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LECTURE XI.

REPARATION: HEALING OF WOUNDS.

Reparative Inflammation; Reparation not necessarily attended with Inflammation; depends on Inherent Disposition of Tissues to revert to their natural state.—Reparative power in Animals is proportionate to the simplicity of their Structure; the same is in higher Animals true with reference to Individual Tissues; Cicatrix is Vitally, as well as Physically, inferior to the original Tissues, but becomes gradually likened to them; its Contractile Tendency; it possesses Vessels and Nerves.—Reparation nearly allied to Development, is a step beyond Nutrition, and often fails where Nutrition is able to proceed.—Healing of Wounds immediately by the Blood; Healing by Reparative Inflammation, and Effusion of Lymph; reasons for calling this process Inflammatory; Qualities of the Lymph; Share taken by the Fibrin of Effused Blood in Reparation; Healing by Granulation.—Treatment of Wounds; indurated condition of Cicatrices sometimes rendering Extirpation necessary.

Hitherto our attention has been almost exclusively directed to the destructive results of inflammation, and I have said so much about them that you may, perhaps, have forgotten what I told you in the first lecture respecting its beneficial effects. I then endeavoured to explain, that although in its severe stages inflammation gives rise to much alteration and destruction of tissues, causing suppuration, ulceration, and mortification; nevertheless, in its slighter degrees it comes into operation as the process by which wounds are healed and ulcers closed. These slighter degrees I called the reparative, to distinguish them from those severer stages of the process which are appropriately named the destructive.

We will now enter at greater length upon the consideration of those kindly, and, perhaps, more interesting operations, by which the solutions of continuity resulting from accident or disease are repaired, and the integrity of the body is preserved.

Although I have spoken to you of reparative inflammation, meaning thereby an exaltation of the circulatory and nutritive forces, which approaches very closely to the condition of inflammation, strictly so called, and is often observed to attend upon the healing of wounds, the re-union of fractures, &c., I do not wish you to imagine that all reparation is of inflammatory nature, or indeed that inflammation is a necessary assistant to reparation; such would, I conceive, be quite a mistaken view of the subject. A more correct idea of the process of reparation will be formed by regarding it as one of the departments of nutrition very closely allied to development and growth, with which all animal structures are endued, in a greater or less degree, for the purpose of enabling them to preserve their integrity, in spite of the various accidents and disturbing agencies they encounter, as well as to resume their natural condition when they have been diverted from it. If this property be called into play in an unusual manner, it is attended with a corresponding activity of the circulatory and nutritive forces,—that kind of activity which I described to constitute the first stage of inflammation, and in this manner it is that inflammation becomes the handmaid of reparation.

Here I must observe that you are not to limit your ideas of reparation to those grander, coarser, and more palpable displays of it which effect the healing of wounds, and the re-union of fractures, for it has an influence of far more general and extensive operation than such a narrow view of its effects would lead you to imagine. Its salutary working is displayed (at least is attempted) whenever the healthy process of nutrition is in any way disturbed, or the natural structure of the body is in the slightest degree impaired; it is the power by which the weakened and altered tissues of an inflamed part are restored to their proper condition, and its influence is here no less remarkable, and no less beneficial, than in the closing of an abscess, or the formation of a cicatrix. An attack of retinitis, for instance, so alters the delicate structure of the tunic, and adds new and unnatural products to it, that it is unfitted to appreciate the feeble impressions caused by the rays of light; in a little time the inflammation subsides, but the nervous texture would remain imperfect were it not for this force of reparation implanted in it, and ever striving to restore the part to its natural condition.

This force of reparation, as we call it, is therefore

something more than the ordinary force of nutrition, for the latter would merely maintain the structure in a given state, whether that state were normal or otherwise; but the reparative force consists in an inherent tendency in living textures to revert to their natural standard, when they have been diverted from it; a tendency implanted in them from their earliest formation, associated with, and nearly allied to, the disposition which they manifest to assume a given shape and structure; of the same kind, in short, with development and growth, but happily more persistent than either of them.

Now, this force of reparation, constituting as it were a *corps de reserve* against extraordinary contingencies, is in a certain measure essential to the perfection, and indeed, to the continued existence, of the body, but it is possessed in very different degrees by the various classes of animals. It is most sparingly bestowed upon those animals and textures which are endowed with the highest organization; one of the penalties annexed to complexity of structure being a difficulty in returning to the healthy state when injured or otherwise disordered; and this imperfection of reparation, added to much liability to disorder, accounts for the fact that textures of high organization are so often the seat of disease.

