MISCELLANEOUS ARTICLES, ORIGINAL AND SELECTED.

SECTION I.—ORIGINAL PAPERS.

XI.—*Dissertation on Inflammation of the Periosteum, both Acute and Chronic, which obtained the Boylston Premium for 1827.* By USHER PARSONS, M.D.

THE remote situation of the periosteum, and the silence of most elementary writers respecting its diseases, lead the student of medicine to think it an uninteresting subject for investigation, and one of the most sterile kind that could be proposed for a dissertation. A due consideration, however, of the functions and properties of this membrane; of its connexions and relations with the bones, which are often diseased and wounded; of the reciprocal influence which the diseases of both textures have upon each other; and, lastly, the fact well known to practitioners, that both these textures frequently participate in secondary venereal affections;—these considerations, I say, present the subject in an interesting point of view, and as one that, from the very circumstance of its being so casually and briefly noticed by authors, is the more deserving of particular investigation.

In commencing this task, our attention is first drawn to the structure and nature of the periosteum. It is a fibrous membrane, which, as its name imports, is applied to the surface of the bones. It covers all the bones of the body, even the ossicula of the ear. Some are covered by two membranes, as the flat bones of the head, where the dura mater partakes of the nature of periosteum. It pervades the whole surface of all the bones, their apophyses, eminences and cavities, with the exception of the articulating surfaces and crowns of the teeth. The ancients described it as extend-

ing from one bone to another over the articulations, and thus forming a continuous sac for the whole skeleton; and, indeed, so intermixed are its fibres with those of the capsular ligaments, that there seems to be some foundation for this opinion. It sustains direct connexions with the greater part of the fibrous system, and is considered by Bichat as the centre of this system. It furnishes points of support to the broad fascias that surround the muscles, and receives the tendons which are more or less expanded at their insertion. It is imperceptibly lost in the ligaments, and blended, in the different parts of the body, with sheaths and fibrous capsules. A large number of prolongations establish intimate connexions between the periosteum and dura mater, both through foramina and through the sutures.

The periosteum has not the shining whiteness of the dura mater, but is of a white greyish colour throughout its whole extent. Its adhesion to the bone is greatly strengthened by age, to enable it to endure the greater pulling and wrenching, by muscular action, to which it is subjected. Of its two surfaces, one is contiguous and adherent to the bone, the other is united to the surrounding parts by a cellular tissue. The bond of union between the periosteum and bone, is, by blood vessels passing from one to the other, and by very delicate fibrous sheaths transmitted from the periosteum as an envelope to the blood vessels. These prolongations are numerous in those parts of the bones where the cellular tissue prevails, as in the vertebræ and heads of the cylindrical bones. The periosteum furnishes also a sheath, which accompanies the nutritive artery of the long bones, and which is probably prolonged with a diminution of its thickness, throughout its ramifications. On the outside, the periosteum receives the tendons, ligaments, and aponeuroses, and is separated from the muscles by cellular substance.

The periosteum is composed, as before observed, of very compact unyielding fibres, arranged generally in the direction of the bone which it covers. 'Examinations of thickened periosteum in cases of elephantiasis prove,' says Bichat, 'that these fibres placed upon each other are of different

lengths, the superficial ones being longest, and those contiguous to the bone running but a short distance.'

The blood of the periosteum is derived from the surrounding parts. Its vessels may be seen in the minute injection of young subjects. They hold such an intimate relation to those of the bone, that they will be better understood, if we describe the vessels of both textures together. They consist then of three kinds; one, derived from the periosteum, being a continuation of those vessels sent to the membrane from the contiguous parts, and which are distributed to the compact texture of the bones; another set of vessels is sent to the heads of the cylindrical bones that have cells; a third kind, which is transmitted to the marrow of the long bones, through a foramen near the middle of their shaft. 'The two first kinds going to the substance of the bone, appear to be especially destined,' says Bichat, 'to deposite the phosphate of lime.' The third passes through the foramen above mentioned by a single vessel to the marrow, where it divides into two branches, which proceed in opposite directions towards the ends of the bones, where they ramify *ad infinitum* in the medullary organ, and their last branches are lost in the commencing cellular structure of the heads of the bones; or there meet and anastomose with the vessels that are sent to the cells. By this communication of the two sets of vessels, they mutually assist in performing each other's office. Bichat found, in a case where the nutritient artery going to the marrow, had been obstructed and obliterated at its entrance into the foramen; that its two great branches within the medullary cavity were, notwithstanding, completely filled with injection, which must have past to them from the anastomosing branches of the cells.

Although lymphatics are not discoverable in the periosteum, no doubt can be entertained of their existence. The same may be said of their nerves, their existence being proved by pathological observations.

In respect to the *properties* of the periosteum, it is admitted to possess animal sensibility, but peculiarly modified. Those stimulants that put this property in action in other

textures, as mechanical, chemical, &c. cannot develop it here, unless it is in an inflamed state. 'Separated, in fact, by its deep position from every external excitement which can act upon it chemically or mechanically, it has no need like the cutaneous system, for example, of a sensibility which would transmit the impression of such agents.'

The vital activity is much greater in the periosteum, than in the bones or cartilages; this is proved by the greater rapidity of its cicatrization. In laying bare fractures made for the purpose in animals, it has constantly been observed, that the fleshy granulations coming from the periosteum and medullary organ, are all formed, whilst those furnished by the bone itself have hardly commenced. Still, however, there is a remarkable slowness in the vital activity of this system. We see it in mortified limbs, where gangrene, like the inflammation that precedes it, makes rapid progress in the cellular texture, muscles, &c. while the periosteum still remains sound.

The periosteum, as well as other parts of the fibrous system, is remarkable in its not contributing to the formation of pus, the matter which sometimes collects from inflammation being a gummy exudation.

Like all the fibrous system, the periosteum has very little extensibility; yet it is not altogether void of this property. It yields when tumours form on the bone, or when matter is effused under it, and is enlarged in rickets. It possesses a cellular substance, which sometimes becomes swollen and distended, and conceals the fibre which is the base of the periosteum.

Respecting the *functions* of the periosteum, it defends the bones which it covers from impressions of the moveable parts that surround it, and probably also moulds the surface of the bones, since this becomes changed and deprived of its smoothness, whenever the membrane is separated from it and prevented from again reuniting, as will appear in experiments hereafter to be mentioned. Besides giving shape and protection to the bones, this membrane sustains the circulation in the exterior part of them, and gives passage to the

nutritient arteries going to the medullary organ of cylindrical bones, and to the diploe of such as are tabular.

PATHOLOGICAL EXPERIMENTS AND OBSERVATIONS.

It was formerly believed, that the periosteum, when raised from the bone, could not reunite and resume its functions, and that necrosis, more or less extensive, would necessarily ensue. Tenon first proved that the opinion was erroneous, and the same is confirmed by the experiments of many physiologists, among the most recent of whom are the celebrated anatomists, Beclard of Paris, and Cruveilhier of Montpellier. Their numerous and ingenious experiments prove, that the periosteum supplies the outer surface of the bone with osseous matter, yet when cleaved from the bone, it may be readily reunited without the intervention of exfoliation or necrosis, even where the bone itself has been wounded, provided the subject be young and healthy.

