

it is of little use on unbroken skin or mucous membrane. Blondel used a few drops of a saturated solution in forty-per-cent. alcohol for fissured nipples. In zoster or herpes with ruptured vesicles much relief is obtained.

In throat and nose work its use is chiefly limited to ulcerative conditions, though Cheatham reports good results in rose fever. Garnaud's formula for laryngeal tuberculosis is: Menthol 3.0 (gr. xlv.), cocaine alkaloid 0.5 (gr. viij.), orthoform 2.7 (gr. xl.), expressed oil of almonds, 100 (℥ ij. ʒ ij.). It is also used as a spray in five-per-cent. solution in alboline. In painful cancer and ulcer of the stomach it has been administered in dose of 0.5 (gr. viiss.) several times a day with relief from the pain and without any systemic effect. Suspended in water it has been thrown into the bladder for painful cystitis. In dentistry, its slow anaesthesia fits it for allaying the ache of an exposed nerve.

Orthoform is used in five to twenty per cent. powder, ointment, collodion, or solution in oil. Injected hypodermically in alcoholic solution it acts like cocaine, but the latter drug is generally preferred.

Ruhemann, H. H. Wilson, Vogt, Decker, and others who have extensively employed the drug, report the occasional occurrence, from its use, of a peculiar vesicular dermatitis resembling that from poison ivy and very resistant to treatment. Brocq observed hyperæmia and pruritus. Miodowsky had a moist gangrene following the application of a five-per-cent. ointment, and Friedländer collected fifty cases of local or general poisoning and eczema.

W. A. Bastedo.

ORTHOFORM, POISONING BY. See *Synthetic Poisons, Organic*.

OSMIC ACID.—In medical parlance the title *osmic acid* is given to the body *osmic tetroxide*, OsO₄. True osmic acid (H₂OsO₄) is not known in the free state. Osmic tetroxide is a volatile crystalline substance, softening at a moderate heat like wax, and melting at a lower temperature than does that body. It dissolves slowly but completely in water, forming a colorless solution, which, however, on exposure to light, rapidly darkens, even to blackness, by decomposition of the tetroxide with formation of the tetrahydroxide, Os(OH)₄. Osmic tetroxide is a powerful oxidizer, and, to living tissues, is excessively irritant. Its odor is powerful and disagreeable, and its vapor intolerably pungent and poisonous, with a peculiar faculty for exciting irritation of the conjunctiva. In the event of the inhalation of fumes of osmic tetroxide, hydrogen sulphide ("sulphureted hydrogen") has been recommended as a chemical antidote, to be taken by inhalation; but since in this case the remedy is itself a powerful poison, the greatest care would be required in its employment.

Osmic tetroxide is of peculiar service to the histologist, by reason of a faculty it possesses of staining nerve tissue. As a medicine it has been used, by hypodermic injection, for the relief of peripheral neuralgias. The results have been quite variable, but a certain amount of efficacy for the remedy seems to have been demonstrated. A one-per-cent. aqueous solution of the tetroxide is used, and the same should be made only in small quantities when wanted, and kept in the dark. Of such a solution, quantities from 0.20 to 1 gm. (from ℥ iij. to ℥ xv.) have been injected at a dose. The injections are made as near as possible to the painful spot. The operation is often severely painful, is occasionally followed by temporary swelling and thickening of the tissues at the site of the puncture, and, practised over an efferent nerve, has in one instance been followed also by paralysis. No constitutional effects have followed these injections.

Edward Curtis.

OSPEDALETTI, ITALY. a town of one thousand inhabitants, with nearly a mile of frontage toward the sea, is situated midway between Bordighera and San Remo. It is a quiet Riviera resort, lying under the spurs of the Ligurian Alps, well sheltered from the winds and with a south-

ern exposure. "There is no doubt," says Dr. Wendt, in an article upon this resort in the previous edition of the HANDBOOK, "that little Ospedaletti is more effectually protected from winds than almost any other resort on this coast. Moreover, it gets the sun early and keeps it late. There is less blinding calcareous dust there than, for example, at Hyères, Cannes, or Nice."

"Ospedaletti spreads out for something like a mile along the head of a small crescentic bay. The eastern headland of this bay is formed by Cape Nero, and the western extremity, much farther from the village than the former, by Cape Sant Ampeglio. Thickly planted olive hills surround the place, relieved in the plain by orange and lemon trees, and the usual array of graceful palms. Successive girdles of mountains protect it from the icy north blasts, but less in a northeasterly than in a northwesterly direction. It is fully exposed only to the warm westerly marine breezes." "Immediately behind this village there rises a hill of gentle slope, and a number of mountain torrents of mild proportions trace their undulating course seaward." "The place is so hedged in as to constitute a veritable sun trap." "For undergoing a course of absolute quiet and repose," continues Wendt, "in a sunny, well protected situation, no more suitable place has yet come to my notice on the Riviera."

The hygienic conditions of Ospedaletti appear to be good; the town is spoken of by Linn as having a particularly clean and neat appearance. The drinking-water comes from the same mountain source as that which supplies San Remo, and is "soft, sparkling, and pure." The mean temperature of five winters is given by Linn ("The Health Resorts of Europe," by Thomas Linn, M.D., 1901) as follows: January, 49.82° F.; February, 51.62° F.; March, 53.42° F. The mean relative humidity is 62 per cent., and the number of rainy days, 32.

There are several hotels and pensions of moderate price, well kept, and very comfortable. There is also a fine casino. Medical service can be had there. A short distance from the village are some hot sulphur springs. "Gouty and rheumatic elderly people," says Wendt, "should do particularly well at Ospedaletti." Linn states that this place is rapidly coming into favor as a resort, and it seems to combine very many favorable conditions for a winter health station, viz., its fine natural situation, its pleasant surroundings, its excellent protection from cold winds, the large amount of sunshine, its near proximity to San Remo and Bordighera, and the quiet and repose obtainable there. Moreover, it is said to be two degrees warmer than its neighbors, Bordighera and San Remo.

Edward O. Otis.

OSTEITIS, OSTEOMYELITIS, PERIOSTITIS.

I. OSTEITIS.—Inflammation of bone may be induced by simple traumatism—as a fracture or stripping away the periosteum, by thrombosis or embolism of a nutrient artery, by extension from a periostitis, by extension from arthritis, by exposure to cold or to the action of certain poisons—as phosphorus and mercury, by syphilis, by pressure—as the rarefying osteitis of aneurism, by the eruptive fevers, and especially by typhoid fever. While these fevers may possibly act as primary causes, it is quite certain that they predispose to the development of an osteitis. Lastly, certain germs play an important part in the causation of an osteitis. They are either introduced through compound injuries, or else they are carried to the bones by way of the circulation. The emphasis which should be laid upon this last factor in the causation of osteitis cannot be exaggerated.

