. But there can be

no doubt that the alleged new vessels are really the old ones of the sheath, which become enlarged in a greater proportion than the neighbouring capillaries, conformably with a well ascertained law of anasto-motic circulation, viz. that those branches have the greatest tendency to enlarge, which lie most nearly in the course of the obstructed vessel. In order to pre-pare the new passage for nourishing the limb, it has been proposed to delay operating in recent cases; but the inconvenience attending a large sac, the contents of which are sometimes slowly and imperfectly ab-sorbed, or excite irritation that induces suppuration, and the risk of the artery becoming diseased nearer the heart, more than counterbalance any slight advan-tage to be gained in this way.

However free the new channel may be, it is always inadequate in the first instance to afford the full sup-ply of blood requisite for carrying on the various ac-tions as usual. The limb becomes cold and numb, and continues more or less so for a longer or shorter time, seldom exceeding a few hours after the opera-tion. It then rises in temperature a few degrees above that of the corresponding sound one, and is red and painful; and at the same time slight pulsation returns in the aneurism. To prevent this overaction from prov-ing excessive, and inducing mortification, all sources of additional excitement ought to be carefully avoided. When the stage of reaction subsides, which it does in a day or two, the limb still remains weak and liable to suffer from slight irritation, so that even the pres-sure of its own weight occasionally causes sloughing.

The support of a flannel bandage will therefore be proper, and with a similar view, though moderate and even copious bleeding is very proper previous to the operation, the patient ought not to have his strength reduced to a very low ebb by much depletion, and very rigorous diet during the cure.

The bad consequences of this operation are gangrene, hemorrhage, and suppuration of the sac. When the sloughing is of limited extent, and dependent on pressure, or feebleness of the patient's general strength, it ought to be combated by appropriate local and constitutional remedies ; but when it is extensive, and the result of general inflammation of the limb, amputation should be performed without delay, as high at least as the artery has been tied.

The hemorrhage usually occurs about the time when the ligature separates, which is generally from the fourteenth to the twentieth day after the operation; but it may likewise occur either much sooner or considerably later. It appears for the most part very insidiously, not exceeding a few drops, but recurs from time to time in increasing quantity, until the patient, after being repeatedly saved by syncope, is finally exhausted. Pressure, together with the means which tend to lessen the force of the circulation, may be tried in the first instance ; but if the bleeding continues or returns, the surgeon must, without delay, either tie the artery nearer the heart, or amputate the limb.

Suppuration of the sac is a disagreeable, but not very dangerous occurrence, since it does not take place until the artery has been obliterated, so that

there is no fear of bleeding, and nothing to dread but a foul and extensive abscess. Whenever the matter is actually formed, a free incision should be made to evacuate it, together with the clots ; after which, the cavity being in the first instance gently filled with caddis, is to be treated with stimulating lotions and pressure.

The object of tying the artery being not to prevent the blood from entering the aneurism, but merely to cause such stagnation of its current as may induce coagulation, it was proposed by M. Brasdor of Paris to obliterate the vessel beyond the tumour, when circumstances prevented the operation from being performed between it and the heart. Some unsuccessful attempts were made on this principle by Deschamp and Sir A. Cooper ; but Mr Wardrop has lately recorded several instances of its more fortunate application. It is evident that the operation cannot be performed with advantage, if a branch of any considerable size comes off between the aneurism and ligature, as this would allow the current to continue ; it could not be of any use in cases where, the sac being small and regularly dilated, the contents remained fluid ; and the only occasions where it promises any benefit are those in which coagulation is already far advanced. But here the passage through the vessel beyond the tumour must be obstructed nearly, if not altogether, as much as it can be by the ligature ; so that there consequently does not seem to be much probability of this operation being ever extensively introduced into practice.

Treatment of Particular Aneurisms.

Aneurisms are usually divided into external and internal, accordingly as they affect the branches of the aorta or its trunk. The former are generally subject to the operation which has been described; the latter admit of no remedy except what may be afforded by the plan of Valsalva.

External Aneurisms.

Popliteal.—One of the most common situations of external aneurism is the popliteal artery, which being subject to sudden extremes of tension and relaxation more than any other part of the arterial system, must be exposed not only to the directly exciting causes of the disease, but also to the predisposing effect of the same irritations leading to morbid alteration of its coats. The tumour occupies the popliteal cavity, which it gradually fills, but hardly extends beyond, so long as any part of the artery remains entire. A circumscribed pulsating swelling is felt in the ham, which weakens the limb, and occasions constantly increasing pain as well as œdema, by pressing on the nerve and vein that lie over it, and forcing them outwards. When the external coat gives way, so as to let the blood escape into the cellular substance, and convert the true aneurism into a false one, the swelling suddenly extends in all directions, but chiefly downwards, separating and elevating the heads of the gastrocnemius; the limb then becomes entirely useless, excessively painful, and quite shapeless,—the pressure of the tumour induces absorp-

tion of the condyles of the femur,—and if the disease is left to itself, the tumour either opens and gives rise to a fatal hemorrhage, or undergoes a natural cure by coagulation and absorption of its contents.

It was here that the old operation proved most difficult and appalling; and when we consider the deep situation of the artery, the diseased condition of its coats, and their close connection to the bone through means of the tendinous sheath of the triceps; also the large and shapeless cavity, at the bottom of which the vessel was to be secured; the hardly repressible hemorrhage; and the obstacle occasioned by the vein and nerve lying over the tumour, it does not seem surprising that its results should have been almost uniformly fatal.   The modern operation could hardly have been more practicable for aneurism in this situation, if it had not been for the happy improvement of Mr Hunter, who, observing that no large branch rose from the artery above the tumour, proposed to tie it on the fore part of the thigh, where it was nearer the surface, and at a greater distance from the disease; where the operation would be easier, and the coats of the vessel might be expected to remain in a more healthy state.

The artery may be tied either before or after it passes under the sartorius muscle, but more conveniently at the former of these points, being there nearer the surface, and farther from the disease.

The patient being placed in a reclining posture, with his knee bent and the thigh placed on its outer side, the surgeon should feel with the fingers of his

left hand for the triangular hollow which is formed by the meeting of the sartorius and *adductor longus,* then stretching the integuments not transversely, but in the long direction of the limb, he should make an incision from two to three inches long, according to the fatness of the patient, having its lower extremity situated over the angle of union of the two muscles above-mentioned, and running upwards at a nearly equal distance from their respective edges. Separating the lips of the wound he should expose and divide the fascia, after which, making an assistant hold aside the edge of the sartorius, he will expose the sheath of the vessels, and lifting it up with the dissecting forceps, open it sufficiently to let the coats of the artery be seen distinctly. The aneurism-needle previously threaded is then to be passed round the artery, which will be easily effected if it has been adequately exposed, and counter pressure to the point of the instrument be made by a finger placed on the opposite side of the vessel. In doing this it is necessary to avoid the vein which lies below, and the nerve that runs on the outer or fibular side of the artery. So soon as the ligature appears, it must be disengaged from the eye of the needle by the forceps or a hook, and pulled out of the wound while the instrument is withdrawn in the opposite direction. The operator having then satisfied himself that enough and nothing more is included, should tie the ligature tightly in what sailors call the reef-knot, which is done by crossing the ends first one way and then the other. After the ligature is tied, one of the ends should be

cut away to favour union of the sides of the wound. The needle, though introduced with care and dexterity, sometimes occasions a pretty copious flow of blood, which fills the wound almost as rapidly as it is wiped out, but ceases upon the ligature being tied, and probably depends upon the injury of a small branch happening to come off at the part. The edges of the wound should be brought together with a couple of stitches, and lightly dressed.

After this operation, there is a greater difficulty to be encountered in the establishment of an adequate channel for the blood by the anastomosing branches than occurs in most other cases. The perforating and external circumflex branches of the profunda pour their contents into those of the articular arteries, but these rising from the popliteal portion of the vessel, which becomes obstructed by the coagulation that follows the operation, must transmit the blood into other branches communicating lower down with the unimpeded arteries of the leg.

If it is wished to tie the femoral artery below the crossing of the sartorius, an incision should be made in the middle of the thigh, commencing about three inches lower than where the one for the former operation terminates. The external or fibular edge of the sartorius being exposed, should be drawn inwards, when a strong tendinous fascia passing from the *vastus externus* to the triceps will be brought into view; and when it has been divided, the sheath will appear, containing the artery, vein, and nerve in the same relative situation as they were at the other part of their

course. The operation should then be completed as already described.

Ligature of the Arteries below the Knee.

Aneurism hardly occurs below the knee from internal causes; but wounds not unfrequently occasion hemorrhage which requires the arteries concerned to be tied. In such cases it is necessary to secure not only the particular vessel injured above the aperture, but also below it, since the anastomosing branches would otherwise maintain the bleeding.

The posterior tibial may be exposed by making an incision along the inner margin of the tibia, commencing opposite to the insertion of the sartorius, and running three or four inches downwards. The knee being bent, and the foot extended in order to relax the gastrocnemius, the origin of the soleus from the tibia should be brought into view and divided, when the operator may pass his finger down to the artery, which lies somewhat more than a finger's breadth from the edge of the tibia, immediately under the fascia that covers the deep-seated muscles, and then either apply ligatures or a succession of graduated compresses. This artery may be tied very easily at the ankle. An incision about a couple of inches long should be made between the inner ankle and *tendo Achillis*, rather nearer the former than the latter; two layers of fascia, which are the continuations of the superficial one lying immediately under the integuments, and the deep one that covers the blood-vessels, nerves, and deep-seated muscles, with more or less intermediate cellular substance and fat, must next be divided, and then the

artery is found lying with its two *venæ comites* on the tibial side of the nerve. The plantar arteries are frequently cut, and would be tied with great difficulty, owing to the cellular and fatty textures which cover them being so thick and dense, especially when infiltrated with blood, but it is fortunately unnecessary to secure them in this way, as pressure properly applied is always sufficient for the purpose. The caddis ought to rest upon the surface of the bleeding vessel, and therefore the wound should be dilated, if not wide enough to admit of its introduction.

The anterior tibial artery is liable to wounds at various parts of its course, and may be tied throughout almost the whole of it. This is not required below the ankle, as pressure is equally efficient, and much more convenient ; but it may be necessary to apply ligatures higher than this. The vessel is not apt to be wounded farther up than the middle of the leg, where the thickness of the muscles protects it. As it runs close to the interosseous ligament, and along the fibular side of the *tibialis anticus*, it may be always easily found by making an incision about two inches and a-half long, at such distance from the outer margin of the tibia as will allow room for this muscle, and then cutting down in the first muscular interstice.

The peroneal artery is so securely defended by the various parts which surround it on all sides, that it can hardly be injured without a very serious wound of the leg ; and in the rare case of its hemorrhage requiring particular attention, instead of performing

a very severe operation to apply the ligature,* it would probably be better to enlarge the wound if necessary, introduce graduated compresses, and support the limb with a bandage applied from the toes upwards.

Femoral, Inguinal, and Iliac Aneurism.

Aneurism sometimes affects the femoral artery just before it passes through the sheath of the triceps, in which case the vessel ought to be tied above the crossing of the sartorius, as has been described for popliteal aneurism.

The disease not unfrequently appears at the groin, being seated in the common femoral artery above its bifurcation,—and then constitutes a tumour, which fills more or less completely the triangular hollow that naturally exists at this part of the thigh.

The only effectual remedy is ligature of the external iliac ; and Mr Abernethy had the merit of executing this bold attempt for the first time, (1804,) having previously tied the artery in another case on account of hemorrhage, (1796.) Both the patients who were the subjects of these operations died ; but his next case (1806,) was more fortunate. Mr Freer of Birmingham having, much about the same time, but rather earlier, met with complete success. Since then, the ligature of the external iliac has been practised so frequently and successfully that it is now regarded an ordinary proceeding.

The operation consists in making an opening through the abdominal parietes above Poupart's liga-

* Guthrie, Medico-Chirurg. Trans. Vol. vii.

ment, pushing aside the peritoneum, and then tying the artery which is thus brought into view, or at all events within reach of the aneurism-needle. The incision for this purpose ought to run nearly parallel with Poupart's ligament, but slightly diverging from it in proceeding upwards, so as to be about the distance of an inch from the superior spinous process. It should be between three and four inches long, and placed lower down or farther up, according to the situation of the tumour, so as to let the ligature be applied at some distance from the sac. Generally speaking, the lower end of the incision ought to be about half an inch above the middle of Poupart's ligament. The surgeon may cut through the integuments and tendon of the external oblique, as it is usually called, without any ceremony; but in dividing the internal oblique and transverse muscles, he should use the precaution of raising their fibres with the forceps, before cutting them ; and having thus exposed a portion of the *fascia transversalis*, he may readily dilate the opening to what farther extent seems necessary, by means of a probe-pointed curved bistoury, guarded with his forefinger. Gently scratching through the fascia, which, near the crest of the ilium, does not adhere intimately to the peritoneum, he will be able to push this membrane inwards, and introduce his finger down to the artery which runs along the inner side of the *psoas magnus*, loosely connected with the vein. If the aneurism-needle is assisted by the counter-pressure of a finger placed opposite its point, hardly any dissection will be required for detaching the vessel, and if the convexity

of the instrument is turned towards the peritoneum, the risk of wounding it or the vein will be diminished ; but in this particular the surgeon must be guided by his own convenience. If any considerable branch of the *circumflexa ilii* is cut during the operation, it ought to be secured. The edges of the wound should be stitched together, and lightly dressed. In tying this and other deep seated arteries, much assistance is obtained from the use of flexible copper spatulas an inch or two broad, and eight or ten long. Sir A. Cooper recommended another mode of operating, which was certainly in some respects easier, but objectionable on several grounds, particularly in so far as it exposed the vessel too low down, in the neighbourhood of the disease, the lymphatic glands, and the origins of the epigastric and circumflex arteries. This method was, to make a curved incision, having its convexity downwards, and nearly in the direction of Poupart's ligament, beginning over the margin of the inguinal aperture, and terminating near the spinous process, then to cut through the tendon of the external oblique muscle, so as to expose the spermatic cord, which being pushed upwards, along with the muscles lying over it and the peritoneum under it, afforded room for applying the ligature.

The internal iliac has, on one or two rare occasions, been tied on account of aneurisms of the glutæal and ischiatic arteries, affecting the vessels after issuing from the sacro-ischiatic notch. The operation is to be performed in the same way as that for the ligature of the external iliac, the in-

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cision being merely carried farther upwards, and made somewhat longer. The external iliac will form a good guide to the internal, which separates from the other at the sacro-iliac synchondrosis. The ureter crosses the vessel at this part, and might, through want of caution, be included in the ligature.

The common iliac can require to be tied only on account of wounds, or aneurisms extending up the external iliac. Wounds of the common iliac, from balls or thrusts of sharp-pointed weapons, granting that they were not attended with any other fatal injury, would very seldom afford the time and opportunity necessary for applying a ligature, owing to their profuse hemorrhage; and where the aneurismal sac extends up into the pelvis, it generally adheres so intimately to the peritoneum as must render the ligature of the common iliac, without injuring this membrane, all but impossible. Dr Mott, of New York, has nevertheless lately succeeded in tying the vessel successfully. The aneurism reached far into the pelvis, but he managed to separate the peritoneum from its sac, so as to expose the artery, and pass a ligature round it. He made an incision about six inches long, extending higher up than the one requisite for tying the internal iliac artery, and found great assistance from thin wooden spatulas, which were employed to hold aside the peritoneum with the intestines.

The aorta is occasionally found, on dissection of dead bodies, to be very narrow, or altogether impervious, either in consequence of original malformation, or owing to the complete spontaneous coagulation of

large aneurisms in its course. In these cases the blood seems to be conveyed to the parts below the obstruction, chiefly by means of the anastomoses between the lumbar arteries, and those of the intestines. If, therefore, the aorta could be tied without the infliction of a mortal wound, there is reason to believe that a cure might be accomplished of aneurisms ascending too high for being remedied by ligature of the iliac. In dogs and other animals, having long and thin loins, it is not difficult to tie the artery, by making a longitudinal incision between the lumbar and abdominal muscles, and turning aside the peritoneum. In the human subject, there is not room enough for proceeding thus, and the only practicable method seems to be that first adopted by Sir A. Cooper, as a forlorn hope in a case where the patient was reduced to the very point of death by hemorrhage from an iliac aneurism. He cut through the parietes of the abdomen in the *linea alba*, turned aside the intestines, cut through the peritoneum again, and tied the vessel. This operation may be performed without much difficulty, but it does not seem probable that the complicated dangers attending the double wound of the peritoneum, the handling of the intestines, and the shock caused to the system by suddenly impeding the circulation of the great arterial trunk, would leave the patient any chance of recovery. Sir A. Cooper's patient lived thirty-eight hours, and the circulation of the sound limb returned. His death was ascribed to its not doing so in the affected one, which was probably owing to the great extent of the aneurism, obstructing a long tract

of the artery and its branches, and consequently requir-
ing the blood to be transmitted through many succes-
sive anastomoses.

Ligature of the Arteries of the Superior Extremity.

Aneurism seldom or never occurs below the axilla,
except as a consequence of wounds, and then, of course,
has its sac formed entirely by the cellular substance
exterior to the vessel. This happens most frequent-
ly at the bend of the arm, owing to the lancet be-
ing used incautiously, so as either to transfix the
median basilic vein, and puncture the humeral ar-
tery which lies under it, or to open the radial or ul-
nar arteries instead of veins, which, when coming off
high and running superficially, they very much re-
semble. When either of these disagreeable accidents
unfortunately occurs, strong pressure should be exer-
cised over the wound, a bandage being applied tightly
from the fingers upwards to support the arm in bearing
it. If one of the smaller arteries is concerned, this treat-
ment will probably prevent the formation of an aneu-
rism,—but if the trunk of the humeral itself is wound-
ed, the chance of its doing so will be much less. Even
after an aneurism is formed here, the treatment of
Guattani, which consists in rest, and pressure of the
whole limb, sometimes effects the cure, and therefore a
trial should be made of these means. In case they fail,
it then becomes necessary to resort to the ligature, and
it ought always to be applied here as elsewhere, to the
vessel actually concerned. In this situation the old ope-
ration is preferable to the modern one, because it af-

fords the easiest access to the artery, and in cases of
its high division saves the surgeon from the risk of
tying the wrong vessel ; because there is no reason to
apprehend degeneration of its coats in the neighbour-
hood of the disease, as the aperture resulted entirely
from violence ; and also because simple ligature of the
artery higher up than the tumour has proved unsuc-
cessful, owing to the free anastomosis of the branches
distributed about the elbow. The best way of pro-
ceeding is to lay the sac fairly open,—to evacuate its
contents,—and then bringing into view the wound of
the artery either by completely suppressing all flow of
blood through means of a tourniquet, or by withdraw-
ing the fore-fingers or thumbs from each other after
their points are placed fairly on the orifice, to apply a
couple of ligatures, one above and the other below the
opening.

Should it ever be thought necessary to tie the hu-
meral above the elbow, the operation may be perform-
ed by making an incision two inches and a-half in
length along the inner edge of the biceps muscle. The
artery will be found lying on the radial side of the me-
dian nerve, which by its size and firmness affords a
good guide, strictly connected with its *venae comites*,
and covered by the humeral vein.

When the arteries of the fore-arm happen to be
wounded they ought to be tied at the part. The ra-
dial is found in the first muscular interspace next the
radius, and the ulnar in the first muscular interspace
next the ulna.

Wounds of the hands and wrist are frequently at-

tended with profuse hemorrhage, for which the hu-
meral artery is sometimes tied.   But the fact of this
operation checking the bleeding proves that the case
did not require it, since, if the hemorrhagic tendency
were strong, it could not be subdued by a ligature so
far distant from the wound, and with so many bran-
ches intervening.   In all these cases pressure, if pro-
perly applied, will be found perfectly sufficient for the
purpose.

Axillary Aneurism.

Next to the ham and groin the axilla is the most
common seat of external aneurism.   It generally
begins in the form of a small circumscribed tumour,
and suddenly enlarges upon rupture of the sac, which
in the first instance is formed by the external coat of
the artery.   It then not only fills the axillary cavity,
but projects beyond it.

The first attempt to cure the disease in this situa-
tion by operation was made by Pelletan, (1786) who
proposed to divide the clavicular origin of the *pectora-
lis major*, and thus expose the subclavian artery where
it passes out below the clavicle.   His colleagues with-
held their consent, and would sanction only a dive
with the needle after the integuments were divided.
This ineffective and dangerous attempt was tried, and
of course proved unsuccessful.   Mr Keate afterwards
succeeded by executing the proposal of Pelletan (1800)
so far as regarded the division of the pectoral muscle,
but he also then plunged his needle in search of the
artery. Mr Chamberlayne operated more scientifical-

ly (1815) by dividing the muscle, and then dissecting down to the vessel.

This operation is difficult, owing to the depth of parts,—the troublesome hemorrhage proceeding from branches of the *thoracica humeraria* that lie in the way—the subclavian vein overlapping the artery—and the close proximity of the large nerves going to form the axillary plexus, which are apt to impose upon the surgeon, and be mistaken for the artery. It is also seldom admissible, owing to the height which the disease generally extends upwards. The best mode of performing it, is to make an incision along the lower margin of the clavicle, from the coracoid process to near the sternum, and then another about the same length, proceeding downwards from the acromial extremity of the former, in the direction of the space between the deltoid and pectoral muscles. The clavicular origin of the latter being then divided, and any arterial branch that bleeds considerably having been tied, the surgeon, dissecting down on the acromial side of the plexus of vessels and nerves, in order to avoid the vein, will find the artery, and be able to include it in the ligature.

The subclavian artery can be much more easily and advantageously tied above the clavicle, immediately after it passes out behind the *scalenus anticus*, where it is more superficial, detached from the vein, and at a greater distance from the disease. Mr Ramsden had the merit of first performing the operation here (1808 ;) and, though the case terminated unfavourably, it led to others, which have established this as the best proceeding for the cure of axillary aneurism.

Dr Post of New York met with the first instance of success (1817.)

The mode of operating described by Mr Ramsden has hardly been improved. The patient's shoulder having been depressed as much as possible, an incision should be made along the upper edge of the clavicle, from the insertion of the sterno-mastoid, to that of the trapezius. Another cut, perpendicular to the former, and of about the same length, ought next to be carried from its centre upwards, parallel with the external edge of the sterno-mastoid. The flaps thus formed should be reflected with the *platysma myoides* and fat—the jugular vein being, if possible, avoided or held aside ; and then the surgeon dissects down in the form of a crescent, the convexity of which is towards the clavicle, between the *scalenus anticus* and inferior belly of the *omo-hyoideus,* until he exposes the *scalenus anticus,* taking care not to cut the supra-scapular artery, which must be tied if wounded. Tracing this muscle to its insertion into the first rib, he is led infallibly to the artery which passes out behind it, immediately above its attachment. He then either carries the needle round the vessel where thus exposed, or, in case of its showing any indication of morbid alteration, uncovers it a little farther, by cutting or turning back the edge of the scalenus,—in doing which there is no danger of injuring the phrenic nerve, as it lies here quite at the sternal edge of the muscle, having crossed it obliquely in descending. It appears from the cases on record, that the large nerves going to constitute the axillary plexus, though not lying in the way of the artery,

are apt from their proximity to be mistaken for it; wherefore the surgeon should be cautious in passing the ligature, and not draw it until satisfied, by the effect of compressing what he has included, that it is really the artery.

The subclavian artery may be tied also on the inner or sternal side of the scalenus; but the numerous branches that spring from the artery here, together with the close neighbourhood of the pleura, vein, and on the left side, the thoracic duct, render this operation extremely difficult and dangerous—while, as already observed, it offers no inducement in regard to increasing the distance between the ligature and aneurism. Dr Colles of Dublin performed this operation unsuccessfully, (1813.)

Carotid Aneurism.

The carotid artery at the angle of the jaw, where it divides into the two great branches, occasionally becomes the seat of aneurism, which is easily recognized by the general characters. Sir A. Cooper first ventured to tie the common carotid for this disease (1805;) and though the attempt did not succeed, he repeated it most successfully not long afterwards (1808.) Since then the artery has been secured very frequently, and with so little difficulty or bad consequences, that the operation is regarded one of very ordinary interest.

The patient should be seated or reclining. The external incision should be two inches and a half long, or more if the patient is fat. It should extend along

the internal or sternal edge of the sterno-mastoid, and be more or less distant from the sternum, according to the part of the vessel which it is wished to tie. The artery lies most superficially in the higher part of the neck, where it is covered merely by the integuments, *platysma myoides*, and fascia. Lower down it is overlapped by the sterno-mastoid, and sterno-thyroid muscles, and is crossed by the omo-hyoid. The upper part of its course, therefore, would be preferable for the purpose ; but as the disease or injury which requires the ligature is generally seated here, the surgeon has seldom any choice, and must operate at or below the crossing of the omo-hyoid. The edge of the sterno-mastoid having been brought into view, it should be held aside, so as to expose the ascending belly of the omo-hyoid, which in its turn being turned either up or down, according as it is desired to tie the vessel above or below it, of which plans the latter is usually preferable, the sheath of the vessel will present itself. It ought to be opened on the tracheal side, to avoid the *descendens noni*, which runs down the centre, and, what is of much more consequence, to prevent any risk of injuring the internal jugular vein, which lies on the outer side, and overlaps the artery. The *par vagum* being situated behind the vessels, is hardly in the way of harm. The convexity of the needle ought to be turned towards the vein.

The bold operation of tying the *arteria innominata* was first performed by Dr Mott, (1818,) on account of subclavian aneurism. The ligature separated on the fourteenth day, and every thing seemed to be going on favourably, when a week afterwards bleeding com-

menced from the wound, and recurred from time to time, until the patient's strength was completely exhausted, which happened on the twenty-sixth after the operation. Graefe tied the artery, (1822,) with a similar result. The ligature separated, and the patient seemed to be safe, but died at the end of two months of hemorrhage. It thus appears, that when a ligature is applied so very near the heart, the danger of bleeding continues longer than in other situations, owing to the great force of the blood which issues directly from the heart tending to break through the weak and recently formed obstruction. Perhaps the danger might be diminished by weakening the action of the patient's system for some time after the ligature is detached.

The operation, though important and dangerous, is not very difficult. Two incisions should be made of nearly equal length, which may be about two inches, one upwards from the sternum, along the inner edge of the sterno-mastoid, and the other transversely, from the same point across the sternal attachment of this muscle. The flap of skin thus formed being reflected, the sternal attachments of the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, must be divided to a sufficient extent for bringing into view the sheath of the vessels, which ought to be opened as if for the ligature of the carotid. This vessel having been exposed, if traced down, will lead to the innominata, round which the needle should be passed very carefully, with its convexity turned towards the sternum, in order to avoid the pleura and great venous trunk.

In aneurisms at the root of the neck, not admitting of the ligature being applied between them and the heart, Mr Wardrop has lately recommended the practice suggested by Brasdor, of tying one or more of the vessels proceeding from the sac, so to cause stagnation of its contents.* The proposal is reasonable, and Mr Wardrop has recorded two very satisfactory cases, in which he relieved the patients from carotid and subclavian aneurism by tying the vessels respectively; and one of aneurism of the innominata, in which Mr Evans operated successfully by obstructing the carotid. The general observations which have been made above on this subject, render it unnecessary to say any thing farther in regard to it here.

Internal Aneurisms.

When aneurisms are seated so as not to be within reach of surgical operation, they belong to the province of the Physician. The only remedy they admit of is the treatment of Valsalva, and in conducting it there are three circumstances of essential importance; *First,* That the treatment should not be commenced until the sac has attained a considerable size, so as to favour the desired coagulation; *Secondly,* That the patient must be reduced to the utmost degree of weakness, compatible with recovery; and, *Thirdly,* That this must be accomplished, not by a small bleeding every third or fourth day, which would probably produce excessive reaction, a state most unfavourable for attaining the

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* Wardrop on the Cure of Aneurism by a New Operation, 1828.

object in view, but by frequently repeated depletion during the first few days, after which the strictest abstinence must be enjoined, to maintain and increase the effect thus obtained.

Aneurism by Anastomosis.

Mr John Bell described, under the title of Aneurism by Anastomosis, a subcutaneous tumour, which possessed a flattened shape, a doughy consistence, and a cellular structure, communicating very freely with the branches of neighbouring arteries, so that it pulsated or throbbed obscurely, and bled most profusely when opened by incision, though when the morbid structure was cut entirely out, there was not any more hemorrhage than might have been expected from the vessels of the part. Mr Bell regarded this formation as composed of cells with which the veins and arteries freely communicated, and into which the blood was induced to flow with extraordinary force. The tendency of aneurism by anastomosis being to enlarge, open, and bleed, Mr Bell recommended complete and speedy excision as the only and essential remedy for it.

More recent and extended observation has not only thrown light upon the nature of this tumour, but also proved that there are others of an analogous kind which should be arranged along with it; and the term of Morbid Erectile Tissue has been employed as the general title for denoting them. Every part of the capillary system has the power of inducing blood to enter it, and those portions of the body which, being distinguished by a remarkable degree of this pro-

perty, are said to be formed by erectile tissue, in all probability exercise a similar power in a similar manner, but only on a greater scale, proportioned to the developement of their structure. Instead, therefore, of regarding them as constituted by distinct cells interposed between the veins and arteries, it seems more reasonable to suppose that they consist merely of a dilatation, as it were, of the capillary anastomosing vessels. In some animals the natural erectile tissue is evidently formed in this way ; as for instance the glans penis of the ram, and other animals of the same genus. And there are a few cases recorded in which the morbid erectile tissue was no less distinctly composed of dilated and convoluted vessels. *

Under the head of Morbid Erectile Tissues may be ranged, 1. Aneurism by anastomosis; 2. Nævus or longing mark ; 3. The subcutaneous nævus, as it has been called, and well described by Mr Wardrop ;†
4. Also excrescences of the mucous membrane at the verge of the anus, which possess the structure and bleeding disposition of the erectile tissue. The three first of these are, with hardly any exception, congenital. The last one is never congenital, and seldom occurs before middle age.

Aneurism by anastomosis is always seated in the cellular texture lying under the skin, which is more or less elevated, and in general slightly discoloured,

* Pelletan, Clinique Chirurgicale, T. ii. p. 59.—MacLachlan, Glasgow Med. Journal, No. 2.—Wardrop, Lancet, No. 211.—Syme, Ed. Med. and Surg. Journal, No. 98.
† Med. Chirurg. Trans. Vol. ix. p. 200.

having a blue or purple shade observable in it. The swelling throbs synchronously with the heart, becomes smaller when compressed, and more turgid when the circulation through the arteries is excited, or that through the veins impeded. At birth it is usually small, frequently hardly perceptible, and often does not enlarge until puberty. After becoming active it generally increases in size, at length opens, and bleeds from time to time, in the female observing the menstrual periods in its tendency to do so. Its most common situations are the head, hands, feet, and upper part of the trunk. There is no remedy for this disease but excision; and in performing the operation it is proper to cut quickly and completely beyond the morbid structure. Messrs Travers and Dalrymple tied the carotid with success in two cases of swelling in the orbit which seemed to be of this nature;* but as these cases were not of congenital origin, they must be regarded as questionable exceptions to the general rule.