To remove all doubt in respect to the power of the periosteum to reunite to the bone, and resume its functions after having been separated, Mr Cruveilhier detached it from the tibia, in a great number of hares, to two-thirds at least of the circumference and extent of the bone. After ten, twenty, thirty, and sixty days, he found the periosteum reunited, and scarcely any perceptible difference between the surface of the bone and that of the opposite side, excepting a slight increase in thickness. A hare, upon which he separated the periosteum from the whole circumference of the bone, died in consequence of the injury two months after. The exterior wound was cicatrized, but the denuded bone was surrounded two-thirds of its circumference with a copious deposition of matter of a caseous appearance. The anterior face of the bone was covered by a thick bed of new formation which shot forth irregular sprouts, two of which were more than an inch long, stretching backward like wings. These experiments prove, that the periosteum furnishes the external layers of bone. That it secretes and deposits osseous matter on its internal face, when detached from the

bone, is proved by the following experiments:—Upon a very young hare, Mr Cruveilhier separated the periosteum the whole length and circumference of the bone, and interposed slips or lamina of brass between it and the membrane. On killing the animal one month after, the tibia presented considerable diminution of volume at the place of the brass rings; a slight effort served to break the bone at this place; a cartilaginous and osseous bed was formed over the brass, and the periosteum was reunited throughout the rest of the length of the bone. Upon another hare, Mr Cruveilhier passed between the tibia and periosteum a layer of sheet lead, half an inch broad, fastening it to the bone by waxed threads; and two months after, an osseous swelling of considerable magnitude was formed around the foreign body.

‘Every time,’ says Mr Cruveilhier, ‘that I have seen the periosteum in contact with pus, I have never known ossification to take place; and surgeons have long since observed, that pus or blood interposed would effectually prevent a reunion of detached periosteum, so as to prevent exfoliation.’ How is this phenomenon to be explained? I think it may be done by considering the nature of the process of ossification. Thus, when the periosteum is separated from a dead bone, it retains its attachment to the heads or articulating ends of the bone. These swell and soften, and continue to retain between them the sequestrum or mortified bone. The periosteum thus detached, swells and secretes from its internal face a small quantity of reddened fluid, at first very thin, like moisture bedewing the membrane. Its quantity and consistence gradually increase till that which was a limpid fluid becomes a jelly, which thickens daily and passes into a state of cartilage. In this, osseous fibres are deposited, and finally the fluid and cartilaginous substance disappear, leaving the new bone perfectly formed. Now, while pus or blood are lodged between the bone and detached periosteum, the very thin fluid secreted from the latter to form cartilage and bone mixes with the blood or pus, instead of congealing and ossifying, as it does where, in place of such fluids, flakes of bone or metallic substances are interposed.

The foregoing experiments establish satisfactorily the nature of the office of the periosteum in the cure of superficial necrosis. No one can conclude otherwise than that the new bone is the product of this membrane. Dupuytren has, however, ascertained that where a small portion of the periosteum is excised from the bone, and the integuments are carefully brought in contact with the denuded part, that even muscle will adhere to the bone and fulfil the office of the periosteum in furnishing osseous matter. Still, however, the opinion of Wiedman holds good in the main, viz. that in order for good bone to form, the periosteum and medullary membrane concerned in the nutrition of the original bone must have been spared from destruction; for, in cases where the tube of a cylindrical bone has suffered necrosis throughout, the bone is never after reproduced, if the periosteum has also by inflammation or other causes been destroyed.

The periosteum limits its work of furnishing osseous matter of cylindrical bones to their surface, at the same time it gives passage to the nutritient artery going to the medullary organ, and numerous vessels to the cells of the bones. The first mentioned set of vessels going to the surface of the bone can, however, build up its whole shaft, provided the dead bone in the centre be extracted; and from these same vessels, probably aided by the vessels in the heads of the bones, there will ultimately be formed a new medullary organ. When, however, the outside of the cylindrical bone is necrosised, and the supervening inflammation is prevented from extending to the medullary organ to destroy it, this organ by means of the blood sent to it through the nutritient artery, will secrete new bone, and supply it to the internal layers or central portion of the bone; or, even should this artery be destroyed with the external layer of bone, the branches within may derive blood from the cells, as the case mentioned by Bichat of obstructed nutritient artery proves, and the central portion may, in this way, receive a supply of nutriment from this source and be preserved. So that, while one pathologist shall present a cylindrical bone inclosing a dead one, in proof that the periosteum is the organ of

ossification in necrosis, another may produce a living bone inclosed within a dead one, to prove that the medullary membrane is the organ of ossification.

Various opinions have been entertained in respect to the share of labour performed by the periosteum in consolidating fractures. M. Beclard has bestowed such attention on this subject, that the point in question seems now to be well settled. He has observed, that 'when a bone has met with a simple fracture, it may easily be perceived many days after, that the surrounding integuments are swollen; this first phenomenon,' he says, 'is already accompanied with some degree of strength in the part fractured.' After some days the tumefaction diminishes, and is concentrated almost immediately around the place of fracture; still later, the tumour which surrounds the bone becomes hard, solid, and, finally, after more than three months, the tumour has nearly subsided, leaving the bone firmly united. If the fracture be examined during the resolution of the tumour of the soft parts, when it hardens and applies itself immediately upon the bone, there will be clearly seen a kind of belt or ferule of bone formed by the ossified periosteum; the thickness and consistence of which goes on diminishing towards the point of the fracture, to within an inch above and below it. At this time, the surfaces of the fractured ends have scarcely undergone any change, but soon they become softened, and the softened texture fills up all the intervening space. Eighty or one hundred days after the fracture of a tibia or femur, the periosteum has recovered its organization, the medullary canal has formed itself, and the cicatrix of the bone is completed. Thus, after these researches, it is evident that when callus forms, the periosteum swells in the place of the fracture, becoming in some degree a cellular and vascular net-work, and is afterwards transformed into a bony hoop or belt, which preserves the two fragments in contact during the progress of ossification; and, finally, when the cicatrix of the bone is completed, the periosteum recovers its original texture and natural organization. Mr Cruveilhier, whose authority was before quoted, repeated the experiments of Beclard, and obtained the same results.

Mr Bell, in his usually positive manner, asserts, that 'callus may be produced *equally well* from any part of the osseous system; from its periosteum, from its medulla, or from the substance of the bone itself;' and in proof of it, states, that 'in fractures of the patella or kneecap, where there are no medullary vessels, the pieces are united by a callus, which is secreted from the vessels of the bone itself.' Before acceding to this doctrine, it may be well to examine the bone and ascertain if, as he states, it can of itself repair fractures without the aid of the covering and lining membranes. The instance he cites is not so well adapted to his theory, as some others; for the patella, though destitute of medullary vessels, has a periosteum, and is plentifully supplied with blood from it. A case more in point is, where the head of the os femoris within the capsular ligament, which is destitute of both a medullary and of a periosteal membrane, is fractured transversely; and are such fractures often consolidated? Sir Astley Cooper thinks they never are.

