

A handbook of medical pathology : for the use of students in the Museum of St. Bartholomew's Hospital / by W.P. Herringham, A.E. Garrod, and W.J. Gow.

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A HANDBOOK
OF
MEDICAL PATHOLOGY.

FOR THE USE OF STUDENTS
IN THE
Museum of St. Bartholomew's Hospital.



BY

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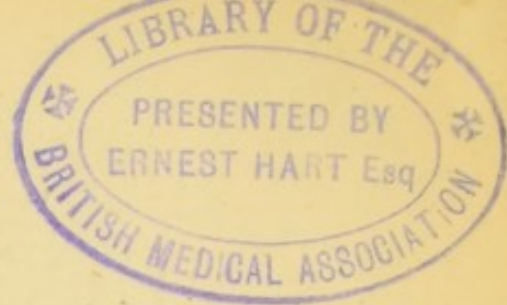


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PREFACE.

THE object of the present work is to supply the want which has been long felt by students of a handbook dealing with the medical and gynæcological specimens in the Museum on the same lines as the Surgical Handbook of Messrs. Walsham and Power.

The authors have selected for purposes of illustration the specimens which afford the most typical examples of disease. They have not thought it necessary to include exceptional cases. They have usually, but not always, quoted the descriptions given in the catalogues word for word.

They desire to express their thanks to the Museum Committee, and to the curator, Mr. Edgar Willett, who have afforded them every help in carrying out the work.

January, 1894.



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SECTION I.

DISEASES OF THE JOINTS.

INFLAMMATION of joints occurs in the course of various diseases, such as :

1. Gout. 2. Rheumatism. 3. Osteo-arthritis, or rheumatoid arthritis. 4. Locomotor Ataxia. 5. Hæmophilia. 6. Syphilis. 7. Pyæmia. 8. Gonorrhœa.

Gouty Arthritis.

The characteristic feature of gouty arthritis is the deposition of sodium bi-urate in the cartilages. The amount of the deposit varies greatly in different cases. Sometimes there is merely a speck of urate in the centre of the cartilaginous covering of the articular surface of the bone ; whereas in other cases the whole of the articular cartilages may appear white and opaque, as if covered with a coating of white paint. In section the articular surface of the cartilage is seen to be first affected, the deposit spreading inwards towards the bone and ultimately in severe cases invading it.

There is frequently some ulceration following upon degeneration of the cartilage, and some pathologists maintain that the deposition of the sodium bi-urate is always preceded by such degenerative changes. In chronic cases not only the cartilages, but also the synovial membrane, ligaments, and even the cancellous portions of the bones, become the

seats of uratic deposits, and large subcutaneous collections of this chalk-like material may form around the joints, constituting the familiar gouty **tophi**.

Microscopically the cartilage is seen to be invaded by numberless crystals of acicular form, which are frequently grouped together into rosettes. The crystals are, in the earlier stages, almost confined to the articular surface of the cartilage. They stand out very brilliantly with polarized light. The deposition of the crystals does not appear to bear any constant relation to the cartilage cells, but in some instances collections of crystals radiate from the capsules.

The commonest seat of gouty deposit is the metatarso-phalangeal joint of the great toe, but, as the following examples show, the larger articulations are frequently attacked.

711c.—Distal end of the metatarsal bone, and proximal end of the first phalanx of a great toe. Observe how the entire surface of the articular cartilages is encrusted with sodium bi-urate.

709b.—An astragalus with the external and internal malleoli of the fibula and tibia. Here, again, the articular surfaces are coated with an unusually extensive deposit of sodium bi-urate.

708.—The articular portions of both femora and patellæ of the same patient. The deposit in the articular cartilages is well seen in this dry specimen.

711.—The phalanges of a great toe; in and around the joint is a copious deposit of urate, forming tophi of considerable size.

Suppuration in a gouty joint occasionally occurs, but is extremely uncommon.

711b.—Section through a knee-joint from a gouty patient in which acute suppuration had taken place. The bones are bare of cartilage, rarefied, and superficially ulcerated, without any marked eburnation or lipping. The crucial ligaments are gone, the synovial membrane is thickened, soft, and in parts destroyed by the suppuration.

Acute Rheumatic Arthritis.

This rarely leads to any changes in the joints which can be recognised by the naked eye; a small quantity of fluid, and occasionally flakes of lymph, are met with, and there may be some injection of the synovial membrane. Microscopic changes in the cartilages have been described.

Osteo- or Rheumatoid Arthritis.

In this disease the changes in the joint structures are very characteristic. The cartilages are very early attacked. The first change observed in them is the splitting up of the ground substance into delicate fibrillæ. This is attended by loss of the cartilage cells, the fibrillated cartilage having a peculiar velvety appearance. As the disease advances the fibrillated cartilage becomes worn away, leaving the underlying bone exposed. This change is first observed in the central portion of the articular surface, but later the entire surface may become bared of cartilage. Meanwhile there is a proliferation of the cartilage at its margin; and the ecchondroses so formed become converted into bone, constituting the bony outgrowths known as **osteophytes**.

The bone, after the removal of the cartilage, acquires a thin superficial layer of great density, which becomes polished and resembles ivory in appearance, whence the name of **eburnation** which is given to this process. At the same time the exposed surfaces may become grooved by their movement upon each other, the striæ thus formed running in the direction of the movement. Occasionally the loss of bony substance thus brought about may be very considerable, and this destructive process, with the attendant formation of osteophytes, may lead to a complete alteration in the mechanism of the joint. The osteophytes, if large, may interlock so as to render the joint almost or completely immovable, but true ankylosis is not met with as a result

of this disease, except in the articulations of the spinal column.

The synovial membrane may be vividly injected, and as the disease progresses it, as well as the fibrous capsule, becomes much thickened. There is conspicuous hypertrophy of the synovial fringes, which form tufts in which cartilaginous masses are frequently met with. The pedicles by which these are attached to the synovial membrane may be ruptured, and in this way loose bodies are formed.

Ligaments enclosed in the joint, such as the ligamentum teres of the hip-joint, become absorbed, as also does the long tendon of the biceps cubiti when the shoulder-joint is seriously affected.

The synovial capsule frequently contains a considerable amount of fluid, and large cysts are occasionally formed in the neighbourhood of, and connected with, the joint.

693a.—A left knee showing in an almost typical manner the results of osteo-arthritis. Notice the general overgrowth of cartilage around the articular surface of the femur, especially at the upper and anterior margin of the external condyle. This cartilage has undergone ossification, and nodular osteophytes are formed. Similar osteophytes and ecchondroses are seen on the patella and tibia.

Notice also the fibrillation of the cartilage covering the articular surfaces, and its erosion, which in this case nowhere reaches down to the bone. The fringes of the synovial membrane are numerous and conspicuous.

691a.—Shows similar changes. Notice the partial destruction of the crucial ligaments, and of the other ligaments around the joint. In this case the bone is eroded and roughened over various parts of the articular surface.

666.—A shoulder-joint, which exhibits the degeneration and removal of the articular cartilage, and the hardening of the subjacent bone. The thickening of the capsule and the pendulous processes of the synovial membrane are also very well seen. Amongst them are two fairly large masses of cartilage.

693.—In this specimen of a knee-joint the deep injection of the

synovial membrane is well seen. The parts were removed in resection of the joint of a man aged 35.

672.—Illustrates the symmetrical character of the lesions of osteo-arthritis. An exactly corresponding portion of the articular cartilage of each ulna has been absorbed.

669a.—Shows the extreme bony changes which may result in this disease. It will be seen that the glenoid cavity of the scapula presents a convex articular surface at its lower part, whilst the upper portion is deeply grooved, and its margin is lipped with new bone. There are also osteophytic growths around the coracoid and acromial processes. The head of the humerus is convex, and exhibits unusually large osteophytic outgrowths. The articular surfaces are entirely denuded of cartilage, eburnated, and polished.

664.—Osteo-arthritis is very apt to attack the temporo-maxillary joint, and this specimen offers a good example of the changes so produced in their extreme form. It will be noticed that the right glenoid cavity is deeply hollowed out, and that osteophytic outgrowths have formed around it. When this joint is affected, the interarticular cartilage becomes absorbed.

678.—Shows the results of osteo-arthritis of the hip-joint. Notice the increase in the depth of the acetabulum, due to the absorption of bone, and the ossification of the cotyloid ligament. The articular surface of the femur has been in part absorbed, and there has been a formation of rough nodulated new bone around the margin of the head and neck of the bone. The articular surfaces both of the femur and acetabulum are rough, hard, and deeply perforated, like worm-eaten wood. Eburnation and polishing are noticed in places.

699.—Shows similar changes in the bones of the great toes of an old person.

1085.—Vertebræ affected by osteo-arthritis. Notice the irregular formation of bone along the margins of the vertebræ. From a man, aged 35, whose left knee was excised for rheumatoid arthritis.

The Joint Affection of Locomotor Ataxia (*Charcot's Joint Disease*).

This form of joint disease is more commonly met with in the larger joints, such as the knee, hip, or shoulder, and is

characterized by its sudden onset and painlessness in the majority of cases. The lesions found post-mortem are similar in kind, although not in degree, to those of osteo-arthritis.

The changes in the cartilages are of the same nature in both affections, and the extremities of the bones may be eburnated in cases of Charcot's disease of long standing. The destruction of bone is, however, much more rapid and well marked than is the case in osteo-arthritis; and the osteophytic outgrowths, although frequently present, especially in long-standing cases, are usually much less conspicuous. Dislocation of joints may occur apart from the destruction of the bony surfaces. The joints affected tend to be greatly swollen by the accumulation of fluid in the synovial sac.

691d.—A left knee-joint, from a patient with locomotor ataxia.

The synovial membrane is vascular and papillated, and the portion below the patella is pulpy. The cartilage covering the internal condyle is ulcerated at one spot. It is thickened, and is clearly undergoing fibrous degeneration over its whole extent, although it still retains its polished surface.

The cartilage covering the external condyle is thickened except at one part, where it is worn away, leaving a dense eburnated surface of bone exposed. The edges of the articulating surfaces of the condyles are lipped. The semilunar cartilages are intact.

The anterior crucial ligament is pulpy and in part eroded; the posterior is also softened. The patella, which is lipped, is covered by cartilage undergoing pulpy degeneration. It is not overgrown by thickened synovial membrane.

The articular surfaces of the tibia are bare of cartilage. The external surface is undergoing erosion at the point at which it is opposed by the eroded surface of the external condyle of the femur. All the soft tissues are more or less thickened, pulpy, and degenerated.

691b.—A right knee-joint showing in an extreme manner the changes of Charcot's joint disease. The joint is much enlarged, and when first opened contained a quantity of thin pus. The

alteration in the shapes of the ends of the bones is most marked. The external condyle of the femur has almost disappeared, whilst the internal condyle is much enlarged, and is flattened from side to side. At the posterior surface of the internal condyle is a large nodular osteophyte, which fits into a cup-shaped surface formed by an outgrowth from the posterior surface of the tibia. The tibia has undergone corresponding changes, the inner part of its head having been rubbed away by the large internal condyle. In consequence the plane of the tibio-femoral articulation has become almost vertical. The patella is irregular in outline, and its cartilage is markedly degenerated. The small residues of cartilage on the articular surfaces of the tibia and fibula have also undergone fibrillation.

Numerous osteophytes surround the articular surfaces. The villous outgrowths from the synovial membrane are conspicuous, and are in places the seats of calcareous deposit.

The Joint Affection of Hæmophilia.

The lesions met with in the joints of bleeders also bear a considerable resemblance to those of osteo-arthritis, and the changes observed cannot be attributed merely to the effusion of blood into the synovial capsule.

The cartilage covering the articular surfaces tends to become fibrillated and to be absorbed in those parts where pressure is greatest; and there is also a tendency to the formation of ecchondroses, and ultimately of osteophytes, around the margins of the articular surfaces; but there is also this important difference between these two morbid conditions, that, whereas in osteo-arthritis there is no tendency to the formation of fibrous adhesions between the articular surfaces, such adhesions are frequently met with in the joints of bleeders. Some effusion of blood has usually taken place into the joint cavity. (See Bowlby, *St. Bart.'s Hosp. Reports*, vol. xxvi., 1890, p. 77.)

740a.—A knee and an ankle-joint from a boy who was a bleeder, and who died, as the result of a cut in the lip, from hæmorrhage. The synovial membranes are coloured by blood,

which has been effused into the joint cavity. Notice in the knee the remains of a fibrous ankylosis between the femur and the patella. (For drawings of the joints in their recent state see **No. 45a.**)

740b, c, d.—Right and left knee-joints and right ankle from a case of hæmophilia. The ankle-joint (**740d**) is least affected. In the left knee (**740c**) traces of effused blood are seen on the synovial membrane and cartilages, but the cavity contained no blood-clot. The cartilages are pearly white. At the under surface of the external condyle of the femur, where it receives the pressure of the tibia, the cartilage is thin and granular over an area of half an inch in diameter.

In the right knee (**740b**) the changes are more advanced. The cartilages are removed in places, and a formation of bone thinly covered by cartilage has taken place at the periphery of the joint. Microscopically the cartilage exhibited changes which, like the fibrillation seen with the naked eye, bore a marked resemblance to those produced by rheumatoid arthritis.

Syphilitic arthritis is a rare manifestation of secondary syphilis, the morbid appearances resembling those of acute rheumatic arthritis. It is also met with in the tertiary stage in association with periostitis of neighbouring bones.

Pyæmic arthritis occurs in general pyæmia, and is usually suppurative.

Gonorrhœal arthritis is a not infrequent sequela of gonorrhœa. It occasionally, but rarely, ends in suppuration.

Tubercular disease of joints is a surgical rather than a medical affection.

SECTION II.

DISEASES OF THE HEART AND PERICARDIUM.

CONGENITAL HEART DISEASE.

IN many cases of congenital heart disease the conditions found post-mortem are obviously malformations or the results of arrest of development; but in others the deformities are such as might arise from inflammation *in utero* and are usually regarded as affording evidence of foetal endocarditis.

There is, moreover, a mixed class of cases in which deformities, probably due to endocarditis, lead to arrest of development by disturbing the balance of the circulation.

Abnormalities in the Number of the Semilunar Valves.

These are met with both in the aortic and pulmonary orifices. Two of the curtains may be fused into one, or only two curtains of almost equal size may be present. Again, instead of three curtains there may be four or five, in which case one is usually of very small size.

3584.—This specimen shows the pulmonary artery of a man aged 31. The valve curtains are four in number, and one is much smaller than the others. The common septum between the small curtain and one of its neighbours is perforated by an orifice through which a thread has been passed.

3586.—Shows a similar malformation of the aortic valves of a woman aged 62. Here again the fourth curtain is very small, but

is complete, possessing a *corpus Arantii*. The curtains have undergone a slight thickening.

3587.—A pulmonary valve with only two curtains. The three flaps of the tricuspid valve are not so distinct as usual, but otherwise the heart is normal.

3586a.—Exhibits a similar condition of the aortic valves; there is a nodule of indurated tissue near the end of one of the curtains.

Abnormalities of Form.

The semilunar valve curtains may be perforated by numerous apertures, and so have a fenestrated appearance. So long as this abnormality is confined to the parts which are in apposition when the orifice is closed (the *lunulæ*) no regurgitation will result.

Abnormalities of the Auriculo-Ventricular Valves.

These are much less common, such deformities as are met with being usually such as might result from foetal endocarditis (which tends to attack the right heart rather than the left) rather than from errors of development.

3598.—Here there is well-marked affection of the tricuspid valve, which is reduced to a narrow membranous ring, and the chordæ tendineæ are almost completely wanting. Notice the hypertrophy of the wall of the right ventricle, and the diminution of its cavity. In addition to the above-mentioned abnormalities, the pulmonary artery is narrowed at the level of the valve-ring, the ductus arteriosus was patent, and the aorta was enlarged to the level of origin of the patent ductus. Notwithstanding these deformities, the patient reached the age of 10 years.

Imperfect Septa.

In considering these deformities, bear in mind that in the early period of intra-uterine life the heart consists of a single auricle and a single ventricle, each of which subsequently is divided into two by the growth of a ventricular septum upwards from the apex, and of an auricular septum downwards. In the same way the common arterial trunk

becomes subdivided, by the formation of a septum, into the aorta and pulmonary artery. The auricular septum remains incomplete during almost the entire period of foetal life, the two auricles remaining in communication through the open foramen ovale, but the ventricular septum is complete rather earlier. Any cause which disturbs the circulation in the great vessels, provided that it is already in action before the septa are complete, will prevent their closure.

Patent Foramen Ovale.

This is not an uncommon abnormality, and may occur apart from any other deformity. In such cases the opening is usually small, and it is probable that little or no admixture of blood takes place through it. When isolated, this lesion may neither produce any symptoms during life, nor be revealed by any abnormal physical signs.

3593.—The heart of a woman aged 30. Notice the large oval aperture, an inch in diameter, in the auricular septum. There is general cardiac hypertrophy.

3594.—Shows a much smaller orifice in the foramen ovale of a man aged 43, who died of phthisis.

3596.—The heart of an infant showing a patent foramen ovale. The ductus arteriosus is also patent, but its wall is somewhat thickened and the lumen contracted.

Incomplete Septum Ventriculorum

is nearly always secondary to abnormalities of the pulmonary artery (*q.v.*).

Patent Ductus Arteriosus

This channel, which normally closes shortly after birth, may remain patent and allow of an admixture of the blood in the aorta and pulmonary artery. Patency of the ductus arteriosus is frequently secondary to other lesions.

See specimens 3596, 3598, 3612.

Stenosis and Atresia of the Pulmonary Artery

is the commonest of all congenital cardiac lesions. In some cases the artery itself is narrowed or obliterated above the position of the valves, which may be entirely absent. In other instances the valve curtains are replaced by a diaphragm which has a small central orifice, and assumes a conical form, the apex of the cone pointing into the artery. Such diaphragm valves are probably produced by foetal endocarditis. Where such lesions are present the ventricular septum is almost always incomplete. The orifice between the ventricles may be quite a small one, and confined to the space normally filled by the membranous part of the septum; but, in cases in which there is complete atresia of the pulmonary artery, the intraventricular septum may be almost entirely wanting, being only represented by a small crescentic fold near the apex of the single ventricle. It is easy to understand why this should be so, for if, as is almost always the case, the pulmonary lesion is present before the septum is completed, there will be a constant stream of blood from the right ventricle, escaping by the aorta instead of by the constricted pulmonary orifice. Moreover, the auricular septum also is frequently incomplete, and if the child survives the ductus arteriosus usually remains patent, supplying, in cases with complete atresia, the only channel by which blood can reach the pulmonary circulation.

3601.—Here the pulmonary artery, and the portion of the right ventricle which leads to it, are markedly narrowed, and at the upper part of the ventricular septum there is a large opening with smooth edges. Notice that the orifice of the aorta is so placed above this orifice in the septum that both ventricles open into it. Notice also the great hypertrophy of the wall and columnæ carneæ of the right ventricle, and compare it with the left ventricle, the walls of which are of normal thickness. The aorta is enlarged, but the ductus arteriosus was closed. The heart is that of a person aged 16 years. These patients rarely live to grow up.

3601a.—Shows the conical diaphragm with a small central opening, which often replaces the pulmonary valves in these cases. It was probably produced by the fusion of the valve-curtains as the result of inflammatory changes. The aorta is here also enlarged, but its valves are normal.

3605.—Exhibits a very remarkable deformity. It will be seen that there is one large ventricular cavity, into which both the mitral and tricuspid valves open, but which corresponds to the right ventricle. To it the very small left ventricle forms a sort of ante-chamber, separated by a muscular ridge. From this ante-chamber the aorta takes its origin, but is so placed that the blood from the right ventricle had easy access to it. The auricles are normal, and the ductus arteriosus was obliterated.

The pulmonary artery possesses no valves, their place being taken by a thickened ring, probably formed by adhesion of the valve-curtains.

The aortic orifice and valves are normal. There is a slight narrowing of the mitral orifice.

The superficial vessels lie in a groove between the large right and small left ventricle.

The pericardium was closely adherent.

3608.—The heart of an adult showing complete atresia of the pulmonary artery. The orifice is apparently closed by adhesion of the valve-flaps. Beyond this the artery is small and its walls are thin. There is the usual orifice at the upper part of the ventricular septum, and a small opening in the foramen ovale.

3612.—Heart of an infant five weeks old. Here, again, there is complete atresia of the pulmonary artery, which is imperforate as far as its bifurcation. The ductus arteriosus is large and patent. The aortic orifice is situated above the incomplete septum, but appears to rise rather from the right than from the left ventricle.

3614.—This specimen shows a similar deformity of the aorta, which is less commonly met with. The pulmonary artery is, if anything, larger than the normal; its valves are perfectly formed, but have some earthy deposit at their bases. The aorta, on the other hand, is stenosed. All the cavities are dilated; the walls of the right ventricle are thicker than those of the left, and there is a large oval aperture in the ventricular septum, just between the orifices of the aorta and pulmonary artery. There is also a small aperture in the fossa ovalis.

Absence of the Pericardium.

This is an uncommon malformation. In such cases the heart is included with one of the lungs in a common serous sac, the pleura. The working of the heart is not interfered with, and no symptoms are produced during life.

3621.—The heart and a part of the left lung of a man who was the subject of this deformity. The heart, which was otherwise natural, lay in the left pleural cavity, the serous covering of the heart being continuous through that over the pulmonary vessels with the visceral pleura, and through that of the aorta and vena cavæ with the parietal pleura.

Ectopia Cordis.

In cases where there is defective development and incomplete closure of the thoracic walls, the heart may lie outside the thoracic cavity, usually in the middle line. In such cases the misplaced heart may have no pericardium, and usually exhibits defects of development, as in the case from which the following specimen was taken.

3617.—Heart and lungs of an infant. At birth the heart lay outside the thoracic cavity in front of the anterior chest-wall. The heart shows conspicuous abnormalities. The two auricles form a single cavity, the ventricular septum is incomplete, and the ventricles are very imperfectly developed.

DISEASES OF THE PERICARDIUM.

Milk spots are pearly-white patches of thickening upon the pericardium which result from a chronic inflammatory process. They usually form in places in which the heart comes in contact with some bony structure, such as the sternum or fifth rib. Milk spots are especially common upon the hearts of soldiers, a fact which is usually ascribed to the pressure of cross-belts.

1240.—Affords an excellent example of such thickening.

Acute Pericarditis

may be simple or purulent :

1. **Simple acute pericarditis** is met with in two stages, clinically described as dry pericarditis and pericarditis with effusion.

In the early stage there is merely an exudation of plastic lymph upon the surfaces of the membrane, but an accumulation of serous fluid soon takes place. The epithelial lining is removed, and the surface of the pericardium becomes roughened and hyperæmic.

The thickness of the deposit of lymph varies greatly in different specimens, and when abundant it usually has a shaggy appearance, owing to the movement of the visceral and parietal layers upon each other. Such a shaggy heart has received the name of "*cor villosum*." Instead of being shaggy, the lymph may have a honeycombed appearance, as if two viscous surfaces have been brought together and then pulled apart.

Microscopically the lymph is seen to consist of a network of fibrin enclosing large numbers of leucocytes.

1217.—Shows a deposit of soft lymph upon the surface of the heart, as well as upon the reflected parietal layer of the pericardium. There is some reticulation of the surface of the deposited lymph.

1226.—Here there is a much more abundant covering of lymph over the whole surface of the pericardium. The lymph is shaggy; and long shreds, many of which are branched, hang loosely in the sac.

1227.—Illustrates the honeycomb variety; the thick covering of soft lymph upon the surface of the heart shows a coarse reticulated pattern. There is also considerable cardiac hypertrophy.

The chief causes of simple pericarditis are :

- i. Acute rheumatism (by far the most common cause).
- ii. Extension from neighbouring parts, *e.g.*, the pleura.
- iii. Chronic renal disease, in its later stages.

2. **Purulent pericarditis.**—In cases in which the effusion is purulent, deposits of lymph are met with, but these are, as a rule, not so abundant as in simple cases.

1834.—Is the heart of a child aged $2\frac{1}{2}$ years, who died of pyæmia, associated with acute periostitis of the femur. A fairly abundant deposit of lymph is seen upon its surface.

This variety of the affection is met with in connection with septic conditions, either primary or secondary, such as pyæmia, acute periostitis, or scarlatina.

Sequelæ of Pericarditis.

Adherent pericardium usually follows upon pericarditis. The adherent surfaces may either be found in close contact, being lightly bound together by the union of the granulating surfaces, or they may still be separated by a layer of lymph, which in extreme cases may be as much as an inch in thickness.

The obliteration of the pericardial sac usually leads to hypertrophy of the heart, by acting as an impediment to its movements.

1232.—Shows the pericardial surfaces closely adherent, the adhesions being completely organized. The aortic valves are also diseased.

1231.—Illustrates the alternative condition, the visceral and parietal surfaces of the membrane being separated by a layer of lymph in one part nearly an inch in thickness.

Occasionally the exuded lymph becomes the seat of **calcareous deposit**, with the result that the base of the heart may be enclosed in a case or ring of bony hardness.

1235.—Here the base of the heart is encircled by a broad ring of bone-like substance, which occupies the place of the parietal pericardium. The remaining portions of the pericardium are firmly joined to the heart by a false membrane, which is in parts as hard as cartilage.

Tubercular Pericarditis.

In this not uncommon affection, miliary tubercles are found both upon the visceral and parietal surfaces of the membrane, as well as in the lymph, which is effused into the cavity and forms adhesions between the surfaces.

In cases of general tuberculosis, tubercles may be formed in the pericardium without giving rise to any active inflammatory changes, but this condition is less commonly met with in the pericardium than in the other serous sacs.

1231a.—Heart of a boy, aged 16, who died of general tuberculosis. The pericardium, which is generally adherent, has been deflected over a portion of the anterior surface of the heart, and both the visceral and parietal layers are seen to be studded with miliary tubercles. These were much more conspicuous in the fresh state than they now are. The heart is enlarged, but the valves appeared to be healthy.

Malignant Growths.

Malignant tumours, and especially lympho-sarcoma originating in the mediastinum, may invade the pericardium.