The little fresh water polypes, which, from the exceeding simplicity of their structure, rank almost at the lowest end of the animal kingdom, are entirely composed of homogeneous substance, consisting of granules or cells, loosely connected by a semi-fluid matter. This structure is moulded into a particular shape, so as to form a bag or body, with an orifice surrounded by tentacula, and no traces of nerves, vessels, or other complicated textures, have been discovered in it, so that each particle of the polype possesses the same organization as every other part, and is independent of every other part for its nutrition and existence, although the several parts are all harmoniously united in the disposition to assume and to maintain a certain shape. So strong is this disposition, and so simple the process by which it is accommodated, that if one portion of the animal be separated from the rest, and continues to live, it will grow till it has attained the size and shape of the parent being. "If one of these animals," says Professor Owen, "be transversely bisected, both halves will survive, the cephalic one developing a terminal sucker, and the caudal one shooting forth a crown of tentacula, each moiety thus acquiring the characters of the perfect individual; and in a healthy polype the same phenomenon will take place if it be divided into ten pieces." Here then we have an instance of simplicity of structure co-existing with facility of reparation in the most remarkable manner.

Even in the planariæ, where the internal cavity, as you see in this drawing, branches into a number of blind tubes, hollowed out in the parenchyma of the body, and a rudimentary vascular system is visible, multiplication by division may be effected in the same manner as in polypes; every piece, even if it be not more than the eighth or the tenth part of the creature, will become an entire animal. Some worms, the

segments of whose bodies represent in miniature the complete being, may in like manner be multiplied by division, but in the earth worm, where the functions are beginning to be concentrated into organs of greater importance, this property is much limited. If this animal be divided in halves, the anterior segment only survives. The wound caused by the operation is converted into an anus, but the posterior segment invariably perishes. It is, nevertheless, able to reproduce small portions of its body, for if the seven or eight anterior rings only be cut off, although the mouth, the cephalic ganglia, and part of the œsophagus are thus destroyed, they have sometimes been observed to grow again.

Crustaceans have the power of re-producing extremities. Thus, if the leg of a crab be removed, the wound closes, and a small cylindrical appendage sprouts from the cicatrix, which soon presents distinct articulations, resembling in miniature the limb it is destined to replace, and it continues to grow till it has attained its normal size. Imperfect attempts at re-producing limbs have even been observed in some reptiles,—in lizards, salamanders, frogs, and toads; and in fishes fins are occasionally re-formed.

In the higher vertebrata, and in man, where complexity of structure, and the mutual dependence of parts upon one another exist in the highest degree, we see nothing approaching to such attempts at re-producing members. The greatest efforts at reparation are confined to the closing of gaps, and the re-union of cut, broken, or lacerated parts. Even this is effected in an imperfect manner, for the new bond of connection is almost always of an inferior kind to that which it replaces, both in its physical and its vital qualities. It is with tissues, as I have told you is the case with animals, that those which possess the lowest organization, whose function is of a passive nature, retain the greatest power of repairing injuries; for instance, bone, the areolar, and fibrous tissues. Structures of higher organization and more active function are re-produced, in a very imperfect manner at the best. Generally they are not reproduced at all, but are replaced by some other tissue more easily formed, and of simpler structure. Thus a wound in a muscle or gland is repaired not by the formation of muscular or glandular, but by cellular or fibrous, tissue, so that a white line of cicatrix always remains, denoting more or less clearly the situation of the injury. Skin and mucous membrane (the natural coverings of the body,) are necessarily more exposed to injury than other parts; each performs an active, as well as a passive, duty, for it furnishes certain secretions, besides resisting external agencies, and protecting the delicate structures beneath; and it is to be remarked, that each is re-produced after injury sufficiently well to fulfil its passive function, but the new product is, for the most part, defective with regard to any active duty. The cicatrix of skin, for instance, protects the subjacent parts well enough, and being furnished with cuticle, prevents injurious evaporation, but it is quite destitute of secretory apparatus; it contains no sweat glands, and no sebaceous follicles, and it has not that complicated form of cuticle which constitutes hair. It bears a near

resemblance to those portions of skin in which, owing to partial failure of original development, the texture remains imperfect. You have, perhaps, observed how much like cicatrix is the smooth line of integument devoid of hair and glands, surmounting an incomplete hare lip, and have possibly mistaken this imperfect portion of skin for the scar resulting from an ill-executed operation.

The cicatrix formed in mucous membranes is in like manner an imperfect substitute for the original structure, being composed merely of a layer of compressed areolar tissue, covered by a simple epithelium, and devoid of the glandulæ and more complicated kinds of epithelium on which the peculiar functions of the membrane depend.