It is of little clinical value to classify the inflammations of bone, from an anatomical standpoint, into osteitis, osteomyelitis, and periostitis, since primary periostitis, with the exception of the traumatic and the syphilitic varieties, is very rarely observed; and, on the other hand, every case of myelitis leads, sooner or later, either rapidly or slowly, to involvement of the periosteum in the inflammatory process.

Regarding the firm bony substance itself, when compared with the marrow and the periosteum, it may be

truly said not to take any active part in inflammation; and therefore osteitis, in a narrower sense of the word, as compared with myelitis and periostitis, is unimportant. The firm bone, however, is passively affected, as we shall subsequently notice; and clinically the death of the bone, or of a part of it, may prove to be an affair of the greatest gravity. So much is this true that it has been customary to study acute osteitis under the title of one of its most frequent results—necrosis—and a certain form of chronic osteitis under the heading of caries.

II. PERIOSTITIS.—Periostitis, like osteomyelitis, may originate from traumatism, either simple or compound, and in character may be simple (that is, aseptic) or septic (from the presence of micro-organisms). The syphilitic variety of the disease should probably be classed under this latter heading, although we cannot to-day speak with certainty as to its germ origin. The periosteum is first affected during the secondary stage of syphilis, that is, the stage of invasion following the incubation of the syphilitic virus in the system. Those bones which are subcutaneous seem especially liable to periostitis—for example, the tibia, sternum, and ulna; but the others are not exempt. In severe cases there sometimes appears to be a simultaneous involvement of most of the bony sheaths of the body, with consequent almost unbearable osteocopic pains. These pains are distinctly worse at night, and seem to be increased by warmth; but I am inclined to think that sufferers from osteitis and periostitis of other than syphilitic origin also complain most at night.

The syphilitic periosteum is quite tender, and I have many times noticed pitting on pressure. In this disease it is rare for the periosteum to become separated from the bone by exudations; and consequently necrosis, from failure of the superficial blood supply, is very infrequent in this form of periostitis.

In the later or "tertiary" stages of syphilis, nodes, usually flat, and of sharply defined extent, sometimes make their appearance. They are caused by infiltration of the periosteum with small round cells, and, like all gummata, tend to soften and break down. Their course, and the probability of bone involvement, seem influenced for the worse if the medical attendant, finding fluctuation, use the knife instead of rapidly pushing the iodides or other appropriate medicines.

In acute periostitis, when accompanied by free exudation of fibrin, serum, and pus, the cortical lamellæ of the Haversian systems may be separated from their vascular supply; and unless the surgeon promptly realizes the state of affairs, and makes free incisions down through the dense, unyielding periosteum to the bone, a necrosis of more or less superficial character may, and often does, result.

The clinical picture of acute periostitis is best studied, as it will be later, together with osteomyelitis; for these two diseases are commonly associated together.

A rather rare concomitant of an acute osteomyelitis, usually of a mild type, is a periostitis with exudation of a simple serous character between the periosteal sheath and the bone. Because of the abundance of albumin in this fluid, Ollier here adopted the title of "osteitis albuminosa."

Chronic, non-infective periostitis may be either fibrous or ossifying in character. In the former there is much increase in the amount of connective tissue, and the thickened membrane adheres unusually closely to the bone. In the latter we have as a result an ossific deposit, which may go on increasing for months or even years, ultimately producing exostoses or osteophytes. The new bone of inflammatory origin is not deposited in a regular system of lamellæ, probably owing to faulty nutrition; and it is sometimes absorbed, and disappears, the abnormal activity of the osteoblasts ceasing. This variety—ossifying periostitis—may be associated with either rarefying or condensing osteitis.

With regard to tuberculous periostitis I may state that it is especially apt to appear in the subjects of the so-called scrofulous diathesis, and in the poorly nour-

ished, and to be accompanied by tuberculous osteitis. The discussion of its symptoms, course, and treatment need not be dissociated from that of the latter disease.

III. OSTEOMYELITIS.—The terms osteitis and osteomyelitis will here be considered as one. Where the vascular changes greatly predominate, where pus, fibrin, and serum are abundantly produced, where the brunt of the inflammation is felt by the marrow and contents of the Haversian spaces, the latter term may be applied with especial propriety. And, on the other hand, those cases in which changes in the firm bony structure itself form the prominent feature, may properly be designated as cases of osteitis. However, the two go hand-in-hand. Changes in the relative density of the bony structure can occur only through cellular activity in the marrow spaces and vascular canals. These changes are of two kinds: osteoporosis, or rarefying osteitis, and osteosclerosis, or condensing osteitis. In the former the character of the bone changes from compact to cancellous, and if the process continue the bone may even entirely disappear, its place being taken by a mass of granulation tissue. This variety of osteitis is very common. It is one of the essential phenomena in tuberculous osteitis; it is the process by which the rough, ossified callus following fractures is rounded off; and when a bone is subjected to pressure—as by a growing aneurism—it is a rarefying osteitis by which it is eroded.

In osteosclerosis, on the other hand, the bone grows more compact, and may even—as may be observed in some exostoses—become as dense as ivory.

It often happens that both osteoporosis and osteosclerosis are going on at one and the same time in different parts of the same bone: an osteoporosis within, for example, and an ossifying, even condensing, periostitis externally; and as a result the bone may become widely expanded, although it is a mere shell filled with granulations or with inflammatory deposits.

Or, again, following an osteoporosis, the opposite process may be inaugurated, and the cavities caused by the former morbid process may become filled with new bony deposit, perhaps of even abnormal density. We do not yet know why inflammation of bone terminates sometimes in one and sometimes in the other of these conditions. It is supposable that in condensing osteitis the osteoblasts have an undue activity. In rarefying osteitis the absorption of bone is thought by some pathologists to be caused by the presence of certain large, multinucleated cells—the myeloplaxæ of Robin; cells which are also by reason of the power which they are supposed to possess, called osteoclasts. In subacute osteomyelitis ragged holes, opening from the marrow spaces and Haversian canals, are formed in the solid bone. These cavities are known as the caverns or lacunæ of Howship. They contain many of the so-called osteoclasts, which, if not the cause, are certainly the witnesses of the osteoporosis.

Other pathologists repudiate the idea that these large cells possess any such power, and attribute the absorption to the influence of the new granulation tissue which is present in these cases, and which lies in contact with the bone. In agreement with Billroth they hold that just as a granulating synovial fringe erodes the articular cartilage against which it rests, "like ivy climbing over a ruin," so here in bone the granulations possess a similar disintegrating power.

