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 vertebræ. 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 vertebræ 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 trabeculæ 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 appearance 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 vertebræ 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 *Acromegaly*, 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 infantrymen, 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,"

it would be well if these terms were not applied to other bony growths, but, in addition to their more limited significance, the terms are generally applied to almost any irregularity on or in bone. In this article, "exostosis" signifies an osteoma situated on the surface of a bone; "enostosis," an osteoma situated in the interior of a bone.

Osteomata have in the main the structure of normal bone, though they have not the regular architecture of the trabeculæ, nor the typical arrangement of the vascular and medullary canals and bone corpuscles.

Virchow classified osteomata according to their structure as osteoma eburneum, osteoma spongiosum, and osteoma medullosum.

"Osteoma eburneum," or "eburnate osteoma," or "ivory exostosis" is a tumor consisting altogether or for the most part of dense osseous tissue. In this form the tumor is made up of nearly parallel or concentric branching layers of compact bone, containing possibly a few small vessels, and covered by a connective-tissue periosteum. The number of bone corpuscles is usually not great.

"Osteoma spongiosum," or "spongy osteoma," consists of looser, cancellous bone. In the spaces between the trabeculæ there may be marrow.

"Osteoma medullosum," or "medullary osteoma," has an outer shell of compact bone covering cancellous bone and a central marrow cavity, the tumor having the structure of a long bone. At times the marrow cavity composes the greater part of the tumor. The marrow in the osteomata may be either normal red or white marrow, or a myxomatous change may occur, such as is seen in osteomalacia, etc.

The eburnate osteomata are more frequently found on the bones of the head than elsewhere; they are usually multiple, rarely attain a greater diameter than 1 or 2 cm.; and occur as small, flat, rounded outgrowths from the bones. The eburnate osteomata of the orbit and frontal bone, and the osteomata occurring near the epiphyses of the long bones may grow to the size of a man's fist or larger. These tumors have a very rough, irregular surface; they may be very firmly or loosely attached to the bone. The multiple osteomata of the dura and arachnoid are small and very rough and spiculated. The multiple osteomata of the skin are the smallest medullated osteomata. They occur as platelets the size of a grain of sand in the cutis or subcutaneous tissue. Skin osteomata are more common in old people.

It is at times impossible to tell where normal bone ends and osteoma begins; in other cases a slight attachment gets severed, the osteoma becomes necrotic, and is discharged as a foreign body. This has happened in the case of some of the tumors arising in the diploë of the frontal bone.

The tumor formed from cartilage, "osteoma cartilaginea," is covered by a more or less incomplete layer of cartilage. These tumors are found on the long bones, especially on the humerus, tibia, and femur. They may be progressive and form tumors as large as a man's head. In the early stages they are usually made up of compact bone; later they may be spongy. It is often impossible to distinguish between osteomata of cartilaginous origin and ossifying enchondromata.

The following are the chief etiological factors:

1. Misplacement of embryonal bone elements. Although formerly it was considered the most important factor in the etiology of tumors, the tendency of the present day is to attribute importance to this factor only in those rare cases of multiple osteomata which are present from birth.

2. Post-natal disturbances of development are supposed to be of much more importance. Under this heading rachitis is of special interest. It is supposed that, as a result of the irregular growth which takes place in rachitis, small bits of cartilage are nipped off and come to lie behind the growing line of the bone. These islands for some unknown reason develop into enchondromata or osteomata. Usually osteomata arising in this manner are multiple. According to Otto Müller, this post-natal misplacement of cells is most apt to occur in cases of recurring rachitis. Müller traces the different possibilities which may result from misplacement of these cartilaginous elements. The focus may disappear, or persist unaltered, or it may persist as a tumor-like centre without sufficient vitality to cause it to grow; the focus may develop into a chondroma, or an osteoma; into a rapidly growing myxo-enchondroma, or into a malignant tumor (chondrosarcoma, etc.).

3. Trauma is a factor in the production of some osteomata.

4. Heredity has been observed to be of etiological importance quite often. Reinecke collected from the literature thirty-six cases of multiple osteomata which occurred in families. In one instance the condition was transmitted through five generations; in two instances to the fourth generation; in fifteen instances to the third generation; and in twelve instances to the second generation. It has been observed that the inheritance is more common among the male members of a family. Inheritance is of importance chiefly in connection with multiple osteomata.

5. An osteoma may arise secondarily. In the case of some of the osteomata of the membranes of the brain and cord it appears that a soft, fibrous tumor of the arachnoid may impinge upon the periosteal dura mater, and a new growth of bone from the dura may then replace the fibrous tumor.

6. The opinion which prevails at the present time is that the osteomata arising in gland, muscle, lung, tracheal mucosa, etc., are best accounted for on the hypothesis that they arise from a metaplasia of cells.

7. It must not be forgotten that heredity, trauma, disturbances of development, etc., are of themselves not sufficient to account for the presence of osteomata, and in every case there is some unknown influence at work, which gives the decisive impulse to tumor formation.