Nævus is an enlargement of the venous capillaries, apparently confined to the surface of the cutis. There is little swelling, but very obvious discoloration, generally of a dark or purple hue. There is no pulsation, but turgescence when the circulation is disturbed, especially by any circumstances which obstruct the passage of the veins. The disease is most frequent in the head and trunk, but also appears on the extremities. It is always congenital; and when first observed is usually of very small extent, being merely a point or

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* Med. Chirurg. Trans. Vols. ii. and vi.

speck, which increases rapidly after birth. After attaining a certain size it generally either remains stationary, disappears by absorption, or ulcerates and scabs away by degrees.

The treatment ought to vary according to circumstances. If the nævus is small, and the cause of much deformity, it ought to be cut out. If of such extent and situation that it cannot be cut out, the natural cure by absorption may be induced through the application of pressure and astringent washes, or if these fail, by some local irritation, such as that produced by vaccination, which leads to the ulcerating and scabbing process. If stationary, and not inconvenient, it ought not to be meddled with.

The subcutaneous nævus is a disease similar to the one last mentioned, but more deeply seated. It exists either alone, or, more generally, along with the superficial nævus; like which it seems to depend more upon the veins than the arteries. It occurs in the same parts of the body, and is always congenital. At the time of birth it occasionally has attained a large size, and soon afterwards begins to bleed profusely. But much more frequently it increases slowly from a very small commencement, and may not prove troublesome until a pretty advanced period of life. It is recognized by its bulk and subcutaneous extent, together with the negative character of wanting pulsation. Like the superficial nævus, it occasionally shrinks or ulcerates away.

When this tumour is seated on the face, it ought to be cut out as soon as possible, if within reach of

the knife. If it is not, or increases slowly without bleeding, or remains stationary, it should not be interfered with. If it opens and bleeds, ligatures may be introduced at different parts of its base, so as to complete the destruction of its greater part, leaving the remainder to be removed by the ulcerative process thus instituted, or changed in its structure by the effusion of lymph consequent on the inflammation excited by the ligature. Nearly the same effect may be obtained from the use of caustic or the actual cautery.

In a case of this disease in an infant, where the tumour was large and bleeding, Mr Wardrop, in order to save the life of the patient from immediate danger, tied the carotid artery ; and with success. He was induced to follow this course by the unfortunate result of an attempt to cut out the nævus in a similar case, when the child died during the operation.* It would probably be safer as well as surer practice, in such circumstances, to apply the actual cautery once or oftener if required.

The vascular excrescences which are met with on the inner side of the verge of the anus, hold a middle place between aneurism by anastomosis and nævus. They throw out a jet of arterial blood when injured ; but their hemorrhagic disposition is not nearly so strong as that of the former of these diseases. Their situation precludes excision ; and the ligature ought always to be chosen as the best means for removing them.

* Wardrop, Med.-Chirurg. Trans. Vol. ix. p. 203

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Osseous Aneurism.

There are various detached cases on record of tumours occurring in bones, and presenting several of the characters of aneurism. In 1826, M. Breschet published an essay on this disease;* and in the same year, without any knowledge of his views, I introduced the title of Osseous Aneurism into the Syllabus of my Lectures on Surgery.

The tumour in question has been met with, out of all proportion, most frequently in the tibia, at its upper extremity. It has been observed also in the femur and scapula, and the wrist and ankle. The predisposition to it seems strongest in the male sex, and at the time of life between puberty and middle age. The enlargement is attended with severe pain from the commencement. It is at first equally firm and resisting with the other parts of the bone, but, on increasing, becomes more soft and yielding, not over the whole surface, but at some points of its extent, where an obscure pulsation or throbbing can generally be perceived. If pressure be made at other parts of the sac, it often gives way with a crackling sort of sensation. As the disease increases, the limb affected becomes weak and œdematous, the superficial veins over the swelling are greatly enlarged, and the pain is extremely distressing. At last the sac gives way, and the profuse hemorrhage which ensues, renders immediate amputation necessary. When the tumour is then examined, it is found to contain fluid and coagulated blood, to be hollowed out of the bone

* Repertoire d'Anatomie, T. ii. p. 142.

concerned, and to have for its cyst the periosteum, more or less strengthened with a lining crust of bone, not dense and compact, but possessing a honeycomb structure, the laminæ of which radiate towards the centre of the cavity. If the arteries of the limb be injected, it is found that their trunks are entire; but that their branches which enter the substance of the bone communicate so freely with the cavity of the swelling, that the matter used for injection, however coarse, readily flows from them into it.

The only remedy for this disease is amputation. There is one case recorded, where ligature of the femoral artery proved sufficient to cure an aneurismal tumour of the tibia; * but this must be regarded merely as an exception to the general rule. In amputating, it is always desirable to remove the whole of the bone in which the disease originated; since, though part of it may be apparently sound at the time, it tends to renew the morbid action.

VEINS.

Inflammation of Veins.

The veins are more numerous and capacious than the arteries, whence the blood moves through them more slowly and less forcibly. The veins not only communicate by capillary anastomosis of their neighbouring branches, but are frequently united in their course; and hence occasion even less inconvenience by their obstruction than that of the arteries does. When the

* Lallemand, ibid. p. 138.

principal trunk of a limb is concerned, the resistance which is opposed to the return of the blood causes more or less œdema. The coats of the veins resemble those of the arteries, but are thinner, more closely connected, and tougher, so that a ligature merely draws them together without cutting the internal ones.

The veins are prone to inflammation, which is very much disposed to spread, and chiefly in the course of the circulation. The vein affected feels hard and painful, especially when extended. The surface of the skin which covers it is often red, from the adjacent tissues taking on the same action. The pain is of a peculiar, oppressive, sickening kind, similar to what attends inflammation of the glands and absorbents. When these local symptoms are at all acute, they are accompanied with more or less fever, which is distinguished by what is called the typhoid type or character. The pulse is quick and small; the respiration hurried and anxious; the countenance dark, contracted, and expressive of much distress; the tongue dry and brown. There is great prostration of strength, and often, especially in the progress of the disorder, low delirium. Death may ensue in a very few days, but seldom before the end of a week. In proportion as the inflammation is chronic, the danger is small. The local effects are, in the first instance, redness and thickening of the vessel, then suppuration into the cavity, or the effusion of lymph, which, together with coagulation of the blood, just as happens in the arteries in similar circumstances, impedes the circulation, and obliterates the channels affected. The

veins are induced to take on the adhesive action by compression, and the other kinds of irritation which occasion it in the arteries, but they are much more readily excited by these means to inflame. The atheromatous and calcareous degenerations occur so rarely in their coats, that they may almost be said never to affect them.

The causes which have most effect, and are most frequently concerned in the production of inflammation in the veins, may be referred to four heads:

1. Inflammation of a neighbouring organ.
2. The application of a ligature.
3. Immoderate or long-continued distension.
4. The infliction of wounds which do not heal by the first intention.

John Hunter, who had the merit of directing attention to the causes and important consequences of venous inflammation, when they were almost entirely overlooked, * observed that the veins running near or through inflamed parts, took on a similar action, and effused pus or lymph, or both, into their cavities. Succeeding inquiry has ascertained that this is not a constant, or even very common occurrence ; but there can be no doubt that it occasionally happens. Of all the causes which induce inflammation of veins, there is none more certain than the application of a ligature. It was formerly the custom to tie them without any ceremony ; and there is every reason to believe that many of the fatal results of operations, which

* Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, Vol. i. p. 16.

used to be attributed to peculiarity of constitution, or unwholesomeness of the atmosphere, really proceeded from this source. The danger from ligatures applied to veins was particularly insisted upon by Mr Travers. * Generally speaking, the danger of tying veins is in direct proportion to their magnitude; but death has often happened from the ligature of the saphena below the knee. Immoderate or long-continued distension seems to be the cause of that inflammation of the iliac veins, which is occasionally observed in women who have suffered a severe or protracted accouchment. And if, as appears very probable, or rather positively proved, the complaint called *phlegmasia dolens,* which consists in a painful œdema of the inferior extremity, depends on obstruction of the iliac veins, in consequence of inflammation, † this cause of its production must be regarded as one of frequent operation. When the wound of a vein does not heal by the first intention, it must of course inflame; and the morbid action thus instituted, is apt to follow its characteristic tendency to spread. John Hunter showed that many of the bad consequences of venesection, which used to be referred to pricks of the nerves or tendons, really depended on the wound not healing, and the veins inflaming. ‡

With regard to the treatment, it must be admitted, that when the inflammation is acute, and attended with much constitutional disturbance, it hardly

* Cooper and Travers's Surgical Essays, i. 227.
† Davis, 1823. Med.-Chir. Trans. Vol. xii. p. 419.
‡ Op. et loc. cit.

yields to any remedy. In such cases, therefore, the prognosis should be very unfavourable. General bleeding seems to do no good ; and, on the contrary, rather to increase the irritability of the system, which more requires calomel and opium. Local bleeding and fomentations are useful when the inflammation is acute. Warm solutions of acetate of lead with opium, and the *tinctura saponis cum opio* with camphorated mercurial ointment, and the pressure of a tight flannel bandage, constitute the best local applications when the affection is chronic.

Wounds of Veins.

When veins are cut across, their orifices are closed by the same process which effects the obstruction of arteries in similar circumstances ; and the smaller moving force of their contents favours this occurrence on one side of the aperture, while the valves still more effectually prevent any disturbance of the adhesive process at the other. If the vein concerned is one of the great trunks, and devoid of valves for preventing a retrograde motion of the blood, pressure ought to be preferred to ligature for restraining its hemorrhage, and a very slight resistance will be found sufficient. When veins are not divided, but merely wounded through a part of their circumference, they do not necessarily or usually either remain open or suffer complete obstruction, as the arteries do, but heal, and regain their original condition. This difference is owing to the smaller distension of the venous coats, which allows the effusion of lymph that takes place

from their cut edges to become organized. If the lips
of the wound continue *in situ*, they unite at once with
each other ; but if they are displaced, owing to their
transverse direction, or any other cause, there is, in
the first instance, injection of blood into the surround-
ing cellular substance ; then the formation of a firm,
round, smooth coagulum, exterior to the wound ; and,
lastly, an exudation of lymph from the vessels of the
vein, which, resting upon this clot, extends from one
cut edge to the other, and gradually unites them toge-
ther, after which, the clot being absorbed, the cure is
completed.

Varix.

Varix consists in a dilatation and thickening of
the veins, which become at the same time elongated,
and thus constitute a tortuous swelling. It occasions
deformity, weakness of the part concerned, by imped-
ing the circulation, and pain from the same cause. It
also renders the vein liable to chronic inflammation,
ulceration, and hemorrhage. The saphena, spermatic,
and hemorrhoidal veins are most liable to the disease.
It seldom appears in the limbs before maturity, but
occurs in the other situations which have been men-
tioned at a much more early age. Tall stature, and
largeness of the veins, predispose to the disease ; con-
stipation, pregnancy, and sedentary occupations, fa-
vour its actual commencement.

The treatment of varix consists in obviating the
exciting causes, for which purpose the bowels ought
to be kept open, the testicle ought to be suspend-

ed, and the leg ought to be supported with a bandage or laced stocking. The horizontal posture ought to be preferred, and the erect one avoided. When the vein inflames, it ought to be treated according to the rules already explained ; the symptoms are almost always chronic, and local remedies merely are required. When it bleeds, pressure must be applied. When ulceration occurs in connection with it, which most frequently happens in the case of varix of the saphena, and affects the inner side of the leg a little above the ankle, the surgeon should be guided in his practice, by the indications of indolent or irritated action which the ulcer may exhibit. If there appears not to be any obstacle to the cure on either of these accounts, he may simply use the black wash and a bandage, under which cicatrization is in general speedily accomplished.

In order to effect a radical cure of varix, it has been proposed to obliterate the vessel above the diseased part, so as to take off the dilating effect of a superincumbent column of blood, and this has been done in various ways. The ligature, which had been long before tried and rejected on account of the danger attending its use, was recommended by Sir Everard Home, and on his authority tried rather extensively, but with such troublesome and not unfrequently fatal consequences, as effectually prevented it from being employed in future. Mr Brodie revived a still older method, viz. obliterating the vein by incision. Instead of cutting out the varicose portion, which was the ancient practice, he merely divided the vessel, using a narrow knife, and

making a small puncture of the skin. The conse-
quences of this practice, though not so disastrous as
those of the ligature, were still occasionally disagree-
able enough to overbalance the chance of benefit.
Another proposal has been lately made by Mr Mayo,
viz. to make an eschar with caustic over the vein at a
sound part of its course above the varix, and thus excite
such inflammation of the vessel as might be sufficient
to occasion obliteration of its cavity by the effusion of
lymph. This method has the recommendation of being
an imitation of a natural process of cure, for it some-
times happens that the varicose vessel, in consequence of
spontaneous inflammation, becomes completely imper-
vious. In exciting this action artificially, however,
there is great difficulty in avoiding the opposite ex-
tremes of deficient and excessive irritation, and alarm-
ing inflammation has in consequence been repeatedly
induced. The actual cautery may perhaps be found a
safer means of curing varix, for which purpose it is
extensively used by the native practitioners in India.
But in the present state of information upon the sub-
ject, it seems that the most judicious course in treating
varix is to be satisfied with remedying its bad conse-
quences, and using means for preventing their occur-
rence.

Aneurismal Varix.

When a contiguous artery and vein are wounded to-
gether, it occasionally happens that the orifices of the
vessels remaining undisturbed, the blood is allowed to
pass from the artery into the vein; the consequence of

which is, that the latter vessel becomes large and tortuous, communicating a jarring sort of sensation to the hand which examines it, and a peculiar thrilling sound, like what would result from the prolonged articulation of the letter R, (*bruit de râpe,*) is heard when the ear is brought near the injured part. The limb becomes œdematous and cold, owing both to the want of its usual supply of nutritious fluid, the greater part of which, instead of proceeding onwards to its destination, flows back to the heart, and also to the obstacle opposed to the return of the blood from the veins below, by the distension of those above, which is caused by the forcible current of the artery. From the same cause there is hardly any pulsation of the artery below the part where it is wounded, while it pulsates above more forcibly than it did before, in consequence of the preternaturally free exit which is afforded to its contents.

Dr Hunter first described this disease, (1756,*) but Dr Cleghorn of Dublin suggested the name which is used to denote it,† (1765.) It is most apt to happen at the bend of the arm, where the median basilic vein lies over the humeral artery, but may occur in any part of the body where a large artery and vein are contiguous. Instances of it have been observed in the femoral, popliteal, and subclavian vessels, from wounds; but there is only one example of its spontaneous production on record,‡ in which case the aorta and *vena cava* communicated by a large aperture.

* Med. Observ. and Inquiries, Vol. i. p. 340.
† Ibid. Vol. iii. p. 110.
‡ Ed. Med. and Surg. Journal, Vol. xxxvi. p. 104.

Aneurismal varix is generally more inconvenient than dangerous, the veins, after they become fully distended, usually remaining without any farther change. It is therefore seldom necessary to do more than apply a bandage to the limb, with a compress over the injured part. Should the swelling, pain, or other symptoms of the case be so severe as to warrant an operation, a radical one may be performed by tying the wounded artery both above and below the opening. Sometimes a sac formed by the injection of blood into the connecting cellular substance, is interposed between the vessels, which constitutes what has been called Varicose Aneurism. Dr Hunter did not consider this complication deserving of distinction.

CHAPTER IX.

EXTERNAL INJURIES.

Bruises.

By a bruise is understood an injury caused by a blow, or by violent compression, without division of the integuments. Its effects vary according to circumstances, but the most common one is Ecchymosis, or the injection of blood into the cellular tissue, which occasions more or less swelling and livid discoloration of the skin. The blood after being thus effused is gradually removed by absorption, during which the colour of the part passes through various shades of red, green, and yellow, that have been differently explained, but not as yet satisfactorily. To promote this absorption, some stimulating lotion, containing the salts of ammonia, spirits, and vinegar, ought to be applied, together with moderate pressure. It is usual to apply leeches in the treatment of ecchymosis, but it is clear that, the blood being not contained within its own vessels, and, on the contrary, extravasated into the cellular substance, bleeding from the surface cannot possibly be of any service, and may even do harm by increasing the weakness which the skin has previously suffered, both from the immediate effect of

the injury, and also the separation from the parts beneath, which attends the bloody infiltration.

The blood is sometimes effused in larger quantity, and collected in a cavity formed by the torn and distended cellular substance. In this kind of bruise there is usually the same sort of discoloration of the skin as in the former, but the size and fluctuation of the tumour readily distinguish it. This bloody effusion is comprehended under the title of ecchymosis, but it is necessary to make a distinction between the two, though no doubt merely different degrees of the same injury, since the process of recovery is apt to be considerably different.

It is always desirable to promote absorption, and for this purpose the same means as those employed to discuss ecchymosis are proper, especially discutient lotions and pressure. Sometimes the clot, greatly contracted and indurated, remains after the serum has been removed, without suffering any farther change. At other times the serum also continues little or not at all diminished, in which case blisters succeeded by pressure ought to be used, and if these means fail, the fluid may be drawn off with a trocar. The contents of these effusions are also apt to shift from one part of the body to another, according to the tendency of their weight.

When the effusion is large, or the parts about it have been much injured, or the patient is of an irritable disposition, the parietes of the cavity are apt to inflame and convert it into an abscess. Any tendency to this ought to be allayed or prevented by cold applications ; but so soon as there is reason to believe

that matter is actually formed, vent should be afford-
ed to it and the remaining blood by a free incision;
after which pressure and some stimulating metallic
wash will promote contraction and closure of the ca-
vity.

Wounds.

By wounds are understood solutions of continuity
in the surface of the body effected by violence. They
are divided according to the injury which the parts
concerned sustain in addition to the wound, and also
the form which it possesses, into incised, punctured,
and contused.

In incised wounds, there is merely a solution of con-
tinuity made by a cutting instrument, without any
other injury of the part concerned, and the length
of the aperture bears a large proportion to its depth.
The great object in treating such wounds is to in-
duce union by the first intention, and the general ob-
servations which have been already made on that pro-
cess suggest the practice to be followed with this view.
All foreign matters should be removed from be-
tween the cut surfaces; blood and serum should be
prevented from collecting by avoiding early and close
dressing, and the action of the part should be kept with-
in proper bounds by suitable local and general means.
Wherever pressure is sufficient to keep the cut edges
in contact, it ought to be preferred for the purpose.
Plasters are apt to approximate the lips of the wound
merely, and so far from pressing the deeper parts of
the wound together, rather render them more separ-

able by relaxing the superjacent integuments. Stitches
introduced at the distance of about an inch from each
other generally answer better; but if the wound opens
into a cavity, so that it has two surfaces, the best me-
thod is to use the twisted suture, as it is called. This
consists of needles or pins passed through nearly the
whole thickness of the edges of the wound, at the dis-
tance of from one to three quarters of an inch, accord-
ing to circumstances, being inserted most closely where
the parts concerned are thinnest. A silk thread such as
that employed for stitches or ligatures is then twisted
round each needle in succession in the figure of 8, so
as to draw the cut surfaces very closely together. The
needles may be withdrawn on the third day, but the
recent union ought not to be subjected to any strain for
some time afterwards. In treating all incised wounds,
it is proper to enjoin perfect quiet and the strict anti-
phlogistic regimen; also if the weather should be warm,
or the patient much disposed to inflammatory action,
to keep the wound constantly covered with cold wet
cloths, unless the parts should be defective in action
from weakness, when spirituous applications are often
very useful.

When the superficial extent of a wound is very small
in proportion to its depth, it is said to be punctured;
such wounds are caused by instruments which have
small points and generally blunt edges. They are not
at all formidable in their appearance, but usually
turn out much more troublesome than incisions of far
greater size, being apt to occasion extensive inflam-
mation, and widely diffused suppuration. These bad
consequences of punctures are usually ascribed to their

penetrating some fascia, which inflames and gives rise to the effects in question. And there can be no doubt that they are generally most productive of bad consequences when they do penetrate such a structure. But in this view of the matter they ought not to prove troublesome at all, except when thus seated, which is contrary to fact ; and it seems on the whole more reasonable to refer the diffused inflammation occasioned by them, in some measure at least, to the confinement of the discharge which necessarily results from their narrow aperture, and the effects of the fibrous expansions in keeping up irritation by their pressure.

The most effectual method of checking the inflammation which proceeds from punctures, consists in dilating the orifice of the wound, and it is therefore often recommended to do this immediately after their infliction, to prevent bad consequences. It does not appear that the chance of these is thus diminished, and therefore the most prudent course is, in the first instance, merely to apply cold water or other lotions proper for moderating action and preventing inflammation. Should it actually commence, dilatation ought to be performed without delay, and then fomentations with poultices are proper for a few days, or until the suppurative action is fully established, when compression and stimulating washes must be substituted in their stead.

Contused wounds are solutions of continuity, in which the surfaces are injured by the violence that occasions them,—the agent being usually some blunt edge moving with great force. Contused wounds

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in general bleed less than incised ones; their sur-
face is ragged or lacerated; and, together with the
surrounding parts, is of a dark livid colour, owing to
effusion of blood into the cellular substance. When
the contusion is considerable, it renders the wound in-
capable of uniting by the first intention, and excites
inflammation, which either terminates in mortifica-
tion, or leads to suppuration, according to the extent
of the injury, and the irritability of the patient. It
was formerly the custom to cut away the contused and
lacerated edges, to supersede the more tedious process
of sloughing; but nature is now allowed to determine
what portion is incapable of recovering. All foreign
matters ought to be carefully removed from the wound,
and its edges should then be placed as nearly as pos-
sible in contact. If there is no great degree of con-
tusion, stitches may be employed for this purpose;
but, generally speaking, it is better to abstain from
them; and if they are used, the first appearance of
inflammation should be the signal for their removal.
Cold applications are proper in the first instance, and
ought to be continued until the wound either unites or
inflames. In the latter case warm fomentations and
poultices are indicated; but they must be laid aside
as soon as the sloughs have separated and the granu-
lating action is established. If continued longer than
this, they induce great relaxation of the parts con-
cerned, already weakened by the injury, render the
granulations large and flabby, and prevent the sores
from contracting. The ulcer always tends from its
own nature to weakness of action, and therefore, instead

of these enfeebling applications, requires stimulating washes, with pressure.

Gun-shot wounds are solutions of continuity effected by substances impelled from fire-arms. They are generally punctured as to their form, and always contused as to their surface. They are consequently apt to occasion extensive inflammation, and sloughing of the parts more immediately concerned. The orifice by which a ball enters is small, round, depressed, and livid; that by which it escapes larger, more elongated, and rather everted at its edges. These appearances vary with the velocity of the ball, the entrance being most, and the exit least distinctly characterized when it is greatest, and *vice versa*. The wound when first received, occasions a numb sort of sensation, but before long becomes acutely painful. It bleeds less than an incised wound in the same situation would do. When of any considerable extent, it invariably causes, immediately on its infliction, an extreme degree of mental alarm, despondency, and prostration of strength. This constitutional effect is proportioned to the importance of the injury, the weakness of the patient, and his apprehension of danger.

The bad consequences of gun-shot wounds were formerly ascribed to the poisonous agency of the gunpowder; and upon this belief was founded the cruel practice of scarifying or excising the wounded surfaces, and dressing them with scalding oils. Paré introduced a milder practice, which he was led to, in the first instance, by necessity, and was afterwards confirmed in by experience and reasoning on the sub-

ject.   He used merely unctuous applications, and
with such success, that his example was soon gene-
rally followed.   The treatment of gun-shot wounds,
though so far improved, still continued unnecessarily
severe, since the scarification, which was formerly pre-
ferred to remove the poison, still remained in use, to
prevent tension and inflammation from the fistulous
shape of the wound.   John Hunter exploded this sys-
tem of dilatation, as it was called, by showing that it did
not prevent the effects in question, and was performed
soon enough if delayed until they actually appeared.
The best application at first is a pledget of oiled caddis
placed on the wound, and covered with cold wet cloths.
Should inflammation supervene, free dilatation, in-
cluding any fascia that has been wounded, and lies
within reach, fomentations, and poultices, become
proper ; when the sloughs are detached, pressure, with
the usual metallic lotions, must be carefully employed,
as there are apt to be extensive sinuses ; and if these
have not a sufficiently dependent opening, it ought to
be afforded by the knife.

When the ball, or any other foreign matter intro-
duced into the wound, is not carried through, but re-
mains, it ought to be removed, if this can be done with-
out any very serious cutting or searching ; for, though
it is no doubt true that such extraneous substances of-
ten acquire a fibrous cyst, and cause no disagreeable
symptoms, they more frequently excite inflammation,
which leads to various troublesome consequences, and
may do so after lying for a long while without causing
any disturbance.   The finger is the best probe for de-

tecting the ball or other foreign body ; and when far-
ther search is requisite to find it, the nature of the tis-
sues concerned ought to be carefully considered, since
the direction of its course is much affected by those
of dense and unyielding structure, as the bones, fasciæ,
and even the skin. The velocity of the ball, and the
position of the body when it entered, ought also to
be taken into account.

When the injury is so severe as to render amputa-
tion necessary, it has been disputed whether the ope-
ration ought to be performed immediately, or be de-
layed until the primary inflammation subsides, and
suppuration is induced. In reference to this question,
the effects of gun-shot wounds may be divided into
four stages:—1. Confusion and prostration of strength,
commencing immediately after the injury is sustain-
ed, and lasting seldom less than one, or more than
six hours, unless it terminates in sinking. 2. Re-
turn of strength, attended with more composure of
mind, and sensation of the injury. This continues
until inflammation begins, which is hardly deferred
beyond twenty-four hours. 3. Inflammation ending
in death, gangrene, or suppuration, and occupying
from one to several days. 4. Suppuration, which con-
tinues until the patient recovers, or has his strength
completely exhausted, and dies,—which may be in a
week or two, or not until the end of many months.
Amputation may be performed with most advantage
in the second and fourth of these stages. Different
opinions were formerly entertained as to which of them
was preferable; but the extensive experience and accu-

rate observations of the military surgeons who were en-
gaged in the Peninsular war decided the question ; and
it is now admitted that amputation during the second
stage is out of all proportion most successful; to say no-
thing of the risk which men wounded on the field of bat-
tle must run, if permitted to go through the inflamma-
tory stage, while their shattered limbs are subjected to
the irritation of rough carriage, and their constitutions
injured by the unwholesome air of crowded hospitals.
Should the surgeon find that his patient does not rally
within the period usually occupied by the first stage,
though assisted by the stimulating effect of wine or
spirits, he ought to afford the chance derived from re-
moval of the limb, unless his strength seems at so low
an ebb, that it would certainly sink under the shock
of an operation ; and, on the same principle, when
inflammation has been allowed to come on, and pro-
ceeds to gangrene, amputation ought to be performed,
as giving the patient a chance, however small, of escape
from otherwise certain death.

Cannon balls not unfrequently occasion contusions
without any breach of the surface, varying from the
slightest ecchymosis to complete destruction of the sub-
jacent tissues, so that they are reduced to a gelatinous
pulp. Sometimes when the contusion is sustained on
the trunk, it causes instant death, in consequence of
important organs being ruptured. These effects used
to be ascribed to the *wind of the ball*, or air violently
agitated by its motion. They are now more scientifi-
cally and satisfactorily referred to the action of the

ball itself, which has its velocity so far spent as to bruise merely without wounding.

Extremes of Cold and Heat.

The first effect of cold is to diminish the vital action of the part to which it is applied. This state of depression, when not carried too far or continued too long, is succeeded by more than usual activity, or what is called re-action, especially if heat or any other stimulus co-operates with the natural tendency to excitement. If this alternation be frequently repeated, the part concerned becomes permanently weakened, being slightly swelled, of a purple colour, and not so warm as usual. It is then easily affected by cold, becoming pale, contracted, and numb, and re-acts with so much violence as to show symptoms of inflammation, becoming red, hot, itchy, and painful; not unfrequently vesicated and ulcerated. A part thus injured by cold is named a Chilblain.

Chilblains are most apt to occur in persons who possess weak powers of circulation, and on the same principle take place chiefly at the extremities of the body, viz. the hands and feet. They ought to be guarded against by avoiding sudden and severe alternations of cold with heat. When formed, they should be protected from cold, and supported in their actions by stimulating embrocations, such as camphorated oil, strong spirits, or, what has been particularly recommended by Mr Wardrop, a mixture of *tinct. sap. c. opio,* with *tinct. lyttæ,* in the proportion of six of the former to one of the latter. The ulcer of chilblains

presents the appearance of a smooth superficial excavation, with thick white edges, and a peculiar viscid slimy discharge. It heals most readily under the *unguentum oxydi hydrargyri rubri*.

More intense cold not only weakens, but entirely suspends vital action. The part becomes pale, insensible, and shrivelled, and is said to be *Frost-bitten*. The extremities of the body, such as the fingers and toes, the ears and the nose, are most liable to be thus affected, both from their situation and comparatively languid circulation. A frost-bitten part is not dead, and when freed from the influence of the cold, regains its power of action. It is difficult to determine how long the torpor may last without permanently depriving the part of life ; but there is reason to suppose that the period is considerable ; and it appears from the relation of Captain Franklin, that an animal may be restored to its usual actions even after its whole body has been frozen. *

In treating frost-bite, the great object should be to moderate the reaction, since, if it proves excessive, mortification readily occurs, both because the part is weak, and because its irritability being consequently increased, the inflammation is apt to be intense. The best method is to use friction without any external heat, or even to effect it through a cold medium, such as that of snow, in order to promote the return of circulation, and at the same time guard against excitement. If inflammation comes on, the part ought to be soothed with anodyne and astringent applications,

* Franklin's Journey to the North Coast of America, p. 248.

such as warm solutions of acetate of lead with opium ; the tincture of soap and opium, &c. Local bleeding would increase the weakness, and consequently render the diseased action more unmanageable ; but general depletion will be proper if the patient is plethoric. Should mortification ensue, the best dressing will be the resinous ointment, with oil of turpentine, spread on caddis, and covered with a soft poultice.

Burns.—When any part is exposed to a higher temperature than usual, its actions are increased. It becomes red, more or less swelled, and hot. If the heat applied is moderate, or of short duration, these symptoms disappear when it is removed ; but when it is intense, or longer continued, the redness caused by it is bright and permanent, and there is a painful sensation of burning. The part is then said to be burned, while in the former case it was merely excit- ed. The inflammation thus induced generally termi- nates in effusion of serum from the surface of the cu- tis, which detaches the cuticle, and elevates it into blisters. When the heat is still more intense or pro- longed, it destroys the life of the part. The cuticle is then detached and thrown into irregular folds or wreaths, exposing the subjacent cutis discoloured and dry. When the heat operates through the medium of fluids, its effects are named Scalds. Burns and scalds are always painful,—often long in healing, ow- ing to the feeble action of the resulting ulcer, which is seated in parts that have been more or less injured by the heat,—and sometimes fatal by the shock to which they subject the constitution, by the profuse suppu-

ration which they occasion, or by exciting inflamma-
tion of some internal parts.