In acute osteomyelitis the vascular changes are of the deepest import, since obstruction of the nutrient arteries means death of the bone *en masse*. Let us study the common cases of apparently spontaneous origin. Here the marrow tissue is at first of a deeper red, from intense congestion. Sometimes it is mottled with hemorrhagic spots. Later, a grayish hue appears, due to the presence of great numbers of pus cells; and occasionally little-medullary abscesses develop. In bad cases not only does thrombosis of the nutrient vessels occur, but gangrene of the marrow and of the contents of the Haversian canals also takes place, with rapid liquefaction. The bone cells being no longer nourished die. The infection may spread rapidly, involving the whole length of the bone,

or, in the milder cases, it may remain limited to a comparatively small area.

Usually the process begins in the bone, and extends thence along the course of the nutrient vessels to the periosteum, which then becomes involved. Some surgeons think that the infection spreads also through the canaliculi, from bone cell to bone cell, and from centre to surface.

Sometimes the reverse is the case, the periosteum being first attacked. Inflammatory products—pus, fibrin, and serum—rapidly strip the swollen and oedematous periosteum from the bone, inducing the most frequent form of necrosis, that of the superficial lamellae.

The pressure caused by the exudations is very great; so much so that fat contained in the medullary tissues may be forced out, and can sometimes be seen in globules upon the surface of the pus (Roser).

The pus finally breaks through the periosteum at some point of softening and disintegration; it enters the intermuscular connective tissue, and may finally reach the surface. In that case the pus can sometimes be seen to pulsate from its contact with the richly vascular medullary substance.

When the osteomyelitis is near a joint, the articular lamella may become involved by extension, perforation through the cartilage may occur at some point, and the most dreadful arthritis ensue. In the very young, separation of the epiphysis from the shaft may, after a week or two, occur. The cartilaginous epiphysis, from its comparative lack of vascularity, is not so subject to attack as is the adjacent bone; yet even this may die.

Those parts of the bone which are cut off from their blood supply die in consequence; and this necrosed bone, upon its subsequent separation, is called a *sequestrum*. Next in frequency to the cortical sequestrum is the central sequestrum—that composed of the bone surrounding the main medullary canal. In extreme cases the whole thickness of the bone, or even the whole bone, may die. This separation of living from dead bone occurs, however, only at a much later period. On an average from three to five months is required for the complete separation in the case of a young adult. The length of this period of time also varies according to the extent of the involvement and the degree of vascularity. In the elderly, the same separation may need, perhaps, as long a period as one year for its accomplishment.

Along the line of demarcation between living and dead bone, granulations spring up; they start from the blood-vessels. The granulation tissue seems to possess the power to erode and absorb the dead bone with which it is in contact, until at last the sequestrum lies loose upon a bed of granulations springing from the sound bone. In the process of solution of the dead osseous substance, whereby separation is effected, certain salts—such as calcium phosphate—which are not soluble in an alkaline medium, are dissolved and disappear. Hence it is thought that the granulations evolve an acid. Formerly it was believed that lactic acid was the solvent. Tillmanns' later researches seem to show that it is the active, nascent carbonic acid contained in the blood which dissolves the dead bone tissue; and that, in the accomplishment of this, aid is derived from the activities of the osteoclasts.

Unfortunately, this process of absorption is extremely slow, so that we can hardly hope for the complete disappearance of even a moderate-sized sequestrum. Evidences that a certain amount of absorption has already taken place are found, however, upon almost all loose pieces of dead bone.

When a sequestrum lies near the surface of the body, nature is sometimes able to extrude it, and new bone, the *involucrum*, is formed from the granulation tissue, and pushes the sequestrum out. More commonly, however, it cannot escape. The greatest growth of involucrum springs from the periosteum, save in those cases in which the bone-forming layer of the periosteum has been destroyed by the suppurative process; and this new bone of periosteal origin, while it strengthens the shaft as a

whole, prevents the escape of the sequestrum. The reason for the failure of a central sequestrum to be ejected is obvious.

For mechanical reasons, therefore, nature cannot, as a rule, complete a cure after separation of the sequestrum. Consequently, if the surgeon do not interfere, there will continue to be, for an indefinite length of time, a discharge of pus through more or less tortuous openings, called *cloaca*. As regards the kind of interference which is needed, I will simply state briefly that the surgeon must chisel, saw or drill through the ensheathing involucrum (involving the transverse diameters as little as may be) and release the imprisoned dead bone. It is very unwise to delay interference after the cast-off bone is found to be loose in its cavity, since the patient is thereby subjected to serious danger from exhausting suppuration, from amyloid degeneration of the viscera, from involvement of the neighboring joints in the inflammation, and from hemorrhage, through mechanical erosion of some large nutrient vessel by the jagged sequestrum.

Causation.—Although we have discussed to some extent the pathology of acute suppurative osteomyelitis, we have not as yet dealt with its true cause. The question arises, Have we not here to deal with microbes? Numerous accurate investigations of the pus obtained either directly from the medullary canal or from the depth of the tissues immediately in contact with the bone, and subsequent pure cultivations, have settled this question definitely. "It is not due to a specific poison, but it may be caused by any kind of micro-organism which excites acute inflammation and suppuration" (Tillmanns). Among these the variety most frequently found in cases of this nature is the staphylococcus pyogenes aureus; less often the staphylococcus albus and staphylococcus citreus; and rarely the pneumococcus, the bacillus communis coli, Eberth's bacillus, the typhoid bacillus, the bacillus pyogenes fetidus and pyocyanus, and the micrococcus pyogenes tenuis and tetragenus. Although I mention the pyogenic streptococci last, they are far from being the least in importance. They are found chiefly in the osteomyelitis of young children, and this type of the infection is very apt to prove promptly fatal from sepsis.

How are we to explain the entrance of germs into the bone without an apparent traumatism as a doorway? The only plausible assumption seems to be that they pass into the blood through slight abrasions of the mucous or other tegumentary surfaces of the body and eventually find lodgment in the bone. Clinical facts support the theory that, preceding osteomyelitis, patients will be found to have suffered from bronchitis, enteritis, etc. (Kocher).

The majority of cases of this disease, with the exception of suppurative myelitis in connection with compound fracture, occur during the time of the development of the skeleton—*i.e.*, during childhood and adolescence. One is inclined to think that the physiological growth of the bone predisposes to inflammatory processes. This theory finds support in the fact that in most cases of acute and chronic myelitis the disease is found to be near the epiphyseal cartilage, and therefore in the most newly formed bone. It furthermore seems to appear with greatest frequency in that end of a long bone which furnishes the greatest amount of growth, and in which the current of blood is least active. It is commonest in the upper end of the tibia and the lower end of the femur; and in the upper end of the humerus and the lower end of the radius and ulna. It will be remembered that the nutrient arteries of the long bones of the lower extremity run *away* from the knee; and in the upper extremity they run *toward* the elbow.