A cicatrix, once formed, is a component portion of the body, is nourished after the same manner, and governed by the same laws as the other parts; if they be growing it grows also, and grows in due proportion, so that the scar in the adult retains the same relative size which it had in the child; but it is weaker than the other tissues,—that is to say, the nutritive and vital forces corresponding with the imperfection of its physical structure, are less vigorous in it than in other parts, so that it more easily falls a prey to disease, and when inflamed it more quickly ulcerates and mortifies. This deficiency of the nutritive forces in the products of reparation is remarkably shown when any common cause occurs to affect the whole system. In scurvy, for instance, the scars of ulcers and wounds, and the callus of fractures, are the parts where the ravages of the disease generally first display themselves. A cancerous disease also not uncommonly begins in a cicatrix. In process of time, however, owing to the continual operation of the surrounding assimilative forces, and the natural disposition of parts to return to the healthy type, the cicatrix becomes gradually more and more likened, both in physical and vital properties, to the tissue which it replaces, so that scars are observed to wear out, and to be less and less subject to disease. This is particularly the case in the early periods of life, when the reparative, as well as the developmental, forces are in greatest activity. Some of you very likely bear, on your own persons, evidences of the truth of this remark in the faint traces now remaining of scars which were the result of severe wounds, and which you may remember to have been much more visible a few years ago. The changes going on in a fractured bone continued sometimes for many years after its re-union, which I shall point out to you when speaking upon the subject of fractures, are also remarkable instances of the inherent tendency of parts to revert to the natural standard of shape as well as structure.

Of the contractile quality of cicatrices I have already spoken. I said that, though occasionally productive of serious inconvenience, it nevertheless operates beneficially on the whole, by rendering necessary a smaller surface of the new and imperfect medium of union than would otherwise be required. I said that the contraction was probably due to the incomplete assimilation of the fibrin, from which cicatrices are formed; and I said that in course of time the

disposition to contract ceases to exist, so that if hindered for awhile it may be prevented altogether, and if the cicatrix be stretched after that time, it is probable that it will not resume its contracted state.

The minute blood-vessels are reproduced without difficulty; and the capillaries of cicatrix, though at first weak and dilated, become, after a little time, reduced to the ordinary size, and do not seem to differ in structure or function from the natural capillaries. The nerve-tubes also are formed in cicatrix sufficiently well to transmit the nervous influence. I may remark that the function of both these structures is, in a great measure, of a passive kind; and I am not aware that the active agent in generating nervous influence—the grey or vesicular matter—is reproduced under any circumstances.

The process of reparation is, without doubt, very closely allied to that of development, and in the lower animals both take place very much after the same manner, the completeness of the one being proportionate to the facility of the other. Thus the freshwater polypes, which I adduced as such remarkable instances of the extent to which reparation is sometimes carried, are no less remarkable for their power of generation. They are sometimes propagated by spontaneous fission, and more commonly by gemmation. A little process is observed to project from some part of the animal, after the manner represented in this drawing, and the little process or bud increasing is gradually developed into a polype, and separating from the parent becomes an independent being. Whatever be the exciting cause of this gemmation, the reproduction of an entire animal from a detached fragment is but the counterpart of it, the injury sustained in its separation being the stimulus to the development which proceeds. Several of the worms are also propagated by spontaneous fission between their component segments, each segment being developed into an entire animal, precisely in the same manner as when the division has been artificially produced. The formation and growth of new members in crustaceans, takes place very much after the mode in which the members are originally developed. The shape, size, and structure of the new limb are determined by the same laws which presided over the formation of its predecessor, for the former generally attains without ever exceeding the dimensions of the latter. It seems that the forces by which the animal was originally formed, and reached its proper size, do not become extinct when the period of growth has terminated, though they lie in a dormant state. They continue as a *corps de reserve*, at all times ready to come forward under particular emergencies to rebuild the structure they had contributed to erect, and to preserve the integrity of the animal in spite of the various accidents to which it is liable. Surely in the whole physical creation there is nothing more calculated to excite our wonder and admiration than this self-repairing power, which is peculiar to structures endued with life, and almost peculiar to the animal world.

In the nobler species of animals, where so much care is required to effect the generation of a new being, whose development and growth is a most

elaborate proceeding, the resultant, as it were, of the highest and most exquisite properties impressed upon matter by the Creator's power, we cannot marvel that reparation is a difficult and comparatively imperfect process. Nevertheless in them, as well as in the lower animals, the developmental forces do not become altogether extinct when the work of development is done; a remnant of them still lingers behind, and shows itself in the formation of cicatrices, though it is incapable of such grand demonstrations as the growth of a limb, or the reproduction of an entire being from a fragmental nucleus.

That the reparative is but a relic—a renewal, in short, of the developmental processes, is probable in these higher, no less than in the lower animals. It seems that in the growth of cicatrix, the formation of fibres, vessels, and nerves that compose it, takes place very nearly according to the same plan as that by which those tissues are developed in the embryo; and the comparison of the process of ossification in fetal bones with the successive stages which lead to the formation of callus uniting a broken bone, is no less striking. Above all, the remarkable similarity between the ill-formed portion of skin surmounting a harelip, and cicatrix, that is, between a tissue whose development has been imperfect, and one which is the product of reparation, must not be lost sight of, for it goes a long way to prove, if proof be required, that reparation is, after all, but a lame attempt at development.