1239.—Here the pericardium is infiltrated by a new growth, which was shown by microscopic examination to be lympho-sarcoma. The growth is thickest towards the base of the heart. The inner surface of the pericardium is lined by a distinct fibrous layer, which is rugose and papillated. The growth extends along the pulmonary vessels to the lungs. It also surrounds the vagi and the aorta. The mediastinal and cervical glands were also involved. The visceral layer of the pericardium is only slightly thickened. The cavity contained a sanious fluid. The tumour is moderately firm, and in section is pale and homogeneous. A small tumour of the same nature was connected with the xiphoid cartilage.

Microscopically the growth was found to consist of small round cells, supported by an abundant matrix of ill-formed connective tissue. Fibrous trabeculæ traverse it in all directions.

AFFECTIONS OF THE HEART-MUSCLE.

Atrophy.

In diseases which are attended with extreme emaciation the heart may be very greatly reduced in size, and in some cases the atrophy is so extreme that the heart of an adult may weigh no more than three ounces.

The colour of the atrophied muscle is considerably darker than that of the normal organ, and for this reason the name of "**brown atrophy**" is frequently applied to the condition under consideration. The fat which normally surrounds the base of the heart becomes absorbed, and consequently the coronary arteries stand out with undue prominence.

The following specimens are examples of atrophy, in both instances secondary to malignant disease of the stomach.

1242.—A heart very much reduced in size, but in which the relative proportions of the several parts are preserved, and the muscle appears healthy. It weighed 5 ounces and 4 drachms. It measured a little less than 4 inches across at the base, and $5\frac{1}{4}$ inches from base to apex. The patient was a man 50 years old.

1243.—An exceedingly small heart, which weighed only 3 ounces and 1 drachm, from a woman aged 46, who died of cancer of the pylorus. Her illness lasted two years. She was extremely emaciated, and the other viscera were remarkably small.

Hypertrophy

may result from a variety of causes, all of which act by imposing extra work upon the heart. The muscular walls become thickened, the increase in size being in part due to an actual increase in the number of the muscular fibres, and in part to an increase in size of the individual fibres. The size of the cavities is rarely, if ever, diminished.

The hypertrophy may affect all parts of the organ, but more commonly the extra strain is chiefly thrown upon some particular part which is far more affected than the rest.

The most important causes of hypertrophy which specially affect the left ventricle are the following :

- i. Continued over-exertion, as in athletes, which tends to throw extra work upon the left ventricle.
- ii. Disease of the aortic valves. The left ventricle hypertrophies to meet the extra strain thrown upon it.
- iii. Chronic renal disease. Here the obstruction to the systemic circulation is the cause of the hypertrophy.

The right ventricle hypertrophies in :

- i. Mitral disease. In stenosis the left auricle also hypertrophies, and in regurgitation the left ventricle as well is often affected.
- ii. Disease of the pulmonary valves, which throws extra work upon the right ventricle, just as aortic disease does upon the left ventricle.
- iii. Diseases of the lungs which cause obstruction to the pulmonary circulation ; and especially emphysema.

Among the causes of hypertrophy adherent pericardium must also be included.

1241.—The heart of a man aged 62, who had long suffered from disease of the aorta and its valves. The organ weighed 32 ounces, this increase being due to hypertrophy of the left ventricle.

1241a.—A heart showing enormous hypertrophy of the left ventricle, the walls of which are seen in section. The valves are healthy, and in this case the enlargement resulted from chronic nephritis.

Dilatation.

The cavities of the dilated organ are increased in size, and their muscular walls are diminished in thickness, unless the dilatation has followed upon antecedent hypertrophy,

under which circumstances the walls may still be as thick or thicker than normal in spite of the dilatation.

The valvular orifices may be so greatly increased in size that the valve flaps are no longer able to effect their complete closure, and in this way, although the valves are not diseased, regurgitation may take place.

Primary dilatation is usually present in cases of severe anæmia, and the secondary form is met with in valvular disease, emphysema, or other conditions, if the heart, although hypertrophied, is no longer able to meet the demands made upon it.

1255.—A heart in which the cavities of both ventricles are enlarged, while their walls are thinner than natural. The walls of the right ventricle are especially thin. In this instance there is no valvular disease.

1256.—A heart in which both ventricles are dilated, thin-walled, and pale. There is some mottling of the inner surface of the left ventricle due to fatty degeneration.

1257.—A heart exhibiting great dilatation of the cavity of the left ventricle, although the walls are thicker than usual. The aortic valves and the internal coat of the aorta are slightly thickened and opaque. Here the dilatation was obviously secondary to hypertrophy.

1259.—Part of a heart, showing thickening and rigidity of the mitral valves, and of the chordæ tendinæ, with extreme contraction of the auriculo-ventricular orifice. The cavity of the left auricle is enlarged, and its lining membrane is opaque and thickened. A thick layer of dry laminated coagulum is firmly attached to the upper and posterior part of its wall, where it is rather more dilated than elsewhere.

1259a.—Here there is extreme dilatation of both auricles, due to stenosis of both the mitral and tricuspid orifices. The contraction of the mitral orifice is extreme, and it would scarcely admit the tip of the little finger.

Fatty Changes.

The heart is liable to two kinds of fatty change, which must be carefully distinguished from each other:

1. *Fatty Infiltration.*

Here the adipose deposit is chiefly met with in the sub-pericardial tissue upon the surface of the heart-muscle, and may be regarded as merely an undue increase of the fat which is normally present in that situation. In extreme cases, however, the muscular substance itself becomes penetrated by streaks of adipose tissue.

Microscopically the fat globules are seen to lie between the muscular fibres, which have not themselves undergone a fatty change.

This condition is chiefly met with in very obese persons.

1244.—A heart exhibiting great dilatation of the left ventricle and thickening of its walls. Notice the abundant deposit of fat over the whole of the outer surface of the organ.

1245.—The heart of a man who, although but 5 feet 7 or 8 inches in height, weighed 30 st. 6 lb. some months before his death. The heart, depleted of its blood, weighed 2 lb. 6½ oz.

2. *Fatty Degeneration.*

Here the morbid process affects the muscular fibres themselves. They lose their transverse striation either completely or partially, and are seen with the microscope to contain numerous tiny granules or globules of fat, which stain readily with osmic acid.

The affected muscle, which is considerably paler than normal, has often a striated or "tabby" appearance, and becomes soft and friable. Indeed, the strength of the cardiac walls may be so greatly impaired that actual rupture takes place.

The degenerative process may be general, or may be confined to a limited portion of the heart-muscle. Even when general it may be unequally distributed, as in the so-called "tabby" degeneration of the papillary muscles.

Fatty degeneration is very common. Among its most conspicuous causes are the following :

- i. Some acute fevers.
- ii. Diseases attended with profound anæmia.
- iii. Phosphorus poisoning, in which condition the heart shares in the fatty changes which affect other organs also.

1246.—Heart of a man who died under chloroform. The ventricular walls, and especially those of the right ventricle, appear to be in a state of advanced fatty degeneration.

Localized fatty degeneration may follow inflammation of the pericardium or endocardium, and an extreme degree of this change is met with as the result of obstruction of the coronary arteries. It is in cases in which the degeneration depends upon coronary obstruction that spontaneous **rupture** of the heart walls is most frequently met with.

1249.—Portion of a heart in which rupture of the left ventricle has occurred. The heart is of natural size, with abundant fat at its base and over the coronary arteries. In the middle of the prominent rounded part of the left ventricle is a rent, about an inch in length, extending obliquely downwards from the middle of the ventricle towards its apex. Below this, and in a line towards the apex, are two much smaller rents, which, like the larger one, have irregular edges. They all extend to the cavity of the ventricle, and are seated in what appeared after death as a space of about three inches square, in which the colour of the muscular substance was mottled, dull yellow, or drab, and pink, and no fascicular or fibrous structure could be discovered. In this space the muscle was in a state of advanced fatty degeneration, while that of the rest of the heart was normal, or nearly so. The principal branch of the left coronary artery supplying this part of the heart is enlarged; its coats are thickened and made rigid by opaque yellow deposits, and its cavity is filled by a firm coagulum. It seems to be obliterated at the margin of the degenerated area, whereas the rest of the coronary arteries, although diseased, are pervious.

1247.—A left ventricle, ruptured. The opening is a mere fissure

through the muscular substance at the junction of the anterior wall with the septum, near the middle of the heart. The wall of the ventricle around the orifice is not thinned, but the muscular substance is softer than natural and of a brown colour. There are numerous small deposits of fat beneath the lining of the aorta and of the left ventricle, and the quantity of fat on the outer surface of the heart is abnormally great.

For other examples of rupture of the heart-walls, see specimens 1247a, 1248, 1248a, 1250, and 1251.

Tumours of the Heart-walls.

Fibrous tumours are occasionally met with in the muscular substance of the heart.

1284.—The interventricular septum of a heart. Projecting into the left ventricle towards the anterior part of the septum is a roundish plaque about the size of a florin, which has been cut through. Its surface was covered by ragged, decolourized, friable clot. In section the growth is seen to have a fibrous structure, and a thickness of about a quarter of an inch, and it appears to be of the nature of a fibrous thickening of the endocardium. Microscopically the growth was found to consist of fibrous tissue, dense, and arranged in parallel bundles through the greater part of its thickness, but loose and reticular towards the deeper surface. No distinct endothelial lining could be detected on the ventricular surface to which the remains of blood-clot were adherent. The connective tissue between the subjacent muscular fibres was increased.

Emboli had lodged in a number of large arteries.

Gummata also are sometimes found in the heart.

1280a.—A new growth, having the appearance and histological characters of a syphilitic gumma. It springs from the internal surface of the posterior wall of the left auricle, and extends into the muscular tissue of the wall. It is of rather soft consistence and of a light-yellow colour. Microscopically it consists of degenerative fibrillary tissue, in which a reticulation is distinguished in places; no giant cells are found.

Malignant Tumours.

Primary Malignant Growths are uncommon, but the Museum contains some excellent examples of Secondary Growths in the heart-walls in connection with primary tumours elsewhere.

Carcinoma.

1286.—Medullary carcinoma of the heart secondary to a similar growth of the testicle. The cavity of the right ventricle is almost filled by some soft roundish masses, which when fresh had a dull red colour. One lobe extends upwards towards the orifice of the pulmonary artery, and another projects into the tricuspid opening.

1287.—Portion of a heart with a small medullary tumour embedded in the muscular substance near its apex.

Sarcoma.

1285b.—A heart the substance of which is studded with a number of small white sarcomatous tumours. From a woman, aged 41, who died with generally disseminated sarcomatous tumours secondary to a small melanotic warty growth which was removed from the sole of the foot seven months previously.

1285a.—A heart with numerous small soft tumours beneath the pericardium and endocardium. Microscopic examination showed them to be round-celled sarcomata.

Melanotic Growths.

1288.—Section of a heart, in all parts of which are minute melanotic deposits. Some are beneath the pericardium, some beneath the endocardium, and others embedded in the muscular substance. Some minute deposits are also seen in the portion of the vena cava superior, which is attached to the heart.

1290.—Heart showing several small melanotic growths in the muscular walls, secondary to a melanotic growth of the eye.

Hydatid Tumours.

1295.—A heart exhibiting a collection of acephalocyst hydatids between the lining membrane and the muscular substance of the posterior wall of the right ventricle. The hydatids are enclosed

in a cyst between 2 and 3 inches in diameter. The cyst projects into the lower part of the ventricular cavity, and gives a rounded form to the heart's apex.

1295a.—A heart showing a large hydatid cyst in the outer wall of the left ventricle. The cyst, which has been laid open, is situated in the muscular wall. It is enclosed by a thick white membrane. It contained a number of daughter cysts. The whole heart is enlarged.

Cysticercus Cellulosæ,

the bladder worm of *Tœnia Solium*, is occasionally found in the heart, but there is no specimen in the Museum.

Calcareous Changes

are sometimes met with affecting the muscular substance of the heart.

1283.—In this specimen there is valvular disease, but the chief interest lies in the calcareous degeneration of portions of the wall of the left auricle. The bone-like plates are covered by the endothelium lining the cavity.

Tubercular Disease of the Heart.

In acute tuberculosis the heart-muscle is not infrequently invaded by miliary tubercles, and much more rarely tubercular nodules are formed in its substance.

1281.—Portions of a left ventricle embedded in the wall of which is a small spherical mass of tubercular matter, about 2 lines in diameter. The surrounding tissue is healthy.

Acute Myocarditis.

Inflammation of the heart-muscle may be primary or secondary.

Primary myocarditis may occur in—

1. Pyæmia.
2. Acute rheumatism.
3. Diphtheria.
4. Small-pox and other fevers.

Secondary myocarditis results from the spread of inflammation from

1. The pericardium.
2. The endocardium.

The heart-muscle is softened, and becomes infiltrated with leucocytes. In pyæmic cases the muscular substance may contain small diffuse abscesses.

1279.—Section of left ventricle. Its membranous lining is partly ulcerated, and partly thickened by deposits of earthy material. Pus is extensively diffused through the muscle near the apex of the ventricle.

Chronic Indurative Myocarditis or Fibroid Degeneration

usually results from the extension of inflammation from the peri- or endocardium, and is not infrequently met with in the muscle adjacent to clots formed in the cavities during life.

The process leads to the formation of leathery patches of sclerosis, which are seen on microscopic examination to consist almost entirely of fibrous tissue, the muscle cells in the affected area having undergone conspicuous atrophy or having entirely disappeared.

When an extensive area of the heart-wall is thus affected, the inelastic fibrous tissue which has replaced the contractile muscular substance yields to the pressure from within, and in this way a **cardiac aneurysm** is formed.

1260.—Section of a left ventricle, with a shallow aneurysmal pouch at its side. The inner surface of the pouch is smooth, and apparently formed by the lining of the ventricle partially covered by layers of fibrin. The pericardium is adherent to its outer surface.

1261.—A heart, exhibiting a pouch formed by dilatation of a circular portion of the anterior wall of the left ventricle near its base. The pouch was filled by laminated coagulum; its mouth is round, narrow, and smooth; and its parietes apparently consist of the serous covering and inner membrane of the heart, thickened, united, and having small deposits of a soft yellowish substance in

and around them. The muscular tissue of this part has entirely disappeared. The coagulum which was within the pouch is at the bottom of the bottle.

The patient was a girl 19 years old. The disease of the heart probably commenced about eighteen months before death ; but its progress was marked by various and singular attacks of paralysis, erysipelas, and signs of phlebitis.

1262.—A heart, with a sac attached to the left side of its left ventricle. The sac is spheroidal in form, and upwards of 3 inches in its greater diameter. Its walls in part are composed of muscular substance, together with the pericardium, and a dense tissue by which the opposite surfaces of the pericardium were adherent. It is lined by irregularly laminated coagula : the phrenic nerve runs over its anterior part ; it communicates with the cavity of the ventricle by an oval aperture, about a quarter of an inch in diameter, the margins of which are smooth and round. A piece of white glass is passed through this aperture. The muscular substance of the ventricle immediately around the aperture has disappeared, and is replaced by a dense white tissue. The rest of the heart is healthy ; but its exterior is covered by false membrane by which it adhered to the parietal pericardium. It may be presumed that there was in this case a rupture, or an ulceration, through the wall of the left ventricle ; that the blood was prevented from being effused into the cavity of the pericardium by adhesions previously formed between its two surfaces ; and that these adhesions, and the pericardium for a considerable distance around the aperture, were stretched by the force of the blood, so as to form the sac, in nearly the same manner as a false aneurysm is formed by the distension of the sheath of an artery after the destruction of the coats.

As other examples of cardiac aneurysm :

1263 may be referred to, and

1263a, which exhibits multiple aneurysms, viz., two small ones springing from the left ventricle, and a third from the left auricle. In addition the pericardium is adherent at the base of the heart, the mitral valves are diseased, and the foramen ovale is patent.

1266a.—Aneurysm at the apex of the right ventricle.

1268a.—Aneurysm of the sinus of Valsalva.

BLOOD-CLOTS IN THE CARDIAC CAVITIES.

Clots formed during the life of the patient are readily distinguished from those formed post-mortem by the loss of their colour, and by their attachment to the heart-walls. Such clots are not infrequently met with in dilated or fatty hearts, and in cases in which death was preceded by a period of asthenia. Their most common situations are in the auricular appendices, or in the muscular network upon the inner surfaces of the ventricles.

Not infrequently the coagula assume a polypoid form, and extend from one cavity to another. Their attachment to the cardiac walls may be a very close one, so that the boundary between the organized clot and the lining membrane cannot be distinguished in a section of the part. Sometimes, on the other hand, they lie loose in the cavities, and such a clot may become converted into a dense smooth ball by the action of the blood-stream. Globular thrombi are also found attached to the walls by pedicles. The clots are liable to undergo softening in their central portions, and present cavities containing a fluid closely resembling pus in appearance.

1270.—The anterior wall of a right auricle and ventricle, with part of a firm, decolourized coagulum clinging to its inner surface. This coagulum is moulded to the inequalities of the muscular bands, as shown in the upper portion of the preparation, where it is turned away from the cardiac wall. It also extends uninterruptedly behind the cusps of the auriculo-ventricular valve. On one side (the right) is a layer of coloured coagulum, part of a clot which commenced in the *venæ cavæ*, extended thence into the cavities of the heart, and terminated at the apex of the right ventricle.

1271.—Part of the posterior wall of the same cavities, and the commencement of the pulmonary artery. The remainder of the clot which occupied the right cavities is here seen. Above, it commences as a tape-like portion which occupied the upper and left side of the canal of the superior vena cava, the remainder being

filled by the coloured coagulum already described. The decolourized clot extends behind the valve cusps, and is continued through the infundibulum into the pulmonary artery. The latter portion is superficially streaked, above and below, with thin layers of coloured coagula, but these have no connection with those derived from the venæ cavæ. On the other hand, they can be traced upwards into the canal of the pulmonary artery.

From a woman who died with colloid cancer of the ovaries. Toward the last she suffered from compression of the lungs and considerable dyspnœa, but no symptoms arose to indicate before death the formation of clots in the cardiac cavities.

1274.—Heart of a woman, aged 43 years, with dilatation of all its cavities. The mitral orifice is greatly contracted, so as only to admit the tip of the little finger. In the left auricle was found the round ball which is suspended over the heart. It is about an inch in diameter, very elastic, very smooth, without any trace of pedicle, and lay quite loose in the left auricle. It appears to be formed of fibrin, and without doubt had been in process of formation a long time before death.

1278.—A left ventricle, in which there are several round and oval portions of fibrin firmly adhering to its internal surface, among the fleshy columns near the apex. The two largest portions present cavities which contained a fluid resembling pus.

From a man 35 years old, who died of phthisis.

1275.—The appendix of a left auricle. It is occupied by a clot, which is closely adapted to its wall. The top of the coagulum is raised to show the ragged, broken-down character of its interior. In the recent state this central portion was soft and diffuent and of the colour of ordinary pus. It consisted of granular matter and oil globules, the latter in great abundance.

ENDOCARDITIS.

1. *Simple.*

Simple endocarditis occurs in :

Acute rheumatism.

Chorea.

Scarlatina, and rarely some other fevers.

Endocarditis does not affect the entire endocardium,

but is usually limited to the valves, and especially those portions of the valves which are brought into contact during closure. Bead-like vegetations, which are at first minute, are formed in rows along the edges of the lunulæ of the aortic valves, and near the edges of the mitral valve curtains on their auricular aspect.

These vegetations have a grayish-pink colour, are translucent at first, and microscopically are seen to be produced by proliferation of the subendothelial fibrous tissue, which is infiltrated with leucocytes. The larger vegetations are covered by caps of fibrin deposited from the blood which circulates over them. Such fibrinous deposits may attain to a considerable size, and may become detached, forming emboli.

1330a.—Shows the bead-like vegetations extremely well. The patient was a girl aged 16, who died of chorea. On the auricular surface of the edges of both cusps of the mitral valves are rows of small vegetations which completely encircle the orifice. When fresh some of the beads were soft to the touch, others rather firm.

1300a.—A heart from a case of tetanus. A fringe of small pink semi-transparent vegetations encircles the free edge of the mitral valve. Two of the aortic valves are adherent, but there was no aortic regurgitation. The posterior aortic cusp is fenestrated. The pulmonary and tricuspid valves are normal.

Simple endocarditis is—at least, in extra-uterine life—almost confined to the left side of the heart; when the valves of the right side are attacked, those of the left heart are always seriously affected also.

2. *Ulcerative or Malignant Endocarditis.*

In cases of this condition the fibrin caps which cover the vegetations are always found to contain areas which stain deeply with aniline dyes, and which, under high microscopic powers, are seen to consist of colonies of micrococci. In different cases different species of micrococci are present. The vegetations formed are, as a rule,

larger, and are by no means confined to the surfaces of the valves. In many cases the inner surface of the auricle is studded with numerous vegetations, and the right side of the heart is much more often affected by ulcerative than by simple endocarditis. In some instances the vegetations attain to a great size. They are readily detached, and being conveyed away from the heart by the blood, form septic emboli in various organs and structures. It appears that in many instances fresh portions of the endocardial surface are infected by contact with the diseased tissues. The softening and removal of the out-growths leads to the formation of cavities or ulcers, which may lead to aneurysmal dilatation or perforation of a valve, or to rupture of the chordæ tendineæ. Ulcerative endocarditis not infrequently occurs in hearts which are the seats of long-standing valvular disease.

1297.—Part of a boy's heart, in which there are numerous fibrinous vegetations attached to the lining membrane of the left auricle. Many of them are half an inch in length, lobed and pendulous, and attached by narrow bases. The lining membrane of the auricle appears slightly thickened.

The patient was 15 years old, and had been considered as suffering with some organic disease of the heart for thirteen years. Four months before his death he had an attack of hemiplegia, which was followed by persistent contraction of the left arm and leg. Five days before death, after a sudden seizure like apoplexy, he became completely unconscious, and so died.

After death, upwards of six ounces of serum were found in the cerebral ventricles and the spinal canal. The right optic thalamus and the parts about it were softened and dark, but no hæmorrhage had occurred.

1298.—A heart suspended so as to expose to view the left auricle and ventricle. A patch of papillomatous vegetations extends over a considerable portion of the surface of the left auricle, and also over the auricular surface of the adjacent cusp of the mitral valve. Both cusps of the mitral valve are thickened and contracted. A pendulous vegetation is attached to the aortic cusp.

From a woman aged 27 years. She had an attack of acute rheumatism when 16 years of age, and another seven years later. A loud systolic murmur was heard at the apex, and very loudly behind. She suffered no inconvenience from her heart affection, but died of uræmia, supervening from an acute exacerbation of chronic nephritis.

Traces of infarcts were found in the kidney, and more recent infarcts in the spleen.

1299.—Mitral and aortic valves, with a middle cerebral artery and its chief branches. The free border of the mitral valve is thickly studded with a ridge of rough cauliflower-like masses of firm white fibrin, forming warty excrescences of various sizes and shapes. The aortic valves are studded by a similar collection of smaller warty vegetations. The texture of the valves is scarcely changed. Impacted within the right middle cerebral artery, just at its origin, is a firm plug of pale, fibrinous substance, about the size of a hemp-seed, completely blocking up the canal of the vessel; but there is no appearance of disease in the coats of the artery. It is believed that the fibrin obstructing the artery was detached from the valves of the heart, and carried in the stream of blood to the spot at which it was arrested.

1299b.—Heart of a girl aged 20, who had multiple aneurysms of the arteries of the extremities following embolisms. The organ is the seat of ulcerative endocarditis, and it appears to have been diseased for a considerable period before death. The aortic valves are covered with vegetations and calcareous matter. The sinuses of Valsalva are dilated so as to form aneurysmal pouches.

1299c.—Heart with ulcerative endocarditis. The aortic valves are extensively ulcerated, the cusps being ragged and in great part destroyed. Shreds of decolourized and recent blood-clot adhere to the ulcerated surfaces. An ulcer has penetrated the mitral valve, and a clot is adherent to the diseased tissue in the left auricle.

1299e.—Heart showing ulcerative endocarditis, in which there is a communication between the left ventricle and right auricle, either congenital or the result of ulceration. At the base of the posterior aortic valve is a ragged ulcer surrounded by irregular fibrinous deposits. There are also two small endocardial ulcers near this region. Immediately above the valves are several patches of calcareous degeneration.

1316.—A heart in which there are but two pulmonary semilunar valves, and both of these are covered with thick irregular layers of soft fibrin and vegetations, which are deposited in such quantity on the posterior valve that they form a layer extending quite across the artery. On the inter al wall of the artery there are several small wart-like bodies, which are firmly adherent to it; and behind the posterior valve there is a circumscribed ulceration of the inner membrane. The rest of the heart, its other valves, and the large vessels, are healthy.

1322.—The pulmonary orifice and commencement of the pulmonary artery of a boy aged 16 years. There is a circumscribed patch of vegetative endo-arteritis just above the junction of two cusps of the pulmonary valve. The patch is elevated, shelving gradually to the edge; at the summit is a crater-like opening with undermined edges, which leads into a small cavity bounded externally by the external coat of the artery. The disease also affects the two adjacent cusps of the pulmonary valve: the inner portion of the outermost is destroyed, its free edge is thickened, cloudy, and fringed by minute papillæ; the inner half of the middle cusp is similarly thickened, cloudy, perforated at its lower part, but its attachment is not destroyed. The remainder of the pulmonary artery was healthy, as were also the other valves of the heart.

The boy was admitted to the hospital with what was believed to be phlegmonous erysipelas of the upper arm. Pyæmia developed itself, of which he died. The autopsy revealed acute necrosis of the humerus. He had no cardiac symptoms.—See “Henry Ward Book,” vol. vi., p. 308.

1323.—A portion of the right ventricle and the commencement of the pulmonary artery. The cusps of the pulmonary valve are very extensively ulcerated. On one of the cusps a mass of fibrin the size of a hazel-nut has been deposited. This, hanging by a narrow neck, and easily moving to and fro in the blood-current, must have supplied to some extent the place of the valve. The heart was otherwise healthy.

From the body of a woman aged 40 years, who died in the hospital of renal disease and pyæmia. No evidence of heart-disease was observed during life, and, on account of the patient's great weakness for many days before her death, no auscultation of the chest was made.

Effects of Endocarditis—Valvular Disease.

In hearts which have been the seats of endocarditis progressive changes are apt to take place, leading either to narrowing of the valvular orifices or to inability of the valve-flaps to close the orifices completely.