The selection of the youngest bone tissue as the favorite nidus of the microbes seems dependent upon the peculiar form of the developing blood-vessels. It will be found upon investigation that the sprouting blood-vessels of the growing long bone correspond to wide, hollow spaces close to the epiphyseal cartilage. It will be easily

seen that the blood current grows less rapid in these lacunae, where the capillaries enlarge, thus giving the cocci contained in the blood a better opportunity to adhere and remain. It is further stated (Hoyer, Rindfleisch) that the blood of the medullary canals flows unenclosed by any tunic in these spaces, and thereby the cocci are brought into direct contact with the bone.

Schiller has demonstrated by a series of experiments that coloring matter introduced into the circulation is retarded in its course and deposited in the blood-vessels of the youngest bone tissue; thus showing, as Hueter says, that there is a tendency for the cocci contained in the blood to be left at this point as a sediment. This being so, we can readily understand how the infection of the young medullary substance occurs.

Clinical Picture.—Sometimes exposure to cold, a wrench or a blow, exhaustion from eruptive fevers, etc., may act as predisposing causes, determining either the time or the seat of the attack, or both. Or, again, no cause whatever may be discoverable. In any case of acute, suppurative osteomyelitis the actual and exciting cause is probably always bacterial.

The disease usually begins with one or more chills, followed by fever, which is often very high. In a child delirium is common, and the little sufferer may not be able to point out the seat of pain, which, however, rapidly becomes severe.

With the intensity and mode of infection, and the degree of vital resistance possessed by the patient, the symptoms vary. He may even die within a day or two, overwhelmed by the poison. To rather less severe cases, from a resemblance in the violence of their onset and symptoms, Chassaignac has given the title "typhus des membres." Later, and in more insidious cases, typhoid fever may be simulated. There may be some slight resemblance to a cellular erysipelas. In not a few instances, owing to the fact that the constitutional manifestations alone were taken into account, a dozen other diagnoses—some of them quite absurd—have been made.

Repeated rigors and pyæmic temperatures may point to the involvement of more than one bone, or to suppurating foci elsewhere, and pyæmia, septicæmia, ulcerative endocarditis, etc., may develop in the worst cases, especially in the absence of prompt surgical intervention.

Diagnosis.—The disease with which that under consideration is most often confounded is acute articular rheumatism, and this mistake is especially likely to occur when more than one long bone is attacked. The local symptoms, however, will soon clear up the diagnosis, unless, owing to delirium of the patient, or to the fact that he is too young for speech, attention is not called to the real seat of suffering. Rather near the articular end of the bone, as a rule, a distinct swelling is soon observed. This is caused first by the great congestion and oedema of the periosteum and adjacent tissues, and later by the separation of the periosteum from the bone by inflammatory products. While the tenderness over this swelling is very marked, it does not extend beyond the limits of the tumor. Furthermore, unlike what is observed in acute rheumatism, motion of the neighboring joint is not specially painful. The skin over the swelling is not reddened at this time; it may even be paler than normal. Later, when the pus is about to escape through some disintegrating point of its dense sheath, the skin becomes reddened, softened, and gives way.

Acute Epiphysitis.—Acute epiphysitis presents problems of the gravest importance. In addition to the risk of a suppurative joint trouble, by extension, the focus of infection—whether it begins in the shaft or in the epiphysis—is commonly close to the narrow line of cartilage which connects the two. The importance of this lies in the fact that if the cartilage become severely involved in the inflammation there may result a diastasis—*i.e.*, a separation of the epiphysis from the shaft, with dislocation, a condition which demands the utmost care and the most skillful splinting to prevent a final deformity from union in a bad position. Even when the involvement of the cartilage is somewhat less grave,

if the normal cellular activity in the vicinity of this narrow line of cartilage be permanently impaired or destroyed, growth of the bone, so far as this end is concerned, will cease. And the seriousness of this circumstance is still further enhanced by the fact that the greater portion of the growth of the long bones takes place normally from that end which is most subject to attacks of acute osteitis. For example, in the case of the long bones of the extremities the ends which are nearest the knee, and farthest from the elbow, supply most of the growth, and are also more subject to acute osteitis than are the opposite ends. And—to mention a single instance only—von Bruns has collected evidence which shows that diastasis of the femur from all causes occurs in the proportion of twenty-eight cases of separation of the lower epiphysis to one of the upper. And according to Ollier, the development in length of the thigh bone is about two-thirds from the epiphyseal cartilage of the lower end and one-third from that of the upper end. When it occurs in a little child, a diastasis of the lower end of the femur, even though the separated parts are properly replaced and adequately splinted until bony union shall have taken place, may result in a shortening of as much as nine inches; whereas if the diastasis occurs at the upper end, the records show that only about half this amount of final deformity results. These are facts, therefore, which it behooves the physician in charge to know in order that he may, for his own protection, and especially in view of the possibility of a suit for malpractice, give timely warning to the parents.

Treatment.—As regards the treatment of acute epiphysitis, prompt surgical intervention and careful splinting to prevent diastasis are the only means worth mentioning. On the other hand, the proper management of the sequelæ will depend upon the precise character of the pathological conditions left by the acute disease. A problem very difficult to solve is that which is presented when the epiphyseal cartilage of only one of the two bones (of either the forearm or the leg) is involved by the disease. In such a case growth will be entirely arrested in one bone while it will continue to take place in the other. Under such conditions the ultimate result—if the parts are left to themselves—can scarcely fail to be a dwarfed and grotesquely twisted limb. Surgical intervention may be resorted to at a relatively early period, with the idea of preventing the evil to which attention has just been called, or surgical measures may be adopted for the correction of the deformity after it has been fully established.

In the former case the surgeon, having to do with a case of diastasis, should—after all suppuration has ceased—chisel through the thin plane of cartilage of the neighboring or sound bone of the same extremity. This stops the growth of that bone, and results in a straight though shortened limb. On the other hand, if interference is postponed until the deformity shall have reached its full measure of development, the surgeon will have to tax his ingenuity by the employment of various means (chiselling, aseptic fracturing, resection, etc.), to overcome in a measure the extreme deformity so commonly found at that time.

Something further needs to be said about the treatment of acute osteomyelitis in its incipient stages. In the first place, it must be borne in mind that the inflammation, in a case of this nature, has already produced, or is soon to produce, pus, and that this pus is confined beneath dense, unyielding tissues. The indication is therefore plain; the knife must be used, and that too with as little delay as possible. A free cut should be made through the periosteum, clear down to the bone; and with a dressing forceps entered closed and withdrawn opened, the wound should be enlarged for free drainage. Then it should be irrigated with some antiseptic solution—bichloride of mercury 1 to 2,000, for example—and, if the incision has been made through deep tissues, a drainage tube is to be inserted down to the bone. Otherwise the wound may be packed loosely with wet antiseptic absorbent gauze.