Diagnosis.—An osteoma is a painless, benign, slow-growing tumor, usually small, in most cases arising from bone, appearing, as a rule, during childhood or early youth, that is, during the developmental period of bone. The tumors are seldom seen in very young children, and are rare after the third decade. Tumors found in older people have their origin earlier in life. The growth of osteomata is slow and ceases after middle life. The exostoses at the epiphyses do not enlarge after the growth of the skeleton is complete. Osteomata occur more frequently in males than in females. The tumors are sometimes symmetrical, as in the nasal osteomata. The position, the consistence, and the features that have been mentioned will usually give the basis for a diagnosis. It is often difficult to distinguish between "dental osteoma," which arises from the cement substance and is found at the root of the tooth, and "odontoma," which arises from the dentin and may be found also on the shaft or crown of the tooth.

Prognosis.—All osteomata, even the progressive osteomata, are benign. This of course does not apply to the mixed tumors containing bone. No osteoma is dangerous except as a result of its pressure upon neighboring parts. The frontal or orbital osteomata may press upon the brain or eye; an osteoma of the pelvis may obstruct labor; an osteoma may press upon vessels or nerves, or the skin over the tumor may be injured and a chronic ulcer result.

Unless treatment is indicated to relieve pressure, the tumor should not be attacked.

Treatment is altogether operative. Owing to the firm attachment and dense structure of some osteomata, it is often difficult to remove them without injury to the adjacent soft parts. *Harry T. Marshall.*

OSTEOMALACIA.—(Synonyms: Mollities ossium; malacosteon; halisteresis ossium.)

Pathology.—Under this name is recognized a disease in which an unusual softening of fully formed, hard bone develops; this softening being followed by great deformity of those bones upon which strain is placed, either by the action of muscles or by the mere weight of the body. The softening is caused by an insufficient amount of inorganic salts. Whether this insufficiency of salts is due to absorption (decalcification) or to failure of calcification during the regeneration of the bone, has not been fully determined. Recent investigations seem to indicate that both processes go hand-in-hand. By the absorption of the calcareous matter in the bones the medullary substance encroaches upon the bone. Two forms of the disease have been distinguished—viz., osteomalacia cerea, or waxy osteomalacia, in which the whole shaft is softened and consequently bends like wax; and osteomalacia fragilis, or brittle osteomalacia, in which the inner portion of the bone is affected, and there remains a thin bony shell which is very liable to fracture.

In the spongy parts the process starts in the medullary spaces, and in compact bone from the periphery of the Haversian canals; in the latter case the affected area constitutes a margin of bone in which the calcareous salts are absent, although it still retains its connections with the calcified portions. The limits between the decalcified and the normal bone may be quite regular, or they may present an irregular or even a zigzag outline. The affected margin of bone stains red in Van Gieson's mixture. At first, when the salts of lime begin to disappear, the basement substance still presents a finely fibrillated or a homogeneous appearance, with the original lamellation still preserved; but after a time the decalcified tissue may disintegrate and be absorbed, its place being occupied by new-formed marrow or granulation tissue. The canals either disappear or persist as small, oval vacuoles. The canaliculi along the softening margin become irregularly widened and enlarged, and appear like "latticework" spaces, star-shaped and feathery. Large and small smooth-walled cysts may be found in decalcified areas; they are filled with mucoid material, resulting from the enlargement of the Haversian canals and spaces, and they may extend into the marrow itself. Canals perforating the bone trabeculæ also appear in considerable numbers, but osteoclasts and Howship's lacunæ are not present any more numerously than in normal growing bone.

The marrow is variously changed. In some places it is yellowish and fatty, in others it contains reddish lymphoid tissue with giant cells, while in still other places there are gelatinous areas. It may also contain cysts. Constant and characteristic changes do not occur; in fact the marrow may even become quite fibrous. Some areas are very anæmic while others are distinctly hyperæmic. Pigment and hemorrhages are frequently found in the marrow, and there may be a great accumulation of small spheroidal cells.

The periosteum is thickened in many places and has a fibroid structure with few nuclei. When it is stripped off, the underlying bone is found to be rough, and often is perforated by openings from which marrow escapes.

Simultaneously, or subsequently, there takes place a more or less extensive formation of new osteoid tissue, which in many instances is excessive, and which for the time being may remain uncalcified. This new tissue is produced by the osteoblasts, and may be quite dense and contain only fine spaces; it may present a lamellated appearance, or more frequently an interwoven, fibrillated structure, with large corpuscles. This new tissue is formed most extensively at points of flexion and of fracture of the softened bone; the callus formation may be prolific, but it is not followed by perfect calcification. It also forms to an excessive degree at the points where the bone is exposed to mechanical strain, *i.e.*, where strong muscles, tendons, and ligaments are attached. This new-formed osteoid tissue is easily distinguished from decalcified old bone, as it contains larger, better formed cells.

Owing to the softness and pliability of the bones which are acted upon by the superimposed weight, by the resistance of ligaments, and by the traction of muscles, there is sure to be produced a series of deformities. These consist of curvatures of the spine, sternum, ribs, and long bones, of partial and complete fractures of various bones, and of contractions and alterations of shape of the pelvis. Fractures refuse to unite properly and false joints result; or if they do unite, angular deformities occur.