The diseased valves may also exhibit extensive deposits of calcareous material.

Mitral Valve.—The most usual changes are the following :

1. Shrinking and hardening of the valve-flaps.
2. Adhesion of the flaps. The opening, reduced to very small dimensions, may be surrounded by a rigid ring or by a funnel-shaped valve.
3. Shortening and thickening of the chordæ tendineæ.

1303a.—Portions of the left auricle and ventricle of an adult heart. The mitral valve is thickened, and its cusps are fused into a single circular membrane which projects into the auriculo-ventricular opening, with a central "buttonhole" opening with a rigid border.

1304.—A mitral valve greatly thickened. Its cusps, united, project into the auriculo-ventricular opening, forming a rigid diaphragm. A narrow chink remains for the passage of the blood.

1329.—This specimen is also an excellent example of the button-hole mitral.

Aortic Valves.—1. The aortic valves are apt to become thickened and shrunken, so that they no longer close the orifice.

2. The valves become united, and narrowing of the orifice results.

Stenosis may also be due to the projection of the thickened valves into the opening, or to deposits of calcareous matter in them.

Aortic valvular disease is as frequently due to atheromatous change as to endocarditis.

1305.—Aortic valves thickened and opaque. The chief thickening is in the adjacent halves of two valves whose angles, either congenitally or by later morbid adhesion, are united and drawn down. They thus appear as one valve, and present in place of their two angles a continuous concave border. The inner coat of the aorta is thickened, opaque, white, and tuberculated.

1306.—Aortic valves thickened and calcareous. They nearly close the aortic orifice.

Tricuspid Valves.—As already stated, the tricuspid valve is seldom, if ever, affected alone by simple endocarditis, in extra-uterine life. When tricuspid disease exists there is nearly always associated disease of the valves of the left heart.

1304a.—Heart from a case of chronic endocarditis. The flaps of the tricuspid and mitral valves are fused, so as to produce well-marked stenosis of both orifices. The heart weighs 18 ounces. The right auricle was much dilated, and its walls were thin, as also were those of the right ventricle and left auricle. The left ventricle is little affected.

1311.—Also shows stenosis of both mitral and tricuspid orifices. The tricuspid admits the tip of two fingers, the mitral only the tip of the little finger. The aortic valves are also diseased. Notice the firm, coloured, ante-mortem clot which lies behind the chordæ tendineæ, at the upper and back part of the left ventricle. A similar clot, attached by a pedicle, was found floating in the left auricle.

1312, 1314, and 1315.—Also illustrate tricuspid stenosis.

Pulmonary Valves.—The most frequent affections of the pulmonary valves are congenital stenosis and other abnormalities dating from intra-uterine life, and ulcerative endocarditis.

The congenital affections have been described above, and several specimens of ulcerative endocarditis of the pulmonary valves were also referred to in connection with that affection (**1316, 1322, 1323**).

Simple endocarditis very rarely affects the pulmonary orifice.

Valvular Aneurysm

is usually the result of the ulcerative form of endocarditis. Owing to the erosion of the surface of a portion of the valve-flap, it may no longer be able to resist the pressure to which it is exposed, and as a consequence a bulging takes place, constituting a valvular aneurysm, which projects into the adjacent cavity. Aneurysms of the mitral valve project into the cavity of the left auricle, as will be seen in the following examples :

1354.—Heart of a woman aged 51 years, with aneurysm of the mitral valve. The mitral valve is healthy at its attached and free borders, but in the centre of the large (anterior) cusp is a circular aperture half an inch in diameter, leading into a sac, which projects into the auricle, and is formed by a dilatation of the layer of endocardium on the auricular aspect of the valve. The ventricular layer appears to cease just within the margin of the aperture. The aneurysm is of conical shape, seated obliquely on the auricular surface of the valve. The largest side, that next the free border of the valve, is an inch and a quarter in length ; the shortest, next the attached border, a quarter of an inch. Its diameter at the base is three-quarters of an inch. At the apex is an aperture about a quarter of an inch in diameter, with an irregular fringed margin. There is a second minute orifice on one side, midway between base and apex. On the side of the auricle, at a part corresponding to the apex of the sac, is a white patch. In the recent state the cavity was filled with coagula, partly dark and soft, partly firm and laminated. Both apertures, but especially the auricular, were fringed with fibrous vegetations. The free border of the aortic valves is slightly thickened, and in one of them is a small round aperture almost in the situation of the central fibrous nodule. The heart weighed 13 ounces.

The woman had enjoyed good health until ten months before death, when she had a severe attack of rheumatic fever. Only for the last two months of her life had she suffered from symptoms of disease of the heart, such as dyspnœa, lividity of surface, and anasarca. There was a harsh systolic murmur at the apex and at the angle of the left scapula.

1355.—A mitral valve, with some of the adjacent parts. The substance of the valve is generally somewhat thickened, and the middle of its left portion has been distended into a small bilocular pouch, like an aneurysm. The pouch projects into the cavity of the left auricle: it is about three-quarters of an inch high, and half an inch wide; its orifice on the ventricular surface of the valve is about a quarter of an inch in diameter. It has burst by a large irregular rent in one of its lateral walls. The aortic valves have numerous warty growths on their outer surface and borders, but are otherwise healthy.

Although, as will have been seen, there is so much diversity in the lesions of valves which result from endocarditis, the various lesions all fall into three clinical groups, representing the disturbance of the circulation to which they give rise; viz.:

1. Lesions which cause incomplete closure of the valvular orifices, and so lead to regurgitation.
2. Lesions which narrow the orifices (stenosis).
3. Lesions which both narrow the orifices and also prevent their complete closure.

DISEASE OF THE CORONARY ARTERIES.

The effects of embolism of a coronary artery have already been described in connection with fatty degeneration of the heart-walls, of the localized variety of which degeneration this is the chief cause.

The coronary arteries are not infrequently found to be affected with calcareous degeneration in patients who have suffered from **Angina Pectoris**, and as a result of this change in the arterial coats the lumen of the vessels may be very greatly reduced. It is probable that this condition has an important share in the causation of the angina in such cases, but it is by no means constantly present in those who have suffered from this affection. Occasionally in such cases there is merely narrowing of the orifices of the arteries in association with aortic disease.

1373.—Coronary arteries of a man who had been the subject of angina pectoris. Earthy matter is abundantly deposited in the coats of both the arteries, but their canals are patent. The change was confined to the first division of the arteries, and their small branches were unaffected.

1306a.—Heart of a woman, aged 56, who had suffered from repeated attacks of angina. It weighed $21\frac{1}{2}$ ounces. All the cavities are dilated, and their walls hypertrophied. The aortic valves are contracted and thickened, and had upon them two soft, easily-detached growths. The orifices of the coronary arteries are much contracted. A glass rod has been passed into each, and they have been partly dissected out. There is advanced atheroma of the aorta. The chordæ tendineæ of the mitral valve are shortened and thickened.

Aneurysms of the Coronary Arteries

are occasionally met with, as is well seen in the following specimen :

1374.—From the body of a boy aged 7. There are here no less than three aneurysms : one on the upper and anterior aspect of the right ventricle, near the origin of the pulmonary artery ; a second near the apex of the heart ; and a third is seen at the upper and back part of the right ventricle. The two former have been opened, and are filled with cotton-wool.

In this case no cause for the condition could be discovered, but there were a few atheromatous patches in the aorta and the mitral valve. The patient died of scarlatinal nephritis, with meningitis and pneumonia.

(*For Aneurysm of the Aorta see "Surgical Pathology,"*
Walsham and Power, p. 313.)

SECTION III.

DISEASES OF THE LARYNX AND TRACHEA.

A. AFFECTIONS OF THE CARTILAGE.

Ossification

1. DUE to senile change. Occurs also in the rings of the trachea. True bone is formed.

1610, 1611.

2. A sequel of perichondritis (*q.v.*).

Inflammation.

Acute Suppurative Perichondritis, with death of the cartilage. A sequestrum is formed, and if the patient lives is spat up. It is sometimes cartilage in which the cells have broken down and the intercellular matrix has softened. It is often bony, and it is uncertain why. Either the ossification has determined the inflammation, or, as is more probable, the inflammation has set up ossification.

1625.—Shows an ulcer which, beginning in the mucous membrane, has extended “into the substance of the cricoid cartilage, which is *partially* ossified.” This shows that ossification may result, and rapidly (for the symptoms lasted but one week in this case), from inflammation.

Acute suppurative perichondritis is—

1. Idiopathic. Very rare; corresponds to idiopathic acute suppurative periostitis (acute necrosis) in other parts.

2. Syphilitic.

1639.—Shows “necrosis and separation of the left arytaenoid, and of part of the cricoid cartilage.” These parts were calcified. From a man between 40 and 50 years old, who had been profusely salivated for syphilis. It is possible that mercurial poisoning, and not syphilis, caused the perichondritis.

3. From extension of a tubercular or cancerous ulcer.

4. From injury.

5. A sequel of specific fevers.

1640.—Shows the necrosed arytaenoid cartilages of a man of 36, “who died of exhaustion from typhoid fever on the fifty-third day of his illness.” The intestinal ulcers were healing.

1641.—A similar specimen from a woman of 27, who died on the twenty-fourth day of an attack of typhoid. The intestinal ulcers were healing.

1643.—Shows necrosis of the arytaenoid and part of the cricoid cartilage, from a man who was “recovering from a bad attack of unmodified confluent small-pox.”

Note that the acute stage of the fever had in each case already passed.

Of the various cartilages the arytaenoids are most, the thyroid least liable to acute perichondritis.

Chronic Perichondritis.—Usually due to syphilis.

No specimen.

B. AFFECTIONS OF THE SOFT PARTS.

Acute Laryngitis.—Due to—

1. Cold; excessive use of the voice; or irritants (*e.g.*, tobacco).

2. Extension from nasopharynx, as in ordinary catarrh.

3. Mechanical or chemical injury (boiling water, corrosive poisons, foreign bodies). These may sometimes produce a membranous laryngitis (*q.v.*).

1615.—Shows the effects of acute laryngitis; the mucous membrane is upraised and the glottis much narrowed by œdema. It

was due to a fish-bone which stuck in the fauces. Inflammation extended thence into the larynx.

Acute Phlegmonous Laryngitis (Œdema Glottidis).—Very rapid; attended with great swelling, caused by sero-purulent infiltration of the submucous connective tissue and muscles. The swollen parts are bright red and hard. The swelling is "brawny," and when a cut is made the fluid does not readily drain away.

It almost always occupies the parts above the vocal cords, rarely those just below the cords, and hardly ever the cords themselves, but the swelling of the soft parts is so great as to suffocate.

It is very rare in children, and much more common in men than in women.

(a) Primary.

(1) Idiopathic; rare, and very fatal; probably always due to septic poisoning.

(2) Due to extension from neighbouring parts.

(b) Secondary, occurring in typhoid, small-pox, and scarlet fever, in tubercular or syphilitic inflammation, and rarely in chronic renal disease.

1612, 1613, 1614 are examples. All show the extreme œdema, and the great narrowing of the glottis. The history remaining is not distinct enough to specify the cause in each case.

Membranous Laryngitis.—The surface is covered by a yellowish or grayish membrane, either in a large sheet or in small patches. When this is removed the mucous membrane is always found to have lost its epithelium, and sometimes its basement membrane too. The inflammatory product consists of a fine fibrinous network, which is produced by the death of the epithelial cells and the effusion of liquor sanguinis. Both these processes are due to the inflammatory agent. Epithelium, when alive, hinders

coagulation, but when dead has no such power. The liquor sanguinis, therefore, forms a layer on the surface, enclosing the dead cells and some stray leucocytes. The process is one of "coagulative necrosis."

Foreign pathologists lay stress upon the depth to which the process extends, calling the more superficial variety "croupous," the deeper "diphtheritic," inflammation. In England most men think that these merely represent different degrees of intensity. The foreign use of the word "diphtheritic" in this sense does not necessarily mean that the affection is due to diphtheria, and is, therefore, confusing.

This kind of inflammation is due—

1. By far most often to diphtheria, the inflammatory agent being the bacillus diphtheriæ.

1616 to 1622.—1616 shows both the shreddy and the continuous varieties of false membrane. 1617 shows its extension down the trachea and bronchi.

2. Rarely to other specific fevers—small-pox, typhoid, cholera, scarlet fever, and measles.

1642.—Is an instance of a thin membranous deposit in small-pox.

3. Occasionally to severe injury—scald, burn, or corrosive agent.

Chronic Laryngitis.—The simple form occurs naturally when the voice "cracks," and is also produced by all the causes of the acute.

It is sometimes subglottic, lying just below the vocal cords.

It often leads to thickening by growth of interstitial tissue, and so to stiffening of the vocal cords and paresis of the laryngeal muscles which lie in the submucous tissue. As in the kidney chronic inflammation of the epithelium leads to growths of the interstitial fibrous tissue, so in the

larynx, which may be considered as a single very large epithelial tube, the surrounding interstitial tissue often increases.

Ulceration.

Due to—

1. Injury, such as impaction of a foreign body.
2. Acute fevers, typhoid and small-pox, the most common site being then over the arytaenoid cartilages.
3. Lupus and leprosy, from the breaking down of the small tumours peculiar to these diseases.

No specimens of the above three classes.

4. Tuberculosis, syphilis, and malignant disease (*q.v.*).

These, and especially the first two, are by far the commonest causes.

Stricture.

1. Most commonly results from healing of a syphilitic ulcer.
2. Is an occasional sequel of tracheotomy.

1635. — Shows the larynx and trachea of a man on whom tracheotomy was performed twelve years before death. The opening into the trachea is situated immediately below the cricoid cartilage. The rima glottidis is almost closed by the thickening and contraction of the mucous membrane lining the larynx. The chordæ vocales also are so much shortened that the arytaenoid cartilages are within a quarter of an inch of the angle of the thyroid cartilage. The patient continued to the time of his death to breathe easily through a cannula in the opening made in the operation.

It is not certain how tracheotomy causes stricture. There are probably two factors. Firstly, so long as the cannula is the passage for breath, the laryngeal muscles are without exercise. Muscles left inactive tend to become short and stiff. In the limbs this has to be overcome by passive movement. In the larynx such a cure is impossible, and

they therefore run a risk of continuing in this condition. Secondly, their immobility very likely affects the circulation of blood and lymph there.

Tuberculosis

occurs more often in men than in women, usually between 20 and 40 years of age; rarely in children. Whether it is ever a primary affection is doubtful. It is, at any rate, nearly always consequent upon tuberculosis of the lungs. There are several stages:

(a) Anæmia of the mucous membrane; probably pre-tubercular, possibly predisposing merely.

(b) Pale swelling, usually of the aryteno-epiglottidean folds. This coincides with deposit of tubercle.

1631a.—The larynx from a patient who died of tubercular phthisis. It presents the appearances seen in early cases of laryngeal phthisis, viz.: some tumefaction and slight thickening of the mucous membrane.

(c) Ulceration, due to breaking down of the deposit. The favourite sites are over or between the arytenoid cartilages, the laryngeal surface of the epiglottis, the vocal bands (= false vocal cords), and the anterior commissure of the cords. The process is chronic. The ulcer is on a pale base, and is at first superficial.

1631b.—The larynx of a child, showing very early tubercular ulceration of the inter-arytenoid fold.

It is usually multiple.

1631c.—The larynx from a case of tubercular phthisis. The whole mucous membrane is in a condition of diffuse superficial ulceration.

1631e.—The larynx and a portion of the trachea from a patient who died with tubercular phthisis. The epiglottis is thickened by a tubercular inflammation, and has undergone some amount of ulceration at its apex. The right vocal cord is ulcerated, and there is a deep circumscribed ulcer in the subglottic portion of the larynx.

It will extend deeply and widely, destroying both soft parts and cartilage.

1632.—The process of ulceration has spread into the trachea. It is diffuse, multiple, and in most parts shallow, but at the beginning of the trachea the cartilages are laid bare symmetrically on either side of the middle line (in which is a tracheotomy wound). An inch lower on the right side an ulcer has extended through the tracheal wall.

Syphilis.

Secondary syphilis produces chronic inflammation of the mucous membrane, interstitial thickening, superficial ulceration, and condylomata.

1634.—The tongue and larynx of a man who for some years before his death had suffered severely from syphilis. He died suddenly, apparently suffocated. The mucous membrane covering the larynx, epiglottis, base of the tongue, and surrounding parts, is much thickened and indurated. The papillæ circumvallatæ are considerably enlarged.

Tertiary syphilis produces superficial ulceration, usually of the vocal cords, deep and destructive ulceration usually beginning on the lingual surface of the epiglottis, and gummata, which by breaking down also cause ulceration. Syphilitic ulcer is usually solitary. It is surrounded by a zone of inflamed membrane, whose swelling makes the ulcer seem deep. The process is acute or subacute. It will extend deeply and widely, destroying both soft parts and cartilages.

1627.—A larynx and trachea, with the base of the tongue. The whole of the epiglottis, and part of the arytenoid cartilages with their connecting folds of membrane, have been removed by ulceration.

1628.—A tongue with part of a larynx, in which a circumscribed irregular ulceration has destroyed the epiglottis, the right arytenoid cartilage, and the fold of mucous membrane connecting them.

1629.—A larynx, exhibiting considerable swelling of the right

arytæno-epiglottidean fold and the tissues of the right false vocal cord. Immediately beneath the right true vocal cord there is a slit-shaped ulcer, extending along nearly its whole length. The ulcer leads into a small but deep cavity, containing débris. A similar smaller ulcer is seen beneath it. From a man aged 42, admitted with dyspnœa. Tracheotomy was performed shortly after his admission, and he lived three days after the operation. There was a history of primary syphilis seven years previously, and at the time he had gummatous syphilitic disease of the tongue. On post-mortem examination the rima glottidis was found completely closed by œdema of the cellular tissue about the right arytæno-epiglottidean fold, which formed a soft, well-defined tumour about the size and shape of a cob-nut.

1630.—The larynx of a man aged 50. He was admitted into the hospital with loss of voice and other symptoms indicating disease of the larynx, the origin of which was referred to syphilis. He never complained of, or seemed to experience, any difficulty in swallowing. Death took place rather suddenly from softening of the brain. The larynx is laid open from behind, and the mucous membrane is seen to be thickened and indurated throughout. In different portions there is evidence of former ulceration. No traces of the epiglottis are visible; it appears to have been wholly destroyed, a slight ridge alone marking its place of attachment.

Syphilis is also a cause of suppurative perichondritis (*q.v.*).

Tubercle sometimes causes as complete destruction as syphilis. The epiglottis may almost completely disappear. There is no specimen of this in the museum. These advanced cases cannot be distinguished by the unaided eye. In earlier stages the diagnosis rests upon (1) the number, (2) the shallowness, (3) the rough symmetry, of the tubercular ulcers.

The **infectious fevers** have a great tendency to affect the larynx. Measles and scarlet fever produce a laryngitis which occurs early in the fever, and is probably an internal eruption like that upon the skin. In small-pox and typhoid

there is often laryngitis, usually slight, but sometimes severe. Often small ulcers are found, usually on the surface of the arytaenoid cartilages. Occasionally acute suppurative perichondritis occurs in the later stages of the fever.

Tumours of the larynx belong rather to surgical than to medical pathology.

Diseases of the Trachea.

Primary disease of the trachea is always coincident with disease either of the larynx or of the bronchi, and needs no separate description.

It may be secondarily affected by disease of neighbouring parts, most commonly by aneurysm, less commonly by malignant or inflammatory tumours. These may either compress it or ulcerate through it.

SECTION IV.

DISEASES OF THE BRONCHI.

Inflammation—Bronchitis.

THERE are several forms :

1. Simple or "catarrhal," due to cold, damp, inhaled irritants, or extension of inflammation from the larynx and trachea.

The condition is that common to all mucous membranes when inflamed: turgescence, desquamation of epithelium, and secretion of a serous, mucous, or purulent fluid. Occasionally the secretion is putrid (**Putrid Bronchitis**), but for this no definite cause is known save that it occurs sometimes in bronchiectasis, and may then be due to retention of the secretion in the saccules.

No specimen.

2. Membranous (*vide supra*, p. 41).

(1) Due to diphtheria, by extension downward from the larynx and trachea. The bronchi are never the seat of the original lesion.

1682.—A false membrane that formed in the trachea and bronchi during an attack of diphtheria. The patient, a girl aged 10 years, had been ill for some days, when tracheotomy was performed, and the membrane was drawn out through the wound at the time of the operation. Death occurred on the following day from exhaustion.

- (2) Due to irritants.
- (3) Extending in acute pneumonia from the alveoli to the smaller bronchi.
- (4) A peculiar chronic inflammation, fibrinous or plastic bronchitis, which for some unknown reason forms fibrinous casts and membranes. These are from time to time expectorated.

1683, 1684. 1685.—From a young woman aged 19 years.

1685a.—Casts of the bronchial tubes from a case of plastic bronchitis. The casts are solid cylinders, measuring more than an inch in length, and of the thickness of a crow-quill; they consist of a fibrinous material. Some of the cylinders have a bifid extremity, which represents the dichotomy of the smaller bronchi. From a gentleman aged 30, who had suffered for three months previously from an attack of tracheitis with some bronchitis. The bronchitis ran a somewhat chronic course, and about the end of the third month the casts were coughed up. Before this happened the patient perspired a great deal, but had no marked rise of temperature.

Ulceration.

1. Occurs from within—

(a) From lodgment of a foreign body.

1681b.—The larynx, trachea, and right lung of a child aged 5 years, who had inhaled a nut into the air-passages four days before death. In the upper wall of the right bronchus is a ragged, ulcerated hole communicating with an abscess cavity in the surrounding tissue and containing the nut.

(b) In cases where the purulent secretion, either by long retention, as in bronchiectasis, or from putrid change, as in putrid bronchitis, becomes very irritating.

(c) In tuberculosis (*vide infra*, p. 64).

(d) Rarely in syphilis (*vide infra*, p. 68). A possible specimen is

1687a.—Portion of a lung exhibiting an ulcerated opening ex-

tending through the anterior wall of the right bronchus into one of the main branches of the pulmonary artery. The ulcer of the bronchus is larger than the aperture in the wall of the pulmonary artery. From a man who was brought to a hospital with profuse hæmoptysis, which was at first checked, but recurred and proved fatal. No foreign body was found in the bronchus, and the cause of the ulceration was not explained.

2. Occurs from without—

(a) Of the bronchi inside the lung. Very commonly from the extension of a vomica; sometimes of a pulmonary abscess or of an empyema; rarely from a hydatid.

1688.—Portion of the left lung of a girl with a large hydatid cyst. The cyst had existed in the pleural cavity, and evacuated its contents through the bronchial tubes a fortnight before the patient's death. There were several ragged apertures on the surface of the compressed lung; a piece of whalebone introduced into one of these communicates directly with a bronchus.

(b) Of the bronchi outside the lung. From erosion by an aneurysm, malignant growth, or inflammatory tumour.

1686.—The bifurcation of a trachea, within the angle of which there are several bronchial glands enlarged, and containing deposits of tubercular matter. From the largest some of the tubercular matter, softened and liquefied, has been discharged through an ulcerated aperture in the right bronchus.

1687.—A similar specimen.

Obstruction.

Intrabronchial.

1. Due to bronchitis. The secretion, when thick, tends to stick in the tubes. This is the commonest cause of that increase of expiratory pressure which produces emphysema (*vide infra*, p. 59). If, as very rarely happens, the plug is not removed by coughing, it may caseate. In that case it

causes considerable inflammation, both in the bronchus and outside it (**Peribronchitis**).

No specimen.

2. Due to tubercular deposit. This only occurs in small bronchi.

No specimen.

3. Due to foreign bodies.

1681.—An umbrella point.

1681a.—A seed.

4. Due to scars of ulcers. A very rare cause.

5. Due to intrabronchial growths.

No specimen of either.

Extrabronchial.

Malignant growth at the root of the lung; cancerous or tuberculous deposit in the bronchial glands; cancerous growth of neighbouring organs, especially of the œsophagus; aneurysm of the aorta, and other rarer diseases, may compress the bronchus.

Occasionally an extrabronchial disease may ulcerate through, or, when malignant, infiltrate the bronchial wall, and appear on the inside, causing intrabronchial obstruction.

Dilatation (Bronchiectasis)

is of two kinds, **Cylindrical** and **Sacculated**. The two appear to differ entirely.

1. Cylindrical Bronchiectasis.

The tubes diminish little from the root to the circumference of the lung, and look like the fingers of a glove. The larger are less affected than the smaller, whence the diameter remains nearly the same throughout. The bronchial walls may be thickened or not. The mucous membrane may or may not be congested. The condition

of the surrounding tissue at the time of death is quite variable.

The change is usually local, affecting part of one lung only. This part is commonly the lower lobe.

The mechanism by which this form of dilatation is produced is doubtful. Its site points to a connection with bronchitis. It has been suggested that it is due to the same cause as ordinary emphysema (*vide infra*, p. 59), viz., expiratory pressure. It is difficult to see how this can be, for the obstruction which raises the expiratory pressure must be on the proximal or laryngeal side of the dilatation, and must thus be situated in the large bronchi—a very unlikely place.

It seems more likely that it is due to obstruction of the smallest tubes, which, especially in children, whose power to cough is small, is of common occurrence in bronchitis. When the chest expands in inspiration, the vesicular structure usually expands to fill the void; but when the small tubes are clogged the air cannot reach the infundibula or alveoli, and the lung-tissue cannot therefore expand. The suck of the chest-wall is, therefore, transferred directly to the bronchial wall, which yielding, the tube is dilated. This hypothesis, therefore, ascribes the dilatation to inspiratory pressure (like compensatory emphysema, *vide* p. 59), but it is not taken from any writer of authority, and must, therefore, be read as a mere suggestion. As it is not productive of any particular symptoms, the original cause of the condition may well have passed away, and the condition itself have become wholly latent by the time of death, as is particularly mentioned to have been the case in 1679, from a man who died of pneumonia.

1680.—Portion of a child's lung, in which many bronchial tubes are dilated. The first portions of the larger tubes are of their natural size, but as they proceed in the substance of the lung, they become gradually wider, till near the surface of the lung they

gradually contract, and appear to end in closed extremities. The walls of the dilated portions are thin, smooth, and not marked, as the others are, by the longitudinal elastic fibres projecting on their surface; the adjacent pulmonary tissue appears healthy.

