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A

TREATISE

ON

INFLAMMATION.

BY JAMES MACARTNEY, M.D.

F.R.S., F.L.S., M.R.I.A., F.S.S.L.,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, LONDON; HONORARY FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS IN IRELAND;
FOREIGN ASSOCIATE OF THE ROYAL ACADEMY OF MEDICINE, PARIS;
HONORARY MEMBER OF THE LITERARY AND PHILOSOPHICAL SOCIETY OF NEW YORK;
HON. MEMBER OF THE BRITISH PROVINCIAL MEDICAL ASSOCIATION;
PROFESSOR OF ANAT. TO THE ROYAL HIBERNIAN ACADEMY OF PAINTING, SCULPTURE, ETC., ETC., ETC.

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TO

W. F. EDWARDS, M.D.,

MEMBER OF THE ROYAL INSTITUTE OF FRANCE, F.R.S.,

ETC., ETC.,

A MAN ALIKE DISTINGUISHED FOR TALENTS OF THE HIGHEST ORDER,

AN ARDENT DEVOTION

TO THE CULTIVATION OF MORAL AND PHYSIOLOGICAL SCIENCE,

AND AN UNBENDING INTEGRITY,

THIS TREATISE

IS DEDICATED

BY HIS SINCERE FRIEND,

JAMES MACARTNEY.

TREATISE

ON

INFLAMMATION.

HISTORY OF INFLAMMATION.

THERE is no reason for believing that a process of the same nature of inflammation, exists under any circumstances in the vegetable kingdom. When *plants* are injured, or have a part of their substance destroyed, there is no new process of reparation set up, but the vacancy is filled by the regular and natural growth of the vegetable body. Thus when the wood of a tree is laid bare by an accidental injury, it is covered in by the annual deposit of the cambium or organizing substance, which is shed at the same time, and in the same manner, from the inner layer of the bark, as on every other part of the tree. The formation of galls and other excrescences on the leaves of plants, produced by the punctures for the insertion of the ova of insects, bears some resemblance to the effects of inflammation in animals: it is, however, only an exuberant growth.

Animals that have no visible nerves, and those in whom the nervous system is very simple, exhibit none of the phenomena of inflammation. In *polyps* and other *gemmiparous* animals, incision and division, instead of acting as an injury, constitute one of the means for multiplying the species, in the same manner as the slips and cuttings of plants serve for propagation. The grey and green polyps have been united together, it is said by Blumenbach, so as to constitute one animal. This operation is similar to the incorporation of different kinds of plants by the process of engrafting.

When *worms* are cut into two portions, the divided surfaces assume the disposition to heal, from the moment the injury is inflicted. The edges of the wound approximate each other, and remain in close contact until they are perfectly healed, after which they recede to restore the tubular form of the animal. The healing is a very brief process. In this class of animals we observe some very remarkable instances of reparative power. In the *planariæ*, the worm may

be multiplied by cutting it into several pieces, each section forming a new individual. Dugès divided one of those animals longitudinally through the head and anterior part of the body, and each division developed a perfect head. The *nereides* and the *nais variegata* are described also as being capable of propagation by being cut transversely into two or more portions. It has been likewise asserted, that if the *common earth-worm* be divided into two parts, each will become a perfect individual. On repeating this experiment, however, I have found that the anterior half only reproduced the perfect worm.

It does not appear that *insects* are susceptible of inflammation after injuries. It is not known in what manner the poison generated by certain species of insects affects others of the same class; but it is quite certain that it does not cause inflammation as in quadrupeds and the human subject. When the spider inflicts a wound on a fly, it is usually instantaneously fatal; but when a sufficient quantity of the poison is not inserted into the wound, it stupifies the insect, producing the effect of a vegetable narcotic poison. In this class of animals we meet with some curious examples of the reproduction of parts of the body. Thus, if a *crab* or *lobster* have one of its limbs torn off, the broken surface speedily heals without any appearance of inflammation, after which a new limb usually is seen to sprout out, commencing as a bud or germ, and proceeding to grow until it acquires the shape, structure, and magnitude of the original member. Heineiken states that the *arachnida*, when young, can reproduce their legs, but when fully developed, cannot do so. The age of insects seems to have great influence over their reproductive power. When the antennæ are removed in the larvæ, they grow again, but not in the perfect insect. The *phasmæ*, while larvæ, but not afterwards, are able to reproduce their legs.

The class *mollusca* do not seem to be capable of genuine inflammation. In some of the *testaceous mollusca*, as the *oyster* and *muscle*, we often find that some parts of the body may die and putrefy, yet remain in connexion with the rest, and apparently not affect it. The presence of an extraneous body will produce an exuberant growth of the shell. The production of pearls is usually the effect of the presence of a small worm which lies behind the membrane that lines and secretes the shell, and probably deposits its ova there. A pearly formation may be also produced by a wound of the membrane of the shell and by placing a piece of wire in the whole. In short, the presence of any extraneous matter causes a greater flow of the juice of which the shell is composed, and thus the growth of pearls is perfectly similar to the excrescence of plants caused by the gall insect. The reproductive power of some mollusca is very considerable; the head of the *snail* may be cut off, and provided the ganglion, which lies above the œsophagus, and which is analogous to the brain, has not been injured, the loss is repaired by a new growth. Schweigger says, that the experiment will not succeed in a cold temperature.

In neither of the two classes of vertebrate animals with cold blood, do I believe it is possible to produce the genuine effects of inflammation. In conducting some experiments on the swimming bag of *fishes*, I was surprised to find that the wounds made into the belly of the animals did not inflame. I was therefore curious to know what injuries fishes would bear without producing inflammation. Having taken some living fishes from the water, I introduced pieces of wire beneath the skin and amongst the muscles of the body; the fishes were then returned to the water, and on examining them several days afterwards, I found that no suppuration had taken place. The tracts of the wound were pale and smooth, and only moistened with a serous fluid, and none of the usual appearances of inflammation were visible. A very common occurrence in fishes, is the existence of worms, which perforate the tunics of the alimentary canal, without producing any change of structure, except an increased vascularity around the perforations. The productive power of fishes is confined to their fins, which are sometimes regenerated after being lost by accident, or by a species of death which is quite different from that which is the consequence of inflammation in the higher class of animals.

I have never seen any appearance of inflammation in *reptiles* after wounds or injuries. *Serpents* often lose a portion of their tail; and although there is no attempt made for its reproduction, it is very speedily cicatrized without inflammation. Some *lizzards* are able to reproduce parts that are lost, though not so perfectly as in the lower classes of animals. When lizzards get a new tail, it wants the vertebræ. The *salamander* has more power of reproduction than any other of the class, being capable, according to the statement of many physiologists, of regenerating the tail, the limbs, and the lower jaw. I have seen imperfect attempts at the reproduction of the fingers and toes in the *toad* and *frog*. In all this class of animals, there is great tenacity of life, and power of repairing the effects of injury, though not always the ability of regenerating limbs. Having had occasion to make the experiment of removing a part of the brain of a *toad*, it became necessary to take away a considerable portion of the skull. The wound never seemed to inflame. In a very short time it was healed, and the vacancy in the skull was made up by a substance half cartilage and half bone, leaving, however, a depression corresponding to the quantity of brain removed.

In the class of *birds* we first discover the existence of genuine inflammation as the consequence of external mechanic injury; but the instances in which internal disorders become a cause of inflammation, are very limited, and are nearly confined to febrile states and particular epidemics.

Quadrupeds are subject to inflammation both from external injury and internal disorders; they usually, however, show but little constitutional sympathy with local disease. A dog or a horse will continue to eat, although suffering from an accident or a disease that may prove fatal.

The human being, above all others, is disposed to inflammation, sometimes in consequence of the slightest external irritation, and of various internal disorders. The nervous system of the human subject is so complicated, that there is hardly a local affection with which the constitution does not sympathize, nor any constitutional disturbance which may not become the cause of local disease. The same susceptibility, however, communicates a power to the means we may employ for preventing or abating inflammatory action, which does not belong to animals of an inferior organization; and when by those means we are enabled to remove the sense of injury sustained, or produce a state of sensibility inconsistent with inflammation, the reparative processes go on much in the same manner as in animals endowed with an inferior degree of feeling.

The history I have given of the effects of injury in the different classes of animals, proves that the powers of reparation and of reproduction are in proportion to the indisposition or incapacity for inflammation, and leads necessarily to the induction, that inflammation is so far from being necessary to the reparation of parts, that in proportion as it exists the latter is impeded, retarded, or prevented, and that when inflammation does not exist, the reparative power is equivalent to the original tendency to produce and maintain organic form and structure; that it then becomes a natural function, like the growth of the individual or the reproduction of the species. I am aware that this opinion is opposed to universally received doctrines. The subject, I think, has never been fairly examined. The necessity of some degree of inflammation to the process of reparation has been supposed by the early surgeons, and has been received by the moderns without inquiry. The opinion arose in those rude ages of the art when nothing was trusted to nature, and when the treatment of every wound was such as to induce and maintain for a certain time the most severe inflammation. The ignorance of the ancients of the use of the ligature for suppressing hemorrhage, led them to employ, instead of it, strong compression, and the actual cautery in cases of wounds and after amputation; and being accustomed to see wounds ultimately heal after such barbarous treatment, they naturally supposed that inflammation and all its evil consequences were necessary; which they took care to ensure in all cases, by boiling oils, hot and irritating ointments, tents, setons, and strict and cumbrous bandages.

Mr. Hunter, in his inestimable work on inflammation, when describing the union by what is called the first intention, seemed aware of the possibility of wounds healing without any inflammatory action; he says the union in such cases is without pain or constitutional disturbance, "proceeds as if nothing had happened." In another place he says, "There is only a feeling of tenderness in the part, and that is entirely from the injury done, and not from the operation of union." In treating of the same subject, he further says, that inflammation comes on as a necessary consequence of "parts being too weak to unite by the first intention, or not having

the power and disposition to heal." It is true, there are many other passages in Mr. Hunter's work, which are in favour of the doctrine of inflammation, being within certain limits a sanative action, and terms which he unhappily employed of *adhesive*, *suppurative*, and the *ulcerative inflammations*, have misled those who have not studied and compared the different parts of his book with sufficient care and attention. The consequence has therefore been, that Mr. Hunter has been quoted as an authority for opinions, directly at variance with those principles of physiology which it was the great object of his life to establish. If he had lived long enough to revise and republish his Treatise on Inflammation, he would, doubtless, have divested it of many of its errors and contradictions, and in making the different parts consistent with each other, he would have been compelled to deny the necessity of the process of inflammation to the healing of any wound. His treatise, however, notwithstanding the obscurity which attends many of his deductions from the facts he observed, and the unsuitability of many of the terms employed, is a rich and deep mine of pathological science, which we cannot hope to see rivalled by the labours of any future writer.

I have said that the received opinion of the present day, both in these countries and on the Continent, is that some degree of inflammation is required, even for the union of the simplest wound. The practice of British surgeons is often the opposite to what such an opinion would dictate; but most of the Continental surgeons act in conformity with it, as they will not suffer any wound to heal until it has gone through the processes of inflammation, suppuration, and granulation. The doctrine has been avowed by Sir Astley Cooper in the strongest language, in his Lectures on Surgery, published by Mr. Tyrrell. The passage may be taken, as expressing the general opinion of the profession in this country on the question. He says: "*Inflammation is a restorative process; no wound can be repaired without it; even the little puncture made by the lancet in bleeding, would inevitably destroy life, if this salutary process did not prevent it.*"

I am well pleased, that the doctrine has thus been so clearly and unequivocally asserted, that no doubt can exist respecting the meaning of the author. It is also fortunate, that Sir Astley has selected the wound made in venesection as his example; as I shall afterwards have occasion to quote the healing of this wound as one of the strongest and most familiar instances of union being effected without the slightest inflammation. The public will now have the opportunity of drawing their own conclusions, with respect to two opposite theories, founded on the same facts; for I presume there can be no difference of opinion, with regard to the actual phenomena which attend the healing of the wound after bleeding with the lancet.

PHENOMENA OF INFLAMMATION.

These are denominated *heat, redness, tumour*, and *pain;* to which should be added, an *alteration* or *suspension* of the *natural secretions of the part.*

The increased temperature of inflamed parts, is the circumstance which must have attracted the chief attention of the first observers, as it gave origin to the application of the term inflammation, or burning. The redness also being the natural accompaniment of combustion, contributed, no doubt, to the idea on which the name has been bestowed.

It has been ascertained, that the heat evolved during inflammation, is less than was originally supposed. According to the experiments of Hunter and others, the heat of an external part of the body, when inflamed, never exceeds the degree of heat which constitutes the natural standard of the interior parts. When inflammation exists in any of the internal cavities, however, their heat is proportionably elevated.

It is impossible to account for the increased heat of inflamed parts, in a manner that would be quite satisfactory, as the present extent of knowledge respecting the nature of heat as a general property of bodies, is unsettled; and as the mode in which the heat of living bodies is produced or evolved, is, notwithstanding the numerous experiments made on the subject. still not clearly understood. Every year's experience continues to add strength to the opinion, that neither light nor heat are material substances, but are the result of some species of movement; a doctrine which the phenomena attending the evolution of heat and light by living animals, would seem almost to confirm. If the matter of heat were acquired in the act of respiration, and afterwards diffused throughout the body, the quantity thus gained must be fixed, we must suppose, within certain limits: the following fact, in conjunction with many others, however, shows that the power of the living system for generating heat is unlimited. In the intense frost of the winter of 1805, I found a clustre of the *larvæ* of the *musca pendula* enclosed in a mass of ice, in which situation they must have remained for several weeks, from the duration of the frost. I was surprised to find that they were not congealed; a thermometer was applied to their surface, it sunk to 32°; the atmosphere at the time was 30.° On the worms being removed, and placed on the hand, they soon began to move. During the time that they were enclosed in the ice, their respiration must have been completely suspended, and it is obvious, that if they had resisted congelation by the evolution of caloric, the quantity expended during the period that they were surrounded by the ice must have been immense, and must have far exceeded the quantity of caloric that could have resided in creatures so small in a latent state.

The experiments of Sir Benjamin Brodie have proved, that the effect of respiration is to cause the departure of animal heat, when the influence of the brain is removed. I arrived at the conclusion long ago, by a different train of experiments, that the heat of animals was not dependent on respiration; and proved that vital temperature is preserved under circumstances where the function of respiration has not yet commenced. Thus, I have found that the fœtus of quadrupeds and of birds, possess the power of resisting external temperature, either higher or lower than that proper to themselves, by some degrees; even if the animal be enclosed in fixed air, and its blood in consequence of a deep purple colour, it preserves its independent temperature. It is a fact well known, that the fœtus possesses a lower temperature than the parent, and that when it dies, it acquires the heat of the mother's body.

The above facts, to which many more might be added, and the changes that take place in the temperature under various states of impression or excitement, would lead us to look on animal heat, as one of the phenomena of sensibility. Thus, we find the heat is increased in all cases where the vital powers are excited or called forth in any unusual degree. When *bees* are swarming, their heat is augmented so much as to produce a sensible warmth to the human hand. During incubation, the heat of the *hen's* breast is raised to 104 degrees, although it is divested of the covering of feathers. Hope, joy, and anger exalt the temperature of the body, while all the depressing passions reduce it.

In all cases where the nervous system is complicated, it seems to exert a continual influence on the vital temperature. If the principal nerve of an extremity be divided, the member becomes instantly three, four, or five degrees hotter than it was before. Injuries to the spinal marrow augment the heat of the posterior extremities several degrees. I divided the spinal marrow in a young dog in the middle of the back, when the paws of the posterior limbs became immediately so hot, as to yield a sensible heat to the human hand, and formed a very remarkable contrast with the fore-paws, which according to our sensations always feel cold. I am aware that an opposite result has been stated to occur from a similar experiment, but this was performed in the presence of a large class, and there could be no doubt of its accuracy.

It may be questioned whether, if instead of cutting the spinal marrow, the nerves distributed to the arteries could have possibly been divided, the temperature would not have fallen. I believe such would have been the effect. The arteries would probably have gone into the state of collapse, as in the cold stage of ague. The vessels of the surfaces of the body are immediately concerned in cholera, and I understand in this disease, when the thermometer is applied to the tongue, it sinks to between 70° and 80°. It appears that it is the partial subtraction of the nervous influence, which causes the extraordinary changes of vital temperature. Thus, in death from apoplexy, it has been often found, that the natural heat

has been retained for many hours longer, than it usually is after death from other causes. A case has been related to me, of death by injury to the spinal marrow near the head, in which the heat of the body rose as many as twelve degrees (if I recollect right) above the natural standard.

The facts respecting the unusual indications of animal heat, would seem at first to contradict each other; but, like many other apparently inconsistent phenomena of the living system, they may be reconciled on a closer inquiry. In those cases where the temperature is raised by exciting passions or instincts, it is because these excitements act on the organic sensibility; and on the other hand, where the influence of the individuality of the nervous system is destroyed, by division of the spinal marrow or trunks of nerves, the organic actions are liberated from the restraints, under which they are carried on as long as the integrity of the nervous system is preserved. Many organic actions become more distinct and striking on the cessation of individual life. The heart will continue to beat longer in the dead body, or even when taken out, than it will when removed from the living body.

I once had occasion to open the abdomen of an animal while it was alive. Some gentlemen present observed, that the vermicular motion of the intestines did not appear as it usually does, when the parts are exposed to the cold air after death. I foretold that on putting an end to the individual life, we should see the intestines begin to crawl, which they did with great activity, as soon as the animal was killed. Upon a subsequent occasion, on opening the body of a man, three hours after death, some alarm was felt on observing the vermicular movement of the intestines going on; but I was enabled to assure the persons present, that what they saw was the best evidence of individual life having terminated; which assertion was proved, by the morbid appearances that were discovered.

I may add, that the motions we observe in the intestines are neither natural nor regular. If the alimentary canal were to move in the same manner during life, the contents would not pass, and colic would be produced. The movements, that we see immediately after death, are in some respects analogous to the convulsions of the voluntary muscles, when set free from the restraint of the nervous system.

It is difficult to decide how far the increased heat of inflamed parts depends on the higher degree of sensibility, or on the state of circulation and impeded secretions; since we find, that the temperature is most augmented when inflammation affects those tissues that are the seat of active circulation and secretion. The inflammation of bones, tendons, and ligaments, which receive in a natural state few blood-vessels, and which furnish no secretions, is attended with very little increase of temperature, while the skin and mucous surfaces have their heat greatly exalted during inflammation. It should nevertheless be considered, that these surfaces are most

richly supplied with nerves, as well as blood-vessels. From finding, however, that the heat of animals keeps pace with their sensitive powers; that it is augmented by excitement, and diminished by causes which depress the other sensitive powers, I am disposed to ascribe the increased heat of inflamed parts, more to their state of local or organic sensibility, than to the condition of their arteries, as regards circulation or secretion.

The *redness* of inflamed parts is easily accounted for; the arteries which only carry the colourless parts of the blood or the serum, becoming under inflammation so much dilated, that they admit the red blood. The opportunity of discovering this fact occurs in the inflammations of any of the naturally transparent membranes, as the pleura, peritoneum, &c., on which we may count the vessels that produce together the red colour of these membranes, when inflamed. One of the most instructive examples is the inflammation of the transparent cornea, in which the red vessels are very distinct.

The degree of redness from inflammations equally severe, varies in different tissues according to the natural supply of red blood which such tissues receive, and likewise on the disposition of their blood-vessels to dilate under excitement. The vessels of the skin are peculiarly numerous and excitable; and, therefore, when it is inflamed, the redness has a painted or stained appearance, the vessels being so much crowded together, that they are not distinguishable from each other. The same is found on the mucous membrane. When that part of the arachnoid coat, which loosely covers the brain is inflamed, no red vessels are visible, while there can be little doubt, that red blood enters the vessels of the arachnoid, where it lines and is incorporated with the dura mater. The redness of inflammation, is therefore a circumstance, depending, in a certain degree, on the original circulation and structure of the part.

The kind of redness is also determined by the nature of the affection, and the state of the circulating vessels in the inflamed part. Thus, in genuine erysipelas there is so little impediment to the passage of the arterial blood into the veins, that gives the skin a bright or scarlet colour. Several other inflammations of the skin, as scarletina, rose-rash, herpes, &c., are distinguished by their bright colour; and, indeed, most inflammations of the skin, which do not involve the cellular substance underneath, assume more or less the colour of arterial blood. In these instances where inflammation is attended with much tumefaction, or hardness, the colour is more or less purple, or that of venous blood; because, under such circumstances, the circulation is impeded, and, consequently, the blood longer detained, and thereby rendered venous, although still moving in the arteries. The purple colour is very remarkable in many scrofulous inflammations and tumours, in which the circulation is languid.

It is difficult to explain the dusky-brown colour, which is observed in the spots of measles, syphilitic blotches, in carbuncle, etc. It is

probable that it arises from the intimacy of contact between the true skin and its insensible coverings being disturbed, as in all brown-coloured inflammations the cuticle and rete mucosum are disposed to scale off.

The *tumour* of inflamed parts is in very various degrees, according to the causes which give rise to it. A slight swelling or tumefaction is the consequence of the vessels containing more blood than they admit in a natural state; and this kind of tumour is much increased by the part being placed in a depending position, or in other circumstances which would impede the return of blood, or the freedom of the circulation in the part; but the species of tumour which attracts most attention, is occasioned by an effusion into the cellular substance of some of the elements of the blood, or of the blood itself, or of pus.

These different effusions mark, however, the kind, degree, and stage of the inflammation, and should therefore be considered under the head of *Consequences*, rather than be arranged amongst the immediate and necessary phenomena of inflammation.

The *pain* is more difficult to explain than any of the other phenomena of inflammation. It has been sometimes ascribed to mechanic causes, such as the distention of the vessels, the pressure of the tumour, tension from the presence of pus, etc. It is true all these circumstances aggravate the pain, but they do not produce it; for, the same degree of pressure or tension would not cause any pain in parts not inflamed.

We might be tempted to suppose that the nerves in the inflamed part acquired their peculiar sensibility, in consequence of the additional number of minute vessels carrying red blood, since we observe that the faculty of sensation is so much influenced in all cases, by the quantity of blood, which may be either naturally or accidentally sent to any organ. In all the parts of the body endowed with much sensibility, there is a copious supply of red blood: thus, the skin and mucous membrane which are the two great sentient surfaces, receive a great quantity of arterial blood, and in proportion as this natural quantity is increased or diminished, the sensibility of those surfaces is augmented or lessened, and when deprived of red blood, as when the fingers sometimes become pale and shrivelled from cold and damp, the sensibility of the skin may be quite extinguished. We find also that the brain and organs of sense receive a very great quantity of red blood, and that the occasional distention of erectile tissues, exalts their natural sensibility. The circumstance of a person fainting, from the brain not receiving its usual quantity of blood, and again recovering on restoring the circulation in the head by the recumbent position, is another proof of the influence of the circulating system on the sensibility of the nerves. In a similar manner I would account for the irritable state of the mucous surfaces causing vomiting and diarrhœa, when the cutaneous circulation is repelled by cold, and consequently an unusual quantity of blood sent to the internal surfaces of the body.

But, although we may admit that the natural sensibility is in a great degree dependent on the state of the circulation in the minute vessels, still the varieties of pain felt in different tissues, when they are inflamed, cannot be altogether explained on this principle.

When inflammation is confined to the surface of the skin, or of the mucous membrane, the pain resembles that from the injury of high temperature. In vesicular diseases of the skin and erysipelas the scalding sensation is very marked; and when vesicular inflammation affects the alimentary canal, the patient is often sensible of very urgent burning pain. In many cutaneous diseases, the itch is more intolerable than the pain.

When serous membranes are the seat of inflammation, the pain is usually acute and tensive, and the cellular membrane has the same mode of feeling, provided the skin be not involved; but in proportion as the latter is concerned, the sensation is modified. It should also be observed, that the inflammation of the cellular structure of the internal viscera is usually dull or obtuse, in consequence of the manner in which these viscera are supplied with nerves.

When the muscular structure is inflamed, the pain partakes of the peculiar sense of fatigue.

Ligaments and bones resemble each other in feeling under inflammation, which is that kind of sensation that is called aching, with a peculiar morbid tenderness in the surrounding tissues.

The inflammation of the nervous substance is variable in degree and kind according to circumstances, being sometimes excruciating and intolerable, and at others dull and aching, with surrounding tenderness.

When inflammation is of a peculiar and morbid kind, or arises in structure which has not the power of reparation, the pain most commonly differs from that of ordinary inflammation. It is more continual, or sometimes greatly aggravated, independently of external circumstances. It is often a burning sensation, with a peculiar morbid tenderness, sometimes lancinating as in cancers. When new formed or imperfect or condensed structure is the seat of inflammation, the pain has a peculiar morbid character, of which it is very difficult to give an accurate idea by words.

From the preceding account we can perceive that the varieties of pain which are felt, depend partly on the character of the inflammation, and partly on the structure of the parts engaged.

The last circumstance which I have mentioned as deserving to be classed amongst the phenomena of inflammation, is the change which takes place in the *secretions;* sometimes these are increased when the inflammation is slight on secreting surfaces, as we see in numerous cases of slight affections of the mucous and serous surfaces. When inflammation proceeds to a greater length, the secretions are not only more abundant, but changed in their quality, becoming of a thicker consistence, and sometimes assuming the appearance of pus. Thus the serum of blisters, when the skin is much irritated, is found to be coagulated; the cutaneous secretions of the eye-lids, ears, and other parts of the skin, are changed into

a glutinous adhesive fluid. It is probable that the secretions of the mucous membranes and of the glands are equally affected by slight degrees of inflammation, although less observed. We are perhaps too prone to overlook functional affections of the skin, because its diseased structure is so obvious, and to consider the diseases of internal parts as deranged functions, when there is more or less inflammation present.

When parts are excessively inflamed, whether they are situated internally or externally, secretion of every kind is stopped. Even the secretion of pus ceases, when an abscess, an ulcer, or an issue is suffering a severe degree of inflammation.

Heat, redness, tumour, pain, and changed or suppressed secretion, although they are considered as the necessary phenomena of inflammation, may exist separately in parts which are not inflamed. Heat and redness are produced in the skin by a merely excited state of circulation, as may be observed in blushing, and in the turgid state of various erectile tissues, as the genital organs, the skin about the turkey-cock's neck, the comb or crest of the common cock, and other similar structures. I have known an instance in which, from a violent passion, the face was rendered so hot for several hours, that it became necessary to bathe it with cold water. During the rapid growth of certain parts, as the horns of the deer kind, the heat and vascularity are greatly augmented. A degree of tumour may be occasioned in any part, by the accidental extravasation of serum or blood. Pain of various kinds may be excited by many different causes, besides inflammation. The secretions also are often increased or altered by different circumstances without inflammation, and are totally suppressed in that state of the circulation the farthest removed from the inflammatory, as when the arterial system is suffering from collapse.

The phenomena of heat, redness, pain, and altered secretion must be conjoined, in order to indicate the presence of inflammation; the pain also must be characteristic, or of the kind that properly belongs to the peculiar inflammation existing at the time, and the structure of the part affected.

OF THE CONSEQUENCES OF INFLAMMATION.

What are denominated the phenomena of inflammation are the *immediate effects* of the augmented sensibility and circulation in the parts engaged. To these succeed, or rather, there arise out of them as a matter of necessity, if the inflammation persist for any time, a number of consequences, of which we shall now give an account.

The real *consequences* of inflammation are always injurious, and ought to be carefully distinguished from those reparative processes,

which sometimes, from injudicious modes of treatment, are made to be concomitant with them; or which being exhibited most on the decline of inflammation, have been improperly called its modes of termination.

The true consequences of inflammation are *chemosis*, *œdema*, *vesication*, *suppuration*, and the total *disorganization* and *death* of the part.

When *chemosis*, or the extravasation of the blood, takes place without a rupture of the vessels by mechanic injury, it is not designed to become organized, and therefore it remains in a fluid state. The absorption of the blood, when shed under these circumstances, is tedious. I have known chemosis arising from erysipelas of the face, remain for months before it was removed. When blood is found extravasated in an inflamed part, there are always, I think, ruptured vessels. Such effusions take place under circumstances favourable to the laceration of the small arteries; as when inflammation is very violent, or occurs in lax cellular tissue; or where parts are not yet supported by the deposition of coagulable lymph. Thus, the mucous membrane and the surface of ulcers, when highly inflamed, yield blood. The loose cellular membrane joining the conjunctiva to the globe of the eye, becomes charged with blood in severe ophthalmia, and the submucous tissue of the great intestines is similarly affected in acute dysentery. In the first steps towards the formation of an abscess, before the parts are made solid by coagulable lymph, blood is commonly extravasated.

In some abscesses, as those of the liver, spleen, and brain, we sometimes see with the naked eye the lacerated vessels; and in the first, I have observed the biliary vessels also to be broken, and the bile mixed with the blood and pus contained in the cavity of the abscess. The best evidence is to be obtained by injecting any part, in which blood has been extravasated, when the fluid injection will escape through the broken vessels, and imitate the previous effusion.

Œdema is the diffused extravasation of serum. It is usually found in relaxed and depending parts. It may occur with a very low degree of inflammation, as in some species of erysipelas. Persons are most prone to œdema in inflammation, who have the small veins full, or who have a tendency to anasarca; and the parts of the body where œdema is most remarkable, are those, in which the cellular membrane is most lax, as the eyelids, the prepuce, the scrotum, and external labia of females. Œdema is always unfavourable to reparation, and parts once affected with it, are apt to retain some serum in the cellular membrane afterwards, giving them a bloated or tumid appearance. Where the disposition to œdema is general in the body, it is a proof of weakness, and often leads to a fatal result, after severe accidents or surgical operations.

Vesication is the elevation of the cuticle and rete mucosum, from the surface of the true skin, by an effusion of serum. This effusion may arise from two causes; either the immediate irritation of the skin, as by means of blisters, friction, or high temperature;

or by the occurrence of inflammation in constitutions or parts, which are indisposed or incompetent to effect reparation. Hence we observe vesication in diffused inflammation, and in mortification; in which cases, it is conjoined with the effusion of serum into the cellular substance. The serum furnished in such cases is more fluid, than when the effusion is the result of the direct irritation of the skin; and it is often tinged with the colouring matter of the blood. The fluid formed in vesicles, pocks, and pustules on the skin, at first resembles that of a common blister, but is changed afterwards, either for an opake white fluid, or genuine pus.

Suppuration, or the formation of pus, is one of the most common consequences of inflammation.

There is a good deal of confusion, in the opinions of authors, respecting the nature of suppuration; some considering inflammation as necessary to the formation of pus, and hence use the term of *suppurative inflammation;* others view suppuration as a cause of the abatement, or the cessation of the inflammatory action; and others again, as one of the modes in which inflammation may terminate. These different views arise from the secretion of pus being observed under such different circumstances. A closer consideration of the matter, however, will lead to the opinion, that some degree of inflammation is always co-existent with the process of suppuration. Sometimes this inflammation may be very slight, and in other cases very severe. For example ulcers tending to heal, issues, setons, maturated eruptions of the skin, and the latter stage of abscess, present such very slight traits of inflammation, that some have denied its existence altogether, in these instances: whereas, in some of the severest inflammatory diseases, as purulent ophthalmia, gonorrhœa, inflammation of the bladder, dysentery, &c., the secretion of pus is very copious.

I shall be able to show hereafter, that when all irritation is removed from an ulcer, a seton, issue, or abscess, that the formation of pus either diminishes or ceases altogether. I am satisfied that the alleviation of the pain of an abscess after perfect suppuration has taken place, arises entirely from the change effected in the structure of the part, by which the tension is relieved; the walls of the cavity being rendered thinner by absorption, and thereby the pus better accommodated; instead of the inflammation having terminated by suppuration, as is supposed by many surgeons.