It is true a union took place in this part after a longitudinal fracture, made by Sir Astley, on the thigh bone of a hare, where the socket acted as a compress and support, and preserved them in exact opposition, so that the divided vessels in the bone may have had their communication re-established. But here, simply a bony union or adhesion was all that took place, a process very different from that of forming callus, in the manner and to the extent that is done by the membranes of the bone. Sir Astley, in his attempt to prove that opposition is necessary to effect the formation of callus to any extent, relates cases which show, that ossification by the bone alone, is very limited, if it take place at all. Where the tibia alone had been fractured, and the ends sawed off, were prevented from coming in contact by the fibula, a consolidation never took place. 'Again,' he says, 'I sawed out one seven-eighth of an inch from the radius of a rabbit, and the ends of the bones never united to each other, but only to the ulna. In another rabbit I took out one-ninth of an inch, with the same result. The failure of ossification, in this case, was evidently attributable to the destruction of both

membranes by the operation. Had these remained entire, as in simple fracture, or had the medullary membrane only been broken, as when the fractured ends are thrust by each other, or are separated from each other more than half an inch, callus, even then, might have formed, and filled up the intervening space.

‘Desirous of observing the comparative agency of the periosteum, and the bone, in the formation of fractures, I fractured the radius and ulna of a hare, and with the aid of counter-extension, separated and confined asunder the fragments one-third of an inch. Callus formed and filled up the intervening space, and the limb was that measure longer than its fellow of the opposite side. Again, I fractured the radius of another rabbit, then dissected down carefully to the bone and raised the periosteum for quarter of an inch each way from the fracture, then applied a thin plate of silver round the ends half an inch wide, which served to keep the bones in exact apposition. I then healed the integuments by the first intention, keeping splints on the limb, in addition to the support it received from the belt and from the unbroken ulna. After fifty days I found the outside of the silver belt covered with cartilaginous and osseous matter, the broken ends were diminished in size and some change was induced at their junction, but no progress made towards consolidation. Again, I fractured transversely the radius of a hare, and interposed between the fractured ends a thin layer of silver, the diameter of which was equal to that of the bone, so as to project no further than the surface of the bone, the periosteum being cut through on one side only to receive the plate. The integuments were closed over and dressed, and after ninety days the bone was found united by a belt of callus surrounding the fracture, and which must have been furnished by the periosteum alone. These experiments fully established my opinion, that the membranes of the bones, particularly the periosteum, are the chief organs that form callus; and that the bone itself is not, as Mr Bell boldly asserts, equally concerned and active in the consolidation of fractures, as the membranes.’

The view here taken of the structure, properties, and functions of the periosteum, as also of its connexions with neighbouring parts, particularly with the bones, prepares the way for a clearer and more satisfactory examination of its diseases. We have seen, that, like the other textures, it possesses its own peculiar degree and modification of the vital properties; that, in respect to the degree of their development and activity, it holds in common with the other fibrous textures, an intermediate rank between the softer and more vascular textures, and the hard osseous substance. This consideration leads to a supposition which experience confirms, that its susceptibility to inflammatory action is of a corresponding intermediate grade; all the phenomena of inflammation being developed with a rapidity and in a degree proportioned to that of the vital energy which this membrane, compared with other textures, possesses. This position is, however, true in respect only to simple and local inflammation; for, when the inflammation is of a specific kind, take the venereal for an example, the susceptibility of parts is not proportioned to the degree of vital activity which they possess. There is a tendency of the disease to particular parts rather than to others, to the periosteum and bone rather than to the viscera of the large cavities, as we shall have occasion to remark more particularly when treating of venereal inflammations.

If we refer to elementary treatises on simple inflammations of the common cellular substance, they will be found to be arranged by many writers according to the violence of their symptoms and modes of termination. It may not be amiss to consider periostosis under the same heads of division, as the analogies and points of difference in the two kinds will elucidate their character, and facilitate our investigations. The terminations of common inflammation are in 1. Resolution; 2. Ulceration; 3. Suppuration; 4. Gangrene; 5. Adhesion; and 6. In the growth of new parts; and the processes which lead to these terminations are too well known to require a description.

Periosteal inflammation, as will hereafter be shown, may

terminate according to the first; second, fourth, fifth, and sixth mode. It rarely if ever ends in suppuration; why it is so, says Bichat, I know not. Inflammations of the cartilaginous systems are also remarkable, in that they rarely or never terminate by suppuration. Formerly it was believed, that ulceration and suppuration were always coexistent; subsequently, it was ascertained that the mucous membranes, particularly those of the lungs, might suppurate without becoming ulcerated; since which, a purulent expectoration has ceased to be regarded as an indication of ulcers in the lungs. Still later, it has been ascertained, on the other hand, that ulceration may exist in some parts, as in the articular cartilages* and periosteum, without producing pus.

But, though inflammation fails of producing suppuration in the fibrous texture, it produces matter in place of it, that seems to be peculiar to this system. This is a gummy, glairy mucus, sometimes appearing in the form of ganglions on the tendons, sometimes round the capsular ligaments after chronic rheumatism, particularly over the olecranon, and often in the periosteum, in the form of small prominent tumours, in secondary venereal affections. These tumours have long attracted notice, and, on account of their contents, have in France received the name of *gommè*.

Inflammations of the periosteum must, however, be regarded as of minor importance in respect to their effects on the membrane itself. It is the bone with which it is so intimately connected by situation and attachment, and to which it serves as a parenchyma of nutrition, that claims our chief attention in all diseases of this membrane. Thus, ulceration, if extensive, or long continued, must extend itself from the periosteum to the bone, inducing caries or exfoliation; and,

* 'The ulceration of soft, vital parts, is usually,' says Brodie, 'so far as I know, always attended with a secretion of pus; but it is otherwise with the articular cartilages, in which suppuration seldom takes place, while the ulcer is small, and after the disease proceeds so far as to cause caries of the bones to a considerable extent, without matter being formed on the joint. This circumstance, he adds, is worthy of notice; for it has long been established that suppuration may take place without ulceration; and it appears, that, in this instance, ulceration may take place without suppuration.'

in wounds of this membrane, we are alarmed chiefly for the safety of the bone, and direct our attention in the treatment to its preservation. Even an exaltation of its functional action, as in the exuberant secretion of osseous matter in the form of tumour or node, effects a greater ultimate change in the bone than in itself. In short, the periosteum can hardly undergo any material change from disease, without affecting a still greater and more serious change in the bone.

These morbid changes, produced in the bone by periosteal inflammation, will be varied materially in their character by the nature, the degree of violence, and the extent of the inflammation. Thus, if the inflammation be circumscribed and of a chronic character, and affect the outer layer only of its fibres, and of so moderate grade as not to interrupt its functions in relation to the bone by changing or destroying its nourishing vessels, there will be produced that peculiar secretion of gummy matter before mentioned, that belongs to the fibrous texture. I do not know that inflammation of this membrane from local causes, can be continued a sufficient length of time of so uniform a grade as to produce this deposition of matter. Chronic rheumatism in the capsular ligaments often causes it; but I know of one kind only, the syphilitic, that causes the fibres to secrete this kind of matter.