When, in 1854, Chassaignac and other French surgeons

advocated a similar free incision, their advice was followed by disastrous results; generally by pyæmia and death. That was before the days of antiseptics. To-day, any surgeon who knows what surgical cleanliness means can make such an incision without threatening the life of his patient; and it is, in fact, his duty to employ the knife. Whether this incision alone will be of much value will depend upon whether the infective nidus was situated in the periosteum, or whether that membrane was only secondarily involved by extension of inflammation from the marrow. The latter supposition is in most cases the correct one, and may be considered almost a certainty if drops of free oil be observed between the periosteum and the bone—it evidently having been forced out by the tremendous pressure within the bone.

It is well to wait a very few hours after cutting down to the bone, rather than to penetrate at once to the marrow; unless indeed the violence of the onset seems to the operator disproportionate to the amount of trouble thus far discovered, in which case delay would add to the peril. If, at the end of this period of delay, the local and general symptoms seem aggravated, or at least not diminished in intensity, showing that the trouble is within the bone, and not mainly periosteal, then the trephine should be used, or the burr or chisel, and the marrow should be exposed, curetted just as far as it appears to be diseased, irrigated, and freely drained. This should be done at several places if the disease seems to be extensive; and it should be followed by continuous irrigation with solutions of bichloride of mercury, or of acetate of aluminum, of appropriate strength—this irrigation to be kept up until the more severe symptoms shall have subsided.

Such treatment seems radical, but is really conservative of the patient's limb, and very possibly of his life.

The constitutional treatment consists simply of measures intended to support the patient's strength. It is, perhaps, of little avail to give antiseptics; still, the safer ones—as benzoate or salicylate of soda—may be employed. It may also be well to use free inunctions of the Credé liquid silver ointment. The writer's experience has not been favorable to the injection of antitoxin serums in such cases.

As regards those cases which are seen at a later stage and in which the disease is complicated by the presence of a certain extent of necrosis of the bone tissue, the practical questions which present themselves are these: How is the existence of such a bone necrosis to be ascertained? and, What steps are to be taken for the relief of the condition after we have discovered its existence? By the intelligent use of the flexible silver probe—or, in certain cases, of two probes—the surgeon should have no difficulty in ascertaining that a necrosis exists, and also occasionally in determining how great is its extent, and whether the necrosed portion is or is not loose. In other instances, however, he will be forced to resort to an explorative operation in order to determine to how great an extent the bone is necrosed, and whether the sequestrum has become sufficiently detached to warrant the adoption of radical surgical measures for the removal of the dead bone. Furthermore, in reaching the latter decision he will have to weigh very carefully the question how far the patient's health is being undermined by the constant discharge of pus which invariably accompanies the separation of the dead from the living bone.

The late Prof. Thomas M. Markoe, in his article on "Necrosis" in the first edition of the HANDBOOK, expressed himself as follows in regard to the steps which should be taken in the presence of a necrosed condition of the bone:

"Having now settled the question as to the propriety of operation, the time of its performance may be considered. As a general rule, it is better to remove the sequestrum just as soon as it can be ascertained to be loose. But if the patient be much reduced in health, if the season be unfavorable, and if the discharges and the sufferings from the local disease be not excessive or exhausting, then it is quite proper, and generally quite safe, to wait until, by careful attention to nutrition, by fresh air and

exercise, perhaps by change of air and surroundings, we secure a better reparative condition of the system, in view of the often serious operation which is contemplated. If there be no considerations of this nature, the operation should be undertaken without unnecessary delay.

"The operation itself consists in releasing the sequestrum from its mechanical confinement within the tissues, and removing it. The operative procedure will vary, therefore, with the extent and solidity of the tissues enclosing the sequestrum, and with the accessibility of the sequestrum from the surface. In most cases of superficial necrosis, or exfoliation, it is only necessary to divide the soft parts covering the dead piece in order to remove it with great ease. This, however, is not always the case in exfoliation, for it sometimes happens that the dead plate extends on the sides of the bone far from the surface, and it occasionally occurs that a thin plate of superficial necrosis surrounds completely certain portions of the shaft of the bone, thus producing a condition of things which renders operation extremely tedious and severe, and, not infrequently, even then the entire removal of the deepest portions of the sequestrum is not accomplished.

"To take a typical case of necrosis of the shaft of the tibia, where the diagnosis is clear, the involucrum sufficient, and the sequestrum entirely separated, the steps of the operation may be described as follows: A free incision is made on the anterior surface of the limb, where the bone is most superficial, and this incision should extend as far as the supposed limits of the necrotic action, and may be crossed by another at about its middle, so as to give easy access to the surface of the involucrum. The flap then being dissected up clean from the exposed bony surface, we select the most favorable point for attacking the bone case enclosing the sequestrum. This is generally to be found at one of the larger cloacæ, which, being further enlarged by the chisel or gouge, soon gives us access to the cavity in which the dead bone lies. By means of this first exposure of the cavity we learn the size, the degree of freedom, and the extent of the sequestrum, and we take our measures accordingly. If the sequestrum prove to be very long, then the incision through the involucrum must be extended so as, if possible, to release it without breaking off any of the irregular and slender processes in which it terminates. About this the operator should be extremely careful, as, if any of these fragments are left in the bottom of the wound, they are apt to give trouble, and if we cannot reach and remove them with slender forceps they are frequently a long time in making their way to the surface, during which time, of course, the wound will not heal. In exposing one of these large sequestra, it should be borne in mind that restoration of the involucral bone which we are cutting away takes place to only a very limited extent, particularly in those who have passed the earlier periods of life. It must be remembered that nature has already, in forming the involucrum, accomplished a very elaborate and extensive restoration of bone, and if we destroy this new formation she will hesitate about repeating the process. In point of fact, we find that the cavity left after these operations does not, except in very young subjects, fill up with bone, but rather with a firm, fibrous, cicatricial tissue, which, while it fills up the gap left in the bone, contributes very little to its strength. We must be careful, therefore, not to weaken the bone by any unnecessary cutting in its transverse diameter, though in the longitudinal direction we may proceed with more freedom. The cutting is done most satisfactorily, I think, with a gouge, though if a cloaca is not in a favorable position for enlargement a small trephine answers a good purpose in making the first opening through the involucrum. The gouge and the rongeur, however, will be all that in most instances will be required. After the removal of the sequestrum a careful examination should be made with the finger and the probe, to make sure that no fragments remain, and that no cavities are left without sufficient openings to secure drainage."