Of course all the conditions necessary for nutrition, such as a due supply of nutritive fluid, proper assimilative energy, &c., are essential to reparation; and something more, for reparation requires an unusual effort of the nutritive powers, and may fail to take place under circumstances which do not arrest nutrition. Thus in old people wounds often do not heal, giving rise to ulcers, or even to gangrene. One of the causes of failure of the operation for extraction of cataract in elderly persons, consists in the want of healing of the wound, owing to a deficiency of nutritive energy. Mr. Travers mentions the case of a man paralyzed in his lower extremities from injury of the lumbar vertebræ; he fractured at the same time the humerus and the tibia; the former united, the latter failed to do so. As a general rule, wounds heal less readily, and leave a more decided scar in the lower extremities than in the upper, and in the latter than in the trunk and face. In very early infancy, when the textures are of exceeding delicacy and tenderness, I do not think wounds heal readily, the uniting medium is soft, and easily gives way, and inflammation with ulceration is very quickly excited in the surrounding parts. For this reason it is usually wise to postpone the operation for harelip till the child is a year old.

Let us consider the more ordinary modes in which the healing of wounds takes place. In the case of a simple incised wound, where the soft parts are merely divided by some sharp instrument without any further injury, if the divided surfaces be maintained in close and tolerably accurate apposition, they will often adhere together, being united by the thin layer of blood effused between them, which seems to become organized, and to form the narrow line of

cicatrix observable for a certain time afterwards. This union by first intention as it is called, is a very simple process, scarcely amounting to more than a mere sticking together of the divided structures; the blood finds its way from vessel to vessel across the chink, and the current of nervous influence is re-established, as if nothing had happened. There is no unusual activity of the circulation or nutrition, and the reparative forces are scarcely called into play at all.

Commonly, however, owing to the more extensive division of parts, or their less accurate coaptation, this adhesion does not so immediately occur, or it takes place only in certain parts, and the remaining intervals require to be filled up by some new formation. These intervals are at first occupied by blood, poured into them from the divided extremities of the vessels; and, provided the blood do not exist in too large a mass, it coagulates, the red colouring matter disappears, and the fibrin may remain, and form part of the uniting medium. At the same time an increased amount of activity is manifested in the adjacent small vessels, which become loaded with an unusual quantity of white corpuscles, and are, in short, in that condition which I described as belonging to the first stage of inflammation. Lymph, by which I mean the fibrin of the blood altered by this inflammatory process, is quickly effused in greater or less quantities into the wound; and this lymph, mixing, it may be, with the previously effused fibrin, or supplanting it, forms what has been called the lymph-bed of organization, in other words, forms the medium from which the new tissues of the cicatrix are to be evolved.

The subsequent stages of the process consist in the gradual conversion of the lymph into a structure capable of firmly uniting the divided tissues, and bearing a more or less close resemblance to them. In virtue of its own inherent properties it becomes organized and forms a tissue, and the qualities of that tissue are modified by the assimilative influence of the structure near which it lies. This takes place in the same manner as in ordinary nutrition, though the process is now less perfectly completed in consequence of the disadvantageous circumstances under which the assimilative influences are exerted. Integument thus reproduced has a fibrous structure, and is furnished with cuticle, so far resembling the natural skin, but the want of complete subordination of the fibrin to the regulating forces of nutrition is shown by the harshness of the cicatrix, its contractility, and the absence of that softness, suppleness, and elasticity, which give so great advantages to the true skin. It is also without glands and hair. Vessels are formed in the lymph apparently in the same manner as they are produced in embryonic structures, first presenting themselves in arborescent streaks which coalesce into a vascular network and anastomose with the surrounding capillaries by the same property which enables them to communicate with one another. The formation of nervous tissue between the divided ends of a nerve must be referred also to the assimilative influences which are operating upon the nascent cicatrix; but, although microscopical observation and experiment sufficiently prove the reunion of nerves, the extent to which it actually occurs is not

quite certain ; for instance, in the reunion of a compound nerve are the individual fibres respectively joined together according to their particular properties ? or are they first blended together in one cicatrix which after a time becomes traversed by fibres passing in an irregular and accidental manner between the divided ends of the nerve, 'so that sensitive and motor filaments become linked together in a confused manner, and the powers of sensation and motion are incompletely restored ?