2. *Sacculated Bronchiectasis.*

The tubes are dilated irregularly, and not throughout their course. When they are opened their walls seem crossed with valve-like ridges. These are merely the borders of the pouches formed by local dilatation. When dilated the bronchial wall afterwards becomes changed, the mucous membrane losing its epithelium, and the rest of the wall being so infiltrated with inflammation as to lose its natural character. Then it becomes impossible to distinguish such a dilatation from a vomica formed in the lung-tissue, and communicating with a bronchus.

This form is due to the sclerosis, or interstitial increase of fibrous tissue, which occurs to a greater or less extent in most cases of chronic pneumonia. The tissue contracts, and this pulls upon and stretches the bronchi which lie near it.

1679b.—A left lung showing marked dilatation of the bronchi. These have been laid open, and it is seen that three of the largest all lead into a considerable cavity situated at the base. (There must therefore have been some ulceration of the lung tissue.) The walls of the bronchi are much thickened, and there is a large increase of fibrous tissue throughout the lower parts of the lung. The bronchi leading to the upper lobe are also dilated. From a man aged 32, who had general emphysema with many signs of old tubercular disease.

Tubercular deposit is found in the submucous tissue of the bronchi, carried thither by lymphatics from a previous deposit in the lung. It thickens and inflames the mucous membrane, and eventually causes ulceration, which may extend outwards into the lung-tissue.

Syphilis (*vide* p. 68).

Tumours in the bronchi are extremely rare.

SECTION V.

DISEASES OF THE LUNGS AND PLEURA.

A. THE LUNGS.

Congestion is not illustrated in the Museum.

It is a common condition, due either to stasis from weakness or disease of the heart, or to dyspnoea.

When the heart fails, the lower part of the lung, whence the blood has to be forced uphill, becomes more congested than the rest (**Hypostatic Congestion**).

Hæmorrhage.

Besides that due to pneumonia (*q.v.*), the principal forms of hæmorrhage in the lung are—

A. Circumscribed Interstitial.

1. Due to the causes of congestion. In this case it occurs usually at the bottom of the lower lobe. The lung becomes heavy, hard, dark red or black, and airless. The affected part is not wedge-shaped, and fades gradually into healthier tissue.

1707a.—A portion of the lower lobe of the lung of a man aged 50, who died from hæmoptysis. The majority of the air-vesicles and bronchi are seen to be filled with blood, but the lung does not appear to have undergone any structural change. The hæmorrhage was capillary, and no plug was found in any pulmonary vessel.

1707b.—The same change is shown. It is the lung of a woman who died with mitral stenosis.

2. **Infarction**, due to the occlusion of an artery either by embolism or by local thrombosis. If by embolism, the plug is derived either from the right side of the heart or from some distant venous thrombus.

For a minute description of the process see p. 186.

Infarcts in the lung lie at the surface and usually at the edge of a lobe. They are wedge-shaped, with the apex toward the centre. They are distinctly limited by neighbouring healthy tissue. Their appearance is much like that of the previous variety, but the shape, the distinct limit, and usually the site of the infarct, distinguish them.

There is no good specimen of simple infarct of the lung. 1705 is very doubtful. 1706 is now too old to be distinct. 1707 is instructive to criticise. It shows the lower edge of the lower lobe of the lung solidified, and in the upper part (reversed in the bottle) of the solid tissue is a large deposit of pigment. Above this the lung becomes gradually more and more open. There is no distinct margin. The site and the appearances would better fit the preceding variety, and so would the history. The man died of cardiac disease, and had lately had frequent hæmoptysis. There is no mention that an artery was plugged, and the specimen is probably not infarct at all.

The process can, however, be beautifully seen in 1711a, which is a pyæmic infarct, the embolus being a poisonous morsel from some other poisonous centre. The mechanical results are the same, but, pyæmic plugs being very small, the infarct is small too. The patch is wedge-shaped. Its apex points to the centre. It is divided into two parts. The inner is pink and quite solid. It is the part served by the plugged artery. It is surrounded by a deep-red zone, which is still partly open, of surrounding inflammation.

In pyæmic cases the plug, being poisonous, forms the nucleus of an abscess, as in 1711b. But in simple cases the lung differs from harder organs in that scars of old infarcts are rare, showing that in most of them the circulation is re-established.

The name **Pulmonary Apoplexy** is given indiscriminately

to both these forms. It is a thoroughly bad name, and those who use it either ignore or are ignorant of the meaning of the word.

B. Vomical.

Due to rupture of an artery in a vomica. The change in the arterial walls is sometimes ulceration from without, the vessel being involved in the process that has destroyed the lung tissue, sometimes aneurysmal. In the latter case the vessel, passing free along the wall of or across a cavity, receives no support from the surrounding tissues, and is therefore prone to yield to the blood pressure.

1758.—Lower lobe of the right lung, showing a small cavity the size of a cherry, which contained a clot of blood. The clot proceeded from a rent in an aneurysm of the size of a cherry-stone, seated upon a large branch of the pulmonary artery.

1758a.—Portion of the lower lobe of a lung from a case of phthisis in which there was extensive excavation. An unruptured aneurysm of the pulmonary artery as big as a small bean is seen to have been formed in the cavity.

1758b.—A similar specimen. The patient was a man aged 25, who died of tubercular meningitis.

1758c.—Portion of the left upper lobe from a male aged 39, who died from a sudden hæmoptysis in the course of phthisis, although he was gaining flesh and improving in his general health. There is a tubercular excavation. In one recess of the cavity is a ruptured aneurysm of the pulmonary artery as large as a small cherry. The rupture is a small linear slit.

1758d.—A similar specimen, in which also death came by hæmoptysis.

When blood is thus extravasated in mass into a cavity, it is coughed into the bronchi and trachea, and thence *inhaled* into the bronchioles and alveoli.

The appearance due to inhalation of blood is well seen in **1708**. The distribution is alveolar and lobular. The edge of the hæmorrhagic patches is quite sharp, the neighbouring tissue healthy. The line of demarcation plainly in many places corresponds to an

interlobular septum. The patches are multiple, and of quite irregular shape. The infiltrated tissue is not solid, for air is mixed with the blood. The septa are not, as in 1707a, concealed.

C. Petechial.

Small, circumscribed, and sharp-edged hæmorrhages situated both on the surface and in the substance of the lung. They occur in hæmophilia, purpura, scurvy, and infectious fevers of a malignant type, and are sometimes due to congestion.

1709.—Taken from a child who died of asphyxia.

Collapse.

The lungs of the foetus are dense, fleshy, livid, and airless. A part may at birth fail to expand from occlusion of the bronchus, compression of the lung, or want of inspiratory power. This part will remain in the foetal condition. This is **Atelectasis**.

Collapse is the same condition when acquired by lungs that have held air. The lividity is produced by the venous and unoxygenated blood in the airless part. Collapse is due either to occlusion of a bronchus or to compression.

In the first case the chest-wall is unable to suck air into the area served by the plugged tube, and this part cannot therefore expand. It is sunk below the surface of the rest, and has the appearances described above. The commonest cause of collapse is bronchitis.

In the second case the pressure exercised by the compressing body is aided by the natural tendency of the lung to contract whenever it is released from the suction of the chest-wall. The commonest cause of compression is pleural effusion, which when large will squeeze blood as well as air out of the lung and leave it a shrunken gray mass lying near the vertebral column (**Carnification**).

Other causes of compression are pneumo-thorax and

mediastinal tumour, whether pericardial effusion, aneurysm, or new growth.

1683.—Portion of the left lung of a girl with a large hydatid cyst. The cyst had existed in the pleural cavity, and evacuated its contents through the bronchial tubes a fortnight before the patient's death. There were several ragged apertures on the surface of the compressed lung; a piece of whalebone introduced into one of these communicates directly with a bronchus. The patient, 23 years old, had been troubled for a year and a half before death with cough and occasional hæmoptysis, and died with symptoms of pneumothorax, which ensued suddenly a fortnight before death, and immediately after coughing up a large quantity of watery fluid. There was a large hydatid cyst, containing echinococci, in the liver of the same subject.

1696.—A portion of lung indurated and collapsed, and invested by a layer of extremely thickened pleura. From a patient who suffered from chronic pleurisy.

Emphysema.

1. The lung is larger than natural, often completely hiding the heart and overlapping its fellow behind the sternum. It will protrude also into the "complemental" pleural spaces between the diaphragm and the ribs. Its size is due to over-expansion of some of its parts. The pieces affected are pale and stand out above the surface of the rest when the chest is opened, or if they occupy the edge they make it irregular and lobulated. They feel soft and downy, they pit on pressure, and if the change is extensive the lung is lighter than usual. Sometimes large bullæ filled with air project from the surface.

Emphysema varies in site. Sometimes it is general, affecting the whole of both lungs; more often it is confined to the apices and the edges. In other cases, as in phthisis, or in children's bronchitis, it is confined to the neighbourhood of contracted or collapsed parts of the lung, and is then called "**Compensatory**" **Emphysema**.

2. In all the above forms the lung tends to become larger

than usual. But there is another variety occurring in old age, "**Atrophic**" **Emphysema**, wherein the whole lung is smaller than natural and the chest-wall shrunken.

The minute change consists in a degeneration of the alveolar and infundibular walls, which finally disappear in whole or in part, and thus allow the coalescence of the alveoli, and even of neighbouring infundibula. The walls that remain are stretched by distension of the cavities.

This atrophy greatly diminishes the elastic contractility of the lung, which accounts for the enlargement, the failure to shrink when the chest is opened, and the pitting on pressure. The pallor is due to the loss of capillaries from disappearance of the septa on which they lie. The stretching of the alveolar wall diminishes the capillary calibre, so that it may be obliterated even before its disappearance. This loss of capillary area obstructs the pulmonary blood current, and reacts upon the right side of the heart.

The various forms of emphysema vary in cause.

Atrophic emphysema is due entirely to senile degeneration. There is no, or hardly any, distension of the alveoli.

Compensatory emphysema is due to the sucking power of the chest-wall, under which, if a part of the lung is collapsed or contracted, the neighbouring tissues tend to be sucked out and distended to fill its place. The immediate cause is the *inspiratory* atmospheric pressure within the lung.

Idiopathic or general emphysema, both bad names, is due to *expiratory* pressure. Normal expiration is brought about by the elasticity of the lungs, which shrink as soon as they are relieved from the suction of the chest-wall, and fall in, dragging the chest-wall with them. When, however, the tubes are clogged with mucus, as in bronchitis, the elasticity of the lung is insufficient to expel the air, and the chest-wall itself actively contracts. But the chest-wall is not uniform in strength. The ribs and intervening muscles are stiff and powerful, but the rib cartilages are soft, and if any great

force is put upon them yield, allowing the sternum to bulge forward; the diaphragm depends upon the abdominal walls for its compressing force, while the upper aperture is weakest of all, having nothing but the parietal pleura to retain the lungs. The weak parts of the chest, therefore, yield to the stronger, and allow the lungs to bulge at those places. The apices and the edges are therefore the first to yield. If obstruction is not relieved the whole chest becomes inferior to its task, and bulging takes place in all directions, the chest contracting hardly at all in expiration, and the person becoming short or broken winded.

The elasticity of the lung is probably slightly diminished by the bronchitis which precedes emphysema. Besides bronchitis, which is by far the commonest cause, increased expiratory pressure from other sources may produce emphysema. Blowing wind-instruments, and employments involving severe exertion for a short time, especially lifting heavy weights, have been found to cause it.

It is in many cases associated with gout and chronic renal disease.

There is no specimen of the slighter and much commoner form of emphysema.

1689, 1692, 1693, 1694.—Show extreme stages of the disease, with large bullæ formed by distended infundibula projecting from the lung.

1704b.—A beautiful specimen of compensatory emphysema. It is taken "from a case of diffuse symmetrical pulmonary cirrhosis. The lung-tissue is traversed throughout by numerous intersecting grayish fibroid strands, which appear in places to follow the lines of the interlobular septa." It happens that one side of the section shows the fibrous tissue, and the other the emphysematous; but this is accidental. The point is that, close to the fibrous parts, the lung is stretched to fill up the chest.

Atrophic emphysema is not represented.

Pneumonia—Lobar, or Croupous Pneumonia.

A parenchymatous inflammation affecting a considerable area, usually of one lung only.

The inflammation has three stages. In the stage of **Engorgement** the lung is red and moist, but still contains air. Microscopically the capillaries are greatly dilated. In the stage of **Red Hepatization** the lung is solid and airless, sinks in water, is large and often indented by the ribs. It is easily torn. When cut it is red, dry, and granular. Through the microscope the alveoli are seen full of an exudation which contains a network of fibrin, some leucocytes, and many blood-discs. In the stage of **Gray Hepatization**, while the general signs of solidification are the same, the cut surface is gray, less granular and moister than before. Microscopically the alveoli are full of granular leucocytes and their remains. The fibrin and the blood-discs have disappeared. This stage has been called suppuration and purulent infiltration of the lung.

The disease appears in the lower lobe more frequently than in the upper, and in the right lung more often than in the left. The pleura over the inflamed lung is itself usually inflamed.

When primary, pneumonia is due to several causes:

1. Probably to a specific poison, the pneumonia being the local manifestation of a general disease.
2. To chill.
3. To injury from without by violence, or from within by the inhalation of irritants, such as dust and gases in the air, or foreign bodies, such as food, vomited matter, or other things dropped by accident into the larynx.

It occurs as a secondary affection in heart disease, kidney disease, infectious fevers, and rheumatism. In these cases the symptoms are much less acute, but the post-mortem appearances are similar.

It may also be caused by extension from neighbouring structures.

Results :

1. Resolution, chiefly by liquefaction and reabsorption of the exuded matter, partly by expectoration.
2. Gangrene.
3. Abscess (?).
4. Chronic pneumonia with sclerosis.

1698.—Shows two lobes of the lung. The upper is healthy, and its tissue open ; the lower is solid. The pleura surrounding the lower lobe has shared in the inflammation.

1700.—Similar.

1699.—Section of a lung of which the whole of the lower lobe is of a pale but rather bright yellow colour from the infiltration of pus. This represents an extreme form of gray hepatization, and has been by some men classed as a fourth stage.

1704.—Although the history of the case is wanting, this is probably pneumonia resulting in gangrene. There is consolidation of the lower lobe, and of the lower part of the upper. In each a piece of lung has died. These cases usually occur in persons whose tissues are debilitated by drink.

1697.—Shows consolidation which had lasted five weeks. This is probably one of the uncommon cases which resolve very slowly, and may be classed as chronic pneumonia.

Broncho-Pneumonia—Lobular, or Catarrhal Pneumonia.

A parenchymatous inflammation affecting many small patches, usually of both lungs.

The inflammatory patches vary in size from that of a pea to that of a filbert. The naked-eye appearances are those of red or gray hepatization. The lung consequently looks mottled. The patches may, however, be so closely set that a large area is consolidated.

When the patches are separate there is no difficulty in distinguishing broncho-pneumonia from pneumonia. But when many have coalesced they present an appearance not

unlike the latter disease. There are, however, distinct differences to be seen through the microscope. The alveoli are filled with cells which are derived from and resemble those of the alveolar walls, not as in pneumonia with leucocytes or red blood-cells, and there is no network of fibrin such as marks the stage of red hepatization in pneumonia.

The favourite site is the base of the lung.

The disease is nearly always in children.

It is due to bronchitis either directly from inhalation of the secretion into the alveoli, or by collapse, which favours hyperæmia and inflammation. Thus the irritant enters the alveoli by means of the air passages.

There is no specimen.

Pyæmic Inflammation.

From some distant poisonous centre small pieces of septic material are carried by the blood and sprinkled through the lungs. They stick in the very small blood-vessels and produce each an infarct. Their poisonous qualities cause also much surrounding inflammation, which ends in abscess. In pyæmic infarcts, therefore, there may be traced both the mechanical effects of plugging (*vide* p. 55) and the peculiar effects of the pyæmic poison.

1711a.—Shows the earliest form.

1712.—Shows similar patches viewed from the surface of the lung. The pale spot in the centre is the part deprived of blood, which will die and break up. The surrounding dark ring is caused by inflammation. These infarcts are not more than three days old, as the primary disease, acute necrosis of the tibia, began only three days before death.

1711b.—Shows a later stage, in which abscesses have formed and the pleura has inflamed over each.

1712.—Shows how, by extension of the destructive process, a

hole has been eaten through the pleura, and the abscess has thus opened into the pleural sac.

The boy, aged 17, from whom this preparation was taken died fifteen days after amputation of the left thigh. The left femoral vein was full of puriform fluid, which had a free entrance into the blood. The bronchial glands, the liver, spleen, kidneys, and certain muscles were also the seats of infarcts; and the right hip, elbow, and left sacro-iliac joints contained puriform fluid.

Sclerosis—Interstitial Pneumonia, or Cirrhosis of Lung.

The interstitial fibrous tissue increases at the expense of the epithelial, and subsequently shrinks. The surface of the lung is in consequence distorted, and the bronchial tubes tend to be dilated. Nodules of fibrous tissue occur in parts, and compensatory emphysema is produced. The whole lung is smaller and harder than natural, and the chest-wall is dragged in and flattened.

The disease is due :

1. Most commonly to "**coniosis**," or inhalation of irritant dust, as in many forms of mining, steel-grinding, flax-spinning, etc.

2. Sometimes to chronic pleurisy with effusion, to broncho-pneumonia, or to a chronic lobar pneumonia.

The disease is rare, and in the only specimen in the Museum, **1704b** (for description see p. 60), could not be attributed to any of the above causes, but was dependent on increase of fibrous tissue in and outside the bronchi and their branches, for which there was nothing to account. There was no sign of tubercle. (The term **Fibroid Phthisis** is used of this condition, but includes also cases of very chronic tuberculosis, and is a clinical rather than a pathological name.)

Tuberculosis.

The tubercle bacillus produces two lesions in the lung : first, tubercles ; second, inflammation of the parenchyma in the neighbourhood of the tubercles.

A tubercle, which is a zone of peculiar tissue surrounding the parasite, is very small, gray, and hard. This is **Gray or Miliary Tubercle**.

See 1715a to 1718.

1713.—In which are the lungs of a child so young that the ductus arteriosus and foramen ovale are both patent, shows that the deposit may be congenital.

Its contents are giant cells, large cells surrounding these, and an outer ring of small cells. A variable amount of fibrinous network permeates the mass. There are few capillaries, and none appear to be of new formation.

Thus in 1714, 1715, 1719, though the rest of the lung is minutely injected, the injection has not penetrated the tubercles.

Where many tubercles lie near together the lung itself becomes inflamed, and by effusion of cells between them, partly epithelial, produced by the alveoli, partly leucocytes, derived from the blood, is solidified. A solid mass is thus formed of inflamed lung dotted with tubercles.

1716.—Shows such a specimen. The patches in 1719 and in many other specimens would show the same if examined with the microscope.

Such a part has a peculiar tendency to break down and liquefy, forming a yellow cheesy mass. Such a mass is a **Yellow Tubercle**. Yellow tubercle is therefore many gray tubercles and inflamed lung, the whole breaking down. Each gray tubercle also tends to break down, but is so small that the softening is microscopic.

A yellow tubercle spreads by continuity of inflammation, and eventually ulcerates into a bronchus, through which its liquefying contents are expectorated and a cavity or **Vomica** is thus formed.

These, small at first, as in No. 1718, may become of any size and shape. They may extend to the surface of the lung, and by ulceration through the pleura cause pneumo- or pyo-pneumo-thorax.

They are at first bounded simply by inflamed lung-tissue, but later, if the ulcerative process becomes chronic, a wall is formed of fibrous lined by granulation tissue.

1718a.—The right lung of a patient who died of tubercular phthisis. The apex of the lung is characteristically puckered. The puckering corresponds to deeply-seated encapsulated cavities lying in spongy lung-tissue. Numerous nodules are scattered through the rest of the lungs. The left lung of the same patient was extensively excavated and generally diseased. From a man aged 23, a candle-maker by trade, who had chronic phthisis of more than four years' duration.

1718b.—The left lung of a patient who had tubercular phthisis. In the upper lobe are large cavities with trabeculæ running across them. In the lower lobe are numerous small suppurating cavities, some filled with caseating material, whilst others are of acute origin. In a small cavity at the base is a single unruptured miliary aneurysm. From a man aged 27, a metal-turner by trade. The phthisis was of two years' duration; it commenced with hæmoptysis, and he suffered much from diarrhœa. A portion of the intestine showing the tubercular ulceration is preserved in Series xviii., 2016a.

1718c.—The right lung from a patient who had tubercular phthisis. In the upper lobe is a large excavation across which run numerous trabeculæ. The rest of the lobe is filled with caseous nodules. In the lower lobe are softening caseous masses with acute suppurating cavities. From a man aged 19, a porter. The phthisis had probably existed for about a year. It commenced with an attack of bronchitis. The urgent symptoms lasted six months.

1718d.—Shows a still larger cavity.

The parenchyma of the lung yields more readily to ulceration than the trabeculæ. Parts of these are therefore often left free or partially free in the vomica. They contain bloodvessels, and these, left without their natural support, are prone both to become aneurysmal, and if the ulcerative process attack their walls, to be ruptured (*vide supra*, p. 56).

But the tissues tend also to resist, and, by the formation of fibrous tissue round the tubercle, to stop its spread. The

power of the two tendencies varies with the patient, and accordingly there will be rapid softening, large cavities, and early death, or little softening, much formation of fibrous tissue, and a very chronic condition of sclerosis of the lung (**Fibroid Phthisis**), or, as is shown by the numerous cases in which traces of previous tubercle are found in the bodies of persons who died long afterward, the resistance overcomes the attack, the tubercle is encapsuled, often becomes calcareous, and results in a scar which puckers the lung and contains a little chalky mass.

1726.—Section of the upper part of a lung in which a soft material, resembling mortar, and mixed with particles of calcareous substance, has been deposited in small cavities, which, it may be presumed, were previously occupied by tubercular matter. Sections of two cavities are seen filled with this substance; two others have been partially emptied. The surrounding pulmonary tissue is condensed, dry, and of a dark gray colour, from the quantity of black matter deposited in it. The surface of the lung is deeply wrinkled and contracted over the remains of the cavities, and several bands of false membrane are attached to it at the same part.

There are two vehicles by which the parasite is received into the lungs, the air and the blood.

When conveyed by the blood it is derived from some other tubercular deposit in the body, and is sprinkled, usually in great numbers, in the small bloodvessels of the lung. A sudden and widespread eruption of miliary tubercles is thus produced. Fatal cases of acute tuberculosis are usually of this form.

When inhaled with the air it adheres to the alveolar wall, and there sets up an inflammation, which is an alveolar pneumonia due to a specific cause, viz., the parasite. The alveoli become full of the products of inflammation, and small patches of solidification are thus formed in the lung. This (**Catarrhal Phthisis**) is the commoner and more chronic form of tuberculosis.

From the original spots of inflammation the poison is conveyed to others in the lung itself, forming fresh gray tubercles, and to the bronchial glands, which can be seen enlarged in 1713, 1718c, and others. The lymph vessels, and probably the bloodvessels also, are the channels of conveyance.

The above account is in accordance with the usual faith, and for the lesions of acute miliary tuberculosis is true. But the bacillus is rarely found in the earliest or pneumonic stage of catarrhal phthisis before caseation takes place. This surprising fact is not yet explained, but it has not shaken the general belief, and it is still thought that the pneumonic nodules are caused either by the bacillus, or possibly by a spore, or, lastly, by some product of these.

The apices of the lungs and the upper part of the lower lobes are the favourite sites, both of the catarrhal or aerial and of the miliary or vascular infection.

Syphilis

occurs in the lung in two forms, both of great rarity: ulceration of the bronchial mucous membrane (*vide* p. 49), and gumma of the lung-tissue.

The bronchial ulcers occasionally scar and cause contraction and obstruction of the bronchus.

New Growths.

“Primary carcinoma and primary sarcoma of the lung both occur, and the lung is a frequent region of secondary masses of new growth.

“Carcinoma when primary originates in the small columnar cells of the glandular crypts of the bronchi. It usually grows slowly, and forms a large dense whitish mass at the root of the lung, progressing into the lung along the lines of the bronchi, narrowing the large bronchi by pressure and by actual projection on their inner surface.

"Secondary deposits occur in the bronchial glands" (Moore, "*Med. Pathol.*," p. 248).

1729a.—A portion of lung affected with new growth. The lung is infiltrated round its root by a new growth of carcinomatous type. The growth followed the line of the bronchi, and was continuous with a mass of new growth surrounding the main bronchi. From a man aged 26.

Secondary deposits of cancer are shown in **1729**. Portions of lung containing masses of epithelial cancer. In the lower portion an oval mass of the morbid growth, two inches in diameter, is imbedded in the lung at its root, and a portion projects from it into one of the larger bronchi. It is doubtful whether this mass is seated in the lung itself, or in a cluster of the bronchial glands. In the upper specimen a mass of large size occupies the very substance of the lung, immediately beneath the pleura. In the interior of this mass is a large cavity, which was filled with pus and softened cancerous matter, and has irregular broken walls formed by the less softened substance. The boundaries of the cancerous growths are well defined, and the substance of the lung in which they are imbedded appears healthy. The patient was an old man, part of whose penis was removed on account of cancer eighteen months before death.

"Sarcoma when primary occurs in the connective tissue about the root of the lung. It is indistinguishable in its naked-eye appearance from carcinoma, and penetrates the lung in the same way. It is accompanied by the formation of much dense connective tissue outside the small-celled new growth" (Moore, "*Med. Pathol.*," p. 249).

1728a.—A portion of the right lung infiltrated with a round-celled sarcoma from a case of primary sarcoma of the lung. The surface of the lung is covered with soft lymph. It was collapsed against the root. From the root a new growth penetrates the lung. The growth begins around and between the bronchi, and extends for two inches into the walls of both bronchi, but without penetrating into their interior. In the lower part of the lung is a cavity filled with coagulated flocculent lymph. The patient, a man, aged 52, a year before admission to the hospital, began to complain of weakness

and cough, with pain in the chest and occasional hæmoptysis. Five weeks before admission he became hemiplegic. A week before his death he had a large pleural effusion on his right side. At the autopsy several secondary growths of sarcoma were found in various parts of the brain.