By way of supplementing the remarks quoted above I

will state that it is important, after laying bare the bone, to curette away the entire granulating surface, and to sterilize the living bone, thus laid bare, by peroxide of hydrogen or other effective means. Often such curetting lays bare the entrance to more than one chamber containing sequestra. There may even be a chain of such running along the marrow. And unless the operator makes sure by probe and curette that this is not the case, his work, in removing the first sequestrum exposed, may prove by no means a success; and a continuing discharge of pus will show that he has not removed the whole cause. Following these steps, it is possible by at least nine different ways to treat the bony cavity in an endeavor to hasten its healing. (1) The old-fashioned way of simply packing with gauze to compel healing from the bottom. (2) Neuber's plan of "deep canalization." (3) Schede's healing by the moist blood clot. (4) Thiersch's skin-grafting directly upon bone. (5) Lücke and Bier's "osteoplastic necrotomy." (6) Healing by aid of decalcified bone chips. (7) Autogenetic fresh bone chips (human). (8) Heterogenetic fresh bone chips (rabbit or calf or lamb, for example, have been used). (9) Heteroplastic fillings. These are still largely in the experimental stage; but we may mention sterilized plaster-of-Paris, bone charcoal, iodoform starch, dental gutta percha, and Richter's cement. Upon the skull the writer has successfully used a specially prepared celluloid plate, deprived of all excess of nitric acid, and substituting in its composition a little synthetic urea for the more irritating camphor, to give resiliency. The lack of space permits us to discuss briefly only two or three of these nine methods.

According to Neuber's plan, which has for its object a material shortening of the tedious healing by granulation, the integument and subjacent connective tissue, for a short distance on either side of the wound, should be stripped up in the form of flaps, and then these should be stretched in such a manner as to cover, either entirely or at least to a large extent, the excavation left in the bone by the removal of the sequestrum. They may be retained in place by nailing them to the bone. The deep trough-like depression in the skin which remains after healing takes place soon grows shallower through the development of connective tissue between the bone and the skin; and eventually this connective tissue is supplanted to a greater or less extent by newly formed bone.

A still more recent method is that for which Schede deserves the credit. It consists in allowing the wound, after removal of the sequestrum, to fill entirely with blood clot. This, under perfect aseptis, does not break down or putrefy, but undergoes rapid organization, blood-vessels springing into and permeating it from all sides. This idea, in properly selected cases, proves an excellent one. It is, of course, unsafe unless accompanied by absolute sterilization of the cavity and by protection from atmospheric germs.

Thiersch's method of skin-grafting directly upon the bone is frequently successful in hastening a cure. As with Neuber's plan, nature, in the course of time, deposits its new bone beneath the skin, and to a large extent fills up the deep depression left by the removal of the sequestrum.

Still another recent plan which deserves to be mentioned here is that of Lücke and Bier. It is spoken of as "osteoplastic necrotomy." In the execution of this plan the long bone is sawn transversely with the wire saw, half-way through at two points, viz., just above and just below the seat of the necrosis. These transverse lines are connected, on one side, by a longitudinal one, and along this latter line the chisel is used, until the cavity of the bone is opened; then, by depressing the handle of the chisel, the rectangular flap of bone and superjacent parts is broken loose along a line opposite to that made by the chiselling, and is temporarily turned back like the lid of a box; and, finally, as a last step, the sequestrum is to be extracted. The cavity in which it lay must next be well curetted and irrigated, and then, after provision has been made at the most dependent point for free

drainage, the lid-like flap mentioned above is to be restored to its natural position.

There are certain subacute and chronic cases of osteomyelitis, limited in extent and indicating a mild degree of bone infection, which deserve mention. They are accompanied by more or less pain and tenderness of the bone over a small area, and this may continue for months and years with slight or no constitutional symptoms. In some of these cases, called "Brodie's abscess," the pus may finally reach the surface, or may remain permanently surrounded by compact bone; an osteoporosis has occurred, sufficiently great to hollow out a pus cavity, usually lined with granulations; but commonly no necrosis—no death *en masse*—takes place. It may be that a few of these abscesses represent the site of softened and broken-down gummata of late syphilis.

The treatment is self-evident. By means of the trephine the cavity is to be reached and drained. Even supposing the diagnosis to be erroneous; supposing the case to be in reality that uncommon disease, a neuralgic osteitis—one in which a chronically congested vascular state in the bone seems to induce nerve dystrophia and consequent neuralgia,—experience proves that penetration of the bone gives the surest relief, and is a safe operation.

RHEUMATIC OSTEITIS does occur, but is very infrequent, and is apt to be secondary to rheumatic periostitis. The coexistence of rheumatism elsewhere in the fibrous framework aids the diagnosis. Heat, counter-irritation, and, as a last resource, opening the bone, give the greatest relief, and should be conjoined with the usual purely medicinal and hygienic means of treatment.

SYPHILITIC OSTEITIS presents itself chiefly as a result of gummatous involvement in the later stages of the disease. It is also, however, to be noted as one of the manifestations of inherited syphilis. The osteochondritis of infants, first described by Wegner, is a frequent manifestation, as is also dactylitis syphilitica. Regarding the former, Taylor states that it is often the only sign of this inheritance; and that at other times its presence decides the syphilitic nature of coexisting lesions. It involves chiefly the shafts and epiphyseal junctions of the long bones; and is usually found at birth or within the following month. The swellings are rather distinctly limited, as a rule, and the baby suffers when they are handled. In bad cases separation of the epiphyses, suppurative osteomyelitis, and necrosis may develop.

The dactylitis when present affects mainly the first phalanges. It differs from the tuberculous variety in this regard, as also in the fact that when luetic it is apt to be multiple, and to appear upon both hands.

"Parrot's nodes," involving the two halves of the frontal bone and the two parietal bones, are found in infancy, and are due to the same cause. These swellings, upon all sides of the anterior fontanel, are very characteristic, and are caused by both a periostitis and an osteitis of these bones.

In later childhood and in adolescence are found the bony irregularities, hypertrophies, and asymmetries which often are so characteristic of syphilis. In the face, the nasal bones are those which suffer most. As a result of necrosis of the bony support the nose undergoes shortening, the lower part retreating toward the upper part; or else the bridge is sunken. Of the remaining parts of the skeleton the tibia presents the most striking of these late bony inflammatory changes due to syphilis. It may be greatly thickened, its crest being no longer a mere ridge, but broadened and swelling forward, so that when seen from one side the tibia presents the characteristic shape of a sabre.

For a fuller study of the bony stigmata of this disease, including the pathology and clinical course of gumma of bone, the reader is referred to the article upon *Syphilis*.