The chest is flattened laterally, its antero-posterior diameter increased, and the ribs and sternum are much distorted. Softening of the clavicle allows the weight of the limb to rest on the thorax, and a corresponding depression in the wall of the chest results. The bones of the arm are usually fairly free from marked deformity, owing to the absence of pressure. The lower ribs may come into contact with the crests of the ilia. The spine is variously altered. The normal curves may be accentuated, or new ones produced. In some cases there is a simple curve of the column backward, a condition of kyphosis; or this may be accompanied by a compensating curve inward in the upper part of the column, or the curves may be exclusively lateral. For this reason the stature of the patient is much decreased.

The abdomen bulges and is very prominent. The deformities in the pelvis are characteristic. The iliac bones may yield when pressed together, and spring back when released. The pelvis is usually very flat, the promontory being on the same plane as the pubis and pressed forward and downward. The sacrum is strongly curved longitudinally, the apex being turned forward. The acetabula are pressed inward and approximated, the ascending branch of the pubis being bent inward. The pillars forming the pubic arch are also pressed inward and approximated, so that the symphysis pubis protrudes forward in a beaked form. The tuberosities of the ilia are brought nearer to each other, and may even come in contact. The brim of the pelvis has the shape of the letter Y. In some cases, in consequence of these deformities, the cavity of the pelvis may be reduced so as scarcely to allow the passage of the natural evacuations through it.

The early deformity of the bones of the lower extremity consists in an exaggeration of the normal curves of the bones, but in the later stages there will be bends and twists which are due to the traction exerted by certain muscles. Fractures at the angles are frequent. Imperfectly healed masses of callus are found about these points of fracture, and these contribute greatly to the deformity of the bone. In the femur, as a rule, the greatest deformity is found in the angle of the bone just beneath the great trochanter. The pressure of the body above causes the bone to give way at this point, so that the trochanters may be higher than the head of the bone. It is characteristic of the puerperal form that the bony changes almost always begin in the pelvis, and from here advance upward upon the spinal column; while in the other form of the disease, which occurs in both men and women—after the puerperal period in the latter,—the disease usually begins in the lower extremities. In order of frequency the various bones are affected as follows: most frequent of all is the pelvis, next the sternum, then the upper extremities, and lastly the lower extremities. While the proportion of inorganic to organic matter in normal bone is about two to one, this is reversed in osteomalacic bone until the proportion is as one to two. The nervous system is found post mortem to be free from gross lesions, but histo-pathological examination has revealed in the cord organic changes which appear to begin in the cells of the anterior cornua. These are not inflammatory in character, and clinical evidence shows that they are capable of repair.

The weakened muscles show, post mortem, fatty degeneration, multiplication of nuclei, and other changes similar to those observed in progressive muscular atrophy. The chest and abdominal organs usually are not altered.

The urine presents no characteristic changes and is of little importance for diagnostic purposes. The presence of lactic acid in the urine cannot be regarded as proven. The same holds true of albumose. In some cases the excretion of lime salts has been very great, leading to the formation of gravel and small calculi. Albumin has been found in some cases.

The microscopical examination of the blood is of no

importance in the matter of diagnosis. Under various conditions there may be a slight increase in the eosinophile cells in the blood, but variations in the number of these are not an uncommon occurrence in normal individuals.

The ovaries have been thought to have an influence on the disease. In some cases of osteomalacia they were found in a hyaline condition, in others in a fibrous or other pathological condition, but in many they were perfectly normal. Perhaps the ovarian internal secretion plays a part of some importance in the chemistry of the organism. Removal of the ovaries has seemed in a number of cases to have been followed by a surprisingly beneficial result.

Etiology.—The real cause of this remarkable affection is unknown. It is a singular fact that the disease is much more frequent in certain regions than in others. It is very common along the Rhine and in Westphalia, in Eastern Flanders, in Schütt Island in the Danube, and in Northern Italy. This suggests that there is some specific cause for the disease, endemic in certain localities. It is in addition found occasionally in almost every country in Europe, but in North America Dock was able to collect records of only ten cases. It is mainly a disease of adults, occurring between the thirtieth and the fortieth years, but it may exceptionally be found later or earlier in life. The disease attacks females almost exclusively during the child-bearing period. Isolated cases have been found in men, but are extremely rare. Among exciting causes, child-bearing is certainly the most important, for both the first signs of osteomalacia and also fresh exacerbations of the disease usually date from a pregnancy. It has, however, been found in women who have never had children, and it may begin after the menopause. The relations of osteomalacia to the sexual processes are so close that there is some justification for the supposition that osteomalacia is directly dependent for its development upon disturbances of metabolism in the ovaries.