Again, if the whole thickness of the periosteum or of its circulating vessels be affected with a low degree of inflammation, which, instead of abridging its healthy function, shall exalt it, causing an exuberant deposition of osseous matter, it will produce a growth of new substance on the bone, in the form of nodes and exostoses. From the manner in which ossification commences, first by a thickening of the membrane, then a deposition of lymph, which becomes cartilaginous, forming a nidus for the deposition of bony matter, there are periods of time when such tumours might with propriety be termed cartilaginous. When, however, such tumours are perfectly organized and matured, they are even harder in their textures than the bones on which they rest.

Another instance where inflammation of the periosteum

is attended, like the last mentioned, with an increase of its functional office, and which serves a valuable purpose in the animal economy, is that which takes place in the formation of callus, and in the deposition of new bone in necrosis ; subjects, that have already occupied so much of our attention.

Lastly, inflammation may run so high in the periosteum as to destroy it by ulceration or sphacelus ; and here, as in the other grades of periostosis, the bone is the more important organ implicated in the affection.

With these remarks on the nature and effects of periosteal, compared with other inflammations, and on their effects upon the bone, it is proper to observe, that an important distinction should be made between those cases which are constitutional, or originate in some internal disorder, and require constitutional remedies, and those which are purely local, and require to be treated accordingly ; in other words, between those that are *symptomatic* and those which are *idiopathic*. Another division of periostoses founded not so much on their extent, tendency, and mode of termination, is into *acute* and *chronic*. This division of periostoses is of early date, and is probably the best that can be made. It is best, because it accords with the usual divisions of other inflammations with which we are more familiar ; it is best, because it lays the foundation for a more correct prognosis than any other ; and best, on the present occasion, as it accords with the question proposed for the dissertation. Availing myself of both divisions, I shall divide periostoses into *constitutional* and *local*, and subdivide each of these classes into *acute* and *chronic*.

Under constitutional periostosis may be enumerated the following kinds :—Rheumatic, arthritic, serofulous, scorbutic, cancerous, and venereal. Of these, the last only will receive particular notice. In taking leave of the others, it may be briefly remarked of them, that they depend on an internal cause, which may in most cases be determined by the previous state of the constitution ; that the rheumatic kind is merely an extension of the inflammation from the other fibrous textures, particularly from the capsular ligament to the

periosteum, and produces a circumscribed thickening of the membrane; that gout will, in some rare cases, after producing chalky concretions about the capsular ligaments of the extreme joints, affect also the neighbouring periosteum, and produce a deposition of similar matter between it and the bone; and that scorbutic and scrofulous periostoses are of rare occurrence, and are to be met with in such cases only as are strongly marked with a previous constitutional affection. Lastly, it may be remarked, that soft cancer or fungus hæmatodes, which is considered by Sir Astley Cooper and M. Beclard to be a fungous, and by others a lymphatic tumour of the periosteum, though often excited by some injury, are believed to be, in all cases, preceded by a diseased state of the constitution, and that most of these constitutional periostoses may vary from acute to chronic, and vice versa, during the course of their progress.

We now proceed to the consideration of the last mentioned inflammation of the periosteum of a constitutional kind, the venereal, which occurs more frequently than all others. It is the consequence of a neglected or ill-treated syphilis, and makes its appearance only after the usual symptoms of syphilis have existed for a great length of time. The time, however, varies according to the situation and circumstances of the patient. Inflammation of the periosteum has been known to show itself within four weeks after the first appearance of chancre; at others, it has not appeared till after a lapse of years, but ordinarily it shows itself between three and twelve months. It is the consequence of a general, deep-rooted venereal taint of the system, aided, in some instances, by misuse of mercury and by exposure to cold. The disease affects the periosteum and bones at a late period of the disease, partly because of the slower tendency of these textures to become inflamed than exists in those parts in which the affection first shows itself. The forwardness of this membrane or of the other textures to participate in the venereal disease, is, however, by no means proportioned, as we have already remarked, to the degree of vitality it possesses; for, as Mr Hunter observes, ‘as far as our knowledge extends,

certain parts cannot be affected at all. The brain, heart, stomach, liver, and several other organs, have never been known to be attacked by syphilis.' 'The first order of parts, or those which become affected in the early stage of the lues venerea, after the genitals have been diseased, are the skin, tonsils, nose, throat, inside of the mouth, and sometimes the tongue.' 'The second order of parts, or those which are affected at a later period, are the periosteum, fascia, and bones.'

These tumours, we have observed, are occasioned by syphilis with the misuse of mercury. This may be by too liberal an exhibition, or by even a moderate quantity of the medicine, without due regard being paid to regimen. According to the most extensive observations that have been made of late, it would appear that where mercury is not employed in the cure of the venereal disease, periostosis rarely occurs. In the great number of cases treated without mercury by Dr Hennen, not a case was seen, in which the bones of the nose were affected: some cases of periostosis, and of pains and swelling of the bones of the cranium and extremities were met with; but, except in two, he never remarked any nodes which could be regarded as *unequivocally syphilitic*. On the whole, he adds, 'it appears tolerably certain that mercury, especially when employed unmercifully, and even when employed with moderation, and the patient exposes himself to dampness and cold, tends to promote the frequency of nodes as a sequel of the venereal disease.' But then, as the long and abundant use of mercury does not produce periostosis after other complaints, and seeing that chancre treated altogether without mercury rarely lead to nodes, it would seem as if these swellings are the product of the combined operation of syphilis and mercury together. Be this as it may, no one is able to determine by inspection, when any case presents itself, whether it partake most of the venereal or of the mercurial character.

A doubt has been expressed by some eminent surgeons, among whom are Mr B. Bell and M. Monfoncelon, whether inflammations and swellings of the periosteum ever proceed

from an internal or constitutional cause ; that is, whether all such cases of swelling as have been supposed to be in this membrane, may not be referred to a disease of the bone. ‘ That the periosteum may become inflamed,’ says Monfalcon, ‘ there can be no doubt ; but it may well be doubted, whether those hard tumours resulting from syphilis originate in the periosteum.’ To prove this, he assumes the point as granted, that nodes originate from the bone ; and then, on this false basis attempts to show, that all other periosteal tumours must, from their analogy to bony tumours, arise from the same source. ‘ They have,’ says he, ‘ identity of seat, that is, on the osseous tissue, as venereal exostosis ; identity of cause, viz. syphilis ; the same local symptoms ; for, like the reputed periostoses, so venereal exostoses are preceded by pains of a peculiar character ; the tumours in all cases are hard, circumscribed, and painful, when pressed.’