1728b.—A section through a left lung infiltrated with a round-celled sarcoma. The lung-tissue proper is almost entirely replaced, except at its anterior surface, by the new growth, which has a yellow mottled appearance, and is of a firm consistence. The growth is most dense along the parietal pleura. The pleural cavity was entirely obliterated. From a waiter, aged 18 years, who had symptoms of pulmonary phthisis at the left apex. An attack of hæmoptysis first drew attention to the disease, when the patient gave a history of two attacks of pleurisy on the left side. The signs of a cavity at the left apex developed, and subsequently disappeared, the only physical sign which remained being an absolutely dull note on percussing over the left side of the chest in front. A large new growth springing from the iliac bone developed itself, and gave rise to acute pain in the right leg, which prevented the use of the limb. Many nodules of new growth subsequently developed in other parts of the body.

Secondary deposits are shown in **1740**, **1740a**. An ossifying deposit, secondary to primary sarcoma of the knee, is shown in **1728c**.

Parasites.

1748a.—A section of human lung infested with the ova of *Bilharzia hæmatobia*. From the same case as the genito-urinary organs preserved in Series xxviii., **2393c**. The parent worms are preserved in the same Series, **2393d**. A microscopical section of the lung is preserved in Series lv., **69j**.

1746a.—Portions of the walls of a hydatid cyst, which were coughed up from the lungs of a young woman who was supposed to be phthisical. After expectorating the hydatid membrane she made a good recovery.

1746b.—A portion of a lung, in which there is an irregular cavity with a smooth lining membrane caused by a hydatid cyst. The cyst itself lies at the bottom of the bottle.

B. THE PLEURA.

Inflammation (Pleurisy).

The pleura is reddened and lymph is effused on the surface of one of the layers of the sac. This tends to adhere to the opposing layer, and becomes organized into fibrous tissue, binding the two layers together at one spot, or at several, or over a large area. A severer inflammation produces a larger effusion, the fluid part of which tends to collect at the lowest part of the cavity, and compresses the lung at that part. As the fluid increases it presses upon other parts, displacing the mediastinum, the heart, and the diaphragm, and distending the intercostal spaces.

Either the effusion is reabsorbed or it is not. If it is, the lung expands again or the chest-wall falls in, the pleura is left thickened, and its two layers usually adhere.

1665.—Portion of a lung, from the surface of which a layer of false membrane formed upon the pleura has been reflected. The substance of the false membrane is compact and firm, but its free surface is shreddy. The pleura exposed by its reflection is thickened and opaque.

1668.—Portion of pleura costalis thickened and indurated so that it resembles a layer of cartilage.

1670.—Extreme thickening, with adhesion, of the pleural layers, the result of repeated inflammation.

These thickened membranes sometimes become calcified.

1671.—A large portion of bone-like substance, which formed in a false membrane uniting the opposite surfaces of the pleura. The patient was an old man, who had long had dyspnœa, and was subject to frequent affections of the chest.

1672, 1673, 1674.—Similar specimens.

But, either because the visceral layer forms adhesions

which prevent expansion of the lung, or from some other cause, reabsorption may fail. Then the leucocytes in the fluid increase, and it gradually turns from serous to purulent, forming a collection of pus in the cavity (**Empyema**). Occasionally this pus, if in small amount, becomes surrounded by adhesions, and may remain latent, or dry up, leaving a cheesy mass. But usually, and always if there be much of it, or if it become putrid, it points and bursts by ulcerating through an intercostal space, or, more rarely, above the upper opening of the thorax, through the lung into a bronchus, or behind the diaphragm in the loin, or in the sheath of the psoas muscle under the ligamentum arcuatum internum.

After evacuation of an empyema the lung is rarely able to expand, owing to long-standing adhesions. Cure is effected by collapse of the chest-wall.

1675.—Portion of a lung with the pleura covering it; the lower lobe is uppermost in the bottle. It is compressed, and the great thickness of the pleura must have prevented expansion. The patient was a woman 30 years old, who eighteen years before death coughed up a large quantity of pus, which it is presumed had been contained in the cavity of the pleura. The corresponding side of the chest was very much contracted.

When the chest does not collapse spontaneously, operations are performed to produce this result.

1675a.—Portions of five ribs of the left side, which were removed by operation from a patient who had suffered previously from empyema. It was hoped that the chest would fall in around the collapsed lung, and thus cause the obliteration of a large suppurating cavity.

Pleural effusion is occasionally bloody (**Hæmorrhagic Pleurisy**).

Pleurisy is—

(a) Primary, most commonly due to cold, sometimes to external injury.

(b) Secondary.

1. Inflammation may extend from neighbouring parts. In pneumonia the pleura covering the inflamed lung is always itself inflamed (1698, 1699, 1700). Occasionally there is much effusion, which in these cases often becomes purulent. Pericarditis, peritonitis, and some diseases of the liver, may also extend by continuity to the pleura.

2. It occurs in acute rheumatism.

3. It is not infrequent in eruptive fevers and pyæmia. In these cases it is generally purulent.

4. Over tubercular deposit in the lung when near the surface the pleura is usually inflamed. The inflammation is then usually slight and leads merely to the formation of thickened spots or adhesions (1718, 1718a, 1718b, 1718c). But many cases of general pleurisy with much effusion occur in young persons who afterwards show signs of tubercle. The pleurisy is in such cases probably due to already existing but latent tubercle, but its exact pathology is unknown.

5. Malignant disease affecting the pleura or lung produces effusion. The fluid is then frequently bloody.

6. The pleura is also inflamed over an infarct or abscess (1711, 1711a, 1711b), and if it be perforated by ulceration (1711), and receive the contents of the abscess, empyema will be set up.

7. In diseases of the heart, and diseases of the kidneys, pleural effusion is common; it occasionally occurs in great anæmia. In these cases it is usually double, there is less tendency to form adhesions, to become purulent, or to be reabsorbed, and the process is one of exudation from venous stasis rather than of inflammation.

When communication is established through the pleura, either with the outer air, with the lung, or with some part of the intestine, air is sucked by the chest-wall into the pleural sac (**Pneumo-thorax**). This is—

1. Most commonly due to ulceration extending from a tubercular vomica.

1678.—Apex of a lung from a patient who died with pneumothorax. On the anterior surface of the lung are two oval apertures, into which portions of glass are passed, and which lead into small tubercular cavities. There is a third aperture near them of smaller size, and partially closed by false membrane. In the upper part of the lung there is a large cavity; and all the rest of the pulmonary tissue is affected with tubercular disease in different stages.

2. Less commonly to an empyema rupturing inwards or undergoing decomposition.

3. Rarely to gangrene or abscess of the lung, and to ulcer of the stomach or intestines, causing adhesion to, and perforation of, the diaphragm.

4. Lastly to laceration of the lung by fractured ribs, or to external wounds.

When the pleura contains air and a serous effusion the condition is called **Hydro-pneumo-thorax**.

In all these cases pus also tends to form in the pleural sac (**Pyo-pneumo-thorax**).

SECTION VI.

DISEASES OF THE PHARYNX AND ŒSOPHAGUS.

A. THE PHARYNX.

Inflammation.

ACUTE inflammation of the pharynx leads to redness and swelling of the parts. The pillars of the fauces are reddened, the tonsils are often greatly swollen, and the uvula may be œdematous.

This condition sometimes results from local irritation; may be one of the manifestations of some acute infective disease (*e.g.*, scarlatina, syphilis, rötheln), or may occur apart from all other local symptoms (tonsillitis).

The inflamed tonsils often exhibit white or yellowish patches (**Follicular Tonsillitis**), due to the collection in the crypts of inflammatory products and epithelial debris.

Not infrequently suppuration takes place (**Quinsy**), and a tonsillar abscess is formed on one or both sides. These abscesses burst into the pharyngeal cavity. In such cases one or both tonsils may be so much enlarged as almost to occlude the opening of the pharynx.

Ulceration of the tonsils and pharynx may occur in simple tonsillitis or the scarlatinal form, and is not uncommon as the result of syphilitic or tubercular disease.

1839.—The base of a tongue, with the pharynx and other adjacent parts. A large portion of the mucous and submucous

tissues of the pharynx, and of one margin of the epiglottis, is destroyed by sloughing and ulceration. The mucous membrane covering the upper part of the larynx is œdematous and, in some parts, superficially ulcerated.

From a girl who was greatly debilitated by the effects of syphilis and mercury.

1839a.—A tongue and larynx with a portion of the soft palate, showing the narrowing of the pharynx which has resulted from the cicatrization of long-standing syphilitic ulcers. A glass rod has been passed through a perforation which remained in the soft palate.

Hypertrophy of the Tonsils

is common, as a result of repeated attacks of acute tonsillitis, or of a chronic inflammatory process. There is frequently an associated enlargement of the lymphoid tissues at the back of the naso-pharynx (**Adenoid Vegetations**).

1806a.—The pharynx of a child exposed from behind, showing enlargement of the tonsils.

Granular Pharyngitis

is a chronic enlargement of the small lymphoid follicles, especially of those upon the posterior wall of the pharynx.

Thrush.

The pharynx in children shares with the rest of the mouth cavity the liability to the growth of this fungus (**Oidium albicans**), and this must be borne in mind as yet another cause of the development of white patches in this region.

Diphtheria.

The pharynx is one of the most frequent, if not the most frequent, seats of diphtheritic membrane, which may be formed extensively upon the tonsils, arches of the fauces, soft palate and uvula. Patches of diphtheritic membrane

upon the tonsils often bear a very close resemblance to patches of follicular exudation, and must be carefully distinguished from these. When the grayish membrane is stripped off, an ulcerated bleeding surface is usually exposed. The pharyngeal tissues around the membrane are swollen and frequently œdematous, and the lymphatic glands of the neck are swollen, as is the case in many other forms of pharyngeal inflammation. The membrane has the same character as that formed as the result of laryngeal diphtheria.

1837.—Membranous films removed from the mucous surface of the pharynx. Similar ones extended into the larynx. One of these is preserved, and shows that the disease involved the bronchial tubes. The films are opaque, firm, and tough. They do not present any recognisable structure, but consist of granular matter, exudation corpuscles, with traces of imperfect filaments.

From a case of diphtheria.

1805a.—A covering of diphtheritic membrane from the tonsil of a patient with diphtheria.

B. THE ŒSOPHAGUS.

Congenital Deficiency of the œsophagus is occasionally met with.

3639b.—Congenital deficiency of the œsophagus associated with imperforate rectum. The pharynx ends blindly in a pouch of greater calibre than a normal œsophagus at a point one inch below the orifice of the larynx. That part of the œsophagus immediately above the stomach is also well developed, and measures two inches in length. Above this point it is attached to, and communicates directly with, the trachea at its bifurcation.

Inflammation of the Œsophagus

is not a common event, but a catarrhal affection with desquamation of the lining epithelium is sometimes met

with. Lymph may be deposited upon the mucous membrane, which in chronic cases is apt to become thickened.

1836.—An Œsophagus with a portion of the stomach. The inner surface of the Œsophagus is covered with lymph, deposited in strips corresponding with the wrinkles of its lining membrane. Portions of the lymph have become detached, and the subjacent membrane appears unaltered. There was no reason to suppose that this deposit of lymph was occasioned by a poison.

1835 is a similar specimen.

Perforation of the Œsophageal Wall may result from a variety of causes, such as :

1. Ulceration caused by impacted foreign bodies.
2. The action of corrosive poisons.
3. Malignant disease of the walls.
4. Rupture of an external abscess.
5. Pressure of an aneurysm.

1. *Impacted Foreign Bodies* are of various kinds, artificial teeth with their plates being perhaps the commonest. Such bodies are particularly apt to become impacted on account of the sharp metallic hooks which frequently project from them. Fragments of bone are also not uncommon.

1867.—A heart, pericardium and Œsophagus. The broken end of a large fish-bone projects from the Œsophagus about a quarter of an inch above the cardiac orifice of the stomach ; the sharp-pointed extremity is seen protruding through the upper and posterior portion of the pericardium. The bone was in a position directed obliquely upwards and forwards, and it transfixed the diaphragm. On the upper and back part of the wall of the left ventricle, half an inch to the left of the posterior inter-ventricular septum, and corresponding in position to the point where the fish-bone projects from the pericardium, there is a lacerated wound of the heart, consisting of two punctures placed side by side, which extend about a quarter of an inch into the ventricular wall, but do not penetrate it. The parietal and visceral layers of pericardium in the neighbourhood of the wound are discoloured and covered with lymph. The heart is dilated and flabby.

The parts were taken from a man aged 59 years, who came to the hospital stating that he felt a fish-bone sticking in his throat. He complained of pain over the centre of the sternum. On the previous evening he had eaten some fish, whilst partially intoxicated.

A dilating horse-hair probang was passed by the house-surgeon. On leaving the hospital he was very faint, and complained of pain in the region of the heart. He took to his bed, and on the following day appeared rather better, but vomited all his food. On the evening of the third day he suddenly expired. The pericardium was found distended with blood-stained serum and contained some blood-clot.

1867b.—The Œsophagus and trachea with a portion of the stomach of a girl who swallowed a marble. The Œsophagus is ulcerated for about an inch immediately above the cardiac orifice of the stomach, and was so much softened that its wall gave way as soon as it was removed from the body, leaving a large ragged opening through which passed the small black marble seen in the preparation.

The patient was 4 years old. The marble was swallowed three days before her death.

See also 1866.

Other specimens of impacted foreign bodies are 1869, 1869a, 1869b, 1869c.

2. *Effects of Corrosive Poisons.*—When corrosive substances such as mineral acids or caustic alkalies are swallowed, the effects vary according to the concentration of the solution.

The lesions produced extend throughout the Œsophagus and stomach, and even the upper part of the intestinal canal may be involved.

Intense inflammation of the walls of the Œsophagus is produced, and the mucous and even the muscular coat may slough and become detached. If the poison is very concentrated, the entire thickness of the wall of the Œsophagus or stomach may be in places completely destroyed.

The sloughing mucous membrane is black or gray when sulphuric or hydrochloric acid has been taken, whilst nitric

acid produces a yellow slough owing to the formation of picric acid by its action upon the tissues. The effects of other poisons will be referred to in connection with their action upon the stomach.

1870.—An œsophagus showing the effects produced by drinking one ounce of strong nitric acid. Death followed in fifteen hours. The mucous membrane is shrivelled and thrown into longitudinal folds. The tissues were stained of a bright yellow colour, and this staining ceased at the entrance to the stomach. The epithelial and mucous coats of the stomach were destroyed, and the inner surface of that organ was rough, and had a brownish-red colour.

In milder cases when recovery takes place the inflammatory changes lead to cicatrization and narrowing of the calibre of the œsophagus, leading to what is known as simple stricture of the tube.

Post-mortem Digestion.—It is important to distinguish from the changes above described the effects due to post-mortem digestion of the walls of the œsophagus and stomach by the gastric juice, leading to softening or complete destruction of the mucous membrane over a circumscribed area, and even to perforation of the stomach-wall. The normal condition of the mucous membrane elsewhere, and often the locality of the digestive area, will serve to distinguish changes due to this cause from the effect of disease or corrosive poisons.

1861.—An œsophagus with a small portion of the stomach. About half the circumference of the walls of the œsophagus at its lower end is thin, soft, and pulpy; and in the centre of the digested portion is a large aperture with ragged flocculent edges partially blackened. The adjacent parts of the œsophagus and stomach are healthy.

1862.—Here there is almost complete destruction of the œsophageal wall for three inches above the stomach. The portion of the wall which remains in this situation is pale, soft, and pulpy. The stomach appeared healthy.

The child from whose body this specimen was taken died from an

accidental injury, and exhibited no signs of disease of these parts during life.

3. *Perforation from Malignant Disease* will be referred to under that heading. See p. 84.

4. *Rupture of an Abscess into the Œsophagus.*

1859.—An Œsophagus, trachea, and adjacent parts, exhibiting the remains of an abscess, which had formed in the deep cellular tissue of the neck, and had burst in two directions, namely, through the upper part of the Œsophagus, and into the right pleural cavity. A bougie indicates the course of the abscess on the inner side, and across the front of the sheath of the carotid artery and jugular vein.

5. *Pressure of an Aneurysm.*

1860.—Part of an Œsophagus and of a trachea. Below the division of the trachea the pressure of an aneurysm has caused ulceration of the outer walls of the Œsophagus, exposing the mucous membrane, which alone prevented perforation.

Rents in the Œsophageal Wall are occasionally produced in the act of vomiting.

1863.—An Œsophagus and stomach, exhibiting an extensive laceration of the muscular fibres of the former, which occurred in the act of vomiting. Both layers of the muscular fibres of the Œsophagus are torn through at their connection with those of the stomach; and by their retraction towards the upper part of the Œsophagus its submucous tissue is exposed over the whole extent of its last four inches. A similar retraction of the muscular fibres on the fundus of the stomach has taken place, exposing a large portion of its submucous tissue. There is a small laceration of the mucous and submucous tissues of the Œsophagus about two inches from the cardiac orifice.

The patient was a man 65 years old. For about a year before his death he had dyspepsia, and was believed to have stricture in the lower part of the Œsophagus, for which probangs were passed. He was subject to vomiting, and could not swallow anything solid. He felt the rupture of the Œsophagus during a slight act of vomiting, thirty-six hours before death. Great visceral disease is stated to have been found after death; but there is no appearance of stricture

or of any change of structure having existed in the œsophagus previous to the rupture.

Sometimes lacerations are produced by the passage of a bougie down an ulcerated œsophagus.

1864.—The œsophagus and left lung. About one inch below the level of the cricoid cartilage a small glass rod is passed through an aperture on the anterior surface of the œsophagus, leading into a channel formed by the separation of the longitudinal from the transverse layer of muscular fibres. The channel communicated below by two openings immediately above the diaphragm with the left pleural cavity, and by another with the lower part of the canal of the œsophagus: into these apertures portions of glass rod are inserted. Immediately below the upper aperture described, three flat condyloma-like growths project from the mucous membrane of the gullet; otherwise there was no obstruction of its canal. At the lower part of the œsophagus there are two large openings, one above the other, apparently produced by post-mortem digestion. The left pleura is covered with lymph, and there was some pleurisy at the base of the left lung.

From a child aged 2 years. Catheters were passed down his œsophagus on account of difficulty in deglutition, occurring nine weeks after he had swallowed some oil of vitriol. A slight contraction of the œsophagus was felt. A few hours after the passage of some gum elastic catheters down the gullet under chloroform, the mother brought the child back to the hospital, stating that it had been very ill since recovering from the chloroform. The child was admitted, and died on the second day from pleurisy.

Stricture of the Œsophagus is one of the most important results of disease of the tube.

Narrowing of some portion of the lumen of the œsophagus may result from:

1. Disease of the walls of the tube.
2. External pressure, as by an aneurysm.
3. A functional stricture, such as is sometimes met with in neurotic patients.

1. Stricture from disease of the œsophageal walls may be due to:

- (a) Simple inflammatory changes and cicatrization.
- (b) Malignant disease.

(a) Simple stricture is usually of traumatic origin, but occasionally results from ulceration, either simple or syphilitic. Among traumatic causes swallowing of boiling water and irritant poisons are the most common.

The following specimens afford examples of simple strictures, but in neither instance was the origin of the condition known:

1840.—A pharynx and œsophagus, with the larynx and other adjacent parts. Just below the border of the cricoid cartilage the canal of the œsophagus is reduced to a quarter of an inch in diameter, and appears flattened from before backwards. The tissues for some distance around are thickened and indurated. The mucous membrane of the anterior wall of the pharynx above the stricture is ulcerated, and appears œdematous, as if an abscess had discharged through it. Below the stricture the œsophagus is healthy.

1841.—Portion of an œsophagus, showing a marked narrowing of the canal. The mucous membrane is firm and dense, and some cicatrices are seen upon its surface; but there is no evidence of new growth.

The patient, who died of pneumonia, had long suffered from dysphagia, which was supposed to be due to malignant disease of the œsophagus.

(b) *Malignant Stricture*.—Carcinoma of the œsophagus is a comparatively common form of primary malignant disease. The lower part of the tube is its commonest seat, and after that the middle region. The most usual form is squamous epithelioma. The growth commences in the lining membrane, but soon involves the other coats of the œsophagus also, and extends to the neighbouring structures, in which it is apt to set up inflammatory changes, and often suppuration.

A ring of new growth surrounds the lumen of the tube,

which it gradually narrows, so that first solid food, and ultimately even liquids, cannot be swallowed.

The inner surface of the ring of new growth is frequently the seat of ulceration, and, as already mentioned, perforation into the trachea, bronchus, or adjacent lung, with gangrene of the lung, may result.

1845.—The œsophagus of a man, aged 38, on whom gastrostomy was performed one week before death (see specimen, Series xvii., No. 1950). In its course is a broad ring of epithelial cancer, smooth on the outside, but superficially ulcerated on the mucous surface. The stricture produced from it was nearly complete; water would pass through only drop by drop. Above the stricture the œsophagus was only slightly dilated, and elsewhere was quite healthy. The pneumogastric nerves were involved in the cancerous mass. On the upper curve of the stomach, at the pyloric end, was a small nodule of epithelial cancer; no cancerous deposits were found elsewhere.

1846a.—Œsophagus, pharynx, and trachea. The œsophagus is contracted by a narrow ring of epitheliomatous cancer.

The stricture was treated by the retention in it for ten weeks of a soft indiarubber tube similar to that in the bottle.

1847.—The lower half of an œsophagus, with the cardiac portion of the stomach. Within and just above the cardiac orifice there is an annular, flat, spongy growth, probably of medullary substance, ulcerated in its centre; by which growth, as well as by the thickening and contraction of the surrounding tissues, the termination of the canal of the œsophagus is reduced to a very small calibre. Above the stricture the œsophagus is dilated, its muscular coat is hypertrophied, and its mucous membrane appears œdematous, and at one part is superficially ulcerated. The walls of the stomach are healthy.

1849.—The lower end of an œsophagus and cardiac orifice of the stomach affected with cancer. The cardiac orifice is narrowed by the protrusion of the gastric wall by a new growth, and only admits the little finger.

1852.—Illustrates perforation into the trachea.

A larynx, with part of the trachea, pharynx, and œsophagus, from a man aged 49 years. A large ulcer, two inches across, nearly surrounds the gullet. Its walls are thick and cancerous, and an

opening into the trachea is seen as large as a sixpenny-piece. It was on a level with the top of the manubrium sterni.

1853.—Perforation into a bronchus.

Part of an œsophagus, with the trachea and bronchi. Opposite the bifurcation of the trachea, the walls of the œsophagus are nearly surrounded by a firm cancerous growth. The surface of this growth, where it projects into the œsophagus, is ulcerated; and ulceration, penetrating at one part through its whole thickness, has extended into the right bronchus, in the course indicated by the piece of quill.

1854.—Perforation into and gangrene of the lung.

The œsophagus and cardiac orifice of a stomach, showing extensive cancerous ulceration and infiltration, and consequent narrowing of the œsophagus. An ulcerated perforation of the wall of the œsophagus at its lower end is seen, which led into a gangrenous patch in the base of the right lung. The cardiac end of the stomach is thickened and corrugated.

Secondary deposits of medullary cancer were found in the liver, but the lymphatic glands of the abdomen and thorax were not enlarged. From a man aged 68 years.

Less usual forms of œsophageal cancer:

1855.—Part of an œsophagus, in which nearly the whole of the submucous tissue is occupied by a substance resembling that of colloid cancer. In many places the mucous membrane is upraised by colourless and nearly pellucid cystic growths clustered beneath it, and at one part a globular mass of the same structure, about two-thirds of an inch in diameter, is suspended from the submucous tissue into the cavity of the œsophagus.

1858.—A tumour, probably lymphadenomatous, which completely surrounds the œsophagus, so compressing the tube behind the division of the trachea that its canal hardly admitted the quill which is passed along it.

Dilatation of the Œsophagus

is a not uncommon result of stricture, the dilated portion being above the seat of obstruction. The œsophagus usually becomes dilated in all directions, forming a large pouch in which food which fails to pass the stricture accumulates.

The walls of the dilated portion of the tube may exhibit some thickening, owing to hypertrophy of the muscular coat.

1834.—In this specimen an annular stricture of the œsophagus at its cardiac extremity has given rise to great dilatation of the tube, attended with hypertrophy of its muscular coat. In this case the disease had existed for several years.

Sometimes there is conspicuous dilatation of the œsophagus without stricture, and of this the following specimen offers an example.

1833.—An œsophagus with a portion of the stomach. The dilatation commences immediately below the larynx, and gradually increases to its termination in the stomach. In its lower half the tube measured nearly six inches in circumference. In the upper part of the dilated œsophagus the mucous membrane is healthy, but in the lower half there is much superficial ulceration of the mucous membrane, shreds of which hang in the interior of the tube. Just above the stomach the hypertrophied muscular fibres are exposed. The stomach was healthy, and its cardiac orifice is not constricted.

Diverticulum.

Instead of a general dilatation of the canal of the œsophagus, a localized pouch or diverticulum may be formed in the posterior wall, which is practically a hernia of the mucous membrane which has been pushed through the muscular coat.

In addition to these pressure diverticula, others occur on the anterior aspect of the œsophagus, which are produced by the traction of a band of cicatricial tissue which has formed attachments to the wall of the tube. The process appears to have its origin in the inflammation of a bronchial gland, and these bulgings are most commonly situated at about the level of the bifurcation of the trachea.

Diverticula are apt to become distended with an accumulation of food, which may decompose in them, or the loaded

sac may press upon the œsophagus and so cause dysphagia. In one or two instances they have been successfully removed by an operation.

1833a.—An œsophageal diverticulum removed by operation. It measures rather more than an inch in length, and is mainly composed of striped muscular tissue with a lining of mucous membrane.

Clots in the Œsophagus.

Swallowed blood occasionally undergoes clotting in the œsophagus, and so forms casts of the interior of the tube, which may be vomited.

1835a.—Three fibrinous casts vomited by a man who had repeated attacks of uncontrollable epistaxis. They consist of fibrin with blood-corpuscles in its meshes. They measure from three to twelve inches in length, and are nearly an inch in breadth at their thickest parts.

SECTION VII.

DISEASES OF THE STOMACH.

Post-mortem Digestion.

At post-mortem examinations the stomach is sometimes found to have undergone digestion by the gastric juice, and, as a consequence, the wall of the organ may be destroyed over a large area, but evidence of inflammatory change is altogether wanting. This condition is well illustrated by a series of specimens.