In treating burns, it is necessary to consider whe-
ther the injury is so severe as to destroy the vitality
of the part affected, or merely sufficient to induce in-
flammation of it. In the latter case cold applications
afford great relief, and if employed immediately after
the accident occurs, may prevent the inflammation
and vesication altogether. Another mode of treatment
which answers extremely well, though it is difficult
to say on what principle, consists in enveloping the
burned part with cotton. This practice was intro-
duced from America a few years ago, and is now in
very general use. It appears that its good effects are
most conspicuous when pressure is conjoined with it ;
and a bandage, therefore, ought to be applied with
moderate firmness. When blisters rise, they ought
to be punctured ; and if ulcers remain, lotions of sul-
phate of zinc, or acetate of lead, are required to sti-
mulate the granulating surface. It was formerly the
custom to dress burns with unctuous matters, such
as the carron oil, or *linimentum aquæ calcis* ; but
these filthy and useless applications are now almost
entirely superseded by the means which have been
mentioned.

When the burn is so severe as to destroy the life
of the part, it must always be regarded as a very se-
vere injury. In very young or very old subjects, or
those who on any other account are very weak, it is
apt to induce immediate sinking ; especially when it
affects the trunk, and more particularly the abdomen.

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In patients whose powers of action are stronger, the local irritation is apt to occasion very smart symptomatic fever; and whenever the integuments of the thorax or abdomen are affected, there is a risk of the membranes lining these cavities internally, inflaming from their contiguity. The constitutional treatment must depend upon the circumstances of the case. If the patient is drowsy, with cold extremities, and a weak pulse, spirits, wine, and other cordials should be assiduously administered, while the body is warmly covered and sources of artificial heat applied to the feet. If, on the other hand, the ordinary symptoms of inflammatory fever should be present, the lancet ought to be freely employed. The local treatment may be more uniform; since the state of the burned parts, though differing in degree, is always nearly the same in kind. Dr Kentish, of Newcastle, recommended the application of stimulants to bring down the excited action gradually to the healthy standard. It is not easy to understand how any advantage could be gained in this way, and the defects of the theory have prevented many from following the practice. But it is well ascertained that stimulants afford great relief to the patient's feelings, and diminish the inflammation. The explanation of this may perhaps be, that in severe burns, a part being killed, while those which surround it are weakened, stimulants prove useful just as they do in cases of mortification, by supporting the debilitated actions.

The stimulant generally used by Dr Kentish was oil of turpentine, which was applied warm by means

of caddis soaked in it, some common plaster being placed over them to prevent evaporation. This dressing was continued for twenty-four hours, or so long as it continued to be agreeable to the patient. It was then changed for some milder application, such as the resinous ointment, which could be readily diluted by the addition of axunge, until it ceased to have any stimulating power, which was usually requisite by the end of the third day, to prevent it from irritating the patient. Cotton is also used by some practitioners for severe as well as for slight burns. It should be allowed to remain until the crust which is formed by the fluid absorbed into it, is detached from the ulcerated surface by suppuration. The ulcer which remains after the separation of sloughs caused by burning, is still more tedious in healing than that which results directly from the inflammation thus originating, and is observed to be so in proportion to the depth of parts injured in the first instance. Stimulating washes, pressure, and nourishing diet, are requisite during the cure, and great attention ought to be directed towards the prevention of inconvenient adhesions and contractions of the granulating surface. If the raw surface is very extensive, the whole of it ought not to be exposed during the dressing at once, lest the astringent effects of the cold air may repress the action of it, and thus indirectly excite disease in some other part of more consequence. Substances having poisonous properties should be used cautiously when they are applied to such extensive ulcers. Should the patient's strength prove inadequate to support the tedious and exhausting process of cure, if the

part affected is seated on a limb, it ought to be amputated.

Poisons.

By poisons are understood agents which have the power of destroying the structure, or inducing disturbance in the actions of the body, independently of mechanical violence and temperature. Those which directly affect the structure are named Escharotic Poisons, or simply escharotics. Of these the most powerful are the concentrated mineral acids, potass, and some metallic salts, as the nitrate of silver and oxymuriate of mercury. They are frequently used intentionally to remove morbid structures, &c. and are then named Caustics. Occasionally, whether from accident or design, they are applied so as to produce serious injury. In such cases, as their effect is generally completed before surgical assistance can be procured, the only treatment admissible, is that which promotes separation of the slough and healing of the sore. Poultices, until the first of these stages is completed, and then stimulating washes, afford most benefit.

Poisons, more strictly speaking, are those agents which produce their effects independently of chemical properties, as well as mechanical force and temperature; they do not directly alter the structure to which they are applied, but produce such changes in its natural actions as frequently give rise to the most important local and general consequences. A very large proportion of the articles comprehended in this class are employed to produce their effects in order to relieve

the system from other diseases, whence they are named not poisons but medicines, the former title being reserved to denote those which are distinguish- ed by the malignity of their action. The only poisons which afford subject for surgical consideration are af- forded by the animal kingdom, and may be divided in- to, 1. Those which exist naturally in the animals that yield them ; 2. Those which are the results of diseased action ; and 3. Those which depend on changes after death.

Natural animal poisons are afforded chiefly by the two classes of Insects and Serpents. In this and other temperate climates, the effects of those of the former are hardly more than local, consisting of pain, swelling, and redness of the part injured. The treatment, when any is judged necessary, should also be local, and the sedative solution of opium, the solu- tion of acetate of lead with opium, *aqua ammoniæ*, and other preparations of ammonia afford most relief. There is considerable variety in the effect of these poi- sons, according to the irritability of the individual on whom they operate ; and habit has a very remarkable influence in lessening its intensity.

The poison of serpents produces more serious con- sequences, which vary according to the species which affords it. The most deadly sort occasions intense local pain, speedily followed by swelling of the limb, rapidly extending, and attended with mottled livid discoloration of the skin. The patient, almost im- mediately upon being bitten, feels sick, weak, and con- fused. He appears as if intoxicated; vomits; becomes

quite insensible; and dies within a few hours, or it may even be minutes, after sustaining the injury. The viper, which is the only poisonous serpent in this country, hardly produces fatal effects; but the pain and swelling caused by its bite are often extremely distressing.

The treatment must be both local and general. The former consists in opposing the entrance of the poison into the circulation; the latter in counteracting its depressing effect on the vital powers. In accomplishing the first of these objects, the means of most use are, 1. Removing the poison from the body either by cutting away the part, or destroying it with caustics or cauteries;—the application of ammonia also seems to have some effect in preventing it from producing its characteristic effects; 2. Applying a tight ligature on the limb to compress the veins and other absorbent vessels; and 3. To direct the current of the fluids towards, instead of from, the injured part, by causing suction over it, which may be effected with the mouth, or a cupping-glass. One or other of these proceedings may be trusted to chiefly, according to circumstances, but in severe cases it is proper to combine the operation of the whole. The general remedies are such as tend to prevent sinking, by creating a sort of artificial strength through their stimulating property. Ammonia, given pure or in the state of carbonate, with spirits, and warm water, sufficient to make the mixture palatable, ought to be administered every five minutes. Arsenic has been strongly recommended also, as a remedy in such cases, and although it might

be difficult to account for its salutary operation, the facts in proof of it are so striking and well authenticated, that when circumstances permit, this means should certainly be combined with the others. The arsenite of potass, or Fowler's solution, is the most convenient preparation for the purpose, and two drachms of it may be given every half hour. *

All morbid poisons which affect the human species originate in diseased action; they may all be produced by the human body; but two of them, cow-pox and the matter of hydrophobia, were in the first instance derived from the lower animals. They exist both in the liquid and in the gaseous state. In the former they hardly act unless inserted or inoculated into the texture of the body. In the latter they produce their effects when received into the lungs during inspiration. It is only the first or inoculated poisons which belong to the surgical department. They always occasion more or less irritation of the part to which they are applied, and generally afterwards more or less constitutional disturbance. Their *modus operandi* is not at all known. They seldom cause any immediate local alteration; and days or even weeks may elapse before there is any indication of their action. The constitutional disturbance follows, and after being fairly instituted, it cannot be subdued by removing the part on which the morbid matter primarily acted. The effect of some of these poisons will be more particularly considered hereafter. At present it may be observed, that the treatment proper for them in the first instance requires to be merely local, and should be con-

* Ireland Med. Chirurg. Trans. Vol. ii. p. 396.

ducted on the same principles of prevention as that of natural poisons.

The poisonous effects of dead animal matter are involved in considerable obscurity.   It frequently happens that wounds received in the dissection of animals after death, whether for anatomical investigation or the preparation of food, are followed by troublesome consequences, both local and general.   It is observed that those which have a punctured form are most apt to be so.   Sometimes there is violent inflammation of one or all the tissues in the neighbourhood, from the skin to the bone, terminating speedily in suppuration or sloughing.   In the finger this constitutes what is called paronychia or whitlow.   The absorbent vessels leading from the injured part often inflame, and by propagating their morbid action to the surrounding tissues, occasion hard painful cords under the skin, and red lines on its surface.   Still more frequently the lymphatic glands in the course of the absorbents inflame and suppurate.   At other times the patient first complains of cold shivering, headach, and vomiting of bilious matter, after which the usual symptoms of fever come on, and are generally characterized by extreme irritation—the pulse being excessively quick—the respiration very hurried —and the countenance unusually expressive of anxiety. Along with this derangement of the system a diffused inflammatory blush appears in the neighbourhood of the injury, from which it soon extends itself irregularly in various directions, and, terminating in mortification, proves fatal within a week or little more; or the pa-

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tient may die, as it seems, merely from the exhausting effect of the irritative fever, with very little local appearance of disease.

Since the effects of punctures now mentioned differ from each other very much in kind, and are subject to no less variety in the degree of their severity, while they are all occasionally produced, so far as can be ascertained, by the same circumstances,—it has been inferred that they depend not so much upon a poisonous influence in the subject dissected, as on peculiar irritability of the individual injured.

In regard to the treatment it may be observed, 1. That when punctures occur in suspicious circumstances, they ought to be converted into incisions, sucked, and touched with an escharotic. 2. That persons exposed to such injuries ought to lessen, so far as possible, the irritability of their systems. 3. That, when the effect is an acute and local inflammation, a free incision through the affected part affords most relief. 4. That, when the absorbents inflame, warm solutions of acetate of lead with opium have the most soothing influence. 5. That, when the lymphatic glands become affected, warm fomentations are the most powerful means of relieving the patient, which they do either by inducing the inflammation to terminate in resolution, or by hastening suppuration if it be inevitable. 6. That, when the constitutional disturbance precedes the local affection, and there are signs of great irritation, scarifications of the inflamed part, followed by hot anodyne fomentations, and accompanied with calomel, opium, and cordials, though they may seldom succeed in cur-

ing this most dangerous condition, seem to have more tendency to do so than general bleeding and the anti-phlogistic regimen, which usually, by increasing the weakness of the patient's system, increase its irritabi-lity, and render its treatment more unmanageable.

CHAPTER X.

AMPUTATION.

THE expression amputation, though sometimes applied to the excision of parts from the trunk, is generally confined in its meaning to the removal of limbs by the knife. In performing this operation it is not sufficient merely to cut away what is diseased or injured, since the surface that remains ought to be left in such a state as will favour the healing of the wound, and afford a useful stump to the patient. Many different modes of operating have been contrived, with the view of attaining these objects ; but they are now becoming generally superseded by one which is out of question greatly preferable to all the others.

Amputation was anciently performed by the direct and simple process of cutting down at once to the bone, and sawing it through on a level with the soft parts. But it being found that in this way there was no covering afforded to the bone, whence followed a tedious and imperfect cure, various modifications were introduced to supply the defect. The muscles were drawn up by metallic plates, or split cloths and pieces of leather, called retractors. Cheselden, (1720,) drew back the skin after it was cut, and then divided the mus-

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cular parts higher up. This method of double inci-
sion was carried to an extreme by Mr Mynors of Bir-
mingham, who dissected the skin, and turned it back
like the cuff of a coat. Louis cut the muscles by two
circular incisions, so as to divide the portion of them
nearest the bone higher up than usual. Alanson, by
holding his knife obliquely, while he made the circu-
lar sweep through the muscles, cut them at once in
the same form that resulted from two successive inci-
sions.

The object of all these contrivances was to leave
the soft parts sufficiently long to cover the bone ; but
this they failed in accomplishing, excepting so far as
concerned the skin ; for the muscles being in the first
instance cut shorter than the integuments, and subse-
quently becoming still more diminished in length by
the unopposed effect of their contractility, could never
be made to meet over the bone, which often protrud-
ed during the cure, and required to exfoliate or be
shortened by the saw. Hence its permanent covering
was merely a thin adherent cicatrix ; and even in more
favourable circumstances, when the integuments unit-
ed over the bone, the covering of skin thus afforded to
it, did not constitute a good protection.

The most simple and effectual plan for covering the
bones properly was obviously to form one or more flaps
from the part of the limb most able to supply them ;
and there can be no doubt that this mode of operating
would have long since come into general use, had it
not been that prejudice in favour of the circular inci-

sion directed the attention of practitioners entirely to improving it. The operation by flaps was performed occasionally during the last century and a half, and recommended by various surgeons who practised it more or less extensively. Lowdham, of London, seems to have been the first of these, (1697,) and he was followed by Verduin, (1696,) Koenerding, (1698,) Sabourin, (1702,) and Vermale and Ravaton, (1739.) Towards the conclusion of last century, it was advocated by several of our countrymen in amputating the leg, of whom may be particularly mentioned Messrs White, (1760,) O'Halloran, (1765,) Hey, (1770,) and Alanson, (1780.) Of late years it has come into general use in this part of the country, chiefly through the example of Mr Liston ; and perhaps an essay which I wrote with the view of comparing the relative advantages of the two modes, may have also had some effect in overcoming the prejudice that previously opposed the adoption of flap amputation.[*]

The great advantages of this method are, 1. That it is much more quickly performed, and consequently much less painful to the patient than the circular incision ; 2. That it cuts the parts smoothly, and leaves them in a state favourable to union ; and, 3. That it affords a much better covering for the bones than can be obtained from any modification of the other operation.

The flap may be formed by cutting obliquely inwards to the bone, by transfixing the limb and cutting outwards, or by first cutting inwards, so as to

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[*] Edin. Medical and Surg. Journal, 1823.

obtain one flap, and then outwards to form a second. The particular circumstances of the case often render one of these modes preferable to the others; but when the surgeon has his choice, he will generally find transfixion the easiest method. The size of the flaps, and proportion of muscle and integument composing them, must be regulated by the thickness of the bone, and laxity of the soft parts. The flaps ought to be cut longer than would be sufficient to constitute a well-formed stump in the dead body, to compensate for the contractility of the living muscle. When the skin is loose, and the muscles attenuated, the surface of the flaps should be convex, to preserve the latter, and diminish the extent of the former tissue. When, on the contrary, the limb is muscular, and the skin tense, the knife should be made to describe a concave line, to prevent redundance of muscle. The best knife for amputating fingers and toes is represented (Fig. 5, Plate I.) For the limbs, a larger blade is of course required; and it may be stated generally, that its length ought to be about a half more than the diameter of the part to be subjected to operation. (See Figs. 6, 7, and 8.)

For restraining hemorrhage during the operation, there are three means which may be used. The first of these is the tourniquet or turn-stick, invented by Morel (1674,) consisting of a strap or bandage carried twice round the limb, encircling a firm roller, or other suitable compress placed in the course of the artery, and a piece of wood, which, being inserted between the turns of the bandage, when twisted, effects any degree of constriction that may be required. The second is

a modification of this apparatus, contrived by Petit (1716,) who, instead of the turn-stick, used a screw and couple of plates, which, being separated by turning the handle, effected the pressure more gradually, and so as to dispense with the services of the assistant who was employed to hold the turn-stick. This screw tourniquet, variously modified and improved, is the instrument still generally used for the purpose. The third mode of commanding the vessels, is by simply compressing them with the hands. In certain amputations this is the only means that can be used, owing to the proximity of the operation to the trunk; and some surgeons, from the facility and dispatch attending it, never employ a tourniquet on any occasion. In cases where the tourniquet can be applied without doing any harm, it ought to be preferred, as it relieves the assistant from a fatiguing duty, and prevents the patient from losing so much blood as he is apt to do when the vessels are subjected to manual pressure, if many of them require to be tied, or there is any unsteadiness, either on his part or on that of the assistant. The arteries ought to be pulled out with the forceps, and tied quite detached from their neighbouring connections.* After the principal vessels are secured, the tourniquet ought to be entirely removed, to prevent its slackened band from exerting such pressure on the veins as may cause them to bleed, and induce the surgeon to tie them instead of arteries.

* The forceps contrived by M. Amussat for effecting the torsion of the arteries will be found extremely convenient for this purpose.

The earlier modes of amputation rendered union by the first intention impracticable; and when the operation had been so far improved as to retain the soft parts sufficiently long to meet over the bone, the old system of dressing still continued in use, and the cavity of the stump was stuffed with caddis, as all wounds were in those days healed by the granulating process. Mr Alanson had the merit of exploding this practice, and introducing light superficial dressings in its stead, which greatly shortened the cure; and though some surgeons on the Continent still interpose dressings between the edges of the stump, union by the first intention is always sought for in this country. Stitches, if necessary, ought to be employed to keep the lips of the wound nearly in their proper position; and when the bleeding has ceased, plasters or long strips of caddis may be used to retain them in accurate contact.

The bad consequences of the operation are chiefly hemorrhage, suppuration, and sero-purulent effusion into other parts of the body, especially the cavity of the thorax.

Hemorrhage may appear immediately after the operation, either from arteries which have not been tied, owing to their not showing themselves by bleeding during the state of collapse succeeding the removal of the limb, or from the veins being compressed by too tight a bandage. In the former case it is necessary to apply as many ligatures as may be requisite, —in the latter it is sufficient to slacken the bandage. Hemorrhage sometimes commences a few hours after the stump is dressed; and then depends either upon a

general oozing from the cut surfaces, consequent upon
the re-action of the system, or upon some imperfection
in the ligature of the vessels, which allows the blood to
escape when impelled with more force than it was while
the patient remained weak and faint.   Cold lotions and
pressure will restrain it, if proceeding from the first
of these sources ; but additional ligatures will be re-
quired, if, resisting such means, it proves to be from
the second of them.   The hemorrhage occasionally
does not occur until the third, fourth, or even seventh
day ; and then almost always depends upon ulcera-
tion of the artery.   In this case, as ligatures can-
not be applied to the orifices of the vessels with any
advantage, owing to the morbid state of their coats,
the bleeding must be arrested either by pressure, ef-
fected through means of compresses introduced into
the stump, and a tight bandage applied externally, or
by tying the trunk of the artery.   The former of
these methods is greatly preferable, when adequate to
the purpose, which, with very few exceptions, it is
found to be.

When the stump does not unite, but inflames and
suppurates, fomentations ought to be frequently ap-
plied until the discharge is fully established, when
stimulating washes and pressure must be employed to
support the weakened action of the granulating sur-
faces and make them unite together.

Purulent effusions into internal cavities occur chief-
ly in weak, debilitated, irritable subjects, and have
been accounted for variously. They are known to
result in such habits from excited action, whatever be
the cause producing it ; and there is reason to believe,

that if amputation has more frequently the effect of occasioning this disturbance than other wounds of the same extent, it is owing to the disturbance which it causes by suddenly removing a large part of the body. The ligature of veins, whether through accident or design, has also been supposed to be the cause of their occurrence. There are no means of remedying such effusions, and the only way of avoiding them is, in the *first* place, to avoid operating in circumstances which predispose to such occurrences ; and, in the *second*, to control diligently from its commencement, by small bleedings, opiates, and the tartrate of antimony, the constitutional excitement which precedes them.

Particular Amputations.

The fingers may be amputated either at the joints or through the phalanges. There used to be a strong prejudice against leaving any articular surface, the cartilage of which was thought to exfoliate necessarily, so as to render the cure more tedious and troublesome. Disarticulation was therefore avoided as much as possible, and when, from any circumstances, it proved to be inevitable, the precaution was taken of scraping off the articulating cartilage. It is now well ascertained that union by the first intention generally occurs as readily after disarticulation, as after amputation through the shafts of bones, and that when it does not take place, the only inconvenience experienced from the cartilage, is merely a slight increase and longer continuance of the irritation. The stump swells and discharges thin sero-purulent fluid in considerable quantity, often together with small scales of cartilage floating out

from the cavity. Such being the case, though it would be wrong to amputate through a joint by preference, when there is any lasting advantage to be gained by doing so, the chance of bad consequences, so trivial as those just mentioned, ought not to be regarded as a sufficient objection to it.

When the distal phalanx alone is affected, it ought to be removed by cutting into the joint on the dorsal surface, dividing the lateral ligaments, and then carrying the knife forwards parallel with the palmar surface of the bone so as to save a flap to cover the stump: Or the operation may be reversed by transfixing the fingers, forming the flap, and then cutting through the joint. When the finger requires to be amputated above this joint, the operation should be performed by making two semilunar incisions, one on each side, so as to form two lateral flaps, which being dissected will expose the bone, and allow it to be divided by the saw, or, what is better, the cutting-pliers. Afterwards the flaps are made to meet together over the face of the stump. The second phalanx might be removed at the joint in the same way as the first ; but as the portion of the finger thus left would be neither useful nor ornamental, it is better, unless the patient positively refuses his consent, to take away the whole of it at its metacarpal articulation. In doing this, while the other fingers are held aside, the surgeon should cut obliquely over the joint so as to form two semilunar incisions, beginning on the back and ending below in the palm of the hand. The flaps being detached, he may readily pass the point of his knife round the head of the bone. Lisfranc makes one flap first, then carries his knife

through the joint, and completes the operation by cutting outwards. When the parts retain their natural laxity, this proceeding is equally easy and expeditious; but if they are thickened and indurated, as is generally the case, the second flap is very apt to be injured in detaching the head of the bone. When a portion of the metacarpal bone requires to be removed, the best method is to cut obliquely upwards from the angles formed by the affected finger and its neighbours, and having thus exposed the bone, to divide it with the pliers where the two incisions meet. When the metacarpal bone of the thumb is the one concerned, a portion of it may be removed without cutting into the palm of the hand, by making two semilunar incisions, commencing where the bone requires to be divided, enclosing the thumb, and meeting together at the angle of union between it and the fore-finger. If it is necessary, the whole bone may be easily disarticulated. The thumb and fore-finger being held separate, the surgeon should cut upwards in the angle between them as far as the bones will allow him, then turning the edge of the knife laterally he will at once enter the joint, and having cut through it, may readily form a sufficient flap to cover the raw surface in carrying his knife outwards. The same processes are proper for removing the metacarpal bone of the little finger in part or in whole; but in this case the external flap must be formed previous to the disarticulation, which is most readily effected by introducing the knife from the ulnar side.

After all these operations, the arteries which are found to require ligatures must be tied; and the pres-

sure of lint compresses, supported by proper ban-
dages, will always supersede with advantage both
stitches and plasters.

The toes ought to be amputated on the same prin-
ciples ; but with the exception of the great one, which
may be removed through the joint of the second, or
shaft of the first phalanx, it is always proper in re-
moving them to perform disarticulation between the
first phalanx and metatarsal bone, since the small por-
tion that might be allowed to remain would be of no
use, and in all probability occasion lameness.

Partial amputation of the foot may be performed
through the metatarsus, between the metatarsus and
tarsus, and through the tarsus. The first and second
of these methods are very seldom admissible, owing
to the disease which requires removal of a part of the
foot, generally extending so far as to encroach upon
the bones where they would be divided ; and they
are also objectionable from the difficulty which attends
their execution, while there is no counterbalancing
advantage in their favour, since, when once the ante-
rior extremity of the longitudinal arch of the foot is
taken away, no additional inconvenience results from
removing a larger portion, so long as the posterior
extremity or heel is allowed to remain. It has been
objected that the extensor muscles of the ankle-joint
having no opponents left attached when amputation
is performed through the tarsus, must draw up the
heel and point the cicatrix to the ground. But expe-
rience has proved that this unpleasant consequence is
effectually prevented by the flexor tendons adhering to
the cicatrix ; and the patient has no difficulty in

adapting to the stump an artificial foot, or stuffed shoe, with the assistance of which he walks nearly free from any perceptible lameness.

The operation through the tarsus, which was invented by Chopart, has been very much neglected until lately, owing to the hypothetical objections just mentioned, but deserves to come into more general use. The following directions, though in some respects different from those hitherto given, will, I believe, be found most conducive to its easy and successful performance.

The knife employed should be about six inches long, and half an inch broad, sharp at the point, and blunt at the back. The tourniquet ought to be applied immediately above the ankle, having its compress placed over the posterior tibial artery. The surgeon should measure with his eye the middle distance between the *malleolus externus* and the head of the metatarsal bone of the little toe, which is the situation of the articulation between the *os cuboides* and *os calcis.* Placing his fore-finger here, he ought to fix his thumb on the other side of the foot directly opposite, which will show him where the *os naviculare* and *astragalus* are connected. An incision somewhat convex forwards is then to be made from one of these points to the other, when, instead of proceeding to disarticulate, the operator should transfix the sole of the foot from side to side at the extremities of the first incision, and carry the knife forwards, so as to detach a sufficient flap, which must extend the whole length of the metatarsus to the balls of the toes.

The disarticulation may finally be completed with great ease, as the shape of the articular surfaces concerned is very simple, and nearly transverse.*

The external plantar, anterior tibial, and any other arteries that require to be secured, must then be tied, and the flap having been secured in its place by a few stitches, some light dressing ought to be applied. During the cure the knee ought to be kept bent to relax the *gastrocnemius.*

In amputating the leg, it would serve no good purpose to preserve more than the half of its length, since a stump of this extent is quite sufficient for retaining the use of the knee-joint; and if the operation were performed lower, it would be hardly possible to provide a good covering for the bones. A tourniquet having been applied to the popliteal artery, the knife should be introduced close to the edge of the fibula, and pushed directly through the limb, so as to make the distance between its exit and entrance rather more than a third of the circumference of the leg, and then carried downwards, gradually approaching the surface, so as to form a smooth convex-edged flap, somewhat longer than it is broad. A cut should then be made transversely between the two upper extremities of the first one, and slightly curved, so as to form the edge of the integuments suitably for uniting with that of the flap. The inter-osseous parts being next cut, the saw is to be applied with light, but steady strokes, so as to cut through the fibula before it divides the tibia; the arteries are

* In performing this operation before my class, I once met with the *os calcis* and *os cuboides* anchylosed.

then to be tied, and the flap stitched into its place. It is a good precaution to remove the projecting corner of the tibia, which would be apt to irritate the soft parts during the cure, either by means of the cutting pliers, or by sawing a little obliquely before making the transverse section of the bone.

When it is necessary to amputate the leg higher than the middle, the operation by circular incision is less objectionable, while that by flap is not so advantageous as in the lower part of the limb, since by the former method it is here possible to obtain an ample covering of integuments for the bone, and a muscular cushion is not so much required, the patient in this case resting his weight on the knee, not on the face of the stump. The flap mode is still, however, preferable, on account of its dispatch, being less painful, and leaving the parts in a favourable state for uniting. If any circumstances ever render it necessary to operate by the other method, a circular incision should be made through the integuments, about three inches below where it is proposed to divide the bones. An assistant then grasping the leg with both his hands, pulls the skin upwards, while the surgeon by some slight touches of the knife detaches its connections with the fascia. The muscles having been exposed to the extent of rather more than an inch, should be cut through by a strong steady sawing motion of the knife, and then, a piece of cloth or leather, split longitudinally into three portions, being introduced to retract the parts between and on both sides of the bones, the saw is to be applied, as has been already

explained. The edges of the integuments should be brought together laterally, so as to form a perpendicular cicatrix.

The tibia cannot be cut higher than its tuberosity, and the head of the fibula should never be disarticulated, as the insertion of the biceps is thus detached, and a risk encountered of exciting inflammation in the joint, by opening bursæ connected with it.

Amputation of the thigh ought always to be performed by making flaps; they should be two in number, and may be lateral, anterior and posterior, or oblique. The state of the limb must to a certain extent determine the choice of these modes. Generally the first of them answers best in the lower part of the thigh, and the third when the operation requires to be performed very high up. If the limb is to be removed at or below the middle, the pad of the tourniquet may be applied over the femoral artery where it lies between the *sartorius* and *adductor longus*; but if the operation is to be performed higher than this, it is better to subject the vessel to manual compression in the groin, as the tourniquet might in this case be in the way of the knife or saw, and also prevent the muscles from retracting so much at the time as they would do afterwards. The point of the knife should be introduced directly over the bone, and then guided close past it. The flaps should be rather longer than the diameter of the limb; the external one ought to be cut first. In tying the arteries after this and all amputations performed in the same mode, it is necessary to use great circumspection, as they are generally divided very ob-

liquely, and are therefore apt to have their orifices only partially included in the ligature.

The thigh may be amputated at the hip-joint; but in this case the shock inflicted on the system is so great, and the wound which remains to be healed is so extensive, that the operation ought never to be performed unless the patient's situation affords him no other chance of escape from certain and speedy death. There are various modes of operating, the choice of which must be regulated by the circumstances of the case, but in general the following one will be found the most eligible, in respect both to ease of performance and to its result.

An assistant should grasp the limb as high as possible, pressing with his thumbs upon the artery in the groin, where it lies on the brim of the pelvis, and with his fingers upon the hip. Then the surgeon introduces the point of a narrow knife about ten inches long, nearly half way between the spinous process of the ilium and *trochanter major*, thrusts it through obliquely behind, so as to come out just below the tuberosity of the ischium,—and then, while the limb is abducted, completes the flap by cutting downwards close to the posterior surface of the bone. The assistant should now transfer the fingers of one hand to the bleeding surface, and compress directly the mouths of the arteries that seem to be largest. The operator next inserts his knife between the fore part of the bone and parts that remain to be divided, and cuts down along it so as to obtain a large flap to compensate for the smallness of the first one. While this is doing, the assistant should

place the fingers of his hand which has hitherto rested on the pubal side of the limb in the breach formed by the knife, so as to compress still more certainly the femoral vessels, which will not be cut across until the flap is nearly completed. The limb being now strongly abducted, the surgeon cuts round the pubal margin of the acetabulum, sufficiently to let the head of the bone escape; after which the muscular and ligamentous connections that remain are easily separated.

This operation can be performed very rapidly, affords plenty of room to the assistants for compressing the vessels, renders the previous ligature of the artery unnecessary, and leaves ample materials for the constitution of a good stump.