Although it appears that the suppurative process requires some degree of irritation or inflammation to excite or maintain it; it is equally true, that a very inordinate degree of inflammation will, as in all other secretions, either change the qualities of the pus, or altogether suppress the discharge. This may be observed, when ulcers become much inflamed, when the urethra during gonorrhœa is provoked into a higher degree of inflammation; or when an abscess is made to inflame still more, from injury, pressure, or any improper treatment. The suppression of the secretion of pus by a very severe degree of inflammation, is a fact which has led some practitioners to employ irritating and caustic injections, to stop the

discharge in gonorrhœa. Fever also has sometimes the effect of suspending the secretion of pus. I have seen this, in ulcers, and in acute abscesses; and on one occasion I knew the discharge of gonorrhœa to be entirely suppressed during the fever from measles, and afterwards to return when the fever abated.

Pus is formed in three situations: 1st, upon the inflamed surfaces of the skin, the eye, and the mucous membranes, without any other apparent change of organization, than an increase of the natural vascularity; 2dly, on the naturally unexposed surfaces of the body, after they have acquired a new organization, by increase of red vessels, and usually, if not always, by the addition of coagulable lymph: for, it may be questioned, whether in any instance, the surfaces of the cellular, synovial, serous, and medullary membranes, the pia mater, or periosteum can furnish genuine pus, without the deposition and organization of some coagulable lymph. I have never seen an example of real suppuration of any of the investing membranes, without a new organization of those membranes.

The third situation in which pus is generated, is the surface of the peculiar structures, called granulations, the vascularity of which, exceeding that of all the natural surfaces of the body, the pus formed on the granular surface of an ulcer, is the best example of this fluid.

The distinction between pus and serum is obvious enough, when these fluids are not mixed. Pus and mucus are not unfrequently effused together on the surfaces of the air tubes of the lungs, the bladder, the intestines, &c., and in some cases, the mucus becomes so much inspissated, as to bear a considerable resemblance to pus.

The characters of genuine pus, are thus laid down by authors.

The *smell* is peculiar and mawkish, but not fœtid or offensive.

The *colour* is a pale yellow, or like that of a primrose.

In *consistence* pus resembles cream. It has something of the same unctuous character, without, however, containing an oily matter.

The consistence of pus depends on its composition, which is found to be serum, holding globules of a proper colouring matter. It, therefore, bears an analogy to chyle, milk, and blood, but we do not at present know on what circumstance the characteristic colours of these fluids depends.

Pus is said to have a sweet and mawkish *taste*.

The muriate of ammonia coagulates pus, which Mr. Hunter considered as the circumstance distinguishing it from all the natural fluids of the body. Pus is not coagulable by the diluted acids, by alcohol, by the oxymuriate of mercury, or the acetate of lead. It is not soluble by the caustic alkalies, but is converted by them into a tough stringy substance.

The qualities of pus are liable to be changed by various circumstances. It may be mixed with blood or serum, as already mentioned. It may be altered by an access of inflammation, or by improper applications to the surfaces that secrete it.

The properties of pus also are peculiar in certain specific diseases. In gonorrhœa, when the inflammation becomes severe, it may assume a green or orange tinge; or it may be stained with blood. The access of inflammation in a common ulcer will alter the colour of the pus also in the same manner. Animal substances or rancid vegetable matters, and several metals, if not in the state of oxide, when applied to ulcers, will affect the colour of pus, similarly.

When pus is mixed with blood or serum, and detained long under the dressings, it yields a very fœtid smell, as we experience in undressing a stump, the first time after an amputation. When in contact with bone, it acquires a peculiar fœtor. Although pus has no tendency to putrefy, if long pent up by dressings, or mixed with other animal secretions, it soon becomes irritating to inflamed and even to sound skin. In cancer it is naturally irritating.

From contrasting the circumstances, under which pus of different kinds is furnished, surgeons have applied to the bland and innoxious fluid, found in abscesses, and in ulcers that are tending to cure, the very absurd name of *healthy* or *laudable* pus; and this term is even used by those who speak of the *suppurative inflammation*.

It cannot be shown, that the production of pus is, in any way, beneficial, or that it is connected with the process of reparation. What is called a kindly suppuration, is still an evil, in a mitigated form. It has been conjectured, that pus might have been destined to be a protection to the soft and tender granulation of an ulcer; but if it be allowed to dry, or to accumulate under the dressings of a sore, it will fret and arrest the healing process. If it should be granted, however, that ulcers are conveniently covered with pus, it must still be admitted, that no advantage can be gained by the secretions of this fluid from an inflamed surface, nor from the formation of an abscess in the interior parts of the body.

Although we look upon the existence of an abscess, as one of the evil consequences of inflammation, in proportion as the latter subsides, some very curious reparative processes are set up.

In the *acute abscess*, or that produced by active inflammation, in the first instance always, some of the small vessels give way, and some blood and serum are poured out into the surrounding tissue. In order to separate the disorganized from the healthy structure, lymph is shed, by which the extravasation of the blood and serum, is restricted within certain limits. This lymph next acquires vascularity and organization, and then, and not before, the secretion of pus commences. In the first stage of abscess, if the fluid be evacuated, it is well known to consist of blood and serum streaked with pus. As the lymph which is designed to compose the walls of the abscess advances in organization, pus of a better quality is secreted; and as the contents of an abscess are proved to be, like the other parts of the body, transitory in their existence, while fresh pus is being added, the original contents are removed by ab-

sorption; hence, an abscess of some duration is found only to hold genuine pus. During the time that this change is taking place in the fluid contents, a similar one is proceeding on the solid walls of the abscess. On one side, the process of absorption is reducing the thickness of the parietes, while the other sides are increasing in the same proportion, by the addition of new substance. There is also another remarkable circumstance attending the progression of an abscess, which was first accurately described by Mr. Hunter. On the side of the abscess that is becoming thinner, there is also a disposition to yield, or to be extended; and on the side that is growing, there is a tendency to contract. The pus of an abscess is, therefore, brought to those surfaces on which it is to be evacuated, by four processes—absorption, new growth, extension, and contraction; and as the object to be attained in this case, is the removal of the fluid, the same means are employed for conducting extraneous substances out of the body. In most cases, the pus is brought to the nearest surface, on which it can be discharged; but sometimes it seeks the skin, in preference to making an exit by a nearer internal surface.

When the coverings of an abscess become very thin, they yield a little at one spot, and thus occasion an elevation which has been called the *pointing* of an abscess; and when the matter is discharged by the natural process, one or more small openings are made by absorption of the thinned parietes of the abscess, through which the pus gradually distils. The expression of *bursting* is very incorrectly applied to the opening of an abscess, unless it be effected by external force.

The natural process for the removal either of pus or extraneous matters, exhibits in a striking manner those elective actions of parts, which I should ascribe to a local or organic instinct; and which, like the instincts of animals, produces the same results as intelligence.

In a few instances, the pus of an abscess, instead of being discharged on a surface, has been removed by absorption.

That the contents of an abscess undergo a continual change by absorption, is proved by pus having been detected in the absorbing vessels of the neighbourhood. In the case of the entire absorption of the contents of a bubo, mentioned by Mr. Hunter, the urine was loaded with pus. I think it probable, that if all inflammation were removed in an abscess, the absorption of its contents would not be an unfrequent occurrence.

The pain attending the progress of an abscess is entirely produced by the tention of an inflamed part, and it is felt just in proportion to the tension, and the severity of the inflammation. The thinning, and relaxing or extending processes are not the cause of pain, but, on the contrary, produce rather an agreeable sensation. These processes are so far from partaking of the nature of inflammation, that they are impeded just in proportion as the latter exists. They are stopped altogether by a severe degree of inflammation, and when the inflammatory action is removed, the preparatory steps

for the discharge of the pus go on with a rapidity and a feeling of ease to the patient that would seem incredible to those who have not witnessed the fact.

When the attempt is made to form an abscess by weak or scrofulous constitutions, and in situations where the cellular substance is lax, the progress of the disease is very different from that above described. The first extravasation is serum, which passes easily into the large cells of the cellular membrane, with little or no injury to their structure; the parietes of the chronic abscess are not composed in the beginning of organized and vascular lymph; no genuine pus therefore is found in such cavities in the first instance; the fluid they contain is serous, mixed with coagulable lymph, parts of which are found as flakes floating in the serum. As the cavities of chronic abscesses are not provoked, either by severe tension, or the quality of the contained fluid, there is no preparation made for some time to remove their contents. These collections therefore often traverse a considerable distance along muscles or under plates of fascia, before they arrive at the skin, which ulcerates very slowly; after which the cavities may inflame, their interior surface become more highly organized, and secrete genuine pus.

Sometimes these slow forming abscesses, after they have attained a considerable size, are absorbed. I have known this to occur several times in psoas abscess, where there was no disease of the vertebræ. In one instance a young lady had one of these languid abscesses formed suddenly above the clavicle: it descended behind the clavicle, and proceeded underneath the mammary gland until it came to the waist, where it was finally removed by absorption; the patient's constitution was strengthened, during this time, which I have found in several instances effectual in causing the absorption of such collections.

The worst consequences of inflammation are the *disorganization* of parts to such a degree, that they cannot afterwards perform their natural functions; and their perfect disorganization, by which the *death* of the part may ensue. The various tissues in the body are able to sustain and recover from inflammation, just in the proportion to the perfection of their natural structure and vital principles. Parts which are naturally provided with many red blood-vessels and nerves soonest inflame after injury, but have the greatest power of resisting and repairing the effects of inflammation. The skin and the red portions of the mucous membrane are often inflamed to a considerable extent, without suffering any material change in their organization. The tissues endowed with little natural sensibility and vascularity, as the fibrous, cartilaginous, and osseous structures; those parts that are regenerated, or formed in place of others, as cicatrices, and new and morbid growth, as the various tumours, are all, when seriously inflamed, liable to be removed by ulceration, or to slough, or die. The same class of tissues have their vitality most easily extinguished, by the other causes of death as well as by inflammation. Thus, pressure causes the ulceration of a cicatrix, or of cartilage, and concussion most readily kills a bone.

Inflammation, according to its degree of violence, and in relation to the nature of the tissue, or the general weakness of the constitution, may affect the organization of a part, either to such an extent as to fit it for being removed, by the process of absorption called *ulceration*, or to the degree amounting to those changes which are termed *slough*, *gangrene*, *sphacelus*, and *mortification*.

These last terms are not very accurately employed by surgeons, nor always used in a distinct sense. When disorganization is produced by inflammation, it seems to be of two kinds. One consists in the disturbance of the natural connexions of parts, or an unravelling of their texture, so that they can no longer carry on their natural functions, although an imperfect circulation and sensation may remain. This kind of disorganization takes place in diffused inflammation and in erysipelas, and probably would be liable to occur in all severe degrees of inflammation, if the effusion of coagulable lymph did not serve to limit its destructive effects to a small space, as in the formation of abscess. When the disorganization is produced by an unrestrained effusion of serum, and consists of an unravelling of the structure of the parts, instead of an essential change in the elements of the body, it is commonly distinguished by the name of *moist gangrene*.

The other kind of disorganization which inflamed parts occasionally suffer, is not only attended with the death of the part, but a new and peculiar arrangement of the animal substance, totally different from that which takes place by the death of a part, in consequence of mechanic injury, or its being separated from the rest of the body.

The appearance which a part completely killed by inflammation puts on, varies a little. Tendon, muscles, nerve, and cellular substance look like dirty shreds or wet tow; the skin sometimes appears as if it had been destroyed by caustic, or the cautery. To this mode of death the terms of *slough*, *sphacelus*, and *mortification* are indiscriminately applied.

Although mortified parts yield an offensive fœtor, they never undergo the putrefactive fermentation, however long they may be kept, under the favouring circumstances of heat and moisture. When these dead parts are allowed to dry, they assume the appearance of brown or black wood. I macerated a slough which came away from a boil, until it had parted with everything that could be diffused in water, and there remained an arrangement of a cellular membrane, far surpassing in fineness and delicacy any of the membranes of the body, if we except the one that pervades the structure of the brain.

From what has been said it would appear that the only direct and genuine consequences of inflammation are the effusion of some of the fluid elements of the blood, which cannot receive organization; the breaking down of some of the solid textures of the body; the formation of a new fluid denominated pus; and the disorganization, or the absolute death of the inflamed parts.

OF THE REPUTED CONSEQUENCES OF INFLAMMATION.

There are certain processes which, from being sometimes associated with inflammation, are ascribed to an inflammatory action, although in their own nature they are perfectly different. Some surgeons will be surprised to learn, that I include under this head the *effusion* of *coagulable lymph*, and that species of absorption, which is called *ulceration*. Mr. Hunter, in employing the terms of *adhesive* and *ulcerative inflammations*, did not clearly define his meaning. He has lead his readers into the supposition, that the union of parts, by the medium of lymph, and the removal by absorption of those which are either so far disorganised, or injured, that they are not fit to remain, are both modes of inflammation: yet, in the detailed accounts which he gives of these processes in his work, he clearly distinguishes them from the real effects of inflammation.

It is well known, that coagulable lymph may be thrown out by a natural and healthy action, as in the formation of the decidua uteri: that it is eminently conservative, in arresting hemorrhage from opened vessels; in the union of all the soft parts when divided; in forming the medium of conjunction of fractured bones, and in constructing the walls of an abscess, and of an aneurismal sac. Immediately on the receipt of an injury, also, lymph is shed before there is time for inflammation to set in. The surface of a wound that does not bleed is covered by a layer of lymph, in the very moment that the injury is inflicted. The inflammation which would ensue from the opening of a serous cavity is sometimes altogether averted, and almost always restrained within certain bounds by the effusion of lymph uniting the opposed surfaces with each other.

In discussing this question with surgeons, it has generally been raised as an objection to my opinions, that the cure of hydrocele is effected by injury, followed by inflammation. There are two ways of obliterating a serous cavity. The one is to commit such an injury on it as will furnish the motive for the effusion and organization of lymph, by which inflammation is anticipated and prevented. The other is to cause inflammation and suppuration to supervene; and after they have terminated, the remains of the granulations serve as the uniting medium, as in any common wound. The two modes of treating hydrocele are formed on these rules. When injection is used with success, the inflammation of the tunica vaginalis is prevented by the effusion of lymph. When incision, caustic, or the seton are employed, the hydrocele is cured after the inflammation has ceased, and not before. We might with equal propriety consider the approximation of the edges of an ulcer, and its final cicatrization, inflammatory actions, as the cure of hydrocele, by the medium of granulations.

It is true, there are some cases of adhesion, which are highly

detrimental to the parts concerned. Wherever freedom of motion is necessary to the functions of parts, adhesion may be inconvenient, or fatal. Thus, the iris has its office destroyed by being bound to the adjoining parts; the actions of the heart are embarrassed, by extensive adhesion between it and the pericardium; and I have known the general union of the peritoneal surfaces of the intestines cause strangulation of the whole alimentary canal, and death. It is also the agglutination by lymph, which is the most frequent cause of hernia becoming irreducible, and occasionally of the protruded parts being strangulated. The effusion of lymph in the trachea during croup, causes as much danger as the inflammation: so likewise, when the bladder and urethra are blocked up with lymph.

Because evils occasionally result from the adhesion of parts, we are not therefore to conclude, that the effusion of lymph is an inflammatory action; or that the union and re-organization of parts are not, in general, salutary. Every tissue and organ of the body acts under peculiar laws, depending on its own sensibility: the stomach will reject what is offensive to it, whatever pain the individual may suffer; the sensation caused by the presence of an extraneous body, is the motive for closing the eyelids; but, when the foreign substance is lodged within the lids, their closure tends to fix it, and aggravate the mischief; when a person is exposed to the inhalation of irritating and noxious gases, the muscles of the larynx will close the aperture of the glottis so firmly and so long as to endanger actual suffocation from mechanic obstruction.

The actions which are the immediate result of sensations, are, however, as a general rule, calculated to effect the most beneficial purposes; but, like the instincts of the individual, they are not always successful. Persons expect the best effects from the direction of intelligence; next from the instinct of the individual, and the least from the organic instinct. I believe the order should be reversed: and that the fewest errors are to be discovered in the actions of the different tissues.

As the arteries deposit the coagulable lymph, in order that it may serve to unite parts that are in a fit state to be conjoined, the absorbents are endowed with the organic instinct to remove parts, of which the organization has been so much impaired, either by internal action or external influence, that they are not fit to remain as component parts of the body. This action of the absorbents, when it becomes the means of producing the deficiencies, which are afterwards to be replaced by granulations, is called *ulcerative absorption* and *ulceration*.

The term *ulcer* is indiscriminately applied to the vacancy that is caused by absorption, and to the same part, when filled up with granulations secreting pus, and perhaps daily proceeding to be healed. An ulcer, in the state in which it is commonly seen, is the conjoint product of absorption; and of a new growth.

It is a law of the absorbent and arterial vessels to work to one common end. There are but few instances, either of natural or

diseased action, in which the result is not conjointly effected by these two sets of vessels. In constructing the frame of the body, the absorbing vessels collect the materials, and remove the used and useless substances. In giving the proper shape to the different parts, the absorbents are even more important agents than the arteries. It would avail nothing to have new materials accumulated and deposited, unless the old were removed in the due proportion to effect the ultimate object.

In all cases where parts are to be repaired or reorganized, the mutual operations of the arteries and absorbents are strikingly exhibited. When a bone is to be repaired after fracture, the arteries furnish the uniting medium, while the absorbents remove the projecting parts, which would interfere with the natural form. After amputation, at the same time that the wound of the soft parts is healing, the shape of the bone is modelled by absorption to accommodate it to the ultimate figure of the stump. In cases of necrosis, the whole of the old bone, provided it be not exposed, is carried off by the absorbents, into the system, while the new bone is generated by the arteries of the vascular structure that invests it; and the regenerated bone, which is at first round, thick, and clumsy, is converted, in the end, by the absorbents, into a more perfect semblance of the original one, both as regards its shape and structure. In the cure of an abscess, as already mentioned, the organization of its cavity, and the progression of the pus to the surface of the body, are accomplished by the conjoint operations of the arteries and absorbents.

When extraneous substances are to be removed, or decayed or dead parts are to be detached from the living body, the absorbents display a curious elective power, effecting just what is necessary, and no more than is necessary, if there be no inflammation. Thus, as much material is absorbed, as will be sufficient to separate a ligature from an artery, or to dislodge a piece of cloth from a gunshot wound. The same tendency to select, is exhibited in a great number of natural processes. As examples, we may mention the imbibing of assimilated parts of the food; the absorption of bile and urine, only when these fluids cannot be ejected by their natural outlets; the progression of the ova from the back to the front of the ovary, and the absorption of the dense tunic of the ovary, when the ova are to be discharged; the removal of the fangs of the deciduous teeth, and the preparation for permitting the secondary teeth to come into their proper place. In all cases, the absorbents seem to act under the influence of their own organic instinct, by which, in general, their operations are as beneficial, as if they were directed by the most perfect intelligence. There is no essential difference between the most salutary action of the absorbents, and the most destructive ulceration: in all cases, these vessels are governed by the same law, which is, to remove parts that are not necessary, or not fit to remain. There is every reason to believe, that ulceration always takes place, because the vitality or the organization of parts have been impaired by inflam-

mation, weakness, pressure, or other external injuries. All new formed parts and morbid growths are peculiarly subject to ulceration, on the slightest provocation, because their vital powers are low, and their structure imperfect: hence, cancer, fungous, and medullary tumours are sometimes rapidly destroyed by phagedæna or by slough. The structure in which scrofulous deposit exists, is liable, on slight excitement, to set up the ulcerative process. The inferior parts of the body, as they have less vital power than the upper, are most frequently the seat of ulcers.

As we see that the process of ulceration, in so many cases, is palpably intended to remove parts, which are first rendered incapable of performing natural and healthy actions, we have a right to assume that there is no instance of parts ulcerating, whose existence is necessary, and whose structure is quite sound.

We have the opportunity of observing, that the devastation produced by the ulcerative process, is great in proportion to the diseased state of the parts, and that the very extent of the local destruction may be the means of bounding for a time the progress of the worst species of inflammation, and of relieving the constitution from a dangerous sympathy; for it does not appear, that the system is affected by the loss of substance produced by the most extensive ulceration, so much as by the nature and extent of the inflammation, which places the parts in the proper state for ulcerative absorption.

If this view of the nature of ulceration be correct, it is of the greatest practical importance, as it would instruct us to address our remedies to the causes of ulceration, by which the effect may be often rendered unnecessary. Thus, by removing the excitement or inflammation of parts, which have a weak or morbid structure, they will escape ulceration. This theory would also teach us to abate inflammation, as the best means of arresting the progress of destructive ulceration. When we make a new surface to an ulcer, we imitate the natural process of absorption; but we may be certain, that nothing is gained by creating a new surface, unless the diseased condition which caused the natural ulceration, be at the same time rectified.

The term of ulcerative inflammation, as used by Mr. Hunter, in many passages in his work, would lead to the conclusion, that he considered ulceration as an inflammatory and diseased process in itself; yet, in his chapter on *the intention of the absorption of the body in disease*, he views it as necessary and salutary. He says, "even in the formation of an ulcer, or the spreading of an ulcer, its use may be considerable:" he proceeds so far as to call it the "*natural surgeon.*" I should be disposed to apply the same name both to the effusion of lymph, and the process of absorption. The one acts like the surgeon that unites parts; the other like the one who removes them, because they are not fit to remain; and it would not appear more justifiable to call adhesion and ulceration, inflammatory processes, than to consider the operations of surgeons themselves, as particular modes of inflammation.

The absorption of the substance of the body is conducted in two ways. When the removal of a part is effected by the absorbing vessels that exist internally, the absorption is called *interstitial;* and when foreign substances are taken up by the vessels opening on a surface, the term of *external absorption* is used. These two modes of absorption are not essentially different in themselves, but produce very diffrent results.

The interstitial or internal absorption is continually employed in a great number of natural functions, such as changing the materials of the body; regulating the quantity of vapour in the close cavities; diminishing the fat, and determining the forms produced by organic growth and development. It is also the means by which pus and extraneous bodies lodged in the body are conducted to the surface. It constitutes the first line of division between dead and living matter. By removing a small portion of the latter, it produces the deficiencies of ulcers previous to the formation of granulations; and also removes the granulations themselves, when they are not in a state to carry on their functions, or when they ultimately have fulfilled the end of their temporary existence.

External absorption can only take place on certain surfaces, which are in contact with foreign substances. The most active natural absorbing surface is that of the first coils of the alimentary tube, because it is the most vascular; for, it is found that the artificial surfaces capable of absorbing foreign matters possess the highest degree of vascularity. The granulations of an ulcer absorb extraneous substances so much more readily than the common skin, that deleterious effects are sometimes produced on the constitution, by the dressings applied to a sore, which would have no effect through the medium of the common integuments.

The granulations take upon themselves, the office of detaching dead portions of bone, which lie exposed in an ulcer. The first step towards *exfoliation*, as it is improperly called, is the formation of a line of distinction between the dead and the living bone, by the interstitial absorption of the earthy material of the latter. The granulations are thus better enabled to pursue their course, from the ulcer under the edges of the bone until they meet beneath it, and when the dead bone is thus set at liberty, its inferior surface is found to be impressed, in perfect correspondence with the shape of the granulations, which present themselves on the removal of the bone, as the continuation of the ulcer. A similar succession of operations appears to be employed in the separation of the soft parts of the body, which lose their vitality. In the removal of an eschar, or a mortified foot, the line of demarcation is made by the interstitial absorbents in the first instance, and in proportion as this spontaneous and conservative ulceration proceeds, granulations arise on the new surface, and widen the breach, between the dead and living structure.

In the absorption of the fangs of the teeth, and the removal of the necrosed bone, or where a slough cannot be perfectly detached

by interstitial absorption; a structure, as vascular as granulations, if not possessing exactly the same form, is provided; which leaves on the teeth, and the necrosed bone, the precise counterpart of the surface of the vascular absorbing organ; proving beyond all doubt, that the absorption of these parts is effected by this vascular, or granulation structure.

The term *ulcer* is not a correct one. It expresses only a part of the history of the object, to which the name is given; or applies to that state in which the ulcerative process only is going on; perhaps, we might say, that in all instances, where either inflammation or morbid structure does not prevent it, the phenomena that belong to an ulcer, are more reparative than destructive; since in many cases of ulcers tending to cure, there is only that degree of interstitial absorption of the granulations, which serves to approximate the edges of the sore, thereby diminishing the magnitude of the cicatrix. An ulcer, therefore, as it is usually presented to our observation, is the result of a compound, or rather opposed action, as the granulative, succeeds the ulcerative processes.

Phagedæna is that species of ulceration, which destroys parts with great rapidity, and to a great extent; after which granulations form slowly, or not at all, as long as the phagedenic process persists. The granulations that arise after phagedenic ulceration has ceased, are large, irregular, and spongy; and the sores are apt to heal with a puckered or a depressed cicatrix. The presence of phagedæna always indicates a degree and kind of inflammation, which the parts cannot sustain; or, what is equivalent to this, a previous morbid condition of the constitution, which will not allow a common degree of inflammation to be borne.

Phagedæna may be combined with slough, as in the hospital sore, and other destructive ulcers; and when this occurs it is a proof of a very high degree of inflammation, acting on parts too weak from local circumstances or state of constitution to bear it.

Although the effects of phagedæna are most destructive, it is the result of the same organic instinct of the absorbing vessels, by which they are actuated in all cases of ulceration; whether they diminish a hard cicatrix, or destroy the most important structure, they do so, because the parts are not in a state to perform their natural and healthy functions.

OF THE DIFFERENT MODES OF REPARATION.

Surgeons have hitherto described only two modes of healing; to one of which the name of *union by the first intention* has been given; the other is by means of granulations. Further inquiry, however, will show, that this division of the subject is imperfect.

Reunion and reorganization are effected in four different ways, which may be designated in the following manner:

First, immediate union without any intervening substance such as blood or lymph.

Second, the union by the medium of coagulable lymph, or a clot of blood.

Third, reorganization without any medium of lymph or granulations, the cavity of the wound becoming obliterated by a natural process of growth.

Fourth, the reparation by means of a new, vascular, and organized substance, called granulations.

To the first of these modes of cure, I should wish to give the name of *immediate*. The second may be called the *mediate by lymph or blood*. The third, being compounded of different actions, I find a difficulty in distinguishing it by a single name. It might be denominated the *approximating* or the *modelling* process of reparation, or that by a *natural growth*. The fourth mode of union, should be termed *mediate by granulation*.

The three first mentioned modes of restoration are quite incompatible with the presence of inflammation; a slight degree of which may, however, exist with the fourth. Not that I admit the growth of granulations to be an inflammatory process in itself. It ought rather to be viewed as the mode of reparation, adopted under the unfavourable circumstances of irritation, or a degree of inflammation being still continued, and proves that parts previously in a healthy state, are disposed to heal in despite of many impediments thrown in their way.

The circumstances under which immediate union is effected, are the cases of incised wounds, that admit of being, with safety and propriety, closely and immediately bound up. The blood, if any be shed on the surfaces of the wound, is thus pressed out, and the divided blood-vessels and nerves are brought into perfect contact, and union may take place in a few hours; and as no intermediate substance exists in a wound so healed, no mark of cicatrix is left behind.

We have familiar examples of this mode of healing, in slight cuts received on the fingers, which after being bound up, if no inflammation be induced, perfectly heal without the individual having any unpleasant sensation in the part, after the moment of the infliction of the wound. A case has been lately communicated to me of a considerable cut of the hand having been cured by this mode of direct union, without any sensation of pain, and in the short space of four or five hours.

The incision made in venesection, if kept perfectly at rest, although it engages an important tissue,—the venous, may be healed with scarcely any intervening lymph, and with no consciousness on the part of the patient of having received a wound, except at the very instant when the puncture is made. The operation of bleeding leaves a line of white cicatrix, because it would not be

justifiable to apply in this case the same degree of pressure, as in the small cuts of the fingers, for the purpose of retaining the edges of the wound in close contact. Every one knows that if the puncture of venesection be provoked, to inflame, or in common language to fester, that its progress towards healing is interrupted; yet, this very wound has been quoted by Sir Astley Cooper, as an example of one requiring the aid of inflammation for its reparation. Those who contend for the necessity of inflammation, in all cases, for the reparation of injury, cannot refuse to admit, that in the instances I have just mentioned, none of the phenomena ascribed to inflammation exist: and that whenever the surgeon intends to accomplish union by the first intention, his success will depend on his being able to keep the parts in so easy and tranquil a state, that none of the phenomena of inflammation make their appearance. If there be any degree of inflammation, in which there are no heat, redness, tumour, pain, or disturbed vascular action, it ought to be clearly distinguished from that kind, which is attended with these phenomena; and then, we should have two sorts of inflammation; the one with phenomena, the other without, which, if we chose to disregard the logical contradiction involved in such an admission, would amount to the same practical result, as if on one occasion inflammation did exist, and on others did not.

The union of parts with the medium of lymph or blood takes place in wounds, which either cannot, from the extent or shape of their surfaces, be brought into perfectly close contact, or where the parts will not sustain much pressure, without the danger of inducing inflammation. The lymph which issues from the adjacent surfaces, in the first instance, glues them together, and in a few days is found to have acquired some vascularity, and an imperfect degree of organization; after which, an external restraint for keeping the divided surfaces in contact becomes unnecessary.

Mr. Hunter assumed, that the vessels arose in the lymph, and subsequently established their connexion with the vessels of the part, because, he observed, that vessels began to form in the membrane of the incubated egg, before they existed in the fœtal chick. There is a great difference, however, between the original formation of vessels, and the acquisition of vascularity by lymph, deposited in contact with surfaces that are already organized; and it is more difficult to imagine, that vessels should commence in a clot of lymph or blood, than that they should be extended into it from the adjoining surfaces. It is also impossible to conceive that the thin layers of lymph which unite serous membrane, or the effusion which consolidates cellular structure, do not obtain their vascularity from the adjoining parts. Further, I have seen vessels passing for a short way into a clot of blood, covering the surface of an ulcer, when the coagulum possessed no vascularity of its own. I have also succeeded in forcing injection into the coagula formed in the cavities of the heart after death, which injection presented the appearance of red elongated lines. I am therefore induced to dissent from the opinion of Mr. Hunter on this subject.

Every surgeon knows, that if wounds united by means of lymph be provoked to inflame by motion, friction, too much constraint, or any other cause of disturbance, the tender and half organized medium is destroyed, and the chance of union by the first intention is lost. We cannot, therefore, with any consistency, describe the adhesive process as an inflammatory one, when we perceive that it is interfered with by any sensible degree of inflammation.

When the uniting medium of lymph is fully organized, it possesses a considerable degree of vascularity, and can be rendered red by injection, as we observe in callus of bones, and the adhesions of serous and cellular membrane. For the same reason, the cicatrices of wounds appear red for some time.

Depositions of lymph, made for adhesion or reparation, may in the end acquire, as nearly as possible, the original structure of the neighbouring parts. Thus, when serous surfaces are conjoined, the uniting medium becomes thin and membranous, and elongated, in proportion as motion may be requisite. The callus of bones acquires the osseous structure, and the cicatrices which form on the external surface of the body bear an imperfect resemblance to the skin.