NECROSIS OF THE JAWS DEPENDENT UPON THE ACTION OF PHOSPHORUS.—This is a condition which the surgeons of the present generation rarely have the opportunity of observing. I may therefore be permitted

again to quote from Professor Markoe's article on "Necrosis" in the first edition of this work.

"These cases occur almost exclusively among the operatives in match factories, who are living in an atmosphere containing the fumes of phosphorus and phosphorous acid. The workmen most liable to be affected are those employed in the dipping-room, and in the packing-rooms. In the first there is a constant prevalence of the fumes of the volatilized phosphorus, and the air in the second is still further vitiated by phosphorous acid from the frequent burning of the matches while being counted and packed. It is believed that these phosphorous emanations, which are quite soluble in water, are dissolved in the saliva, and thus come in contact with the teeth and gums, upon which latter the poison seems to exert its primary influence. Why these particular parts are selected by the poison in preference to the rest of the buccal and to the Schneiderian membrane, which are equally, if not more, exposed to its action, is a pathological fact which we are not able to explain. That the poisonous action is a local, not a general, one seems further proved by the fact that constitutional cachexia does not often appear as a condition preceding the local outbreak; and still more strongly by the fact that if the teeth be sound, and the gums unbroken, the disease is rarely developed. On the other hand, it ought to be stated that there are sometimes evidences of slow systemic poisoning by phosphorus, terminating in necrosis; and also that it is rarely those who have been for only a short period subjected to the poison who develop necrosis, but rather those who have been some years in the occupation. Again, it has been recorded that the prolonged internal use of phosphorus may lead to typical necrosis of the jaw, as in a case recently reported by Mr. Hutchinson. It may, therefore, in the light of our present knowledge, be assumed that the action of the poison, at least in most cases, is purely a local one, though the system is probably predisposed to the local outbreak by a constitutional infection from the poison slowly introduced into the blood, either by inhalation of the vapor or by the ingestion of the drug as a medicine. It acts by inflaming first the gums and the linings of the tooth sockets, from these spreading to the alveolar processes of the bone, and finally, by extension by continuity, involving a large part, and not infrequently the whole, of the bone. This destruction of the entire bone is sometimes found in the lower jaw. In all the cases I have seen affecting the upper jaw, the ravages of the disease were mainly confined to the alveolar arch."

(For further information in regard to this subject consult the articles on *Occupation, Hygiene of, and on Phosphorus, Poisoning by.*)

OSTEITIS DEFORMANS.—This essentially chronic condition is, though recognized and studied since 1876, still illy understood as to its etiology. It occurs most often in middle age, and involves perhaps more frequently the long bones, but also at times the skull, pelvis, and vertebrae. Hypertrophy may go hand-in-hand with softening, resulting in malformations which give the disease its name. Nevertheless, it does not advance to the extent of causing fractures. Some authors—Tillmanns for instance—differentiate two clinical varieties, the painful and the painless. The former is the more frequent, usually involving the bones of the lower limbs. The painless is believed to occur more often in the upper limbs, and in females rather than in males. Generally several bones are involved, thus indicating a systemic rather than a local cause. Treatment has thus far proved of little avail; and since we cannot definitely ascertain the real cause and direct our treatment to that, the only course which remains to us is to alleviate pain or other symptoms.

TUBERCULOUS OSTEITIS.—Under this title we shall discuss that inflammation of bone which, until within a few years, writers have studied under the name of caries; paying more attention, as in necrosis, to the result of the process than to the causative agent.

This is a chronic malady, affecting mainly the red-

marrowed, cancellous bones, such as the bodies of the vertebrae and the carpal and tarsal bones. It is essentially an osteoporosis, with tuberculous deposit as its cause and accompaniment, and it results in molecular death of the bone. Sometimes, by extension, the compact tissues are involved, but here the bone first changes its character, becoming cancellous through osteoporosis; and later even the remaining bone trabeculae may disintegrate, and a suppurating cavity be left. The lime salts are dissolved, and the remaining membranous or gelatinous bone breaks down under the devitalizing influence of the tubercles.

It may be objected to the term *tuberculous* that caries is not always of this nature. It is undoubtedly true, however, that chronic, granulating, rarefying osteitis is commonly so, and at the present day the cases of caries in which careful investigation fails to find the bacillus tuberculosis are very few, and are becoming fewer.

The bone frequently expands in one or both of its diameters while becoming a mere shell filled with pus, bony detritus, and granulations. Apparently the growing mass of granulation tissue forces out the walls of bone when they become thin enough to permit it. A rather common example of this condition is found in "spina ventosa." Here the bone—a metacarpal, for instance—may gradually assume the shape of a spindle. Syphilitic dactylitis may produce the same distention; this latter inflammation, which is usually a result of inherited syphilis, most often involves one of the first phalanges.

The deposit of tuberculous material in bone may or may not present all the ordinary appearances of a focus of tuberculous disease. It may undergo caseation, or it may, as it usually does, soften and liquefy. Some suppuration is probably always present, but this varies greatly in degree. In the caries of children it is almost always a feature. Pott's disease, for example, is accompanied by the formation of so-called "cold abscesses" of varying size, and the pus starting from the disintegrating bone follows a downward course, governed by gravity and the path of least resistance, and may finally find an exit for itself upon the surface. Or, in cases with less discharge, the pus may become cheesy, its ensheathing connective-tissue covering may undergo a change into calcareous material, and the abscess may never descend far from the diseased vertebral bodies which gave it origin. Such an abscess may be discovered only at the autopsy.

In elderly individuals the formation of granulation tissue and a slow advance of the disease, with but slight discharge—a "caries sicca"—are generally to be expected.

Tuberculous osteitis may occur at any age, but it develops more commonly in early childhood than at any other time. Its onset is usually insidious. The patient may, after a time, complain of a little tenderness or aching after exertion. Later, some swelling of the bone may perhaps be noted. The skin is not involved at first; after several weeks—possibly months—it becomes distended, looks inflamed, breaks down at one or several points, and gives exit to pus. This pus varies in consistency, and is sometimes gritty to the feel, containing minute spicula of bone. A probe introduced may—if the sinus be moderately straight—touch bare bone, and may by moderate pressure be made to fix itself firmly in the cancellous tissue; this could not be done in the case of the compact sequestrum of necrosis. The lips of the sinuses and their walls soon become lined with flabby, inactive granulations, in which the bacilli are sometimes to be discovered. Meanwhile the patient may be subject to more or less fever, night sweats, and similar signs of vital depression.

By extension a caries may involve an adjacent joint, with resulting "white swelling" and all the manifestations of tuberculous osteo-arthritis. Or, conversely, a primary joint tuberculosis may lead to erosion of the articular lamella of the bone, and then to tuberculosis of the cancellous tissue.