The fore-arm ought to be amputated by making two nearly equal flaps, from before and behind; and if the muscles are relaxed while this is done, by alternate pronation and supination, the operation will be more easily performed. The hand may be removed at the wrist-joint by transfixing the limb laterally, and forming a flap from the palmar aspect; but the longer stump thus obtained is not found to facilitate the adaptation, or increase the utility of an artificial hand; and the large articular surface which remains, though it may seldom delay the cure, must always cause deformity.

The arm may be amputated above the elbow, either by double flap, or circular incision; but the former mode is greatly preferable. A tourniquet is here quite unnecessary, as the vessel can be compressed

easily and effectually by the hand placed between the biceps and triceps.

Amputation at the shoulder-joint is not very unfrequently required, and may be performed in various ways, with three of which the surgeon should be familiar, as the state of the parts concerned sometimes leaves no room for choice.

1. The circulation through the subclavian artery being arrested by pressure above the clavicle, where the vessel issues from between the scaleni, and rests on the first rib, the surgeon thrusts a sharp-pointed knife down to the head of the humerus, immediately below the acromion process ; and cutting downwards in a semilunar direction, first backwards and then forwards, so that the two incisions meet at the axilla, he forms two lateral flaps, which, being dissected back, expose the joint, and enable him to effect the disarticulation very readily, by pushing his knife through the capsular ligament, and then cutting round the glenoid cavity.

2. The surgeon cuts in a semilunar direction from one side of the deltoid to the other, so as to form a large flap of this muscle, which, being dissected from its subjacent connections, and held up, exposes the joint, allows the disarticulation to be completed, and permits the finger of the assistant to be introduced to compress the vessels before they are divided, together with the remaining muscles and integuments, by a transverse incision.

3. The surgeon introduces the point of a long narrow knife a little nearer the clavicle than the middle

space between the acromion and coracoid processes, thrusts it downwards and backwards until it issues at the inferior margin of the axilla, and then cuts in the same direction, so as to form a large external flap. Having, in doing this, cut through part of the capsular ligament, he has no difficulty in passing the knife round the head of the humerus, and making a suitable flap from the remaining parts, the assistant introducing his finger as soon as sufficient room is afforded for the purpose, and compressing the vessel.

After all of these operations, the arteries ought of course to be tied, the edges of the flaps stitched together, and a proper bandage applied.

CHAPTER XI

BONES

Fractures.

THE osseous tissue resembles in general the other vascular parts of the system as to the healthy and morbid actions of its nutritious system ; but is remarkably distinguished by its power of reproduction. It is not possible to explain on what this difference depends ; but its existence is of great consequence in remedying the accidents to which bones are most exposed by their rigidity, viz. Fracture.

Bones may be fractured in three ways. 1. By external violence operating directly upon the injured part. 2. By external violence causing a strain upon the bone so as to break it, not where the force is applied, but at some other part of its extent. 3. By inordinate action of the muscles. Fractures result most frequently from the first and second of these causes, and very rarely from the third. They occur at all periods of life, but are more frequently met with in particular bones at one age than another. In children the femur, humerus, and clavicle ; in adults the bones of the leg and fore-arm, the shaft of the femur, the humerus, clavicle, and ribs ; and in old people the

neck of the femur, are the bones most liable to be
broken. Independently of diseased conditions to be
mentioned afterwards, which render the bones more
subject to fracture, it would appear that the bones of
some individuals are more easily broken than those
of others. Fractures may be transverse or oblique in
respect to the axis of the bone—they may exist at
one part of it, or in several, whence they are distinguish-
ed into single and comminuted—and they may be at-
tended with a wound exposing the bone, or without
one, whence they are divided into Compound and Sim-
ple. In explaining the symptoms and treatment of
fracture it is necessary to consider separately the two
departments of this last division, which is of great im-
portance.

Simple Fractures.

The symptoms of simple fracture are, 1. Distortion
or change of shape, owing to the broken bone being
unable to counteract the displacing tendency of the
surrounding muscles and weight of the limb itself.
There is thus caused shortening or retraction, the ex-
tent of which depends upon the obliquity of the frac-
ture, and rotation. 2. Diminution or total loss of vo-
luntary motion. 3. Preternatural mobility by exter-
nal force. 4. Swelling from the effusion of blood
by ruptured vessels, and from the same cause ecchy-
mosis appearing some time after the accident. 5.
Pain and spasmodic starting of the muscles, owing to
the irritation of the sharp extremities of the bone.
6. Crepitus, or a grating sensation when the limb is

moved, from the rough osseous surfaces rubbing against each other.

When the extremities of a broken bone are allowed to remain at rest they unite together, and if examined by dissection afterwards, exhibit a mass of new osseous matter which serves as their bond of union. The old surgeons believed that this callus, as it was called, resulted from an effusion poured out by the surrounding soft parts, in consequence of the irritation of the injury, which concreted about the broken bones, and so united them together. The great object of treatment, according to this view, was to restrain, by local pressure, the effusion from going beyond due bounds. For this purpose short splints, or pieces of wood, pasteboard, or iron, were tightly bandaged to the limb over the injured part. Mr Pott had the merit of exposing to the surgeons of this country the impropriety of such practice, and introducing another more scientific as well as practically useful.

Mr Pott attributed exuberance of the callus to imperfect adjustment of the broken bones, which, causing irregularity and projection of their extremities, consequently rendered their union large and clumsy. He, therefore, insisted upon carefully setting or replacing the fracture, and in doing this, pointed out the importance of relaxing, by proper position of the limb, those muscles which by their contraction caused or increased the distortion. Here he remarked very justly, that what is usually called the riding end of the bone, from its seeming to project, is, with some few exceptions, really in its place, and appears prominent merely be-

cause the other is drawn back by the muscles. He show-
ed the folly of attempting to squeeze down the projection
by local pressure, and discarded the short splints which
were employed for this purpose. But in order to retain
the proper position after obtaining it by due relaxa-
tion of the muscles, and prevent the weight of the
limb, the movements of the patient, and the spasm of
the irritated muscles from causing displacement, he
recommended the use of splints long enough to ex-
tend beyond the joints at both extremities of the
broken bone.

The process by which reunion is accomplished can
seldom be inspected before its completion, and experi-
ments on the lower animals are not to be regarded as
unexceptionable evidence; it has therefore been very
variously explained, and still remains somewhat un-
certain. The following steps seem to be well ascer-
tained. In the first place, the parts which form the
cavity that encloses the fractured extremities become
thickened and hardened to more or less depth from
their surface, by the interstitial effusion and organi-
zation of lymph. The medullary membrane under-
goes a somewhat similar change, while the surface
of the bone acquires a thin lining of gelatinous-look-
ing lymph. The external shell or crust, which is thus
formed by the indurated periosteum, muscles, fat, or
whatever other tissue happens to be in the way, gra-
dually becomes firmer, and has ossific matter deposit-
ed in its substance, generally in small specks at many
different points, but in largest masses where it is con-
nected with the old bone, with which, though at first

detached, they soon unite. The broken extremities are thus by degrees joined together and rendered immoveable, but still remain unable to resist any considerable force which tends to separate them. The process of ossification then proceeds inwards from all the surface, both of the old bone and of that newly formed. A gelatinous sort of mass, or sometimes blood, fills the cavity that exists while this is going on, and when the cure is completed the bone possesses more strength at the injured part than any other portion of its extent.

The time required for this process varies with the size of the bone, being performed most quickly when it is smallest, and *vice versa*. The shaft of one of the large bones, such as the femur or tibia, generally acquires rigidity in the course of four or five weeks, but does not regain sufficient strength for supporting the body or performing locomotion until many weeks afterwards; and, so far as can be judged from the opportunities of observation occasionally afforded, is not completely ossified at the fractured part before the lapse of several months. The age, constitution, and peculiar circumstances of the patient also cause variations in the period of cure. It is most speedy in youth and health. In pregnancy it is performed in general with less energy than usual. Rest of the limb promotes it, and motion not only retards, but if considerable or long-continued, altogether prevents it; in which case the substance that ought to have formed the callus acquires the appearance and properties of ligament, so as to render the limb flexible, and con-

stitute what is called an artificial joint, the different
kinds and treatment of which will be more particu-
larly considered afterwards.

In treating fractures, it is of great consequence to
set or replace the extremities of the bone as soon as pos-
sible after the injury is sustained, in order to prevent
the bad effects of their continued irritation; to effect the
adjustment before it is impeded by swelling of the limb
or thickening of the parts which surround the bones ;
and to avoid disturbing the process of re-union by al-
tering the position of the broken surfaces at a later pe-
riod. When swelling and tension are actually present,
it has sometimes been thought proper to delay the set-
ting until they were subdued by leeches and fomenta-
tions; but as these means can have little effect while the
cause of irritation continues in operation, it is always
better to reduce the bones into their proper situation
as soon as possible, and then keep the limb steady by
means of splints. The best material for splints is
thick pasteboard, which should be long enough to ex-
tend beyond both ends of the fractured bones, and
broad enough to equal the diameter of the limb. They
must be well softened by being dipt in hot water, or
thoroughly wetted with it, and then padded with card-
ed tow, caddis, or flannel. There are usually requir-
ed two splints, one for each side of the limb, and the
best bandage for retaining them is the *looped ban-*
dage of the French, the tailed bandage, or the com-
mon roller. The first of these consists of narrow
strips of calico, about an inch and half broad, and long
enough when folded double to pass round the limb

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with a few inches of excess ; one of the ends is then drawn through the loop, and tied to the other. The number of pieces thus applied varies with the length of the limb, as there ought not to be more than three inches between them. This bandage is useful when the degree of its tightness requires to be occasionally altered, and the limb cannot be moved without disadvantage. The tailed bandage consists of a common roller, divided into pieces long enough to encircle the limb somewhat obliquely, and cross over far enough to keep their hold. Six, eight, ten, or whatever number of these tails the length of the limb requires, are placed transversely under it, so that each overlaps the one above it about two-thirds. The lowest one is then drawn tightly round the limb, and while its ends are still held by the surgeon and his assistant, the one next above is applied in the same manner, so as to secure the former, and so on until the whole are thus disposed of. This bandage effects a very close and equable pressure, and can be changed without disturbing the limb ; but it does not admit of partial relaxation or tightening. The common roller is the simplest and easiest of all the means for the purpose, but can be used only where the limb may be moved without any inconvenience. There are various contrivances for assisting the splints and bandages in preserving the proper position ; but they will be best explained along with the particular circumstances requiring them.

Compound Fractures.

The wound which constitutes the distinguishing

character of compound fractures occasions a most important difference in respect to the danger, and difficulty of cure attending them. There is apt to be violent inflammation and fever, terminating in profuse suppuration or gangrene, or death without any remarkable local change, merely from the effect of violent constitutional disturbance. These consequences used to be ascribed to the admission of air, but are now referred with more reason to the inflammation of an extensive wound implicating many important and irritable tissues; for unless the orifice of the cavity heals by the first intention, its surface must necessarily inflame as the first step to granulation. The great object in treating such injuries is consequently to obtain immediate union, and thus convert them into simple fractures.

If the bone projects through the wound, and cannot be readily replaced, a portion ought to be removed from its extremity by the saw or pliers sufficient for allowing this to be done. To prevent irritation, which is so adverse to adhesion, the bones ought to be carefully set as soon as possible; and to keep down inflammatory action, cloths wet with cold water should be assiduously applied, until there is no longer any fear of it, or until it actually commences. With the same view, the patient must be depleted according to his strength, and confined to the most strict antiphlogistic regimen. Should inflammation come on, fomentations and poultices must be substituted for the cold applications. Bleeding is to be used with caution, since the patient, if he survives the immediate danger, will have

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to support a copious and profuse suppuration; and those means which subdue violent action without permanently weakening the system, ought to be preferred. Of these the tartrate of antimony, and tobacco injections, are the most efficient. So soon as the inflammatory tension begins to subside, the relaxing applications must be exchanged for those of a stimulating, astringent, and discutient kind. The lotions of acetate of lead, sulphate of zinc, &c. are the best adapted for this purpose. Counter-openings, if required, should be made to afford the matter free vent, and pressure must be carefully effected by compresses and bandages, while the most unceasing attention is bestowed on the preservation of proper position and perfect rest. The patient's strength requires of course to be supported by nourishing food. Pieces of bone occasionally become detached during the cure, and delay or prevent it, they ought therefore to be diligently searched for and extracted.

When the injury is so severe as to preclude the possibility of recovery, amputation must be performed. The circumstances to be taken into account in determining on this severe proceeding are, 1. The state of the soft parts; 2. That of the blood-vessels and nerves; 3. That of the bones; and, 4. That of the patient's constitution. It is possible that any one of these circumstances may be so unfavourable as to render the measure in question necessary, but it more frequently happens that the surgeon is influenced by several or all of them in deciding on the operation. In civil practice it is not requisite to discriminate very accurately on such

occasions, since, unless the state of the limb is manifestly so bad as to render recovery impossible, an attempt ought always to be made to save it. For if the bones are carefully replaced, and the means which have been mentioned are employed to prevent and moderate action both local and general, the patient will not be exposed to much risk in the first instance; and if his strength should prove unequal to the exertion required of it in the future progress of the case, the amputation may be performed with a more favourable prognosis than if it had been done immediately after the accident was sustained: since it has been amply proved by experience, that the results of primary and secondary amputation performed in civil practice, are the reverse of those obtained after gun-shot wounds.

Particular Fractures.

Hands and Feet.—The phalanges of the fingers and toes, owing to their shortness and mobility, are little subject to fracture. The injury, when it does occur, is readily recognized, and easily treated by means of a narrow wooden splint, padded with caddis, and supported by a roller. The metacarpal and metatarsal bones are more frequently broken, when there is little displacement, but considerable swelling, pain, and crepitus, with preternatural mobility of the corresponding digit. A compress of tow, supported by a roller, prevents motion of the extremities, which is all that the case requires.

Bones of the Leg.—The fibula is apt to be fractured by twists of the foot outwards, and usually

gives way from about an inch and half to two inches and a-half above its inferior extremity. The eversion and lateral mobility of the foot, with the pain and crepitus caused by the broken surfaces, render the injury very distinct. The best mode of treatment is that devised by M. Dupuytren. It consists in placing on the inner side of the leg a thick compress, to which, after having been secured in its place by means of a roller, a wooden splint, long enough to extend beyond both the foot and knee, is fastened; and then applying a bandage at each extremity of the splint, so as to draw the limb towards it, and effectually counteract the distortion which is caused by the weight of the foot, and the action of the peroneal muscles. When the fibula is fractured higher up, the cause is generally direct violence, and the symptoms are so obscure, that unless the examination be instituted early, before swelling comes on, it is difficult to decide whether the bone is broken or not. The treatment requires merely a roller applied from the toes upwards, to prevent motion.

The tibia is occasionally fractured, while the fibula remains entire, generally in consequence of the strain caused by a twist of the foot in falling. It gives way most frequently either at the malleolus, or about a third of its length from the lower end. There is usually not much displacement, but great pain, and complete loss of power over the leg. The treatment is easily conducted, since it requires merely the use of means for preventing motion; and a couple of pasteboard splints, secured by the looped bandage, so that

they may be relaxed or tightened according to the degree of swelling, will be found sufficient for the purpose, the limb being laid on its outer side, with the knee bent.

The tibia and fibula are very often broken together. The fracture is generally oblique, and seated about the middle, or towards the lower third of the limb. The two bones give way seldom opposite to each other, and frequently at the distance of several inches. The accident sometimes results from direct violence, but much more usually is caused by strains on the shafts of the bones, from twists or falls. There being in this case no longer any resistance to the distorting tendency of the weight of the limb, and the retraction of its muscles, there is always much eversion of the foot, and bending of the leg, the upper extremity of the tibia pressing upon the skin, or projecting through it, owing to the lower one being pulled upwards and backwards by the gastrocnemii muscles.

Various methods are followed in treating this common and important fracture. It is evident that the extended position is very objectionable, from not affording any relaxation to the muscles which produce the distortion, and that, therefore, the knee ought always to be bent. This may be done either by simply laying the limb on its outer side, properly supported with splints, or by placing it on a double inclined plane. It will be found, that, owing to peculiarities in the seat and direction of the fracture, the extremities are retained in apposition more easily, sometimes by one of these modes, sometimes by the other.

The most convenient inclined plane, is that contrived by Mr Macintyre of Newcastle, by means of which the patient may, if it is desired, be treated out of bed. When the fracture occurs very near the knee, the upper fragment becomes subject to the action of the extensors of the knee, and the straight position, consequently, is required to keep the broken surfaces in contact.

The patella is occasionally fractured, both by the direct effect of external violence, and also by inordinate contraction of the muscles attached to it. In the former case, which is rarer than the other, the fracture is generally comminuted, and sometimes longitudinal. In the latter it is always transverse, and allows the two portions to be widely separated, so that the condyles of the femur can be felt between them. The nature of the accident is consequently very obvious, and is still farther indicated by the complete loss of power over the joint which attends it. When the fracture is longitudinal or comminuted, it is distinguished by pain, mobility of the fragments, and crepitus.

Reunion of the transverse fracture is opposed by the following circumstances :—1. The difficulty of approximating the broken surfaces, and keeping them steady. 2. The presence of the fluid of the joint, which is secreted in increased quantity, owing to the irritation of the injury. 3. The want of vascular parts to afford a bed for the new bone. Osseous union consequently seldom, or rather never, takes place ; and there is formed merely a sort of ligamentous con-

nection, varying from a few lines to several inches in extent. The treatment ought always to be conducted, however, as if a complete cure were practicable, so that the flexible medium of connection may be rendered as small as possible. With this view, the limb ought to be laid out not only quite straight, but also somewhat elevated by a pillow, to relax the pelvic extremity of the rectus muscle. A single circular turn of a roller being then applied above, and another below the portions of the bone, the broken surfaces may be drawn very nearly into contact by tying two longitudinal bands introduced under the circular ones, alongside of the patella. Some discutient lotion to promote absorption of the effused fluid may be afterwards employed.

When the fracture is longitudinal, little or no displacement occurs; and all the treatment required consists of lateral compresses with a bandage. In this fracture the union is osseous, because most of the adverse circumstances which operate against bony union in the former case are absent here.

The thigh-bone, notwithstanding its great strength, is very frequently broken, sometimes by direct violence, but much more commonly by the strain which happens in falling, particularly on the side. In adults it usually gives way at the lower third,—in children at or about the middle,—and in old people at the neck. When the shaft is broken, the symptoms, besides those generally characteristic of fracture, are, more or less shortening of the thigh, according to the degree of obliquity of the surfaces of

the bones, the lower extremity being always, except in some extremely rare cases, drawn up behind the superior one, and rotation of the foot outwards, owing to the weight of the limb.

As the thigh is covered before as well as behind with muscles, which extend beyond both the joints at its extremities, and are nearly equal in strength, it is obvious that no position can have the effect, as in the leg, of relaxing them on one side without tightening them on the other. Various mechanical contrivances, therefore, have been invented for permanently extending the limb, of which the long splint of Desault far surpasses all the others in simplicity and efficiency. It is merely a thin board about four inches in breadth, long enough to extend from the false ribs a few inches beyond the sole of the foot, and having at each end two holes for the attachment of bandages. The patient's bed having been prepared, by being rendered smooth and firm, his limb is extended until it corresponds in length and direction with the sound one ; then a pasteboard splint properly softened and padded, is applied on the inner side of the thigh, extending from the perineum to beyond the knee, and another on the outer side, reaching from the *trochanter major* as far down as the former. These splints being secured by four or five looped bandages, the board, wrapped in a sheet or tablecloth, of which enough should be left to surround the thigh, is placed alongside the limb, and a handkerchief passed under the perineum, is tied to its upper end, while the foot is secured to the lower one. Retraction is thus

effectually prevented ; and when the unfolded part of the wrapper which lies under the limb is brought over, and fastened to the splint, a handkerchief at the same time being tied round the patient's body to prevent any lateral displacement of the apparatus, the fracture is rendered perfectly steady.

The plan of treatment recommended by Mr Pott, which was to lay the limb on its outer side with the knee bent, and apply two pasteboard splints to prevent the ends of the bone from moving, is very objectionable. It affords no extension, and renders a permanent eversion of the limb almost unavoidable, owing to the patient, who is of course unable to lie always on his side, turning on his back during the cure, and thus causing the bones to unite in such a manner, so as to produce this effect. The double inclined plane, of various forms and materials, is much used, and has the sanction of high authority. It is alleged to relax the muscles by a bent position of the joints, without occasioning the inconvenience last mentioned, and also to effect extension by the weight of the body, which is, as it were, suspended from the injured thigh. But, as has been already observed, the muscles are equally tense when the joints of both the knee and hip are bent, as when they are extended ; and effectual extension could hardly be obtained by suspending the body from the knee, without causing injurious and insufferable pressure on the popliteal vessels. The upper portion of the bone too, must be influenced by every motion of the patient's body, and accordingly the worst cases of retracted and ununited femur are met with in persons treated by means of the

inclined plane, by surgeons whose known reputation precludes the objection, that the machine might have been carelessly or unskilfully employed. Even granting that its efficiency were equal to that of the long splint, the simplicity and facility of procuring the latter apparatus would render it preferable. Particular circumstances, however, occasionally occur, which render the inclined plane more convenient, such as the position of the wound, if the fracture is compound, or rigidity of the knee-joint from previous disease preventing extension, and therefore every surgeon ought to be provided with it.

The thigh bone is occasionally fractured through one or other of the condyles into the knee-joint, in which case the cure is not only difficult on account of the mobility of the detached portion, but generally unsatisfactory, owing to the callus encroaching on the cavity of the joint, so as to impede its motions. The best treatment consists in extending the limb, in order that the head of the tibia may by its pressure assist in keeping the condyles even, and then applying lateral compresses with a bandage.

The bone is apt to be fractured through the trochanters and neck, in consequence, generally, of falls on the side. In persons beyond the age of sixty, the neck most frequently gives way, but in those not so old, the trochanters usually suffer, while the neck remains entire, and is driven into the thick mass of bone at its root, so as to split it into several portions like a wedge. The symptoms of fracture in both of these situations are pretty much the same; the limb is short-

ened from one to two inches; the toes are everted by the weight of the limb, and the action of the muscles which perform rotation outwards, as their attachments remain untouched, while the usual resistance to their operation is removed by the fracture. When rotation is performed, the *trochanter major* may be felt moving as if round its own axis, instead of describing the arc of a circle, as it does when the neck is entire ; the shortening of the limb readily yields to moderate extension, and returns when it is discontinued, during which movements an obscure crepitus is sometimes perceived.

If the fracture splits the trochanters, so as to detach the smaller one from the shaft, and also the posterior part of the greater, to which the muscles that perform rotation outwards are attached, leaving the anterior portion of the process which receives the insertion of the *glutæus medius* connected with the body of the bone, the eversion of the limb is prevented, and the toes are turned inwards, but in other respects the symptoms are the same.

Except in the last mentioned case, which is not common, the discrimination between fracture of the neck alone, and that extending through the trochanters, is not easily accomplished with accuracy. When the patient is not very old, when the shortening of the limb is considerable, and when the trochanter feels, on examination, larger than usual, it may be suspected that the injury is not confined to the neck of the bone. This distinction is of little consequence, except in respect to the prognosis, since the treatment proper for both ac-

cidents is the same ; but the cure is much more readily accomplished when the fracture is through the trochanter, than when it is confined to the neck. In the latter case, many surgeons in this country believe that osseous union is impossible, unless the reflected ligament, or fibrous covering of the neck which is continuous with the capsule of the joint, remains entire. There is no doubt that the surfaces of the bones are very apt either to continue quite separate, or to be united by a flexible fibrous medium. But none of the arguments which have been adduced to prove the *impossibility* of osseous junction seem to be conclusive, and though the small extent and mobility of the broken surfaces, the absence of vascular tissues surrounding the fracture, and perhaps also the presence of the synovial fluid, may render the cure very difficult, it ought still to be regarded as a possible occurrence. An attempt, therefore, to unite the fracture ought always to be made, and if it fail, the patient will at least have no ground to reflect on the careless treatment of his attendant. The long splint affords the most effectual means of preserving the proper position, but the pressure on the instep of the foot and on the sacrum which its use necessarily occasions, is very apt to cause mortification in the old people who are subject to the accident. Should any indication of this disagreeable effect appear, the limb ought to be immediately freed from all restraint, and simply laid over a large pillow or folded bolster, which will tend to prevent displacement of the fractured surfaces. A fibrous connection will then be gradually formed, with more or less shortening of the thigh, and as strength

returns, the patient should, by cold affusion, and gentle exercise, endeavour to regain the use of the limb. In process of time he becomes able to walk with the assistance of a staff and high-heeled shoe.

Of the bones of the fore-arm the radius is most liable to be fractured, and generally gives way an inch or two above the wrist. The accident is recognized by the usual characters, and is often rendered very obvious by the hand being bent inwards, owing to the *pronator radii quadratus* drawing the broken extremities of the bone towards the ulna. The accident almost always happens from falls on the hand. When there is little distortion, the treatment requires merely the prevention of motion ; and this is easily effected by applying a couple of pasteboard splints and a bandage, which in this case may be a simple roller, as it can be readily changed without deranging the fracture. When the hand is inverted, some counteracting power must be employed, and the most effectual method of obtaining it, is to apply a cushion and splint of wood or iron in the same way as for fractured fibula. The splint ought to be channelled or grooved longitudinally, to insure its steadiness, and at the extremity which is to be placed next the hand, somewhat curved outwards, so that when the bandage is applied, the inversion may be perfectly under command.

The shaft of the ulna also is occasionally broken alone, but not nearly so frequently as the radius. The cause is violence acting directly on the injured part. There is generally little displacement ; and the treat-

ment is consequently very easy, requiring merely splints and a bandage.

The olecranon is sometimes broken away from the shaft of the bone by falls on the elbow. When the tough ligamentous covering of the process remains entire, the fragment suffers no displacement, and its lateral mobility is the only indication of the fracture, in addition to the ordinary pain, swelling and crepitus. But when this fibrous connection is ruptured, the triceps pulls up the detached olecranon to the distance of an inch or two from its proper place. This fracture, in several important respects, resembles that of the patella and neck of the femur ; and accordingly like them is generally repaired by a fibro-cartilaginous medium instead of bone. With proper care, however, the broken surfaces may be kept so near each other, that no inconvenience is experienced on this account. The treatment obviously requires that the limb should be extended, and this is best done by placing a pasteboard splint on the fore-part of the limb, a figure of 8 bandage having been previously applied, so as to retain the fragment in its proper position.

Both the bones of the fore-arm are sometimes broken together, but this is a rare occurrence, and happens either from falls on the hand or blows on the arm. The accident is readily recognized, and easily treated, so far as the cure admits of being promoted by external means ; but it is difficult to prevent the bones from approaching each other more or less, and uniting together, so as to impede their rotatory motion.

A couple of pasteboard splints, supported by a roller, and if the patient is thin, a longitudinal compress placed between the radius and ulna on both sides of the limb, are all the means that can be employed to prevent such consequences, and preserve the shape of the arm.

The humerus is very liable to fracture in almost every part of its extent ; and in respect to the diagnosis and treatment, it is necessary to consider the accident as occurring through the shaft,—through the neck,—and through the condyles.

The shaft is broken most frequently about its middle, between the attachments of the deltoid and *brachiæus internus* muscles. The fracture is usually transverse, and very readily recognized by the flexibility of the limb at the injured part. It is caused by falls, blows, and inordinate actions of the muscles. The treatment consists in applying pasteboard splints on the inner and outer sides of the arm, supported by a bandage, which may be a simple roller, or, if there is much swelling, of the looped kind ; the elbow ought to be bent at a right angle to relax the muscles equally, and supported in a sling, the patient being kept if possible out of bed to get the advantage of the weight of the limb in effecting extension. When the fracture is seated above the insertion of the deltoid, the lower extremity is apt to be drawn so forcibly upwards as not to admit of being secured by the means which have been mentioned. In this case the patient must lie in bed with the arm separated from the side

so as to relax the deltoid, while it is supported by the splints usually required.

The humerus may be fractured at its lower extremity either obliquely or transversely, so as to detach one or both of its condyles. Such accidents are generally caused by falls on the hand or elbow, and though they not unfrequently occur in adults, are particularly common in children. The transverse fracture is best detected by extending and bending the fore-arm alternately while one hand embraces the elbow ; the oblique one is easily recognized when the external and internal tuberosities are pressed backwards and forwards with the two hands. The treatment is extremely simple, requiring merely compresses of tow, and a figure of 8 bandage, the arm being kept in a sling.

When the fracture occurs above the attachments of the *pectoralis major* and *latissimus dorsi,* it is said to be in the neck of the humerus. In this case the muscles just mentioned draw the lower portion of the bone towards the side, while the *supraspinatus* and other muscles inserted into the tubercles cause the upper fragment to project forwards and rather outwards. This accident happens from falls on the hand, and blows on the shoulders, and is easily recognized by placing one hand in the axilla, while the other subjects the humerus to rotation and abduction. The treatment requires a thick compress in the axilla to counteract the effect of the *pectoralis major* and *latissimus dorsi,* with a spica bandage to restrain the up-

per extremity of the bone from being everted, and a sling to support the limb.

The clavicle is frequently fractured by external violence acting directly, and also when transmitted through more or less extent of the superior extremity. The pain, swelling, mobility, and crepitus of the broken part, which is usually about the beginning of the acromial curvature, readily betray the injury, which is rendered still more obvious, by the sternal extremity of the bone being drawn up by the sterno-mastoid muscle; and the shoulder being depressed, brought nearer the sternum, and rendered more prominent forwards by the action of the *pectoralis major* and *latissimus dorsi*, assisted by the weight of the limb.

Great difficulty has been experienced in treating this fracture; and Desault's method, though complicated and troublesome, is generally regarded the best one for the purpose. It consists of a thick cushion fixed into the axilla, to serve as a fulcrum for removing the shoulder outwards to its proper position, by means of the humerus when brought close to the side; a bandage to keep this cushion steady, another to fasten the arm, and a third to elevate the shoulder, by drawing up the affected elbow. When the cushion in the axilla is secured so high and so firmly as really to serve the office of a fulcrum, it compresses the nerves and blood-vessels beyond endurance; and if allowed to descend so as not to do this, it increases the distortion, by separating the arm from the side.

The method which, on the whole, appears to be the most simple and efficient, is to brace back the shoulders by a figure of 8 bandage, or shoulder straps drawn together by any simple contrivance ; and having thus obviated the distortion, except so far as regards the depression, to remedy this also, by placing the affected arm obliquely across the chest, with the fingers pointing to the acromion, and securing it in this position by means of a sling or bandage.

The scapula may be broken through its acromion and coracoid processes, neck, body, and inferior angle. The first of these fractures is the most common, the others being very rare. It happens from direct violence, occasions nearly the same symptoms as fractured clavicle, but not so well marked, and requires similar treatment.

The neck of the scapula is broken by violence, transmitted through the humerus. The symptoms of this fracture are filling up of the axillary cavity by the head of the humerus,—a hollow under the acromion process from the bone being out of its place,— and easy restoration of the parts to their natural position, when the shoulder is gently extended outwards ; during which adjustment there is usually some crepitus perceived. The treatment required is the same as that recommended for fracture of the neck of the humerus.