The effusion of coagulable lymph is always more abundant than is ultimately necessary for reparation; and hence it is gradually diminished by interstitial absorption, and thus the lips of a wound, which held between them a plate of lymph nearly one quarter of an inch in thickness, may come so close together as to exhibit, in some cases, little more ultimately than a thick white line of cicatrix. Usually, however, when much lymph has been employed in the union of parts, a thick, hard, and puckered cicatrix is formed and remains.

The mode of reparation by the modelling process, has never been described; because surgeons, heretofore, did not know that it was possible for open wounds to heal without inflammation, in the higher classes of animals. However, when healthy parts are injured, although it may be to the greatest extent, if placed under the most favourable circumstances for carrying on their natural actions, the process of reparation is nearly the same, even in the human subject, as that which I have described as belonging to the animals of a simple structure. The pain arising from the injury soon ceases. No tumefaction ensues, separating the edges of the wound, and its surfaces are not only disposed to lie in contact, but even to approach each other so much, that they cannot be kept asunder by mechanic restraint; there is, therefore, no necessity for the effusion of lymph; and as there is no cavity to be filled up, granulations are not formed. The surfaces of the wound, although they come into contact, do not unite by vessels shooting across; they are smooth, red, and moistened with a fluid, which is probably serum, and present the appearance of one of the natural mucous surfaces of the body. If any parts have been killed by the injury, they are separated, by simply as much interstitial absorption as is sufficient

to set them free. The wound is finally healed by the same means which determine the shape of the natural parts of the body. It gradually diminishes in extent until it is obliterated; or it may be cicatrized before the surfaces are abolished, after which the same process of natural growth goes on, until no part of the original wound is left. The cicatrix which succeeds the cure of injury by the modelling or growing process, is small, pliant, free from those callous adhesions to the parts underneath, and the morbid sensations that so often belong to those cicatrices, which have for their bases the deposits of lymph, or the new formed structures called granulations. When the modelling process or cure by natural growth goes on perfectly, there is no inflammation in the part, and the patients are so entirely free from all uneasy sensations, that I have known instances of their being ignorant of the real site and extent of the injury, until they had examined the part with their hand, or saw it in a looking-glass.

It might be anticipated, that as this mode of reparation bears so strong a resemblance to the natural formation and development of parts, it is the slowest mode; but this is of little account, when compared with its great advantages, in being unattended with pain, inflammation, and constitutional sympathy, and leaving behind it the best description of cicatrix. It constitutes the nearest approach in the higher classes of animals, to that regenerative power which is exhibited by some of the inferior tribes.

When parts have been removed by the process of ulceration, or kept asunder by some degree of inflammation, we find the vacancy will be filled up by the growth of granulations, instead of organized lymph. It would appear that the granulation structure, being endowed with more vascularity and a higher degree of organization, than can be acquired in a short time by effused lymph or blood, is the reason of its being formed for the purpose of reparation, when the parts are placed under unfavourable circumstances to accomplish a cure; for we find, that if blood or lymph be shed on a common ulcer, by incisions of its surface, and perfectly enclosed so as to avoid all external irritation, and kept in an easy state of sensation, it unites with the surfaces of the ulcer, and acquires organization, as when the same substance is shed in common wounds.

The existence of granulations has been supposed to be necessary to fill up deficiencies; this, however, is not the correct explanation, for we meet with very considerable vacancies filled by lymph, which is never converted into granulations; as in cases when recent incised wounds are imperfectly closed, but nevertheless are healed by the first intention. The necessity of the granulative process seems entirely to arise from the parts being in that degree of excitement, which is not enough to prevent reparation altogether, but to permit it to be effected by a highly vascular medium. Thus, in simple fracture, the union is by the medium of coagulated blood or lymph, although the quantity of new material required is often greater than in compound fracture, where granulations are em-

ployed. If the cavity of an opened joint inflame, it is filled with granulation; but if inflammation be presented after such an accident, its cavity may be obliterated by effused lymph. I recollect seeing a case of a most extensive laceration of the leg, in which the deficiency produced by the injury was filled up by pale organized lymph, instead of granulations; the reason of which was, that so much blood had been lost, that no inflammatory action had been excited. And further, it is only in the beginning that granulations take the place of the natural structure; for the approximation of the edges of a wound or of an ulcer is accomplished by the interstitial absorption; and finally, wounds that are healed by the granulative process, exhibit no more remains of the new medium employed for union, than if lymph had been the substance employed. Granulations, therefore, exist for a special purpose, and that being effected, they cease to occupy the place of the original structure longer, or more than is necessary. The ultimate absorption of the granulations are something like the contracting or approximating action, which exists in open wounds that have never inflamed; and it does not take place until the inflammation has subsided in a common wound or ulcer.

The organic structure of granulations is very peculiar; although easily destroyed by injury, or a high degree of inflammation, it is endowed with important vital properties.

A deposition of lymph, after being united to an exposed surface, as in an ulcer, or in the interior of an abscess, may assume the granulation structure; but the usual manner in which it is formed, is by deposition and organization going on together, as in the growth of the natural parts of the body. In whatever mode granulations are produced, they are composed of a fine cellular membrane, into which blood-vessels proceed from the subjacent tissue. It is understood that these vessels have their branches directed to the surface of the ulcer, without much radiation or inter-communication; and perhaps, the little eminences on the surface, from which the name of granulations has been given to this structure, may be produced by the force of the circulation being unequally distributed, or directed from the small trunks underneath, on particular parts of the surface of the sore. Whether this explanation would satisfy us or not, it is the fact, that in proportion to the activity of the circulation the granulations are large and eminent; and when it is languid, they are minute and of a brown colour, as in the irritable ulcer; smooth, flat, and glossy, as in some old venereal ulcers; and in the indolent ulcer the surface is not granular, but depressed, hard, striated, and is nothing more than very imperfectly formed lymph.

The surface of granulations is always covered by a delicate pellicle, somewhat similar to the almost invisible integument of the mucous membrane.

I am not aware that any person has traced nerves into the substance of granulations; but no doubt can be entertained of their existence. The natural sensibility of granulations is very similar

to that of the vascular, and delicately covered surfaces of the true skin; a gentle touch to the surface of a healing sore is agreeable. The feeling in granular structure is liable to be augmented by inflammation. In various diseased states ulcers are affected with different kinds of pain. They are also excited by any species of mechanic injury, or external cause of irritation.

Besides the sensibility which granulations possess, in common with the external surfaces of the body, they enjoy also that of the mucous surfaces in an eminent degree. Like the stomach and intestines, they are capable of distinguishing the different qualities of substances placed in contact with them, independently of mechanic impression. Upon this species of sensibility of granulations, the effect of many applications to ulcers solely depends. One kind of ointment must produce the same mechanic effect as another; and the litharge plaster, whether it may be spread with too much heat or not, can make no difference in the qualities of its surface; and yet we know that the greatest variety of effect may be produced on ulcers, by the composition alone of their dressings. It is the peculiar sensibility of granulations, which causes them to select the objects for absorption, in the manner of the mucous coat of the alimentary canal: and as they resemble in their sensitive properties, both the skin and the internal surfaces, the condition of an ulcer is liable to be much influenced by the state of the constitution.

OF CICATRIZATION.

This term is applied to the last stage of reparation, in which a wound or an ulcer assumes a covering resembling, in some degree, the skin or other adjacent surfaces: for in no instance does the cicatrix perfectly possess the structure of any of the natural tissues. The cicatrix differs most from natural structure in those instances, where much lymph or granulations have been organized, and where these substances have not been sufficiently absorbed, but continne in a callous state, adhering to the adjoining parts, and probably involving some palpable branches of nerves. In such cases, the state of feeling in the part is sometimes so unnatural, that the constitution becomes greatly disturbed, and various affections of the nervous and muscular systems are experienced.

The process of cicatrization is carried on under different circumstances. It may occur under a hard and adherent covering, as a dried clot of blood, a scab or crust; or on a smooth moist surface, or where granulations have existed; and the character of the cicatrix, and its mode of growth are in some degree regulated by these circumstances.

When cicatrization occurs under a clot or scab, there is every

reason to believe that it does not proceed from the edges of the wound; but that it takes place over the whole surface at the same time, as the covering is usually detached at once. In this mode of terminating the cure, the cicatrix is pliant, and more nearly resembles the common skin than in other instances. The healing under a cake of dry blood or pus is perfectly inconsistent with the presence of inflammation; it therefore is only suitable to recent wounds that are kept perfectly at rest, and in several diseases of the skin, in which the inflammation terminates in a certain period, as in some vesicular diseases and the pocks. It is almost always impracticable in common ulcers, although it may occasionally take place in issues and setons, when their irritation has ceased, by the removal of the extraneous bodies.

A practice has been lately recommended by Mr. Higginbottom, and adopted by some surgeons, which consists in imitating the natural process of scabbing, by producing a thin and adherent eschar with lunar caustic, both on recent wounds and on many raw and suppurating surfaces. I have not found this mode of treatment to answer so well in my hands, as other surgeons have represented; but no doubt, if a thin, pliant, and intimately adhering substance, without the inconvenience of the pain, and the danger of inducing inflammation by the caustic, could be formed on a wound, and on many cases of ulcer, it would be a most valuable discovery, by enabling us to imitate the natural scab, at the most convenient time and in the best manner.

When a cicatrix is to be formed on coagulable lymph which has been deposited in a wound, and has not been allowed to dry, the whole of the surface appears to be covered at the same time with a thin, soft pellicle; but it is probable, that the formation of this pellicle keeps pace with the organization of the coagulum, being extended to the surface of the wound.

When reparation proceeds by the mode of natural growth, or what I have called the modelling process, the entire surface of the wound often attains the structure which fits it for cicatrization, long before that event takes place. In many wounds healed by this mode, the surfaces look like a natural mucous structure, and have no disposition to acquire a thicker integument than their own delicate pellicle, until the applications which keep up the moisture are removed, after which the wounds will cicatrize at every part equally in two or three hours. As the modelling process consists in the growing of the surfaces of the wound to the level of the skin, instead of filling up the interval by means of any new formed substance, the cicatrix which is produced is usually a mere line, where the wound has been originally extensive and irregular in its shape; and where inflammation has been perfectly prevented, there is often no appearance of a cicatrix to be seen. Sometimes, when a dead part has been removed, no attempt is made to supply its place, and the site of the wound exhibits the appearance of a depression of the natural skin. I have known the deficiency, occasioned by the

separation of the slough of a boil, continue, and present the appearance of a deep dimple in the skin.

When the process of cicatrization is to take place on the surface of granulations, it usually commences on the edges of the ulcer, and proceeds gradually from thence to the centre. As a preparation for the final act of healing, we observe that the granulations on the edges of the sore are reduced by absorption to a flat surface; the vascularity of the edges about to cicatrize declines, and the thin pellicle which covered the granulations becomes opaque and thicker. It is indispensable also, that inflammation should have ceased in the skin immediately surrounding the sore. The blood-vessels which previously ascended to the surface of the granulations now give place to vessels that are extended from the skin to the surface of the cicatrix, in a radiated manner; as may be demonstrated by the injection of the limb with a coloured fluid, in a case of recent formation of a cicatrix. These vessels, which at first form but few cross communications with each other, ultimately acquire more of the reticulated arrangement of the blood-vessels in the common skin. In proportion as cicatrization proceeds, the granulations are removed by absorption, and the surface of the ulcer daily diminishes. At last, if the adjoining skin be not prevented by adhesions to the parts underneath, the cicatrix bears but a small proportion to the size of the original ulcer. We observe, therefore, when granular structure is prepared by the cessation of inflammation, that the mode of healing bears a strong resemblance to that which takes place when open wounds are cured without inflammation having occurred. Its chief difference consists in a certain quantity of the medium of lymph or granulation remaining, and being incorporated with the cicatrix.

Inasmuch as a cicatrix is composed of a newly organized substance, its structure is imperfect. It does not possess the natural sensibility of the skin. It is white and hard. It does not generate the villi, which belong to the original skin. The rete mucosum is either slowly or never reproduced; and hence the cicatrices of blacks are devoid of colour for a considerable time; and if they ever acquire it, the colour is not like the original one, being sometimes lighter, and in others more intensely dark. A cicatrix is usually incapable of furnishing hairs, and there is no reason to believe that it possesses sebaceous glands.

Although cicatrization usually proceeds from the circumference to the centre of ulcers, there are some instances of specific sores, in which it may also commence at the same time at other points. In such cases the healing process is very rapid, and the granulations acquire their proper integument, before there is time for their being diminished by absorption, or by their having assumed a plain surface. Under these circumstances, as might be anticipated, the cicatrix possesses a very irregular and puckered appearance, which is afterwards somewhat improved by the processes of contraction and absorption.

It is well known that one of the great inconveniences attending extensive burns, arises from the irregular shape and extent of the cicatrix which is formed, and its subsequent absorption. This peculiarity would seem to depend on the cicatrix involving so much of the skin, in consequence of new organized lymph or granulations being formed on the cutaneous tissue, which has been only imperfectly destroyed, and the basis of the true skin being afterwards removed by absorption, along with the structure of the cicatrix.

When cicatrization takes place on an ulcer of the mucous membrane, it exhibits a different appearance from that which succeeds an ulcer of the skin. There is no attempt made to fill up the vacancy produced by ulceration of the internal coat of the stomach or intestines, either by lymph or granulations. It is true, we sometimes see the surface of small ulcers of the intestines covered with a white lymph; but we do not find that this effusion acquires vascularity. The healed surface of the ulcers of the intestines, unless the other tunics besides the mucous are engaged, always appears depressed. It is also smooth, soft, and pliant, and has no disposition to contract, so that it is of the same extent as the ulcer that preceded it. I had in my possession a preparation of the alimentary canal being denuded of its mucous coat, to the extent of eleven inches, and perfectly healed without any contraction or puckering. In cases of severe dysentery, however, where the cellular and muscular coats of the intestine are involved in the ulceration, the cicatrix is white and puckered, and appears very singular to one which would remain after a similar ulceration on the external part of the body.

The surface of the cavities that succeed the formation of abscesses in the lung, when it heals, receives a covering somewhat like that produced by the cicatrization of the mucous membranes, although coagulable lymph has been abundantly shed, and rendered vascular also, to constitute the walls of the abscess in the pulmonary tissue; neither is there any tendency in these cases to obliterate the cavity by contraction, or the growth of granulations, as in common abscess. In a few rare instances, after the cure of psoas abscess, the cavity remains in the state of a thickened and contracted cyst, holding a serous fluid, or it has been found to contain air. The interior surface of all such cavities nearly resembles the lining of sinuses.

OF REPARATION IN DIFFERENT TISSUES.

The power of repairing or of restoring the natural structure, exists in very different degrees in the several tissues of the body. In some, there is no attempt made to fill up vacancies at all; in others, a new growth is substituted for the original one, which is

sometimes competent to perform the same functions; and in other cases, the new formed substances merely serve to sustain the mechanic connexion of parts; and lastly, some tissues are so perfectly reproduced, that it is with difficulty they can be distinguished from the originals they represent. The power of repairing tissues is not distinctly regulated by a general law. The nearest approach we can make to a principle on which regeneration is conducted, is to state, that it prevails in the greatest degree in the tissues which are of a simple structure, and which are not endowed with peculiar or very superior vital properties.

Vacancies in the *brain* are not filled up by any substance, bearing a resemblance to the cerebral tissue. The *spinal marrow* also is never regenerated. When blood is extravasated in the interior of the brain or spinal marrow, it forms, in the first instance, a coagulum; and if the patient survive, it is ultimately absorbed, leaving a gelatinous fluid in its stead.

The non-reproduction of any substance resembling the brain or spinal marrow, is the more remarkable, as the *nerves* are regenerated, at least so far as to carry on their functions. The subject of the reproduction of nerves has given rise to much discussion, and many unnecessary experiments, amongst the Continental physiologists: some asserting that nerves are not reproduced, others denying it. A knowledge of the facts is in every person's power, who has dissected a stump, and has had the opportunity of observing the consequences that follow the division of a nerve in the living body.

All wounds of nerves heal by the formation of a hard bulb or nodule; this exceedingly firm and condensed structure is found uniting the two ends of a divided nerve, and also surrounding the part of it which has been cut in amputation; therefore, this is the natural mode of the healing of a nerve, whether by the medium of lymph or granulations. It has been found, that this bulb is nearly equally hard or solid throughout, and the continuation of visible nervous filaments in the interior has been sought for in vain in the human subject; nevertheless, sensation and voluntary motion being sooner or later restored beyond these bulbs, we can entertain no doubt, that the true sentient substance is ultimately regenerated within them. A hard, condensed structure is natural to nerves, in certain situations: for instance, the posterior tibial nerve below the inner ankle, the median where it enters the palm of the hand, and that branch of the radial which is distributed to the carpal joints, are enlarged, and so dense, as to obscure the appearance of the filamentous structure at those places.

When the nerves are divided some way from the end of the stump, I have been able to trace the appearance of filaments radiating from the bulbs, and proceeding to the skin. A preparation of this kind, in the stump of a finger, was preserved in my anatomical collection, which is now in possession of the University of Cambridge. Professor Muller states, that his assistant, Dr. Schann,

was able to dissect filaments passing from one end of a divided nerve to the other in the frog. Also, it cannot be doubted that the sensibility of granulations is caused by the extension of nervous filaments into them.

I once had the digital nerve of my thumb divided by a wound. The sensation was not perfectly recovered for some years, but is now as complete as before the accident. I observed a curious fact on this occasion. I was aware, from the depth of the wound, that the nerve must have been divided, and I was surprised that the sensation was not instantly lost; but, while examining the part, the sense of feeling vanished, giving me the impression of a blast of air having passed from the thumb up my arm. This occurred in about two minutes after receiving the wound.

From the above facts it is manifest, that the nervous substance is actually reproduced, although the imitation of the original structure is never so perfect in appearance, as not to leave some traces of the injury which has been inflicted.

The loss of any part of a *muscle*, I believe, is never supplied by a substance possessing the proper muscular structure, in the higher classes of animals. We commonly observe that the deficiency is partially filled up by a pale substance, which appears to be coagulable lymph imperfectly organized. Muscles that have been long disused, as in old paralysis, or from the compression of stays, degenerate into a substance very much like that which fills the intervals made in them by wounds.

When *tendon* is divided, and afterwards united, it is by means of a newly formed condensed substance, not possessing the true structure nor the brilliant metallic lustre of tendon, yet sufficiently strong to perform its offices. If tendinous structure do not unite, as in the laceration which occurs in a dislocation, the ends of the fibrous tissue form a number of tags or little bulbs, by the effusion of coagulable lymph; these become very hard, and finally smooth on the surface. It is said that the *dura mater* is not reproduced. A dense membrane, however, is formed, which answers a similar purpose. The only fibrous structure which is perfectly regenerated, is the *periosteum*.

The *cartilages* covering the ends of bones, when destroyed, never appear to form again. In old persons, especially, the place of the cartilages of the joints is often supplied by a curious change in the composition of the bones; by which the osseous substance assumes the density, hardness, and polished surface of china or white glass. This is the more remarkable, since we observe, in what are called *false joints*, the ends of the bones that rub on each other become covered with a sort of spurious cartilage. A vacancy in the cartilages of the larynx is filled up by a tough, dense cellular substance. The cartilaginous portions of the ribs are not reproduced by genuine cartilage, and the union of these parts is often confirmed by being surrounded with a shell of bone. I doubt whether the place of the *fibro-cartilages* is ever supplied, except by a tough cellular struc-

ture, not unlike common ligament, but wanting its brilliancy; in the cases, where the original structure possessed elasticity, that property is also absent, as we observe when the elastic cartilage of the ear has been divided.

No new formed structure more nearly resembles in the end the original, than the adhesion between *serous membranes;* although, in the first instance, these consist of a layer of soft coagulable lymph. In some cases, when a thick layer of lymph is deposited on the pleura, it is converted into a solid substance, somewhat resembling cartilage, in which occasionally is put down a considerable quantity of soft osseous matter. The *pericardium* also we sometimes find converted into a gristly substance. The *common cellular substances* is at first thickened by the deposition of coagulable lymph, and when this has been absorbed, the cellular membrane recovers its original structure.

In speaking of cicatrization, I have had occasion to state that no attempt is made to renew the *mucous membrane*, when it has been removed; and I have also explained the difference between a cicatrix and the true *skin*. But even when the basis of the skin remains, the villous surface is never regenerated, as we find in small-pox and cow-pock; after which the site of each pock, that has proceeded so far as to denude the skin of its villous substance, is always to be distinguished by a white depressed spot.

In the *arterial system* it has not been observed, that the elastic tunic is regenerated, nor that any of the vessels that possess this coat are formed again. The puncture of an artery is closed by condensed cellular membrane.

The proper tissue of the *veins* never grows again. I have always observed that veins on which venesection had been performed, presented on the inner surface a depressed line corresponding to the incision made with the lancet. The vacancy in veins being always closed by the cellular membrane somewhat condensed, accounts for those little pouches that are occasionally perceived over the vein, when the edges of the puncture have not been brought together after the operation of bleeding. These pouches are often seen, and sometimes of a large size, on the veins of horses, in consequence of the mode employed by farriers of pinning the edges of the wound, made in bleeding these animals, and the horse being allowed to stoop the head after the operation. There is no true venous tissue found in these pouches.

Bones are repaired in different ways, according to circumstances. In *simple fracture*, where the uniting medium is coagulable lymph, this substance undergoes several transitions. It is first absorbed in part, leaving as much of the lymph as is necessary for filling up the vacancy between the broken bones, and also sufficient to cover in the ends. This lymph next acquires organization, and becomes of the nature of cartilage, constituting, what is absurdly called, the *soft callus*. Into this nidus osseous matter is shed; and while this is going on, the absorbents are busily employed in giving the fractured parts

more of the natural form, by removing the rugged and irregular portions. When the *hard callus* (so called) is first formed, it is solid throughout; but afterwards the medullary structure of the interior of the bone is reproduced; and finally, in part by absorption, and in part by new deposition, the form and structure resemble in a great degree those of the original bone before the fracture occurred. When the patient is very young, the reproduction may be so perfectly accomplished, that no trace of the injury may remain. In cases of *compound fracture*, the same processes go on, with this difference, that all the surfaces which are exposed, are clothed with granulations; and that when a portion of the bone lies naked in the ulcer, it is detached by the process of what has been called *exfoliation*.

The section of a bone, contained in a stump that is healed by the first intention, has the sharp edges speedily rounded by the absorbents, and the medullary structure is for some way obliterated by an effusion of coagulable lymph, which undergoes the changes, first into cartilage, and subsequently into solid bone. When a stump suppurates, the difference in the mode of reparation consists in the end of the bone being covered with granulations, in place of coagulable lymph; ossific matter is deposited in the granulations; and, finally, the bone acquires a rounded form, or one which is consistent with the general shape of the stump.

A great deal has been written, and much that is erroneous, respecting the mode of reparation in *necrosis*. If we consult the authors who have treated of this subject, we find the greatest obscurity and confusion to prevail in the accounts they have given. Some ascribing to the periosteum, in its natural state, the power of regenerating new bone; others imagining, that the part of the bone that had not died, became swollen and inflamed, and thereby formed the agent of reproduction; others again supposing, that the periosteum and living bone concurred to produce the changes that are observed. All this confusion has arisen from the subject not having been investigated by the injection, and proper examination of the soft parts.

The mode in which the dead bone is removed, and a new one formed, is perfectly consistent with the general laws for the reparation of bone. A vascular substance is created, resembling granulations in structure and offices, for the purposes both of absorption and of reproduction, which I have called the *vascular investment*. This new organ will grow upon whatever tissue lies next the dead bone; and, as the periosteum is usually in that situation, the mistake has arisen of attributing to that membrane the offices of absorption and reproduction; functions, which it would be quite incompetent to perform in its natural state. I have been misquoted in Mr. Cooper's Surgical Dictionary, as agreeing with those who have supposed, that the periosteum, *as such*, was the proper structure for reproducing the new bone.

The granulation structure is that which is employed for the sepa-

ration of different substances that are not fit to remain in contact with the living body. Hence, we find it constitute the organ for this purpose, in necrosis; in the process of exfoliating bone that is dead; in detaching sloughs; in drawing the line of demarcation in a mortified limb; and in the removal of deciduous teeth.

When the principal part of the shaft of a bone is necrosed, the periosteum becomes detached from the bone; and from the number of red vessels it now receives, it is rendered soft, pulpy, and perfectly red on the surface next the bone; and, as soon as the work of absorption begins, this surface acquires the form of granulations. As this vascular investment proceeds inwards, devouring the dead bone, the shell of the new bone is deposited in the back of the granulation structure, which undergoes the preparatory change into a gelatinous or cartilaginous tissue, previous to its ossification. The shell is at first, of course thin, and with numerous holes in it, for the transmission of red vessels to the vascular structure, and for the exit of a fluid, which hardly deserves the name of pus, in the first instance, if the inflammation be kept down; and as the process advances inwards, the new formed bone becomes thicker and firmer, until at length, when the dead bone is all removed, the regenerated one becomes solid throughout. This description applies to those cases, in which the whole of the middle of a long bone dies, and is reproduced, but when the skin ulcerates, and a certain portion of the sequestrum or dead bone becomes exposed, that portion is separated by the granulations of the ulcer, by the process of exfoliation, if it be not removed by an operation.

We have seldom the opportunity of examining a limb when the process is completed. I had a preparation, however, in which the disease had commenced thirteen years before the death of the patient; and in this case, the interior was becoming cellular, preparatory to the formation of the medullary structure; and a new periosteum was produced, differing only from the original, in being a little thicker. I presume that, ultimately, the bone acquires perfectly the structure of the original one. I have seen a very near approach to the natural appearance and structure of the tibia in a preparation, that had been necrosed fifteen years before the specimen was obtained by the late Mr. Brooks. In this instance, the medullary reticulated tissue was reproduced throughout, although the medullary cells were irregular. The external part of the bone was somewhat thicker and less dense in texture, than in the natural tibia. The progress of reparation in necrosis above described, is fully illustrated by some injected preparations I made many years ago, when I was Demonstrator to Mr. Abernethy; which preparations are still to be seen in the anatomical museum of St. Bartholomew's Hospital. Necrosis rarely affects the spongy ends of bones; but when it does, the process of reparation is similar to that I have described. I had a preparation of the disease communicating with the knee-joint, in which there was a cavity leading into the joint, that had healed, with a smooth surface, and contained synovia.

I have said, that the presence of the periosteum is not necessary for the reproduction of the new bone, which is proved by destroying in an animal the life of the bone, and removing the periosteum, and afterwards healing the integuments over the dead bone; when the same changes take place, which I have described as occurring when the periosteum is present. This experiment was made by Mr. Hunter.

When a portion of the interior of a bone dies, and is completely enveloped by living bone, the latter becomes more or less softened by the interstitial absorption of its earthy substance, in order to admit blood-vessels to pass through to the granulation structure, which, in this case, is formed in the interior of the sound bone, that surrounds the dead portion.

We, therefore, perceive that the vascular structure, resembling granulations, is that which *alone* is capable of absorbing dead bone. We observe also, that the membrane lining the alveoli, acquires the granulation structure and secretes pus, when the teeth of an old person are to be removed; and these granulations leave impressions on the fangs, corresponding to their own shape, just as the granulations of an ulcer act on the lower surface of an exfoliated bone.

Many of the *epidermoid tissues* as the *cuticle*, *nails*, *hairs*, and *teeth* in the human subject, the *horns*, *hoofs*, *feathers*, and *spines* in animals, are intended to be removed, either in consequence of being periodically deciduous, or worn down by friction; the mode in which, therefore, they are reproduced is a natural process, similar to their original growth. This subject does not deserve our consideration at present, as having no connexion with reproductive power, subsequent to injury or disease. I may, however, remark, that as these different productions require a peculiar organization of the parts which furnish them, when that is destroyed, there are few instances of a similar organization being regenerated. Thus, when the villous surface of the skin is lost, the insensible integument is not like the original cuticle. It is thin, adherent to the parts underneath, and does not appear to be regularly cast off, and renewed. When the capsules which contain the roots of the hairs are destroyed, the part remains bald. In the natural growth of hair, a new pulp arises from the bottom of the capsule, but it demands the full vascularity of the skin to generate new pulps; we observe, therefore, baldness in the old, in whom the cutaneous circulation is languid.

If the vascular surface which furnishes the horny substance of the nail, be completely destroyed, no new nail is usually formed; nevertheless, there appears to be sometimes a great disposition to the revival of the proper structure for secreting the nail. It reappears, in some cases, after caustic has been repeatedly applied to it, to prevent the reproduction of a nail which penetrates the skin. Two instances are recorded of a nail growing on the stump of an

amputated finger; and I had a preparation of a finger, which had the last and a part of the second joint removed by amputation. The proper vascular structure had been produced on the stump, and a true horny nail generated; which, however, had a deformed appearance, and was very much hooked. This preparation is now with my collection placed in the University of Cambridge.

OF CONSTITUTIONAL OR REMOTE CAUSES OF INFLAMMATION.

Plethora, which consists in a redundant quantity of the circulating fluid, in proportion to its expenditure for the purposes of secretion, and the growth of the body, is generally considered to be a cause of inflammation. It should rather, however, be looked upon as a state increasing the susceptibility to inflammation, when direct excitements are administered, than as an actual cause.

There are two kinds of plethora; one in which the arterial system is overcharged; the other, wherein the venous blood seems to preponderate. Certain individuals, from original constitution, have a tendency to one or the other of these states of circulation, by which inflammation, when it appears, takes its peculiar character. As a general rule, arterial plethora belongs to the young, and the venous to the aged. Obstructions in the heart, lungs, or liver, organs which are immediately connected with the circulation, may be the cause of the accumulations of blood, either in the system generally, or in particular organs. When young persons have, what is called, the sanguineous temperament; they have bright red complexions, a rapid state of circulation, and much animal heat; they are prone to phlegmonous inflammations, cynanche, and the formation of active abscess: whilst those with purple complexion, languid circulation, and low temperature, are most subject to erysipelatous affections, to boils, and chilblains. The character of activity and speedy termination belongs usually to the inflammations, of the young, and of languor, persistence, and want of reparative power to those of the old and feeble. As the venous blood preponderates in the lower extremities, and the circulation is more difficult in them than in the upper parts of the body, they are most liable to the worst species of inflammation, and after injury or operation are the most difficult to cure.

Another circumstance, which ought to be viewed more as a predisposing than a direct cause of inflammation, is, what is called *local determination of blood.* It is a law of a circulation, that when too much blood is sent to one part of the body, too little at the same time visit some other; the balance, therefore, may be disturbed by external cold repelling the blood from one part, it is sent in undue quantity elsewhere; and usually the circulation is diminished and augmented in parts opposed to each other; hence flushing of the

face and cold feet exist together, and cold applied to the skin of the abdomen determines the blood to the surfaces of the peritoneum and alimentary canal. The state of circulation is more fluctuating in the head than elsewhere; and from the delicate texture of the brain and organs of sense, a determination of blood to the head causes more inconvenience, than when it occurs in any other part of the body. It is also produced by circumstances, which do not determine the blood to other parts; as passion, mental application, the exertion of the sight, and intoxication. A forced state of the circulation in the head, predisposes more particularly to inflammations of the membranes of the brain, the external parts of the nose, and to ophthalmia.

Fever is not an uncommon cause of inflammation, and produces it in different ways. The eruptive fevers are essentially connected with the inflammation of the skin. Certain epidemics are naturally associated with inflammations of some of the viscera. In some seasons, typhous fever is combined with pneumonia, in others, with dysentery, or gastritis; and cases occur, in which fever is attended with phrenitic symptoms from the beginning. Some physicians, from observing real inflammation to be occasionally combined with fever, have fallen into the error of supposing all fever to be essentially a disease of an inflammatory nature; and have mistaken the usual state of congestion in the vessels of the brain after common typhous fever, for the genuine effects of inflammation of the cerebral organ.