Individuals in all classes of society may be affected, but the disease appears to be favored by damp and unsanitary surroundings. Various theories have been put forward to account for the disease, but none of them is satisfactory. Lactic acid has been found in the bones, and the solution of the lime salts in the bones has been attributed to this substance. It has, however, been conclusively shown that the acid may be in excess without producing the disease, and efforts to cause the malady in the lower animals by feeding them with lactic acid have signally failed. Micro-organisms again have been carefully searched for, but with no constant result, and there is no ground for believing that bacteria are instrumental in producing this condition. Fehling's theory is that there is a trophoneurosis, due to reflex irritation from the ovaries, and the remarkable results of castration in osteomalacia seem to confirm this theory; but while the facts cannot be doubted, there is a growing tendency to question the theory. In some cases in which recovery followed the operation of castration, no abnormality could be discovered in the uterus, ovaries, or vessels. The disease has also been attributed to affections of the nerve centres, but anatomical observations on the nerve centres are very scanty and inconclusive. Virchow asserted that the disease was of an inflammatory or hyperæmic nature, but study of the bones gives rise to strong doubts about the validity of this theory.

There are on record a number of cases in which, while the symptoms were somewhat similar to those of osteomalacia, multiple myeloid tumors were found in the bones. In osteomalacia the bones are softened, owing to the removal of the earthy salts by absorption. In multiple myeloma the osseous tissue undergoes atrophy without at the same time being changed in its chemical composition. The atrophy, in this case, is due to the development of a new growth in the marrow spaces and to its spread outward, causing absorption of the hard parts of the bone, and ultimately leading to fractures and deformities. There can be no doubt that cases of multiple myeloma have been confounded with osteomalacia, but they are distinct conditions, and not dependent in the slightest degree on each other. According to Bradshaw, the cases of multiple myeloma may be divided into those with and those without albumosuria. Of these latter there are seven cases in the literature. The first case of this albumosuria was reported by Bence Jones in 1847. Most of these cases were considered to be osteomalacia, and were supposed in some way to depend on the albumosuria; hence the origin of the theory that osteomalacia was due to an albumosuria. This view, it is needless to say, is incorrect, for it has been shown that they were not cases of true osteomalacia at all, but the albumosuria occurred in persons affected with multiple myeloid tumors of bone. The Bence Jones albumose has never yet been found in a case of pure osteomalacia. This condition, known as multiple myeloma, has been variously designated in the literature, some calling it sarcoma, others (*e.g.*, Marchand) calling it "general marrow hyperplasia with disappearance of the bone substance." Schönenberger reports a case of osteomalacia in which there were found, as complications, multiple giant-celled sarcomata and multiple fractures.

Hirschberg reports a similar case, as does also von Recklinghausen. The publication of all these cases seems to render improbable the theory of the neoplastic origin of osteomalacia.

Symptoms.—In the beginning the disease is obscure; it starts very gradually, in most cases, with an ill-defined, deep-seated pain, most often felt in the sacral region of the back, in the pelvis, and down the thighs, and at times even in the legs. Pressure seems to increase the pain. This pain is more or less constant and persistent, is increased by movements, and is usually diagnosed as rheumatic. An important feature of the pain is that it usually starts in the latter part of pregnancy, ceases after delivery, and recurs with subsequent pregnancies. While the pain continues, motion becomes gradually impaired, and there is more and more difficulty in walking, partly because of the pain and partly because of the muscular weakness. This weakness in the muscles of the thigh and pelvis may be present before any bony deformity is discoverable.

Attacks of painful spasm are often present, particularly in the adductors of the thigh. Owing to weakness of the ilio-psoas muscle as well as to deformity of the pelvis, the trunk is thrown from side to side to enable the foot to clear the ground in walking, and thus a peculiar waddling gait results. In other cases the steps are short, slow, uncertain, and almost hobbling, the lower limb and pelvis being jerked forward as if they were one piece. There is tremor of the muscles, the knee jerks are increased, and ankle clonus often is present. After a longer or shorter time walking becomes absolutely impossible, and the patient is permanently bedridden. Even then severe pain persists in most cases, often spontaneous in character and much increased by pressure of bed clothes, etc.

While these symptoms are going on, various distortions of the body occur, sufficient to cause a decided alteration in the appearance of the skeleton. Deformity of the spinal column is usually the first to be noticed. As a rule, there is kyphosis, less often some other deformity, and the head generally becomes more and more bent on the sternum, resulting in the patient growing decidedly shorter. This may help in diagnosis because the patient is apt to remark that she has to keep shortening her gown in front. If the patient becomes bedridden early in the disease then the extremities become less distorted and are less often fractured. The softened bones are usually painful when pressed upon, and they may bend under pressure. The bones of the face and skull are almost never involved. The thorax becomes barrel-shaped and pressed together laterally, so that the sternum has an almost horizontal position. The abdomen becomes very prominent. The teeth become carious or are lost. The pelvis is deformed as described above. In the muscles several observers have noticed trembling and

fibrillary contractions, also paresis and sometimes complete paralysis. In a few reported cases the softness of the bones of the extremities was so extreme that one could bend the limbs at will, like wax, and give them the most extraordinary positions.