The nasal bones, though very thin at their extremity, becoming gradually thicker towards their connection with the *os frontis,* and having a strong support

afforded to them by the projecting process of this bone, on which, together with the ascending branches of the superior maxilla, they are firmly placed, suffer fracture less frequently than might be expected from their exposed situation. The fracture, when it does occur, is generally comminuted, and is easily recognized by the striking deformity which arises from the flattening and obliquity of the nose necessarily attending it. A great degree of violence being requisite to occasion the injury, there is usually much swelling, which is apt to conceal the displacement of the bones, if the examination be not made immediately after the accident is sustained. Whence it is proper in all cases where the injury may be suspected, to search very carefully for it, since the inevitable consequence of its being overlooked would be a deformity equally disagreeable and irremediable. The depressed portions of bone may be easily elevated before they become consolidated by the effusion that ensues, and after being pressed up into their proper places by a pair of dressing forceps, or other suitable instrument, generally remain without requiring permanent support. Should they prove not sufficiently steady, a piece of lint ought to be carefully introduced, so as to distend the upper part of the cavity.

The lower jaw, though much exposed to violence by its situation, is seldom broken, owing to its mobility and strength. The fracture, when it does occur, is usually seated in the base of the bone, opposite the bicuspid teeth. It is sometimes confined to one side, sometimes exists in both. It very rarely happens in

the ramus, and is hardly ever met with at the symphysis. The nature and seat of the injury are readily recognized, owing to the thinness of the parts which cover the jaw ; and it is generally observed that the portion of the bone next the chin is depressed, partly by its own weight, partly by the action of the muscles which connect it with the *os hyoides*.

The broken surfaces are easily retained in contact by tying up the jaw with a handkerchief, or any similar bandage. A pasteboard splint is sometimes applied along the front and sides of the bone, but is in general quite unnecessary. And another contrivance that is frequently recommended, appears, if possible, still less necessary, viz. interposing a piece of wood or cork between the teeth, grooved so as to receive them in a channel both above and below. This is done to restrain motion of the jaw, and afford room for the introduction of nourishment, but the shape of the teeth effectually prevents any lateral displacement when they are held together by a bandage, and there are always sufficient interstices between them to admit the entrance of soups or other fluid articles of food, which kind of nutriment alone the patient is of course able to consume, when deprived of the power of mastication.

The ribs are broken both by direct violence, and by pressure applied to their extremities, which difference in the cause considerably modifies the consequences of the accident. When the fracture is caused by direct violence, the rough spicula of bone are projected inwards, and readily injure the pleura or lungs ; but when the rib is broken by being bent, its

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usual convexity is increased, and if the soft parts are injured, they suffer exteriorly to the chest.

The fracture is attended with pain greatly aggravated by respiration, and with obscure crepitus. It is best ascertained by placing a hand on the injured part while the patient breathes. The diagnosis is frequently far from easy, but its accuracy is not very essential, since the treatment proper for fracture is the same as that required for the only injury with which it can be confounded, a bruise of the muscles. A broad bandage ought to be applied tightly round the chest, and bleeding, purgatives, and tartrate of antimony must be used according to circumstances.

Fractures of the cranium and vertebræ being of hardly any consequence, except in regard to their connection with the injuries of the brain and spinal marrow, will be considered with most advantage when treating of that subject.

The great strength and arched form of the pelvis enable it to resist all ordinary degrees of violence, and it is only when subjected to the most powerful compression, as from the weight of a loaded carriage or the force of machinery, that the bones composing it give way. They yield most frequently in the horizontal and descending branches of the *os pubis,* and at the same time there is usually a separation of the sacro-iliac synchondrosis on one or both sides. The precise extent of the injury can hardly be ascertained, except by dissection; but the existence of fracture is generally rendered very manifest by the pain, mobility, and crepitus which attend it. Sometimes it is made still

more obvious by the ramus of the *ischium* or *pubis* being driven through the perineum, or the coats of the rectum.

Such fractures are almost certainly fatal, from the great shock of the system and injury of important organs with which they are accompanied, but the patient ought always to be afforded the chance of recovery, by binding the pelvis tightly with a broad circular bandage.

The crest of the ilium is occasionally broken by falls and blows ; the accident is easily recognized, produces no serious consequences, and requires merely rest, and a spica bandage.

Diastasis or Separation of the Epiphyses.

Before the epiphyses are united to their respective shafts, they are apt to suffer separation from them by such violence, as in the adult would occasion fracture of the articulating extremities, or dislocation of the bone concerned. The symptoms resemble those which would result from fracture in the same situation, and the treatment does not in any respect require to be different.

Bending of the Bones.

While the bones are young and flexible, they sometimes bend instead of breaking, when subjected to forces that would occasion fracture in the adult. As this accident is not attended with either mobility or crepitus, it is very apt to be overlooked, the distortion of the limb being attributed to swelling of the soft parts, in

consequence of the injury. The bones of the fore-arm are most subject to suffer in this way. In order to remove the curvature, and prevent it from permanently deforming and impeding the use of the limb, it is necessary, without loss of time, to employ force sufficient for straightening the bone. If this is done effectually, subsequent mechanical support will hardly be required, but if from delay or undecided practice in the first instance, the bones should remain bent, a rigid splint of wood or iron ought to be applied, so as to promote the restoration of their proper form.

False Joints.

Fractured bones sometimes do not unite firmly together, and their extremities either remain quite detached, or are connected by a flexible fibrous medium. The most common examples of this occurrence are afforded by the patella and neck of the femur, but there is no bone in the body where it may not take place. Its consequences are in general extremely distressing, since the want of due rigidity of course renders the limbs very imperfect, and sometimes quite useless, in performing their ordinary duties.

The principal cause of this occurrence is unquestionably the want of fixture, which prevents the fractured extremities from remaining at rest during the cure, it being well ascertained that false joints may be certainly produced by subjecting the bones concerned to frequent motion. The best means of prevention are consequently to set the fracture as early as possible, and retain the bones steadily in their proper places during the cure.

Before considering the treatment of false joints, it is necessary to ascertain the nature of the structure which constitutes them. It is often said to be similar to that of the natural articulations, being composed of two opposite plates of cartilage, a covering of synovial membrane, and a capsular ligament. But in most cases there is merely a tough, fibrous, ligamentous looking mass, which extends from one extremity of the bone to the other ; and the nearest approximation to a new articulation which almost ever occurs, consists in the existence of cavities, more or less extensive, between the fibres of this connecting substance. *

The mildest treatment is to excite increased action, by moving the bones rather roughly, or making the patient attempt to use the limb, and then to maintain perfect rest by the usual means. Should this not prove sufficient, an ingenious method, contrived by Dr Physick of New York (1804,) may be tried. It consists in passing a skein of silk or cotton between the extremities of the bone, and allowing it to remain until it appears, from the increasing strength of the limb, that new bone begins to be formed, when it may be withdrawn, and splints applied. In case these means fail, and the patient is willing to suffer considerable pain, and encounter some danger to obtain a cure, the plan originally devised by Mr White of Manchester in 1760 may be executed. This was to cut down upon the extremities of the bone, and

* Probationary Essay on entering the College of Surgeons, by W. Sharpey, M. D. Edin. 1830.

saw them off; after which, the ordinary treatment of compound fracture being employed, the limb regained its firmness, with more or less shortening, according to circumstances. This operation is not always successful; and it must always be attended with considerable danger, especially when the bone concerned is of large size. It therefore ought not to be performed until the more gentle means have proved unavailing, and unless the patient suffers so much inconvenience, from the want of rigidity as to warrant such a severe proceeding. In some bones, as the humerus, the muscles are so equally balanced, that the limb can be used for most purposes.

Inflammation of Bone.

Inflammation of the periosteum, and that of the bone itself, frequently occur together, give rise to similar symptoms, and require nearly the same treatment. The former, or periostitis, is characterized by deep-seated aching pain, redness of the integuments which adhere to the part affected, and slight, diffused swelling. These symptoms vary much in the degree of their acuteness, and are accordingly accompanied with more or less constitutional derangement. When the disease is subacute, it frequently becomes periodically aggravated, and is apt to be increased by all sorts of excitement. It is usually most severe during the night, and after meals. The periosteum is most liable to inflammation where it covers bones near the surface of the body.

It is generally possible to trace distinctly the ope-

ration of a predisposing as well as of an exciting cause of the disease. The former seems to consist in derangement of the system from various circumstances, but most frequently the prejudicial use of mercury. The latter includes exposure to cold and wet, and blows. Middle-aged adults are the most common subjects of its attack.

The mode of treatment depends upon the intensity of the symptoms. When they are very violent, and attended with smart fever, the most effectual practice is to make a free incision through the inflamed parts down to the bone. When less severe, no benefit is derived from this proceeding, but they yield to leeching or cupping, warm anodyne fomentations, and opium administered internally along with calomel, ipecacuan, tartrate of antimony, or colchicum. When still more chronic, they require repeated blistering, with an alterative course of the oxymuriate of mercury given to the extent of half a grain daily in divided doses, occasional small doses of the saline cathartics, the decoction of sarsaparilla for drink, and light nourishing food. The formation of matter is a very common consequence of chronic periostitis, but in this case absorption may be almost always induced by using the means just mentioned ; and therefore an opening of the cavity ought to be avoided, as it is apt to occasion a very troublesome sore. Should it take place, the black wash will be found the best dressing.

Inflammation of the substance of the bone is attended with nearly the same symptoms. The pain is

if possible, still more deep, dull, and aching ; the inte-
guments, though exhibiting the same changes in the
progress of the disease, are not so much altered in the
first instance ; and the swelling affects the shape of
the bone more extensively.   It occurs at all ages, but
chiefly in childhood and youth, and in persons whose
constitutions are deranged in the same way that pre-
disposes to periostitis.   In the former it is generally
acute, and in the latter most frequently chronic.
When acute, it generally terminates in death of the
dense osseous tissue, and in suppuration of the
spongy bone.   When chronic, it expands the texture
of the shafts, so as to make them larger and less com-
pact, and in the cancellated texture usually induces
either interstitial absorption or suppuration.

The treatment is to be conducted on the same prin-
ciples as that of periostitis.   When the inflammation
is acute, it terminates very speedily in suppuration or
death of the part affected, and seems to be hardly in-
fluenced by any remedial measure. But when chronic,
it is more under control, yielding in the dense bones
to blisters employed along with alterative medicines,
and in the spongy bones to the actual cautery.   The
swellings which are occasioned, both by chronic perios-
titis and inflammation of the bone itself, are called
Nodes.   If they resist the means that have been re-
commended, in addition to blisters, some discutient li-
niment ought to be applied, such as the camphorated
mercurial ointment, with tincture of soap and opium,
or the hydriodate of potass.

Necrosis.

The expression Necrosis has been employed to denote various morbid affections of the osseous tissue, and has consequently given rise to much confusion. It literally implies the deprivation of life, and ought to be restricted to this meaning.

All the bones are liable to necrosis, but those which possess a dense texture are more subject to it than the spongy ones. The causes of necrosis are various. It was formerly believed, that the mere removal of the periosteum certainly caused the death of a scale of the bone more or less thick, by depriving it of nourishment, and hence the old rule to hasten exfoliation in all such cases, by applying the actual or potential cautery. But it is now ascertained, that simply removing the periosteum does not necessarily or even generally cause exfoliation, and that when a bone throws off a scale, after being so exposed, it does so in consequence of the injury which it has sustained from the violence that occasioned the separation of the membrane. Blows, falls, strains, and exposure to cold, are the causes that most frequently give rise to necrosis, and they act either directly, by at once destroying the vitality of the part affected, or indirectly by exciting inflammation, which terminates in the death of the bone. The inflammation, when acute, is not confined to the bone, but affects all the tissues of the limb or part of the trunk concerned, whence it has been erroneously supposed that erysipelas or inflammation of the skin may induce necrosis. There often seems

to be a constitutional proneness to necrosis, so that many bones of the same person die together or successively. This disposition exists most frequently in childhood, and is almost always associated with, perhaps dependent upon, weakness of the system.

The dead portion appears as if it had been long and carefully macerated, being hard, white, brittle, and sonorous when struck with a probe. If exposed to the air, it suffers various alterations of colour, and generally becomes blacker; but this depends upon the discharge of the sore, and the action of the air. It is named an Exfoliation, and gradually separates from the living bone by ulcerative absorption. The circumstances which attend the process of exfoliation and its reparation vary much according as it affects the external surface, internal surface, or the whole thickness of the bone concerned.

External Exfoliation.—The external surface of bones being most exposed to those injuries which cause exfoliation either directly by their violence, or indirectly by exciting inflammation, most frequently suffers from it, and of the particular bones those nearest the surface of the body are, as might be expected, more especially liable. The separation of the dead portion being effected by a process of the living system, does not admit of any assistance from the surgeon, and his interference could hardly fail to do harm, by injuring the adjoining sound bone. Free vent ought to be afforded by proper incisions to the matter, which is copiously secreted; and the exfoliation should be examined from time to time with the probe, to ascertain

whether or not it has become detached. So soon as it is found to be loose, it ought to be removed by means of forceps, either through the opening which already exists in the integuments, or a suitable extension of it. The remaining surface granulates, and osseous matter is sometimes effused under the pellicle, so as to fill up the breach, but more frequently a permanent depression is left at the part.

Internal Exfoliation.—It is of course only in the cylindrical bones that exfoliation from an internal surface takes place ; and those of the largest size are most frequently the seat of it. The cause is almost always inflammation, since the injuries which directly occasion necrosis can rarely operate on the interior of a bone. The exfoliation in this situation is named a Sequestrum. It separates from the sound bone as in the former case ; but having done so, cannot escape through the walls of the shaft within which it is inclosed, and therefore remains a permanent source of irritation. The living bone in consequence becomes greatly thickened, and new osseous matter is copiously effused from its external surface in the form of irregular projecting tubercles.

At the same time the pus, which is pent up within the cavity, by its pressure on the parietes, induces absorption, and the formation of cylindrical apertures through the shell of the bone. These *cloacae,* as they are named, allow the confined matter to escape, and present itself under the integuments in the form of an abscess, which, if not opened by the surgeon, sooner or later evacuates its contents by ulceration. Thus far

during the process, the patient suffers great pain and
swelling of the limb, but after the matter obtains free
vent, he finds himself greatly relieved. The enlarge-
ment, though it does not disappear altogether, sub-
sides very much, and so little uneasiness remains that
he is generally able to make some use of the limb.
And if it should fortunately happen that the seques-
trum is not only small, but also favourably situated for
escaping through a cloaca, the source of irritation being
thus removed, the patient may be restored to health.
But if the sequestra do not pass out spontaneously, the
surgeon having ascertained their presence by the probe,
must enlarge the opening which leads into the cavity
containing them, so as to obtain space sufficient for
their extraction. In order to do this, he makes a
crucial incision through the integuments, having the
cloaca for its centre, dissects back the flaps, and ap-
plies the trephine over the opening. If room enough
is not obtained, he either removes another crown of the
trephine at a little distance from the former one, and
unites the two openings together by means of Hey's
saw, or the cutting-pliers ; or with the last-mention-
ed instrument alone, he cuts away what extent of
bone is found necessary for the purpose. The process
of extraction may sometimes be facilitated by dividing
the sequestrum into pieces.

Exfoliations of the whole thickness.—Bones die
throughout their whole thickness from the same cau-
ses which induce exfoliation of their external or in-
ternal surface, and the dead portion separates from
the living by the same process of absorption that oc-

curs in such cases ; but the state of the bones after the cure is completed, requires in this case particular consideration. Sometimes the place of the dead part is not at all, or very imperfectly supplied ; at other times its separation could hardly be suspected from any change visible in the shape or size of the bone affected. In order to account for this remarkable difference, it is necessary to inquire into the circumstances of the cases in which it is exhibited.

When the bone dies suddenly without any previous enlargement of the limb or part of the trunk concerned, the remaining surface granulates just as after the separation of an exfoliation, which extends only partially through the whole thickness, and sufficient osseous matter is effused to round off the edges, so far lessening the gap that exists between them, but leaving a permanent deficiency at the part. The same result ensues when a portion of bone, including its whole thickness, is removed mechanically. But when the death of a bone is preceded by hard and deep-seated swelling in the seat of it, the dead portion when detached is found to be contained within a case, more or less complete, of new bone, which is ready to take the place of the old one whenever it is removed, by contracting its sides together so as to become a solid mass.

It was formerly supposed that the death and reproduction of an entire shaft was a very common event, all cases of internal exfoliation being regarded as instances of its occurrence, and the expression Necrosis has been generally employed to denote this remarkable process.

It might have been supposed that when only small
sequestra made their appearance, or were found on
dissection, decisive proof would have been afforded of
the partial extent of the disease. But the general swel-
ling of the limb, which is caused by the irritation of an
internal exfoliation, having led to the erroneous belief
that an entire new shell was forming about the old
bone, the non-appearance of a sequestrum adequate
to the supposed extent of destruction was accounted
for by attributing its diminution or removal to the
absorbing power of the vessels, or the solvent proper-
ty of the pus. It is now well ascertained that the se-
questrum cannot be acted upon in either of these ways;
and that its size may therefore be safely taken as a
measure of the extent to which the bone has died.
According to this test it is found, that the death and
regeneration of an entire shaft, so far from being a
very common occurrence, is an extremely rare one;
and some pathologists, as Leveillé, have gone so far
as to deny it altogether, alleging that more or less of
the external part of the old bone always remains and
becomes expanded into the new shell. There can be
no doubt, however, judging from the size, shape, and
smooth surface of the sequestrum, that it sometimes,
though certainly very seldom, comprehends the whole
thickness and circumference of the shaft.

The origin of the substitute in cases of this kind
has been variously explained, and is still rather obscure.
It must evidently proceed, 1. From granulating action
of the portion that remains. 2. From ossification of

the periosteum or other surrounding tissues. Or 3. From the old bone previous to its death. The first of these opinions has been supported by Richerand and others, who regard as strongly in their favour the fact, that more or less of the old shaft, and at all events the epiphysis, always remains. But in external exfoliations the granulating action seldom fills up the breach ; and when a considerable portion of the whole thickness of a bone is destroyed suddenly by inflammation, or is removed by mechanical means, the loss of substance is not restored, which it ought to be, according to this view of the matter. The ossification of the periosteum maintained by Duhamel, who was misled by a false analogy between wood and bone, and supported by the ingenious experiments of Troja and others, who destroyed the bones of animals artificially in order to observe the process by which their substitutes were formed, was a doctrine for a long while very generally followed, and is even now not entirely abandoned. If the periosteum really became converted into the new shell, it ought to suffer this change, however suddenly the bone died. But unless the new bone begins to be formed previously to the death of the old one, it is not formed at all ; and though Troja, with many others, overlooked the important fact, the new shell in the first instance adheres to the surface of its predecessor. Dr Macdonald remarked this, (1799) and Professor Russell has the merit of first observing that the vessels of the old bone could be injected while its substitute was in progress of formation. It seems evident, therefore,

that the old bone has some share in the production of a new one ; and the most careful observations lead to the conclusion, that a gelatinous effusion having taken place into the periosteum, or other parts adjacent, ossification is excited in it by the same irritated state of the bone which in the first instance occasioned this effusion. After the process of ossification has once commenced, it may go on independently of the old bone.

The treatment seldom admits of active measures on the part of the surgeon. Abscesses should be opened when they point. Sequestra ought to be assisted to escape, and the patient's strength supported by nourishing diet, and the other usual means. If the death of the bone is so sudden and extensive, that the new shell is not able, in the first instance, to support the strain of the muscles and weight of the limb, splints must be carefully employed until the process of ossification is advanced far enough to render them unnecessary. Finally, in case the patient proves unable to bear the long-continued and exhausting exertion requisite for accomplishing the cure, he ought to be relieved by amputation.

Suppuration and Caries of Bones.

It is only in the cancellated or spongy texture of bone that inflammation induces suppuration ; and the dense parts never take it on unless they are previously expanded and loosened, in consequence of chronic inflammation. The matter is collected either on the external surface, or in the interior of the bone. In both cases there is more or less excavation, effected

by absorption of the bone concerned; and in the latter not only this effect ensues from the distension, but also an enlargement of the external shell of the bone, which thus forms a large cavity, constituting what is called *spina ventosa.* Such cavities frequently contain loose portions of the spongy bone, which have been deprived of vitality by the inflammation. When the matter escapes from a hollow of the bone by causing absorption of its sides, or when it is formed, in the first instance, exterior to it, the integuments are elevated, and at length give way, with great relief from the pain which was previously suffered. The abscess may then heal readily, like an ordinary superficial one, or prove very obstinate, or permanently resist all means of cure. It is impossible to foretell positively which of these events will ensue, but experience and attention to the following circumstances generally enable the surgeon to form a pretty accurate opinion as to the result. 1. If the patient possesses a good constitution, and suppuration in the bone has been induced in consequence of inflammation caused by external violence, the prognosis may be favourable. 2. If the patient possesses a bad constitution, and the primary inflammation has commenced without any external cause, or a very slight one, which of itself is evidence of his constitution being unsound, the disease will probably be obstinate or incurable. 3. If the patient is an infant or child, and especially if he suffers from suppuration of several bones at the same time, there is a good prospect of an ultimate cure, but not without a very tedious process of recovery. 4. If the suppuration

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takes place in a bone that naturally possesses a dense texture, but which has been opened out by previous disease, it generally admits of cure more readily than when seated in one originally cancellated.

Whatever be the opinion entertained of the probable result of the case, it ought always at first to be treated as if the sore were expected to heal. Free openings should be afforded to the discharge; stimulating washes, with moderate pressure afterwards applied; and the patient's general health carefully preserved. If these means fail, some more powerful agents must be employed locally, such as the red oxide of mercury, or nitrate of silver; and if the patient's system seems to require it, an alterative course of mercury should be prescribed. Counter-irritation, such as that effected by the actual cautery, is sometimes useful, and ought certainly to be tried, if the disease is attended with much pain. When the ulcer of the bone resists all means of cure, it constitutes what is called Caries.

The distinguishing character of caries is the same as that of cancerous ulcers in the soft parts, viz. obstinacy of the action. The local symptoms vary considerably as to the quantity and quality of the discharge, the degree of pain, and the appearance of the orifice. The matter is generally thin and fetid, but sometimes possesses all the properties of perfect pus; the pain for the most part is gnawing and incessant, but often is hardly perceptible, or extremely severe. The orifice is usually small and callous, but occasionally exhibits large and flabby granulations.

The disease has for the most part remissions more or less complete, and of considerable duration, in which the pain and discharge nearly or altogether cease, and the ulcer seems to be on the point of healing, or actually becomes covered with a thin, soft, cicatrix. But these amendments are only partial and temporary, being always followed by relapse, and there is no natural limit to the duration of the disease except the life of the patient, who, after months, or even many years of suffering, becomes finally exhausted, either by the caries itself, or some other disorder which the irritation produced by the caries has excited. When a carious bone has been macerated, the diseased part is found excavated and rough, the cancellated texture being remarkably spicular, white, and brittle, so as to resemble a spongy bone which has been exposed to the action of fire. The surface thus affected is often of considerable extent, though frequently very small, even in cases of old standing, but the disease seldom reaches to a considerable depth. The field of the disease seems to be determined by the primary inflammation, and after being thus established, has little or no tendency to become larger. Around the carious part there is always an effusion of new osseous matter in the form of warts or tubercles, extending to a considerable distance, and greatly increasing the thickness of the bone. This new mass, which is no doubt produced in consequence of the irritation of the disease, like that formed to re-unite fractures and supply the place of exfoliations, is characterized by compactness and smoothness when minutely examined, though on

superficial inspection it appears rough and porous. The pores are apertures for the transmission of blood-vessels, but their form is circular and their edges rounded off, so that sharp edges cannot anywhere be perceived. The newly effused bone may thus be readily distinguished from the diseased part, to the irritation of which it owes its origin. It is necessary also to distinguish between caries and the exposure of the cancellated texture which is caused by absorption owing to pressure. In this case the bone presents the same appearance that it would do if its external crust were removed by mechanical means ; and it possesses none of the whiteness, brittleness, or spicular surface observed in caries. As this difference can hardly be ascertained until after maceration, a more useful distinction is afforded by the history of the case, and whenever the excavation is plainly referable to pressure, no apprehension need be entertained of caries. It is thought by many, that deep-seated collections of matter, if not evacuated early, may occasion caries ; but when this morbid state of the bone is connected with deep suppuration, it will always be found to have been the direct result of the primary inflammation. That mere pressure is not sufficient to produce caries may be learned from the want of any morbid disposition in the sides of the cloacæ which are formed by absorption to evacuate confined matter. In the living body the carious surface is generally more or less completely covered with unhealthy granulations, which often possess very considerable firmness, and render the discovery of its extent, or even existence, by no means

easy. The disease occurs at all ages, but commences most frequently in the early periods of life. It is most frequently met with in persons disposed to scrofulous action, and often follows suppuration in bones which have been the seat of depositions proceeding from that morbid action.

The treatment of caries is to be conducted on the same principles as that of cancer, and consists in the use of means which have the effect either of destroying the life of the morbid part, or of removing it at once from the system. There is this difference, however, that there being no malignant tendency to take on the same diseased action in the neighbouring parts, it is not necessary to remove any of them, except in order to gain access to the seat of the evil. Notwithstanding this favourable circumstance, it is found extremely difficult to eradicate the disease by depriving the part affected of its vitality. The bone usually lies at a considerable depth ; the caries, though it seldom penetrates deeply into its substance, generally occupies an extensive and irregular surface ; and the effect of agents used with the view of killing the morbid part is necessarily much weakened by its humidity. The concentrated mineral acids—the nitrates of silver and mercury—the red oxide of mercury—and the actual cautery, are considered the best means for the purpose. In using them the bone affected ought to be very freely exposed by a crucial incision, and then dried as well as possible, after which the caustic or cautery selected should be applied so as

to produce a decided effect. The fluid caustics should
be applied by means of a piece of caddis soaked in
them; the solid ones should be rubbed on the part,
or, if they are in the form of a powder, as the red ox-
ide of mercury, laid on it in substance; the cautery
should be of a spherical or ovate shape, it must be
pressed down firmly, and be succeeded by two or three
others until the whole morbid surface has been subject-
ed completely to their action. The effect of all these
applications, however carefully employed, is very su-
perficial, and it is extremely difficult, if not impossible,
to insure their operation even on the whole surface
of the diseased part. They, therefore, always require
to be frequently repeated, and generally prove quite
inadequate to destroy the disease, unless it is very li-
mited and accessible; and it is even not improbable
that some of them, as the actual cautery, may occa-
sionally make the matter worse, and extend the dis-
ease to the neighbouring bone, by exciting inflamma-
tion in it. For these reasons excision ought to be pre-
ferred to caustics for removing the carious bone; and
if the part affected be within reach, which can always
be ascertained previous to commencing the operation,
it may by this method be surely and thoroughly era-
dicated at once. If the disease is superficial, and of
small extent, it is easily scooped out with a gouge,
the toughness and compactness of the sound bone dis-
tinguishing it from the morbid portion. If extensive
and deeply seated, it is best removed by taking away
the whole of the articulating extremities concerned,
as will be explained hereafter when the diseases of

the joints are considered. When the situation of the caries prevents it from being cut out, amputation ought, if possible, to be performed ; if this be impracticable, the disease will sooner or later prove inevitably fatal.

Exostosis.

The term Exostosis is employed to denote various morbid conditions of the osseous system differing materially from each other, and has consequently occasioned great confusion. In order to avoid this, it ought to be confined in its meaning to imply an unnatural growth of bone. Exostosis in this sense exhibits three remarkable varieties in respect of its structure; being sometimes solid, at other times hollow, and also not unfrequently spicular or foliated, that is, composed of radiating points or plates. The first of these kinds of exostosis exists independently, but the two others are connected with and dependent upon different morbid formations, along with which they may more properly be considered.

The first, which may be called the simple or solid exostosis, consists of a solid mass of bone, growing out of or resting upon one naturally belonging to the skeleton. It is sometimes thin and flat, rising gently from the surrounding surface, and not causing any sharp projection, when it is named a node, an appellation which is also used to designate a similar swelling dependent on chronic thickening of the periosteum. In other cases it forms an abrupt projection, the neck of which is usually narrow in proportion to the

extremity. The substance composing such excrescences is of various solidity, being sometimes open and spongy, at others extremely dense and compact. It usually increases in density with its duration, and is sometimes more like ivory than bone. The bones most frequently thus affected, are the femur, tibia, lower-jaw, and distal phalanx of the great toe; but there is no bone in the body exempt from it, though those of dense structure are certainly the most liable to it. It may appear at any age, but most frequently commences at or a little before the adult period of life.

The inconvenience which this sort of exostosis occasions, depends very much upon its situation. Generally while the growth is enlarging, pain and annoyance are experienced from obstructed function of the neighbouring parts; but when it ceases to increase and becomes dense, which it usually does sooner or later, the irritation of its pressure becoming habitual, is no longer troublesome. The treatment, therefore, seldom requires to be active; and nothing more is usually requisite than to protect the limb, or part affected, from the irritation of motion or pressure, so long as the exostosis is enlarging. Should it prove permanently or seriously troublesome, excision affords easy and effectual means of relief. For this purpose many ingenious contrivances have been recommended, but nothing answers so well as the cutting pliers when the neck of the tumour is not very thick; and the common saw, when it is of too great breadth for being divided with the former instrument. It has been thought necessary to perform amputation of the

great toe on account of the exostoses which are apt to grow at the side or extremity of the nail ; but this proceeding is equally severe and unnecessary.

The hollow exostosis depends on the expansive effect of fluid or solid formations within the bone ; and the osseous substance may be regarded as devoid of any morbid disposition, so that if the contents were removed it would contract to its ordinary dimensions. The same observations apply to the spicular or foliated exostosis, which is always found connected with some source of irritation, and is to be looked upon rather as a consequence than a part of the disease. The causes usually concerned in giving rise to this production, are morbid growths, ulcerations in its neighbourhood, and exfoliations from its internal surface.

Fibro-Cartilaginous Tumour of Bone.

It is usual to comprehend all the solid tumours of bone, the consistence of which is less hard than that of the bone itself, under the title of osteo-sarcoma. But as this leads to much confusion, it is better to divide the softer tumours of bone into the fibro-cartilaginous, and medullary-sarcomatous, which differ essentially in their nature and consequences.