It is a much disputed question whether the reparative process which I have been just describing to you, is of inflammatory nature, and whether the medium of union constituting the cicatrix, is to be regarded as an inflammatory product. This must of course be decided by the latitude of meaning which you allow to the term inflammation. I have already told you that this process, though widely separated in its results, differs only in degree from that to which the name inflammation is admitted by general consent. It is no easy matter to draw the line between inflammation reparative, and inflammation destructive, and I think it is better to indicate this close relation by including both under the same name, distinguishing them as I have done, by the expletive, which rather denotes a difference in the results or in the degree, than in the nature of the phenomena. The reparative inflammation consists of that stage of the process which is characterized by an unusual activity of the circulatory and nutritive forces ; the blood-vessels are enlarged, the rapidity of the current through them is increased, the fibrin is elaborated in greater abundance, and is endowed with greater energy, so as to meet the extraordinary demand occasioned by the unusual effort of nutrition attendant upon the healing of a wound. Even this same degree of inflammation ceases to be reparative and becomes destructive, leading to various effusions and alterations of structure when it takes place without a necessity for its operation ; and one of our great objects in the treatment of wounds is to prevent the inflammation exceeding the bounds of reparation and running on to the destruction of the parts involved, whereby it occasions suppuration and ulceration, instead of cicatrization.

It would seem that one of the great ends answered by that degree of inflammation, which we call reparative, is the effusion into the wound of fibrin possessing a greater force of organization than usually pertains to that component of the blood. This peculiarly gifted fibrin, or lymph as it is called, displays its energy by transforming itself into tissue under circumstances where ordinary fibrin would probably fail of so doing. It is partly in consequence of its greater inherent energy that the fibrin so effused is less amenable than usual to the surrounding assimilative forces, which, besides, operate upon it at greater disadvantage than usual, in consequence of the particular circumstances under which it is effused. No wonder, therefore, that it retains some of its own peculiar properties in spite of them, and that the new tissue presents a sort of intermediate structure between lymph and the tissue it replaces. I have pointed out to you one of the remarkable instances of this half and half formation, viz., the cutaneous cicatrix and its likeness to lymph on the

one side, and to skin on the other, of which either resemblance preponderates according to circumstances. I may remark that the lymph effused in the process of reparation, seems to present little or no difference from that which results from inflammation occurring under other circumstances.

When the divided surfaces of a recently-incised wound are brought into contact, however accurate the apposition may be, there necessarily remains a thin layer of blood between them ; and I have said that in some instances, the immediate agglutination of the divided parts seems to be effected by means of the fibrin of this blood, which becomes organized and forms a narrow line of cicatrix. In other cases this fibrin appears to become intermixed with the coagulable lymph subsequently effused into the wound, and uniting with it, forms the so-called lymph-bed of organization, from which the uniting medium, the cicatrix, vessels, nerves, &c., are developed. But I should tell you that the part taken by the fibrin of the blood in the actual process of reparation has not been clearly ascertained. Some persons, indeed, doubt the capacity of fibrin for organization under such circumstances, unless it has previously undergone that peculiar change in the blood-vessels, which gives to it the properties described to belong to coagulable lymph. This is, I think, assuming rather too much, for although we may readily admit that coagulable lymph has much greater capacity for organization than the ordinary fibrin of the blood, there is sufficient evidence that fibrin does also sometimes become organized. A rude attempt at the formation of structure is observable in blood which has coagulated after its removal from the body and in the coagula found in the heart and great vessels after death, also in the laminated coagula contained in an aneurismal sac ; and a slight degree of organization takes place when fibrin concretes upon some rough point to which it may be accidentally exposed in its circulation through the blood-vessels. The warty formations so often formed upon the valves of the heart, appear to originate in this way, being dependent on a slight ulcer or abrasion of epithelium occasioned by inflammation, in consequence of which a rough surface is presented, upon which some of the fibrin of the circulating blood coagulates and becomes organized. I grant that this organization of effused fibrin takes place very unwillingly and very scantily. I have often been surprised to find in how slight a degree it had occurred in the coagula formed in vessels which had been tied for weeks and months before death, and it is not certain that it ever actually takes place in the blood effused among the tissues in ecchymosis. In by far the greater number of instances effused blood becomes absorbed rather than organized. You will understand, therefore, that the share which the blood takes in the reunion of divided parts is a debatable question, and in expressing the belief that it may, under some circumstances, become the uniting medium, I by no means am disposed to acquiesce in the favourite theory of Hunter, that "blood extravasated from ruptured vessels is efficacious in becoming a living solid equally with coagulable lymph."

You must also bear in mind that the blood is likely

to take part in forming the bond of union only when it is effused into the wound in very small quantities. For if a large mass of it be present, it not only interferes with the coaptation of the divided surfaces, but it loses its own vitality and becomes the source of considerable irritation, till it has been discharged, so that before closing a wound it is always expedient to remove any coagula that may happen to have formed in it, and to take measures for preventing any subsequent effusion of blood by securing the bleeding vessels, applying pressure, and so forth.