In reply to this it may be remarked, that the proofs here adduced, viz. identity of seat, cause, and local symptoms, are as well suited to establish a belief in the existence of periostosis, as to refute it ; they go as far to prove that exostosis exists as a consequence only of periostosis, as to prove what the author has attempted, that the bone in all cases of venereal nodes is the part primarily affected ; and, although it is not positively certain that nodes originate in all cases in the periosteum, yet its greater activity and susceptibility to inflammation, qualifies it for earlier participation in disease ; to which it may be added, that in a great proportion of cases, such equivocal tumours are more readily resolved than bony tumours can be, judging from our experience in well marked cases of the latter kind. We may, therefore, doubt of the existence of venereal exostosis, except as a consequence of previous periostosis—and this doubt is strengthened by the concurrent opinion of the best physiologists of the present day.

‘ Some writers,’ says a distinguished author, ‘ have divided venereal exostosis into *true*, when the swelling is owing to an increase of the substance of the bone, and *false*, when the tumour arises from a thickening and inflammation of the

periosteum. But the hardness of periostosis is often as great as if the bone itself were affected ; hence these tumours have been, and are still, often mistaken for real complaints of the bones, which are much less frequent than is commonly imagined. Dissections have lately shown that these tumours especially, on their first appearance, are generally in the periosteum and not in the bone. Sometimes, and especially when they have been long neglected, or ill treated, the bone itself becomes affected with a real *exostosis*.' The same author remarks, that he had seen what he took to be a 'voluminous exostosis from syphilitic origin, occupying all the lower part of the humerus, and after having for a long time resisted scientific treatment, disappearing quickly and completely on the occurrence of other syphilitic affections in the fauces ;' and, in another place he lays it down as a general rule, that 'exostoses are never resolved, and that the examples of this mode of termination cited by authors are cases of periostosis, the nature of which is different, though its appearance is very similar.' Beclard observes, 'there are tumours that seem to be deposited, as it were, on the surface of the bone, so that it is perfectly sound below ; such are most exostoses. This affection depends upon an inflammation of the periosteum, in consequence of which this membrane swells and secretes, from its internal face, a matter which hardens and becomes confounded with the texture of the bone ; thus a sort of periostosis precedes the osseous tumour. This is more or less voluminous, according to the extent of the inflammation. If this be circumscribed, there results from it what are called *nodes*. These tumours are at first very distinct from the bone ; afterwards maceration still detaches them from the bone, and they are seen holding to the periosteum, and it is not till a long time has elapsed, that they appear to be continued from the osseous texture ; it may then be seen by the microscope, that their vessels have not the same arrangement as those of the rest of the bone.' It may be added in conclusion, that almost every anatomical museum contains skulls having nodes, which are harder than the bones on which they rest, and that, in the

early stages of these, there was no observable difference between them and those that have terminated by metastasis or resolution. Unless, then, we hold that tumours of bone can be readily resolved, which is somewhat doubtful, we are authorized in believing that venereal exostoses and nodes, originate in most, if not all cases, in an inflammation of the periosteum.

Venereal periostosis is generally seated on those parts of the osseous system that are superficial and exposed. Commonly it appears under the scalp, over the os frontis and ossa temporum; sometimes upon the outer surface of the sternum, on the side of the radius and ulna, and often on the inner surface of the tibia. The greater tendency of the disease to these parts seems to be founded on the exposedness of their situation to the influence of external exciting causes; to contusions, and to changes of atmospheric temperature, both of which are often referred to by the patient, as the cause. And it is remarked by persons experienced in the diseases of seamen, that such tumours appear much oftener on ship-board, where cold and dampness prevail, than on land, and are earlier in coming forward, in proportion to the degree of exposure. The exposed situation of the bones of the nose, accounts also for their being so often the seat of secondary venereal affections.

Venereal inflammation of the periosteum is preceded by constant pain, more or less acute, and which is particularly severe in the night. A swelling then takes place; at first it is moderate, is more or less tender to the touch, and is circumscribed in its limits. Its circumference is insensibly confounded with the bone, on which it rests. The tumour adheres to the bone, is immovable, and appears to grow up from it; and, until the disease is somewhat advanced, the most experienced practitioner is unable to determine by touch, whether it exists in the bone or periosteum. As the disease however, makes progress, its peculiar character is developed, and the nature of the tumour is then found to vary, according to the extent and violence of the inflammation.

Periosteal tumours, in their advanced stage, will be found

to consist of three kinds :—The *first* is a tumour, which, to the touch, appears to arise from the bone, and acquires the volume of a nut or small egg ; at first hard, firm, and shining, after an indefinite length of time it softens in its centre, where matter collects. The skin then becomes thin, and when opened or spontaneously discharged, the matter is transparent and gummy, like a solution of gum arabic ; hence the French name *gommè*. Sometimes a whitened or grumous lymphatic matter is discharged, of the consistence of paste or soft cheese. Cirillo, Cullerier, and Astruc, say, that this kind succeeds to buboes that have suppurated badly, after painful ulcers of the throat, pustules on the skin, and more particularly in subjects that are debilitated by the abuse of mercury ; but that they may be the consequence of any species of primitive symptoms that have been neglected or ill-treated. This affection, I believe, is seated in the outer layer of the periosteum only, for the following reasons :—Because the greater length of its superficial fibres, as stated by Bichat, will allow of their distention by matter lodged between them and the inner layer ; because the vessels destined to furnish calcareous matter to the surface of the bone, are not affected by this inflammation as they are when the whole thickness of the periosteum is alike moderately inflamed, as in the formation of callus, and exostosis, and as they were in the experiments on rabbits, where osseous matter was deposited on the surface of the metallic ferule ; and lastly, because in opening tumours of this description, the bone is found not entirely denuded, although the outer surface of the periosteum has evidently participated in the disease. This tumour I shall call *gummous*.

The *second* kind of tumour may, from its nature, be termed cartilaginous or osseous, according as it is recent or of long standing. As it is resolvable, probably, in its early stage only, and more intitled therefore to medical attention at this period, I shall use the term *cartilaginous*, which is expressive of this stage. It presents nearly the same appearances as the gummous kind, is attended with considerable pain, is firm and hard, as if proceeding from the bone,

and is slow in its progress. In a few cases, the tumour continues stationary for some time and then diminishes a little, or it may entirely disappear. This termination by resolution rarely takes place spontaneously, unless by metastasis, and then the venereal affection is apt to be translated to the throat; most commonly, after the tumour has acquired considerable magnitude, it becomes indolent and harder, and continues in this state for life.

There is a *third* kind of venereal periostosis, which, from its nature and tendency, I shall call *necrotic*. It differs from the gummous kind, in that it extends through the periosteum, oftentimes affecting the surface of the bone with superficial necrosis, and from both the gummous and cartilaginous kind, in that the inflammation is of a graver character, is more rapidly developed, is attended with great pain, especially in the beginning, and is very tender to the touch. The integuments are more highly and extensively inflamed. It differs also in the nature of its discharge when it breaks through the skin, being a dark foetid kind of matter, and the bottom of the abscess is of a dull yellow colour. Soon after it opens, a greyish decayed substance is discharged, which proves to be the dead periosteum, and the bone is now left denuded, or is covered with red granulations.