The fibro-cartilaginous tumour, when occurring in bones, possesses the characters which have been already described in the general account of this kind of morbid growth. Its colour is a mixture of white, grey, and yellow ; its consistence nearly approaches

that of cartilage, and it has often interspersed through it small cysts of transparent fluid. It generally originates in the central part of the bone affected, and gradually enlarging, expands the surrounding shell, which still preserves the properties of sound osseous tissue, though sometimes singularly altered in shape. The tumour is productive of little inconvenience except from its size, but on this account is often a source of great annoyance and distress; as when the lower jaw, metacarpal bones, or phalanges of the fingers are affected. There is reason to believe, that if the fibro-cartilaginous substance could be completely eradicated, the bone would resume its natural shape and size; but as its cellular or honeycomb-looking structure, when expanded by the disease, renders such an extraction impracticable, the only remedy is removal of the bone affected; and this operation, however disagreeable in some situations from the deformity occasioned by it, may at least be performed with a favourable prospect of effecting a permanent cure.

Medullary-Sarcomatous Tumour of Bone.

Medullary-sarcoma occurs in bones more frequently than in any other tissue of the body. It commences sometimes immediately under the periosteum, and causes an excavation in the surface of the bone, around which more or less osseous matter is effused; at other times it begins in the interior, springing apparently from the medullary membrane, and then expands the bone into a shell, or by inducing absorption, causes a

perforation in it, through which it issues and swells into an external tumour, or it opens out the bone into beautiful needles or plate-like processes radiating from the central seat of the disease ; or lastly, it may simply occupy the place of the bone. But, whatever may be the diversity in this respect, the morbid degeneration always exhibits its characteristic features. There is usually great pain from the first, and often for a long while before any external swelling is visible. The patient loses flesh, and indicates, by his anxious expression of countenance, the presence of a malignant disease. The tumour, though at first seldom so soft as when originating in the less dense tissues of the body, in its progress becomes softened, and acquires, at least in some parts of its extent, a consistence so nearly approaching that of a fluid, as to render the discrimination of it from a collection of fluid extremely difficult. Then the veins enlarge—the integuments inflame—ulceration ensues—fungous excrescences protrude,—and the patient sinks under the exhaustion which results from profuse discharge of ill-conditioned matter or blood. The disease attacks all ages, and both sexes ; but seems, on the whole, most frequent in young adults. The only remedy is amputation ; and unless this be performed early, before the constitution of the patient is much injured, and freely, so as to remove the whole of the affected bone, it will in all probability prove of little permanent benefit.

Cystic Tumour of Bone.

The bones sometimes, but very rarely, become the

seat of cystic formations. The swelling is generally not attended with much pain, and at its commencement may be mistaken for a solid exostosis or cartilaginous growth; but as the cysts enlarge and approach the surface, the thinness of their parietes betrays the nature of the case. This disease occurs most frequently in the earlier periods of life. So long as it retains the characters of the cystic tumour, it may be regarded as free from any malignant action; but this morbid structure seems to have a disposition to change into medullary sarcoma. The best mode of treatment is early and free removal of the bone affected. Puncturing the tumour, or even laying it open by free incision, though productive of temporary benefit, by causing more or less collapse of the distended parietes, cannot be trusted to for curing the disease, and must always be attended with the danger of exciting malignant action.

Rachitis or Rickets.

By Rickets is understood a morbid state of the osseous system, in which the bones are soft and flexible, being converted into a substance more like leather than bone; having a brown colour and cartilaginous consistence, with no appearance of marrow, but numerous irregularly circular and oval cells, even in the parts naturally most compact, containing a brownish-red fluid. The disease does not directly cause pain, but occasions great inconvenience by allowing the bones to bend under the weight of the body, and contraction of

the muscles. It is accompanied with weakness and de-
rangement of the whole system, the symptoms of which
are a pale and sickly countenance, tumid abdomen,
flabbiness of the muscles, and unhealthy evacuations.
It is confined to the period of childhood, and seldom
begins later than the second or third year of age. It
affects chiefly the offspring of young or unhealthy pa-
rents, and occurs most frequently in cold moist climates.
It terminates either in death or in a return to health,
after months or years of duration. Contrary to what
might be expected, rickety bones are readily broken by
slight degrees of violence, and their reparation in such
cases is effected by cartilage, so that the limb remains
preternaturally moveable, as if it had a false joint at
the injured part. When the bones regain their healthy
nutritive action, they become as hard and unyielding
as usual, retaining, however, the curvatures which
have taken place during the softened state. The new
osseous substance which is afterwards deposited, occu-
pies chiefly the concave side of the arches into which
the bones are bent, where it has most effect in strength-
ening their power of resistance, and gives them a re-
markable flattened shape.

Rickets used to be ascribed to the operation of a mor-
bid acid humour pervading the system, and the reme-
dy consequently consisted in liberally supplying the pa-
tient with alkaline and earthy preparations, in order to
neutralize this acidity, and replace the defective earth
of the bones, which was supposed to have been remov-
ed by its chemical agency. The disease is now referred,
more consistently with scientific pathology, simply to

disorder of the nutritive action of the osseous tissue, and the means employed to correct it are merely those which tend to strengthen the system in general, while every prudent precaution is taken to prevent the bones from suffering distortion, so long as they remain exposed to it by their softness and flexibility.

With these indications in view, the patient ought to be frequently put into a warm bath, and every day have the whole surface of the body subjected to friction with gently stimulating liniments. He should be warmly clothed, and, if possible, removed to a dry situation sheltered from the cold. His diet must be moderate, easily digested, and nourishing ; and he should abstain from all medicine, except what is required to maintain or excite the intestinal secretions. While the bones are in a yielding state, exercise in the erect posture may cause curvature and distortion, especially of the bones composing the trunk and inferior extremities ; the patient ought, therefore, to be debarred from walking, running, &c. and encouraged to creep and roll upon the floor or on the ground in the open air. Should the limbs unfortunately have been bent through neglect or injudicious treatment, they may often be straightened by the gentle and continued use of rigid splints.

Mollities and Fragilitas Ossium.

By Mollities Ossium or Malacosteon is understood a general disease of the bones, in which they become extremely soft, much more so than in rickets, so that in its advanced stages there hardly remains any trace of

the osseous texture, and the periosteum includes mere-
ly a yellow or brownish mass of lardy consistence.
This affection is attended with excessive and almost
incessant pain,—is almost confined to females,—occurs
chiefly at the middle period of life,—and though often
very slow in its progress, always advances until the
patient dies.

There is no remedy for this dreadful malady, and
the only practice admissible in its treatment consists
in the use of means proper for palliating the patient's
sufferings, of which the different preparations of opium
are the best.

Fragility or unusual facility of being broken, natu-
rally leads to the idea of a redundance in the earthy
constituent of bones; and a certain degree of it de-
pending on this cause is often observed in old people;
but the condition which is generally understood to be
denoted by this title, and in which the proneness to
breaking is so great that fracture is caused by the slight-
est external violence, or even by the action of the mus-
cles in effecting the ordinary movements of the limbs, is
a state of preternatural softness instead of increased
density. Rickets, malacosteon, and the medullary-sar-
comatous degeneration, all occasionally render the bones
more liable to be broken; and fracture being sometimes
the first obvious effect of the diseased action, is not only
thought to be the cause that induced it, but also cho-
sen as the characteristic feature for its designation.

Diseases of the Spine.

There are two morbid states of the spinal column

which occur so frequently, and are attended with such important effects on the system, that they require to be considered by themselves. These are, inflammation and some of its consequences with or without curvature, and curvature without inflammation.

When inflammation occurs in the vertebrae, it is seated in the spongy texture which constitutes their bodies, and is indicated first by a dull gnawing pain at the part, which is aggravated by pressure and motion; then a slight degree of swelling generally appears so as to make the spinous process of the affected vertebra appear more projecting than usual; the patient loses his appetite and strength, becoming dull and listless, and preferring the horizontal posture; his inferior extremities are reduced in bulk, and affected with numbness and rigidity; whence the gait is awkward and vacillating, the legs frequently crossing each other, while the trunk is held peculiarly erect and rigid, to protect the diseased part from motion. As the disease advances, the patient sometimes loses the use of his limbs entirely; and, in addition to his other complaints, is generally distressed by an uneasy feeling at the pit of the stomach, and a painful sense of constriction round the chest, in the region of the diaphragm. Suppuration usually ensues, and the matter is either confined to the neighbourhood of the bone affected, or descends in the interstices of the soft parts so as to present itself lower down. When the dorsal vertebræ are affected, it generally points in the loins, and constitutes a lumbar abscess; when the lower dorsal or the lumbar vertebræ are concerned, it for the most part passes

down along the psoas muscle, and appears in the groin, sometimes above, but more frequently below Poupart's ligament, when it is named a psoas abscess. The matter in order to point above Poupart's ligament, must perforate the abdominal muscles through means of absorption, which happens generally by a small aperture; the pus thus comes to be quite superficial, and from this circumstance the abscess is very apt to be regarded as entirely subcutaneous. It must be observed, that though chronic abscesses in the loins or groin most frequently proceed from diseased bones, they may and often do exist independently, as in other parts of the body.

When the pus ceases to be confined near the bone, and begins to drain away from it, the patient generally experiences great relief from his complaints. The pain becomes very much lessened, and the use of his limbs is often in some measure or altogether regained. But this amendment is usually accompanied by a serious change to the worse in another respect; since the vertebral column is apt to bend under its superincumbent weight, when weakened by the destruction of bone and intervertebral cartilage which attends the suppuration. The curvature in this case takes place forwards, and being confined to a small extent of the spine, causes an acute projection behind, so that one or more of the spinous processes appear to be dislocated backwards. This change of shape does not take place either when the extent of the disease is small in proportion to the size of the bones in which it is seated, or when it is so great that the patient is

s

constantly confined to the horizontal posture ; but the latter circumstances are comparatively rare in proportion to those which favour the occurrence of curvature. The surface of the abscess either heals with approximation and consolidation of its parietes, the vertebræ concerned appearing as if run into one mass, or a state of caries remains, and gradually wears out the patient's strength.

This disease may happen at any period of life, but is by far most common in children from two to eight years of age. In adults it generally occupies a small part of the bone, and proves extremely obstinate, or rather always incurable, at least with such few exceptions as hardly deserve to be mentioned. In childhood it usually engages the whole substance of two or three adjoining bodies of the vertebræ, which on dissection are found almost entirely wasted away, together with the intervertebral substance, portions of dead bone and pus occupying the cavity.

The disease is usually ascribed to twists or blows ; but as these injuries are seldom thought of until long after they are alleged to have been received, and not before the alteration of appearance attracts attention, there is much reason to discredit their effect in exciting the morbid action. The patient, if a child, almost always possesses a weakly, and in general a scrofulous constitution. It is said that it is liable to be excited in adults by venereal excesses.

In conducting the treatment of this acute curvature, as it is generally named, surgeons proceeded formerly in the belief that the primary evil consisted in

displacement of one or more of the vertebræ from violence; that the pain and loss of voluntary motion depended on pressure caused by the dislocated parts on the spinal marrow ; and that the disease of the bones was not only caused, but kept up by the irritation proceeding from their unnatural position. Their practice, therefore, consisted in the use of mechanical contrivances for rectifying the displacement. The inefficacy and danger of such a mode of proceeding must be obvious to every one acquainted with the true condition of the bones, which having their substance destroyed more or less extensively, though separable by force, must resume their situation as soon as it is removed. And if the vertebræ are much weakened or partially united, they will be very apt to suffer such fracture or disjunction as may render the limbs below permanently paralytic, or prove immediately fatal.

Mr Pott, observing that curvature of the spine from rickets, though productive of the most extreme distortion and deformity, was not attended with palsy ; and that the palsy accompanying the disease in question did not resemble the state which is induced by pressure on the spinal marrow, the muscles of the limbs being not soft and flaccid, but rigid and unyielding, concluded that the curvature was an effect, and not the cause of the disease, which he thought might more reasonably be referred to inflammation seated in the bodies of the vertebræ, and causing more or less irritation in the neighbouring organs.

With this view of the matter he, in the first in-

stance, used counter-irritation by means of issues open-
ed with the caustic potash, in order to subdue the in-
flammatory action, and interdicted the erect posture,
as increasing the irritation. This practice still con-
tinues to be regarded as the most rational, and condu-
cive to recovery ; but for opening the issues, which
should be seated on each side of the projecting spi-
nous processes, the actual cautery seems to me pre-
ferable to the caustic. All mechanical contrivances
ought to be carefully abstained from, since none of
them afford the diseased spine nearly the same re-
pose which is obtained from the horizontal posture,
and they very frequently occasion the greatest mis-
chief, by pressing injuriously on different parts of
the trunk, as well as by inducing the patient to in-
dulge in exercises which the diseased spine cannot
bear with impunity.

This disease occasionally, but fortunately not of-
ten, affects the first or second upper cervical ver-
tebra, with the corresponding part of the occipital
bone. The symptoms, in the first instance, are the
same as those which have been already described,
consisting of deep-seated pain, felt chiefly at night,
and aggravated by motion. But, owing to the im-
portance of the portion of the nervous system which
lies within the direct influence of the disease, when
it is thus situated, namely, the lower part of the *me-*
dulla oblongata, and the mobility of the joints con-
cerned, the patient's sufferings are extremely severe.
In eating and speaking he feels darting pains through

the neck. In changing his position, he keeps the head perfectly steady, and employs both his hands to assist the muscles in preventing any rotation or flexion of the affected vertebræ. He loses his appetite and strength ; complains of almost unremitting and intolerable nausea ; and exhibits, by a peculiarly anxious and unhappy expression of countenance, that he labours under a disease of the most agonizing kind. Loss of voice, difficulty of breathing, convulsions, and palsy, occasionally supervene ; the head generally suffers more or less distortion to one side, in consequence of the bone giving way under the ulcerative process ; and at length, after months or years of misery, the patient dies, either gradually, from mere exhaustion, or suddenly, from dislocation of the odontoid process of the second vertebra, which, becoming detached from the occipital bone, presses backwards on the *medulla oblongata*. If an abscess forms, it is generally not evacuated previously to the patient's death, but sometimes opens into the pharynx.

The subjects of this disease are mostly young adults. The treatment ought to be counter-irritation, effected early and powerfully by the actual cautery ; and practitioners ought to beware of mistaking the first indications of this destructive disease for slight rheumatic ailments, deserving of no particular attention. The preparations in museums prove that the cure of the disease, though perhaps very rare, is not impossible.

The other disease of the spine which requires to be

particularly considered, on account not of its danger to life, but its frequency and important consequences in respect to the patient's appearance and comfort, consists merely in curvature, without any specific or general morbid affection of the osseous system. It is named the lateral curvature ; its direction being very rarely from before backwards, and almost invariably from side to side. It occurs chiefly between the ages of seven and seventeen ; and with few exceptions is confined to the female sex. It generally comes on insidiously, increases progressively, and, terminating at a more or less advanced stage, leaves the patient permanently disfigured in a proportionate degree. The part of the spine principally affected is the dorsal portion, which bending to one side, almost always the right one, makes the corresponding scapula and shoulder seem larger and more prominent than usual. As the disease advances, a counterbalancing bend in the opposite direction takes place in the lumbar region, causing the hip concerned to appear enlarged. When the spinous processes are traced downwards from the neck to the sacrum, the alternate bending in their course may be readily observed. As the curvature continues to increase, the distortion becomes more and more apparent ;—the trunk is shortened and looks compressed ;—the ribs are approximated from side to side, and protruded forwards to increase the capacity of the contracted thorax, which thus has its shape entirely altered, and is widest from before backwards. However far the disease may proceed, the

limbs and pelvis remain free from any participation in it.

In ascertaining the cause and nature of this curvature, the following circumstances, which attend its commencement, must be carefully recollected :—1. It occurs almost exclusively in females, who devote a large proportion of their time, during the period when the morbid disposition exists, to the pursuits usually followed in acquiring a fashionable education, and in those who follow a sedentary occupation, which does not require or permit much bodily exertion. 2. It usually affects most seriously those individuals who possess a slender frame, or one characterized by indications of a phlegmatic temperament,—their bodies, though large and stout-looking, being pale, flabby, and prone to all morbid states depending on weakness of action. 3. Other things being equal, it occurs most certainly, and proceeds most rapidly, when the trunk is habitually maintained in a bent position.

The predisposition to the disease, therefore, appears to be constitutional weakness, and its exciting causes, circumstances which increase the weakness of the spine particularly, and promote its bending by the figure they make it assume. The strength of the spine depends partly upon the bones, and partly upon the muscles composing it ; and it is probable that the former are chiefly affected by the predisposition, while the latter are influenced more by the exciting causes. All muscles require frequent exercise for the preservation of their strength ; but, during the occupations of drawing, playing, sewing, &c. while the extremi-

ties are either constantly employed, or, at all events, unrestrained in their movements, the trunk is not only held perfectly steady in one position, often a curved one, but also compressed with the rigid articles of dress which are used under the erroneous expectation of improving the shape. The muscles of the back, therefore, becoming extremely weak, and, indeed, as may be learned by actual examination, almost completely absorbed, are no longer able to restore the erect position of the spine when bent by the weight of the head and superior extremities, or by the occupation of the patient. It consequently assumes a permanent curve; and then the predisposition, which depends on a softened state of the bone, acts with full effect; because the more the column bends, the longer levers are afforded to the superincumbent pressure. As the distortion increases, the viscera of the thorax and abdomen are more and more compressed and displaced, their functions suffer corresponding derangement, and the whole system becoming disordered, the bones even less properly nourished than before, lose still more of their resisting power. Should the patient unfortunately, during this process, fall into the hands of a machine-maker, who attempts to prop up the weak and twisted spine by means of iron frame-works, the morbid alterations which have been described will be accelerated; for all such contrivances must prove either insupportable to the patient, or inefficient in straightening the spine; and granting even that they could accomplish this, they would still labour under the great objection of confining the move-

ments of the trunk, and preventing the muscles from obtaining that exercise which is essential to the recovery of their strength. The result would be not more satisfactory if the practitioner were to go to the opposite extreme, and, regarding the muscles as the sole seat of the disease, attempt to strengthen them by enjoining long-continued exercise in the erect posture, or, still worse, recommending a weight to be carried on the head, in order to render their actions in balancing it more energetic than usual. Such practice, however useful in preventing curvature, must manifestly tend to increase it when once commenced.

In the management of persons predisposed by their age, sex, temperament, or constitutional make to this disease, every means ought to be used for strengthening the system in general, and the trunk in particular. All long-continued and constrained positions must be interdicted,—frequent exercise of such kind as calls into action the muscles of the trunk should be enjoined. The use of stays, corsets, and every rigid article of dress, however designated, must be strictly prohibited. If curvature has already taken place, it is evident that the first step towards reparation must be relieving the weak and bent spine from pressure. The only mode of effectually accomplishing this is to make the patient assume the horizontal posture, which can be done without any great hardship, if a smooth well stuffed sofa is provided, instead of the floor or a board, which is sometimes used for the purpose. The warm bath ought to be employed, if possible, two or three times a-week, and the back should be rubbed with some stimulating liniment for twenty

minutes every night and morning. When the curvature begins to diminish, the patient may rise occasionally for a few minutes, and exercise the muscles by some suitable employment, which ought never to be continued after the slightest feeling of fatigue is experienced. By persisting in this system, the disease will certainly be arrested in its course, the distortion, if not very great, will be removed, and the worst cases will be considerably improved.

CHAPTER XII.

JOINTS.

Strains.

THE ligamentous tissue is not liable to pain excit-
ed by the ordinary stimuli which occasion it in other
parts ; but though thus insensible to cutting and tear-
ing, it suffers severely from being over-stretched, in
conformity with the general law, that the sensibility
of parts bears some relation to their use in the animal
economy.

When the ligaments of a joint have been overstrain-
ed, it is said to be strained, or sprained. This injury
never occurs in the ball and socket articulations, the
mobility of which protects them against it, and is most
apt to happen in those of the ginglymoid or hinge-like
structure, especially the wrist and ankle. It is attended
in the first instance with severe sickening pain, and com-
plete inability of exercising the joint. To these symp-
toms succeed swelling, tension, and discoloration from
ecchymosis, and not unfrequently inflammation, parti-
cularly if the patient possesses a scrofulous or other-
wise irritable constitution. The inflammation, when
chronic, leads to thickening and adhesions of the arti-
cular apparatus, which occasion deformity and lame-

ness, or morbid degenerations of the same part, which frequently end in the destruction of the joint; when acute, it may induce the same result more speedily and directly. The immediate effects of strains are always distressing, and their secondary consequences, though not certainly serious, are generally inconvenient, and sometimes destructive of the limb. Such accidents, therefore, ought always to be treated with attention, so that nothing may be neglected in any way calculated to guard against bad consequences to the joint.

The means that afford most relief from the pain directly caused by the injury, consist in the preservation of perfect rest, and the application of hot fomentations. The ecchymosis is often considered an indication for leeching or cupping; but, as has been already explained, the blood which produces the discoloration being effused from the vessels, cannot be withdrawn in this way, and must be removed by absorption. If symptoms of inflammation come on, blood should be abstracted freely, both locally and generally, and the other means employed that will be mentioned when the inflammation of joints is considered. After the injured part has ceased to be painful on pressure or motion, and remains merely swelled and stiff, it ought to be compressed with a bandage, and have at the same time some stimulating ointment or lotion applied to promote absorption. Blistering, warm pumping, the vapour-bath, friction, and gentle but frequently repeated exercise, are useful at the same time, and with the same view.

Dislocation.

By dislocation is understood displacement of the respective surfaces of an articulation. The dislocation may be partial or complete; and also simple or compound, in the same sense of these terms as when they are used with reference to fractures. It is simple dislocations only which will be considered under this section, as those which are compound may be arranged more conveniently under wounds of the joints.

The joints least subject to strains are most readily dislocated, since the mobility and looseness of ligamentous connection which protect them from the former injury, expose them to the latter. The circumstance of having been dislocated increases the predisposition. The causes of dislocation are, 1. external violence; 2. inordinate muscular action; and 3. diseased alteration of the articular apparatus. The displacements which proceed from the last of these causes are named spontaneous dislocations, and will be considered along with the diseases which give rise to them.

The process of dislocation usually consists of two stages or acts; there being first the displacement of the articulating surfaces which results directly from the violence that causes the accident; and then a farther separation of them by the action of the muscles which formerly held the bones together, but now pull them past each other. These two steps are sometimes designated by the names of primary and secondary dislocations.

Of the symptoms of dislocation, the most constant

and characteristic one, especially as a distinction from fracture, is immobility or fixture, when motion of the limb is attempted either by means of its own muscles or by an extrinsic force; which depends upon the unnatural position of the articulating extremities of the bones, and the contraction of their surrounding muscles. The limb is generally shortened, but sometimes it is lengthened, and when this is the case there cannot of course be any suspicion of fracture. There are also attending the accident deformity from the altered situation of the bones, pain or numbness from their pressure on the muscles and nerves, and swelling with coldness from the pressure on the blood-vessels.

The treatment of dislocation consists in reducing or replacing the articular surface which has been moved from its proper position; in doing which it is necessary to counteract the forces that caused the two acts of the removal. This is effected by first extending the limb so as to draw back the bone to the point where the muscles began to operate in producing its displacement; and then urging it in a direction opposite to that in which the external violence acted primarily. These steps in the process of reduction, which are named extension and coaptation, have sometimes an equal share in its accomplishment, but more frequently one or other of them is chiefly useful.

The dislocated bone ought generally to be extended in the direction which is given to it by the muscles. The force for this purpose may be applied so as to act either on the bone itself or on a part of the limb separated from it by one or more articulations. The

former method is on the whole more convenient in most cases, and is almost always employed in this country. In order to make extension effectually, it is necessary to have counter-extension exerted on the corresponding surface from which the bone has been dislocated, viz. the one nearest the centre of the body; and the more directly it is subjected to the power employed for this purpose, the more perfectly will the object in view be attained. The force employed may be either simply the manual strength of one or two stout assistants, or this increased by the power of the pulley. In all cases of dislocation, except perhaps sometimes where the hip-joint is concerned, mere manual extension is sufficient, and it ought, therefore, in general, to be preferred, being more readily obtained and also more easily managed than the pulley. The strength of the patient's muscles may be weakened by bleeding—the warm bath—tobacco injections— and the tartrate of antimony, given in solution in small doses frequently repeated. Of these means the first and last mentioned are the most convenient, but it is seldom necessary to employ either of them. The involuntary resistance may also be lessened by preventing fixture of the thorax, which being the central point of attachment directly or indirectly to all the muscles of the body, is instinctively rendered immoveable whenever any strong effort is to be made. But if the patient is obliged to speak, this cannot be done, and consequently the opposing force is diminished. With a similar view it is sometimes advantageous to effect the extension suddenly when it is not

expected by the patient; but unless it should seem practicable to effect the reduction in this way instantaneously, the limb ought to be extended slowly and steadily, since the duration of the stretching force has more effect than its power in subduing the contractile energy of the muscles.

Coaptation is more or less required according to the resistance which is opposed to the reduction by the shape and situation of the articular surfaces. It is generally least useful in the ball and socket-joints, and of most advantage in those of the hinge form. In the former, it is sometimes not required at all; and in the latter, it is occasionally sufficient of itself to accomplish the operation.

After the dislocation is reduced, the joint ought to be protected against the operation of those circumstances which tend to renew the accident. It ought to be kept perfectly quiet, and frequently fomented to allay the pain and irritation consequent on the laceration of the muscles. It might be expected that the immediate pain, and danger of consecutive inflammation, would be greater in dislocation where the ligaments are torn, than in strains where they are only much overstretched. But this is not the case, and though inflammation, both acute and chronic, may no doubt result from the former accident, it is very seldom followed by any serious bad consequences.

When the dislocation is not reduced, the bone acquires adhesions to the neighbouring parts round the margin of its articular surface, and by its pressure often induces absorption of the surface it comes to act on,

so that a cavity is formed for its reception and a sort of new joint produced, which enables the patient to regain considerable use of the limb. While this process is going on, the old articular hollow gradually contracts, and ultimately becomes obliterated, so that if the bone were displaced from its new situation it could not be returned to its original one. The time that may elapse before reduction becomes impracticable varies with the age of the patient and the nature of the joint concerned, from two or three weeks to as many months. It is longer in old people than in young, and in dislocations of ball and socket joints than in those of hinge joints.

Shoulder Joint.—The head of the humerus may be dislocated downwards, forwards, and backwards. The first of these displacements is the most common, and happens more frequently than the dislocation of any other joint. The accident is caused by external violence proceeding from falls on the hand or elbow, or blows on the shoulder, while the arm is separated from the side, and also, though rarely, by sudden violent contractions of the *pectoralis major* and *latissimus dorsi*, the limb being in the same position. The capsular ligament is necessarily torn, and the head of the bone rests upon the neck of the scapula over the origin of the long head of the triceps.

The symptoms are slight elongation of the arm, which is stiff and powerless, projecting considerably from the side, and nearly though not quite straight, as both the biceps and triceps are put upon the stretch. The tension of the former muscle generally

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occasions pretty complete supination of the fore-arm ; the axillary hollow is filled up with the head of the humerus ; and under the acromion there is a remarkable depression instead of the usual convexity of the deltoid, from the absence of the bone. There is pain of the shoulder, numbness of the fingers, and more or less swelling of the whole limb.

The reduction may be effected by various methods, but the one which will generally be found the most convenient, is to make the patient sit on a chair, and then having confined the motions of the scapula by means of a folded sheet or tablecloth encircling the chest, and held at its extremities by one or two assistants, to extend the arm horizontally or slightly downwards. The lac, as it is called, or bandage used for pulling, which may be a shawl or hank of worsted, should be fastened a little above the elbow. To perform the coaptation, the surgeon puts his foot on the chair, and his knee in the patient's axilla, then places one hand on the acromion, and with the other seizes the fore-arm. While the extension is gradually increased, he rotates the limb outwards, and endeavours to raise the head of the bone into its place, by elevating his knee at the same time that he depresses the shoulder. When the operation is completed, a sudden snap, or more frequently a dull grating noise, is heard, and all the symptoms of the dislocation disappear.

Another method which may be employed when the surgeon has no assistant, is to place his heel in the axilla of the patient, while both he and the opera-

tor lie horizontally in opposite directions, then per-
form extension by pulling the hand of the affected
arm ; and finally effect coaptation by bending the limb
inwards over the fulcrum which is afforded by the
foot.

In dislocation of the humerus forwards, the head
of the bone lies on the sternal side of the coracoid
process, a position into which it can get of course on-
ly by suffering a secondary displacement after having
been forced downwards. The muscles then draw it
upwards and inwards, and continuing to do this after
the accident, at last elevate it as far as the clavicle al-
lows.

In this case the limb is rather shortened. The el-
bow is bent and more distant from the side, owing to
the position of the head of the humerus, and, from the
same cause, there is less numbness and swelling of
the limb. There is not so much perceptible deficiency
under the acromion, and the axilla is not so complete-
ly occupied as when it contains the head of the bone.
As might be expected from the negative character of
these symptoms, the diagnosis is not so easy as that
of dislocation downwards ; and hence practitioners
who are not sufficiently careful frequently mistake the
nature of the accident. The most certain indication
of it, is afforded by the head of the humerus filling
up the hollow which naturally exists between the del-
toid and pectoral muscles, and moving there when the
arm is subjected to the degree of rotation which it is
still able to perform.

The reduction should be performed as in the former

case ; but it is generally found advantageous in the first instance to extend obliquely downwards, in order to dislodge the bone from the position into which it is drawn by the muscles.

Dislocation of the humerus backwards or outwards is very rare. In the few cases of it which have been observed, the head of the bone lay between the scapula and infra spinatus muscles, below the spine, so as to cause a distinct external swelling in this situation, and a deficiency at the fore part of the shoulder. The arm was directed forwards across the chest, and could not be moved into any other position without both force and pain. The reduction is easily effected, and requires no peculiarity in its performance, except that the extension should be made in the direction which the limb retains from the accident.

Elbow-Joint.—The elbow-joint is liable to various sorts of dislocation, the diagnosis of which is often very difficult, especially as fractures near or through the articular surfaces produce in some respects similar symptoms. There is a difference of opinion as to the comparative frequency of these accidents, and also as to the characters for distinguishing them, with the exception of one dislocation, which is certainly the most common and best marked of the whole. This is displacement of both bones of the fore-arm backwards. The articulating extremity of the humerus stretches the biceps and *brachiæus internus*, occasions a hard tumour at the bend of the arm, and causes permanent semiflexion of the limb. I have seen it quite straight ; but this is rare, and probably depends upon rupture

of one or both of the before-mentioned muscles. The olecranon projects behind much farther than usual, and the triceps is very much relaxed. The forearm appears shortened, and there is little or no mobility of the elbow. This accident happens from falls on the hand while the arm is bent.

The reduction is very easily performed by making extension, and then bending the fore-arm, while the surgeon embracing the elbow with his hands so that the fingers rest on the olecranon, and the thumbs on the extremity of the humerus, pushes the displaced bones into their proper position.

The radius is liable to be dislocated separately, and may be driven either forwards or backwards. In the latter case the displacement is so obvious from the tumour which is caused by the head of the bone, that it can hardly be overlooked ; but in the former, which is the more common of the two, the nature of the accident is very apt to escape detection until it is too late to afford relief.