1895.—The stomach of a child, aged 10 years, through the coats of which there are four large irregular apertures at the great end and middle of the organ. The edges of these apertures are soft and flocculent, and the remaining mucous membrane of the adjacent parts is soft, pale, and almost gelatinous in appearance.

See also specimens **1896, 1897, 1898**, which exhibit similar changes.

Dilatation of the Stomach is usually due to mechanical obstruction, as by :

1. Narrowing of the pyloric orifice, either congenital or resulting from disease. This is the most common cause.
2. Displacements of the viscus, or adhesions.

Cases however occur in which no such obstruction exists, the dilatation being due to :

1. Some disorder of digestion or of muscular contraction, which allows food or liquid to collect in large quantities, or :
2. Gaseous distension affecting both the stomach and the rest of the alimentary tract.

Dilatation of the stomach is among the points illustrated by specimen 1951b.

Hypertrophy of the Stomach-wall is met with—

1. In association with dilatation, as in pyloric stricture.
2. As the result of chronic inflammatory changes, as in chronic peritonitis.

All the coats of the organ share in the hypertrophy, but the chief increase is in the fibrous tissues. Hypertrophy is sometimes associated with marked contraction of the organ.

1907.—Thickening of the walls of the stomach, consequent upon chronic peritonitis. The stomach is reduced to the calibre of an ordinary large intestine, and the walls are nearly half an inch thick. The mucous membrane is intact, but in one place there is a polypus the size of a horse bean. The stomach was attached to the surrounding structures by strong adhesions. The cardiac orifice would just admit a probe. One inch short of the pylorus all the thickening ceases, and the organ rather abruptly assumes a natural appearance.

Hæmorrhage into or from the Mucous Membrane is of common occurrence, and may result from :

1. Capillary oozing or rupture of small vessels ; usually due to portal engorgement (as in Cirrhosis Hepatis) or to hæmorrhagic diseases.
2. Rupture of varicose veins.
3. Rupture of an aneurysm.
4. Ulceration, simple or malignant.
5. Injury by swallowed bodies or corrosive poisons.

1. *Punctiform Capillary Hæmorrhages.*

1904.—The stomach of a girl, aged 11 years, who died of very rapid diabetes mellitus. The patient suffered with vomiting and purging for several weeks. Two ecchymoses appeared upon the right leg before death. The organ is laid open along its greater curvature. There is capillary congestion of the mucous membrane. Numerous punctiform hæmorrhages are seen, especially about the anterior surface of the greater curvature. The mucous membrane

was covered by a layer of viscid mucus mixed with altered blood, and much resembled the condition seen in poisoning by oxalic acid.

Hæmorrhagic Erosion.—When blood is effused into the mucous membrane, the hæmorrhagic spot is apt to be digested by the gastric juice, and in this way an ulcer is formed to which the name of a “hæmorrhagic erosion” is applied. The ulcer may increase in depth, or cicatrization and repair may take place.

1901.—The cardiac end of a stomach with the lower end of the œsophagus. Six superficial ulcers of irregular outline are seen in the mucous membrane near the cardiac orifice. They vary in diameter from two lines to half an inch. Their margins are clearly defined, their bases smooth and of a deep-black colour from blood effused in and upon them, and from discoloration by the action of the gastric juice. All the adjacent textures of the stomach appear healthy. In the lower part of the œsophagus the epithelium has been removed, the bloodvessels are in parts intensely injected, and the blood in them is deeply blackened.

The patient, who died of granular kidney with cardiac symptoms, showed no signs of gastric disorder during life.

1903.—Part of a stomach showing numerous circular ulcers from half a line to two lines in diameter, which penetrate the mucous membrane. In the recent state many of them contained points of effused blood. From a woman with sarcoma of the breast.

2. *Rupture of Varicose Gastric Veins.*

1905.—A stomach, in the fundus of which are two large varicose veins filled with soft black recent thrombi. A small aperture is seen in the wall of one of them, into which a double bristle has been inserted. The opening was closed by a clot.

The patient died three hours after an attack of hæmatemesis.

3. *Rupture of an Aneurysm.*

No specimen.

4. *Simple Gastric Ulcer.*

Most commonly occurs in young women, but may be met with at any age and in either sex.

The loss of substance in gastric ulcer is, as in the minor hæmorrhagic erosions above described, due to digestion by the gastric juice, and such ulcers are only found in the stomach, duodenum, and occasionally at the lower end of the œsophagus. In the stomach the most common seat for these ulcers is about the lesser curvature, towards the pyloric end of the viscus.

What it is that exposes the tissues to the digestive action is not fully known, and the cause may be different in different cases. Any cause which arrests the blood supply to the part may bring about such a result, and among such causes embolism, thrombosis, and effusion of blood into the mucous membrane, may all be occasionally at work.

The ulcers are usually circular or oval in form, and become narrower from the surface downwards, the mucous membrane being more widely destroyed than the subjacent structures. Sometimes the sides of the ulcer exhibit steps corresponding to the several coats of the stomach.

The muscular coat may form the floor of the ulcer, or may be itself destroyed over a considerable area. The floor of the ulcer usually becomes adherent to some adjacent organ, such as the liver or pancreas, and may perforate into this organ; but perforation may also take place into the general peritoneal cavity.

In recent cases the edges of the ulcer appear clean cut, and there is no thickening of its margin; but when the ulcer has existed for a long time there is well-marked thickening of the surrounding parts, and the clean-cut appearance is, to a large extent, lost.

1908.—Portion of a stomach, exhibiting a general thickening of its coats, with ulceration. The ulcer is oval in outline; its edges are smooth and abrupt. Its base is hollow but smooth; the tissues around are elevated and deeply wrinkled.

1908b.—Portion of a stomach showing an oval chronic ulcer with raised and thickened edges. The wall is almost completely perforated

in the centre of the floor of the ulcer. The ulcer was on the posterior wall at the lesser curvature, about four inches from the umbilicus.

1908d.—Portion of the wall of a stomach showing thickening of its coats and a circular chronic ulcer, with abrupt edges. In its floor are two perforations, both closed with lymph. There are no old adhesions, nor is there any thickening at the base.

1909.—A chronic ulcer, occupying the posterior wall of the stomach close to the pyloric orifice. The edge of the ulcer is at one part cleanly cut and steep, at another bevelled, and the mucous membrane is slightly everted. The muscular coat of the stomach is exposed in the centre of the ulcer. The pyloric orifice was narrowed, apparently from the thickening of the mucous membrane, and the stomach was dilated.

From a man, aged 45 years, who for two or three years vomited every two or three days a large quantity of brown fluid; he never vomited blood. Death took place from exhaustion.

1910.—Portion of a stomach, in which there is an ulcer extending completely through its coats. The ulcer is situated near the lesser arch; its edges are smooth and abrupt, shelving towards the aperture in the peritoneal coat, which is much smaller than that in the mucous coat. The tissues immediately around the ulcer are thickened and indurated, but the rest of the stomach appears healthy.

1912.—Portion of the anterior wall of a stomach, in which there is an oval ulcer, like that in the preceding specimen. The form of the base of the ulcer indicates that it made progress from the mucous to the peritoneal coat, by several distinct steps or stages.

From a girl, 20 years old, who, while in apparently good health, was suddenly attacked by acute peritonitis, and died in twenty hours.

1913a.—In this specimen the ulcer is situated in the lumen of the pylorus, at the end of the lesser curvature. The ulcer has a diameter of a quarter of an inch, and had perforated into the pericardium.

1914.—Portion of a stomach, exhibiting a large ulcer with cleanly-cut margins, which at the upper part has penetrated the wall of the stomach by two irregular openings. There is another smaller, elongated, but deeper ulcer nearer the pyloric orifice. The wall of

the stomach, especially the mucous membrane, is much thickened. A piece of glass tube is inserted into the cardiac orifice.

In favourable cases the ulcer becomes completely healed, leaving a small puckered cicatrix.

1918.—Part of a stomach, with the scar of an ulcer in its mucous and submucous tissues. The place of the scar is marked by radiating wrinkles of the mucous membrane, which converge to it. The membrane itself, both at and around the scar, appears healthy. The ulcer was probably a simple chronic one, such as in No. 1910 had proceeded to perforation of the stomach.

Inflammation.

Acute Gastritis is characterized by congestion of the mucous membrane, with or without hæmorrhages or superficial ulceration of the mucous membrane.

Cases of **Chronic Dyspepsia** fall into two distinct classes, viz. :

1. Those in which the mucous membrane has undergone atrophy, and the secreting structures have shared in the atrophic changes (**Atonic Dyspepsia**).

2. Those in which the mucous membrane is thickened by increase of fibrous tissue. Here, again, some of the gastric glands become atrophied, and others are converted into retention cysts (**Chronic Gastric Catarrh**).

In some cases of **Diphtheria** the false membrane spreads from the pharynx down the œsophagus, and occasionally the whole of the mucous surface of the stomach itself is found to be covered by it, as in the following specimen.

1918b.—The stomach of a child who died of diphtheria. Nearly the whole of the mucous surface is covered by the false membrane. In the fresh state the mucous membrane was red from acute inflammation. The membrane, which had an ashen-gray tint, did not spread beyond the pylorus.

From a child aged $1\frac{1}{2}$ years. At the post-mortem examination the pharynx was found to be affected, but the œsophagus was normal.

Action of Corrosive Poisons upon the Stomach.

When such a poison as a mineral acid or solution of caustic alkali is swallowed, severe lesions of the mouth, œsophagus, stomach, and even of the intestine, result. As in the œsophagus, *q.v.*, the character of the changes in the stomach varies according to the nature of the poison; but all such poisons, when concentrated, cause sloughing and separation of the mucous membrane.

Sulphuric and hydrochloric acid produce gray or black sloughs, whereas those caused by nitric acid are yellow in colour. The sloughs produced by oxalic acid are of paler tint, and carbolic acid and perchloride of mercury whiten the surface.

Caustic alkalies act very much like the mineral acids.

Concentrated corrosive poisons may produce extensive destruction of the entire wall of the organ, whilst more dilute solutions give rise to active inflammatory changes if the patient survive long enough for such changes to be developed, and ultimately cicatrization may take place, with considerable contraction of the walls of the organ.

The action of more dilute or less powerful poisons leads to very marked contraction of the organ, the mucous membrane being corrugated and thrown into folds.

The museum contains an excellent series of specimens illustrating the effects of the various poisons belonging to this class.

Sulphuric Acid.

1940.—The stomach of a person who died in consequence of having taken sulphuric acid. The deep-red colour, mottled with black, and extending throughout the interior of the stomach, is

occasioned by blood effused from the eroded vessels and acted on by the acid. The greater part of the mucous membrane is destroyed, and the surface exposed is rough and shaggy. In the œsophagus and near the pyloric end of the stomach, portions of the mucous membrane remain, and are red, thick, and corrugated.

1943.—The stomach of a woman who died ten days after taking sulphuric acid. Part of its mucous membrane is soft and of a dirty ash-brown colour, and near its pyloric end a portion between three and four inches in diameter has sloughed, and, except at one margin, has been completely separated. The slough hangs loosely; it is very soft and flocculent at its edges, and of brown and yellow colour. About the cardiac orifice of the stomach (which is shown at the back of the preparation) there is a rough and somewhat granulated surface, from which a layer of mucous membrane, after sloughing, completely separated.

Hydrochloric Acid.

1946.—Part of a stomach, showing several large, but healing, ulcers.

From the body of a man who died eleven days after swallowing about two ounces of strong hydrochloric acid.

1946a.—A stomach the mucous membrane of which is corrugated and thickened, and blackened from the effects of hydrochloric acid. Four or five ounces of strong hydrochloric acid were swallowed. Death took place in 24 hours.

See also 1946c.

Nitric Acid.

1947.—The yellow staining is lost in this specimen.

Oxalic Acid.

1948a.—Part of the stomach of a man, aged 32, who died from the effects of oxalic acid poisoning. Nearly the whole of the mucous membrane is in a soft and sloughing condition, with dark-brown patches in places. Near the centre of the specimen is a large oblong patch from which the mucous membrane has been removed, and the muscular coat is thinned in places.

Corrosive Sublimate.

1949a.—Shows the effects of corrosive sublimate. The mucous membrane was at first of an ashen-gray colour, but is now brown as the result of exposure to light.

Phosphorus.

1949b.—Portion of a stomach from a case of acute phosphorus-poisoning. The patient was a man who accidentally took rat paste, and died eight days later. The mucous membrane appeared healthy, but microscopically there was a general degeneration of the gland cells.

Carbolic Acid.

1949d.—A stomach, together with the lowest four inches of the oesophagus, from a case of poisoning by carbolic acid. The stomach has been laid open along the lesser curvature. Notice the firm yellowish coating upon the mucous membrane. This when fresh was brilliantly white, and presented a marked contrast with the inflamed mucous membrane seen in places where the incrustation had been removed.

The patient died three hours after taking the poison.

Polypi on the Stomach Wall.

Small papillary growths are sometimes met with upon the mucous membrane of the stomach, and these are described as polypi. These growths are of inflammatory origin. There is a marked increase of the interglandular tissue, and small cysts are frequently found on cutting them across.

1919.—A stomach exhibiting numerous pendulous and lobulated growths upon its mucous membrane. They apparently consist of tissue similar to that of the mucous membrane itself. The intervening parts of the mucous membrane have a peculiar villous appearance, like the interior of a small intestine when the villi are distended.

See also specimens 1919a, 1920, 1921.

Malignant Growths of the stomach may be conveniently divided into :

1. Those affecting the cardiac orifice.
2. Those involving the body of the stomach.
3. Those affecting the pylorus.

1. Cancer of the cardiac end of the stomach is comparatively rare, and when it occurs is usually an extension of œsophageal cancer, being, like such growths, of the nature of squamous epithelioma.

2. Cancer of the body of the stomach assumes various forms :

a. The entire organ may be thickened and indurated, and of unusually small size, the growth infiltrating all its coats. In such cases the carcinoma is of the scirrhus type (1922, 1924, 1924a).

b. Soft fungous growths of medullary or adeno-carcinoma may spring from some portion of the lining of the viscus (1930).

c. An extensive carcinomatous ulcer with a thickened and indurated base may arise from the breaking down of an adeno-carcinomatous growth. The edges of such an ulcer consist of cancerous material, and are raised and indurated, whilst its floor has a rough or nodular appearance. Not infrequently such ulcers extend so deeply as to perforate the stomach wall (1931a).

3. Cancer of the pylorus is usually of the scirrhus variety, but the softer fungating growths may be situated near to, and partially occlude, the orifice (1927).

The typical scirrhus tumour of the pylorus forms a rounded swelling, due to the infiltration of the whole circumference of the orifice (1926).

The enlargement falls off somewhat abruptly on the duodenal side, but towards the stomach the transition to normal

tissue is more gradual. The mucous membrane of the narrowed pyloric orifice is usually the seat of ulceration.

The stomach is a not uncommon seat of the colloid form of cancerous growth (1935).

1922.—Stomach from a woman aged 47 years. The organ is very small, and all parts are greatly thickened by a cancerous infiltration, except the cardiac and pyloric orifices. The walls are quite three-quarters of an inch thick, and the stomach looks almost like a gizzard. The ileum and the omentum were also affected with cancer.

1924.—Section of a small contracted stomach, exhibiting similar changes.

1924a.—A stomach much contracted, and widely infiltrated with cancer. Its wall is thickened and soft mammillated growths project from its mucous membrane. The surface of these is composed of mucous tissue, and the deeper portions are infiltrated with cancer.

1930.—Part of a stomach, showing an extensive deposit of medullary cancer projecting from its mucous aspect into the interior of the organ.

1931.—Portion of the great end of a stomach, exhibiting a large cancerous ulcer of its coats. The arch of the colon is adherent to the diseased part, and is penetrated by the ulcer extending through it from the stomach.

1931a.—A stomach showing a large malignant ulcer on the posterior wall of the greater curvature. As the result of the consequent inflammation the stomach has become adherent to the adjacent portion of the transverse colon, into which a fistulous opening has been formed. On the gastric mucous membrane near the pylorus is a small nodule which is probably malignant.

1926.—Scirrhus cancer of the pylorus.

1927.—A stomach, with a large round lobular tumour at the pyloric end, and smaller tumours near it. The largest tumour is attached to the exterior of the pylorus and the adjacent parts of the stomach and duodenum. It consists of a close-textured, broken, medullary substance, intersected by white bands. Some of the other tumours project into the cavity of the pyloric portion of the stomach; and in the corresponding part of the mucous membrane there is a large ulcer with elevated and everted edges.

1933.—Cancerous deposit at the pylorus, with a large ulcer extending over the adjacent surface of the stomach.

Colloid Cancer.

1935.—Portion of a stomach exhibiting the changes of structure characteristic of colloid cancer, with ulceration of its coats. There is a large and deep ulcer of circular form, the base and borders of which are formed by a thick, hard, fibrous tissue, containing minute cells filled with a clear jelly. In two situations the ulcer has penetrated all the coats of the stomach.

SECTION VIII.

DISEASES OF THE INTESTINES.

Congenital Malformations of the Intestine.

SUCH malformations are not very uncommon. The intestine may be deficient in parts, or the arrangement of the colon may be abnormal, or its parts may be transposed, and the lower end of the large intestine may open into the bladder or vagina. Sometimes the anus is congenitally wanting, the rectum being incomplete, and ending in a blind sac at a greater or less distance from the surface.

Occasionally a portion of the omphalo-mesaraic duct persists as a diverticulum from the small intestine, which it resembles in structure, and may remain connected with the umbilicus by a fibrous cord.

This abnormal structure, which is known as **Meckel's diverticulum**, is of some pathological importance, since it sometimes leads to strangulation of the intestine and acute intestinal obstruction.

3635b.—Congenital deficiency at the commencement of the jejunum.

3635c.—Congenital interruption of the alimentary canal at the commencement of the ileum.

2168.—A diverticulum arising from the ileum at about fifteen inches from its termination in the cæcum, and attached by a ligamentous cord to the umbilicus. The portion of ileum between the

origin of this appendage and the cæcum had become twisted and entangled about it, causing fatal strangulation.

2168a.—A piece of the small intestine, communicating with which is a diverticulum four inches in length, which leads up to the umbilicus—*i.e.*, a patent omphalo-mesaraic duct. In the loop thus formed another piece of small intestine became fixed and strangulated, causing death from intestinal obstruction. A small opening at the umbilicus allowed the passage of a fine probe. In this opening a thin rod of green glass has been placed.

Catarrhal Inflammation of the Intestines

is attended with injection and swelling of the mucous membrane and excessive secretion of mucus or muco-pus. In severe cases there is in addition a loss of the epithelial lining of the intestine, and there may be so-called catarrhal ulceration of the deeper layers of the mucous membrane in places.

After the subsidence of the inflammation an atrophic condition of the membrane may persist, but in chronic cases there is a tendency to hyperplasia and consequent thickening of all the coats of the bowel. The internal surface of the hypertrophied mucous membrane has in such cases a nodulated appearance, being closely beset with numerous small polypous excrescences.

Thickening and Hyperplasia resulting from Chronic Catarrh.

1970a.—The descending colon with the upper part of the sigmoid flexure, from a case of chronic diarrhœa occurring in an insane person.

The mucous membrane is much hypertrophied. Running for the most part parallel to the long axis of the bowel are deep, irregular, but narrow ulcers, which extend down to, and in one instance had perforated, the peritoneal coat. The peritoneal coat is much thickened, as was also the parietal layer generally.

Amyloid Disease of the Intestine.

The intestinal wall may become the seat of amyloid disease, and this affection is one of the causes of intractable diarrhoea in cases of phthisis.

The mucous membrane is paler than normal, and stains in the characteristic manner with iodine. The staining is in points which correspond to the vessels of the villi, which under the microscope show the characteristic changes of amyloid disease, their walls being swollen and transparent. The Peyer's patches and solitary follicles show merely a yellow stain, and stand out in conspicuous contrast to the deeply-stained portions of the mucous membrane.

1953a.—Portion of a small intestine stained with iodine, showing the selective staining resulting from amyloid disease.

Asiatic Cholera.

In this disease the profuse outpouring of liquid into the intestinal tract is attended with an acute inflammatory condition of the coats of the bowel.

There is swelling and injection of the mucous membrane and its villi, and the Peyer's patches and solitary glands are swollen so that they stand out clearly from the surrounding mucous membrane. In the later stages ulceration may occur, and small hæmorrhagic points are seen in the mucous membrane.

1958.—Portion of the ileum of a patient who died of cholera during the epidemic of 1848. The mucous membrane is dark and congested, and the villi and solitary glands are much enlarged. Some of the latter are raised above the surface, as if on pedicles.

Typhlitis and Perityphlitis—

i.e., inflammation of the cæcum and of the structures which surround it—are now thought to originate almost always in

an affection of the vermiform appendix, but there are some cases in which the inflammation of the walls of the cæcum is due to impaction of fæces. The inflammation of the appendix may be due to the lodgment in it of a small foreign body, *e.g.*, a cherry-stone, a nail, or an orange-pip; but more commonly there is found in it a small mass of impacted fæces, which may be enclosed in a phosphatic coating. Ulceration and perforation of the walls of the appendix frequently results, and as a consequence the adjacent peritoneum becomes involved in the inflammatory process. If the inflammation preceding the perforation has set up sufficient peritonitis to form adhesions, the inflammation may remain circumscribed, and an abscess may form, on opening which the appendix may be found bathed in pus, and not infrequently in a gangrenous condition. Such an abscess may burst externally, or into the general peritoneal cavity or bowel. When the adhesions are not sufficient to form a closed cavity, the perforation of the appendix gives rise to acute general peritonitis.

Slighter degrees of inflammation may cause obliteration of a portion of the canal of the appendix, and by the accumulation of secretion the end furthest from the cæcum may become dilated into a cyst of considerable size.

As a rule, typhlitis has a merely local origin as described, but both the cæcum and its appendix may be the seat of tubercular or typhoid ulceration.

2031.—An appendix vermiformis, in which a hardened mass of fæces is lodged.

2031a.—An appendix vermiformis. The first inch is normal, but immediately below this a small, not very hard fæcal mass was impacted in such a manner as to cause ulceration and perforation of the bowel. The apex of the vermiform appendix was entire, but between the impacted mass and the apex the wall was ruptured in more than one place.

2032d.—A small mass of hardened fæces, which was impacted in a vermiform appendix.

2034.—A cæcum with its appendix. The appendix is dilated, and its walls are thickened. In the middle are two large ulcerated apertures in its coats, which apertures, it is presumed, were the consequence of the lodgment of a gall-stone in its cavity.

2032.—Appendix vermiformis, from a man, aged 43 years, who died of abscess in the brain and liver. The point of a pin may be seen protruding from it into the cæcum, while the head is embedded in a mass of hardened fæces. There was no sign of ulceration, or of either recent or old peritonitis.

2033.—A cæcum; the sharp point of a nail protrudes through an ulcerated aperture in the vermiform appendix. The head of the nail lies in the termination of the cul-de-sac, which is filled by some firm material. There was a small collection of pus around the protruding nail, but no peritonitis. Three or four small abscesses were found in the brain; one in the left centrum ovale being as large as a hazel-nut. There were also abscesses in the bases of the lungs and purulent infarcts in the liver.

2036.—A dilated appendix vermiformis, which has no communication with the cæcum. It was filled with a gelatinous colloid-like material.

From a man who died from disseminated sarcoma.

Effects of Corrosive Poisons.

The effects of such poisons upon the œsophagus and stomach have been already referred to, and it only remains to mention that the intestines also may show similar lesions through a greater or less part of their extent, even to the large intestine.

2042.—A duodenum, exhibiting the effects of sulphuric acid. The mucous membrane is very dark with congested vessels and effused blood; it is in some situations corrugated, in others completely destroyed.

From the same patient as No. 1940. See p. 94.

2043.—Portion of the jejunum of a man, aged 29 years, who twelve hours before death had swallowed about three ounces of commercial nitric acid, the stomach being empty. The surface of the mucous membrane has lost the bright scarlet colour which it

had before immersion in spirit, but the corrugation of the membrane is well shown.

2044a.—A portion of the small intestine showing the changes which have occurred as the result of carbolic acid poisoning. The mucous membrane is much swollen, and has a velvety appearance, owing to the enlargement of the villi and effusion of lymph. The patient died three hours after taking the poison.

Simple or Catarrhal Ulceration of the Intestines.

Simple ulceration of the intestine usually arises in association with catarrhal conditions. There may be extensive superficial ulceration of the mucous surface, or the ulceration may be limited to the Peyer's patches and solitary follicles (**Follicular Ulceration**). In the latter case the formation of the ulcers results from suppurative inflammation of the follicular structures. The cæcum and the rectum are the most frequent seats of catarrhal ulceration.

1963.—Portion of a colon generally thickened, and exhibiting numerous minute ulcers of its mucous membrane.

1963a.—A portion of the descending colon which is greatly thinned, as a result of over-distension. The mucous membrane shows numerous small irregular ulcers, which extend so deeply as almost to perforate the intestinal wall. The ulceration is of the simple variety, and appears to be due to the mechanical distension and irritation to which the walls have been subjected. At the upper portion of the preparation the peritoneum has given way, and the extreme tenuity of the muscular coat is well seen. At one spot the wall has been accidentally ruptured in removing the preparation from the body. The distension was due to cancerous stricture of the rectum.

See also specimen **2018a**, in which simple ulceration is attended with stricture at the ileo-cæcal valve.

1987c.—A portion of the transverse and descending colon from a very advanced case of **Ulcerative Colitis**. The anterior wall of the transverse colon has completely disappeared for a distance of four inches, whilst for a further distance of three inches the intestine

presents a fenestrated appearance. The mucous membrane which remains is extensively ulcerated. The ulcers are sinuous in outline, and are separated from each other by islets of mucous membrane. Their bases are formed by the transverse muscular coat. The omentum was somewhat adherent to the intestines as a result of chronic peritonitis. There were also extensive ulcers in the rectum, extending for a distance of five inches from the anus, and separated from the higher ulceration by five inches of healthy gut.

From an unmarried girl, aged 20, who had passed blood per rectum for eighteen months. Five days before her death she developed subacute peritonitis.