I am aware that this kind of diseased periosteum may be considered, and indeed by some has been pronounced a necrosis in its origin, and that the inflammation of the periosteum is a secondary affection. Admitting, however, that there is as much in the history and appearance of the disease to support this opinion, as the one I have advanced, of its being of periosteal origin, yet, considering that the periosteum takes on inflammatory action sooner than bone; that it is here destroyed and discharged with the matter soon after the tumour is opened, and is not so destroyed and discharged in those cases of artificial necrosis produced by a slip of lead passed round the bone inside of the periosteum, where this membrane remains entire and deposits new bone on the outside of the lead; seeing too, that such tumours in their incipient state are oftentimes speedily resolved by a mercurial

course with antiphlogistic treatment, which could hardly be supposed to arrest the progress of a real necrosis ; ' for,' as Richrand observes, ' a necrosis *begins* as it were with death of the bone ;' these considerations together, must weigh in favour of the opinion, that superficial necrosis of venereal origin is in all cases the consequence of an acute inflammation of the periosteum, that kills the surface of the bone by the previous destruction of its nourishing vessels in concurrence with the disordered action communicated from the inflamed membrane. Should it be urged, that, because in deep-seated necrosis the periosteum remains quite unaffected, the bone must therefore be the primary seat of the disease, it may be said in reply, that, in this case, the medullary membrane which serves as a periosteum to the central part of the bone, supplying it with nourishment, holds the same relation to deep-seated necrosis as the periosteum does to the superficial kind.

There are, then, three kinds of venereal periostosis, differing from each other chiefly in their seat and degree of inflammation. The first is indolent in its character, and affects only the outer surface of the membrane, and from the nature of its contents, may be called *gummosus periostosis*. The *second* is a low degree of inflammation which affects the whole thickness of the membrane, and results in exostosis. Under this grade of inflammation may be ranked that which exists in the formation of callus and of new bone. The tumour being in the first instance cartilaginous, in which osseous matter is deposited, and this being the stage in which it may be dispersed, and is, therefore, as before observed, the most interesting to the surgeon, I call it *cartilaginous periostosis*. The *third* is a high degree of inflammation of the whole thickness of the periosteum, which ends in the destruction of the membrane and contiguous layer of bone ; this I call *necrotic periostosis*.

In subdividing these kinds of constitutional periostosis according to the question proposed for this dissertation, the two first, or gummosus and cartilaginous periostoses, may be pronounced *chronic* in their character, differing from each

other chiefly in their seat. The third, or necrotic kind, may, on the other hand, be considered an *acute* inflammation of the periosteum, so violent, that if not subdued, it ends in gangrene. The degree of inflammation found to exist in any case, is of itself sufficient ground for determining to which of the two classes such case belongs.

Venereal periostosis of either kind, may be distinguished from other constitutional affections of this membrane, by the previous existence of syphilis, and exemption from scrofula and scurvy, and such other constitutional diseases as affect the periosteum; by the greater pain attending such venereal swellings from their first appearance, than exists in swellings of this membrane from other causes, and by its exacerbations in the night; by their situation, which is on the surface of superficial compact bones; the other affections, and caries in particular, preferring the cellular part of bones, as their heads and the bodies of the vertebræ.

The prognosis, in such affections, may be regulated by their difference of character. The gummous kind will yield to anti-venereal remedies, and entirely disappear. The cartilaginous kind will end in exostosis, if not arrested at an early period by a similar course of treatment. Cases of the necrotic kind, if not arrested at an early period by anti-venereal and antiphlogistic remedies, will, notwithstanding their subsequent use, end in necrosis.

When syphilis, in concurrence with the causes we have mentioned, has extended to the periosteum, it shows the disease to be far advanced, and to have taken deep root in the system. It is often accompanied with other symptoms, as various cutaneous eruptions and affections of the throat, and the whole constitution is more or less impaired. The indications of cure are so fully laid down in treatises on the venereal disease, that very little can here be added. Mercurial remedies are chiefly to be relied on, and may be administered internally, or applied by frictions, or what is better, the employment of both methods simultaneously, it being important to make a general and sensible impression on the system as soon as possible. The form of medicine best suited

in such cases for exhibition is found to be muriate of mercury, given in some convenient vehicle, and in such doses as the stomach can bear. Its peculiar advantage over other forms of mercury, probably, consists in its acting sooner on the whole system, and its greater tendency to affect the extreme vessels, as is evinced by its efficacy in cutaneous diseases. Although the army surgeons of England have strenuously maintained, of late, that mercury is not necessary for the cure of early stages of syphilis, and that its incautious use produces most of the inflammations of the periosteum of which we are now speaking, they still acknowledge its efficacy in the cure of them, and depend on nothing so much as on moderate doses of the medicine combined with other remedies, particularly sudorifics. The free use of the medicine here recommended is to be continued so long only as may be necessary to make a sensible impression on the system, to be manifested in the breath, and by a slight uneasiness in the gums. Beyond this point most modern practitioners agree, that its use would be injurious, and the object in *hastening* a mild mercurial action at the onset is, to arrest the progress of the local affection as soon as practicable.

After the constitution is slightly impregnated, it will be necessary to preserve it in this state for a time, till the periostosis begins to yield; and should this not take place in two or three weeks, there will, after this period, be as much to apprehend from a further continuance of the remedy, in a system already somewhat impaired, as from the disease. 'In the great hospitals in Europe,' says Mr Cooper, 'long protracted mercurial courses for the cure of such swellings, are totally relinquished.'

Auxiliary constitutional remedies should be employed, both during and subsequent to the mercurial course, as the decoction of the woods, guaiacum, &c.; opium may be employed with advantage to allay pain and irritation. A class of medicines, termed alteratives, as arsenic, antimonials, and the blue pill, have been advantageously employed in conjunction with sudorifics, after the mercurial remedies are laid aside.

A new patent medicine, *Swaim's panacea*, has been employed with great success, after a failure with mercury.

When mercurials and local applications have been continued two or three weeks, without producing any sensible diminution of the tumour, it will in some cases, particularly those of the gummous kind, seem to aggravate the disease. Whether this be attributable to disorder of the constitution, induced by the medicine which disturbs healthy action in the part; or whether the disease has assumed a mercurial in exchange for a venereal character, as Mathias would maintain, I am unable to determine. Be this as it may, such tumours have improved in their aspect, by dropping the mercury and adopting such a course of medicine, aided by such diet and regimen as will invigorate the system and improve the health generally.

Local treatment should vary according as the inflammation is acute or chronic. In the former, or necrotic kind, two things are indicated; to reduce inflammation and to allay pain. The first should be attempted by the free application of leeches and saturnine lotions. Pain, which is more severe in the night, may in some degree be mitigated by the application of laudanum and anodyne plasters, such as extract of poppies and of cicuta, or by anodyne balsam. Blisters have been extolled by some, and are used in St Bartholomew's hospital; but in the highly inflammatory kind their application interferes with the use of the above named remedies, which are more strongly indicated.