The symptoms are pain and swelling about the elbow, which is half bent, and allows a very slight degree of flexion and extension ; any attempt at the former being attended with a sudden snap or catch, owing to the head of the radius, which lies over the coronoid process of the ulna, striking against the humerus. I have seen in one case the flexion continue quite free. When the hand is rotated, the radius is felt rolling under the origin of the flexor muscles, and a cavity is perceived where its head ought to be. Both forms of this accident result either from direct violence sus-

tained on the elbow, or from falls on the hand. The reduction is very easy if performed early, and requires merely that the hand should be extended while pressure is made on the head of the bone.

Wrist-Joint.—The wrist often appears to be dislocated, owing to the swelling and immobility which it suffers in consequence of external injury, but these symptoms in the great majority of cases are merely the effects of sprains ; and real dislocation of the joint is an extremely rare occurrence. It may take place in two directions, forwards and backwards, the bones of the carpus being driven upwards under either the extensors or the flexors. The causes are falls on the hand. The reduction is effected by extending the hand, and pressing on the dislocated bones.

Thumb.—The first or proximal phalanx of the thumb is occasionally dislocated from its connection with the metacarpal bone, in consequence of falls or blows. It is usually driven upwards and backwards, where the extremity can be felt distinctly, while that of the metacarpal bone is not less perceptible on the palmar side.

The reduction of this apparently trivial displacement has been generally found very difficult, and sometimes altogether impracticable, the reason of which would seem to be that the lateral ligaments of the joint remain more or less entire, and being separated by the wedge-shaped extremity of the metacarpal bone to allow its passing between them, afford a serious obstacle to its return. The best mode of proceeding is to extend the thumb with moderate force,

and at the same time to exert strong pressure on the extremity of the phalanx in the proper direction for pushing it into its place. The operation when thus performed is sometimes executed with great facility. In cases where the difficulty proves insuperable, it has been proposed to cut one of the lateral ligaments, which may be done by a very small incision, and this would certainly be better than leaving the bone unreduced, as has sometimes been the case.

Fingers.—Both the proximal and distal, or first and third phalanges of the fingers, are occasionally dislocated backwards, so that the displaced extremity rests on the dorsal surface of the corresponding bone. The accident can hardly be overlooked or mistaken, and the reduction is generally very easy, provided the force employed be directed chiefly upon the projecting end of the phalanx.

Hip-Joint.—The hip-joint, notwithstanding the great strength of all the parts which enter into its formation, is subject to dislocation in four different directions. 1. Upwards and backwards on the dorsum of the ilium. 2. Backwards into the sacro-ischiatic notch. 3. Downwards into the *foramen ovale.* And 4. Forwards upon the pubis.

In dislocation upon the dorsum of the ilium the limb is shortened from one and a-half to two inches— the affected knee is bent over the sound one—and the foot is turned inwards so much that the great toe of it rests on the tarsus of the other. The thigh cannot be moved except slightly inwards—the *trochanter major* is higher up, and nearer the crest of the ilium

than usual—and the head of the bone can sometimes be felt rolling under the muscles when the limb is moved.

This accident happens from falls on the side while the foot is fixed so that it cannot be carried outwards, and the circumstance of having a load on the back, promotes the dislocation by increasing the strain. It happens most frequently in males, and is seldom met with either in very young or in very old subjects, being in a great measure confined to those in the vigour of life.

The reduction is effected by fixing the pelvis by means of a sheet, or other bandage of the same sort, passed under the perineum obliquely, and then extending the thigh in the direction which is given to it by the dislocation. Coaptation is hardly required, as the muscles generally pull the head of the bone into its place when the extension has been carried far enough; but if it should seem that the margin of the acetabulum opposes any resistance to its return, the difficulty may be surmounted by drawing the upper part of the thigh outwards while the knee is still held across the sound one.

The dislocation into the ischiatic notch is produced much in the same way as that on the dorsal surface of the ilium, but does not happen so frequently. The symptoms also are similar, and differ only in being less marked. There is less shortening—less bending of the affected limb over the sound one—less inversion of the toes—and less displacement of the *trochanter major*. The reduction is accomplished in the

same way, except that it requires more force to lift the head of the bone out of its preternatural situation.

The dislocation downwards is caused by heavy bodies falling on the hip while the limb is in a state of abduction. The symptoms are extremely characteristic, there being elongation to the extent of an inch and a-half,—abduction, owing to the stretching which is suffered by the gluteal muscles,—and flexion of the thigh on the pelvis, from the same cause affecting the *iliacus internus* and *psoas magnus.* The reduction is accomplished by extending and counter-extending transversely the thigh and pelvis, while the foot of the affected limb is carried inwards under the sound one.

The dislocation forwards on the pubis is caused by the body being suddenly bent backwards, while the foot is fixed and the limb is kept straight by the strong involuntary action of its extensor muscles. The symptoms are slight shortening, eversion of the toes, and the head of the bone being felt distinctly rolling under the integuments of the groin. The reduction is performed by extending downwards and backwards, while the patient lies on his sound side, and then drawing the upper part of the thigh outwards, so as to lift the head of the femur over the acetabulum.

It is only in cases of dislocated thigh-bone that the pulley is ever necessary or even useful, and even here it may in general be dispensed with, unless the patient is extremely robust, or the dislocation has remained long unreduced.

Knee-Joint.—The patella may be dislocated laterally by direct violence, and this accident is most apt to

happen when the parts concerned are in the relaxed state, which results from sudden removal of a dropsical effusion into the joint. The dislocation is very readily recognized, and admits of easy remedy, either by bending the thigh upon the pelvis while the knee is straight, so as to relax completely the extensor muscles, or by bending the knee, so as to make the patella descend below the condyles of the femur, and thus remove the obstacle which they afford to its replacement.

The tibia and fibula are so strongly connected with the femur, that they very seldom suffer dislocation. In consequence of a violent wrench to one side, there is sometimes a laceration of one or other of the lateral ligaments, and a partial displacement of the articulating surfaces of the tibia. In the rare cases of its complete dislocation, it has generally been found behind the femur ; but according to Sir A. Cooper, it may also be driven forwards. The accident is very readily recognized, owing to the great size of the articulating surfaces, and the thinness of their surrounding parts. The reduction, which is not difficult, requires extension and counter-extension, accompanied with pressure on the dislocated bone.

It is thought that the semilunar cartilages are subject to displacement, since persons of relaxed frame sometimes complain of pain and stiffness in moving the knee, which are felt suddenly, and disappear no less so when the joint is forcibly bent and extended.

Ankle-Joint.—Though the ankle is frequently dislocated as a consequence of fracture through either

malleolus, as has been noticed under the proper head, yet dislocation happens so rarely by itself, that it is hardly necessary to mention the possibility of its occurrence. This dislocation can be only backwards or forwards, and is reduced chiefly by coaptation.

Astragalus.—When a person falls from a considerable height on his heel, the violence thus sustained not being diffused over a number of articulations, as when he alights on his toes, is transmitted to the astragalus with such intensity, as sometimes to force it out of its place, turn it upside down, and make it project under the integuments of the instep, through which it sometimes makes an aperture. This dislocation does not admit of reduction, and the bone, when thus displaced, must be removed. If an opening has not been caused by the accident in the first instance, one ought to be made without delay, in order to anticipate and prevent the violent inflammation which will otherwise occur, as the precursor of ulceration or sloughing, by which the loose astragalus must make its escape.

Lower jaw.—The lower jaw cannot be dislocated so long as it is closed, since the condyles are then firmly secured in the glenoid cavities. But when opened, so as to bring them forwards on the anterior convex part of the articular surfaces, it may be readily displaced by a lateral impulse, or even excessive action of the muscles. One or both of the condyles then glide forwards over the root of the zygomatic process ; and, sinking into the hollow on the opposite

side, retain the jaw fixed and opened in a painful, unseemly, but most characteristic position.

The reduction of this dislocation is extremely easy, since, if a fulcrum be placed at the back part of the grinding surface, the anterior portion of the jaw affords a powerful lever for replacing the deranged condyle or condyles. The best fulcrum for this purpose consists of one or both thumbs protected from the action of the teeth, by being wrapped in the corners of a handkerchief or towel. After the reduction the patient for some time ought to avoid opening his mouth wide, and exposing his jaw to the circumstances which favour a recurrence of the accident, as a considerable predisposition to it remains.

Clavicle.—The sternal extremity of the clavicle is sometimes dislocated forwards in consequence of falls on the shoulder and arm. The displacement is readily recognized by the swelling arising from the projecting end of the bone and superjacent portion of the sterno-mastoid muscles, and by the mobility of the clavicle and depression of the shoulder that proceed from it. The dislocation is readily reduced by elevating the shoulder, and pressing down the sternal extremity of the clavicle, but returns so soon as the restraint which produces these effects is removed. A bandage, therefore, sufficient to retain the bone permanently in its proper position, should be applied; and the apparatus best calculated for doing this, consists of a sling to support the arm, together with a compress placed on the end of the

clavicle, and secured by means of a figure of 8 bandage.

The acromial extremity of the clavicle is also occasionally dislocated; but this accident requires no particular consideration, as its causes, symptoms, and treatment are the same as those of fracture of the acromion, or acromial extremity of the clavicle.

Vertebræ.—The vertebræ are very seldom dislocated without fracture or morbid alteration of the bones; and in all cases the accident is of importance chiefly in respect of the organs contained within the vertebral column, along with which, therefore, it may be more properly considered.

Club-Foot.

Children are sometimes born with a dislocation of the bones of the foot, which, if not rectified, occasions a permanent, unseemly, and inconvenient distortion. This displacement consists in a bent or twisted position of the tarsus and metatarsus, which makes the toes, instead of being directed forwards, point either inwards or outwards. The former case, which is by far the most common, is designated Varus, the latter Valgus, and both are included under the title of Club-foot. The malformation is sometimes confined to one foot, but more frequently affects both. It is found by dissection that at the time of birth the bones concerned are of their usual shape and size, and that the fault lies in the ligaments, which are preternaturally lax, and in some of the muscles which are

unusually tense. When the patient is allowed to grow
up with this deformity unremedied, the bones suffer a
change of figure, which suits them for their peculiar
position, and prevents them from resuming their pro-
per one ; the ligaments become firm, the muscles ac-
commodate themselves to the other parts, and the sole
of the foot being turned back, so as to point rather up-
wards than downwards, a large *bursa mucosa* is formed
under the integuments which come to bear the weight
of the body.   The treatment of club-foot consists in ·
using mechanical means for counteracting the distort-
ing tendency of the muscles, and maintaining the
bones in proper position, until the ligaments and mus-
cles have suffered the necessary alteration for prevent-
ing their displacement.   Various apparatus have been
contrived for this purpose, and almost every practi-
tioner has peculiar ideas as to their construction. They
essentially require the following parts : *First*, A shoe
or boot having an iron sole, and sides more or less
stiff ; *Secondly*, An iron plate or rod attached to the
side of the sole, and ascending as high as the knee ;
and, *Thirdly*, A collar at the summit of this rod for
embracing the leg below the knee.   In applying this
machine the operator should expand the foot into its
proper form, and place it fairly in the shoe, where it
must be strictly confined by a long narrow bandage,
fastened to the inside of the shoe, and closely wrap-
ped round it in the opposite direction to that of the
distortion.   The foot having been thus secured, the
stem should be brought as nearly as possible into con-

tact with the leg, and retained there by means of the roller. The patient cannot of course bear this restraint long at first, but will be gradually enabled to do so, and at length the apparatus may be applied constantly without any inconvenience. It ought to be changed every day, and rendered tighter according to circumstances. It is evident that the treatment ought to be commenced as early as possible, since every day of delay increases the difficulty which attends it, and if weeks, or still more if months, are allowed to elapse before proper steps are taken, the cure will be very tedious, and most probably incomplete. In such cases the bones cannot be at once restored to their proper position, and require the assistance of warm-bathing, frictions with oily matters, and gradual extension before they admit of being replaced.

Wounds of the Joints, and Compound Dislocations.

The synovial membrane is very prone to inflammation, which causes violent constitutional disturbance, and leads to the most destructive morbid alterations. Wounds of the joints, therefore, must always be regarded as serious injuries ; and the more so in proportion to the size of the joint, and degree of irritation which accompanies the wound.

The great object in treating such wounds should be to make them heal if possible by the first intention, which, of course, prevents the necessity of inflammation as the precursor of granulating action. With this view, all sources of irritation, whether direct or

indirect, that may seem to exist, ought to be removed. If there is displacement of the articulating surfaces, they ought to be accurately reduced, which is generally effected with ease, owing to the laceration of the surrounding parts; and if the head of a bone protrudes so as to resist moderate force employed for this purpose, it must be cut away with the saw or pliers, since the distension that would be caused by its pressure would excite inflammation. The edges of the wound should be placed in contact, and assiduously cooled by wet cloths frequently changed, while motion of the limb is carefully prevented by the application of splints. The constitutional treatment is to be conducted on the same principles. The patient will generally be benefited by bleeding and purging, to lessen his strength of action; but sometimes the opposite means are required to correct the irritability that proceeds from weakness. The diet in general should be strictly antiphlogistic; but here also exceptions may require to be made on account of the peculiar circumstances of the case.

When compound dislocations are treated on these principles, the necessity of amputation, which used formerly to be generally performed as their only remedy, is almost entirely superseded. The ankle-joint is most subject to the accident, and the formidable appearances which are presented by it seem at first sight to warrant the removal of the limb; but when the projecting extremities of the bone are sawed off, the distortion rectified by suitable splints or ban-

dages, and the edges of the wound placed fairly together, the cure is often accomplished very readily. The elbow or wrist-joints may in general be preserved by the same means, but the knee-joint, when subjected to the great irritation which attends both a dislocation and penetrating wound, can hardly be expected not to inflame, and either proves speedily fatal or requires subsequent amputation. Hence in such an injury the limb will generally require to be amputated immediately. Gun-shot wounds of the shoulder and elbow, unless the integuments, blood-vessels, or nerves, are much injured, may be remedied by cutting out the articulation as in caries, and when this state is induced by a wound, of course the same treatment will be applicable.

Inflammation of Joints.

Inflammation of the joints is attended with deep-seated pain, greatly aggravated by motion or pressure, swelling, redness, and tenderness of the integuments, and more or less constitutional disturbance, according to the intensity of the local symptoms. It is caused by the direct irritation of wounds, strains, and bruises; and indirectly, by exposure to cold, errors of diet or exercise, and whatever induces derangement of the system. The consequences of inflammation in this situation are numerous and important, as might be expected from the number and nature of the tissues which enter into the constitution of the articular apparatus. The synovial membrane becomes the seat of dropsical

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and purulent effusions, adhesions, thickenings, and gelatinous degeneration; the cartilage suffers ulceration and exfoliation; and the bones are liable to suppuration, caries, and anchylosis, or union of their adjoining surfaces. The consequences of inflammation are serious, in proportion to the severity of the attack, and the unsoundness of the patient's constitution; but it ought always to be dreaded, and induced, if possible, to terminate in resolution.

When the symptoms are acute, blood should be freely abstracted locally by leeches or cupping; and if there is much strength of action in the system, general bleeding must also be practised. Calomel and opium are very useful where there is much irritability; and the tartrate of antimony given in frequently repeated doses of a dilute solution, is on all occasions a most valuable remedy; not only by allaying violent action, but also by promoting the secretions of the skin and mucous membranes. When the inflammation is subacute, warm fomentations, anodyne liniments, such as the tincture of soap and opium, with the internal use of diaphoretic medicines, as Dover's powder, calomel and opium, or *vinum colchici*, afford most relief. In its chronic state, counter-irritation effected by stimulating liniments, blisters, tartrate of antimony, setons, and issues, especially those made by the actual cautery, with perfect rest, and a moderate degree of pressure, are the means which deserve most confidence.

Dropsy of the Joints.

The synovial membranes of the joints, though all similar to each other, and resembling in structure as well as function the serous coverings of the soft parts, are not equally subject to dropsical effusion. It is extremely common in that of the knee, but very rare in all the others.

Dropsy of the knee-joint is occasioned by a great variety of circumstances. It occurs most frequently in persons of weak and irritable constitutions; who often suffer from it in consequence of very slight direct irritations, such as twists or bruises, or the indirect operation of exposure to cold. It is met with, however, occasionally in the strongest frames; but then the irritation is always direct and severe; such as fracture of the patella or femur, especially in its lower third, or a violent strain. The effusion generally appears almost immediately after the injury is received, and is at first attended with more or less acute symptoms of inflammation. It is readily recognized by the swelling and fluctuation which are caused by its presence. The enlargement reaches as far up the thigh as the synovial membrane extends, it fluctuates when subjected to pressure, and the patella is felt to float as it were, so that it may be made to strike upon the condyles of the femur if pushed downwards with moderate force.

The means employed for treating this affection must vary with the acuteness of the inflammatory symptoms which attend it. In the first instance it is

often necessary to cup or leech and foment the joint,
while the constitutional remedies of a co-operative
kind are at the same time administered. When the
swelling ceases to be very painful, but continues still
more or less red, tender to pressure, and unable to
bear motion, a cooling discutient lotion may be used
with advantage. Finally, when there is no longer any
indication of excited action, and the only inconve-
nience that remains is merely that occasioned by the
presence of the fluid, the joint should be blistered once
or oftener, according to the extent and duration of
the disease, and then carefully bandaged. For some
time after the cure is completed, the patient should
wear a laced cap to protect the part concerned from
the various external injuries to which it would be ex-
posed in consequence of its weakened state.

Moveable Cartilages in Joints.

Small cartilaginous bodies are occasionally met with
in the cavities of the joints, either quite detached or
connected with the parietes of the articulation by a
narrow neck. They have a glistening pearly lustre,
and when divided are found to consist of a gristly
substance inclosed in a firm capsule, with a bony nu-
cleus in the centre. They are of various magnitudes,
from the size of a barleycorn to that of a pigeon's
egg, and are also very different in their shape, which
is generally round, oval, or lenticular, but sometimes
tuberous. They exist either singly or in numbers to-
gether, but two or three are most frequently met with.
They have been discovered in many of the joints, but

are beyond all proportion most common in the knee. Even here, however, they may be considered a rare occurrence. They generally make their first appearance in young adults.

The origin of such bodies has been ascribed to the effusion and organization of blood and lymph, to the detachment by fracture of a portion of the articular surface, and to the separation of morbid growths from the margin of the cartilages of the joints. The last of these suppositions is on the whole the most probable, as the bodies in question are often observed by the patient to be fixed before they become moveable, and they have been repeatedly found on dissection adhering to the extremities of the bones. It may also be observed, that, so far as can be learned by external examination, they do not suffer any change of shape or size after they are first discovered.

These bodies occasion no inconvenience, except when they happen to be squeezed between the opposite articular surfaces ; they then excite a sudden and severe sickening pain, which forces the patient instantly to desist from the exertion in which he was engaged, and frequently makes him fall at once to the ground. In consequence of this irritation repeated from time to time, the joint becomes the seat of a dropsical effusion, which is sometimes the first symptom of the disease that attracts the patient's attention, as he is apt to account for the pain previously suffered by referring it to rheumatism. Unless proper means are now employed, the use of the limb may be almost completely lost.

The radical cure is easily effected by cutting into the joint, and extracting the cause of irritation. But this very simple operation is attended with considerable risk of exciting such a degree of inflammation, as might endanger not only the patient's limb, but also his life. In order to diminish the danger, as far as possible, the patient should be confined to bed, and restricted to a regulated diet for some days previous to the operation. The cartilage should then be moved into that part of the joint which is most superficial, and held steadily there, while a free decided incision is made down upon it, so as to allow of its escape when urged out by the same pressure that was employed previously to fix it, and render unnecessary any groping with hooks, forceps, &c. which must increase the chance of inflammation. The edges of the wound ought to be placed together, and kept constantly cool with wet cloths; the joint being at the same time protected carefully from motion, and all other kinds of irritation.

Mr Hey of Leeds, as a substitute for excision, which, though performed with every precaution, must always be considered a hazardous proceeding, suggested the application of pressure to the joint, so as to prevent the cartilaginous body from moving about as usual. He has recorded several cases in which this practice proved completely successful, the moveable substances, though they still remained perceptible, ceasing to occasion any inconvenience. The dropsical effusion which attends the disease opposes or altogether prevents effectual compression with this view, and therefore leeching, discutient lotions, or blisters,

according to the circumstances of the case, must in the first instance be employed to promote absorption, after which a bandage or laced cap surrounding the joint ought to be constantly worn. The operation is now very seldom resorted to, and will probably soon be abandoned entirely.

Gelatinous Degeneration of the Synovial Membrane.

The synovial membrane is liable to a process of morbid nutrition, which changes its natural structure into a soft greyish yellow gelatinous mass, varying in thickness from a line to a quarter or even half an inch. This alteration usually occurs in individuals who are disposed to scrofulous action, whence it is generally named the Scrofulous Affection of the Synovial Membrane. It most frequently commences in young persons before the age of puberty, and is generally induced by some local cause of irritation, though there are many cases in which its origin seems to be entirely spontaneous.

The first symptoms of the disease that attract attention are swelling and stiffness of the joint affected. The swelling is soft, elastic, and colourless, and is diffused over the whole extent of the synovial membrane which does not cover the articulating cartilages. As the morbid thickening increases, the degree of enlargement and immobility keeps pace with it, but still the patient hardly complains of pain. If the parts be examined by dissection during this stage, the synovial membrane is found more or less thickened, gelatinous,

and vascular ; the surrounding cellular substance is greatly thickened and condensed by albuminous effusion into its interstices, and the ligaments do not present an outline so distinct as usual, being expanded in their texture, and matted together with the adjacent tissues. The joint may remain thus altered for many months, or even years, without suffering any farther changes ; but the diseased condition at last terminates either in absorption or suppuration. In the former case the articulation is restored more or less completely to its previous condition, but almost always continues somewhat swelled and stiff ; in the latter, openings into the joint are formed for the discharge of matter, the articular cartilages exfoliate or are absorbed, the cancellated structure of the bones is exposed, and the patient, if not relieved, either dies hectic, or recovers with a limb rigid and shrivelled. Instead of the joint, there is then either a perfectly unyielding union by osseous matter, which is named Anchylosis, or a firm fibrous bond of connection, constituting what is called false Anchylosis.

The treatment of the disease in its first stage ought to be directed with the view of preventing inflammation, inducing it to terminate in resolution if actually existing, and promoting absorption of the morbid structure. In attaining the first of these objects, it is necessary to protect the joint concerned from all irritations, both direct and indirect. Not only strains, blows, and violent exercise, should be avoided, but also motion of any kind or degree ; to prevent which the more effectually, splints of pasteboard, or some

other rigid material may be advantageously employed,
the limb being fixed in that position which will ren-
der it most useful to the patient after the cure is com-
pleted. The various actions of the system should be
supported by a moderate allowance of nourishing
food—by exercise of such kind as will not derange the
affected limb—and by medicine when it is found neces-
sary. Should inflammation be unfortunately excited,
leeches, cupping, fomentations, and general remedies,
if the severity of the symptoms seems to require them,
must be promptly and freely resorted to. In promot-
ing absorption, the general principles which have been
already explained will indicate the proper course to be
pursued. Blisters, pressure, and ointment of iodine
with mercury, afford the most powerful means for
this purpose. Mr Scott has lately brought the ad-
vantages of pressure very prominently forwards, and
led many people to believe that in this, as well as
some other chronic affections of the joints, it may be
deemed an almost certain and invariable specific. Mr
Brodie went into an opposite extreme in regarding
the disease as altogether incurable, and all the reme-
dial measures proposed for its removal as at best
but palliative. Pressure is apt to occasion pain, and
by thus exciting irritation, gives rise to inflamma-
tion, so as to bring on the malady to its last stage; it
ought, therefore, to be employed with great caution.
The best plan of treatment is, after subduing any in-
flammatory symptom that happens to exist, to blister
the joint repeatedly, and then apply pledgets of cad-

dis, covered with an ointment composed of camphorat-
ed mercurial ointment and the hydriodate of potass ;
lastly, to surround the limb and joint with a com-
mon roller, applied so firmly as to effect the desired
degree of compression.   Mr Scott recommends slips
of plaster instead of the roller, and changes them not
oftener than once in several weeks. But this practice
seems objectionable on several grounds, since inflam-
mation may thus be very easily overlooked, and allowed
to proceed the length of suppuration before it is disco-
vered ; and if things go on well, it is obvious that in
a very short time the diminution of the swelling must
render the bandage loose and inefficient.   Any de-
gree of pressure may be effected with the roller ; it
may be readily changed ; and being removed every
day or two, prevents the inconveniences which have
just been mentioned.

When suppuration ensues, free vent ought to be
afforded to the matter. Stimulating washes should
be applied to the sinuses, and moderate pressure still
carefully continued, together with, if possible, even
more rigid abstinence from motion. If the patient's
strength proves inadequate to support the profuse and
long-continued discharge which is apt to result, he
must be relieved by amputation or excision of the dis-
eased bone. It might be thought that the degenerated
synovial membrane would oppose the completion of a
cure, even after the carious bone was eradicated, but
experience has proved this to be not the fact ; and all
trace of the morbid structure in question soon disap-

pears during the copious suppuration which succeeds the operation.

Ulceration of the Cartilages of the Joints.

The cartilages which cover the surfaces of articulation are often found to be destroyed more or less completely, being in some places merely thinner than usual,—in some rough and irregularly abraded,—and in others detached from the bone, so as to lie in their natural situation, but nearly or altogether loose. These changes are ascribed to a process of ulcerative absorption in the cartilages; and though it may probably commence in the synovial membrane which lines them, they certainly are the parts principally affected by it. Ulceration of the cartilages occurs at all ages; but is more common in adults than the disease which originates in thickening of the synovial membrane. It is met with in persons of scrofulous constitutions, and in those subject to rheumatism. The exciting causes are irritation of various kinds, both direct and indirect. It is indicated by deep-seated gnawing pain, often referred to one particular point of the articulation, aggravated by motion, and felt most severely at night. There is no swelling in the first instance, and but little subsequently, unless the thickening of the synovial membrane is associated with the abrasion of the cartilages, which is not unfrequently the case. When there is no swelling from this source, the enlargement that does take place is confined to the space between the bones, and is of a more firm, unyielding consistence than that accompanying the other disease,

as it depends here merely on dense effusion into the cellular substance.

Ulceration of the cartilages sometimes causes such violent pain and hectic irritation of the system as to require amputation even while the parts remain in the state that has been described ; but, in general, it either leads to suppuration, or terminates in recovery. When suppuration takes place, the joint passes into nearly the same condition as that which exists in the last stage of the disease originating in the gelatinous degeneration of the synovial structure, so that it would be difficult to discover from dissection where the morbid changes had commenced. It appears that the articulating cartilage is never restored, and that the osseous surfaces deprived of it either unite together by means of a fibrous or bony medium, or become extremely hard and perfectly smooth, so that they seem as if incrusted with porcelain. This Porcelanous alteration of the articular surfaces has been only lately noticed, though far from rare in its occurrence. The corresponding bones are often grooved and ridged, so as to allow of motion in only one direction, and there is always an effusion of new osseous substance around the margin of the joint, as if an attempt had been made to effect anchylosis. It may be regarded as a substitute for the cartilage in facilitating motion, and is observed occasionally in the new joints resulting from dislocation. If recovery is not accomplished in either of these ways, the patient's strength ultimately gives way,—he becomes hectic, and at length sinks exhausted.

In conducting the treatment, the first indication is obviously to protect the joint from all irritations tending to render the morbid action more acute, and hasten it on to suppuration. For this purpose perfect rest, insured by means of splints and bandages, together with strict attention to the various secretions, ought to be particularly insisted upon. The next and not less important object is to subdue the chronic inflammation, or rather ulcerative action, that is constantly going forwards. With this view all sorts of counter-irritation are in common use, but it appears that the choice of them need not be very extensive, if due regard be paid to their effects. Issues have unquestionably most power in checking and subverting the morbid action, but the means by which they are opened is not a matter of indifference. Caustic, moxa, and the actual cautery, may all be employed for the purpose, but the last-mentioned agent is infinitely preferable to the others. It is often thought that the pain which attends the opening of the issue affords all the benefit that is derived from it, and that therefore the moxa, which usually produces a superficial effect, should be selected. But it is well ascertained that no considerable amendment can be perceived until the discharge of the new secreting surface has been fairly established. The ulcers of burns are always very slow in healing, and hence an obvious advantage of the cautery over the caustic; but its chief recommendation is the result of experience, and this is so strong as to leave no room for doubt or hesitation in preferring it to the other means. When the cautery is used, one or

two eschars three or four inches long should be formed on each side of the joint. In mild cases, some more gentle counter-irritant, such as the ointment of tartrate of antimony, occasionally proves sufficient ; and in these, as well as those in which convalescence is advancing, the forcible aspersion of warm water by pumping, or pouring from an height, is attended with much benefit. To remedy the rigidity that remains after recovery, steaming with the vapour of hot water, frictions with gently stimulating liniments, shampooing, and persevering exercise, are the means that ought to be employed.

White-Swelling.

The expression White-Swelling has been long used to denote chronic enlargement of the joints ; and though dropsical swellings had been previously excluded from this comprehensive signification, it was reserved for Mr Brodie to ascertain that the disease originated in three different seats, and to point out the signs by which they might be distinguished. Gelatinous degeneration of the synovial membrane, ulceration of the articular cartilages, and suppuration of the heads of the bones, are now known to occasion the affections in question. The symptoms and treatment of each have been already explained ; and from these the requisite combination of practice will readily suggest itself when there are indications of the co-existence of the affections.

Morbus Coxarius.

The morbus coxarius, or hip-disease, is an affection of the hip-joint, which requires separate consideration, not on account of any peculiarity in its nature, but from the frequency of its occurrence and importance of its effects. It prevails in cold moist climates, and attacks chiefly children between the ages of seven and fourteen, though it is not unfrequently met with both before and after this time of life. The first symptom complained of is generally pain of the knee, which often exists for months before any indication can be perceived of the true seat of the disease. Sooner or later the patient is observed to walk awkwardly, and less vigorously than usual; and when the circumstances on which this difference depends are investigated, it appears that the affected limb is elongated and emaciated—that the convexity of the hip is flattened so that the sulcus between it and the thigh is less distinct and more oblique in its direction—and that in standing, the foot is advanced a little before the other one, with the toe slightly everted, and that the patient does not rest his weight upon it. Pain is now felt in the hip-joint itself, and though aggravated by motion, often becomes more severe from time to time without any such cause of irritation. It is most apt to do so during the night, particularly when the weather is wet and changeable. In this second stage, the disease remains generally several months, and sometimes a year or two. At length the symptoms which have been mentioned either disap-

pear, and the limb recovers its former condition, or they are succeeded by others still more disagreeable. In the latter case the limb becomes considerably shorter than the sound one, its mobility at the same time being much impaired or altogether destroyed, and permanent rotation either inwards or outwards also taking place. Collections of matter now generally make their appearance, most frequently on the outer side of the thigh below the trochanter major, but occasionally in the groin and hip. In some few instances, but very rarely, the fluid of these abscesses is absorbed ; and the ordinary course which it follows is to issue externally through openings formed either by ulceration or artificially by the surgeon. The patient then, after a tedious illness, becomes hectic and dies ; or recovers with a stiff anchylosed joint and a wasted useless limb.