The internal organs perform their functions well for a long time, and the appetite remains good. Fever is observed only when the disease is undergoing some marked temporary exacerbation. With regard to changes in the urine, it is a fact that a great many statements have been made, but their significance is extremely doubtful. It is said, for example, that the amount of phosphoric acid excreted is diminished. With regard to the amount of lime, no definite statement can be made. Lactic acid has been repeatedly detected in the urine, as has also albumin. Concretions of lime have been found in the bladder and the kidneys. Microscopical examination of the blood gives no aid in diagnosis. Neusser has found myelocytes and an increase of eosinophile cells in the blood in some cases; but these results in general do not seem to have been confirmed by other observers. Women affected by the disease are said to be more fruitful than others. Eisenhart found the average number of children born in Germany to be 3.9, whereas it was 6.4 in the sufferers from this disease; abortion is also more frequent.

Prognosis.—The course of the disease is a chronic one, most cases lasting for years and undergoing remissions and exacerbations. Pregnancy has a very deleterious effect, always lighting up a fresh attack. The prognosis now is much better than it was twenty-five years ago. We know that the disease is curable in some cases, and we have gained considerable control over it by medical and surgical means. The most important part of the treatment depends upon the possibility of preventing conception. The more frequent termination of the disease, however, is in death, after a duration of time seldom less than two or three years, although in some cases this event may be postponed for five, ten, or even a greater number of years. Death results either from general debility, or, more often still, from the dyspnœa caused by the compression of the lungs, or by some such disease as lobular pneumonia. Death sometimes occurs in labor and is then due to the rupture of the uterus, or it follows one of the more or less dangerous operations for the extraction of the child.

Diagnosis.—This is somewhat difficult to make in the sporadic cases in the early stages. It is almost always called rheumatism, on account of the pains which are located in the pelvis and lower extremities, and which are made worse by bad weather. More careful examination and a rigid inquiry into the history will elicit points—such as sensitiveness of the pelvic bones to pressure, increased knee jerks, and muscular weakness, etc.—from which a diagnosis may be made. At the outset the symptoms may suggest incipient disease of the cord or of the vertebræ. Strümpell mentions the fact that he has repeatedly seen cases in which women, as a sequel to pregnancy or even apparently spontaneously, have developed paresis in the lower extremities, particularly in the psoas and iliacus muscles, associated with pain and exaggerated tendon reflex, and in which diagnosis at first was very difficult. At any rate, it is important to know that even before there are demonstrable changes in the bones there may be paralysis, probably due to an early involvement of the muscles in the morbid process. As soon as bone tenderness and deformity arise, the diagnosis is rendered easier.

From peripheral nervous diseases osteomalacia is distinguished by a careful examination of the bones. In the latter disease the tendon knee reflexes are increased, while in almost all peripheral nervous lesions the tendon reflex is diminished or entirely abolished.

Not very infrequently the complaint of the patient at the start is regarded as hysterical.

As the disease is almost entirely confined to adults we are seldom in danger of confounding it with rachitis. In addition, osteomalacia does not produce swellings of the epiphyses or changes in the bones of the skull. Examinations of the urine and blood do not help us in diagnosis.

There may be difficulty in differentiating the disease from malignant tumors of the bone—for example, from primary sarcomata and especially from diffuse carcinomatous infiltration of the bones, and there is little doubt that the older writers confounded these conditions with osteomalacia. According to Köhler, who carefully investigated cases of the latter type, they are to be distinguished from cases of osteomalacia, first, by the fact that the growths occur only in the bones of the trunk, and second, by the absence of muscular weakness and of any unnatural elasticity of the bones. In multiple myeloma the disease mostly occurs in men in the latter half of life, the bones of the thorax are those chiefly affected, the patient is able to leave his bed until near the end, deformities are not extreme, and fractures are common.

Treatment.—If the case be seen early in pregnancy, in view of the gravity of the labor and the bad influence of pregnancy upon the disease, abortion should be produced if the fœtus can easily be removed by the natural way.

The patient should then occupy a dry, sunny house, and should be put on a very substantial diet, of which milk should form a large part. The chief remedial agent is phosphorus, one-twentieth to one-fifteenth of a grain three times a day. Extract of red bone marrow, a tablespoonful three times a day, is also highly recommended. Others advise the administration of cod-liver oil, quinine, arsenic, etc. Above all things subsequent pregnancies must be avoided. Phosphorus seems to be the most efficient drug and produces at times strikingly good results.

If a woman becomes affected with osteomalacia during the nursing of a child, this must be at once stopped, as it is found to exert an injurious effect upon the disease.

If in spite of all treatment, diet, etc., the disease progresses, recourse should be had to surgical means—*i.e.*, the ovaries should be removed, or, what is probably better, a Porro operation—supravaginal amputation of the uterus—may be performed. Either of these operations fulfils two conditions, viz., it prevents further pregnancies and apparently often arrests the disease. Improvement sets in sometimes surprisingly early, the pains being relieved within forty-eight hours. Many from being bedridden recover so far as to walk and perform their ordinary duties. Of 44 cases collected by Baumann in which Porro's operation was performed, 18 died and 26 recovered. Of the latter, 3 died from other diseases, and 2 were lost sight of. Of the remaining 21 cases, 17 were cured or markedly improved. Finley collected the histories of 40 cases, and the after-histories of 16 of these were traced; 12 of these were cured and 4 improved.