In certain cases, when continued fever has existed for some time, the viscera may be assailed by inflammation; and, in many instances, when the paroxyms of intermittent fever have been often repeated, inflammatory affections of the chest, or parts in the abdomen may arise. The bubo and vesicle are known as part of the symptoms of plague; occasionally also, in the common fevers of this country, the lymphatic glands over the parotid inflame, and proceed to suppuration. Two errors have existed on this subject; one is to suppose such abscesses to be critical and salutary; and the other is to attribute the seat of such abscesses to the parotid gland itself.

When inflammations come on during fever, without being naturally, or necessarily associated with it, they would seem to be produced by the disturbed state of circulation, acting on organs already disposed to disease; and, hence, we find that habitual dram-drinkers are more liable than others to phrenitic and gastric inflammation during fever. The season and the situation of the patient have also considerable influence in modifying the character of fever. Even symptomatic fevers, from wounds, have assumed the remittent or intermittent form, when soldiers were placed in marshy situations. When local diseases occur as the sequel of fever, they would appear to be occasioned by the sudden demand made on the powers of the body, when it is in an enfeebled state; for, the local affections that succeed, are those which indicate want or vigour; as œdema, erysipelas of the legs, mortification of the feet, and death, or necrosis of some of the bones of the lower extremity.

There are *certain morbid states of the constitution* which lead to local inflammation of peculiar character and progress, subsequent to slight accidental irritation; or, in some instances, without any apparent local provocation; as examples, we may mention *scrofula, gout, rheumatism, cancer, &c.* The scrofulous constitution is well understood, because it displays its nature, in the condition of parts even when it does not generate local disease. But, the peculiar states of constitution, which give the tendency to gouty or rheumatic inflammation, or to the formation and development of cancerous tumours, medullary sarcoma, and fungus hæmatodes, &c., have hitherto evaded discovery.

From contemplating the constitutional character of scrofula, we might foresee the kind of local inflammation which might occur; although it is not understood, why certain tissues or organs should be more liable to scrofulous inflammation, than others. In scrofulous persons the vascular system is weak, the vessels are small, the blood is deficient in quantity, and is, I think, imperfectly organized; it wants the full power of generating the coagulable lymph; and either from this cause or the want of power in the arteries, the secretions which indicate strength are deficient; the fat of the soft parts and the marrow of the bones want the genuine oily composition; the earth of bones is not formed in the proper quantity; the unctuous secretions of the skin are deficient; the sabaceous secretion is albuminous and inodorous; it is, therefore, liable to dry, and produce irritation of the parts it ought to protect. The mucous and serous secretions are alone perfectly formed, as being those which require the least strength in the constitution. The brain is pale, and does not possess the usual quantity of red blood; and yet, there is a mental character belonging to the scrofulous habit, which more strikingly indicates the pecular state of the constitution than all the other signs. Scrofulous children, in general, exhibit no mental energy, but a gentleness and amiability of disposition, a refinement and judgment in matters of taste, and a purity of moral feeling, which is sometimes so remarkable, as to place them, in these points, far beyond the scale, and even beyond the conception of the mass of mankind.

Deranged or disordered state of the functions of the internal organs is known to be the cause of various local inflammations, and to interfere with the progress of wounds and ulcers towards cure. Those authors, who have attributed the greatest importance to the influence of internal disorders on external diseases, have not stated explicitly, either the impaired condition of the internal organs, nor offered a satisfactory explanation of the manner in which the remote influence operates.

Some have considered the internal derangement to arise from an overloaded state of the alimentary canal; others have thought that it depended on a deficiency of the natural secretions from the mucous surfaces; others again have referred the internal disturbance to a redundant, or an imperfect, or vitiated secretion of the biliary fluid. It is true, that these circumstances, as well as many others, may be the means of producing disagreeable impressions

on the interior of the alimentary tube; but it is the state of feeling in the internal sentient surface, however it may be produced, which constitutes the direct cause of inflammation in the external parts. When we reflect on the extent of the sentient surface lining the alimentary canal, and on the fact of its being so constantly exposed to the impressions of foreign substances passing along it, we must perceive, that it is liable to irritation from various causes; many of which are unattended with the consciousness of the individual, in consequence of the digestive organs deriving their supply of nerves from the sympathetic system. It is a law of the sensation of parts, receiving their nerves from the above source, to extend the influence of its irritation, not only to the whole of the internal sentient surface, but to produce its effects on distant parts of the body; and sometimes to occasion unusual and morbid sensations in them, attended with consciousness: and thus the original irritation may not be the chief object of attention; as examples of which, I may notice the pain in the glans penis, from stone in the bladder; the pain on the top of the shoulder, indicating diseased liver; the pain down the left arm, from disorder of the heart. Stricture of the mucous canals also are known to cause various remote sensations. I remember a very curious instance, in which I discovered a stricture in the œsophagus, by the person feeling an acute pain in the little finger of the left hand every time he swallowed.

The secret irritation of the sentient surfaces may naturally become the cause of the inflammatory actions of arteries in remote parts of the body, inasmuch as both the mucous canals and the blood-vessels derive their nerves chiefly from the sympathetic system. It is observed, that the inflammations which are the consequence of an uneasy state of the internal sentient surfaces, are most frequently exhibited on the skin, which constitutes the external sentient surface. Thus, erysipelas, and various cutaneous diseases, are often merely the signs of internal disorder. From the same cause also, granulations are sometimes assailed with a degree of inflammation, which is incompatible with their existence. An ulcer may, in the course of a few hours, become livid and bloated; and the granulations be afterwards removed by the process of slough, or swept away by rapid ulceration, in consequence of derangement of the mucous surfaces, when, but a short time before, hopes were entertained of a speedy cure: indeed the occurrence of slough or phagedenic ulceration is most frequently produced by irritation of the surfaces of the assimilating organs.

The *suppression of the natural secretions or of discharges*, which have been rendered *habitual*, is known to be a cause of inflammation. The stoppage of the exhalation from the skin may produce inflammation of the viscera, or of the commencement of the internal surfaces; and there is reason to believe, that a diminished secretion from the surface of the alimentary canal, may be the cause of inflammation, both in the interior and external parts of the body.

Long continued purulent discharges, and hemorrhages frequently

repeated, when suddenly suppressed, give rise to inflammations, occasionally, but not so frequently, perhaps, as formerly supposed. Old ulcers of the legs cannot sometimes be cured without risk. When the humoral pathology prevailed, it was believed, that suppressed secretions and discharges produced inflammation, by accumulatiug the blood, or detaining some peccant matter in the body, which had been previously carried off. We have already observed, that plethora, of itself, is not sufficient to cause inflammation, and, even if it were, we have no evidence, that a plethoric state of the system is induced by the suppression of local secretions or customary discharges. Generally speaking, the mischief occurs before there is time for the circulating fluid to become redundant, in consequence of even extensive secretions being interrupted; and in many cases, the discharge which is stopped, is so insignificant, as to quantity, as to be incapable of producing any influence on the mass of blood. It is true, that the removal of a purulent discharge, by amputating a considerable portion of the body, may produce plethora, and a predisposition to inflammation; but this is more likely to occur, when amputation has been performed from wounds, and in a healthy person.

We must, therefore, adopt some other explanation for the suppression of secretion becoming the cause of inflammation, than the disturbance of the balance between the quantity of the circulating fluid, and that of the discharge which has been suspended. It is probable, that the interruption of the secreting function, in any one part of the arterial system, and especially on sentient surfaces, may, from the law of sympathy, which is so remarkable between the vascular system and these surfaces, become a direct motive to the arteries to assume, in certain places, an inflammatory state. This mode of explanation is rendered more probable, from the fact, that the removing very slight external irritation, or inflammations, which furnish very little or no pus, sometimes causes the most severe constitutional disturbance, which is removed by the recurrence of the local irritation.

The general health is most placed under the influence of these affections of the skin, which are in themselves of little importance, and to which, therefore, the constitution can be easily reconciled. It is necessary, also, that they should be disposed to continue, or to recur at stated periods. Scaly eruptions, especially the icthyosis, the itch, certain forms of tinea, and slight inflammations furnishing a crust, or a furfur, can be borne without disturbing the health; yet, when suddenly cured, sometimes give rise to serious affections, while with the more severe inflammations of the skin, as vesicles, pustules, and rashes, the constitution sympathizes until they are cured, and then it is relieved. I have seen the most serious diseases endangering life, induced by the cure of that slight cutaneous affection of the cheek, which sometimes is a mere efflorescence, periodically throwing off a little furfur, or forming a crust. Dr. Jenner once showed me a red spot on his wrist, that could be covered with

a sixpence; he said, whenever it faded, his stomach and general feeling of health were affected.

It would seem, that the reason for cutaneous affections being so often the result of internal derangement, and in their turn influencing the health, is the close sympathy which exists between the internal and external surface, in which the two classes of nerves naturally are distributed.

A long continued presence of a local irritation on these surfaces, so slight in degree as not to disturb the health, constitutes a habit that cannot always be safely interfered with. The laws of habit are amongst the most curious and incomprehensible in the animal economy. Impressions which are at first disagreeable, in time become indifferent, and in the end agreeable or necessary. According to this rule many of our tastes are regulated; the stomach can be taught to digest food, which at first is offensive to it; the skin and various parts of the mucous membrane may be reconciled to impressions, which were in the beginning painful. Even mental irritations may become necessary to health, as is proved, by persons sinking on the sudden cessation of causes, which kept up a continual anxiety or vexation. The laws of habit are more strikingly displayed, in the modifications of the sensibility of the sentient surfaces, than in any other parts of the body; and hence the sudden removal of an impression, to which their surfaces are habituated, may produce as much effect as one of an entirely new kind.

Inflammation is more frequently caused by the event which is called *getting cold*, than by any other means, except direct local injury; and although this is the most common remote cause, it is the one least understood, and the most difficult to explain. Before we attempt to account for getting cold becoming a cause of inflammation, it is necessary to examine the circumstances, under which a change of temperature can produce such an effect.

A person being placed in a situation, where some part of the body is exposed to a stream of cold and damp air, such as would pass through a small crevice, or window not properly closed, is first sensible of that part being chilled, and soon after feels as if the temperature was departing from the rest of the body, especially along the region of the spine, although the body at the time may actually be as warm as usual; the immediate effect of the insidious abstraction of heat is the collapse of the arteries in the part; this extends to the rest of the vascular system, especially of the skin; the surface of the body becomes pale and shrunken. The nervous system takes alarm, and the muscles begin to tremble involuntarily, particularly those of the jaws and of respiration, which are so much disposed to sympathize with impressions made on the nervous system, producing that agitated respiratory movement, and chattering of the teeth, which is called rigor. When the latter is severe, the muscles of the extremities also are engaged, as we observe in the cold stage of ague. To the state of collapse succeeds a reaction in the vascular system, which may exhibit afterwards the general phenomena of fever, or of local inflammation.

The sudden exchange from a heated room to a cold and damp atmosphere, is another way in which cold is caught; and breathing a chill air at night, while the rest of the body is heated, will also give cold to many persons; but most frequently people catch cold by standing or sitting in what is called a draft of cold air, when the body has been previously heated; in which case the impression is made for some time before the person is conscious of it.

Of all parts of the body the back is the most susceptible of cold, thus insidiously applied, and the chilliness is sometimes even felt first along the back, although it may not have been the part immediately exposed. Perhaps this circumstance depends on the nerves of the skin of the back having so direct a communication with the spinal marrow.

Parts of the body naturally or habitually exposed to vicissitudes of temperature, are the least susceptible of the impression which gives cold. The face and hands may with safety be subjected to all changes from heat to cold. Persons who are in the habit of going barefooted, never catch cold from wet applied to the feet; while others, who are accustomed to wear shoes, are extremely liable to catch cold from this circumstance. The inflammations which succeed cold and wet feet, usually occur in the most remote parts, as the fauces, larynx, and bronchi. This fact furnishes an evidence of the sympathy which exists between certain parts, and impressions made on the external surface.

Prostration of strength and dejection, or want of interest in the mind, render people more subject to suffer from the causes of getting cold. When persons are exposed to the same causes under strong mental excitement or attention, they almost always escape the danger from cold or wet, whether partially or generally applied. This is strikingly exhibited by soldiers during a campaign, or on a march; by persons being deeply interested in the amusements of shooting, fishing, and hunting; and indeed in every case in which the attention is much exerted, or the feelings excited. No class of persons endured so much hardship from cold and wet, as those who were employed in the business of exhumation; and yet, these men were nearly exempt from colds and coughs, in seasons, even when epidemic catarrh affected almost every one else.

All the circumstances which belong to what is called catching cold, prove that it is not simply the reduction of the temperature, in the whole or any part of the body, which produces the event, but the sedative effect on the sentient surface, by the insidious manner in which the cold and damp are applied, and the predisposition of the system, at the time, to yield to the impression. Even extreme reductions of the heat, if suddenly made, act as a stimulus, and rouse immediately the energies of the body to resistance; and hence, the affusion of cold water is employed in the cure of fever, and to restore strength and vigour to persons who are debilitated. The only way, in which intense cold produces inflammation, is by the person reviving the natural circulation and temperature too

suddenly in parts that have been benumbed, or have had their actions suspended, by exposure to a very low temperature. Mr. Hunter related an experiment of freezing a mouse, in which the animal submitted to the abstraction of heat to a great extent, without exhibiting any uneasiness; but when it became sensible of the danger of congelation, the creature ran round the vessel in great anxiety, and soon after was frozen. This experiment shows that cold may act as a stimulus, even when carried to an intense degree, if the system be aware of its danger. In the same manner, when a person is placed in the situation favourable to giving cold, the danger may be avoided, by turning the face instead of the back to the direction of the stream of cold and damp air, observing the sensation caused by the impression, and voluntarily rousing himself to a feeling of resistance. In protecting the body by clothing, the back is the part chiefly to be regarded, and hence winter waistcoats should have the back made of at least as thick materials as the front. People commonly fall into the error of clothing the front of the body warmly, and expect to escape cold by muffling the throat. The Irish peasantry more wisely, expose the throat and breast, and defend the back by a warm great coat, which they seldom close in front.

OF THE LOCAL CAUSES OF INFLAMMATION.

These are, *first*, palpable injuries to the organization, which affect the structure in such a way, as to interfere with the performance of its functions; *second*, the application of substances, which irritate the sentient extremities of the nerves; *third*, fluids, which produce a peculiar impression, and that create a disposition to specific inflammation; and, *fourth*, sudden changes in the state of feeling of parts, although, in some instances, to one more agreeable than that which previously existed.

Mechanic forces may injure the organization in various ways. *Incised wounds*, if made with a sharp instrument, would seem to merely divide the structure. All cutting instruments, however, act, in some degree, either as a saw, or a wedge. The edge of even the most delicate lancet, when viewed with a sufficiently high magnifying power, is found to be serrated, and no instrument can be made, which has not more thickness than belongs to its edge. In the purest incised wound, therefore, the structure is partly lacerated, and partly forced asunder. The most delicate cutting edge, however, inflicts a wound, which has scarcely any disposition to inflame.

When ruder weapons are employed, the divided surfaces are more or less torn, constituting what is called the *lacerated wound*.

In some cases the surfaces are so much injured, that their vitality is destroyed, and they are necessarily removed by the process of slough.

The mechanic injury may bruise the living structure, making what is termed the *contused wound.* The contusion may be so slight, that the parts easily recover; or so severe, that a portion of the structure is so thoroughly disorganized, that it dies, and is cast off. The skin suffers more from contusion than the internal parts, especially when it is situated near to hard bones. In *gunshot* wounds, the organization of the skin is injured by the contusion of the ball, while the internal parts may be divided with little injury. In all contusions the small blood-vessels are more or less broken, causing extravasation of blood, and when the skin is unbroken, this cannot escape, and may accumulate to a considerable extent. Unless the blood be wanted for reparation, as in fractured bones, it usually does not coagulate, and is removed by the absorbents; these vessels, taking up first the colouring matter; and hence, the colour of bruised parts is in the beginning a dark-purple or black colour, because the effused blood soon acquires the venous character, and as the colouring matter is absorbed, the part becomes yellow. Both internal lacerations and contusions, even when very extensive, are not necessarily followed by any inflammation of consequence, as we find in simple fracture of bones.

The insertion of a conical-shaped object into the living structure, constitutes the *punctured wound;* the effects of which will vary much, according as the instrument may be fine and sharp at the point, or thick and blunt. In the first case, the wound bears some resemblance to the injury by incision. The mischievous character of the punctured wound depends on the parts being forced asunder, as by a wedge. Wounds made with fine small swords, have been healed without inflammation, merely by keeping them in an easy and quiet state. The operation of acupuncture has no tendency to cause inflammation, whereas, the wound made by forcing in a blunt instrument or weapon produces a greater tendency to inflammation, and that of a bad description, than any other kind of mechanic injury. When a wound is thus made, little or no blood is shed. The pain is peculiar and overcoming. The edges of the wound have, at first, no disposition to approach each other, and any attempt to approximate them by mechanic restraint, increases the pain, and hurries on the inflammation. This last is not confined to the immediate seat of the puncture, but extends along the limb, affecting the absorbents; and when suppuration comes on, it is not confined to the wound, but abscesses form in succession in the neighbourhood of it, and sometimes at a considerable distance.

As the inflammation from punctured wounds has a disposition to extend itself, and to persist, the constitution is affected with an irritable sympathetic fever, more especially, if the tendinous structure be engaged, either in the original wound, or by the subsequent inflammations. When punctured wounds are made by the teeth or

claws of quadrupeds, the spurs of the cock, or the spines of certain fishes, the symptoms are peculiarly severe; and in some of these instances, such wounds are so intractable, that it has been supposed an animal poison had been introduced. A wound with the spine of the *sting ray* is found to be peculiarly dangerous, often leading to the loss of the limb, or life itself. Fishermen universally believe, that the spine emits a poisonous fluid. I have, however, carefully dissected that part of the fish, and I am satisfied that it contains no poisonous apparatus. The severity of the symptoms may be accounted for, by the shape of the spine of the ray's tail; the animal lashing it into the back of the hand; and the subsequent bad treatment of the wound.

In the account here given of the consequences of wounds, it is supposed, that the usual surgical treatment is employed, but when the means, hereafter to be described, are resorted to in time, inflammation does not necessarily follow any of these wounds.

Certain *mineral substances,* when applied to the living structure, enter into composition with it, and destroy its organization, often more extensively than mechanic injuries. If the power of mineral poisons and caustics were not extended beyond the part that is actually decomposed or killed, their application would produce no more effect, than a mechanic force, which would destroy as much of similar parts; but in every instance the structure continuous with that to which the corrosive substance has been applied is more or less irritated, and disposed to inflame. Of the caustics employed by surgeons, the one which diffuses its effects most is arsenic, and that which is most confined in its operation is the lunar caustic. After the application of the first, the inflammation spreads far beyond the part actually destroyed, and is of an angry and diffused character; but the lunar caustic seldom extends the irritation farther than the immediate seat of the eschar.

Arsenic, corrosive sublimate, oxalic acid, &c., when swallowed, produce different appearances on the inner surface of the stomach, but the decomposition of the villous coat is nearly the same in all, and if the person survive long enough, the inflammation from each of these poisons is similar. The experiment made by Sir Benjamin Brodie, in which he spread corrosive sublimate on the peritoneum, and produced instant death, and which experiment I have repeated, with the same result, might lead us to suppose, that this mineral poison had some peculiarity of character; but it is more probable, that the rapidity of its destructive action, and the sympathy of the system with the peritoneum, were the causes of sudden death in these experiments. I have known a woman, intending to commit suicide, take a large quantity of the corrosive sublimate into the mouth. The whole surface was decomposed in an instant, and she was not able to swallow a particle of the sublimate. She had, however, extensive inflammation of the mouth, with sloughing, and salivation.

Temperature, if sufficiently high, will destroy the organic struc-

ture perfectly, but, at the same time, will injure or disturb the organization to a greater or less distance beyond the surfaces that are killed. The pain arising from the contact of boiling water or equally heated solids, is universally known, but it should not be confounded with the pain of inflammation, which comes on later. As in all other cases, imperfect disorganization is a stronger motive to parts to inflame, than great destruction. Extensive burns or scalds, which only partially kill the skin, are not only capable of keeping up inflammation; but, from destroying a greater surface on which the sentient extremities of the nerves terminate, may produce coma in the first instance. In military punishment by flogging, less inflammation follows a deep laceration, than a more extensive, although a slighter injury to the surface of the skin.

It is a law of the animal economy, that internal and external surfaces that are opposed to each other are more disposed to sympathize, than tissues that are continuous. All local and superficial injuries, as inflammations of the skin, are liable to create an inflamed state of the nearest serous surface, without involving the interjacent tissues. I have seen this opposite inflammation set up from burns and scalds, superficial military punishment, the irritation of a blister, tinea capitis spreading to the face, and erysipelas. It deserves remark, that these internal inflammations have a peculiar character. They keep pace with the external source of irritation. The surface of the serous membrane is crowded with red vessels, which do not however pour out serum. The parts are not conjoined by coagulable lymph, nor is there any tendency to the formation of pus. The constitution sympathizes more with inflammations of the serous membranes thus produced, and in a different manner, than with those arising originally on the serous surfaces. Instead of the inflammatory symptomatic fever, we observe prostration, anxiety, perturbation, and in severe cases there is delirium. The event is not unfrequently fatal.

The effects of rapid *friction* on the surface of the skin are exactly the same of a superficial burn. How frictions can produce such an effect is difficult to solve. It does not appear to be from the generation of heat. It is more probable, that friction mechanically irritates and inflames the skin, as we find slow and repeated friction, from walking, raises blisters on the feet. The friction of two opposite surfaces of the skin on each other, causes excoriation and a troublesome inflammation. Highland soldiers suffer excoriation between the thighs on a march, in consequence of wanting the protection of breeches. Fat men also are liable to excoriation in the cleft of the buttocks, by walking long in hot weather, because the skin of the two sides touch. Excoriation from two surfaces of skin rubbing against each other is much promoted by perspiration.

The *reduction* of the *temperature* of the body operates in two ways. If the cold be extreme, it may kill the part exposed to it; and in a lesser degree, it may change the organic sensibility, by

which the ordinary vital actions return, with a peculiar inflammation of an irritable and obstinate character. If the natural temperature be suddenly restored, this species of inflammation will be generated, even when the cold previously applied has been in a moderate degree. When parts have had their vitality destroyed by congelation, the organization of the parts is more or less affected to some distance beyond that which is actually frost bitten, which renders them incapable of bearing natural warmth, without suffering pain and an inflammation of an erysipelatous character, and extremely difficult to remove. The extreme parts of the body, as the feet, hands, and nose, are most liable to affections from cold, because they are most exposed, and have the least power of resisting external temperature, although, in reality, they can bear the reduction of their temperature better than the rest of the body. The fingers, toes, and nose may be frozen and perfectly recovered, if judicious means be employed; whereas if the whole limb be frozen, it dies; and none of the higher classes of animals can have the entire body congealed and escape death.

In chilblains which are produced by sudden transitions of temperature, we have a familiar example of the peculiar, irritable, and languid inflammation I have mentioned. The skin is a purple colour; sometimes vesicates, from whence the name of *blain* is obtained. When the attempt is made to suppurate, a bloody serum instead of pus is effused into the cellular membrane, which, with a portion of the skin, occasionally sloughs. From the state of the circulation of parts affected with chilblains, the reparative power is low, and requires to be roused by stimulation. Certain constitutions in which the circulation is languid in the extreme parts, with a predominance of venous blood, indicated by a purple complexion, and the same colour in the skin of the extremities, appearing on exposure to cold, are peculiarly liable to the chilblain inflammation. I have seen young persons with this constitution, besides the feet, have the hands and nose affected every winter with the disease.

The means which provoke the feelings, and disturb the organization, without evidently or immediately destroying it, are *concussion*, *pressure*, *constriction*, and *uneasy position*.

Concussion suspends for a time all vital actions, or in severe cases, may irrecoverably extinguish them. When the functions of concussed parts are restored, there is a strong tendency to exceed the natural actions, and to proceed to a state of inflammation; in the same manner, as inflammatory actions arise in parts that have their functions suspended by an extremely low temperature. It is possible, that in all cases of concussion, the injury does not merely consist of a suspension of the actions of the part, but in an actual mechanic disturbance of the organization. In severe concussions of the brain, there is an evidence of the injury done to its structure, by the breaking of the small blood-vessels, producing an extravasation of some blood on the surfaces of the organ.

Pressure, unless very severe, or long suffered on one spot, does

not excite inflammation, except in states of general debility, or when the structure compressed is endowed with little vitality. When prominent parts inflame, and ulcerate by receiving pressure from the incumbent weight of the body, it is because there is so much weakness of the muscles, that the person cannot vary his position in the slightest degree: the pressure, therefore, is uniformly and permanently made. We have every reason to believe, that the muscles in young and vigorous people perform slight actions amongst themselves, which, although no apparent alteration takes place in the position of the body, serve to vary the degree of pressure, and thus its bad effects are prevented.

Old and infirm persons feel some uneasiness, from lying, sitting, or standing long in the same position, because their muscles are inactive; and persons who are paralytic, are subject to suffer from pressure, even when lying on the softest bed. We have the opportunity of observing, how much more parts which are in themselves weak, suffer from pressure, in the case of the ulceration of the cicatrix of a stump, on which the weight of the body is imposed, while the original skin may escape. Severe pressure, when long maintained, gives great pain, and tendency to inflammation afterwards, as may be shown by the military punishment of the picket.

Constriction by tight bandage, or dressing of a wounded part, or the adhesion of dried clots of blood, scabs, or crusts, is a cause of inflammation, too much overlooked by surgeons, often disappointing them in their object of producing union by the first intention. No part in which there is the slightest degree of inflammation, will bear the least restraint without becoming more inflamed, and as long as constriction is maintained, no means, except its removal, will abate the inflammation.

An *uneasy* and *depending position*, although not capable of itself to cause inflammation, in a sound part, always aggravates the inflammatory action, if it exist, and may be the means of provoking inflammation in parts that are injured. This is shown by the more untoward progress of wounds and ulcers of the lower extremities, than in the superior parts of the body. A depending position operates by impeding the circulation, and accumulating the blood in the inflamed or injured parts.

Certain irritating substances, either immediately or within a very short time produce local inflammation, merely by their contact, without apparently disturbing the organization. These substances make an impression on the sentient surfaces, which is felt by them, and they inflame in consequence, and in different ways, according to the nature of the impression. Thus, the juice of mustard causes a bright efflorescence on the skin, which although speedily produced, remains for a considerable time; the fluid of the meloe, or blistering fly, raises a vesication; the irritating fluid of the sting of nettles instantly excites a papular inflammation; certain species of medusa, (therefore called sea nettles,) cause, at the very moment of contact, red patches on the skin, with a burning and itching sen-

sation. The ointment made with tartar emetic, produces pustules. Different essential oils, especially when rubbed on the skin, will inflame it, and even occasion vesication.

It is impossible to explain how these, or any other substances, by merely being placed in contact with the living structure, should be the means of irritating the sensations, and exciting, consequently, an inflammatory action. It is one of the original laws of sensation, that different tissues feel the contact of external substances, either agreeably, or the contrary, according to their own organization and state of sensibility. The application of the same stimulant is attended with very different effects on the internal and external sentient surfaces, and on one part of the latter or another. The same parts in different individuals, vary greatly in the susceptibility to irritation, and to all foreign impressions; and even the same part is more excitable at one time than another; showing, that all the phenomena of irritation depend on the state of sensibility, in relation to the properties of foreign matter for affecting the living structure in the mode of sensitive impression, and not by the means of mechanical or chemical agency. We have numerous examples of this interesting and important fact, continually before our eyes, and yet we are always endeavouring to account for them on different principles.

Certain animal fluids act as a species of poison, if introduced by means of a wound, or applied upon the more sensible parts of the skin, and thus become the cause of inflammations of peculiar character and progress. The substances which operate the most remarkably in this manner, are, animal matter in certain stages of decomposition, and serum, or pus, generated by specific diseases in the living body. Besides these, it would seem, that all the natural fluids may act as an irritation, when taken from one person, and applied to another; and it is known that the cutaneus secretions, if too long detained on the surface, especially, if that surface have a thin integument, will inflame it. Thus, many persons cannot receive the fluids of the mouth of particular people on their lips, without immediately experiencing a sense of irritation and smarting in those parts; this impression, however, wears off by habit. Some persons are subject to inflammation of the glans penis and prepuce after copulation with healthy women. A female will sometimes, after marriage, suffer an extensive inflammation of the internal labia and vagina, attended with a purulent discharge, although no venereal disease has been communicated. Perhaps the transmission of pus, generated in this way, and mixed with other secretions, might have given origin to the true venereal inflammation. The secretions of the genital organs, when too long detained, from neglect of cleanliness, are very irritating to the tender surfaces on which they lie, producing excoriation, and sometimes diffused inflammation of the prepuce, or of the labia in females.

The introduction of *dead animal matter*, by means of a wound, or even the application of it to the skin, has often been the cause

of a highly dangerous disease, not unfrequently ending in death. Every anatomical class has annually furnished examples of the effects of this species of infection, except the dissecting class of the Dublin University, during the time it was placed under my direction. Very simple means of prevention were employed, with so much success, that no severe disease from wounds received in dissection occurred, (when the proper means of prevention had been employed,) during the last fifteen years that I held the Professorship of Anatomy in that University. The means resorted to consisted in immediately washing the wounded part, and afterwards keeping it wet for a few hours, with a solution of alum in water. Most probably, any other fluid, such as the liquor plumbi, solution of sulphate of zinc, &c., which would have the effect of coagulating the animal substance, would answer quite as well; but the solution of alum was always at hand, and, I believe, if immediately applied, would never fail in preventing infection. The same means would probably succeed equally well, as a protection against other morbid poisons, applied to the skin, or introduced by a wound.

The two stages of decomposition in the dead body, which render the animal substance most dangerous, are, that which takes place immediately after death, and the extreme degree of putrefaction. The latter is most apprehended, but, it usually occasions only a diffused inflammation in the part wounded, without any serious sympathy of the constitution.

From the introduction of the recently dead animal matter, the most dangerous consequence arise: *first*, a diffused inflammation in the limb infected, communicated along the absorbent vessels to the next lymphatic glands. To this succeeds, very rapidly, in some instances, a highly alarming sympathy of the system. The pulse becomes greatly accelerated, but at the same time very weak; a sense of unaccountable distress and anxiety is felt, and expressed in the countenance. There is sometimes an extreme prostration of strength. The tongue is coated, and the alimentary functions are disturbed. As the disease proceeds, inflammations arise successively in parts of the body remote from the original wound, of a character which augments the constitutional sympathy, as they are not bounded by the effusion of lymph. No pus is, in general, formed in these situations, and when these tumours have been cut into, on the supposition of their being abscesses, they have been found to contain usually only a bloody serum. A very common place for these collections of fluid to form, is underneath the great pectoral muscle, although this situation is not in the course of the absorbents, leading from the hand to the subclavian vein. Indeed, the formation of a spurious abscess under the pectoral muscle, is one of the most characteristic symptoms of the infection from wounds received in dissection. In some instances, vesicles or pocks arise in the neighbourhood of the original injury. If the disease continue in this manner, the patient usually dies in a few days. When the affection is less severe, the person may recover, with very often a

shattered state of health, which gives origin to anomalous and uncertain symptoms, that recur for months afterwards. Sometimes the diffused inflammation extends over the whole limb, and a part of the trunk of the body, attended with disorganization, resembling that from the bite of a venomous snake. At other times, the inflammation assumes the character of common erysipelas. These varieties would appear to depend on the constitution of the patient. I have had one case, in which erysipelas showed itself, first, on the head, and from thence travelled progressively on the body, and on the extremities, as far as the legs and forearm.