In *chronic venereal periostosis* we are to expect more pain and inflammation than is common to exostosis of the idiopathic or local kind; still, however, when compared with the very grave kind that terminates in venereal necrosis, or even in idiopathic necrosis, it may with propriety be termed chronic, and regarded as such in the mode of treatment that is to be adopted. Topical bleeding will rarely be found necessary. Anodynes at night, in combination with diaphoretics, with copious draughts of the decoction of sarsaparilla or mezereon or lignumvitæ, or the three articles combined, as in the '*decoction of the woods*,' are, in concurrence with

a mercurial course, chiefly to be relied on. The topical applications avail but little. The French are particularly partial to the *emplâtre de vigo cum mercurio*.

From *constitutional* or *symptomatic periostosis* requiring constitutional remedies, we turn to the other class which comprises such cases as are idiopathic or of local origin, and require to be treated accordingly. These, like the others, are best divided into *acute and chronic*, on account of the difference in the nature of their termination, depending, as this difference does, on the degree of inflammation, and because such a distinction leads to a more correct mode of treatment.

The causes are of two kinds ; *first*, the existence of a defect in the periosteum itself, occasioned by some previous disease that has impaired the general health, and from which the system seems to relieve itself by concentrating the derangement in a particular part. A few cases have come within my limited observation, and more have probably been witnessed by experienced practitioners, where periostoses have occurred as a sequel of typhoid fever, and which have from this fact been termed *fever-sores*. Another instance of this kind of inflammation, is that of paronychia gravissima, or what is vulgarly termed a *felon*, which often ends in necrosis or caries of the bones of the fingers. Sarcomatous tumours of this membrane, termed by some writers '*lymphatic tumours of the periosteum*,' to which some constitutions have a remarkable tendency, are, perhaps, entitled to a place under this head, though we have enumerated them under the constitutional kind.

The other causes of acute inflammation of the periosteum, and which also endanger the life of the bone on which it rests, are wounds, contusions, comminute and compound fractures, acrid substances, caustics, and extreme degrees of heat and cold. In these cases the membrane may be at once destroyed by the violence of the wound, or by excessive heat or cold, without the intervention of inflammation ; or the inflammation consequent to the injury may cause a sphacelation of the membrane. It was formerly supposed,

that purulent matter collected near a bone would, by remaining there, become acrimonious, and in time corrode the periosteum and injure the bone; hence it became a rule to open such abscesses as soon as their existence was discovered. But it is now believed, where the constitution is sound, that if an abscess be formed over a bone not originally diseased or hurt by the causes that produced the abscess, nor the periosteum injured by exposure to the air or by escharotics, the pus will prove harmless, occasioning merely a thickening of the membrane, as it does of the peritoneum when lodged against it. The admission of air, in such a case, through the sinus to the periosteum, may, however, stimulate its vessels and inflame the membrane; or, as Monfoncelon observes, it may change the pus from a bland, unctuous, inodorous fluid, to one of an acrimonious kind, that will inflame this membrane, if not destroy it.

As acute inflammation of the periosteum, by whatever cause induced, endangers the life of the contiguous bone, by destroying its nourishing vessels, so, on the other hand, a moderate chronic inflammation of it, will exalt its discerning function, and may cause an exuberant deposition of bony matter, in the form of exostosis. The attention bestowed on such tumours caused by syphilis, renders it unnecessary to dwell long on the nature of exostoses of the idiopathic kind. These tumours, like those of syphilitic origin, have usually been considered as growing out of the bone like a tumefaction. My opportunities of examining such tumours have been very limited, a circumstance, however, of less regret to me, since a most valuable account of them has been given to the profession, by Sir Astley Cooper. Although his *Essays* are in the hands of every practitioner, I am induced by the great accuracy of his observations, and by their direct application to the present subject of inquiry, to give an extract from them, which will show that these tumours, like the syphilitic, originate in an inflammation of the periosteum, and are cartilaginous in their early stage.

Sir Astley says, 'I have examined exostoses in the early part of the complaint, in which ossific matter had not yet

been deposited, but in which, from dissection in other cases, I know that such a deposition would in future have occurred.

‘Exostosis has two different seats ; it is either periosteal or medullary. By *periosteal* exostosis, I mean a deposition seated between the external surface of the bone and internal surface of the periosteum, adhering with firmness to both surfaces ; and by the *medullary* is to be understood a formation of a similar kind, originating in the medullary membrane and cancellated structure of the bone.

‘With regard to its nature, exostosis is of two kinds, either *cartilaginous* or *fungous*. By the cartilaginous is intended to be expressed that species which is preceded by the formation of a cartilage which forms the *nidus* for the ossific deposit : and by *fungous*, a disease similar to that which Mr Hey has denominated fungus hæmatodes, but somewhat modified by the structure of the part in which it originates.’ ‘The parts most liable to this affection,’ he says, ‘are the os femoris, tibia, and fibula, next the bones of the face, and particularly about the alveolar processes, the os frontis, and often the bones of the fingers.’

After dwelling on the fungous kind which originates in the medullary membrane, he treats of the cartilaginous exostosis of the medullary membrane, which, he says, differs greatly in appearance from the former ; he then takes up the subject of *periosteal exostosis*. ‘This disease,’ says Sir Astley, ‘like the preceding, is both of a fungous and cartilaginous kind. The former of these scarcely differs in its symptoms from the fungous exostosis of the medullary membrane, except that the general swelling of the limb is less, and the particular tumour is more prominent : but there is the same want of sensibility in the commencement, with some pain afterwards ; the skin remains free from discolouration, and has a similar tuberculated appearance. Ulceration, bleeding, and sloughing, with great discharge ensue, and occasion the destruction of life, if some operation be not performed.’

This disease is attributed to accident ; but any irritation upon a bone, in an unhealthy constitution, will produce it. He concludes this interesting account of fungous periostosis,

with a few remarks on its treatment, and then takes up the subject '*Of Cartilaginous Exostosis between the Periosteum and the Bone.*'

'This is a very different affection to the preceding, and more deserving the attention of the surgeon, since it admits of relief by operation, though sometimes with the loss of the affected limb. It originates in the inflammation of the periosteum and of the corresponding part of the bone; and a deposition of cartilage, of very firm texture, and similar to that which forms the nidus of bone in the young subject, adheres to both these surfaces. The periosteum adheres to the external surface of the swelling, and the swelling itself is attached still more strongly to the surface of the bone. Within this cartilage a bony matter is deposited, which continues afterwards to be secreted as the cartilage increases in bulk; for it appears, that, between the periosteum and bony mass, cartilage is constantly secreted, which constitutes the exterior surface of the tumour. Thus, on dissection we discover, 1st. the periosteum thicker than natural; 2d. the cartilage immediately below the periosteum; and 3d. ossific matter deposited within the cartilage, extending from the shell of the bone nearly to the internal surface of the periosteum, still leaving on the surface of the swelling a thin portion of cartilage unossified. When the accretion of these swellings ceases, and the disease has been of long standing, they are found to consist, on their exterior surface, of a shell of osseous matter, similar to that of the original bone of the same cancellated structure, and communicating with the original cancelli of the bone. Consequently, when an exostosis has formed in the manner here described, the shell of the original bone becomes absorbed, and cancelli are deposited in its place. In the mean time, the outer surface of the exostosis acquires a shell resembling that of the bone itself. When the exostosis has been steeped in acid, and by this means deprived of its phosphate of lime, the cartilaginous structure remains of the same form and magnitude as the diseased deposit; and, as far as I have been able to discover, it is effused precisely in the same manner as healthy bone.