If a case be seen late in pregnancy, the procedure to be adopted will then depend on the degree of the deformity. If this be slight, then premature labor may be induced. If, however, it be very great, Cæsarean section should be done. If the patient be found in labor, the procedure will likewise depend on the condition which is found on examination. If it is found that the child will be able to pass with some help, we may use forceps; or if it may pass after some reduction in size we may perforate, crush the head, and extract the child. Even this latter may not be possible, and we are then forced to perform Cæsarean section. In case this is done the ovaries should be removed, or hysterectomy performed, so as to prevent future pregnancies, and also in order favorably to influence the disease. What the relation between the ovaries and the disease may be is at present inexplicable. We know that there is a close connection between the various processes of nutrition and certain organs of the body. This has been shown in the case of the pancreas, the thyroid, and other glands, but what the influence is, or how much is exercised by the ovaries, is entirely conjectural.

Clarence Arthur McWilliams.

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OSTEOMYXOMA. See *Myxoma.*

OSTEOPOROSIS. See *Atrophy.*

OSTEOPSATHYROSIS.—This term is used in a general sense to designate the condition of excessive brittleness of the bones, and is practically synonymous with *fragilitas ossium*. It may occur as the result of senile or cachectic atrophy, prolonged activity, pressure atrophy, neuropathic atrophy in such diseases as paralytic dementia, locomotor ataxia and syringomyelia, and in syphilis, leprosy, osteomalacia, and rachitis. In rare cases the condition appears in an idiopathic form, apparently of congenital origin, and may be inherited. The etiology and pathology of this form are unknown. Senile osteopsathyrosis is the result of the old-age osteoporosis. The skeleton as a whole, or only certain portions, may be involved. The bones usually become fragile and are easily broken; but in other cases the bones lose their lime salts to such an extent that they may be easily bent or may be cut with a knife. A similar condition may occur in the cachexia of various chronic diseases. In syphilitic infection of long standing and associated with marked cachexia, there often occurs a marked osteopsathyrosis of the long bones and also the bones of the cranium. In the great majority of syphilitics there is an increased fragility of the skeleton. In leprosy there is found in a certain class of cases a very characteristic osteopsathyrosis (leprous osteomalacia) affecting chiefly the bones of the hands and toes. The phalanges, one after another, may be affected until all the fingers and toes are destroyed, or they may be irregularly involved. (See also *Bones, Osteomalacia, Leprosy, Syphilis, Atrophy,* etc.)

Aldred Scott Warthin.

OSTEOSARCOMA. See *Sarcoma.*

OTTAWA, CANADA.—Ottawa, the capital of the Dominion of Canada, is situated upon the river of that name, in the eastern part of the Province of Ontario, about one hundred and ten miles west of Montreal. It has a population of about fifty thousand, and is the centre of a large lumber traffic. The extensive government buildings are noteworthy for their architecture and material; and in the vicinity are various points of scenic interest—the Chaudière and Rideau Falls, and the Rideau Canal with its series of locks. A journey down the Ottawa River to Montreal (ten hours) is one of great interest, and affords constant views of imposing scenery. The climate is a cold one, comparable with that of northern New York and New England; the winters are long and there is much snow.

The accompanying chart will indicate the various climatic features. *Edward O. Otis.*

CLIMATE OF OTTAWA. LATITUDE, 45° 26′ N.; LONGITUDE, 75° 41′ W.—PERIOD OF OBSERVATION, FOURTEEN YEARS (BROKEN PERIODS).

	January.	March.	June.	August.	October.	Spring.	Summer.	Autumn.	Winter.	Year.
Temperature, Degrees Fahr.—										
Average or normal	10.6°	20.5°	64.9°	65.7°	45.0°	38.3°	66.4°	43.9°	12.7°	40.3°
Average range	18.3	16.5	19.8	18.9	18.5					
Mean of warmest	35.3	43.2	76.2	79.9	62.9					
Mean of coldest	17.0	26.7	56.4	61.0	44.4					
Highest or maximum	53.1	55.1	96.3	98.5	80.4					
Lowest or minimum	−33.0	−32.0	34.7	34.1	17.0					
Humidity—										
Average relative	88%	83%	72%	77%	82%	74%	75%	82%	88%	80%
Precipitation—										
Average in inches (rain or snow)	2.81	3.02	2.08	1.81	2.73	7.13	5.79	7.84	8.64	29.40
Wind—	NW. & NE.		W., E.	W. NW.	NW., E.	NW., E.	W., E.	W., NE.	NW.	NW. & NE.
Prevailing direction		NW.								
Average hourly velocity in miles	8.1	7.5	4.9	3.8	5.1	6.6	4.2	5.4	7.6	6.0
Weather—										
Average number of clear days	7.5	7.5	10.7	12.3	6.5	27.0	31.0	18.7	17.9	94.6
Average number fair days	10.2	9.2	13.7	13.3	9.7	32.7	41.0	33.2	27.7	134.6
Average number of clear and fair days	17.7	16.7	24.4	25.6	16.2	59.7	72.0	51.9	45.6	229.2