Caries commonly, though not invariably, makes its ap-

pearance in individuals of the so-called scrofulous diathesis—*i. e.*, those who are especially subject to affections of the glands, skin, and mucous surfaces. Often a family history of tuberculosis may be obtained, or it may be learned that the parents died from some unnamed lung trouble. The patient is apt to be pale and anæmic in appearance, although this is not always the case. In adults the bone disease is sometimes a reappearance of inflammation which existed there for a time during childhood, and then remained for years quiescent.

At any stage in its progress the disease may come to an end, and reparative processes of varying degree begin. Caries does not necessarily go on to the complete destruction of all the cancellous bone involved. If the patient's general condition can be improved, so that the vitality of the bone is enabled to resist the encroachment of the tuberculous disease, suppuration may cease, fistulous sinuses close, and new bone form to some extent. This is the rule in Pott's disease. The bodies of one, two, or sometimes more vertebrae melt away, the comparatively sound bodies above and below come in contact, and if the patient continues to live, as he commonly does, the disease is brought to an end, and the vertebral bodies near the focus of the disease, but which have escaped, unite by firm bony union. In some bones—the calcaneum for example—there is very little tendency to bony repair. The space once occupied by bone becomes partly filled by simple connective tissue.

It is important to bear in mind that a mere local bone tuberculosis may at any time give rise to a general tuberculosis. Although such a catastrophe is quite exceptional, it does sometimes occur. Therefore, when it is possible to remove by surgical means the diseased bone, it should be done. It has even been suggested, of late, that in spinal caries an attempt be made to scoop away the diseased tissue and thus hasten recovery; if need be, resecting one or more ribs to allow thorough work. But whether this become a recognized practice or not, in all readily accessible regions the proper treatment consists in the free use of Volkmann's sharp spoon; the most thorough work under these circumstances being always the best. As with suppurating tuberculous lymph nodes, so here this treatment may save months of effort on the part of nature to remove the tuberculous deposit.

It goes without saying that surgical cleanliness must be strictly observed during and after the operation.

It is to be expected that, in many instances, one such scraping will not suffice entirely to put a stop to the disease. Perhaps the step may have to be repeated a number of times before all the affected tissue is reached and eliminated. During the dressing of bones or of sinuses which have been operated upon for caries, iodine should be our main reliance. In irrigation we may wisely employ a one- or a two-per-cent. solution of the compound tincture, which does not precipitate as does the simple tincture upon dilution with water. This strength will stain the tissues a yellowish hue.

The gauze used for packing and drainage should be first moistened, and then well rubbed with some one of the numerous powders which depend for their value chiefly upon the iodine which they contain—such as (in order of strength) iodoform, iodol, nosophen, aristol, and europhen. The author rather inclines to aristol, and considers it practically as effective as iodoform without the objectionable odor of the latter.

In obstinate cases of caries, after the vigorous use of the sharp curette or gouge, it is well to cauterize also, before beginning the iodine treatment. Perhaps the application first of pure carbolic acid and then of strong alcohol is as effective a measure as any that can be adopted. The severity of this procedure may be easily regulated by shortening or protracting the time during which the pure acid is allowed to remain in contact with the parts before the neutralizing action of the alcohol is brought to bear upon them.

The prognosis in children, after such thorough treatment, is fairly good. In adults it is distinctly more difficult to eradicate the disease completely. In the tarsal

bones, for example, it is questionable whether in adults it is not wiser to excise entirely the affected bone or bones in order to prevent a relapse.

When despite thorough local treatment the disease extends and perhaps involves an entire extremity, amputation at some distance above may be our only remaining resource.

Regarding medicinal treatment, cod-liver oil, iron, and good nourishment are to be administered in the hope of improving the general condition. In the phlegmatic temperament cold bathing daily is of more value than the oil. These means, however, will not remove the bacilli from the bone marrow. They are merely useful adjuvants to the proper local treatment.

Robert H. M. Dawbarn.

OSTEO-ARTHROPATHY, HYPERTROPHIC PULMONARY. See *Arteromegaly, and Hands and Fingers, etc.*

OSTEOCHONDROMA. See *Chondroma.*

OSTEOMA.—An osteoma is a tumor consisting of bone tissue.

Not every bony new formation is an osteoma. The bones occasionally found in the deltoid muscles of infants, caused by the pressure of the rifles, and the "riders' bones" forming at the attachment of the adductor longus in cavalrymen are not true tumors, nor is the new formation of bone at the site of a fracture an osteoma, even though the callus formation be exuberant. A true osteoma may, however, arise from a callus. Furthermore, inflammatory new growths are not true tumors. Thus the newly formed bone around a sequestrum in osteomyelitis, and the osteophytes, periostoses, and hyperostoses resulting from ossifying periostitis are inflammatory new growths and not osteomata. It seems probable that the so-called "osteomata" of the choroid and vitreous should be looked upon as inflammatory new growths. The absence of sufficient, evident etiological factors and the purposeless character of the new growth are to be emphasized as two important criteria of osteomata.

Osteomata are most usually found in connection with bones. Either long bones or flat bones may be affected. In the long bones the tumors are especially apt to arise near the epiphyseal lines. As a rule the bony tumor is formed from a connective-tissue periosteum, after the manner of the cranial bones; less often the osteoma is formed by the transformation of cartilage, while osseous tumors in other tissues are less common, being found occasionally in the membranes of the brain and cord, in tendon, ligament, muscle, in the mammary, parotid, adrenal, thyroid, or prostate gland, in the tracheal mucosa, pleura, or lung, and rarely in the skin. Osteoma in the corpora cavernosa is rare.

In addition to simple osteomata, bony tissue is also found in the mixed tumors of the parotid and testicle, in osteosarcomata, osteochondromata, etc.

Osteomata may be single or multiple. "Cortical osteomata" or "exostoses" are bony tumors on the surface of bone; a "central osteoma" or "enostosis" is a bony tumor in the interior of bone. A "continuous osteoma" is directly continuous with bone; a "discontinuous osteoma" is separate from adjacent bone. "Dental osteomata" spring from the cement substance of the teeth; "subungual exostosis" is employed to designate the osteoma occurring beneath the nail of the great toe.

There is much confusion in the use of the terms "exostosis," "enostosis," or "endostosis," "hyperostosis," "periostosis," and "osteophyte." Although it is customary to give the termination "oma" to all tumors, the use of "exostosis" and "endostosis" to designate certain osteomata is so common that it seems necessary to continue to employ these terms. The terms "osteophyte," "periostosis," and "hyperostosis," however, should be applied only to the inflammatory new formations of bone, such as occur in ossifying periostitis. Since certain true tumors are called "exostoses" and "enostoses,"