‘For the most part these diseases are attended with very little pain, and, especially at their commencement, are but little complained of: when, however, they have acquired some considerable bulk, they do not fail to occasion painful sensations by their pressure upon the surrounding parts.’

The most frequent seat of the periosteal exostosis is upon the inner side of the os femoris, just above the internal condyle, and in the direction of the insertion of the triceps muscles. Occasionally it appears on the tibia, immediately under the insertion of the sartorius and gracilis muscles, and sometimes at the insertion of the deltoid muscle in the os humeri.

‘With respect to the cause of the periosteal exostosis, which has but a small base, and which follows the course of the ligaments or tendons, as that in the direction of the triceps femoris and gracilis, I am of opinion that it arises from exertions disproportionate to the strength of the patient. The tendons, which are fixed in the bone, becoming sprained by over-exertion, inflammation is excited in them, which is thence communicated to the periosteum and bone, and a deposition is consequently produced in the direction of the tendons sprained and inflamed, upon which the weight of the body is more particularly thrown. We see also in horses, that the disease denominated *splent* is produced by sprains of the ligaments. This disease is exostosis. The same effect is also produced in the human subject by a sprain of the ligament, which connects the fibula with the tibia.’ Blows also occasionally produce this disease. ‘I have seen,’ says Sir Astley, ‘an enlargement of the tubercle of the tibia, produced by a fall on the knee, continue for many years.’ Pressure is also sometimes a cause of exostosis, as from long continued bandaging over a bone.

Nature, in her wise and beneficent provisions for the reparation of injuries done to the human system, offers no instance more entitled to admiration than that which is exhibited in the formation of callus after a fracture, and in the deposition of new bone round a dead one. The inflammation concerned in these processes has already occupied a due share of attention, when speaking of the functions of the periosteum.

PATHOLOGICAL REMARKS.

In consequence of severe local injury, we have already seen that the periosteum may at once be deprived of vitality, as by intense heat and cold, and by caustic ; by extensive separation of it from the bone, or by long exposure to the air, the effect of which is, to dry up the few vessels that belong to it ; and the consequence of such injury must always be death and exfoliation of the contiguous bone. The same thing will be likely to follow when the inflammation is acute, when the patient is old, or has a bad constitution, and, more especially, if, as formerly, irritating dressings are applied to the denuded periosteum, or foreign substances, as lint, be interposed between it and the bone. The effects of a wound of the membrane will be varied by the kind of instrument with which it is inflicted, and by the manner in which it is applied. Thus, a contunding instrument presses the periosteum against the bone, tears and breaks the communicating vessels, contuses the bone, sometimes breaking it, and always impairing its healthy action in the part injured. A cutting instrument may, on the other hand, merely incise the periosteum, or, gliding over the surface of the bone, may separate the periosteum extensively, and yet leave the bone uninjured. Or, even if a portion of the bone be shaved off, by the oblique direction given to the cutting instrument, granulations may spring up from the bone to fill the chasm, which will unite and cicatrize with the replaced integuments. So also, when the detached periosteum is of little extent, the patient young and healthy, and the treatment calculated to prevent inflammation, hopes may be entertained that no part of the healthy bone will die ; granulations may soon arise from its surface and cicatrize with the surrounding integuments.

The consequence of violent and long continued inflammation of the periosteum, we have seen, is necrosis ; when circumscribed in extent, the necrosis will be superficial, but where acute periostosis is extensive, the medullary membrane participates in the affection, and this will be likely to destroy the whole intervening bony substance ; and here,

the entire work of forming a new bone is done chiefly by the periosteum. If the acute inflammation be on the cranium, it will extend through to the dura mater, and, from the afflux of humours, it will occasion, may, by compressing the brain, endanger life. Richerand attributes the secondary inflammation to a direct communication of it through the blood vessels. Hunter explains it on the principle of contiguous sympathy. But, whichever theory we adopt in this case, I think it is safe to subscribe to the opinion of Bichat, in referring the occasionally wide extension of periosteal inflammation from a mere puncture to the agency of sympathy; and this fact shows the importance of attending to the state of the constitution, as well in forming a prognosis as in managing the treatment.

TREATMENT.

The existence and extent of an injury of the periosteum are to be ascertained by the form of the wounding instrument, and the manner in which it was applied; by exploring it with a probe or sound, and, on the information thus obtained, the prognosis and mode of treatment should be predicated. It is hardly necessary to add, after what has been said, that foreign substances are to be removed, the integuments carefully re-applied, air excluded from the wound, and soothing and emollient applications employed, instead of spirits and stimulating balsams, as was the practice formerly. The digestive organs are to be regulated and constitutional excitement prevented by attention to diet and regimen, and by depletion, should the symptoms require it.

Where acute inflammation settles upon the periosteum, in consequence of a disordered state of the constitution induced by fever as before mentioned, vesication over the part has proved beneficial by diminishing the evil, and sometimes has entirely obviated it. We observed that the local affection is thought to be a concentration of the general derangement of the constitution. Perhaps the reason why such strong artificial irritation arrests the progress of the disease, is, that

it answers the same valuable purpose to the constitution, that the concentrated local affection does. This suggests an important consideration in all cases which we believe to be produced for constitutional relief, whether we cannot substitute operations for those of nature, which shall answer equally well for the purposes of the system.

When acute inflammation attacks the periosteum at the end of the fingers, there is not so much reason for referring it to derangement of the constitution ; it is often attributable to some local injury done to the part, perhaps a long time previous to the accession of the inflammation, which has left the membrane weakened and susceptible of disease. Here the disease is rendered more severe by the unyielding structure of the integuments, and also by the plentiful supply of nerves constituting the sense of touch. To give relief from the intense suffering of the patient, occasioned by the strong pressure exercised upon the part, by tumefaction and by matter deposited from the inflamed membrane, it has been deemed good practice to lay the part open to the bone, since the admission of air to the bone is not followed with such serious consequences here, as it is where a large bone is implicated in the disease.

‘ Periosteal exostosis,’ says Sir Astley Cooper, ‘ admits of remedy, from internal medicine, from external applications, and when considerably advanced from surgical operations ; but,’ he adds, ‘ that his experience does not furnish him with an example from medical treatment, *except in the very commencement of the disease*. The common alterative plan of small doses of mercury, with decoction of sarsaparilla, combined with stimulating plasters as the *emplastrum ammoniaci cum hydrargyro*, with the view of promoting absorption of that which has been effused, by its stimulating qualities and by its pressure, are the means which are generally adopted.’ Mr Abernethy advised, in constitutions that tended to the formation of osseous tumours, the use of muriatic and acetic acids, but they failed of producing any apparent effect.