Some dead animal substance is more likely to communicate this dangerous disease, than others. The brain, in the recently dead body, is extremely apt to produce it, even when no wound is received. The sero-purulent fluid, found in the large cavities after death, (if no means of prevention be employed,) seldom fails to infect persons; and the most dangerous animal fluid is that contained in the cavity of the abdomen, after puerperal peritonitis, or the serum found in parts which have suffered diffused or gangrenous inflammation. The white cancer of the liver, and the substance of medullary tumours, are found to be very irritating, when merely applied to the hands, without a breach of surface. I have several times had my hands inflamed, from the application of this diseased structure to them, after it had been preserved for some time in spirits, as anatomical preparations.

Some persons are more susceptible of the infection from dead animal matter than others. I have heard of a student who never escaped it, after receiving a wound in dissection. I have, myself, so strong a tendency to be affected by the irritation of animal matter, that I formerly suffered more or less every year from this cause. Since, however, I adopted the means of prevention already mentioned, I never have experienced either local inflammation or constitutional illness, after wounds received in dissection. That there is no diminution of my susceptibility, is proved, by my still having red patches on my hands, which itch and smart, if I dissect a brain, without continually wetting my hands with the alum water.

The spring season disposes persons to this species of inflammation; and the state of the person's constitution at the time, gives a strong tendency to be affected by the inoculation with dead animal matter. When the general health is injured by intemperance, anxiety, or fatigue, even common wounds will be followed by consequences not very dissimilar to those attending the introduction of dead animal fluids. From observing this fact, some persons have been induced to deny that a poisonous quality exists in dead animal matter, and have ascribed the consequence of wounds received in dissecting, to the nature of the wound itself, which is often punctured or lacerated. This opinion is perfectly disproved by the same irritation being communicated, on an unbroken surface, and by the security derived from using the solution of alum, even where there is no wound.

The secretions of the human body, when they are accumulated in foul clothes, occasionally produce a dangerous and obstinate inflammation of the hands of washerwomen. I have not seen anything more than the common sympathetic fever arise in these cases. If the disease be not well treated in the beginning, it is often protracted by successive and ill conditioned abscesses, in the hand and wrist, causing long suffering, and in the end perhaps the loss of the member.

The dead substance of other animals, besides that of the human subject, although less dangerous, is capable of infecting somewhat in the same way. Persons who clean tripes are liable to a peculiar erysipelatous inflammation, which passes up one finger and down another. The same has occurred from paunching a hare, and horse killers occasionally suffer severe diffused inflammation. The fluids of the recently killed animal are, however, much less irritating, than the same in an advanced state of putrefaction, and hence butchers seldom are known to suffer from wounds received in the practice of their business; although, as already observed, the greatest power of infecting belongs to animal substance immediately after death with respect to the human subject. Perhaps the mode of death by bleeding, may make a difference in the condition of the animal fluids. It is further a common opinion, that animals that die from disease are not so safe to touch and eat, as those slaughtered in a healthy state; which opinion is probably well founded.

No part of the pathology of the human body is more curious or inexplicable, than the *transmission* of *peculiar diseases* formed by a *morbid action*, from the *inoculation* with fluids, or the application of them to the skin. In what consists the difference between the virus of the small-pox and the cow pock, no person can tell. We have no means of distinguishing the one from the other, except by the effects they produce. In the mechanic and chemical composition no difference can be detected between the pus in a venereal disease and that of a common ulcer, although the one not only produces its proper local inflammation, but affects parts remote from the seat of contamination, after remaining dormant for considerable periods. The same observations may be extended to tinea capitis, and the itch. But the most extraordinary phenomena which belong to the history of animal poisons, generated by disease, are to be observed in the communication of so remarkable a disorder as hydrophobia, by the saliva, a natural secretion, which has undergone no visible change in its composition. That all the fluids, which are capable of generating peculiar diseases, and that may again be transmitted in the same manner, depends on some distinct arrangement of the materials composing each of the morbific fluids, does not admit of a doubt. This peculiar quality, whatever it may be, does not act by making a mechanic or chemical impression: neither does it operate in the mode of common irritation, but each infecting fluid makes its proper impression on the sensibility of the

part, which is necessary to excite the actions that are observed to succeed.

Although in all these cases a period intervenes between the moment of communication, and the full development of the peculiar disease, there is every reason to believe that the part feels the impression which is made, either immediately, or in a very short time; thus, at the instant of vaccination, not unfrequently a circular blush appears around the puncture, and this is most commonly noticed, when the operation has been performed in the best manner; that is, by introducing the point of the lancet to the villous surface of the true skin, without giving pain, or shedding any blood. When a person is infected by means of a wound in dissection, he is sometimes immediately aware of its being something different from a common wound, by the sensations in the part. In the venereal disease, uneasy feelings often precede the appearance of chancre or gonorrhœa. In the latter the orifice of the urethra becomes sometimes tumid, and a slight uneasiness or itch is felt, very soon after impure coition; and with some persons who have but little susceptibility for infection, the disease never proceeds beyond these symptoms. It is probable that the peculiar impression made by the morbific saliva in hydrophobia, may escape notice, on account of the greater pain produced by the nature of the wound. I have no doubt that a morbid organization is established in the situation of the bite, long before the disease breaks forth, as I have discovered in many instances the bitten part to have acquired a degree of hardness and vascularity which it could not have attained during the short period in which the disease is displayed. In an experiment which was made to communicate hydrophobia to a fowl by inoculation, I found all the punctures surrounded by regularly formed, hard, and very vascular tumours, seventy-two days after the experiment had been made; and from their structure and appearance, it was impossible that they could have been formed during the two days that the constitutional disease existed; and equally so, that they would have been found so long after the infliction of the puncture, if the wounds had been simply so many cuts of a lancet. Persons have been known to experience uneasy sensations in the part that had been bitten, some days before the general disease displayed itself. Possibly, an inflammation of this morbid structure may be the immediate cause of the peculiar state of sensibility, on which depend all the symptoms of hydrophobia; and the disease, perhaps, might be averted, if the morbid structure I have mentioned were to be extirpated at any time before the part inflamed, or had excited the sympathy of the nervous system.

From the account here given of the local causes of inflammation, it is obvious, that they all act by making such impressions on the sensibility of parts as dispose the arteries to assume the inflammatory state. This impression may be perfectly appeased in most cases, and the consequences obviated, and in all circumstances relieved in some degree by appropriate treatment. That even local

injury excites inflammation, by operating on the sensibility, is proved, by its effect being proportioned to all the circumstances connected with organic sensibility, and not measured by the degree of mechanic destruction. As one illustrative example we may mention, that a small punctured wound of the tendinous parts of the hand or foot would naturally induce more inflammation, than blowing off the whole hand or foot by an explosion of gunpowder.

The most striking evidence we have of the impression on the sensibility being the sole cause of inflammation, is found in the fact of all the naturally close cavities inflaming from being opened, and thence placed in a *new state of sensation* to them. It has been thought to explain this fact, by the admission of air irritating the surfaces, but when air is injected into cellular structure it produces no inflammation; and when collected in the cavity of the chest, by an ulcer of the lungs opening on the pleura, it is not a motive for that membrane to inflame. Further, when close cavities are opened, no air enters except into the thorax, in case of the collapse of the lungs. The viscera fill the cavity of the abdomen so perfectly, under all circumstances, that air is not admitted through a wound, and yet the peritoneum is peculiarly liable to inflame on this occasion being given.

It is the organic consciousness or sense of exposure, or rather of imperfection, which causes inflammation in cavities that are naturally close, and hence peritonitis may be induced, by merely suddenly withdrawing an uneasy pressure which the abdominal cavity has long borne, as may occur in tapping hastily for dropsy, and neglecting to continue the accustomed pressure, by applying an external bandage. Peritonitis comes on, sometimes after parturition, from the sudden removal of the fœtus; and probably the uterus not itself contracting sufficiently, may have some share in producing puerperal peritonitis. The sudden removal of the stone from the bladder by lithotomy, although there is a transition from pain to ease, becomes a motive to inflammation of that organ, and of the peritoneum, and in such cases the bladder is frequently found flaccid, thereby creating the organic consciousness of vacuity. For the bladder in a natural state always adapts its size to its contents, and consequently is at all times equally full.

OF THE PROXIMATE CAUSE OF INFLAMMATION.

As all the phenomena and consequences of inflammation are displayed in the arterial system, it is necessary to examine the structure and vital properties of the arteries, and the relation which subsists between these vessels and the nerves, before we can even approach the subject of the proximate cause.

The arteries of a large size are composed of three tunics. The external or cellular coat, differs from the common cellular membrane, in having the cells so minute, that the tunic appears to consist of a web of filaments, rather than a series of cells; they do not partake of the general infiltration of the cellular tissue, in cases of anasarca; they are, however, capable of receiving an effusion of coagulable lymph, and of holding a small quantity of extravasated blood.

The middle coat consists of circular fibres, easily separable from each other by the pressure of a ligature, and have therefore been supposed to be devoid of cellular membrane. There is no structure in the body divested of a cellular uniting tissue: without such a membrane, it would be impossible for the fine branches of vessels and nerves to be conducted to the internal tunic of the arteries. This fibrous tunic possesses a high degree of elasticity, especially in the circular course of the fibres.

The nature of the middle coat of the arteries, is, in all respects, the same as the elastic ligament of the spine. They correspond exactly in appearance; they are alike indestructible by boiling; they equally resist putrefaction; they undergo the same changes of colour by long immersion in various saline fluids; they are also, both equally difficult to masticate and to digest; they further both serve the same purposes in the animal economy. In certain situations elasticity is preferable to muscular power, as its action is uniform and constant, within the prescribed limits, and as its employment induces no sense of fatigue.

The use of the elastic tunic of arteries is to aid the heart in transmitting the blood equally and readily into the smaller, and more distant vessels. It is impossible that the same purpose could be accomplished by a muscular contraction of the great trunks; for, if this were to exist at the same time with the contraction of the heart, it would resist the current of blood; and, if it took place afterwards, the rhythm of the circulation would consist of three pulsatory actions, instead of the simple alternations of the auricles and ventricles of the heart. The elastic power of the arteries acts by a continued and gradual pressure, being greatest in the primary trunks, and diminishing in proportion, as the size of the arteries declines, until it altogether ceases.

In some animals, which have a slow circulation, the elastic coat does not exist, and it is scarcely to be discerned in the arteries of the human brain, although it is plain enough in the carotids and vertebrals outside the cranium; because, the force of the circulation is taken off by the tortuous course of the arteries while passing into the skull, the union of the trunks within the head, the frequent communications of their branches, and their free terminations in the superficial veins of the brain.

The *third*, or internal tunic of the arterial system, is a delicate transparent membrane, highly polished on its inner surface. It is easily torn or broken by pressure, in which it differs from the other

transparent membranes of the body. I have ascertained that the internal tunic of arteries possesses very considerable elasticity, both in the longitudinal and the transverse direction. In this respect, also, it is unlike the cellular and serous membranes, and the inner coat of the veins, which have only a slight degree of elasticity.

The nerves of the arteries are derived chiefly from the sympathetic system. They form, however, many communications with filaments, which proceed from adjacent spinal and cerebral nerves. These conjunctions in some places exhibit enlargements or ganglia, as are represented in Scarpa's and Walter's beautiful plates. Nerves have been demonstrated by Ribes on the arteries of the brain, within the cranium, and there can be no doubt, that the arteries of the very smallest size receive nerves, on which the peculiar sensibility of these vessels depends, and by means of which, the state of the small arteries is affected by remote and indirect impressions.

I have said, that the fibrous or middle coat of arteries, gradually diminishes, as these vessels become smaller, until it altogether disappears in the fine branches, after which the arteries seem to be merely membranous tubes, connected to the surrounding tissues by common cellular substance. Simple as this structure may appear to the eye, it is endowed, as we shall find hereafter, with the most extraordinary properties.

It is admitted by all physiologists, that in proportion as the elastic coat of the arteries declines, these vessels possess the power of enlarging and contracting the size of their tubes. Bichat, who denied muscular power to arteries, referred their action to another property, which he called *insensible contractility*. He, and others have considered the contraction of these vessels, and of other tissues endowed with a similar power, as their proper action, and their extension or dilatation, as their passive state, or that similar to the relaxation of muscles. It appears to me, that this view is incorrect; and, as the dilatation and contraction of arteries are essentially connected with the nature and treatment of inflammation, it becomes necessary that we should possess clear and accurate ideas of these two phenomena.

That there is such a thing as a positive and active extension and dilatation in the arteries, and other tissues similarly endowed, I think, cannot be denied, since we have evidence of dilatation taking place, under circumstances, and to an extent, that could not be produced by a mere cessation of the contractile action; and, as we see in all cases, where vessels are dilated, or surfaces are extended without mechanic force, the causes are some excitement or irritation, or a necessity for the performance of some new, or more vigorous functions. We have, therefore, the right to assume, that the dilatation or extension of parts is their most active condition, and that their contraction is the negative or passive state, it being that into which tissues fall, when they are free from stimulation, or when their functions cease, or when they are deprived of nervous

influence, or when the causes, which produced dilatation, are withdrawn.

At present we have no name which is perfectly applicable to the movements or spontaneous changes of form, in non-muscular structure. It has been called by some *tone* or *tonicity*, which, if applied both to the dilatation or excited state, and to the contraction, as the movement leading naturally to fixedness and quiescence, will be as suitable a term, perhaps, as any other that could be devised. In this sense, therefore, I shall hereafter speak of *tone* or *tonic action*.

The tissues in which the tonic power of movement is most remarkable, are the arteries, all the excretory ducts, especially those which open on the skin, and the skin itself. Many other structures also possess it in a lesser degree; even muscles themselves (as we shall hereafter attempt to show) exhibit the tonic action when their own peculiar mode of contraction has terminated.

The tonic property appears to exist in the white reticulated structure, that constitutes the basis of the skin, and not in the villous surface. It seems also to pervade the whole of the white tissue of excretory ducts, including their lining membrane. In arteries the tonic movement, if not limited to the inner tunic, is most remarkable in those branches which are composed only of this tunic, and common cellular substance.

Arteries are observed to exhibit three states: 1st, the *middle* or *ordinary one*, which is consistent with natural circulation, growth, and secretion; 2d, the *excited state*, in which they are dilated, and thereby admit an unusual quantity of blood; and 3d, the *passive state*, in which they receive a smaller quantity of blood than usual, or sometimes none at all. With respect to the two last conditions, there is considerable variety, according to the circumstances which produce them.

In erectile tissues, such as the penis, the clitoris, the nymphæ, the nipples, and the various vascular parts about the head and neck of certain birds, the dilatation does not extend beyond the vessels which carry *red* blood.

In inflammation the *transparent* arteries dilate, and receive the coloured fluid, and those that naturally carry red blood not only increase in size, but in plegmonous inflammation also acquire proportionate strength. This fact was long ago very satisfactorily proved by Mr. Hunter's well known experiment of freezing a rabbit's ear, and after the inflammation had been excited, killing the animal and injecting it; when, it appeared, that the middle artery of the ear had greatly increased both in width and thickness of its coats; even its branches exceeded in size the original trunk. I have imitated this experiment, by producing inflammation of the rabbit's ear by scalding, and the result has been the same, with this difference, that there was more dilatation of the branches, and less thickening of the trunk of the auricular artery.

Under circumstances in which the course of the blood is interrupted in the main trunks of arteries, the collateral vessels greatly

enlarge, and soon become, not only from their increased capacity, but thickness of their tunic, competent to carry on the circulation in the limb: and this change in the smaller vessels is permanent, otherwise it would not answer the purpose intended.

In all cases of rapid growth, such as the formation of the stag's horns, the deposition of new bone in fracture, and in necrosis, the development of the uterus, the formation of new surfaces for the attachment and nourishment of the fœtus, and many other instances of the same kind, the arteries assume a size and strength proportionate to the offices they have to perform, on the cessation of which they return to their original form.

In all these cases, and many others that might be quoted, it is evident, that the dilatation of the arteries is the result of some excitement, and is attended by increased vascular power, and energy of function; while, on the other hand, the contraction of the arteries is the consequence of diminished vital power. Thus, it is produced by cold, fear, and all depressing passions, by hemorrhage, by great injuries, and shocks to the nervous system, and in all prostrations of the powers of the body. It continues, and in an extreme degree, after the extinction of the life of the individual; and hence the paleness of the dead body, in which even the lips, and other red surfaces, and inflamed parts lose their colour. The recently dead body is known to be unsuitable for injection, and the most successful injections are made after putrefaction has commenced, when the collapse of the arteries yields to the force of the injected fluid. At this period even the coarse waxen injection will return by the large veins.

Similar phenomena to those I have described as belonging to the arterial system, are observed in the other tissues endowed with tonic powers. Thus, the biliary ducts, the ureters, and the urethra, dilate to admit the passage of a calculus, and afterwards return to their original form. When there is nothing passing through these canals, they go into the state of collapse. It is by means of the continual contraction of the urethra, that the urine is retained in the bladder, in place of by a sphincter muscle, which has no existence. If there were such a muscle it would be useless, as no sphincter can retain a mere fluid, when there is muscular power to expel it. The sphincters all relax in extreme degrees of weakness, and in death; but the collapse of the urethra becomes increased to such extent, that the bladder will sometimes burst, if it be attempted to overcome the resistance of the urethra, by distending the bladder with air or fluid passed in through the ureters. What is called spasmodic stricture of the urethra, seems to be an increased disposition to the natural state of collapse. It is produced by cold, and damp, and by fear; causes which occasion similar effects on other tonic tissues.

The dilatation of the living urethra is governed very much by habit, and would appear to be in some degree under the influence of the will, of which, one is I think conscious, in the act of discharg-

ing the urine. The dilatation takes place as rapidly as the muscular action of the bladder. The introduction of a solid instrument into the urethra, and allowing it to rest there some time, gives the disposition to dilate, in parts of the canal the instrument has not yet touched. This circumstance has been described by Dupuytren, and called by him *vital dilatation*. I have, however, explained the fact many years ago, as a general law of the sensibility of excretory ducts, and have illustrated the principle, by quoting also the example of the lachrymal passages throughout which we produce a tendency to dilate, by allowing a solid body to lie for some time in them. A large calculus would never pass through the biliary ducts, or ureters, if they did not dilate, any more than the urine could be forced through a collapsed urethra.

In young and healthy persons the skin is soft and pliant, and although it is exactly applied to the parts it covers, it yields with great facility to all their movements and changes of form, without itself falling into folds or wrinkles. The power of the skin to adapt itself to the parts underneath it, has been attributed to its elasticity. It is nevertheless endowed with the power of extension and contraction far exceeding the range of its own elasticity, or indeed of any elastic structure in the body. Its tonic extension is shown in the approximation of the edges of wounds and ulcers; in the enlargement of the abdomen during pregnancy, and in dropsical and other swellings; and in the expansion of the external parts of generation and the vagina during parturition (for the vagina is nothing more than an inflection of true skin). I am informed that during delivery the skin of the perinæum may extend to eight inches from the margin of the anus to that of the vulva. Much of the extension of the parts concerned in parturition takes place before there is any mechanic cause for it, proving it to be a vital and positive act. A similar dilatation of the anus occurs in birds, preparatory to the exclusion of the egg. I think no doubt can exist, that if an object the size of the head of a full grown child, were to be forced mechanically through the vagina and external parts of generation of a dead woman, or an egg pushed through the anus of a dead hen, that great laceration would be the consequence.

The general integument exhibits a contractile disposition, under the same circumstances which cause the contracted state of the arteries, and hence we find them combined in syncope; under the influence of cold and fear; in the first state of the ague; and in the subsidence of erections. The disposition of the skin of the scrotum to become corrugated is so great, that it was formerly supposed, there was a muscle provided for the purpose. The same causes, however, which constrict other parts of the skin, operate similarly on the scrotum; cold will, under some circumstances, produce an evident, and rather quick movement in it. Some might be disposed, without due consideration, to view the tonic movements of the scrotum as an exception to the general law I have laid down, because the scrotum is often extended under states of great weak-

ness, and usually corrugated in strong persons; but the state of this cutaneous bag depends on the height at which the testicles are sustained by the cremaster muscles, and therefore, when from muscular weakness these organs hang low, the scrotum must be extended. In the ancient statues of vigorous individuals, the testicles are always represented, as being supported higher than they are usually found, and the scrotum in a certain degree pendulous beneath them.

It is a general law of the tonic tissues, that they influence each other. The simple knowledge of the fact has instructed common people to apply cold wet clothes to the scrotum and back of the neck, in obstinate hemorrhages from the nose. In the rigour or cold stage of ague the small arteries are contracted, the skin is constricted, and all the excretory ducts are disposed to collapse. It is on the sympathy, which necessarily exists between different parts, acting under one law, that a stricture of the urethra is capable of producing the symptoms of intermittent fever, more especially the cold or first stage.

When the muscles of a limb are for some paralysed, a slow contractile action goes on; the flexors usually conquering the extensors, as it is supposed, from the latter being weaker, which is not the fact. This contraction has also been considered of the same nature as the insensible contractility of Bichat. It appears to me, that the contraction of paralytic muscles is different from the tonic, which consists of an approximation of parts, instead of the shortening of fibres; that it is, in fact, a slow muscular action, proceeding without the influence of the nervous system; and that the flexors carry the parts farther to their side, because at all times they are capable of moving their attachments to greater distance than the extensors; for, to suppose that the latter are weaker is an anatomical error.

The rigidity of muscles which succeeds death, bears a perfect resemblance to the contraction of tonic tissues, since the fibres of the muscles are not shortened, the parts being left in the same position they possessed at the time death took place. The stiffness comes on equally and gradually, and remains until the commencement of putrefaction. It is also found in the greatest degree on death from hemorrhage, and when the other tonic tissues are found strongly contracted. Perhaps, the disease called catalepsy may be the substitution of the tonic contraction of the muscles, for their proper action. In two cases of this disease which I have seen, there did not appear to be a spasmodic action of the muscles, nor was there any swelling in them, such as attends the shortening of their fibres in ordinary action, but the same appearance of the rigidity, which ensues after death.

The coagulation of the blood should probably be considered as a phenomenon of the same nature, with the approximation of the tonic tissus. In some cases, they are simultaneous, and produce the same results; as, in the arrest of hemorrhage, and in destroying

the vascular connexion between mortified and living parts. I am satisfied that the conversion of the blood into a solid, is not merely the separation of one of the elements already existing in a certain proportion in the circulating fluid, but that the blood has the power of assuming the solid form in a greater or less degree, according to circumstances; for example, in tetanus, and where death ensues from great muscular efforts, all the blood is found as liquid nearly as water; and, on the other hand, I have found almost all the blood that remained in the vessels of a horse that I bled to death, coagulated; and even some serum, which was obtained, *spontaneously* formed a clot.

After the description which has been given of the mode of action in tonic tissues, it is quite obvious, that it differs in all respects from muscular contraction; that it is produced by different causes; that its effects could not result from any apparatus of muscles; that in short, the phenomena of the tonic and muscular tissues are inconsistent with each other, and, if any structure really possessed both modes of action, they could not be produced together, as the same causes which would be a motive to a muscle to contract, would excite an artery to dilate; and the same circumstances which would give rise to a collapsed state of the arteries, would deprive the muscles of contractile power. When people are displaying great muscular exertion, their skin is not pale and shrunken; but, under the influence of fear, or at the invasion of diseases, attended with prostration of muscular power, we see that the blood is not permitted to come to the surface of the body, in consequence of the contracted state of the small arteries. If those who attribute muscularity to arteries, were to apply their opinion in judging of disease, they would find that it would reverse and dissociate all well established symptoms.

Mr. Hunter fell into the error of his day, which was to ascribe all vital movement to muscular structure, and to suppose muscles to exist, where they never had been seen. He, however, described the contraction of the arteries as a vital act, and carefully distinguished it from the power of elasticity. But he was so possessed with the idea of muscular motion, that he overlooked what in other parts of his book, he showed a clear knowledge of, with regard to the character and duration of both the contraction and dilatation of the arteries. It is very common, even in modern books, to read the expression *increased action of the arteries*, as being the cause of the circulation in the minute vessels, and also of the phenomena of inflammation. This phrase is, I believe, always used without any definite meaning at all. An *increased contraction* is also a term applied to inflammatory action; now, if this were unremitting, it is the very state, to effect which, is the object of many of the remedies employed, and if it were alternated momentarily with the dilatation of the vessels, it would have more effect in driving the blood backward upon the great trunks, than on through the minute terminations of the arteries, unless the current of blood were to be

supported behind by valves. Such a mode of circulation would produce a second pulse, much stronger than that at the wrist, the contractile power of the extreme arteries, taken together, far exceeding that of the heart. The small arteries never yield to mechanic force, but always change their calibre from a new disposition, arising out of a new state of feeling.

In Professor Muller's work on Physiology, he admits, that the force of the heart, and the elasticity of the large arteries, are amply sufficient to send the blood through the capillaries and into the veins; and, it is well known, that the impulse of a common syringe will cause fluids to pass through the arteries, and return by the veins. Professor Muller, nevertheless, supposes that when an unusual quantity of blood passes in the minute branches of arteries, as in erection or inflammation, there is vital attraction between the blood and the vessels. He does not, however, explain how any species of attraction could bring more blood into an artery, without the vessel being rendered larger to receive it; and if we acknowledge that the small arteries have the power of assuming a greater or less capacity, we need not seek for new causes, when we have one so simple and sufficient, as the dilatation of the vessels themselves.

Many experiments have been made to ascertain the effects of various stimuli, directly applied to arteries, in producing either their contraction or dilatation. These experiments have generally consisted in the application of some irritating substance to the web of the frog's feet; but as these operated on the skin of the animal, at least in the first instance, nothing could be proved by them with respect to the irritability of the vessels themselves. Some persons have touched arteries with strong acids, and have thereby caused contraction, but a similar effect would be produced on them if dead. Some have asserted that electricity, others that galvanism made arteries contract, as if they had been muscular tubes. I am, on the contrary, quite satisfied, that none of the proper stimuli for muscular action will produce any effect on these vessels. On one occasion, I laid bare the carotid artery in a dog, and having included a considerable portion of it between two ligatures, to take off the force of circulation in both directions, I made a pin-hole in the vessel, and then applied galvanism. No attempt was made by the artery to contract, and not a drop of blood issued. Also, pricking and wounding the vessel, under these circumstances, had not the least effect upon it; but, on slitting it up, and removing the blood, the artery contracted to two-thirds of its previous circumference, showing very strikingly the disposition which the arteries, in common with the other tonic tissues, have to collapse, on the motive or necessity for their existing in a dilated state, being removed.

The sensibility of small arteries, as far as regards the consciousness of the individual, cannot be easily determined by direct experiments. The capillary vessels are so delicate, and so intermingled

with other tissues, that it is almost impossible to produce an injury or irritation of them without involving other structures. The essential part of the arterial vessels of all sizes is the inner coat, and in my endeavours to ascertain what degree of sensibility it possessed in the larger vessels, I have not been able to satisfy myself, as the effect of cutting or pricking the interior of a vessel, must be rendered insignificant by the wound made in order to expose the part. The comparative pain and loss of blood in the different stages of an experiment, have not, in my opinion, been taken in general into the calculation of many of our modern experimenters; and the consequence is, that where these experiments are made to determine questions of sensibility, there can be little reliance placed on them.

I have ascertained by several trials, that the vegetable narcotic poisons produce no effect on the internal surface of arteries. Verschuir relates an experiment, in which the application of an acid to the interior of an artery, appeared to create pain; and Bichat produced the expression of severe pain, by injecting an irritating fluid into the vessel. Neither of these experiments I should consider conclusive; as the acid might have touched some other tissues, and the injection might have affected many parts besides the artery.

The application of a ligature to an artery of any considerable size, not unfrequently causes pain at the time. It is possible that nerves may be included in such cases, as small arteries, and even those of a larger size, are often drawn out and tied, on the face of a stump, without the patient's knowledge. This may, however, happen from the strong contrast between the sensations of a patient, during an operation, and after he believes it over. A medical man who had the external iliac artery tied, told me, that he felt at the moment, as if a hot iron had shot from the part to the toes, and that it was some time before this hot pain subsided.

Although it may be doubted, whether arteries possess, in their natural state, any of that species of feeling, of which the individual takes cognizance, or that they can be excited to contract by any stimulus directly applied to them; they as well as all the other tonic structures sympathize in the most extraordinary manner with impressions made on other tissues. Indeed I should say, that the small arteries are placed entirely under the state of feeling of other structures, sometimes in their immediate neighbourhood, and at other times of those remotely situated, in the same manner as the actions of the iris are associated with the impression of light on the retina. This sympathetic connexion would appear to result from the communications formed between the nerves of the arteries, and those which bestow common sensation. The two great sentient surfaces of the body exert the greatest influence on the tonic tissues, and hence, on these many of the causes of inflammation originate, and on them also, many of the most important remedies primarily operate.

When an injury has been committed on any part of the body, the natural sensibility of that part is roused to a consciousness of what has been suffered, either instantaneously, or in a very short time. This local feeling or impression, or whatever it may be called, is distinct from the sensible pain of a wound, and may exist in the greatest degree where little, or perhaps no pain is felt. At other times it may be coincident with common pain, although when perceived, it is distinguishable from it. In general the organic consciousness is distinct from that of the individual, unless the sense of injury be communicated to the whole nervous system, and then the person feels a degree of agitation and alarm, which he cannot understand or account for. On some occasions, we observe the immediate effect of the impression shown by the vessels of the part, as when the circular blush around the puncture at the moment of vaccination, gives intimation of the sensibility of the part, to the admission of an animal poison; and sometimes the individual is conscious of a peculiarity of sensation from the contact of other morbid poisons, when the organization has not been injured, but has merely received the impression.

As we have sufficient grounds for assuming that an organic sense of injury, or danger, modified according to the causes which produce it, necessarily precedes inflammation, it is reasonable to conclude, that this is the *proximate* or *essential cause* of inflammation; and the opinion seems to be confirmed by the history already given of the constitutional and local causes; as also by the contemplation of the kind of sensibility and vital properties which belong to the tonic tissues, of which the arterial is one.

Sometimes there is evidence of the organic sense of injury being extended to the nervous system generally, and being continued until the sensible phenomena of inflammation are fully developed. At other times it would seem to subside or cease, and after an interval of time varying according to the nature of the cause, or the structure of the parts concerned, to be restored before inflammation make its appearance. As examples of the latter, I may mention the tardy invasion of inflammation after injuries to bones and tendinous structure, and the lapse of time which intervenes between the communication of morbid poisons, and the exhibition of the specific diseases they produce. Whether the organic sense be continued, or cease altogether and may arise again, does not admit of proof, but I am disposed to believe, that it remains without the cognizance of the individual, because it is almost inconceivable that an irritation should entirely depart, and be again revived, without a fresh provocation; and because I know that the organic sense of evil may be removed, by soothing the feelings of the part, by which means the inflammation may be averted.