The union of a wound in either of the ways I have mentioned, is said to take place by adhesion, and it is soon accomplished, a few hours sufficing for the effusion of coagulable lymph, and a few days for its conversion into cicatrix. Parts sometimes admit of being thus reunited when they have been nearly or even completely detached from the body for a short time; thus, flaps of skin hanging by a narrow pedicle, will often adhere again if they be replaced with care, and they will not only adhere to the part from which they have been taken, but to any other recent wound. The taliacotian operations for the formation of new noses and the restoration of lost parts, owe their success to this property. You will read in the works of Mr. Hunter, some interesting experiments with reference to the vitality and capacity for union of parts which had been entirely separated from their natural connections and transplanted to some new locality. He detached the spur from the heel of a cock, and inserted it into the comb where it adhered and grew well, flourishing the more vigorously in consequence of the greater richness of the soil. He also cut out the testicle of a cock and placed it quickly in the abdomen of a hen which he had laid open for the purpose, where it lived and contracted adhesions. It is a well-known fact that teeth may be transplanted in the same manner.

When the union by adhesion fails, either in consequence of the extent of the wound, and the want of coaptation of the divided surfaces, the presence of coagula, or the severity of the injury causing too great an amount of inflammation, the wound is reduced to the condition of an ulcer, and must be healed by granulation and cicatrization in the same manner.

This third mode of healing differs from either of the preceding, in being a much more elaborate process; it involves an intermediate stage between the formation of the uniting medium and its conversion into cicatrix, during which it is developed into a temporary structure, endowed with vessels and nerves, and called granulation. By the subsequent modification or assimilation of this intermediate structure, the cicatrix is slowly formed, in the manner I described to you when speaking of the healing of ulcers.

There appear, therefore, to be three chief processes by which the reunion of divided parts is effected. First, the thin layer of blood effused into the wound coagulating and agglutinating the parts suffices in some cases of slight injury to form the bond of union. Secondly, and more commonly coagulable lymph is poured into the wound from the surrounding vessels displacing the blood, or perhaps intermixing with its fibrin; and this lymph becomes converted into cica-

trix. Thirdly, the blood and lymph first effused do not, either of them, become organized, but pass away in the form of discharge, a process like that of ulceration is established, whereby rough fragments are removed, and a plain surface established. Coagulable lymph exuding upon this surface becomes developed into granulation, and in process of time the granulation is transformed into cicatrix.

In the treatment of simple incised wounds our attention is directed to two chief points, viz., the effecting and maintaining the coaptation of the divided surfaces as accurately as possible, and the prevention of destructive inflammation.

A variety of means are employed to accomplish the first of these objects, and the difficulty of selecting those which are most appropriate in each instance is not great. When the wound is not severe, and the surfaces fall into contact without much trouble, no treatment is superior to that suggested by the instincts of nature, viz., the immediate binding up of the wound by a handkerchief, lint, or other substance. The coagulating blood forms a very effectual and unirritating plaster, the pressure of the bandage serves the double purpose of securing the adaptation of the surfaces and of preventing inflammation, and it may be allowed to remain on for some days, when it will come off easily, and the wound will very probably be found to be healed. If the part becomes painful and swollen, the bandage should, of course, be removed; a little suppuration will then generally be found to have taken place, and a poultice or water-dressing will give relief.

It very often happens, however, that so simple a measure will not suffice to close the wound, and maintain the apposition of the divided parts. I cannot describe to you the plan of treatment I would advise to be adopted in such cases in a better manner than by reminding you of the mode in which you have seen the dressing of wounds caused by amputation conducted in the hospital. In the first place we are very careful to secure the bleeding vessels, for the sake of avoiding the risk of effusion of blood into the stump after it is done up; and I would especially recommend you not to hurry over this stage of the proceeding. Any coagula which may form in the stump being then removed, the apposition of the integuments is secured by interrupted sutures, placed at intervals of rather more than an inch. Between the sutures narrow strips of adhesive plaster are applied, a circular bandage is wound round the stump, and the coaptation of the parts at the bottom of the wound is secured by pads, made of cotton-wool, or other soft material, placed one above and one below. These pads do not meet on the face of the stump, and they are secured in their position by strips of plaster and turns of the bandage. I regard these pads as a great security against secondary as well as immediate hæmorrhage. They facilitate the union of the deep parts of the wound, and, as instruments of pressure, when well applied, they assist in preventing the occurrence of destructive inflammation. By this plan of dressing, the deep parts as well as the edges of the wound are kept in close contact, although the whole line of incision, except at the points where

it is crossed by the narrow strips of plaster, is exposed to the air, and you can watch the condition of the wound, and remove the sutures, if necessary, without disturbing the other dressings in the slightest manner. The patient, of course, is kept in bed, and the stump rested on a pillow, to which it is lightly secured by a bandage.