OUABAIN.—This name has been applied to at least three distinct glucosides, by different chemists, under the impression that they were identical, all derived from African arrow poisons, or from the substances used in their manufacture. The name was derived from "Ouabaio," "Wabei," or "Wabajo," in relation to the Indians who used the arrow poison referred to. Fraser, in order to eliminate this indefiniteness, proposed for one of these substances, that generally employed, the name *Acocantherin* ($C_{30}H_{46}O_{12}H_{26}O$). It is derived from a species of *Acocanthera*, almost certainly *A. Schimperi* (A. DC.) B. et H. (*Carissa S.*, A. DC., fam. *Apocynaceæ*), though the present article of commerce is believed to be derived chiefly from a species of *Strophanthus* ("*S. glaber*"), of the same family. This glucoside occurs in colorless, transparent plates, if crystallized from water, or in fine tufted acicular crystals, if from alcohol. Nearly one per cent. dissolves in water and nearly two and a half per cent. in alcohol, but it is insoluble in ether and chloroform. The aqueous solution is tasteless. Sulphuric acid turns it red, afterward becoming green. Its primary effect is to slow and strengthen the heart. If the dose is very small, there is little effect upon blood pressure; if large, the latter is greatly increased, apparently through the vaso-motor effects. It powerfully stimulates unstriped muscle. In toxic doses it is an extremely active poison, 5-10 mgm. producing death in animals in a very short time. It is estimated that gr. $\frac{1}{65}$ introduced into the blood of man, would prove fatal. There is an early rise of blood pressure accompanied by increased cardiac action, which is followed by weakened contractions of the heart, rapid pulse, and paralysis of the vaso-motors. For further reference to the physiological action of ouabain see *Pharm. Jour.*, 1888, 162; London *Lancet*, xi., 1888, 392; *Ther. Gaz.*, November, 1891; *Br. Med. Jour.*, i., 1892, 27; *Virchow's Arch.*, Bd. cxxxiv., 1893; *Pharm. Jour. and Trans.*, July, 1895; *Berlin. klin. Woch.*, Mar. 31, 1902.

The local application of ouabain produces a condition of anæsthesia, and it has been found that a few drops of a 1 to 1,000 solution, instilled into the eye, cause an insensibility of the conjunctiva and cornea. This lasts for one or two hours, the pupil at the same time being powerfully contracted and the tension of the eye increased.

The medicinal uses of ouabain have not been developed, though they would undoubtedly be almost identical with those of strophanthin, with which ouabain was for some time believed to be identical. The dose of ouabain is commonly given at from gr. $\frac{1}{2000}$ to gr. $\frac{1}{500}$. It is really probably much larger, though its little known character requires that it be used with great caution.

Ouabain has been employed as an antispasmodic in whooping-cough, by Dr. William Gemmell, of Glasgow (*British Medical Journal*, April 26th, 1890). He reports the treatment of forty-nine cases, of which twenty-five had been dismissed cured, four had died, and the remainder were under treatment. The fatal terminations were due to diphtheria, meningitis, and progressive emaciation. From his observations, he arrives at the following general conclusions: 1. Ouabain is of marked benefit during all stages of whooping-cough, and if carefully used produces gratifying results. In the first stage it cuts short the attack; in the second, it reduces the violence and frequency of the cough, and diminishes the number of whoops; and in the third, it hastens convalescence in a remarkable manner. 2. Ouabain is a drug which does not appear to be cumulative; its administration can be stopped suddenly without any ill effect beyond an exacerbation of the whooping-cough; it can be as suddenly resumed. 3. It should be given, at first at any rate, in a dose of gr. $\frac{1}{10000}$ every three hours (gr. $\frac{1}{125}$ daily). 4. For children under one year of age the dose should not exceed gr. $\frac{1}{20000}$ every three hours. 5. In children of from six to twelve years of age, if the cough be very violent and the whoops are numerous, gr. $\frac{1}{500}$ may be given in each dose, but the action of the drug must be carefully watched. 6. Ouabain may be given alone, dissolved in water, or in combination with potassium bromide, or with chloral hydrate. The simplest way is to dissolve one grain in distilled water, so that each minim of the solution shall be equal to gr. $\frac{1}{10000}$ ouabain, as: ℞ Sol. ouabain, ♏ xlviij.; syr. aurantii, ℥ iv.; aq. ad ℥ vi. M. Sig.: A teaspoonful every three hours. 7. Under the administration of ouabain, it is found that the temperature, pulse, and respiration are, in uncomplicated cases, slightly below normal. When the drug is pushed, the respirations become very slow indeed; in one patient, aged four, they were often as low as sixteen per minute. It is from this that danger is to be expected. During the administration the action of the skin is promoted, the amount of urine is increased, and the movements of the bowels become more regular. Ouabain has also been used with equally satisfactory results by Dr. J. Lindsay Porteous, of Yonkers, N. Y. (*New York Medical Journal*, vol. liv., 345). He gave it in three cases, one adult and two children, and in all marked improvement was immediately noticed. To a child of fifteen months gr. $\frac{1}{40000}$ was given every three hours; to a child of four years, gr. $\frac{1}{20000}$ every four hours, and to the adult, gr. $\frac{1}{500}$ every three hours. In all these cases the patient was entirely well at the end of a week. *Beaumont Small.*

OURAY SPRINGS.—Ouray County, Colorado. POST-OFFICE.—Ouray. Hotel and cottages.