One can readily admit that the consciousness of disorganization may be excited in a part, on which the injury is inflicted; but we find a greater difficulty in understanding the reasons for particular parts becoming the seat of inflammation, when, perhaps, others

escape, that are situated more near to the original irritation; as, for example, why pneumonia or bronchitis is caused by cold applied to the back or the feet; why disordered alimentary functions should produce erysipelas and various forms of herpes, &c. Many cases of local inflammation, arising from constitutional causes, however, admit of explanation. When the nervous system, generally, is made aware of any internal irritation, those parts of the body which possess least vitality, or which are more disposed to disease, from any other circumstance, may have the strongest sense of the evil, and, therefore, are most likely to be affected with inflammation; thus, when the system is disturbed, old cicatrices ulcerate, and the lower extremities are more frequently the seat of spontaneous inflammation and of various diseases, than the upper, although the latter suffer more frequently from direct injuries. Original weakness of organs, may not only render them more susceptible of inflammation from common causes, but more difficult to cure. The recurrence of inflammation also creates a morbid susceptibility in parts, so that when a person gets cold, or is in any way out of order, these parts are more disposed to inflame than others. The age and constitution of the patient, the season and states of atmosphere, and various circumstances, may have an effect in determining the part, in which local inflammation will ensue, from general irritation or disturbance. There are certain laws also regulating the circulation of one structure in relation to others, which have great influence in fixing the place for the occurrence of inflammation: for instance, cold applied to the belly may more readily cause peritonitis, or enteritis, or dysentery. Mental excitement or intemperance will induce inflammation of the brain, rather than other parts. We may, however, rest assured, that in every instance where inflammation may invade any part in consequence of remote or constitutional irritation, the reason of that part being the one to suffer, is determined by as fixed laws, as in those instances where parts become inflamed in consequence of local injury.

It might appear to some persons to be an objection to the theory of inflammation being the product of sensibility, that paralyzed limbs are liable to be inflamed. But when we reflect, that paralysis consists in the interruption of the communication between the central parts of the nervous system and those remotely situated, and not in the destruction of organic sensibility, we may readily admit the possibility, of the state of feeling in parts being excited and changed, without the consciousness of the individual. Indeed, facts prove, that excitements which produce perceived sensations, under common circumstances, when applied to paralyzed organs, influence the condition of the arteries, sometimes even more than if the sensations were perceived by the individual. Thus, after injuries to the spine, the penis will be erected by the slightest friction, or even touching the organ, although the individual has no consciousness of the existence of the penis.

Further, the causes which occasion sensible pain, and afterwards

inflammation, in parts with uninjured nerves, also produce the same effects when the nerves are divided; hence, it has been found that the foot of the horse is as sensible of the pressure of a contracted hoof, and as ready to inflame in consequence, after the division of the nerve that supplies the foot, as before the operation was performed, and it is said, even more so, because the animal, not feeling the pain, is careless of what his feet suffer.

In those cases of paralysis, the nerves of the arteries which are chiefly derived from the sympathetic system, have their functions unimpaired; and, therefore, these vessels are influenced by irritations, of which the individual takes no cognizance. I cannot doubt, that if the arteries could also, by any experiment, be deprived of their own nerves, or if the connexion of these with the sympathetic were interrupted, none of the phenomena of inflammation would arise, whatever injury might be inflicted.

In the prevention and cure of inflammation, it is, however, of the utmost consequence to remove or alleviate pain, as with the same means by which this is done, the sympathetic system is also soothed, and where the integrity of both kinds of nerves is preserved, they mutually influence each other.

OF THE SPECIES OF INFLAMMATION.

Authors have made different subdivisions of this subject, according to the principles on which they have formed their classification. Perhaps, strictly speaking, inflammation should be considered as essentially the same diseased action, greatly modified however in its phenomena and effects, by the following circumstances: the age and constitution of the patient, the peculiar state of the body at the time, the causes which produce it, the structure of the parts affected, and the climate, the season, &c.

To give a description of all the varieties which inflammation presents under different circumstances, would be inconsistent with the design of this work; but it is necessary to point out the distinctive characters of what are called phlegmon and erysipelas, between which there are more important differences, than exist between other inflammatory affections.

Phlegmon, as it is called, is usually the consequence of some injury, or evident irritation, and is produced in constitutions or parts of the body, which have been previously carrying on healthy functions. Its phenomena are most genuine in young and vigorous people. The most important characteristic of phlegmon is the deposition of coagulable lymph in and round the inflamed part, by which the diseased action is circumscribed to a given extent. The constitution feels assured, that however severe may be the affection,

it is placed within such bounds as cannot endanger the life of the individual, unless by interfering with the mechanism of some vital organ. If phlegmonous inflammation be not arrested, it terminates in the formation of an abscess, in which, as already mentioned, processes are naturally carried on, that ultimately lead to recovery. The effusion of coagulable lymph obstructs the circulation in phlegmon, and hence the deep red colour, the solid hard tumour, the throbbing or pulsating pain, and the thickening of the coats of the dilated arteries in the inflamed part.

In *erysipelas* the disease is not bounded by the deposition of coagulable lymph, and consequently there is no positive limit to the inflammatory action, which creates a greater sense of danger in the nervous system, than if phlegmonous inflammation occupied the same portion of the animal structure. The effusion is serum, which may be thrown out on the surface of the skin producing vesications; or if the cellular substance be engaged, the effusion spreads from one cell to another, distending them and causing œdema, and if the affection be severe, disorganizing the cellular structure, and causing diffused or moist gangrene. In erysipelas the circulation is not impeded, and hence the pressure of the finger on the skin removes the red colour, which immediately returns on taking the finger off. For the same reason also, the colour of the erysipelatous inflammation is a bright red colour, the arterial blood being readily transmitted into the capillary veins. The pain is hot or burning in erysipelas, with a general feeling of tension in place of the throbbing, which is produced in phlegmon by the endeavour of the circulation to overcome the obstruction in the part. Pure or genuine erysipelas is never attended with the formation of pus, which seems to require the presence of coagulable lymph, or a peculiar organization for its secretion from the blood.

The invasion of erysipelas is usually sudden. Sometimes it declines in the part first affected, and spreads on the neighbouring surface. At other times it is quickly translated to parts of the body remote from those previously engaged, and occasionally returns to them again. When erysipelas is confined to the surfaces of the skin, or mucous membrane, it terminates by the inflammatory action ceasing, or being worn out. The thickening of the skin subsides, the vesications dry up, and the cuticle peels off.

The usual subdivision of erysipelas made by authors, is into the *acute*, the *œdematous*, and the *phlegmonous*. The two first are to be viewed as different degrees of the same disease. The phlegmonous erysipelas is usually the effect of local injury, or irritation, operating on parts, or on constitutions disposed to assume more or less of the erysipelatous action. Thus, in phlegmatic, or anasarcous subjects, erysipelas may arise from injuries, which would cause true phlegmon in persons of a better constitution. Some irritations, also, are more likely to give rise to the disease, than more serious injuries; and hence, it is often produced by the irritation of adhesive plaster, especially applied to wounds of the scalp. It is also

induced by scratches of the skin, that fester, and from the fretting of the slight wound made in venesection. In the phlegmonous erysipelas there is more vigour of the constitution, than in the simple forms of the complaint. In such cases attempts are made to produce imperfect suppuration. When phlegmonous erysipelas comes on after injuries, it is generally to be imputed to the mismanagement of the patient or of the surgeon, unless there be a strong tendency in the constitution to the disease.

Catarrhal inflammation always bears some resemblance to the erysipelatous, and in some instances is truly of that nature, and when yellow serum is extravasated around the opening into the air tube, constituting the œdema of the glottis, the disease is sometimes suddenly fatal.

Some *vesicular* inflammations as the *zona* or *shingles*, where the vesicles become confluent, have a good deal of the character of erysipelas, although the progress is different. Most vesicular diseases are produced by the same fault in the constitution, as erysipelas itself.

OF CONGESTION AS CONTRADISTINGUISHED FROM INFLAMMATION.

It is by no means uncommon for persons in examining dead bodies, to mistake every appearance of the accumulation of blood in the vessels, for the effects of inflammation; thus confounding conditions of parts, totally different from each other. It is obvious, that such an error must lead to false notions in pathology, and serious dangers in practice. Even those who admit the distinction between congestion and inflammation, are not aware, I believe, of the degree or extent of the difference between these two states.

Congestion, properly speaking, belongs to the venous system. It is caused by any mechanic impediment to the free motion of the blood in the veins: such as obstruction to the circulation of the blood in the liver, the lungs, or other important organs, or by pressure on the trunk of any vein. It is also brought on by the suppression or diminution of natural secretions, and by supplying the body with more nutriment than is expended in growth or secretion. It is sometimes induced, and always favoured by dejection of mind and sedentary habits, which serve to accumulate the blood in the venous system, and to embarrass the circulation.

Every impediment to the passage of the blood through the small veins, necessarily renders its motion slow, and whether this be sufficient of itself, to make the blood liquid, and indisposed to coagulate or not, I do not know. The blood, however, is so fluid, in many cases of congestion, that it transudes through the coats of the veins, into the surrounding cellular membrane. This fact was

first noticed, I believe, by Mascagni. I have often observed it, and have preserved the appearances after death. I had one preparation, in which the liquid extravasated blood, from obstruction in the circulation of the lungs, had been taken up by the absorbents of those organs, proving that the infiltration through the coats of the veins is not the consequence of death; although it may be facilitated by that event, as we observe it to be very remarkable after death by drowning, burns, or scalds, electric shocks, long continued struggles, and many other instances of sudden death, where the blood remains in the superficial vessels, and does not coagulate. The blood in congestion is either a purple or a still darker colour. In the disease called melœna, which depends on congestion of the veins of the intestines, the fluid which is poured out is black.

The most remarkable circumstance, with respect to congestion, and the one which has not hitherto been described, is, that arteries found in a congested part are smaller than their natural size. In long continued congestion of the alimentary canal, we often find besides the diminished arteries, a very considerable deposit of fat in the mesentery, of a rich or oily quality, the intention of which is to dispose of the arterial blood. It is for the same reason also that the arteries so frequently relieve themselves by dropsical effusions, and sometimes by hemorrhages, in cases of obstructed circulation.

In order to ascertain the direct effect of venous congestion, on the arteries of the part concerned, I made the following experiment: I put ligatures on both the jugular veins of the rabbit; the animal died apoplectic, and upon examining the state of the vessels of the ears, I found the veins, which lie towards the outer edge of the ear, greatly enlarged, and gorged with dark blood; but the artery, which runs in the centre of the ear, was reduced very much below its natural size, so that it appeared as a mere line. The result of this experiment made me wish to see what would be the instantaneous effect of arresting the venous circulation. I accordingly exposed the mesentery in a young rabbit, and having tied the trunks of several mesenteric veins, their corresponding arteries contracted immediately, in the most palpable manner, and to a very small size; as if taught by their organic instinct, that blood should not be permitted to go where it must immediately return.

From the description just given, congestion never should be confounded with inflammation. They are essentially different in all respects: the uniform and dark red colour of a part in a state of congestion, as contrasted with the brighter red colour, and distinctly ramified arteries in inflammation, ought at once be sufficient to point out the difference between these two affections.

The stomach from various causes not unfrequently exhibits a degree of congestion after death, which there is no reason to believe was the result of any serious disease previous to death. These appearances I have seen persons set down as evidences of inflammation, which would be an awful mistake to make, in cases where there was any suspicion of poison having been administered. The life

of suspected persons, and what is still more valuable to their relatives, the reputation of such individuals, often depend on the testimony of the person who inspects the body of the deceased. It is consequently of the highest importance, that all medical practitioners should be careful in discriminating the true character of inflammation, from other appearances which bear some resemblance to it.

Some authors, although they distinguish congestion from inflammation, confound it with *determination of blood.* When blood is sent in too great quantity to any part, it is because the arteries of that part dilate beyond their natural state, in consequence of some excitement of particular organs; and therefore the sensibility, temperature, and bright red colour of the parts are increased: whereas in congestion neither the sensibility nor temperature is augmented. Determination of blood may itself be easily distinguished from inflammation, by the general appearance, by the causes, by the absence of any of the consequences of real inflammation, and especially by the want of the peculiar pain, which would belong to the tissue concerned, if its turgescence or fulness of blood had arisen from inflammatory action.

OF THE REMEDIES FOR INFLAMMATION.

The means employed for mitigating or abolishing inflammation, may be classed under the following heads:

1st. Remedies which diminish the force of the heart, and give the disposition generally, to the small arteries to go into the contracted state.

2d. Means that effect a diminished size of the arteries, or reduce the sensibility in the inflamed part.

3d. Medicines that augment or reproduce the natural secretions, and thereby abate the circulation, or lessen the effusions made into inflamed parts.

4th. Counter-irritations, secretions, or impressions made in different parts from those which are inflamed.

5th. Lotions or fluids which exert sedative and astringent power.

6th. Means for affecting, in an agreeable manner, the sensations of inflamed parts.

7th. Causes which produce an easy or satisfied state of feeling, on the sentient surfaces, or in the individual.

The internal medicines that are most effectual in diminishing the force of the circulation, are those which produce the sensation in the stomach, called nausea. Of these, the preparations of antimony are most commonly employed, and the one most to be relied on is the *tartar emetic.* It has become fashionable of late to give, and

repeat large doses of this remedy, on what grounds I cannot understand, as small doses are sufficient to produce all the effects we wish for, provided they be repeated with sufficient frequency. If one grain of tartar emetic be dissolved in a pint of water, and a tablespoonful of this solution be administered every half hour or hour, an extreme degree of nausea will certainly be excited, with a reduction in the strength and frequency of the pulse, and usually some perspiration.

The good effects of nausea depend on the feeling being steadily kept up for some time, and this can best be accomplished by very divided, and frequently repeated doses of the medicine. We have a good example, in the operation of this remedy, of the sympathy existing between the stomach, and the heart and arteries. The feeling of nausea not only depresses the powers of the heart, but gives the tendency to collapse in the arteries. Sickness of the stomach and syncope are nearly allied, although affecting different organs.

Nauseating medicines are particularly well suited to the inflammations of the viscera of the thorax; in cases where we are unwilling to employ general bleeding; or, when depletion has already been carried as far as may be thought safe, as they leave no permanent debility.

Preparations of antimony act on some peculiar constitutions as a mineral poison, producing an alarming degree of prostration and distress. I have known these medicines also, when long continued, sometimes induce tenderness of the gums, an increased flow of saliva, and a cadaverous fœtor of the breath. *Nitre* in full doses has the power of reducing the frequency of the pulse, most probably by first affecting the stomach. It is seldom used at present, except in conjunction with tartar emetic in pneumonic affections.

The *abstraction of blood from the system* constitutes the most immediate means of diminishing the action of the heart, and the dilatation of the arteries. It may be effected in two ways, either by drawing a moderate portion of blood very suddenly, or by taking away a large quantity more slowly. The first mode is to be chosen in most cases of inflammation, as it admits of repetition, without inducing permanent debility. The removal of a large quantity of the circulating fluid, although very effectual in subduing inflammation, is unfavourable to the healthy process of reparation, and leads to the formation of that disposition, compounded of excitability and weakness, which is called *hemorrhagic.*

It is a well known fact, that the more suddenly the abstraction of blood is made, the greater and more immediate is the effect on the circulation. The nervous system takes alarm at the rapid departure of the vital fluid; the heart beats feebly; and the arteries also sharing in the sense of danger are disposed to contract, even beyond the degree which would be necessary to accommodate their tubes to the reduced volume of the fluid in circulation. Mere fright or apprehension of being bled, will produce the same effects, and

even syncope; but generally, as soon as the alarm is past, the actions of the heart and the dilatation of the arteries return. In proportion as the vessels are unloaded, the blood acquires more disposition to coagulate; thus the first blood drawn in cases of acute internal inflammation, often does not afford so firm a clot as that of subsequent bleedings, although the inflammation may be lessened.

Venesection and *arteriotomy* constitute sometimes the most important operations, as the life of the patient may depend on their being correctly executed; and yet, from want of early instruction, no operations are in general so awkwardly performed. It is rare to find that the blood is obtained, either in the prescribed mode or quantity, which happens in consequence of the operator acting in haste, and without attending to a number of minute circumstances, on which the success of the operations depends. As directions are not commonly given in works on surgery on this subject, it becomes the more necessary that I should describe the operations here.

In selecting the vein to bleed in, the choice must be determined by various circumstances. As a general rule, the vein which is largest and most thinly covered is the best; but it may have been so often bled in before, that the skin is covered with cicatrices. The cephalic and basilic at the fold of the arm, are more intermingled with large cutaneous nerves, which is an objection to them. The operator should always ascertain the arrangement of the arteries, and their precise relation to the vein he may bleed from; as what are called varieties of arteries, are as much to be expected in the arm, as the normal distribution. In performing venesection, the ligature of the arm should not be so strict, as to compress the artery; and if it remain on long, before the vein be punctured, the blood deserts the superficial vessels, and passes by the deep seated veins. The insertion of the lancet should be conducted *slowly* and *deliberately*, instead of the vein being *suddenly stabbed*, as is commonly practised. If the patient be timid, it is advisable to pass the point of the lancet into the skin, and then persuade the person, that this is the only pain that will be felt, in which he is easily deceived, and afterwards the incision of the vein may be slowly performed, often without the patient's knowledge. The thumb should be used to compress the vein near to the part to be opened, by which it is rendered more fixed and turgid, and the first jet of blood will be less, and the confusion avoided, before the porringer is placed in the proper position for receiving the stream of blood. After the vein has been opened, the position of the arm should not be allowed to vary, so as to cause an overlapping of the skin; as the stoppage of the stream, even for an instant, will produce coagulation in the incision. The blood from the same occurrence will be extravasated in the cellular substance, and coagulating there will produce what is called a thrombus, which sometimes arrests the flow of blood altogether. When the desired quantity is obtained, the ligature should be loosened, and at the same moment the thumb should be placed below the orifice of the punc-

ture. The blood should be cleaned off the arm by a towel wet with cold water, and the edges of the wound drawn into contact, by the thumb already placed below it; and when the compress is applied, the thumb should be immediately shifted upon it. The garter should then be twice wound round the upper part of the forearm, and next passed around the back of the arm above the elbow, and brought to cross itself over the compress of lint, and then and not before, the thumb should be removed. The garter should next pass circularly on the upper part of the forearm, and then be secured.

The compress of lint should be larger than that usually applied to the wound in venesection, and it ought to be also wet with cold water, by which any blood that may soak into it, will not dry into a hard clot, which is often the cause of irritating the edges of the wound. In this mode of binding up the arm, the pressure is only made in three places: around the forearm preventing the influx of blood on the wounded vein, over the compress of lint, and at the back of the arm, by which no impediment is presented to the passage of the blood from the opened vein into those above it. The utmost quietude of the part should be preserved for several hours, and afterwards it must be moved most carefully; for although the wound of venesection is insignificant in itself, if it be allowed to inflame, and suppurate, serious consequences may ensue, of which some constitutions are more susceptible than others.

In timid persons, there is sometimes a great difficulty in getting the blood to flow in a full stream: to effect which, it is usual to put the hand into a vessel of warm water, the consequence of which is a displacement of the surfaces of the incision, and the detention and coagulation of the blood. To obviate this accident, I have contrived a tin vessel for communicating warmth to the hand and forearm, without depressing the position of the hand, which, by twisting the arm, causes the edges of the skin to overlap the orifice of the vein. This vessel is made with two chambers; the inner one is lined with flannel, and receives the hand and forearm; the outer one is filled with hot water, and secured by a cork.

It is necessary to bestow some care on the lancet, to avoid its receiving injury, or causing trouble in cleaning it. The moment after it has been employed to make the incision, the blade should be passed on one side of the handle, and the instrument dropped into a basin holding cold water. When the operation is finished, it can be easily cleaned.

Bleeding in the *external jugular vein*, is seldom employed, although it is an operation easy to perform, and attended with many advantages. It is so easily practised, that I have often substituted it for venesection in the arm, and I have never witnessed any bad consequences from the operation. The patient should sit up in bed, or on a chair. The vein may be raised by pressure made with the fingers on one side of the neck, and with the thumb on the vein that is to be opened. The incision should be made in the direction of the sterno-cleido-mastoid muscle, by which the fibres of the pla-

tysma myoides are divided transversely, and the external jugular is punctured obliquely; the flow of blood is encouraged, by having the vessel that is to receive the fluid, with a projecting lip, which is to be pressed against the vein immediately below the incision. In general blood is more easily obtained by opening the external jugular vein, than the temporal artery, and it is an operation I think to be preferred in affections of the head, as it needs no bandage. The flow of blood from the external jugular usually ceases on removing the pressure on the vein. It is customary to close the orifice by a small piece of adhesive plaster. It might be better to lay a small portion of wet lint on the wound, and secure it there by adhesive plaster. It is also proper for the patient, if in bed, to adopt as nearly as possible, the sitting position for some hours, and as the operation will be most often performed for affections of the head and throat, this position will not be disadvantageous.

Taking blood from *the temporal artery*, is an operation that requires very nice management, and is seldom performed well, except by a practised hand. The great difficulty is in calculating with exactness the depth of the incision, which will open the artery freely, yet not cut it quite across. If the artery be not sufficiently divided, but little blood will flow, and if cut quite through, the ends of the vessel will retract from the incision of the skin, the blood will coagulate in the interval of the divided artery, and the bleeding will sometimes cease altogether. The operation generally fails also, if the artery be opened by repeated cuts or trials, who always produces delay, and coagulation of the blood in the wound.

When the surgeon wishes the bleeding to cease, he ought again to introduce the instrument, and be certain that he completes the division of the vessel; which then, if the first steps in the operation have been properly performed, and the parts not entangled in a coagulum, will retract under the skin, and also being at liberty will contract, so that the bleeding will soon cease. Great trouble is sometimes experienced from binding up the part, and leaving the artery partially divided. This leads to after hemorrhages; sometimes excessive bleedings will establish a fistulous communication between the interior of the vessel, and the wound in the skin, and when such an event takes place, no means will secure the artery, except a ligature applied on each side of the fistulous aperture of the vessel.

The intention of drawing blood from the system, is to produce that kind of impression, which is followed by a weaker action of the heart, and a more contracted state of all the smaller arteries in the body, and by that means inflamed parts are included in the general condition, which, as long as it continues, precludes the possibility of inflammation.

The abstraction of blood from the system requires a good deal of discretion, and foreknowledge of the progress of disease, on the part of the practitioner. On some occasions bloodletting is to be

promptly and extensively used, as, when inflammation exists in internal organs that are beyond the reach of local applications; or when it assails organs, the perfect organization of which is essential to life, such as the brain, larynx, heart, lungs, alimentary canal and bladder, &c., or where the structure of the organs affected is so delicate, that it cannot sustain inflammation for any term without being impaired, as that of the eye.

Bloodletting is, however, always to be seconded by other remedies, as much as possible. The employment of this remedy may be carried too far. In the treatment of the acute purulent ophthalmia, falsely called Egyptian, which at one time prevailed to such an extent in our armies, bleeding was carried to an unwarrantable length, and left the patients in an exsanguined state; one peculiarly unfavourable, to the restoration of the inflamed conjunctiva to a state of health. During the prevalence of the purulent ophthalmia, I had several cases under my care, not one of which terminated unfortunately, which I attributed to my having bestowed a greater degree of attention than others did, on the continued application of local remedies.

It is a common practice to draw blood the moment an injury is received, long before there is time for inflammation to set in. This appears to me to be worse than useless, as it deprives the practitioner of the opportunity of acting with sufficient energy, when the proper time arrives. In many severe injuries to the external parts of the body, bleeding from the system may be dispensed with, provided the general principles of treatment I have laid down, be judiciously followed.

Topical bleeding, as it is called, was in the first instance adopted, under the idea that it directly and mechanically diminished the quantity of blood circulating in the inflamed part; not perceiving that the blood-vessels are continuous, and like so many conduits, distribute their fluid equally and impartially to every part of the body, in proportion to its capacity to receive it. We might as well expect to reduce the quantity of water, passing in one portion of a pipe, connected with a reservoir, by making an opening in it; and yet one often hears practitioners of the present day speak of unloading the vessels of a part, plainly showing that they are ignorant of the modus operandi of local bleeding.

When blood is said to be abstracted from an inflamed part, it is not in general taken from the vessels, which are actually the seat of the inflammation, but from those in their neighbourhood. The object, therefore, in applying leeches, or in cupping, is not merely the removal of the blood, but to make such an impression on the sensibility of the part, as will produce a contracted, or diminished state of the arteries, by which less blood is permitted to circulate in the vessels immediately concerned.

It is a law of the tonic action of arteries, as already mentioned, that they dilate when more blood than usual is to be transmitted through them, but the abstraction of blood either from near or from

distant vessels, creates the organic consciousness of vacuity, which always produces the tendency to contraction. The arteries after local, and indeed also, after general bloodletting, are not unloaded, but are as full of their own fluid, according to their capacity, as in the most active inflammation.

I consider the extraction of blood by leeches, to have a different effect than that taken by the scarificator. According to the most frequent practice in employing leeches, the blood steals away slowly and insidiously, and therefore a greater sense of danger is felt in the arteries, and consequently a greater disposition to contract, than by a larger hemorrhage if effected by different means. When the bleeding by leeches is much protracted, very considerable weakness is induced. I have seen the continued weeping from the bite of a single leech, render the patient more pale and collapsed, than the loss of many ounces of blood from a wound. It might seem contradictory, that very rapid, and very slow abstraction of blood, should agree in the kind of impression that is made on the system; such however is the fact, and it is perfectly intelligible, when we consider the nature of hemorrhage, and the causes which produce or restrain it. If blood flow with great rapidity, the danger may be great, because a large quantity may be lost before there is time even for the contraction of the arteries, and the coagulation of the blood to interfere. The slow and insidious hemorrhage, as from leech bites, is also dangerous, because there is no disposition in the arteries of the wounds to contract, nor the blood to coagulate in them, so long as the bleeding continues.

In general there is more difficulty experienced in obtaining a sufficient quantity of blood by means of leeches, than of drawing too much, owing to the want of method in managing the bleeding after the leeches drop off. The principal difficulty arises from the blood coagulating within the orifices of the wounds inflicted by the leeches; to obviate which, it is advisable to apply warm, dry, woollen cloths, and renew them by others, without a moment's delay; for, the exposure of the leech bites even during a few seconds, is sufficient to produce coagulation of the blood.

In order to direct the leeches to fasten on particular spots, and in regular order, it has been lately proposed to cover the part, to which they are applied, with a piece of adhesive plaster perforated with a number of holes: this answers the purpose tolerably well. When a few leeches are intended to be used, the animals may be enclosed in glass tubes, so small that the leeches cannot turn in them, but must present their heads to given spots.

In cases where bleeding continues obstinately longer than is intended, the part should be exposed to the air, and cooled down by cold water. If this does not succeed, a small fragment of lint may be introduced into each of the leech bites, and retained there by small pieces of adhesive plaster, and each puncture pressed in succession, by the blunt end of a pencil; the part being at the same time kept cool, and elevated. It is recommended to apply the end of a

stick of lunar caustic to the wounds; but if the former means be patiently pursued, this will be unnecessary.

In some situations it is practicable to use the cupping glass, after the leeches fall off. In this, as indeed in all instances where cupping is employed, a deep glass should be used, which will avoid the necessity of changing it. By this means as much as six or eight ounces of blood may be obtained, almost as quickly as from opening a vein in the arm. This mode of operating never fails also to stop the bleeding from the punctures, on removing the glass.

In drawing blood by the scarificator, and cupping afterwards, success depends on not allowing the blood to coagulate in the wounds made by the instrument. For this purpose two large sponges should be ready, and at every time that the glass is removed, one of the sponges wrung out of hot water, should be instantly applied to the part, and kept there until the second glass is placed on the skin, and so on as often as the glasses are changed. The punctures should not be left uncovered a moment, as the action of cupping favours the coagulation of the blood. From neglecting these precautions, many people fail in obtaining blood by the operation of cupping.

Topical bleeding is proper in cases of injury or inflammation, where milder local applications are not, unaided, able to control the actions going on; or it may be employed subsequently to the abstractions of blood from the system; or as a substitute for the latter, when the patient is old and infirm. It should however be observed, that the wounds made by leeches sometimes induce erysipelatous inflammation of the skin. This occurrence is known to be more frequent in some seasons than others, possibly from the importation of spurious with the genuine medicinal leeches. Some individuals are peculiarly susceptible of erysipelatous inflammation from the bite of the leech. When such effects may be expected, and whenever there is any appearance of irritation about the leech bites, water dressing should be employed.

No means can be more effectual for the production of a contracted state of the arteries, than the *abstraction of the temperature*, or in other words the application of substances which generate cold, provided it be made in the proper manner.

We should always recollect the difference between cooling down a living and an organic body. The attempt to suddenly deprive a sentient being of its temperature, provokes a reaction as we perceive in the use of the common cold bath. In the treatment of inflammation, the cold should never be suddenly applied, nor suddenly withdrawn. The inflamed part should be as it were seduced to surrender its temperature willingly, until the power of resistance or of reaction be past, and in carrying it back to the natural state the same principles should be followed. It has been observed that washing the face and hands with tepid water, leaves them cooler than when cold water is employed, which is to be explained by the want of excitement and resistance.

The best example of the power of low temperature to cause contraction of the arteries, is seen in what is called *a dead finger*, in which, there is neither circulation nor feeling, a fact I had the opportunity of proving lately by a direct experiment, on a person whose thumb was benumbed in this manner. On making a cut into it with a pair of scissors, no pain was felt, nor did any blood issue from the wound, until the sensibility and circulation returned: now, this extreme case never occurs in the most intense frost, but always when the atmosphere is damp, and not severely cold. By the suspension of applications which generate cold, their effect is changed: thus, the common cold lotions, in the manner in which they are used, act more like a succession of local cold baths than anything else.

The reduction of the heat of any part of the body, in an *extreme degree*, renders the existence of inflammation impossible in that part during the time, but as cold is a direct sedative to all vital actions, there is a temporary suspension also of the process of reparation.

The remedial operation of a *moderate degree of cold* is in most cases to be preferred. It diminishes in place of extinguishing sensibility and vascular action, and under its operation the reparative processes can be carried on. It is with the view of maintaining a temperature a little below that natural to the body, that we employ cold and evaporating lotions, which, it must be observed, are very imperfectly managed, the inflamed part being allowed to become hot, before the lotion is renewed, and some of them not having so much tendency to evaporate as common water: such is the case with Goulard's or the lead lotion. Vinegar also seems to act as a sedative and refrigerant, yet from its sharp taste, it is commonly supposed to be a stimulant: we are apt to suppose that an application produces the same effect on all surfaces, whereas it is often the contrary: for instance, mustard inflames the skin, but not the stomach; it produces an emetic effect first. Spirituous lotions are sedative to unbroken skin, and cause cold by evaporation.

It is with the view of obtaining the operation of cold and moisture uninterruptedly, that the French make use of what they call *irrigation*. The apparatus employed in Paris for the application of this remedy, is very inconvenient and uncouth. A bucket holding cold water is slung to the top of the bed. On the side of the bucket near the bottom, there is a stop cock, from which the water falls in drops on the inflamed part, which is always uncovered. The patient is obliged to preserve nearly the same position. The water is collected in a sheet of oiled calico, and runs from it into another bucket placed beside the patient's bed. Mr. Josse of Amiens conducts irrigation in a manner not very different to the plan I recommend.

The most easy and manageable way of employing irrigation, is to place the limb of the patient in a trough, and having laid some lint on the inflamed part, to let the water be conducted by means of a stripe

of woollen cloth, from a vessel holding the water or other fluid, which may be placed on a chair or table standing beside the bed. One end of the stripe is to be inserted into this vessel: the other, which should be cut into a pointed shape, laid on the lint. The water will then proceed in the manner of a syphon continually from the vessel, not by drops falling from a height, the sensation of which is disagreeable. The water is carried off by a tube proceeding from the end of the trough, into a vessel placed at the end of the bed. I have found that a stripe of cloth of some breadth, where it is inserted into the water and ending in a point, where it touches the lint, answers the purpose of a syphon much better, than the filaments of candle-wick, which some surgeons have employed. The patient with this apparatus is able to vary his position, which is a great comfort to him. It is obvious, that irrigation can only be used with convenience to the extremities. The water may have any degree of temperature that is desired, and if it should be wished to employ iced water, the vessel holding it may be placed at a distance from the patient's bed, or even outside the room, and conveyed by an elastic tube, on which there is a cock to regulate its admission into a smaller vessel, situate near to the bed.