1987a.—Portion of a colon, the internal surface of which is covered with irregular projections, some of which appear pedunculated. These projections are covered with mucous membrane, which the microscope showed to be comparatively normal. In the fresh state they had a dark-blue colour. Between the projections the surface is whitish and thickened and denuded of mucous membrane. The condition is the result of antecedent ulceration followed by scarring, and leaving projections of healthy tissue.

1937b is another specimen from the same case.

Duodenal Ulcers.

Ulcers precisely similar in character to the round ulcers of the stomach are occasionally met with in the duodenum, and are doubtless produced in the same manner by the action of the gastric juice.

1965.—Portions of the duodenum and stomach of a young man. A circular ulcer, with smooth abrupt margins, has completely penetrated the coats of the duodenum, close to the pylorus. The patient died of acute peritonitis.

1966.—The commencement of the duodenum and pyloric orifice of the stomach of a man aged 22 years, who died of acute peritonitis due to perforation. About half an inch beyond the pylorus there is a small ulcer, which has perforated the coats of the duodenum. The mucous membrane around the ulcer is thickened.

See also **1965a** and **1967a**.

Ulceration of the duodenum is also occasionally met with

as a sequel of severe burns and scalds, and such ulcers are believed to originate in Brunner's glands.

1969.—Illustrates this event. It is the duodenum and part of the stomach of a child about 10 years of age, who died suddenly whilst recovering from a burn. There are two oval ulcers about half an inch in diameter, and many of smaller size, in the mucous membrane of the duodenum. The two larger ulcers have penetrated all the intestinal coats. One of the openings is closed by the contiguous surface of the pancreas, which is adherent; but the other opened into the peritoneal cavity.

Intestinal Ulcers of Enteric Fever.

These are met with chiefly in the lower portion of the ileum, and are the result of the sloughing away of the inflamed Peyer's patches. The neighbouring parts of the intestinal wall are the seats of catarrhal inflammation.

The formation of ulcers is preceded by congestion and swelling of the Peyer's patches, which may be seen in cases fatal early in the disease as raised oval plaques with more or less corrugated surfaces. Minute depressions are also seen upon them, which indicate the situations of the individual follicles of which the patches are composed.

Besides the Peyer's patches, the solitary follicles are the seats of inflammation and ulceration, and the lymphoid structures in the neighbourhood of the intestine, such as the mesenteric glands, are frequently inflamed.

1988.—Portions of small and large intestine of a girl aged 12, who died of enteric fever on about the twelfth day of the disease. The jejunum was natural. Nearly all the solitary and agminated follicles of the ileum were found more or less swollen, the swelling becoming more marked as the ileo-cæcal valve was approached. Near the valve the swelling is extreme, but there is no trace of ulceration. The mesenteric glands were greatly swollen. The large intestine was natural.

Later the swollen patch undergoes necrotic changes, and an ulcer is formed which encloses a slough consisting of the

necrosed tissues. When the slough separates a smooth-floored ulcer is left, oval in form like the original Peyer's patch, and with its long axis in the long axis of the intestine. The floor of the ulcer consists sometimes of the muscular, sometimes of the peritoneal, coat of the intestine. Hæmorrhage may occur from the ulcerated intestinal wall, and constitutes one of the gravest dangers of enteric fever.

1994.—A cæcum with a portion of the ileum, exhibiting enlargement and sloughing of the Peyer's and solitary glands. Many of the glands are simply enlarged, others have sloughed with portions of the tissue in which they lie, and in most instances the sloughs appear to have been in process of detachment. There are also several ulcers in the cæcum and its appendix.

From a case of enteric fever.

1997.—Portion of ileum from a case of enteric fever. Most of the Peyer's and solitary glands, with their investing and connecting tissues, have sloughed. Some of the sloughs have been separated, leaving nearly smooth ulcers based on the submucous tissue; others remain still attached, dark and soft. The borders of the Peyer's patches, and of the smaller ulcers, are, for the most part, raised, inverted, and overhanging, as if in progress of healing. But in one of the Peyer's patches (the fourth from the top) the ulceration has made further progress, and perforated the intestine.

1998.—Ulceration of the intestine in enteric fever. Irregular sloughs hang from the ulcerated surfaces.

1999.—Portion of an ileum, from a case of enteric fever, exhibiting an ulcerated surface of the mucous membrane after the detachment of numerous sloughs.

1991.—Ulceration of Peyer's patches and solitary glands associated with enteric fever. The ulcers are small, but deeply excavated, and are surrounded by thickened tissue.

1992.—A somewhat similar specimen, in which, however, the ulcers are less excavated, and the thickening around less considerable.

Occasionally even the peritoneal coat is perforated, and fatal peritonitis results. Such perforation is not infrequently favoured by solid particles of food, and an orange-pip has

before now been found projecting through a hole in the floor of an ulcer.

2001.—The lower extremity of the ileum, showing extensive ulcerations, the consequence of enteric fever, by which the circular muscular fibres are exposed. At one point a circular opening, an inch in diameter, marks the destruction of the entire thickness of the intestinal wall. Here the fæces escaped into the cavity of the peritoneum, and gave rise to fatal peritonitis. A few shreds of lymph are attached around the serous aspect of this aperture. See also **1997** *supra*.

In favourable cases healing takes place; the overhanging edges of the ulcer become attached to its floor, and the central opening is closed by the formation of granulation tissue, a small depressed scar resulting. Owing to the fact that the area which is healed by granulation is only the central portion of the ulcer, the base of which has been covered to a considerable extent by the overhanging tissue, there is little or no diminution of the lumen of the intestinal tube, and stricture resulting from enteric fever is consequently almost an unknown event.

2005.—Portions of an ileum, showing two small ulcers which have nearly healed. The muscular coat can no longer be seen, and the overhanging edges have united to the floors of the ulcers, and the margins appear smooth and shelving.

2006a.—The last eight inches of the cæcum, showing the condition of Peyer's patches in a boy who had had a severe attack of typhoid fever. Fourteen days after defervescence had taken place he died suddenly from dyspnœa due to necrosis of the cricoid cartilage. The Peyer's patches have evidently undergone extensive destruction, and in each there still remains a small circular ulcer of the mucous membrane, which extends down to the muscular coat. One or two solitary glands in the upper part of the preparation also appear to have undergone ulceration. All the ulcers are in the process of healing. They present even and shelving edges.

The solitary follicles of the colon may, like those of the

small intestine, become the seats of ulceration and even of perforation, as the following specimens show :

2004.—Portion of a colon in which there are several small typhoid ulcers from which the sloughs have separated. The floors of the ulcers are formed by the circular muscular coat of the intestine. Their margins are formed by thin portions of the mucous membrane overhanging their bases. The intervening mucous membrane and other tissues appear healthy.

2004a.—Portions of a descending colon, showing a typhoid ulcer which has perforated the wall.

Tubercular Ulcers

are, like those of typhoid fever, most frequently met with in the seats of the Peyer's patches and solitary follicles.

When well developed, tubercular ulcers usually tend to extend laterally, so that, unlike typhoid ulcers, they have their long axis at right angles to the long axis of the intestine. Again, unlike typhoid ulcers, they have thickened and everted, instead of overhanging, edges, the surrounding tissues being infiltrated by the tuberculous deposit. The floor of the ulcer is rough and irregular, and in advanced cases numerous gray tubercles may be seen scattered beneath the peritoneal coat of the intestine beneath the ulcer.

In their mode of formation such ulcers resemble vomicae in the lungs, the loss of substance being due to caseation of the central portions of a tubercular mass, and the evacuation of the caseous material.

2008.—Portion of a small intestine. There are two small superficial ulcers on the mucous surface, and the peritoneum is studded with tubercular nodules of various sizes.

From a child aged 3, who died with general tuberculosis.

2009.—The lower end of an ileum, with the cæcum and its appendix. The mucous membrane is extensively destroyed by tubercular ulceration. The chief ulcers in the ileum and cæcum are large and oval; those in the cæcum have their long axis at right

angles to the axis of the canal, and in some instances nearly encircle it. Mingled with the larger are a few smaller ulcers, which have originated in the solitary follicles and are chiefly found in the appendix of the cæcum. The general characters of the ulcers are that they are surrounded by an elevated, slightly undulating border, which just overhangs their bases, and is nowhere everted, and that their bases are irregularly excavated.

2011.—Extensive tubercular ulcers of small intestines, showing their transverse direction to the axis of the canal. The thickened and everted edges of the ulcers are well seen in this specimen.

2011a.—Part of the jejunum laid open, showing extensive tubercular ulceration of the mucous membrane. Here also the transverse direction of the ulcers is well seen.

2012.—Portion of small intestine, with tubercular ulcers extending completely around its canal; their surfaces are rough and irregular, their edges raised above the level of the adjacent membrane. Tubercles are deposited around, and in the tissues between the bases of the ulcers and the peritoneal coat, projecting in whitish masses upon the serous surface. At two points the ulcers have all but perforated the coats of the intestinal canal.

Perforation.

2015.—Portion of a jejunum in which a tubercular ulcer has completely perforated its coats, making an aperture nearly half an inch in diameter at the bottom of an ulcer of rather wider extent. At the upper part of the intestine there is another ulcer, which has at one part extended through the muscular as well as the mucous coat. The peritoneal coat of the intestine is thinly covered by soft lymph.

Cicatrization.

2016.—Portion of a colon in which a large superficial ulcer has nearly cicatrized. The healed surface is contracted and irregularly wrinkled, and there are several small oval apertures in it, which have smooth margins and edges.

2013.—Also shows partial cicatrization of the lower ulcers.

2016b.—The cæcum, with portions of the ileum and colon, from a patient who died with tubercular phthisis. The mucous membrane of the ileum and large intestine is much ulcerated, and is puckered

by the contraction of old cicatrices. The cæcum is much thickened and ulcerated, the ulcers being here confluent, and of the sinuous type.

Syphilitic Ulceration

of the intestinal tract, although not uncommon in the rectum, is comparatively rare in other situations. The rectal ulcers have overhanging edges of irregular outline, and the floor is rough, uneven and tuberculated.

2058.—The rectum and adjacent portion of the colon, laid open, showing syphilitic ulceration of the mucous membrane. The whole mucous membrane of the rectum is destroyed, except one small patch, which is thickened and opaque. The exposed submucous surface is uneven, tuberculated, and thickened by infiltration. On the mucous membrane of the colon there are ulcers of regular round or oval shape, from one-sixth to about two-thirds of an inch in diameter, with clean, sharply-cut, scarcely thickened edges, surrounded by healthy or only too vascular mucous membrane. Their bases are, for the most part, level, flat, or with low granulations resting on submucous tissue, nowhere penetrating to the muscular coats, with no marked subjacent thickening or hardening. On some of them are ramifying bloodvessels; on some few there is, at the centre of the base, a small island of mucous membrane. At some places two or more of these ulcers, extending and uniting, have coalesced into a large ulcer of irregular shape. By such coalescence some of the ulcers in the lower part of the colon are continuous with the ulcerated surface of the rectum. No ulcers were found in the cæcum, nor in the small intestine, except one very small one of rather doubtful character in the ileum.

From a woman, aged 28 years, who had contracted syphilis seven years previously.

See also No. 2059.

2007.—Shows extensive syphilitic ulceration surrounding a portion of the colon on its mucous aspect.

2007a.—Portions of small intestine, showing the cicatrices resulting from syphilitic ulceration. The patches are numerous and thickened; some are ulcerated, some show scar-tissue and contraction, and some consist of fresh connective tissue.

Dysenteric Ulceration

is almost confined to the large intestine, but it occasionally extends to the lower portion of the ileum. Two varieties of dysentery, catarrhal and diphtheritic, are described, but these probably represent slighter and more severe stages of the same process. The changes met with are similar, whether the patient has died from the epidemic, endemic, or sporadic form of the disease.

In the acute stage the lining membrane of the bowel is intensely congested, the congestion being most marked in the ridges which surround the intestine, and these ridges are covered by a layer of false membrane, grayish in colour, which cannot be removed without causing a loss of surface. Not only the mucous membrane, but also the submucous tissue, is involved in the inflammatory process, being infiltrated with inflammatory elements. The solitary follicles, and in the ileum Peyer's patches, are enlarged and prominent. In more severe cases there is extensive necrosis and sloughing of the mucous membrane, the loosely-attached sloughs so formed having a black or gray tint. The enlarged solitary follicles are early affected by the ulcerative process. The whole wall of the affected part of the intestine becomes greatly thickened, and has a hard, massive feel. Suppuration is frequently met with in the inflamed intestinal walls, and the less affected portions of the mucous membrane may be undermined and detached by the suppurative process.

In the early stages the intestine is lined with a layer of blood-stained mucus, and later on contains in addition many separated sloughs, which consist of granular debris, and no longer exhibit any definite structure.

If the patient survives, the affection may continue in a chronic form, or healing of the ulcerated surface may take place.

Under the former circumstances the bowel-wall becomes more and more thickened, and its lumen is proportionately diminished. The surface from which the mucous membrane has sloughed away becomes covered with granulations. When healing occurs after extensive ulceration, large areas remain in which the glandular layer of the mucous membrane is entirely wanting, its place being taken by scar tissue, which has a black or slaty colour, and the formation of new fibrous tissue extends into the muscular coat.

Early Stage.

1970.—Swollen and villous appearance of the mucous lining of a portion of a large intestine, anterior to ulceration, from a case of dysentery.

Ulceration.

1971.—A similar specimen showing commencing ulceration, involving especially the various rugæ.

1973.—Portion of a colon. Its mucous membrane is generally thickened and indurated, and there are numerous small but deep oval ulcers in it, with sharply circumscribed borders, which extend down to the muscular coat, and in many instances lead to more widely spread ulceration in the submucous tissue. The muscular and peritoneal coats appear healthy.

From a patient who died with dysentery at the General Penitentiary, Millbank.

1975.—Portion of a colon, from a case of dysentery. Small portions of the surface of the mucous membrane, of various forms, are removed by ulceration. All the ulcers are situated on the free margins of the transverse folds of the mucous membrane, and by the sides of the lines formed by the longitudinal bands of muscular fibres. Their form is generally oval or elongated in the direction of the transverse folds.

1976.—Another portion of the same colon from its lower part. By the extension of such ulcers as are shown in the preceding specimen, nearly the whole surface of the mucous membrane is removed. Portions of it remain hanging in shreds, and in some places the ulceration has extended to the muscular coat. The coats of the

intestine were soft, easily torn, dark, and infiltrated with dirty-coloured fluid.

From a patient in the Penitentiary, Millbank. The whole length of the colon was similarly diseased, the extent of the disease increasing from the upper to the lower part.

See also specimens 1977, 1978, 1979, 1982.

1983.—Portion of large intestine, the mucous coat of which is almost entirely destroyed by sloughing.

Perforation.

1984a.—A piece of a large intestine from a case of dysentery. There is throughout very extensive superficial ulceration of the mucous membrane. Numerous small ulcers, which vary considerably in depth, are scattered over the inner surface of the intestine. One of these, near the head of the colon, had perforated, and near the perforation was a small collection of fæces, bounded by lymph.

1985.—Notice the pigmentation in this specimen. See also 1981.

Cicatrization.

1934.—Portion of large intestine, showing the contraction consequent upon the cicatrization of dysenteric ulcers.

1987.—Contraction, with extreme narrowing of the intestinal canal, of a portion of colon, consequent upon the healing and cicatrization of a dysenteric ulcer.

Stricture of the Intestines

may result from one of several causes, viz. :

1. Malignant disease of the walls.
2. Cicatrization of syphilitic or dysenteric ulcers.
3. Cases occasionally occur in which a stricture exists, usually in the large intestine, which cannot be ascribed to any of the above-mentioned causes. In such cases the coats of the intestine about the stricture are usually the seat of a simple ulcerative process.

Above the stricture, whatever be its nature, the intestine

becomes distended and dilates, whilst the part below the obstruction is unduly narrowed.

Simple Stricture.—The following specimens exemplify this condition :

2017.—Portion of a descending colon, the canal of which is at one part suddenly reduced to a quarter of an inch in diameter. Its walls at this part are slightly thickened and indurated, and a narrow band passes across its canal, dividing into two small apertures the orifice by which the portions above and below the stricture communicate. The appearances are as if there had been an ulcer of the mucous membrane, the healing of which had been attended by contraction of the surrounding intestinal walls and adhesion of a part of its opposite surfaces. Both above and below the stricture the tissue of the colon appeared healthy, but its canal below was very small, while above it was enormously distended with fæces, and burst about two inches from the stricture.

The patient was a lady about 30 years old. She had been for three years subject to occasional attacks of obstinate constipation, which were generally followed by diarrhoea. Four months before her death, the obstruction of the intestines became complete, and after this time she had no fæcal evacuation. The cause of obstruction was found to be a cherry-stone which had lodged above the stricture in the colon, and completely closed the canal.

2018.—Stricture, apparently non-cancerous, of the ascending colon, five inches from the ileo-cæcal valve. The canal is contracted very considerably, and there is superficial ulceration of the mucous surface of the intestine around the orifice of the strictured portion.

From a female, aged about 55, who for about five months before death had suffered from frequent constipation, with vomiting and abdominal pain and distension. For fifty-one days before death there was no action of the bowels, except in the expulsion of gas, nor was any food taken into the stomach for the same period. She drank at intervals a little brandy and water, wine and water, and lemonade, occasionally a little orange-juice, and the juice of a few grapes. Almost every day she vomited bile with the "secretions of the stomach." There was no sign of peritonitis, nor of peritoneal adhesions; no enlarged lymphatic glands; no deposit in the liver. The limbs were much wasted, but there was a considerable amount of fat on the abdomen and in the mesentery and meso-colon.

Polypi.

Polypi are more common in the rectum than in other parts of the intestinal canal. They are usually attached by a pedicle to the intestinal wall. Microscopically they consist of areolar tissue, and contain glands similar to those of the intestinal mucous membrane. They sometimes contain cystic cavities formed by the occlusion of glands. Occasionally large numbers of such polypi cover almost the entire mucous surface of the rectum.

2019b.—Portion of a colon the mucous membrane of which is studded at intervals with small polypoid growths. They commence immediately beyond the ileo-cæcal valve, and extend to about the middle of the descending colon. They have no distinct relation to any particular portion of the circumference of the gut. Some are sessile, others slightly pedunculated, all are soft, and both covered with and surrounded by healthy mucous membrane. They are formed entirely by a thickening of the submucous connective tissue.

2019c.—A portion of the large intestine which has been laid open. Attached by a short pedicle, about a quarter of an inch in length, is a small oval polypus of the size of a horse-bean. About an inch above it is a second pedicle, to which a similar polypus was probably attached.

Rectal Polypi.

2062a.—A portion of the rectum laid open to show a pedunculated rectal polypus. The polypus is attached to the mucous membrane of the intestine by a tapering stalk measuring an inch and a quarter in length. It is spongy in structure, and contains small cavities filled with clear fluid. Under the microscope the tumour is found to be composed of areolar tissue, containing a number of glands resembling those found in the rectal mucous membrane.

2065a.—Rectum and anus, with a portion of the sigmoid flexure, from a case of multiple rectal polypi, associated with adenoid cancer at the junction of the sigmoid flexure with the rectum. From a man aged 20 years.

(For further particulars see catalogue.)

2065a(1).—Six polypi removed by operation from the rectum. Microscopically the structure is that of a simple adenoid polypus.

2065c.—A small papilloma of the rectum produced by the irritation of the ova of *Bilharzia hæmatobia*. It consists of numerous dense papillæ, and its substance is filled with the ova. Other smaller tumours were also present.

2065d.—Five polypi of similar origin.

Carcinoma of the Intestine

is far commoner in the colon than in the small intestine. The most usual variety is adeno-carcinoma, but the colloid variety is not infrequently met with, especially in the rectum. In some cases a fungating tumour grows into the canal of the intestine, but more commonly a malignant stricture is produced by the infiltration and induration of the whole circumference of the gut (2020a, 2026).

The inner surface of the contracted tube usually exhibits ulceration, the malignant ulcers having thickened and infiltrated edges. If there be a partial cicatrization of the ulcerated surface, the contraction which results may materially add to the constriction of the lumen.

The neighbouring lymphatic glands, the peritoneum and organs are frequently the seats of secondary growths, and the presence of the disease of the intestinal wall usually gives rise to inflammatory changes in the neighbourhood, setting up a local peritonitis.

2020a.—A piece of jejunum, about one foot from the duodenum, showing a mass of cancerous material situated opposite to the attachment of the mesentery.

2026.—Portion of a jejunum with several small disc-shaped masses of medullary substance projecting into its canal from the submucous tissue, in which they appear to have their origin. They are covered by mucous membrane.

2021.—Portion of the sigmoid flexure dilated, but not materially hypertrophied, above an annular stricture of the intestinal canal. Below this stricture is a crop of exuberant granulations, springing from an irregular, warty, ulcerated surface. At the point of stricture

the walls are thickened and infiltrated with a scirrhous deposit, upon which has grown the soft medullary mass seen below. A bougie is passed through the narrow portion of the canal.

2022.—Portion of jejunum and two portions of ileum. In each portion of intestine there is a circular constriction by which the canal is almost completely closed. At each of the constricted parts there is a cancerous growth springing from and infiltrating the wall of the intestine in a narrow band, extending around the whole circumference of the mucous membrane. Above each of them the intestine is widely dilated, its coats are generally thickened, and the muscular coat especially appears hypertrophied.

The patient, a woman, 37 years old, suffered for three years before death with attacks of constipation and severe pain in the abdomen. The strictures were about two feet distant from each other, and there was another besides the three here shown.

2022b.—Portion of a jejunum constricted by a growth of cancer. The intestine above the constricted part is dilated into a sac, whilst the part below is atrophied and narrow.

2023.—Part of the sigmoid flexure of the colon laid open. A soft villous malignant growth springing from the mucous membrane surrounds and almost obliterates the canal.

2023a.—A portion of the lower part of the colon, situated about two feet above the anus. The bowel is so tightly constricted by a narrowing of new growth that a narrow glass rod can with difficulty be passed along it. The intestine above the constriction is dilated, but its walls are not thickened or infiltrated. The growth is carcinomatous.

2029.—An ileo-cæcal valve, with parts of the cæcum and ascending colon. The several tissues forming the valve appear thickened and indurated with morbid deposit, which, in the recent state, had the characters of colloid cancer. The surface of the mucous membrane is roughly ulcerated. Similar disease, in less degree, exists in the immediately adjacent walls of the cæcum and colon. The aperture of the valve is an oval opening, about one quarter of an inch in diameter.

Intestinal Parasites.

The parasites which inhabit the human intestinal canal are members of the cestoid and nematode group of worms.

Cestoda, or Tape-worms.

These are met with in the alimentary canals of carnivorous animals. The so-called "**tape-worm**" consists of a number of component individuals, or members of a colony. The entire colony is called a **Strobila**, and is made up of a "head" and a varying number of segments, or **Proglottides**. Each proglottis is hermaphrodite. New segments are formed at the narrow head end of the colony, and in consequence those previously formed are pushed further and further away from the head. As they recede from the head the proglottides increase in size and become mature, ova being developed in their interior.

These ova either escape into the intestine and are voided per anum, or the complete proglottis is expelled and afterwards ruptures.

The liberated ovum finds its way into the stomach of the intermediate host, a vegetable feeder. Its shell is dissolved by the gastric juice, a hooked embryo is set free, and bores its way into the surrounding tissues. Having found a resting-place, it increases in size and becomes cystic, the cyst wall being formed partly by the delicate membrane enclosing the parasite, and partly by a fibrous capsule formed by the tissues of the host.

From the wall of the cyst a projection forms which resembles the head of the tape-worm turned inside out. (In the case of the hydatid, the changes are different from those undergone by other tape-worms.)

If the intermediate host is eaten by a carnivorous animal, the head which was formed in the interior of the bladder-worm becomes inverted, the bladder is dissolved by the gastric juice, and in its place a series of proglottides is thrown off from the neck, and the organism enters upon the strobila or tape-worm stage.

Man, being both a vegetable and meat eating animal, is

liable to become the host of tape-worms, both in the strobila and cysticercus stages.

The most common human bladder-worm is the hydatid, which is the cysticercus form of the *Tænia echinococcus* of the dog, but *Cysticercus cellulosæ*, the bladder-worm of *Tænia solium*, is sometimes met with, especially in the eye and brain.

In the alimentary canal the following tape-worms are not infrequently present :

1. *Tænia solium*, the cysticercus of which exists in the flesh of the pig (measly pork).
2. *Tænia mediocanellata*, which exists as a cysticercus in the ox.
3. *Bothriocephalus latus*, the intermediate host of which is not known with certainty, but is probably some fish or mollusc.

Some other species, *Tænia nana*, *cucumerina* and *flavopunctata*, have been met with in rare instances.

In London *Tænia mediocanellata* is the commonest tape-worm.

Bothriocephalus latus is rare in England, but common in some parts of Europe. When met with in this country, it has probably been imported.

Tænia solium.

The complete strobila usually has a length of from seven to ten feet, but may be longer. The head is furnished with a rostrum, which is surrounded by about twenty-six hooklets, alternately larger and smaller, arranged in a circle. Below the rostrum are four pigmented suckers. The head has the size of a pin's head, and the new proglottides near it (the neck) are very small. At some distance from the head they are square in shape, and further still have an oblong form, the length being considerably greater than the breadth.

The genital pore is situated on one of the lateral edges of the mature proglottis, and communicates with the uterus, a tube running along the middle of the proglottis in the long axis, which throws off eight or ten lateral branches.

The ova are of oval form, their long diameter being .03 mm.

1474a* is an excellent specimen of *Tænia solium*. The head and narrow neck are well shown, but the opacity of the proglottides prevents the forms of the uterus from being clearly seen. Notice the genital pores on the edges of the proglottides.

Tænia mediocanellata

is a longer tape-worm than *Tænia solium*, and may reach a length of four yards.

The head is broader than that of *T. solium*, and has no rostrum or crown of hooklets. It has, however, four pigmented suckers.

The proglottides are larger; the genital pore is laterally situated, but the uterus has many more lateral branches (25 to 30).

The ova are of oval form.

1473a.—In this specimen the head and neck of the tape-worm are well seen, and with a lens the form of the head can be made out.

1473 (microscopic).—Head of *Tænia mediocanellata*.