ACCESS.—Viâ Denver and Rio Grande Railroad (narrow gauge) from Denver, Colorado Springs, and Pueblo.

The town of Ouray is situated in a picturesque amphitheatre of the Rocky Mountains, 389 miles from the city of Denver. The altitude of the town site is 7,500 feet above the sea level, but the neighboring mountain peaks tower several thousand feet higher. Mount Snefflis, five miles west, reaches an elevation of 14,225 feet, while Uncompahgre Peak, ten miles east of the town, attains the superb altitude of 14,440 feet above tide water. The famous and beautiful Bear Creek Falls are two miles south of the town, and near them is the wonderful piece of toll-road, cut in walls of perpendicular quartzite. All about the neighborhood are rich mines of gold and silver. There are also many other natural features of interest, including caves, waterfalls, cañons, peaks, lakes, and gorges, reached by good roads or mountain trails. The climatic conditions about Ouray are quite unexceptionable, sunshine being the rule, with warm and pleasant days during the summer, followed by cool, refreshing nights. The highest summer temperature is about 90° F., and the lowest winter minimum 5° F.; but owing to the rarity and dryness of the atmosphere, these extremes represent much less variation than in most localities of the East. The number of springs in the town limits is estimated at more than one hundred, the temperature of their waters ranging from 130° to 140° F. No analysis has been made, but we are informed by the proprietor of a number of the springs that the waters contain lime, soda, manganese, and iron, and some of them sulphur. Two bath-houses have been fitted up, and are much resorted to in the treatment of rheumatic affections. It is said that the internal use of the waters has been found beneficial in cases of dyspepsia, indigestion, constipation, and blood and skin disorders. The town of Ouray has about twenty-five hundred permanent inhabitants, and is well supplied with pure and wholesome water from mountain springs by water works constructed on the gravity plan. The city possesses a complete system of sewerage, and is always in a clean and healthful condition. The climate is said to be very beneficial to persons suffering from bronchial and pulmonary troubles.

James K. Crook.

OVARIES, DISEASES OF.—The ovaries are two small ovoid or rounded bodies, one of which is attached to the posterior surface of the broad ligament just internal to and below the fimbriated extremity of each Fallopian tube. They are of a pinkish color and vary in size and shape, even in health, without being actually malformed.

The average measurements are: Length, 30–50 mm.; breadth, 15–30 mm.; and thickness, about 12 mm. Ovaries greatly exceeding the above in size are rarely met with, but Altoukhov reported before the members of the Moscow Obstetrical and Gynæcological Society the case of a patient whose right ovary measured 35 × 13 × 7 mm., and the left one 80 × 14 × 6 mm., and at the same time mentioned a patient of Nega's in whom the left ovary was 54 and the right 108 mm. in length. In the latter case the uterus was infantile and the patient a pronounced nymphomaniac; but whether or not the enlarged ovary caused the nymphomania it is very hard to say. Probably excessive irritation of the vulva caused the hypertrophy of the ovary.

The function of the ovaries of producing and discharging ova has long been known, but of late they have been credited with producing an internal secretion which alleviates or prevents the troubles of the menopause.

ABSENCE OF OVARIES.—One or both ovaries may be congenitally absent. When both are wanting there is usually a lack of development of the mammæ and other sexual organs, and when only one is missing the corresponding side of the uterus is poorly developed. When a woman has absolute amenorrhœa, without any molimina, and sterility, you may suspect that she has no ovaries; but as long as one ovary and tube are present maternity and menstruation will likely go on undisturbed. The only way to make sure about the presence or absence of both sets of appendages is to open the abdomen and explore the pelvic cavity.

TRANSPLANTATION OF OVARIES.—On account of the serious results, matrimonially and otherwise, of the absence of both ovaries, either congenitally or as a result of operation, the procedure of transplanting ovaries is of considerable interest. J. Lankashevitsch interchanged ovaries between rabbits, dogs, etc. The operations were carried out with the strictest aseptic precautions. Each ovary was removed along with its mesentery, the cut edge of which was attached to the broad ligament of the new host near the spot from which the corresponding ovary had been taken, but sufficiently far from the cornu of the uterus to avoid compression. In a few instances, however, the ovary was fastened to either the mesentery or the peritoneum of the abdominal wall; the sutures used were fine silk and were placed very close together.

The only dog used was killed nine months after operation, and the transplanted ovary was found firmly adherent in its new situation, and to be but slightly diminished in size. Capillaries and muscular tissue ran from