The mode of maintaining a continual accession or renewal of a fluid application, may be converted to many useful purposes. Professor Wiedleck has availed himself of it in the construction of his chair: in the back of which is placed a reservoir of fluid, from whence a tube passes underneath the seat, to the front of the chair, where it is connected by a stop cock with a catheter, which has been previously introduced into the bladder. This catheter is double internally, or has two passages, each with an opening into the bladder, and the handle of the instrument exhibits the two distinct tubes, into one of which, the end of the elastic tube which is furnished with the cock is introduced. The fluid from the reservoir is thus conveyed by one side of the catheter, and is returned by the other, and consequently there is a sort of stream carried through the bladder. He has used the apparatus for chronic inflammation and catarrh of the bladder.

I have contrived a tube on the same plan, for transmitting a continued stream of fluid through the vagina or the rectum. I have likewise invented a glass vessel, something like a cupping glass, but larger, with two tubes entering it, one which admits the fluid near the top, and another near the bottom that allows it to escape. This vessel was designed for cleansing foul ulcers or cancers; but might be used for the purpose of abstracting the heat, by a stream of cold water, or for administering medicated fluids to external surfaces, if flat, in the same manner as the double canula conveys them to the internal cavities. I have further proposed, that the principle of the double passage should be extended to the tube of the stomach pump; by which I think the effect of this instrument would be made more certain and speedy in its effects.

An *intense degree* of cold has been used as a remedy in very

severe injuries, where the inflammation cannot be restrained by other means, as in compound luxations, after the stage of pain which ensues from the shock has been removed by soothing means; and here it is particularly necessary to attend to the rule of cooling the part by gradual steps. The cold also must be maintained until the period for inflammation has passed by, and afterwards it should be gradually withdrawn. I understand that some surgeons in London have failed in this mode of treating compound luxation, from restoring the temperature too soon and too suddenly, by which the inflammation returned with increased violence. In all cases where hemorrhage is to be apprehended, the use of ice or iced water is most valuable, and may save the patient from the application of ligatures to small arteries. I have treated cynanche tonsillaris by the frequent use of a gargle of iced water, with remarkable success. The disease has been by this means arrested in a few hours. I have also found ice to be effectual in stopping obstinate hiccup, when all other remedies had failed.

Ice or iced water is better for the purpose of generating a great degree of cold, than any of the frigorific mixtures. Some of the latter would congeal the part, none of them would be proper with a raw surface, and it is rarely necessary to reduce the temperature in an extreme degree, without the existence of a wound. When they are proper it may be useful to know, that the mixture of five parts of muriate of ammonia, five parts of nitre, and sixteen parts of water sinks the thermometer from 50° to 10°; equal parts of nitrate of ammonia and water reduce the temperature from 50° to 4°, and five parts of sulphate of soda, with four parts of diluted sulphuric acid, bring down the instrument from 50° to 3°.

Cold in a *moderate degree* is generally suitable where the inflammation is not very violent, and is accompanied with heat. The most convenient mode of obtaining it, is by irrigation with cold water. The age of the patient, and the character of the inflammation, are, however, to be taken into consideration. Irrigation is more suitable for the hot months of summer, than the winter season. It is also better calculated for hot climates than others.

A very simple rule may be safely followed with regard to the use of cold applications, which is, to consult the feelings of the patient. Wherever they alleviate the pain, they do good, and wherever they have not this effect, they are improper.

Mercury came into use as a remedy for inflammation, by being employed for the cure of the venereal disease, and being found particularly efficacious in venereal iritis, it was tried in iritis from other causes, in which an equal success attended its administration. It was next given in many inflammations of the viscera. Before this period, however, the remedy had been relied on as a specific, for affections of the liver contracted in tropical climates.

The mercurial action restores the balance in the circulation, disposes of a good deal of the blood, by augmenting many of the secretions not commonly affected by other medicines, and creates an

extraordinary activity in the absorbent system. These effects we can understand may be useful in many inflammatory affections; but the remedy has powers that are not so easily explained. Calomel, before it has time to act as a purgative, will produce a considerable amelioration in the symptoms of catarrh, even when it appears in the form of an epidemic.

Mercury is particularly beneficial in all inflammations of the air passages, of the pericardium, of the serous cavities generally, of the glandular structure, and in those of the internal parts of the eye. The beneficial operation of mercury is exhibited in the most striking manner in the common fever of this country. In no single instance have I known it fail in arresting the progress of the disease; provided the fever be not combined with visceral affections, or characterized from the beginning with unusual prostration of strength. Mercury is very commonly relied on in cutaneous diseases, in which I think in general it has no effect, and sometimes does mischief. Some surgeons of the present day apply mercurial ointment to the inflamed skin in erysipelas. It is, when used in this manner, very uncertain in its effects; sometimes seeming to have an influence over the erysipelatous action, and at others none.

Mercury is a remedy, in the employment of which a nice judgment is required. When given with the view of affecting the system, it is often carried too far, by which it acts as a poison; and thus produces a worse disease than the one intended to be removed. The best form of the medicine is calomel, occasionally combined with opium, which insures the general or constitutional effects, with the least disturbance to particular functions. Some forms of mercury are more deleterious than others. The corrosive sublimate, when administered in full quantity, acts like a mineral poison on many persons. In a case that occurred in this city, where a woman attempted to poison her husband with this preparation, although she failed in her object, he became a miserable spectacle, being afflicted with tremors of the muscles, a variety of nervous symptoms, and continual disorder of the alimentary functions.

There is nothing more curious than the susceptibility of different persons to the influence of mercurial treatment. In some the mouth cannot be affected at all; in others with difficulty; and the most severe and obstinate salivation I ever saw, came on after twice rubbing in half a drachm of the common mercurial ointment. It becomes therefore necessary to learn the effect of mercury on the constitution of the patient by inquiry, if it had been used before, or to watch very closely the progress of the treatment.

Diaphoretic medicines, in promoting secretion, are useful as auxiliaries in many inflammations, more particularly in those of the internal parts of the body. The copious libation of common water constitutes one of the most certain diaphoretics. It acts by surcharging the blood with the watery fluid, in separating which, the aqueous secretions generally are reëstablished.

The *saline purgative medicines* operate by augmenting the liquid secretions of the alimentary canal, and also by unloading the intestines tend to produce a more agreeable state of sensation in the mucous membrane.

Warm baths have not only the effect of increasing the secretions of the skin, but by sympathy, also of encouraging the secretions generally; and as many cutaneous diseases are combined with a deficient or deranged secretion from the skin, baths become the most effectual means of curing many cutaneous inflammations. Sulphureous baths place the skin in a better condition for carrying on its natural functions, than any other remedy: and as every cutaneous disease is affected by the condition of the whole exterior surface, sulphureous baths constitute the best and indeed the only means of removing many chronic inflammations affecting the skin.

Of the class of remedies which are called *counter-irritants*, some are very mild, others very severe in their operation; for example, sinapisms, and friction with essential oils, are intended to merely redden and slightly inflame the skin, and are hence called *rubefacients;* blisters cause vesication, and afterwards a sero-purulent discharge; the ointment made with tartar emetic creates a pustular eruption, sometimes of a severe character; a purulent secretion is also maintained by the savin cerate, or other irritating ointments; by the introduction of extraneous bodies into the cellular substance under the skin, as by peas in issues, or the threads of a seton, a purulent discharge is maintained; and lastly, the death of a portion of the skin and the subcutaneous cellular membrane may be procured by the kali purum, arsenic, and the actual cautery, or the moxa, which is a modification of it.

The employment of these remedies requires a good deal of consideration and discretion. The milder counter-irritations are suited to diseases near to the surface, or which are situated opposite to the skin to which the application is made. The cautery or severe caustics are only justifiable, where the disease to be counteracted has a deep situation, and has a variety of interjacent structures, as in the hip disease and caries of the vertebræ.

All counter-inflammations should be of a kind easily cured, or in other words, that naturally tend to subside, after a given period. Whenever they partake of the character of a disease having a tendency to continue, they lose their good effects. Thus, when a blister is indisposed to heal, or when boils arise around it, although the degree of external inflammation may be much increased, it is no longer capable of exerting any influence over the internal disease. When sinapisms are left on too long, when issues or setons are irritated into a morbid state, or caustics are too extensively applied, their powers as remedies cease; they are then diseases in themselves. It was the error of St. John Long, and of his followers, (of whom there are more than avow themselves,) to create a very severe degree of inflammation, and that not of a curable kind; and consequently the constitutions of their patients sympathize more

with the inflammation produced, than the disease intended to be removed.

If any artificial inflammation be carried so far as to join or communicate with the original disease, it becomes mischievous; for, it is essential to the operation of any counter-irritation, that the parts placed between it and the internal disease, should be entirely free from inflammation, although they may be very thin, and consequently the two inflammations very near each other. From not following this principle, I have often seen disease of thinly covered joints, and of the tibia, greatly aggravated by maintaining a severe inflammation by blisters and savin cerate, in the parts covering them.

If the inflammation from the previous disease, and that induced by the surgeon, be kept perfectly separate, although near each other, the influence of the latter is very considerable in diminishing the former: nevertheless, the original disease does not appear to possess any power over the counter-inflammation, either in diminishing or increasing it. This fact is difficult to explain; indeed, the mode of operation of any counter-irritation is very obscure; perhaps it is because the artificial disease being always disposed to cease or recover, creates the same tendency in the original inflammation. On this subject we can offer nothing better than conjecture, but that counter-irritation does not act by deriving or transferring the internal disease, is sufficiently plain. In the first place, the two inflammations are of different characters, and attended with different consequences; no person would wish to add another scrofulous inflammation of the skin, to that already existing in a joint, but one of a more vigorous and curative kind. In the next place, the external artificial inflammation is naturally of short duration, except in issues and setons, which are rendered permanent, only by repeated irritations; and in the third place, internal diseases that are treated by counter-inflammation, are often of a nature that could not be transferred to the external surface. There is not the slightest analogy, for instance, between the progress of the caries of a bone and that of a blister or an issue on the surface. The term *derivation*, therefore, appears to have had its origin in inaccurate observation.

Sinapisms are counter-irritants of more value I believe than is generally supposed; the rapidity of their action is of importance, and the redness which remains on the skin for a considerable time, is an advantage, that does not belong to any of the milder kinds of counter-inflammations. From observing the good effects of blisters in gonorrhœa, gleet, and irritable bladder, I am disposed to think that sinapisms might be more useful in those diseases. I have found sinapisms very effectual in removing the inflammation of the tonsils in some cases.

It is generally believed, that when bloodletting and blisters are to be employed in the same disease, the abstraction of blood should take precedence, in order that the blister should produce its proper

effect. I think the opinion is correct, although I am at a loss to account for its being so.

Blisters having long been a remedy in the hands of every person, too little care and consideration are given to their employment. In general they are suffered to remain on too long before they are cut, unless it be in persons with strong skin. It is usually sufficient that the skin be inflamed, the serum will continue to flow at the first and second dressings. When it is designed to heal a blister soon, the water dressing should be used in place of any ointment. Some persons are much more susceptible of the irritation of cantharides than others. I remember an instance, in which a blister caused great excitement. The pulse was rendered very rapid, and the cremasters were acting with so much force, that the testicles were drawn up against the abdominal ring, causing excruciating pain. On removing the blister, the pulse immediately fell, and the cremasters relaxed. It is advisable, especially with children, and persons with delicate and irritable skins, to interpose a piece of tissue paper between the blister and the skin. This scarcely interferes with the effect of the plaster, and prevents any fragments of it being left behind when the blister is cut.

With some persons blisters continue to form serum, and there is no tendency in them to heal. In one instance the blister remained open for weeks. In such cases the discharge is speedily stopped, and the blister healed, by sprinkling, over its surface, a powder composed of equal parts of lapis calaminaris and cinchona, and using the water dressing over the part, to prevent the powder encrusting on it. The tender skin of children requires that blisters should be cautiously used. Sometimes the surface will go into a state of ulceration, and even slough. I have known two instances in which the children lost their lives by this occurrence, which would not have happened, if water dressing had been resorted to in the beginning.

Blisters have lately been used in the treatment of erysipelas with variable success. When they do succeed in arresting the disease, it is by producing an inflammation of the skin, of a more defined character, and one which more nearly resembles in its nature the phlegmonous action.

I should say the same of those deep and extensive incisions recommended by Mr. Lawrence and Mr. A. D. Hutcheson. If the constitution be in a state capable of responding in a healthy manner to the injury inflicted, the incision may constitute a new and more curable species of inflammation, than the erysipelatous; and in no other case can I conceive, that such extensive injuries can be productive of advantage. If the abstraction of blood were the sole object, that could be attained by other and safer means. The liberation of pent up serum, could also be effected by a milder operation. The cases recorded do not appear to me to justify the practice, as even where the cure has been attributed to these severe and dangerous incisions, we have no proof that it might not have been

effected by other means. That it is dangerous treatment is certain, by several patients dying in consequence of it. It is a common practice to attempt the arrest of erysipelas, by rubbing lunar caustic on the inflamed skin, and beyond it on the sound. As far as my experience extends, this treatment is more certainly efficacious, than either the application of blisters or the mercurial ointment. The properties of this caustic are very curious and difficult to explain. Although I do not adopt Mr. Higginbottom's practice with respect to the use of it in wounds and ulcers, there are other cases in which the formation of an eschar by the lunar caustic, is decidedly useful. I have removed by its means spots of psoriasis, and also corns. A friend of mine is in the habit of using a very strong solution of the caustic as a permanent dressing, and he informs me with very marked benefit.

During the reign of the humoral pathology, it was customary to insert issues in the arm, with the view of preventing diseases which did not exist; and even in the present time, some practitioners place more reliance on these artificial drains than they merit; perhaps the only case in which such conduct is justifiable, is where an old person has been long accustomed to an ulcer on the leg, which has suddenly healed; but even under those circumstances, I doubt the efficacy of an issue, unless it be placed as near to the habitual discharge as may be convenient.

For producing a discharge of pus the tartar emetic ointment is sometimes employed, and savine cerate for keeping up a formation of pus, but these sometimes occasion too much inflammation. There is a plaster made by only one person in Paris, for maintaining a purulent discharge on a blistered surface, which is much to be preferred; it is paper on which there is a soft plaster very thinly spread; there are two kinds, one milder in its operation than the other, but they both keep up a secretion of pus, from a raw surface, apparently for any length of time, without inducing as much irritation as the savine cerate occasions in a few days. It is made and sold by *Mr. Albespeyres*, Rue du Faubourg St. Dennis, No. 84, Paris. The composition of the plaster is a secret.

Burning with moxa may be either made a severe, or mild remedy, according as it may be used in the common way, or as employed by Baron Larrey. His mode consists in inflaming the moxa from the outside, and by means of a blow-pipe conducting the heat to the side placed on the skin, and as soon as pain begins to be felt, to remove the moxa, and immediately after to apply the aqua ammoniæ pura, by inverting a wide-mouthed bottle containing this fluid, on the part for about half a minute; the aqua ammoniæ pura being a lesser stimulus, brings the part nearly back to its natural state, leaving merely some redness of the skin; thus avoiding the formation of an eschar.

Much caution and discrimination ought to be exercised before we perform so painful an operation, as the formation of issues in the hip or back, by means of caustic. There are, no doubt, numer-

ous cases, in which this has been done without any necessity. The symptoms of spinal and hip diseases are often simulated in young women with bad uterine health, so perfectly, that it becomes very difficult to distinguish the spurious from the genuine disease. We are indebted to Sir Benjamin Brodie for much useful practical information on this subject. But I should go farther, and say, that even when real disease of the spine or of the hip joint exists, the necessity of severe counter-irritation may sometimes be obviated, by the early use of leeches, blisters, rest, and the various remedies for improving the strength of the constitution, especially the sulphureous warm baths, and under certain conditions the cold affusion, which is by far the best method of using the cold bath.

The different medicated lotions are to be varied according to circumstances. They may be considered as possessing sedative, astringent, refrigerant, or stimulant properties. The two latter have already been noticed in describing the production of cold and counter-irritations.

The dilute liquor plumbi subacetatis, in combining the sedative and astringent qualities, is most generally useful. There are few cases, indeed, of inflammation, in which the lead lotion will not be found serviceable, made in different proportions, according to the intention of the practitioner. I have employed it extensively both over raw and unbroken surfaces, in almost every variety of local inflammation, and I never knew it give rise to the deleterious effects of the metal.

The lead lotion is a valuable application in erysipelas. In severe ophthalmia it is soothing, if used warm, and in the chronic stage it is equally beneficial cold. It is particularly well suited to a great number of cutaneous diseases, in consequence of its astringency and sedative powers, being brought into immediate contact with the inflamed surfaces. I have kept the face constantly under the influence of the lead lotion in small-pox, with the effect of moderating the inflammation, and preventing in a great measure the marks of the disease.

The lead lotion never fails to cure tinea capitis, however long and obstinately the complaint might have resisted other remedies, provided the application of the lotion be properly conducted. The hair should first be cut close to the head, but need not be shaved off; water dressing or a poultice of any kind is then to be applied, merely for the purpose of cleansing the skin of the crusts, and all other impurities. There will then be seen under each crust, a red spot of the skin, denuded of its cuticle, and the villous surface exposed. The lotion should now be applied by means of lint thoroughly wetted with the fluid, and covered with a plate of indian rubber, or a piece of oiled silk to prevent evaporation. Every time this dressing is changed, which should be very frequently at first, the head should be washed with some of the lotion, and the lint should be replaced by some that is clean, which is to be completely wetted with the lotion, and covered as before.

The efficacy of this mode of treatment, depends entirely on the head being continually subjected to the operation of an astringent fluid; for, if the application be suspended for one night, or even for a few hours, the peculiar viscid secretion which forms the crusts, will reappear, and the whole treatment will have to commence again.

By carefully pursuing the steps above described, I have never failed to eradicate this complaint in a very short time. I have cured cases of several years duration in as many days. It is not, however, always safe to remove a disease to which the constitution has become habituated, so quickly; I have therefore in some old cases, cured different parts of the head in succession.

I think it is very probable that a solution of alum or any other astringent fluid might answer equally with the lead lotion. In one case, which was particularly obstinate, from improper treatment having been previously employed, I was obliged to use the lead lotion of an unusual strength, as two, and three drachms of the undiluted liquor plumbi to a pint of water.

If the lead lotion be applied to scrofulous inflammations, it is necessary to add more spirits to it than is directed by the pharmacopœia.

It is to be understood that in all cases, where any medicated lotions are employed, the application should be unremitting, which is easily accomplished, by the means of lint wetted with them, and covered by the oiled silk or a plate of indian rubber.

The means by which we produce *an agreeable state of feeling*, either in a part of the body or throughout the sensitive system, are apparently so simple, that those who have not witnessed their effects, can hardly be brought to believe them, or rather I should say, to credit the tendency and power which belong even to the human being, for the reparation of injured parts, when the sources of irritation are removed, or counteracted by sensations of a different kind.

The application of *steam*, at a suitable temperature, to the skin, is the most powerful means we possess of producing a grateful state of sensation. The skin constitutes the great external sentient surface on which the spinal and some of the cerebral nerves terminate, and the ultimate branches of arteries, with the nerves which doubtless accompany them, also end in the villous surface of the cutis; we do not know the manner in which the last filaments of the nerves are arranged, in a villus of the skin, but as the pulps that form the teeth, and the hair, are so very analagous to the villus elevations of the external surface generally, we may fairly conclude, that the same arrangement of nerves exists in each of these structures. In a paper read by me at the Bristol meeting of the British Association, I explained the manner in which the nerves are disposed in the pulps of the teeth. The filaments that enter into the bottom of the pulp, become so intricately united with each other, and so intermixed with the arterial structure, that the distinct

filamentous appearance is lost, even more than in any of the ganglia of the nervous system, and from this intimate confusion, separate filaments arise, and proceed in a radiated manner to the surface of the pulps. This arrangement seems to be subservient to the highest degree of sensibility. From having proved, that the sentient extremities possess a susceptibility of impression far beyond any other parts of the nervous system, and an extraordinary influence over the condition of the arteries, I am induced to think that the nerves have a peculiar disposition in the villi of the skin, and of the mucous surfaces, similar to what I discovered in the pulps of the teeth; and that the nerves derived from the brain and spinal marrow, and the sympathetic, are in these situations dissolved into one.

In whatever manner we may account for the useful operation of steam, the facts remain unquestioned, even when it is applied in the intermitting and imperfect mode called *fomentation*, a remedy universally employed in some of the most severe and dangerous inflammations.

The ancient, and the present popular opinion respecting fomentations is, that their virtue depends on the herbs, of which they may be the decoctions. Although I should ascribe the efficacy of fomentation chiefly to the contact of steam at a temperature which the parts feel agreeably, still, the effects may be increased by the addition of certain herbs or vegetable juices: for instance, aromatic plants give a pleasant stimulating, mucilaginous, soothing, narcotic and an opiate effect.

In consequence of experiencing the insufficiency of the common methods of applying fomentations, I was led to invent an apparatus in 1820, for the administration of steam, either simple or medicated, and without interruption or variation. After many experiments, I arrived at a principle, in the formation of the boiler, which enabled me to generate not only steam as hot as it could be borne, but at all degrees downwards, to below the standard temperature of the human body.

The apparatus consists of a small tin boiler, supported on a platform, on which a spirit lamp is placed. The peculiarity of the vessel is, that the superior opening is an expanded funnel, in consequence of which the steam ascends from the boiler with a vortical motion, being attracted to the smooth and infundibular aperture. The effect of the steam escaping in this manner, is to diffuse and cool it so much, that if the vessel be uncovered, the hand may be placed within an inch of the surface of the boiling water, without experiencing any unpleasant feeling of heat, although if the steam be made to ascend in a straight line, by diminishing the opening of the funnel, it will scald the hand held two or three feet above the water. The steam is conducted to any part of the body, by means of a tube of woollen cloth, about 12 inches wide, and three feet long. Its cylindric form is maintained, by circular pieces of whalebone. One end of the woollen tube is tied round the contracted neck of the boiler, and the other end admits of being

adapted to the shape of any part that is intended to be fomented, from holding within its opening a piece of flexible wire.

By this apparatus steam, at any temperature, may be applied for any length of time, with only the momentary interruption of renewing the boiling water, and the spirit in the lamp. The great advantage of making a continued, instead of a temporary application, at a determined temperature, and without the intervention of the woollen cloths used in common fomentation, which irritate many wounds and ulcers, gives to the mode I have described for administering steam, the character of a *new remedy*, which it exhibits also in its more extended and more beneficial effects, than those of common fomentation.

The apparatus described above, is better calculated for *inhalation* than any other means yet invented, as the patient may include both the mouth and nose in the end of the tube, and thus breathe the vapour at the heat directed, and without trouble or effort.

By placing the tin apparatus in a small box, on the top of which a large cloak or tube, supported by ribs of cane to maintain its form, is nailed closely, the whole body may be enveloped, and by lighting three or four of the wicks of the lamp an entire steam bath may be procured. The person so inclosed sits on a common chair, with the feet placed on the top of the box, as on a footstool. If only half the body be included in the large cylindric cloak, the effects of fomentation of the inferior part of the body may be obtained; or if the feet and legs only be inclosed, more than the common advantages of the pediluvium will be afforded. By burning the spirit lamp in the bottom of the box, closing its door, and removing the tin apparatus, a hot air bath will be produced, which may be either applied to the whole, or to any part of the body that is desired.

In the use of the steam apparatus certain precautions are necessary. The water should be already boiling, when put into the tin vessel, and should never exceed the quantity of a pint, as it is necessary the surface of it should be some way below the commencement of the funnel-shaped part of the tin vessel. Spirits of wine are improper for the lamp, as they are apt to catch fire. The strong household spirits, which are something stronger than proof spirits, burn most steadily and safely. Very thick strong frieze makes the best material for the large cylindric cloak, and common flannel for the fomenting tube. The whole apparatus, or the part for the local application of steam, have been sold separately, or together, for a number of years, by Mr. Stoddart, surgical instrument maker, No. 401, Strand, London.

The effects of steam, at a high but comfortable temperature, are gently stimulant, and at the same time extremely soothing to the feelings of the patient. When the remedy is used in this manner immediately after the receipt of any of the following accidents, viz., lacerated, gunshot, and punctured wounds, contusions of bones, fractures near joints, recent luxations, bruises and strains of joints,

and in all wounds accompanied with a peculiar overcoming pain, and a shock to the nervous system, it removes all pain and consciousness of injury in a very short time.

After the pain and the sense of injury have passed away, the steam at a lower temperature may be continued; or, if found more convenient, water dressing may be substituted. In injuries to joints and bones, the temperature of the steam ought to be gradually reduced; and when there are open joints, compound luxation, or compound fracture, we may meet the invasion of inflammation (if it should occur) by bleeding, leeches, and cold, according to circumstances.

Steam at a low temperature has an extraordinary power in reducing the heat and vascular dilatation, while at the same time it soothes the sensations of inflamed parts. The difference made by the temperature is very well illustrated by the application of different degrees of heat to ulcers, and shows that temperature is a necessary element in all local remedies. If hot steam be used to healing ulcers, and still more to those with luxuriant granulations, they become tender and painful, and sometimes bleed; but it was found by some experiments made in the Military Hospital at Chatham, to be remarkably successful in improving the condition of the indolent ulcer. Tepid steam would be very unfit for those old sores about the lower part of the leg, which neither contract, granulate, nor furnish genuine pus, and which are called, from these circumstances, indolent.

Where inflammation is of a more active character, and its existence attended with pain, no local application can compete with steam at a low temperature. In this state it removes almost immediately the painful sensations of ophthalmia, and the vascularity of the conjunctiva, the latter being so dependant on the state of feeling, as we observe when any extraneous matters are admitted under the eyelids. It is also singularly beneficial in all cases of phlegmonous abscess, promoting very rapidly the thinning process, by which the tension of the cavity is removed, and the pus brought towards the skin.

The application of water in a liquid form can be used at all temperatures, from the heat of the living body down to the freezing point. This great range extends its efficacy to a variety of wounds and inflammation; but, except where cold is absolutely necessary, the remedy is usually employed at the heat of the body, or rather at that degree to which the application cools the part. The water is retained in some light and porous substances, charged or wetted throughout, and covered with some thin and impervious substance, to prevent evaporation. When water is applied in this manner, the impression it makes is permanent and equal; and as it bears some resemblance to other dressing for wounds and ulcers, in the form of its application, I have given it the name of *water dressing*.

The substance that I have generally made the immediate object of application, is the finest and softest lint; and for the covering material, either oiled silk, or a thin plate of indian rubber. Simple

as this mode of dressing may appear, it requires to be managed with care, and attention to many circumstances, which would appear trivial, to persons unacquainted with the nature of the remedy. Two, three, or four layers of the lint should be first folded together, according to the size of the part to be covered, taking care also that the soft side of the lint is the outer one. In wetting the lint the first time, it is necessary to either float it in the water, before folding it, or if it be first folded, it should be pressed between the fingers, to urge the fluid into the interstices of the lint, which receive fluid with difficulty, until all the air they contain be expelled. The lint, when applied, should just contain as much water as not to drop. The oiled silk, or indian rubber, should project so much beyond the margin of the lint, as may prevent evaporation, which will vary according to the shape of the part on which the dressing is laid, and the thickness of the folded lint.

It is of great importance to use the wet lint without any bandage, that can give to the part affected the least feeling of constraint. The figure of the parts sometimes renders this difficult to effect, without stitching the silk into a particular shape, which is much better than using any strict bandage.

The periods for changing the lint must vary according to the nature of the case; but as a general rule, three times during the day, and twice during the night (if convenient) will be sufficient. In cases where the inflammation is moderate, and the skin unbroken, the dressing will only require to be changed every twelve hours. At each time that the dressing is renewed, the lint and oiled silk should be carefully washed, and when it is applied to ulcers, fresh lint should replace that taken off, the utmost cleanliness being of the first importance.

French oiled silk is very much superior to the English, it does not adhere to the skin, and therefore does not fret it. Some other substance besides linseed oil, I am informed, enters into its composition. Messrs. H. and H. De Villers, silk mercers, 103, Grafton-street, Dublin, have for many years imported and sold the French oiled silk, which, although somewhat dearer in the first instance than the English, is much cheaper in the end, being so much more durable.

The water dressing becomes immediately the same degree of heat as that of the surface of the skin on which it is placed; but when it is desirable to combine it with cold, a bladder holding iced water may be laid over the oiled silk, or where the comfort of warmth may be required, the dressing may be covered with flannel.

Some surgeons now profess to use water dressing, as a substitute for poultice, by which they show their ignorance of the nature and operation of the remedy. A poultice is made of materials, which, in a term far short of its renewal, become sour, and thereby render the poultice, after the first few hours, an irritating application. The greasy substances which are added to prevent the poultice adhering to the skin, do not always answer the end, and soon become rancid.

A poultice favours the formation of pus, and causes a throbbing or pulsating pain, and a feeling of tenderness in the part, which are the natural attendants on the process of suppuration. It imbibes the pus it serves to create, and thereby becomes more irritating. A poultice, before it is many hours on, is a mixture of sour farinaceous substance, rancid oil, and pus, oppressing the part by its weight, and beginning to adhere round its edges to the skin, creating the sense of constriction.

In order to judge of the effects of poultices, it is only necessary to visit an hospital, where they are much employed, before the surgeon comes round, when the sufferings of the patients will be sufficiently obvious; and to contrast this state of feeling, with that which arises after the poultices are taken off, and the wounds and ulcers bathed for some time with tepid water; the soothing and comforting effect of which, is better known by the patients, than the surgeon, and therefore they prolong it as much as they can.

Water dressing has not only better, but very different effects from poultices; it either prevents or diminishes the secretion of pus: a wound may at first yield a little purulent fluid, but in a short time this will be furnished in so small a quantity, as hardly to stain the lint. The pus, even from an ulcer, rapidly diminishes under water dressing. I remember a case of a very extensive ulcer of the leg, to which I applied it; the patient pulled off the dressing in the night, because, as he said, "it was stopping the discharge," he conceiving, like many surgeons, that no open surface could heal without suppurating. Granulations also which are rendered exuberant by poultice, are either never formed, or exist in a very slight degree under water dressing.

Instead of the throbbing pain produced by a poultice, being excited, all pain is removed by the use of this remedy. A man in a fight with another, had the nail of his thumb bitten through near the root. The water dressing was applied. A day or two after I met him with a poultice on his thumb. On inquiring why he removed the first dressing, he said "there was no use in keeping it on any longer, as it took away all his anguish," he supposing a poultice the proper application for the cure. In a word, the tendency of water dressing (if it be properly conducted) is to induce the cure of wounds and ulcers, not requiring excitement, by the approximating or modelling process already described.

The employment of water as a remedy for wounds and inflammation, is no doubt of very ancient date. Hippocrates is said to have discovered, by the inscriptions in the the temple of Æsculapius, that the priests had used water mixed with secret ingredients, in order probably to give the remedy more importance in the eyes of the people.