Such being the insidious and destructive progress of the morbus coxarius, it is evidently of much consequence to ascertain the nature and most efficient treatment of the disease. As an opportunity of dissecting the parts in the first and second stages of the morbid process very seldom occurs, being confined to those cases in which the patient dies of some other disease, the origin of the evil is still involved in considerable obscurity. Different authorities accordingly refer it to thickening of the synovial membrane, ulceration of the cartilages, and suppuration of the bones. But though the second of these opinions be the one generally received in this country, there seems good reason for considering the one last mentioned as

nearer the truth. The facts that have been collected by actual examination are in favour of this view, and the symptoms observed externally all lead to the same conclusion. The long existing pain at *distant* parts of the limb, before any trace of disease at the part really affected can be observed, is strongly characteristic of chronic inflammation in the osseous tissue. The freedom of motion without any crepitus, that continues during the second stage, is hardly reconcileable either with ulceration of the cartilage, or thickening of the synovial membrane; and the dissections that have been recorded, in which the bones were always found principally affected, afford a strong proof that they are the original seat of the malady. In the third stage there is unfortunately no want of opportunity for investigation by the knife; but then, as always happens in diseases of the joints which have advanced to suppuration, the whole articular apparatus is so involved in the destructive process, that the part primarily affected cannot be recognized. In three cases which I have dissected at the beginning of the third stage, that is, after suppuration, but before the matter was discharged externally, the articular cartilage was sound everywhere, both on the head of the femur and on the acetabulum, except a small portion not so large as a sixpence at the centre of this cavity, where it was removed, and allowed a probe to pass into or rather through the bone. In one of these cases the synovial membrane was gelatinous, but not to any considerable extent.

The disease may be then regarded as consisting pri-

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marily and essentially in chronic inflammation of the
bones composing the joint, of which the pelvic por-
tion usually suffers alone, or at all events much more
than the femur ; and the practice proper for subduing
it is consequently that which has been found most ef-
ficacious in the treatment of such affections of the arti-
cular apparatus. This is counter-irritation, and though
the various methods of effecting it by blisters, setons,
caustic issues, and moxa, are all occasionally beneficial,
the actual cautery ought always to be preferred as the
most powerful means that can be employed. The
best place for applying it is the hollow between
the trochanter major and tuberosity of the ischium.
Two or three eschars, several inches long, should be
formed here at the distance of an inch from each other.
The patient must be kept perfectly quiet during the
cure, which generally requires several months. He
seldom experiences much benefit until the slough se-
parates, and the ulcerated surface begins to discharge
freely. It ought to be the size of the palm of the
hand at least ; and though considerably larger, need
not be regarded as too extensive. Should there ap-
pear any tendency to heal prematurely, it may be ea-
sily checked by applying some diluted ointment of
cantharides ; and if the sore remains open after the
diseased action seems to be at an end, some astringent
wash, such as the solution of the acetate of lead,
should be applied to promote its cicatrization.
When the disease goes on to suppuration in adults,
the case may be considered nearly hopeless, as caries
then generally ensues; and being seated in a part where

excision cannot be performed, inevitably proves fatal to
the patient sooner or later. In children the chance of re-
covery is much greater, but the limb almost always re-
mains small, rigid, and distorted. When the head of
the femur is little affected, and the ravages of the
disease, as usually happens, are chiefly exerted on the
acetabulum, the thigh is rotated inwards, and presents
nearly the same appearance as that which results from
ordinary dislocation on the ilium. But when the
head of the bone is destroyed by ulceration or inter-
stitial absorption, the various muscles tending to effect
rotation outwards being no longer opposed by the
usual mechanical resistance, draw the limb into nearly
the same position which follows fracture of the neck of
the femur.

Excision of the Joints.

It has been explained in regard to the treatment of
caries, that the only remedy for the diseased action is
removal of the affected portion of bone. In some rare
cases this may be accomplished by destroying the vita-
lity of the part affected, by means of caustics or the ac-
tual cautery, so as to convert the caries into necrosis;
and occasionally the gouge may be employed, with an
equally beneficial, and more speedy effect. But when-
ever the disease has commenced in, or extends into a
joint, or when the means required for its eradication
would necessarily lay open the articular cavity, the
whole articulating surface of the bones must be re-
moved. If this is not done in those cases where the
joint is actually affected, a part of the disease will in

all probability be allowed to remain, as the extent and
irregularity of the articular surface render its com-
plete eradication otherwise hardly practicable.   And
if on any occasion part of the articulation be allowed
to remain, it will almost certainly be induced to take
on the same morbid action, by the irritation consequent
on the operation exciting inflammatory action in a sub-
ject, of whose unhealthy disposition there is evidence
afforded by the occurrence of the original disease.

Amputation has until lately been regarded as al-
most the only means of removing carious joints.
But it is now ascertained that the limb concerned may
often be saved by cutting out merely the articulation.
The softened, discoloured, and ulcerated integuments,
the thickened and indurated cellular substance, and
the gelatinous synovial membrane, are found to af-
ford no serious obstacle to recovery, provided the
whole of the bones, so far as they are actually carious,
or covered by articular cartilage, are taken away.
The operation requisite for this purpose, though se-
vere, is not more dangerous than amputation, because
the joint, previous to its performance, has been open-
ed by disease ; the whole of the articulating tissues
which are apt to suffer violent inflammation when ir-
ritated are either destroyed or removed ; the great
blood-vessels and nerves are not interfered with, and
the patient is not subjected to the shock which is caus-
ed by taking off a limb.

As to the joints which may be subjected to this
operation, it is evident that the extent to which the
acetabulum is almost always affected in the hip-dis-

ease forbids any attempt at excision. Experience has not yet fully decided whether or not the limbs that are preserved by cutting out the knee and ankle joints are preferable to the artificial substitutes which may be worn in their stead. The wrist, from the number of bones, and complexity of articulations entering into its formation, together with the numerous tendons, arteries, and nerves passing over it, does not seem to be within reach of the operation. But the elbow and shoulder-joints, while constructed and situated most favourably for excision, hold out the greatest inducements to effect their removal without performing amputation. In all ranks and circumstances of life, the use of the hand is of great consequence, and though the elbow or shoulder were to remain perfectly stiff and motionless, yet, if the hand could be preserved entire and serviceable by excision of these joints, it would be infinitely preferable to taking away the limb. But it has been proved by numerous facts, that while the joints beyond the disease remain as useful as ever, the one which has undergone the operation regains such a degree of mobility and subjection to its own muscles as sometimes renders it hardly distinguishable from a sound one, and generally prevents it from impeding, by its stiffness, the ordinary actions of the arm. There is no new joint, strictly speaking, formed, but a strong fibrous substance unites the extremities of the bones, and by its flexibility allows them to move within proper bounds; and the muscles cut across in the operation obtain new attachments, so as to perform their usual office.

Shoulder-Joint.—Different methods have been followed in cutting out the shoulder-joint, but it will be sufficient to describe the one which is decidedly most convenient. The patient being seated on a chair, and properly supported, the surgeon introduces a straight, sharp-pointed scalpel, (Plate, I. Fig. 4,) under the acromion, thrusts it down to the head of the humerus, and then cuts perpendicularly and close upon the bone, nearly as far as the attachment of the deltoid. He next carries the knife backwards and upwards from the inferior extremity of the first incision, so as to divide the external part of the deltoid. And having thus formed a flap, he dissects it from the subjacent parts, so as to expose the articulation. In order to detach the head of the humerus, which is of course his first object, he cuts transversely into the joint, introduces the fore-finger of his left hand, and using it as a guide for the knife, separates the attachments of the muscles, which are inserted into the greater and smaller tuberosities. The arm being then drawn across the breast, the head of the bone protrudes through the wound, and being grasped in the hand, may be readily sawed off. The glenoid cavity should next be examined, and taken away as far as seems necessary, which is easily done with the cutting pliers. The whole of the surface covered with cartilage should always be removed, and in general this will be sufficient; but sometimes the caries extends farther into the bone, and in this case must be carefully followed out by the pliers or gouge.

The only artery cut during the operation that re-

quires a ligature is the posterior circumflex. The edges of the wound should be stitched together, and some light dressing having been applied, the arm ought to be supported by a spica bandage and sling.

The patient need not be confined to bed beyond a day or two, or so long as the fever excited by the operation continues ; and when the wound begins to heal, he must assiduously exercise the limb to prevent it from becoming stiff.

Elbow-Joint.—The best mode of performing the excision of the elbow-joint, is that which was originally contrived and practised by Moreau. The patient should lie with his face downwards, so as to present the posterior surface of the joint. The surgeon using the same kind of knife which was recommended for the former operation, makes a transverse incision into the joint, close above the olecranon, and extending from the inner edge of this process to the external tuberosity of the humerus. It is necessary in doing this to be careful to avoid the ulnar nerve, which lies close upon the inner side of the olecranon, and the safest plan is to thrust down the knife perpendicularly into the joint, with its back directed towards the nerve. At each extremity of the transverse cut thus made, the surgeon next makes an incision about an inch and a-half long, both upwards and downwards, in the long direction of the limb, so as to form two square flaps, and give the form of the wound a resemblance to the letter H. These flaps being detached from the parts below them, the olecranon may be easily removed by the saw or pliers, after which no difficulty will be ex-

perienced in cutting the lateral ligaments of the joint, protruding the extremity of the humerus, and sawing it off through the tuberosities. Lower than this would not be sufficient for removing the whole of the cartilaginous surface, and the caries very rarely extends higher up. The head of the radius may next be cut away with the pliers; and then nothing remains to be done but the separation of the portion of the sigmoid cavity of the ulna that was left after the removal of the olecranon. It might be thought better to take away all of the ulna that required excision at once, but the attachment of the *brachiæus internus* to the coronoid process renders this very difficult, especially if it is attempted before the free space afforded by the removal of the other bones is obtained. After the olecranon and the extremities of the humerus and radius are detached, it is extremely easy to cut out with the pliers any more of the ulna that may be required.

It is seldom necessary to tie any arteries; but if a disposition to bleed should be observed when the operation is finished, the vessels ought to be sought for and secured however small, as the hemorrhage when allowed to continue produces very disagreeable effects by distending the wound, separating its edges, and causing great irritation. The wound should be closed with stitches of the interrupted suture, and then a long bandage must be applied in the figure of 8 to support the limb, which should be bent at a right angle, and to prevent the ends of the bones from moving or pressing injuriously on the soft parts. Rigid cases of iron or

wood have been proposed for this purpose, but they
are found to be in all respects less convenient than the
means just mentioned. The patient will find himself
most comfortable in the erect posture; and when the
inflammatory tension consequent upon the operation
begins to subside, he should diligently exercise the
limb so as to preserve the mobility of the elbow. For
farther information on the excision of joints, I beg
to refer to a work which I recently published on the
subject. *

* See a Treatise on the Excision of Diseased Joints. By James Syme,
&c. 8vo. Edinburgh, 1831.

CHAPTER XIII.

MUSCLES.

Injuries of Muscles.

THE muscular tissue is not by any means prone to diseased action, and in general suffers little irritation from the injuries to which it is subjected.

Wounds.—An incision in the long direction of a muscle occasions very little inconvenience, and the wound heals without any remarkable difference from one confined to the integuments. But if the muscular fibres are divided transversely, their contractility causes a separation of the sides of the wound, more or less considerable, according to circumstances. No new muscular substance is ever formed to supply the defect, and it consequently remains permanent, the intermediate space being occupied by a dense fibrous substance. The muscle concerned is for a time rendered weak in action owing to the distance between its points of attachment having been shortened; but it gradually becomes accommodated to the change, and acts with its former vigour.

In order to prevent this separation of the cut extremities as much as possible, the patient should be made to assume such a position as will most effectu-

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ally relax the injured muscles. Sutures would have little effect in counteracting the retractile tendency, and it is not thought right to employ them lest they should excite irritation. Punctured wounds of muscles are frequently followed by diffused inflammation and extensive suppuration; but these effects are to be ascribed to the form of the wound, and the thick fascia which it generally penetrates before reaching the muscle.

Rupture and strains of Muscles by their own action.—The complete rupture of a muscle by the overaction of its own contractile power is an extremely rare occurrence. Instances of it have, however, been observed in the recti muscles of the abdomen and *rectus femoris.* The symptoms are sudden inability to perform the accustomed motions, and a vacuity perceptible on external examination of the part affected. The treatment consists in approximating the ruptured extremities as much as possible by the position of the patient, and bandaging. When the parts become consolidated, the usual power is regained.

Partial rupture of muscles from violent exertion is far from being uncommon. The situation in which it occurs most frequently is the calf of the leg; where the soleus is apt to have some of its fibres torn during violent extension of the ankle-joint. The symptoms are severe pain, inability of using not only the muscle injured, but also those associated with it in action, swelling and ecchymosis of the limb. The treatment consists in maintaining perfect rest, using warm fomentations while the pain continues, and then applying moderate pressure by means of a bandage, together

with discutient lotions or liniments. The cure is more or less tedious according to the extent of the injury; and requires from a few days to many months for its completion.

Strains are not unfrequently occasioned by violent muscular action. The patient suffers severe pain at the injured part, and is unable to perform almost any motion with the affected muscle. In a day or two the pain subsides; but weeks often elapse before the original strength is regained. This accident is most apt to happen in the loins, where the long muscles of the back are subjected to violent exertion in lifting heavy weights, &c. The treatment requires in the first instance repose and warm fomentations. After the pain has ceased, or has lost its intensity, friction with some stimulating liniment, and the support of a flannel bandage, are the best means that can be employed.

Dislocation of a muscle is met with only in the case of the *latissimus dorsi,* and here very rarely. The portion of this muscle which lies over the inferior angle of the scapula and braces it to the chest, seems, especially in weak relaxed individuals, so loosely connected with the bone, that a very slight force would be sufficient to cause its displacement downwards. Such a dislocation does accordingly sometimes happen, but so seldom, that few practitioners have an opportunity of seeing many instances of it. The accident is easily recognized by the projection of the lower extremity of the scapula; particularly when the arm is raised or separated from the side. All attempts to re-

place the muscle in such cases have proved unavailing. And the only remedy that can be advised, is a bandage to press down the bone, and promote the formation of new adhesions between it and the muscle.

Derangements in the Nutritive and Functional Actions of Muscles.

It has already been observed, that the muscular tissue is not disposed to any peculiar morbid action. And though diseases sometimes extend into it from the neighbourhood, there is no part of the body in which alteration of structure so rarely occurs. The carcinomatous and medullary sarcomatous degenerations sooner or later engage every structure that lies near the one in which they originate, and the muscles are not spared. Scrofulous tubercles may occur in every tissue, but are so rarely met with in the substance of muscles, that preparations of them in this situation are considered extremely valuable by collectors of morbid anatomy. Some fibrous tumours have been met with in the substance of muscles, but still more seldom.

Absorption sometimes occurs in muscles so as to occasion an atrophy or wasting of them. This distressing occurrence may be confined to a single muscle, or affect a whole group of them. It is generally induced by some irritation, as that of a blow, or irritating wound. The pricks sustained in dissecting have led to such consequences. There does not seem to be any efficient means of preventing or removing this morbid action when it has commenced.

The functional action of muscles depends very much upon the nervous system ; and derangement of it is to be regarded, in general, rather as symptomatic of changes in the condition of that important system, than indicative of any alteration in the organs with which it is more immediately connected.

It sometimes happens, however, that inordinate disposition to contract, and also in other cases deficiency of contractile power are met with, when the muscles themselves appear to be the seat and cause of the disease. One muscle, or a group of muscles, occasionally contracts with unusual energy, and either without any, or with very imperfect intermissions of relaxation. A permanent deformity or unusual position of part of the body is thus caused, which becomes increased in degree from time to time owing to paroxysms of contraction. These paroxysms are extremely variable in their frequency and duration. They often occur without any assignable cause, but are usually induced or aggravated by irritations, whether of body or mind. The muscles affected in course of time enlarge, and project more than is natural ; they are also the seat of uneasy sensations, and are painful on pressure. This morbid action of the muscles is most frequently met with in the neck, especially in the sterno-mastoid. It then occasions one kind of wry neck ; the head being turned habitually to the opposite side.

The treatment of this disease consists in removing all sources of irritation, whether direct or indirect, that may be discovered to be in operation. The state

of the various secretions ought to be carefully inquired into, and rectified if deranged. Leeches, warm fomentations, and anodyne liniments should be applied over the seat of the disease. If these means fail, blisters and acupuncturation may be tried. And in the event of the patient remaining unrelieved, a transverse division of the muscle may be performed. This operation has sometimes succeeded, but more frequently failed, and should therefore be recommended merely as a last resource which may do good, and cannot be productive of much harm, as it is extremely simple, and not painful, or likely to cause much irritation.

Single muscles, or groups of muscles, are more frequently met with in the opposite state to that which has just been described, their power of contracting being much diminished or altogether lost. The muscles of the fore-arm are most subject to this affection, and they suffer from it variously, both as to degree and extent. Sometimes it is in the flexors alone, at others the extensors, and in some cases, all of them together which lose the power of action. There is seldom any pain complained of, but the limb is generally more or less cold and numb, though these symptoms may be entirely wanting, while the loss of power is complete. The cause of this condition is sometimes a blow, when the cure is usually tedious and imperfect. All that can be done is to use fomentations, frictions, and persevering attempts to exercise the muscles. The causes more frequently concerned are exposure to cold and long-continued pressure, and both of these often seem to be conjoined in producing the

effect ; as the most common history of the disease is, that the patient fell asleep in the open air, or in some unusual situation, and rested his head on one arm. In such cases, the cure is in general readily accomplished by applying a succession of blisters along the course of the affected muscles.

CHAP. XIV.

TENDONS.

Injuries of the Tendons.

Wounds.—Tendons are sometimes divided by cut-ting-instruments, the immediate consequence of which is loss of power of the muscles concerned. It was for-merly the custom to sew the cut extremities of the tendon together; but this practice is now entirely abandoned, and the only means employed in addition to those which the wound of the integuments requires, consists in careful attention to the position of the limb, in order to relax the muscle connected with the in-jured tendon, and prevent as much as possible the separation of the cut extremities. When the tendon is of a large size, such as the *tendo Achillis,* lateral compresses are useful in keeping the surfaces opposed to each other. It is ascertained that though the ex-tremities remain considerably distant, they are still united together through the medium of a new formed substance, the result of an interstitial process of repro-duction. This part is sometimes thinner, sometimes thicker than the original tendon, but always incon-venient by causing relaxation of the muscle, and con-sequent diminution in the effect of its contractile power.

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The surgeon, therefore, should do every thing in his power to render the bond of union as short as possible.

Rupture.—Tendons may be torn either by external violence, or inordinate contraction of their own muscles. In the former case they are most apt to give way where the muscular fibres are attached to them, and it not unfrequently happens that the tendons of the penniform muscles of the thumb or wrist are drawn out to the extent of five or six inches. It might be expected that great irritation and diffused inflammation would result from such injuries, but the wound in general heals kindly, as if not complicated with any unusual peculiarity. It is a prudent precaution, however, to oppose the commencement of inflammation by using cold applications in the first instance ; and if it should occur, incisions, together with warm fomentations, if the symptoms are violent, and the latter means alone if they are moderate will be proper. When suppuration is established, compression along the course of the sinus, stimulating washes, and bandaging are required.

Tendons are more frequently ruptured by the too energetic action of their muscles. The tendo Achillis is most liable to this accident, and indeed, with the exception of the tendon of the extensors of the thigh, is almost the only situation in which it occurs. It has been supposed that the filamentous tendon of the plantaris may be ruptured without a corresponding injury of the great tendon of the ankle, and that such is the case where patients suddenly after exer-

tion lose the power of extending the foot, while no vacuity can be felt in the course of the tendo Achillis. There can be no doubt that on such occasions the injury sustained is rupture of the muscular fibres, probably of the soleus. It is difficult to conceive that the loss of so small a power as that of the plantaris muscle should render the patient unable to move the ankle, and the pain, discoloration, and tedious recovery which are usually observed to attend cases of the kind in question, are additional grounds for believing that the injury is seated in the muscular tissue.

The *tendo Achillis* is usually ruptured in consequence of some violent exertion in raising the body or preventing it from falling. The patient feels a sensation as if struck with a blunt weapon. It seems to him that his heel has sunk into a hole, and a noise as of a cord giving way is occasionally heard, both by him and the bystanders. When the limb is examined, a hollow may be felt at the part where the tendon is torn, owing to the retraction of its extremities. The patient retains the power of extending the foot slightly when there is no resistance except its own weight, but cannot do so with any considerable force, such as is required in walking. Strong adult males are most subject to this accident.

The treatment consists in bending the knee, and extending the ankle so as to relax the gastrocnemius as much as possible, applying lateral compresses at the injured part to keep the ends of the tendon in proper position, and supporting the limb with a bandage. Va-

rious contrivances have been employed to maintain the requisite posture. Of these the slipper and calf-piece of Monro *primus* are usually regarded as constituting the most effective apparatus for the purpose.

The calf-piece Dr Monro likens to the article of dress which jockeys wear to connect their breeches with short boots, differing only in so far that it is made to lace on instead of being buttoned. By means of a strap and buckle, the heel of the slipper can be drawn up and secured, so as to effect permanent extension of the ankle. Petit used a similar apparatus, which had the advantage of keeping the knee bent, as well as the foot extended, as the upper point of attachment was placed above the knee by means of a circular collar with a ring below. The most simple, and also perhaps most effectual method, is, after having applied lateral compresses at each side of the tendon, and a few turns of a roller to keep them from moving, to fasten another bandage longitudinally on the posterior surface of the limb, from a little above the knee to the hollow of the foot, by means of a roller put on in the usual manner for treating ulcers of the leg ; and then the two ends of the longitudinal bandage can be drawn together, and tied with the requisite degree of tightness. In the course of three or four weeks the reunion is completed ; but it does not become strong enough to resist much force until a considerably longer period has elapsed, wherefore the patient should be cautious in using the limb, and as a precaution against straining the tendon, wear a high-heeled shoe.

Inflammation and Sloughing of Tendons.

The tendons, their fibrous sheaths, and also the fasciæ which lie over them, are very readily deprived of vitality by inflammation. This occurrence most frequently happens in the fingers and palm of the hand in what is called Paronychia. By this term is understood an intense inflammation, generally confined to one finger, but sometimes affecting several, and extending into the palm of the hand, to which also it is occasionally limited. Though the swelling is generally on both sides, the principal seat of disease is almost always confined to the palmar aspect. The pain is agonizing, the tension great, and the redness of the skin affected very bright. The inflammation extends to various depths, and leads to consequences of corresponding importance. Sometimes there is merely a collection of matter found under the thick skin of the part affected. More frequently, in addition to this, there is more or less sloughing of the tendinous structure, and not rarely death of the phalanges. The causes of paronychia are generally local irritations, but it is probably necessary that their effect should be favoured by a state of the system predisposing to derangement. The only effectual treatment consists in making a free incision through the tense and swollen parts. There is reason to believe, that if this were done soon enough it would generally prevent the subsequent suppuration and sloughing ; but the opportunity of interposing thus early is seldom afforded, and the incision is usually practised to eva-

cuate matter.   Much mischief is often done by con-
tinued poulticing in such cases.   Under this influ-
ence the matter is long of making its escape by ulcera-
tive absorption, and the opening, when at last form-
ed, is always too small for allowing free exit either
to it or the tendinous sloughs.   The irritation, there-
fore, is kept up, especially by the retained sloughs of
the tendons, and the destruction of the tissues proceeds.
There is no advantage in poulticing previous to inci-
sion, and though useful for a day or two afterwards
in promoting the separation of the matter and sloughs,
it ought not to be persisted in longer than this, as sti-
mulating lotions or liniments with pressure are much
more beneficial.   When the tendons slough so ex-
tensively as to render the finger rigid and useless, am-
putation is the most prudent course ; but the patient
must decide upon it after being made fully acquainted
with the reasons for its performance.   The distal pha-
lanx often dies, along with a portion of the tendon,
but the extremity of the finger ought not to be remov-
ed on this account, as it is of great consequence to pre-
serve the secreting organ of the nail, which renders the
finger, though shortened, little less useful, or seemly
than it was before.

Ganglion.

By Ganglion is understood a tumour connected
with a tendon, composed of a bag containing glairy
substance, and varying in size from that of a pea to
that of a pigeon's egg.   There is a difference of opi-
nion as to the nature of ganglions, the question being

whether they are entirely new formations, or merely developements of the natural serous structure connected with the tendons. Though arguments might be adduced to support the former of these opinions, it seems on the whole more reasonable to adopt the latter.

The bags vary greatly in thickness, and their contents are no less dissimilar in respect of consistence, being sometimes perfectly watery, but in general gelatinous. The disease occurs most frequently at the wrist and ankle, the extensor tendons being generally affected in the former, and always in the latter situation. Females are more liable to it than males. It seldom produces inconvenience, except from the deformity which it occasions, but sometimes the patient complains of weakness in the limb. It is generally referred to blows or strains, but there is nothing certainly known as to the causes of its production.

The most simple and effectual mode of treatment is to rupture the bag by pressure applied externally, and force its contents into the surrounding cellular texture. For this purpose some recommend that the ganglion should be struck a smart blow with a book or similar body ; but this is a violent and uncertain method, and it is much better to exert a steady pressure on the tumour by means of the two thumbs acting in concert. To promote absorption, a compress and bandage should be applied for some days after the operation. If it should be found impossible to rupture the bag, owing to its strength, the best plan is that

recommended some years ago by Dr Cumin of Glasgow, which is to introduce a narrow sharp-edged instrument obliquely through the skin, and open the sac, after which its contents may be squeezed into the cellular substance, so as to complete the cure in the same manner as when the rupture is effected by pressure. The instrument used for this purpose may be a common surgical needle, or a couching-needle, or, what answers best of all, the small knife used for cutting the iris in making artificial pupil. When the sac is very thick, and constitutes a swelling after its contents have been discharged, a blister ought to be applied, after which iodine ointment and pressure on the raw surface soon induces absorption of the morbid structure. Such being the different methods of treatment which will be found most effectual, and sufficient for the remedy of the disease in all its forms, it would be useless to detail the other measures which have been recommended, and are still occasionally employed. Of these continued pressure, effected by means of a piece of money or similar solid compress fastened over the swelling, repeated blistering, inunction of tartrate of antimony ointment, seton, incision, and excision, are the most deserving of notice, but for the reason mentioned need not be more particularly considered.

Bursæ Mucosæ.

The *Bursæ Mucosæ*, like other serous structures, are subject to dropsical effusion. The exciting cause is usually some local irritation ; but its effect in producing

the disease seems in general referable to a predisposi-
tion of the system, depending on weakness or some
peculiarity of constitution. If the membrane is mere-
ly distended, and does not suffer any thickening or
alteration of structure, blistering, succeeded by pres-
sure, readily induces absorption of the fluid. If the
sac is thick and indurated, these means often prove
insufficient, and it is found necessary to puncture the
swelling, so as to let its contents escape, after which,
a blister having been applied, the raw surface is dres-
sed with iodine and camphorated mercurial ointment,
pressure being effected at the same time, and under
this treatment a radical cure is accomplished. Some-
times, along with the fluid, the sac contains a number
of loose bodies, occasionally quite similar in all re-
spects to the moveable cartilages found in joints, but
more frequently of a less distinctly organized struc-
ture, appearing to consist merely of indurated lymph.
They are of a yellow or brownish colour, tough con-
sistence, and variable size, from that of a millet-seed
to that of a field bean. It is obviously necessary that
in such cases the puncture must be large enough to
let the foreign bodies, as they may be regarded, es-
cape, after which the treatment ought to be conduct-
ed on the principles already explained; and if it
should be found impossible to subdue the disease by
more mild measures, the opening into the sac must be
dilated, caustic applied to its surface, and obliteration
of the cavity by granulation thus induced. The lymph
which is effused from the inner surface of the bursa
sometimes becomes organized in the form of thick

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bands stretching across the cavity. In such cases, after the means for producing absorption have been tried and failed, and the patient insists upon having the disease removed, there is no remedy except incision into the sac, and removal of the morbid structure.

Bursæ, whether in a sound state or one of chronic disease, are subject to acute inflammation in consequence of local irritation, especially that of bruises. The symptoms are severe pain, aggravated by pressure or motion, bright redness of the superjacent skin, and more or less swelling. The inflammation usually terminates either in resolution or effusion of lymph or serum, but sometimes goes on to suppuration. The surrounding cellular substance then also becomes inflamed, and a diffused abscess is the result. Leeches, warm fomentations, and lotions of acetate of lead with opium, are the best means for subduing the inflammatory action, but when matter is formed, a free incision should be made without delay. After the suppuration of a bursa a troublesome sinus remains, and the patient is harassed by frequent exacerbation of the symptoms. Free dilatation is for the most part sufficient in such cases; but should it not prove to be so, the surface of the cavity must be touched with caustic.

The particular bursæ which most frequently suffer the different diseased conditions that have been described are those of the flexor tendons of the fingers, and those seated over the olecranon, patella, and ball of the great toe. In the first of these situations the bursal sheath of the tendons is liable to dropsical ef-

fusion and the formation of solid bodies by the induration of lymph; the wrist and palm of the hand become greatly distended, and the patient loses the use of the limb until the disease is remedied. The superficial bursa lying over the olecranon is subject to irritation and acute inflammation from blows, but not unfrequently suffers an accumulation of fluid with thickening of the membrane, and sometimes also with the formation of internal crossing bands from organization of effused lymph. The bursa over the patella is very often distended with fluid, and thickened so as to constitute what is called ganglion of the knee. It is met with most frequently in persons whose occupation leads them often to rest their weight upon the knee. The bursa over the ball of the great toe, when irritated by the pressure of a tight shoe, lays the foundation of that painful and unseemly swelling named Bunion. The parts adjacent become thickened and indurated ; the bones of the joint enlarge, and in process of time suffer a sort of subluxation ; and the bursa being thus projected more and more against the shoe, is kept in a state of continual excitement. Dropsical effusion, thickening of the membrane, and suppuration with obstinate sinuses generally ensue. It is therefore proper by the timely application of leeches, &c. and the removal of pressure, to subdue the disease in its infancy.

EXPLANATION OF THE PLATE.

Fig. I. A knife for opening abscesses.

Fig. II. Aneurism-needle.

Fig. III. Front view of the same, to show its breadth, and
     the position of the hole.

Fig. V. Scalpel for amputating fingers and toes, and perform-
     ing excision of the joints.

Fig. VI. Small-sized amputating knife, $4\frac{1}{2}$ inches long.

Fig. VII. Larger do. $6\frac{1}{2}$ inches long.

Fig. VIII. Full-sized do. 8 inches long.

PLATE I.

PLATE I.