Supposing all things to go on well, in the course of a few days, (four, five, or six, as the case may be,) the dressings having been well soaked with warm water, or by the application of a poultice the night before, they may be all removed carefully, so as to give the patient little or no pain; and some or all of them may be reapplied, according to circumstances. I am never in any hurry to remove the sutures, for I do not find that their continued pressure during many days does any harm, and the soft bond of union sometimes gives way if the support afforded by them is withdrawn too early; and if they be allowed to cut their way out, no evil follows. It is often advisable, however, to remove some of them on the first dressing, in order that a free vent may be given to any accumulation of matter that may have taken place in the interior of the stump. You will generally find that union of the integuments at the suture points has occurred in several places, and I regard this to be one of the great advantages of sutures, for you can scarcely overestimate the importance of early union at any part of so great a wound, especially when the patient is in a reduced state of health, and has barely force enough to carry on the work of reparation. I believe the simple circumstance of the early union of the integuments at some points, which is best effected by sutures, not unfrequently saves the life of the patient. After this period the dressings should be repeated more frequently, perhaps every day, because there is generally some discharge; and cleanliness is, in the treatment of wounds, of the utmost importance. When you shall have witnessed the practice in other hospitals, I am bold enough to think you will admit that the great attention which you here see bestowed upon the dressing and general treatment of stumps and other wounds, is not altogether in vain. I must leave it to your judgment and experience to suggest the treatment required by particular circumstances as they arise, and will merely add the hint, that it is not desirable to adhere to the starving regimen after severe wounds and operations, so very closely as some surgeons think necessary.

At one time I followed the plan adopted by the Edinburgh surgeons, of leaving stumps and other large wounds open for a few hours before bringing the surfaces into apposition, but I did not find that it was attended with any decided advantage as regarded the healing of the wound; bleeding from the stump, which a little pressure would have prevented, used frequently to occur when the patient was placed in bed; and the pain and annoyance of the dressing to a patient just beginning to repose after the shock of an amputation, is worse than a second operation. I have, therefore, discontinued this practice for some time.

Sutures may be applied in the scalp or any part of the body, but the benefit of them is most perceived in wounds of the face, where the muscles are attached

to the skin, and are continually acting so as to drag asunder the edges of the wound. The thread should be thick or double, and it should not be tied too tightly, otherwise the portion of integument included in the knot perishes, the thread soon cuts its way out, and the scar is increased. As a general rule the needle should be passed through the skin only, for if it be thrust deeper it often fails to bring the edges of the skin in contact, and immediate union does not take place.

The general plan of treatment which we employ after amputation may be adopted, with slight modifications, in the management of other severe wounds. I do not advise you to apply moisture in the form of water dressing or poultice in the first instance to a simple incised wound, because I think that by such treatment you run some risk of losing the chance of union by first intention; the uniting medium, whether it be blood or lymph, being by such means kept in a dissolved state, and not permitted to coagulate readily, and agglutinate the divided surfaces.

When, however, from the severity of the injury, and the torn, contused, or mangled condition of the wound it is obvious that union by adhesion will not take place, I believe it the best plan not to attempt the closure of the wound, but at once to begin the treatment with moist soothing applications, whereby the discharges are facilitated, and the ensuing inflammation modified. The same observation applies to the treatment of gunshot wounds; and the propriety of leaving such wounds open, and covering them only with poultice or water dressing, is confirmed by the fact that all such cases do well in proportion to the size which the external orifice bears to the depth of the wound. Where that orifice is small, as in the case of punctured wounds, the effects of inflammation occurring at the bottom of the wound, and spreading to the deep parts of the limb, are much to be dreaded; and this is especially the case when any tough structure, such as a fascia, has been penetrated, because it prevents the escape of the secretion formed beneath it. I have known the most severe, and occasionally even fatal, inflammation, with interstitial suppuration, excited among the muscles of the thigh, by a simple and apparently slight puncture through the fascia lata. In a case of punctured wound through the fascia lata, a little above the outside of the knee-joint, which was in the hospital not long ago, this kind of inflammation had commenced, and would probably have done much mischief, had it not been arrested by a free incision through the fascia.

The cicatrices and the parts about the cicatrices of wounds which have been occasioned by the bite of an animal, or any poisoned instrument, often remain indurated and swollen for a considerable length of time, presenting a very unsightly appearance. Rat bites are especially troublesome in this way, and the same thing now and then occurs when the wound has been caused by a blow or a blunt instrument. In course of time this induration generally subsides, and the scar assumes the ordinary, soft, supple, healthy condition. Occasionally these lumpy cicatrices increase in size, become warty, and present other alterations of structure, and may even require to be extirpated with the knife.