Hippocrates himself seemed to have understood more of the modes of application of water, and of its adaptation to particular circumstances, than we discover in the practice of many who have lived in later days. He used warm water in gangrene; sea water

for chronic cutaneous diseases; cold water in fractures, erysipelas, and ulcers. His method of application was to bathe the parts with a sponge, afterwards leave it on charged with the fluid, and wet the sponge as often as it became dry.

This simple practice was set aside by the Arabian physicians, and Celsus having introduced a variety of absurd and complicated medicines into fashion, which held their ground until the 14th century; when the surgeons of that period fell as foolishly into the opposite extreme, as that of composing their medicines of a multitude of ingredients. They now endeavoured to discover some one which would be universally applicable. This gave rise to the system of *secret dressing* as it was called, each practitioner assuming that he possessed the panacea. Some of these secret remedies, when discovered, were found to be ridiculous; as for example, oil and cabbage, and an oil made of kittens were much in use. At this period and for long after, water was employed, but accompanied with some absurd form of incantation, to which all its good effects were ascribed.

Ambrose Parè, who was a man of the greatest talent and experience of the age in which he lived, refused for some time to apply water to wounds, as the effects seemed to him to be so extraordinary, that they could only be produced by supernatural agency, which, from religious scruples, he did not consider it justifiable to employ. During the siege of Metz, in 1553, an ignorant quack called Maitre Doublet, as Brantome relates, "performed strange cures with simple white linen, and clean water from the fountains or wells. But he was assisted by sorcery and charmed words, and every one went to him, as if he were Maitre Ambrose Parè himself, a man so celebrated and considered the first of his day."

Ambrose Parè, who equally detested fraud and folly, in writing his report of the proceedings of the medical department of the army, speaks thus: "I do not deny that water is a good remedy in wounds and recent injuries, having employed it myself with much advantage, but I object to the mysterious words, and the vain and unchristian ceremonies, that accompany this new and singular practice, which is so simple, that it requires no aid."

The book on surgery by Gabriel Fallopius, published in 1560, strongly recommends the use of natural water as a "fruitful source of success."

Pallazzo published in 1570 a book on the true method of curing wounds by simple water, hemp and flax. He recommends varying the temperature according to circumstances.

Laurent Joubert in his work on popular errors, published in 1578, exposed the folly of using charmed water, and described common water as being most efficacious in procuring "a favourable termination and a good cicatrix."

Some time after this there was a sharp controversy between Martel, surgeon to Henry the Third, and one Denis, a surgeon of Vendome, and Danguaron, also surgeon to Henry the Third; the

two latter contending for the use of charms. This dispute was terminated by the Chancellor of the University of Montpelier deciding in favour of simple water.

Soon after Van Helmont introduced his mode of curing by magnetic sympathy, and the water was only employed mixed with other ingredients, such as the powder of the Chevalier Digby.

In 1732, Lamorier published "on the use of common water in Surgery." He asserted that there were few wounds which could not be healed by this treatment, more promptly and satisfactorily than by any other means.

Professor Caldani of Padua, also recommended cold water as the best application in recent wounds. Danter published a learned essay at Gottingen, in which he commended the use of water.

In 1785, a number of men were severely wounded in proving the cannon at Strasbourg; a miller of Alsace undertook their cure, by the leave of the Intendant of the province, with *blessed water:* these wounds were all cicatrized in six weeks. A second proving of the cannon wounded thirty-four men. They were dressed with common water by Lombard, the surgeon-in-chief, by which means they were all cured. The progress of the wounds was witnessed by Baron Percy, then a Surgeon Major of Cavalry. The success on this occasion produced a pamphlet from Lombard, in 1786, "on the Properties of simple Water as a topical application in the cure of Surgical Diseases."

Baron Percy always afterwards employed warm or cold water according to the season. He says they often had from 6 to 8000 wounded in their hospitals. His experience, therefore, cannot be questioned, and so strong was his conviction of the utility of this treatment, that he said, "he would relinquish military surgery, if he were prohibited from using water."

Baron Larrey is said to have treated, with great success, the most terrible wounds, with the water of the Nile, during the campaign in Egypt; probably from the want of other remedies being in his possession, as his predilection for complicated applications, would have prevented him choosing so simple a one as water. In his writings he speaks of salt-water being a proper remedy for wounds.

Professor Kern of Vienna, was long known as the strenuous advocate of the employment of water in wounds and ulcers, and in the after treatment of surgical operations. He varied the temperature of the fluid, and consulted the feelings of the patient, by avoiding all useless bandages and medicated dressings for wounds, and his practice was, I have heard, proportionably successful. He claimed the credit of having invented water dressing; an assumption that could only be made by a person ignorant of the history of Continental surgery. Kern, I believe, however, carried out the principle of the treatment farther than those who preceded him.

The practice of most of the surgeons whose works I have mentioned, was to bathe the injured part with water in the first instance,

and repeat the bathing frequently, during the day. Only a few of those writers prevented evaporation by any impervious covering. Frequent ablution, either with warm or cold water, is, according to the nature of the case, an admirable remedy. It is a species of irrigation, but wants the convenience, and the unremitting operation of the wet lint and oiled silk. Within these few years, the practice of irrigation has been revived in France by Breschet, Berard, and Josse, with great improvements on the ancient system of temporary bathing; but, with these exceptions, the simple mode of treating wounds and inflammation cannot be said to exist in any of the civil hospitals of France or Italy. The dressing with dry charpie in the first instance, and after the wound is compelled to suppurate, with medicated ointments, and the use of complicated bandages, are as common throughout the South of Europe at the present day, as they were in the most barbarous ages of surgery.

It is quite manifest from the history I have given of the employment of water in its liquid state, for the cure of wounds and inflammation, from the earliest periods to the present time, that I do not claim the discovery of the remedy: but that I have been the means of introducing it to the attention of the profession in these countries, is a matter of too much notoriety to admit of dispute. I have also connected the use of it, with general views of the nature of inflammation, which (whether right or wrong) are peculiarly and distinctly my own; and I have demonstrated the possibility of open wounds healing without inflammation, and without the medium of either coagulable lymph, or granulations; a fact which, as far as my information extends, has not even been hinted at, by any writer on surgery, either ancient or modern.

In all cases, where it is not desirable to reduce the temperature of inflamed parts, below the standard heat of the human body, I consider water in the state of vapour, as superior to it in the liquid form; but in consequence of the application of steam being attended with some trouble, and sacrifice of time, the water has been generally preferred, except in great and dangerous wounds, painful abscesses, and those internal inflammations, wherein common fomentation has hitherto been adopted. I do not attribute to water, under any form, a specific or medicinal power of controlling inflammatory actions; nor is such power necessary, for if the organic sense of injury, and the feeling of pain be removed, by substituting an agreeable state of sensation, the motives to inflame cease to exist, and the natural actions of reparation proceed without impediment or delay. We have a very beautiful example of inflammation, being not only excited, but maintained, by a slight irritation, and declining without any remedy, except the removal of the object which created the pain, in the common accident of a grain of sand or dust being lodged on the surface of the conjunctiva of the eye. I can conceive that water, either as vapour or fluid, might be capable of preventing, and perhaps of removing the impression of exposure, which most wounds more or less produce; and I am

persuaded as much as I can be of any fact, not proved by experience, that if a serous cavity were to be opened in an atmosphere of steam of the proper heat, and detained in it, the cavity would not inflame, because it would not be sensible of any impression different from what it was accustomed to from its own vapour: for, as I have already mentioned, it is not the wound of the parietes of a close cavity, which spreads inflammation over it. When amputation is performed below the knee, inflammation of the joint does not occur; but if the head of the fibula be taken out at the time, and in doing this the slight capsule which divides its joint from that of the knee, be cut, inflammation is liable to come on the latter.

In the employment of water, those who have not been instructed respecting the nature of the application, do not pay sufficient attention to the influence of temperature. Some persons believe that they use in all cases cold water, which is impossible, beyond the moment of its application, if the dressing be covered with the oiled silk. It is only by perpetually adding the fluid, as in irrigation, or by covering the water dressing with a bladder holding iced water, that a low temperature can be obtained. It is evident, that warmth and confinement of the wound would be improper, when hemorrhage had either taken place, or was expected. In other circumstances the temperature to be chosen, is always that which is most easy and comforting to the patient.

Water dressing may be employed in the common manner, after the pain of the injury is subdued by steam or fomentation, in all great lacerations, punctured wounds, contusions and strains of joints. I have in several instances of such injuries prevented all suffering and inflammation by these means. Whereas in the common mode of treating these accidents, they would have been followed by extensive suppurations, much misery, protracted confinement, and in the end, perhaps, the patient left with a useless limb.

Water has been used with great success, by many military surgeons in gunshot wounds, and in shattered limbs from explosions of gunpowder. I have seen a case in which this mode of treatment was carefully followed, and in which the patient never suffered any pain nor constitutional disturbance, except a little during one night, just before the piece of cloth was expelled. The edges of the wound did not slough, and the discharge was hardly enough to soil the lint. The gentleman walked out well the eighth day after he fought the duel: the ball remained imbedded in the ilium.

Mr. Bird, of Banagher, a very active and intelligent practitioner, has communicated to me some frightful injuries by gunshot wounds treated by water dressing, with complete success; and one particularly severe case, in which amputation would have been formerly thought unavoidable. In consequence of a gun bursting in a man's hand, the carpus was torn open, the end of the radius broken, the metacarpal bone of the thumb was separated from the carpus, and the thumb thrown back on the hand. This man recovered the use of his hand, having only a stiff wrist joint. Mr. Bird informs me,

that since he commenced practice, he has treated twenty-two cases of gunshot wounds solely with water, and always with the same fortunate result.

I have seen under the care of the late Dr. M'Dowel, who practised water dressing extensively in the Richmond Hospital, cases of division of varicose veins, proceeding without the slightest appearance of inflammation.

Boils are completely under our control by this mode of treatment. If resorted to in the beginning, the boils will seldom exceed the size of peas, and produce no pain.

I have repeatedly cured inflamed and protruded piles by a wet sponge covered with a plate of indian rubber, which dressing conforms better to the shape of the parts, than the lint and oiled silk. In these cases the complaint never returned.

I have never used water dressing myself in gonorrhœa, not anticipating that it would succeed; but numerous accounts have been transmitted to me, of the disease being cured by the external application of water to the penis. The symptoms are described as being rendered very mild, and usually disappearing in from one to two weeks.

Water dressing is particularly convenient and efficacious in many chronic affections of the skin, especially those that are dry and scaly. I have sometimes used the oiled silk or the indian rubber alone, in psoriasis, which kept the parts moist by collecting and confining the insensible perspiration. On one occasion, where the disease had spread over the whole body, causing the greatest irritation and a total want of sleep, I had the patient entirely enveloped in a dress of oiled silk with the best effects.

Water dressing never fails to eradicate corns or any other callosities of the skin, provided it be persevered in for a considerable time.

If the effusions called ganglia which form in the sheaths of tendons, be carefully dressed with water, or what is still better the lead lotion, and be kept in a state of rest, the inflammation of the cyst will be removed, and the fluid which distended it absorbed. I have also reduced the size of the cartilaginous bodies found in similar situations by the same treatment, and I am disposed to think, that it is possible to procure the entire absorption of the loose cartilages in the joints by these means.

I have never seen an instance of tetanus coming on, when wounds, however severe, and from their nature likely to produce the disease, were healed under water dressing; and I know of but two cases in which it is said to have occurred, and possibly in these instances the remedy might not have been accurately employed. For I cannot conceive that tetanus could ensue, provided all pain and sense of injury were early removed, and that the wound healed by the approximating process, without inflammation, or the medium of any new organized substance. In a letter from Dr. Bonyen, a very intelligent pupil of mine, now settled in Demerara,

received the 23d of June, 1837, he states, that a medical man in extensive practice there, uses water dressing after amputation, and other operations; and that these wounds healed as well as the best treated cases in cold climates; and that in fourteen amputations he had performed, he had not lost a single patient by tetanus.

The *immersion* of a wounded or inflamed part either in warm or cold water, according to circumstances, has perhaps more influence on the sensations, than any other mode of applying the fluid. I have witnessed the greatest effect from it, when used either warm in place of fomentation to soothe pain, or cold to abate vascular action. It would be a most valuable remedy if any means could be devised for its application, without the inconvenience of the inflamed part being placed in a depending position. A very striking case of the benefit of immersion was communicated to me by Dr. Cardiff, then a military surgeon stationed at Kilkenny; a soldier received a thrust of a bayonet, which passed through his thumb, and between the metacarpal bones of his hand. After the bleeding had ceased, the hand was laid in tepid water, which speedily removed the pain. The immersion was continued for twelve hours, after which the hand was taken out and dressed in the usual manner (I presume with adhesive plaster) after which the pain returned with great severity and throbbing, so that it became necessary to remove the dressing and return the hand to the water. The immersion again removed all pain, and was now continued for twenty hours, and when removed, the common water dressing was employed, no more pain was felt, and the cure of this frightful wound was accomplished without swelling, heat, suppuration, or any of the results of inflammation, and the cicatrix that remained was soft. The man went to duty on the eighth day after receiving the wound.

Baron Percy very truly says, "that if it were possible on the receipt of a gunshot or other serious wound of the elbow, knee, foot, &c., to keep the part for the first ten or fifteen hours plunged in water, we should have fewer amputations to perform, and we should save the lives of a greater number of wounded."

A lady fractured her tibia close to the ankle joint, great swelling, tension, and pain immediately followed. At her own suggestion the limb was placed in a bucket of warm water, which had the effect of removing the pain, and almost all the tumefaction, before I visited her, for the purpose of adjusting the fracture.

Freedom, from the sense of restraint, pressure, and friction, an easy and elevated position, and avoidance of all motion, might seem to some persons to be undeserving of notice here, as all surgeons and patients would assent to the propriety of the above circumstances being procured. I am compelled to say, that most surgeons in their practice, do not bestow the attention on this part of the treatment which it demands. For example, nothing is more common than to see wounds, and inflamed parts unnecessarily probed, squeezed, and rudely handled, when more information would be gained, by gently feeling, or perhaps only looking at them. Di-

vided surfaces are bound together, as if they could be united by mechanic force; the patients are not enjoined perfect rest; and the position of the inflamed part is overlooked, except that it may be directed, to support the lower extremity on a stool, or a sofa.

This mode of treating injured parts, is derived from the dark ages of surgery, when nature was allowed to have as little share as possible in the cure, in order that the more might be done by art; and it is to be feared, that even in the present day, surgeons, in other respects well informed, still imagine they effect the union and restoration of parts, in a direct manner, by the means they employ; whereas, all that the best surgery can accomplish, is to place parts in the most favourable circumstance for carrying on reparative operations. If wounds had no natural tendency to heal, of what use would be operations of any kind? What would be gained by placing the ends of a fractured bone in contact? It is nature, not the surgeon, that unites them. Of what advantage would it be to tie an artery, if the parts did not take on themselves the charge of permanently closing the vessel? Surgery, as an art, consists in the performance of mechanic actions; but, as a science, in knowing what is accomplished by nature, and under what circumstances her operations may proceed with the greatest facility.

Bandages came into use in the early periods of human society, when men fought with sharp and cutting weapons. The wounds from which, required to be bound up to suppress, and perhaps also to conceal the hemorrhage; and, in the middle ages, bandages were so multiplied and complicated by the ingenuity of surgeons, that it became as difficult to dress a wounded man, as a lady for a ball. Although greater simplicity is now used, still the system of mechanic aid is carried too far.

Bandages should never be employed where they can be avoided: and I know very few cases in which they are absolutely necessary; and in no instance, where inflammation is to be apprehended, should bandages be used, so as to produce the sense of unpleasant restraint. A feeling of constriction is in itself a motive to take on the inflammatory action; and if the parts be already inflamed, external force always augments the irritation, and creates a disposition to swell and separate, which cannot be restrained. It is vain, therefore, to expect union by the first intention of wounds, once they become sensible of constraint. This is an affair of sensibility, and not a mechanical constriction, actually obstructing the functions of the part. On the contrary, the smallest restraint is sufficient to rouse the feelings to impatient resistance in the edges of a wound or ulcer, which is propagated to the adjacent skin. Thus, the resin plaster, a scab, a dried clot of blood, and sutures drawn tight, are sufficient to cause the most rapid and dangerous inflammations, which no means will appease, unless the sense of restraint be removed.

Pressure is the cause of the worst kind of ulceration, where the patient is weak or paralytic, which compels him to remain in

one position, by which the weight of the body is thrown on the prominent parts that are thinly covered, as the sacrum and great trochanter. Pressure is always a motive to inflammation, and therefore ought to be avoided, more especially in parts already inflamed.

Friction is not to be borne with impunity by any inflamed surface. A number of cutaneous diseases would never arrive at the degree of severity and obstinacy they often present, if they had not been scratched. In many of these cases, human fortitude can hardly resist the impulse to scratch. Even while asleep, the patient will unconsciously use his nails. Our duty, in such instances, is not to trust to admonishing the patient, but to use means to confine his hands, if the itching cannot be subdued by spirituous and astringent lotions assiduously applied, which generally answer the purpose.

Obstinate ulcerations in the interior of the nose, inflammation and purulent discharge of the meatus auditorius, and deafness, and many other troublesome diseases, are absolutely made to arise out of insignificant irritations, by perpetually teasing and fretting them.

The first sensation which intimates the formation of a boil or carbuncle, is itch. The scratching or rubbing of the part increases the itch, and hastens the development of the tumour, before there is time to abate the action which had commenced. Many boils have been greatly increased in size, from the irritation given to them in the very beginning.

Although the fault lies chiefly at the patient's door, in acting so indiscreetly under the above mentioned circumstances, still the surgeon may derive great instruction with regard to the management of inflamed parts, from observing the mischievous effects of even slight provocations on them.

It is obvious, that every *movement* to which a wounded or inflamed part is subjected, must act upon the one, like a repetition of the original injury, and upon the other, like a continuance of the irritating cause. Rest is not only a negative advantage, as saving the patient from renewed injury or irritation; but a positive remedy, as it diminishes the heat of the body, reduces the pulse, and alleviates pain, by continuing the same feeling unattended with those aggravations of pain, arising from motion, which give a more vivid consciousness of suffering. The nature of all pain, and indeed of all our perceptions, is to lose their intensity, by being long continued without variation. How often do we see patients bear their unvaried sensation of pain without murmur, and even with forgetfulness? but the moment that motion is expected to be suffered, uneasiness and apprehension are felt and often expressed by those who have met with severe injuries. Rest is of so much value in the treatment of inflammation, that in some instances no means will advance the cure without it, and numerous injuries would do well with perfect rest and nothing else.

An *elevated position* of any part of the body, which admits of being raised above the rest, has effects far beyond what are generally known on the circulation of the elevated part, and consequently on the heat, pain, and tumefaction which may have previously existed.

If the hand be held up for a little time above the head, the pulse immediately becomes soft. The hand is soon after found to be paler and reduced in size. There is a feeling of lightness and coldness, which continues for some time after the hand has been taken down. The sensation of cold far exceeds the actual reduction of temperature, which by the thermometer does not appear to sink more than two degrees in the hand while held up. Every one has experienced a change in the state of the circulation in parts when they are permitted to depend below the plane of the body. There is a sense of fulness in them, their colour is a darker red, and when heated a throbbing is felt, especially if they have hung down long. The pulse has a sharpness and hardness in its beat, but is smaller than when the same part is raised above the plane of the body, probably because there is in all depending parts a degree of congestion in the veins.

Congestion, as already stated, is not inflammation, but in its nature the very opposite; yet a slight degree of inflammation is more mischievous, when congestion is present, than a greater degree of it, with the venous circulation unembarrassed, as we see when strangulated hernia inflames. An overloaded state of the veins is unfriendly to the progress of reparation, as we observe in chilblains, all purple coloured inflammations, and in those of the lower extremities generally.

The influence of position has been much attended to by Isidore Bourdon. He ascribes an effect to the position of the body, while lying in bed, and accounts for effusion of blood in the brain being most frequent on the right side, and the more frequent formation of tubercles in the right lung, by our resting most on that side. Be that as it may, there are undoubtedly advantages to be gained by placing injured or inflamed parts above the rest of the body. This can only be effected to any extent with respect to the extremities, and it is very fortunate, that we want the aid of favourable position, chiefly with regard to them.* I understand Professor Fritz, of Prague, has employed an apparatus for suspending the arm or lower extremity, when there is a fracture, more particularly of the forearm or about the knee; but this would appear to be more useful for other injuries, or inflammations of the extremity. The apparatus consists of a trough or hollow splint, supported by cords, which, uniting into one, it is carried over a pulley fixed in the top of the

* It would be a great injustice to the fame of Doctor Physick were we to omit, as the author has done, to remind the reader of the practice of this distinguished surgeon, for so many years, of recourse to position as one of the chief curative means in various injuries and morbid states of the extremities.—*American Editor.*

bed, and the weight of the apparatus and of the limb it may support, are detained in any position in which it may be placed, in consequence of the cord which passed over the pulley being connected with a balance weight, in the same manner as the sash of a window is supported. This mechanic principle admits of a greater number of useful applications with reference to the immediate convenience of the human body, though I doubt the propriety of its employment in cases of fracture.

In order to secure the perfect quietude of a diseased or injured joint, it is proper to lay the limb on a hollow splint. For the purpose of maintaining the part in a state of rest, where the arm is concerned, I have recommended the sling to contain a lath of wood, which prevents the patient raising the arm, and to avoid moving it from the body, the arm should be secured by a bandage passed round the trunk. Instead also of the arm being supported by a common sling, which only sustains one part, I have directed that a hollow splint should be placed underneath the forearm, taking in the fingers, and by these means the motions of the arms are restrained in all directions.

An *easy* and *natural state of feeling in the internal and external sentient surfaces*, is of the greatest importance in all inflammations, but especially in those which make their appearance without any local external cause, as erysipelas, many cutaneous affections, boils, anthrax, certain ulcers, &c. Mr. Abernethy, very deservedly, obtained great credit for directing the attention of surgeons to the connexion which exists between the state of the mucous membrane of the alimentary canal and the production and progress of local diseases. He should not have limited his views to the surface of the stomach and intestines. The condition of the skin as to sensation and secretion, and the breathing of pure and fresh atmospheric air, also exercise great influence on local inflammations. This occasions no surprise, when we reflect, that on these surfaces the two great systems of the spinal and sympathetic nerves terminate, and that these two systems of nerves are united in their distribution to the arteries: in short, that the general health depends chiefly on the two great sentient surfaces feeling naturally and agreeably.

The influence of the state of the muscular system has been but little considered, as affecting the general health; but since the introduction of gymnastic exercises, for the purpose of invigorating and developing the muscles, it has been proved, that the exertion of muscular power has great effect in improving the condition of the sentient surfaces, by augmenting and regulating their secretions, and by creating a more composed and firm state of feeling throughout the body; and although gymnastic exercises are only admissible as a remedy for chronic inflammation, such as some forms of scrofula, they are highly beneficial, as a means of preventing the tendency to many inflammations, which arise in weak constitutions.

The remedies which directly operate on the mucous surfaces of

the alimentary canal, and of the glands which pour out their fluids into it, are aperient and tonic medicines. These require to be given with discrimination. Purgatives should not, as a general rule, be administered to such an extent as to disturb the alimentary canal, nor tonics so as to oppress the stomach.

The state of feeling and the secretions of the skin are greatly improved by the hot and cold bath, according to the circumstances which require the one or the other. When the warm baths exhaust the patient, they are not proper; and when cold baths are not followed by healthy reaction, they should not be employed. In some of the most formidable diseases, and in all scrofulous affections, warm baths, particularly when combined with sulphur, are direct remedies of the greatest value. In the scrofulous affections of the joints, and in the morbus coxarius, I have seen the very best effects produced; in several cases, I have known the patients rescued from the grasp of death by the use of the sulphur bath.

Agreeable mental excitements, passions, or impressions not only conduce to the improvement of general health, but exert a direct and beneficial effect over local disease. No structure in the body is more under the influence of the mind, than the vascular system, as has been already shown. It need not create any surprise, therefore, to find that an agreeable state of mental feeling produces a healthful condition of the minute arteries.

The improvement of the general health from *travelling*, is universally known; many circumstances concur to produce this effect; the expectation of being cured, the diversion of the mind from the cares and anxieties of business, and the sameness of domestic life, the succession of new scenes and occupations, the variety of impression made by the atmospheric air on the lungs and the skin, all contribute to enliven, and at the same time to temper to a healthful degree the circulation, the secretions, and all the operations of the vascular system. The effects of a new train of pleasant impressions is sometimes very striking. A person will get rid of a chronic inflammation of the air passage to the lungs, and a cough, by sleeping one night in the country. I have known obstinate cutaneous inflammations to be manifestly benefited before a few hours were spent at sea. Dr. Hennen found that his amputations recovered better when the patients were carried out every day, than when left in the hospital. I have seen many times the progress of sloughing and phagedenic inflammation immediately arrested, by changing to another and more airy apartment. At one time it was the practice in the army to take patients with fever out in a spring wagon with their beds, for a short distance. I have known this treatment to be in many instances very beneficial; but every repetition of these little excursions, or going the same distance and the same road, diminished the effect.

New and extraordinary mental impressions produce equally extraordinary effects on the body. Thus people who are credulous and sufficiently superstitious, have been cured of various complaints, by

pretenders to supernatural power, using at the same time means perfectly inert in themselves. Thus agues, palsy, and epilepsy, not depending on an organic change of structure in the nervous system, functional amaurosis, convulsions, some kinds of deafness, warts, some cutaneous diseases, tumours, and sea sickness, have all been cured in this manner. Mr. Abernethy used to relate a case of a lady having a hard tumour in the breast, which was increasing in size, by the patient constantly thinking of it and examining it with anxiety, but which disappeared after he had obtained the lady's promise not to touch the tumour for a given time.

The most extraordinary examples of cures under the belief of supernatural agency are to be found in the history of the royal touch for king's evil or scrofula. In a curious book written by John Browne, surgeon in ordinary to Charles the Second, which is called Charisma Basilicon, or the Royal Gift of Healing, and published in 1684, there is a full account given of this singular mode of curing diseases. Browne relates seventy cases of persons touched, with their names and residence, all of whom were healed of what was reputed king's evil at the time, but many were plainly ulcerations from other causes, which does not make the operation the less wonderful. The ceremony was a religious one; a number of prayers being employed taken from the liturgy; it was performed on appointed days in the presence of the whole court, the king sitting on his throne, and after touching the diseased parts with his uncovered hand, he usually, though not always, put a white ribbon round the neck of the patient, to which was appended a small gold coin. When the first touch did not succeed, the patients were touched a second time, which was always supposed to be effectual, provided the persons had sufficient faith in the operation; for, it was observed, that Dissenters and Puritans were not healed, of which Browne gives several cases, and also of the disease returning when the patients sold, or parted with the gold they had received.

The royal gift of healing was first assumed by Edward the Confessor, and continued until the end of the Stuart dynasty. Browne gives an account of the numbers touched, from 1660 to 1682 inclusive, extracted from the register kept by the serjeant of his majesty's chapel royal. It amounted in these twenty-two years to the immense number of 92,107; from which it would appear, the disease was considered very prevalent at that time. Many persons also were healed by the blood obtained at the execution of Charles the First, which people collected and dried on linen rags.

Now, making all due allowance for exaggeration, we cannot doubt, that out of the multitude that were touched during a period of upwards of 640 years, many recovered, though not when touched, as reported. Browne states, that some persons who did not believe that the king possessed a miraculous power, nevertheless admitted the fact of the disease being cured, and accounted for it, much in the same way that I should, that is, by ascribing the effect to the force of mental impression. Others doubted the success of the

operation altogether, "although," as Browne says, "it was confirmed by ocular demonstration as clear as the sun; and that they were not to be brought to the belief thereof, although they see it done before their eyes." The ceremony (of which Browne gives a plate) was to superstitious and credulous people a very imposing one, and calculated to produce extraordinary effects on those who could put faith in it. I need hardly assure my readers, that in recording the curative power of a firm belief in supernatural agency exerted in our favour, I do not recommend the assumption of it, as necessary to the practice of surgery. I merely wish to show, that by encouraging the hopes of our patients, these expectations will in many instances be realized. A person who understands the manner in which travelling operates, will as confidently undertake a journey, as those who are ignorant of its effects. An exhilarated state of mind has often more power in the cure of disease, than any medicine that can be employed. An agreeable journey will remove an irritable state of the bladder, or a confirmed gleet, when every other remedy has been given up in despair.

A new, and at first sight, a very singular mode of treating wounds and ulcers, has been proposed by Dr. Jules Guyot. He published his views in the Archives Generales de Medicine, and afterwards he printed an extract from the Archives in the form of a pamphlet in 1835. The object of Dr. Guyot is simply to expose recent wounds of all descriptions, and ulcers, to hot and dry air, with the view of forcing a scab to form, by drying the clot and serum of a wound, or the pus of an ulcer. He made his first experiments on rabbits, on whom he inflicted several wounds, and afterwards placed the animals in a box having apertures, through which their heads projected. The air contained in these chambers was heated by a spirit lamp, generally to 95° of Fahrenheit, and sometimes higher. The animals were secured so that they could not move. Their wounds wept at first serum, but as they dried their edges approached each other. In some cases, no tumefaction, nor appearance of inflammation was observed; in others suppuration took place after some days, underneath the crust; but by a longer exposure to the heated air, the pus thus formed, also dried ultimately into a thin scab. After it was removed, the wound was found to have been perfectly cicatrized underneath.

Dr. Guyot was not so successful in getting ulcers in the human subject to heal in this manner. After two or three weeks' trial, he was obliged in some cases to relinquish it, the patients not being able to bear the fatigue of having the limb so long confined to a box, without any change of position; nevertheless he did succeed in curing by the process of scabbing some ulcers of long standing and of an obstinate character, although pus formed again and again under the dried films which covered the ulcers. Dr. Guyot imputes great virtue to the heat, but it would seem to be merely instrumental to the drying of the serum, lymph, or pus, which may happen to lie on the wounds or ulcers.

It would be a great object, to relieve the patient from the distress he suffers, from having his limb locked up in a box, for a week or a fortnight, which might be effected, by using some flexible material, such as the woollen tube I have employed for the administration of steam, which would permit a change of position; the greatest rest that can be borne, however, is essential to healing by the scabbing process. It would also abridge the period of the cure, if the secretion of pus were to be diminished or stopped by the use of steam or water dressing, previous to the application of the heated air. With these improvements I think the treatment recommended by Dr. Guyot deserves a trial, although I do not expect it will supersede the other remedies advised in this treatise.

It is certainly very difficult to fortell, what recent wound may, or may not, be curable by the scabbing process, provided the injured part be kept perfectly quiet and undisturbed from the beginning, as the following case will show: Mr. M——— had set out from home, in order to go to the South of England, when he was attacked by a band of robbers. Although unprovided with arms he made resistance, and in the conflict he received seven wounds-inflicted by bayonets and swords in the side and arms. The gentleman being anxious to conceal from his family the injuries he had received, pursued his journey as rapidly as possible to Margate, in order that he might be able to announce to them his safe arrival there. He never stopped on his way to have the wounds examined, nor did he undress himself, lest the clotted blood might be unsettled, and the parts consequently irritated. On his arriving at Margate, where I happened to be at the time, I examined his wounds, and was surprised to find they had all perfectly healed and cicatrized under the crusts of dried blood, with the exception of two bayonet stabs in the forearm, which contained a very little pus, probably on account of their situation, which subjected them more to motion than the others, from the unavoidable use of the hand. This case forms a remarkable example of the cure of wounds by the mode of scabbing, and would go some length in confirming the practice recommended by Doctor Jules Guyot.

THE END.