I have said that one of the objects we keep in view in the treatment of wounds, is the prevention of destructive inflammation, which we endeavour to effect by keeping the part at rest, by soothing applications, &c. When such inflammation does set in, we use the antiphlogistic treatment, as in other cases. Leeches are often highly serviceable in reducing the inflammation attendant on a wound; even general depletion may be needed.

Often as our efforts are required to combat the excess of destructive inflammation, we seldom have grounds for apprehension respecting a deficiency of the reparative stage of that process, provided the general health of the patient be tolerably good. In old people, however, and in persons whose nutritive powers are naturally very feeble, the reparative forces not uncommonly fail to restore the fabric when it has been injured even in a slight manner. Inflammation takes place, but it runs on to ulceration instead of healing the wound, for it seems to require some energy of nutrition to restrain it within the bounds of reparation, and to prevent its advancing to injurious results. You will find a marked difference in this respect between patients whose nutritive powers are naturally feeble, and those whose energies have been prostrated by some severe sudden attack. This difference is well illustrated by two lads now in the hospital, one of whom, (an exceedingly delicate boy) underwent amputation of the knee some months ago, in consequence of strumous disease of the joint, the stump has not nearly healed, a large pale ulcer remaining, with scarce any effort being made to close it up. In the other lad, who possesses greater natural powers, but was so much reduced by sudden and severe disease of the lower end of the thigh bone and the knee, that it was doubtful whether he would bear the shock of the amputation, the stump has almost healed within three weeks after the operation.

CASE OF
ABSCESS IN THE SPLEEN,
OPENING THROUGH THE LEFT LUNG ABOVE THE
CLAVICLE.

By W. NEWNHAM, Esq., Farnham.

John Spreadborough, aged 48, became my patient at the beginning of February 1815; he had been ill for a month, and had been attended by one who has long since passed to his final audit, and of whom *de mortuis nil nisi bonum*.

Spreadborough was a pauper, and sent to me earnestly entreating that I would attend him, and I continued to do so gratuitously till his death. Under the circumstances I was unable to procure any history of the case except from the patient himself, who told me that he had caught cold about a month before, and that, although he was better, yet he did not get well. From the general type of disease in the preceding January, and from his own details, corroborated by the reduced condition in which I found him, I conjectured that he had been the subject of inflammatory fever, from the

disturbance of some internal viscus. He complained principally of pain in his back and hip, both of the left side. His bowels were constipated, and he had abscess forming under the fascia of the right arm; this was immediately opened, and healed kindly though slowly. His general health seemed to improve for a time under the treatment pursued, but the amendment was of short duration, for presently his tongue became loaded, his pulse quick and wiry, with irregular rigors, constant evening accession of fever, and morning perspirations. These symptoms were accompanied by œdema and loss of voluntary motion in the left arm, becoming daily more and more aggravated. At this time a small tumour appeared just above the clavicle, which he spoke of as painful, the pain extending down the œdematous arm. There was an obscure fluctuation but it was very indistinct, in consequence of being hidden behind the clavicle. He now complained of cough and dyspnoea; his hectic symptoms went on augmenting, while his strength declined daily.

On the morning of the 8th of March he had passed a restless night from cough and extreme difficulty of breathing, and so urgent was the latter symptom as to threaten suffocation. Believing these symptoms to arise from the presence of extraneous matters within the cavity of the chest, and being confirmed in my previous idea that the little tumour above the clavicle contained matter, which I had reason to believe communicated with the chest, I cautiously inserted a lancet, and there was discharged more than a pint of very fetid pus. This gave the patient some relief. For a few days his symptoms were mitigated, the discharge continued very great, the œdema gradually subsided, the cough and expectoration diminished, hectic symptoms declined, and his pulse came down to under 100, while his appetite daily improved a little.

At this time, however, he became the subject of slight diarrhœa, and the sedes, though mixed with feculent matter, consisted principally of a dirty black liquid resembling coffee grounds; and this went on increasing, till on the 17th of March he again experienced difficulty of breathing, which symptom gradually augmented, his strength failed, his pulse rose to 160, and on the morning of the 20th he expired.

The *post-mortem* examination took place on the 21st, twenty-four hours after death; and I find the following appearances chronicled in my note-book:—

1. The intestines were much inflated with air, but presented no other morbid appearance.

2. The liver was much enlarged, and on cutting into its substance presented a granulated appearance. Disease was not far advanced, and was probably only a consequence of other more important derangements.

3. The stomach was much distended, and adhered to the left lobe of the liver by a portion of its surface, exceeding the size of a shilling. These adhesions were feeble and easily torn up, bringing to view a considerable ulcer of the stomach, which had destroyed even its peritoneal coat, and excavated the corresponding surface of the liver to a considerable depth. On the internal coat of the stomach this ulceration had proceeded much further; the stomach was itself filled