Bothriocephalus latus

is the longest of the human tape-worms, and may reach a length of twenty-six feet.

The head, which is devoid of hooklets, is club-shaped, and has two deep fissure-like suckers.

The proglottides have a ridge down the middle of each of their flat sides, and are broader than they are long, even when

* The specimens referred to in this section are in the anatomical and physiological series.

mature. The uterus has a rosette shape, being formed of a single convoluted tube, and the genital pore opens in the centre of the ventral aspect of each proglottis. The ova are oval in form, brownish in colour, and are closed by a small lid at one end. The embryo escapes by the lifting of this lid.

1479.—Shows a long series of proglottides of *Bothriocephalus latus*, but the head and neck are wanting. Owing to the transparency of the proglottides, which is a peculiarity of this tapeworm, the form of the uterus can be clearly recognised. Notice the central position of the genital pores.

Nematoda.

The following nematode worms inhabit the intestine of man :

1. *Ascaris lumbricoides* (the round-worm).
2. *Oxyuris vermicularis* (the thread-worm).
3. *Anchylostoma duodenale*.
4. *Trichocephalus dispar*.
5. *Trichina spiralis*.

Ascaris lumbricoides.—The specific name is given on account of the superficial resemblance to the common earth-worm, which creature is sometimes produced by patients as having been passed from the intestine. The female is larger than the male (female 15 inches, male 10 inches long). This worm has a grayish-pink colour ; is cylindrical in form, and tapers towards each end.

The mouth has three lips, with taste-papillæ and small teeth. In the female the genital orifice is in front of the middle of the worm.

The eggs are oval in form, and have a double shell and an albuminous covering.

Several specimens often inhabit the intestines of the same patient.

1488 and 1488a are specimens of the female *Ascaris lumbricoides*.

Oxyuris vermicularis, so called from the pointed tail of the female worm, infests the large intestine, chiefly of children, and often passes out of the rectum, especially at night.

The thread-worm is of very small size, and resembles a piece of white thread in appearance. The male is 4 mm., the female 10 mm. long. The lips are three in number, and resemble cartilage in structure.

Specimen 1488b.—Specimens of thread-worms.

Anchylostoma duodenale (synonyms: *Dochmius duodenalis*, *Sclerostomum duodenale*).—Unlike the nematode worms already described, which live upon faecal matter, this parasite draws its nourishment from the bloodvessels of its host. It is unknown in this country, except in imported cases, but it causes the form of anæmia known as **Egyptian Chlorosis**.

It is a small worm, 8 to 18 mm. in length. The head, which is bent at nearly a right angle to the body, has a mouth armed with four claw-like teeth, by means of which it attaches itself firmly to the mucous membrane of the intestine.

This worm is found in the duodenum and jejunum, especially the latter, and very large numbers may inhabit the intestines of the same individual.

The eggs are smooth and oval, .05 to .06 millimetre long. Their presence in the stool is of the greatest importance as a diagnostic sign.

1491a.—Microscopic specimen of this parasite.

1956a.—(Pathological series.) A piece of intestine infested with the *Anchylostoma duodenale*. A few of the worms still remain adherent to the mucous membrane, but for their better display the greater number have been placed upon a piece of talc below the preparation. In the recent state the mucous membrane was covered with mucus and granular lymph, in which the parasites were partially embedded.

Trichocephalus dispar inhabits the cæcum. The male reaches a length of 40, the female of 50 mm. The front part of the body is very narrow and thread-like, whence the name "tricho-cephalus."

The ova are more or less spindle-shaped, have a length of .05 to .06 mm., and are closed at each end by small transparent lids, which give them a distinctive appearance.

1491 (microscopic). — Female *Trichocephalus dispar*; also 1491b (microscopic).

Trichina spiralis.—Although this worm owes its chief importance to its invasion of the voluntary muscles, it occurs primarily as an intestinal parasite. The male has a length of 1.5 mm., the female of 3 mm.

The eggs are hatched in the body of the female worm, and the embryos which are thus discharged into the intestine in an active state bore through the intestinal coats, and enter the various structures, their favourite locality being the voluntary muscles. In the muscles they undergo development, acquiring an alimentary canal, etc., and become enclosed in a capsule formed from the tissues of the host; in which capsule calcareous matter is, in the course of time, deposited. If the infested muscle is eaten by a carnivorous animal, the parasite enters its alimentary canal, and ultimately the muscular tissues of the new host become in turn infested with trichinæ. This invasion is the cause of the acute disease known as **Trichiniasis**.

1494a.—An unstained preparation of the human biceps, showing the *trichina spiralis* encapsuled, and lying between the muscle fibres.

SECTION XI.

DISEASES OF THE PERITONEUM.

Acute Peritonitis.

THE first sign is injection of the membrane, and red lines often run along the intestines, marking the interstices between the coils.

The peritoneum next loses its lustre, inflammatory exudation takes place into the peritoneal cavity, and lymph covers the serous surface.

The inflammation may be local or general.

A. *Local*.—The two chief forms of local acute peritonitis are :

1. That caused by typhlitis (**Perityphlitis**).
2. That caused by inflammation of the female genital organs.

In both these forms large swellings, easily palpable during life, may be produced.

Other causes are :

3. Inflammation or ulceration of other parts of the alimentary canal—*e.g.*, ulcer of the stomach, and tubercular, typhoid, or other ulcer of the intestine—may produce local adhesive peritonitis, which often acts as a safeguard, preventing perforation into the peritoneal cavity.

4. Inflammation or ulceration of other viscera—*e.g.*, of the gall-bladder from calculus—may have the same effect.

These local inflammations may go on to suppuration, and yet remain local, a capsule of inflammatory tissue being formed around them.

Thus a gastric ulcer may perforate and form an abscess under the liver or under the diaphragm; a tubercular ulcer may cause an abscess close under the abdominal wall; or a perityphlitic abscess may be formed in the region of the cæcum, previous adhesive inflammation having in each case shut off the seat of perforation from the general cavity.

B. General.—

1. The commonest cause of general acute peritonitis is perforation of the alimentary canal, the contents escaping freely into the general peritoneal cavity.
2. It may also occur from rupture of a local abscess, either such as above described, or a pyæmic or other abscess formed in the solid viscera (*e.g.*, hepatic abscess or suppurating hydatid).

In both these cases the inflammation is suppurative.

3. Suppurative peritonitis may also occasionally be produced by pyæmia, or rarely by other acute fevers.
4. Renal disease sometimes causes general peritonitis. It is usually of a sub-acute type.

General suppurative peritonitis is fatal. But if suppuration do not take place, or if it be localized, and the patient survive, the effused lymph tends to organize and form adhesions between the viscera, or between them and the abdominal wall, which adhesions may afterwards cause constriction and strangulation of the intestine.

1872.—Portion of small intestine, with its mesentery and a part of the peritoneum from the adjacent wall of the abdomen. The peritoneum is in every part thickened and indurated, and its free

surface is covered by a large quantity of false membrane. Each of the portions here shown is nearly an eighth of an inch in thickness, and is formed of tough, coarsely-laminated tissue.

1873.—Portion of thickened peritoneum, from the abdominal walls of the patient from whom the preceding specimen was taken. It is similarly thickened, and its internal surface is lined by lymph recently effused.

1875.—Portion of a liver, with long, slender, cord-like adhesions between its peritoneal covering and that of the diaphragm.

Chronic Peritonitis.

This also may be local or general. In both cases the peritoneum becomes thickened and opaque, and adhesions are formed between its various layers.

A. *Local*.—Chronic peritonitis is local only in the parts about the liver and spleen (see Perihepatitis and Perisplenitis), and in the pelvis about the uterus.

All other local thickening is the result of acute peritonitis.

B. *General*.—When chronic peritonitis is general, the visceral layer, the parietal layer, the mesentery and the omentum thicken, and exudation is poured out, causing adhesions between the various parts and a certain amount of fluid. Besides the serous surface, the sub-serous tissues are greatly infiltrated with exudation, which organizes and contracts. In this way the mesentery becomes very short, hard, and thick, and the intestines rigid and short, while thick ridges may be caused by the adhesions between them. The whole mass may form an almost solid tumour, bound closely to the spine. The omentum shrinks up to a solid mass, lying beneath the stomach. The whole abdomen is doughy and resistant, and the omentum and the thick ridges between the intestines can be felt during life.

The adhesions often enclose spaces between the viscera, containing fluid exudation. When this condition is well marked it is called **Cystic Peritonitis**.

The contraction above described necessarily causes pressure upon the veins, and is probably the cause of the chronic ascites which is so common in these cases.

General chronic peritonitis is—

1. Simple, which is extremely rare except as secondary to renal or cardiac disease ;
2. Tubercular—*vide* Tuberculosis ;
3. Malignant—*vide* Malignant Disease.

Tuberculosis.

The peritoneum may be affected by tubercle in three ways :

1. Small patches of inflammation may be produced at the site of intestinal tubercular ulcers without any general peritoneal disease.
2. The peritoneum may be studded with tubercles, as a part of acute general tuberculosis with very slight or no inflammation or exudation.

1877.—Portion of small intestine injected. There is a deposit of miliary tubercles in the sub-serous tissue. They are most abundant at the reflection of the mesentery, and by their white colour contrast with the surrounding vascularity, which, however, is not greater in their vicinity than in other parts of the canal. See also 1879.

3. Tubercle may set up chronic inflammation and adhesions with the signs above described, either as a result of intestinal tuberculosis or as a primary disease.

1874.—Portion of small intestine, exhibiting the results of chronic peritonitis. Two of its convolutions are closely united, and are enveloped by shreddy membrane formed of recently-organized lymph. In the substance of the false membrane, as well as in the peritoneum, there are numerous miliary tubercles. See also 1876, 1878.

Malignant Disease.

Primary **Endothelioma** is rare, but deposits secondary to malignant growths elsewhere are not uncommon. The peritoneum is studded with cancerous nodules of various sizes, and varying in structure according to the nature of the primary growth. The omentum is usually much involved, and, as in tubercular peritonitis, forms a massive nodular tumour. Serous fluid, often blood-stained, accumulates in the peritoneal cavity.

1886.—A portion of omentum, the surface of which is very irregular from the projection of numerous nodules and granulations and its substance is thickened by infiltration with a soft white new growth.

Microscopic Examination.—It consisted of round nucleated cells, not resembling epithelium, crowded together on the surface with no apparent intercellular substance, and infiltrating the substance of the omentum.

From a woman aged 55 years, who was admitted to the hospital with jaundice of six weeks' duration, and occasional vomiting; she had suffered for eight or nine months from pain in the right side of the abdomen. A hard, irregular, tender mass was felt in the right hypochondrium, separated by a patch of resonance from the liver. This was found, on post-mortem examination, to be the enlarged omentum. The parietal layer of peritoneum everywhere was covered with nodules and granulations of new-growth similar to that in the omentum, and the disease extended through the diaphragm.

The liver contained large and small masses of white soft new-growth, and the lumbar and mesenteric glands were infiltrated, but no other organs were affected. The ribs and ileum were markedly softened throughout, and by microscopic examination the cancellous texture of the ribs was found to have almost entirely disappeared.

1886a.—Portion of a small intestine, with the mesentery. Numerous soft, very vascular, and flocculent medullary tumours of various sizes arise from the peritoneal surface. The injection of the tumours shows that they are very vascular.

1886b.—A piece of the great omentum, attached at its upper border to part of the great curvature of the stomach. It is greatly thickened, and has been rendered nodular by infiltration with oval-celled sarcomatous tissue.

From a man aged 21, in whom the sarcoma of the peritoneum was secondary to sarcoma of the testis. The intestines were not distended, but their mesenteric and peritoneal attachments were thickly studded with thousands of small nodules varying in size from a pin's head to a hazel-nut. The appendices epiploicæ were also greatly enlarged, and the parietal layer of the peritoneum was widely affected. The left inguinal canal was filled with the new growth.

1886c.—A portion of the diaphragm and liver. The under-surface of the diaphragm is studded with sarcomatous nodules, but the liver is not affected.

1890a.—Section of the bladder and rectum, from a case of cancer of the peritoneum. The whole of the recto-vesical pouch is occupied by a mass of colloid cancer, which has resulted from the degeneration of a medullary carcinoma. So far as can be ascertained, the carcinomatous growth sprang from the bottom of the recto-vesical pouch. At one spot it has opened by a process of infiltration into the posterior wall of the bladder. Neither the rectum nor the folds of intestine above appear to be involved.

1886d.—A diaphragm, to which portions of some of the lower ribs are still attaching. The under surface is covered with nodular, for the most part sessile, growths. Some of the growths show some tendency to pedunculation. Other parts of the peritoneum were affected, but to a less extent. There were a few nodules in the falciform ligament of the liver, and the pelvic organs were matted together by growths of a similar nature.

Microscopically the growths are seen to consist of carcinoma of the encephaloid type, showing large glandular cells embedded in a scanty meshwork of fibrous tissue.

From the body of a girl aged 15. The primary seat of the carcinoma was not made out, but it was probably in one of the pelvic viscera.

The following specimens are examples of **Non-malignant tumours** of the peritoneum :

Fatty Tumours.

1884.—A tumour growing from the mesentery close to the ileo-cæcal valve. Half of the tumour has been removed. Microscopical examination showed it to be a fatty tumour, with a great excess of connective tissue.

The patient was a boy 14 years old. He had suffered from attacks of severe colic for two years before death; the attacks became more and more severe, and of longer duration, the last attack before the fatal one lasting five weeks. The fatal attack began twenty-two days before death, and had all the characters of ileus, with visible movements of the intestines, fæcal vomiting, and constipation. At the post-mortem examination the tumour was found compressing the lowest part of the small intestine. The kidneys were in their natural position, and, excepting the ileus and its accompaniments, the body was perfectly healthy.

Fibrous Tumour.

1885.—Portion of a large intestine. A small oval fibrous tumour, attached to its surface by a narrow pedicle, was thus suspended in the sac of the peritoneum.

Hydatids.

1893.—An omentum containing hydatid cysts.

SECTION X.

DISEASES OF THE LIVER.

Perihepatitis.

INFLAMMATION of the capsule of the liver and its serous covering may originate in various ways :

1. In connection with general peritonitis, acute or chronic.
2. By extension from a chronic inflammatory condition of the right pleura.
3. By extension from the liver itself in the course of cirrhosis, or syphilitic disease of the organ.

Acute inflammation produces the same results as acute inflammation of other serous membranes, namely, a deposition of lymph upon the surface, and the formation of adhesions to neighbouring structures.

Chronic perihepatitis is characterized by a great increase in the thickness of the capsule ; and as the capsule subsequently contracts, great distortion of the liver results, the organ being contracted into a ball, or divided into two parts, assuming an hour-glass form. Moreover, the pressure which is constantly exerted by the contracting capsule causes the liver substance to atrophy ; and constricts the portal vein and bile-ducts, leading to ascites and jaundice.

2193.—Shows a portion of a liver covered by a thick layer of substance resembling fibro-cartilage, which is but slightly adherent

to its surface, and probably represents the peritoneal covering thickened and indurated. The surface of the liver, exposed by the reflection of a portion of the layer, appears healthy, and is smoothly covered by its fibrous coat.

2193a.—Left lobe and part of the right lobe of a liver, together with the suspensory ligament and adjacent portion of the diaphragm. The peritoneal covering is everywhere thickened by a deposit of false membrane, due to a previous general peritonitis. It now forms a definite and easily detachable covering of uniform thickness, with the exception of a number of small circular pits which extend almost down to the liver beneath. Elsewhere the surface is slightly roughened.

2193b.—Portion of thickened peritoneum from the surface of the same liver.

Atrophy of the Liver

is met with in cases presenting great emaciation. The liver, which is much smaller than normal, is also of a deeper colour, from the deposition of pigment in its substance.

Passive Congestion.

Any morbid condition which produces backward pressure in the great systemic veins soon brings about a passive congestion of the liver. The causes of the condition are those which throw an undue amount of work upon the right heart, such as :

1. Disease of the mitral valve.
2. Certain pulmonary diseases, especially emphysema.

The over-filling of the vessels causes an increase in the size of the organ, which in the early stages appears simply engorged with blood.

After a time degenerative changes are produced, and on section the organ presents a peculiar mottled appearance (small highly-coloured areas being surrounded by others which are unduly pale), which has earned for this condition the name of **Nutmeg Liver**.

Microscopically, the intralobular veins are seen to be unduly dilated, as a consequence of the impeded outflow from the hepatic veins, and even the neighbouring capillaries show a similar dilatation in advanced cases. The liver-cells at the same time have undergone some degree of atrophy, and those surrounding the intralobular veins are seen to contain many pigment granules, whilst the cells of the peripheral zone have undergone fatty change. There may be some connective-tissue increase, but this is seldom at all conspicuous.

It is the contrast between the pigmented central zone of the lobule and the pale fatty outer zone that produces the characteristic nutmeg appearance in the sections.

2203.—Illustrates the above description. The specimen was obtained from a case of mitral disease, with pulmonary engorgement and dilatation of the right ventricle.

2203a.—Portion of a typical nutmeg liver from a man aged 41, who had disease of the aortic valves. The heart weighed 21 ounces.

Acute Inflammatory Changes.

Abscess of Liver.—Suppuration in the liver occurs in two chief forms :

1. A large single abscess.
2. Multiple abscesses or diffuse suppuration.

1. The large single abscess, often called "tropical," is seldom seen in this country, except in patients who have resided in hot climates. In a large number of cases it appears to be undoubtedly associated with dysentery, but the exact nature of the connection is not conclusively made out, and similar abscesses are met with apart from that disease. It is usually held that the infection is conveyed from the ulcerated intestinal wall to the liver by the portal circulation.

Such collections of pus may reach a great size, and cause

much enlargement of the organ. In the course of time the abscess becomes surrounded by a thick capsule of connective tissue, but in the earliest stage its walls are formed by the liver substance itself.

If untreated, the following events may ensue :

(1) In the course of time the contents of the abscess cavity may dry up.

(2) More frequently it ruptures into some neighbouring cavity, such as the peritoneum or right pleura, or even into the lung.

(3) If the liver has become adherent to the abdominal wall, it may point externally.

2195.—Illustrates the rupture of an abscess into the lung. A large circumscribed cavity is seen situated near the convex surface of the liver, and this communicates, by an irregular orifice through the diaphragm, with one of the bronchial tubes of the right lung, the lung, like the liver, being adherent to the diaphragm, although separated from it by a thick layer of tough lymph.

2196.—Shows a large abscess with rough walls, surrounded by condensed hepatic tissue.

2197.—Illustrates the adhesion of the layers of the peritoneum over an abscess cavity, which is situated near the surface of the liver.

2196b.—Shows a large abscess in the right lobe of the liver, which communicates, by an opening, with the peritoneal cavity.

2. Multiple abscesses are usually met with in the course of pyæmic affections. The infection is conveyed to the liver by the bloodvessels, and gives rise to numerous abscesses of various sizes scattered through the substance of the organ.

2196c.—Here a portion of the right lobe of a liver is cut across, showing on the cut surface a number of abscess cavities of various sizes ; the surface of the organ is not much altered in shape.

(Abscess in the liver may also arise in connection with tubercular disease or by the suppuration of a hydatid cyst, *q.v.*)

Chronic Inflammatory Changes.

Cirrhosis Hepatis.—The chief cause of cirrhosis of the liver is spirit-drinking, but very similar, if not identical, changes may have a syphilitic origin. The cirrhotic liver is in the early stage increased in size, owing to the abundant formation of new connective tissue; but the new-formed tissue soon undergoes contraction, causing a marked diminution of the size of the liver, and by the irregular pressure on different parts causing the surface to assume a nodular or “hob-nailed” appearance. When the liver is cut it offers considerable resistance to the knife, the connective tissue being much tougher than the normal liver substance. The liver-cells are stained with bile, and from the yellow colour thus imparted to the section the name “cirrhosis” is derived.

In advanced cases the cut surface shows small nodules, or islets, of liver substance, separated by more or less thick strands of pale connective tissue. In the early stages the liver may be only affected in parts, but as the disease progresses the changes become more or less uniform throughout the organ.

Microscopically the lobules are seen to be separated by the newly-formed connective tissue, and the cells have undergone atrophy by reason of the pressure to which they are exposed. Moreover, the growth extends into the substance of the lobule, separating the individual liver-cells from each other. Groups of cells having a linear arrangement are frequently seen, and some authors have described these as newly-formed bile-ducts. (Ziegler states that this view is certainly not correct.)

Some pathologists describe a special “hypertrophic” form of cirrhosis in which jaundice is a constant and conspicuous symptom, whereas ascites is usually absent. In cases which are classed under this head the connective-tissue

increase has led to great enlargement of the liver, the surface of which is not hob-nailed, as in the atrophic form, but remains smooth. The tendency at the present day is not to class these cases as examples of a distinct disease, but rather to regard the hypertrophic and atrophic cases as extreme varieties of a single morbid process. Intermediate cases, with all degrees of hypertrophy or atrophy, are met with, and it is stated that the hypertrophic may pass on to the atrophic form.

2198.—Notice in this specimen the “hob-nailed” appearance of the surface of the liver, and the appearance of the cut surface, which shows the individual lobules widely separated from each other by pale bands of connective tissue.

2199b.—Shows advanced cirrhosis of the liver of a child aged 10 years. The organ is much contracted, and weighed only 16 ounces. The “hob-nailed” appearance of the surface is very well marked.

Fatty Infiltration.

The liver is apt to become the seat of fatty infiltration in the course of wasting diseases, such as phthisis pulmonalis; and a similar deposit of fat is sometimes met with in chronic alcoholic cases.

The liver undergoes general enlargement, often very considerable, and the edge is more rounded than in health. The organ is unduly soft, is easily torn, and greases the surface of the knife with which it is cut. The cut surface is paler than natural, but in the section the normally-tinted central and pale peripheral zones of the lobules are frequently clearly contrasted.

Microscopically the cells of the outer zone of the lobule are seen to contain globules of fat of various sizes, which stain readily with osmic acid. The fat is deposited first in the outer zone, because it is conveyed to the liver by the portal vessels; but in advanced cases the change is no

longer limited to a particular portion of the lobule, the true liver structure being almost entirely replaced by fat.

Fatty Degeneration

is met with in its most typical form in cases of pernicious anæmia, acute yellow atrophy, and phosphorus-poisoning; and a less degree of the same change is not infrequently met with in patients who die in the course of acute infective diseases.

The organ may be of normal or of unduly small size. Microscopically, in the slighter forms, the liver-cells contain fat granules, and in pernicious anæmia a considerable amount of pigment is present, evidencing the acute process of blood destruction which takes place in the course of that disease.

In these cases the fat is not merely deposited in the liver-cells, but is apparently formed by the disintegration of the albuminous constituents of the liver-cells themselves.

Acute Yellow Atrophy.

Here the degenerative change is very rapid and complete. The size of the liver is very greatly diminished, and its weight is lessened to a corresponding extent.

In advanced cases the capsule appears too large for its contents, and has a wrinkled appearance; the liver is peculiarly flaccid, but is not very friable.

On section the tissue of the organ has in part an unduly yellow colour, from bile-staining, but in other parts has a deep-red tint, the latter corresponding to the regions in which the degenerative change is most advanced. The bile-ducts and gall-bladder are found to be empty, or contain a little colourless mucus.

Microscopically the normal structure of the liver is found to be almost completely lost, and the hepatic cells can no longer be clearly distinguished, their place being taken by

oil globules and granular débris; and in the redder portion even such débris have almost completely disappeared. Crystals of hæmatoidin, and also of leucin and tyrosin, may be met with.

Phosphorus-poisoning

also causes acute fatty degeneration of the liver, but there is usually some enlargement of the organ in the earlier stages.

2238a.—Section of the liver from a patient who died with symptoms of acute phosphorus-poisoning after accidentally eating bread and butter smeared with rat-paste. The liver was of normal size, and on section had a uniform orange colour. Microscopically it showed the changes characteristic of acute fatty degeneration.

Amyloid or Lardaceous Disease.

The causes of lardaceous liver are the same as those of lardaceous change in other organs, viz. :

1. Prolonged suppuration.
2. Phthisis.
3. Syphilis.

The lardaceous liver is increased in size, of firm consistence and elastic, and the edge of the organ is rounded. The weight of the liver is increased out of proportion to its size, owing to the density of the amyloid substance. The cut surface has a waxy appearance, and is much paler than normal, and the selective staining-power of iodine brings out clearly the distribution of the lardaceous material.

Microscopically the intermediate zone of the lobules is seen to be chiefly affected, because this is the arterial zone, and it is in the walls of the arterioles and capillaries that the change commences. The walls of the vessels are seen to be thickened, and have the peculiar translucent appearance characteristic of this disease, especially if the section has been stained with methyl violet. The deposit of

lardaceous material, if copious, may cause the liver-cells to undergo atrophy.

2194.—This section shows the increase of size of the liver produced by amyloid disease, and the waxy appearance on section.

2194b.—Shows the effect of iodine upon the cut surface.

Leucocythæmia.

In this disease the liver is often greatly enlarged, and on the cut surface, in advanced cases, the individual lobules are seen to be separated from each other by whitish bands, and usually nodules of the same pale material are seen in some parts of the organ.

Microscopically the interlobular connective tissue is seen to be crowded with leucocytes, with which the nodules above referred to are also densely packed. Similar changes are seen in some cases of lymphadenoma.

2207a.—This specimen illustrates the latter condition. The liver, which is that of a child of 5 years, is greatly enlarged. The enlargement is uniform, and the organ is very pale. It weighed 40 ounces.

Microscopically it was found that the substance of the liver was infiltrated with small round cells. The destruction of the glandular substance was greatest in the peripheral portions of the liver, whilst in the central area there was an increase of fibrous tissue.

Simple Cysts.

Small multiple cysts are occasionally met with in the liver, and this in cases in which there is no evidence of any obstruction of the large or small bile-ducts. Sometimes the presence of cysts in the liver is associated with a similar condition of the kidneys.

2204a.—Section of a liver showing numerous small cysts, varying in size from a pin-point to a small pea. The patient was a child who was burnt to death.

Tubercular Affections.

Tubercular disease of the liver is almost always associated with tubercle elsewhere. In general tuberculosis the peritoneal covering of the organ is usually studded with miliary tubercles, which appear as small white projections. Isolated miliary tubercles are also found scattered through the liver substance. Sometimes masses of tubercular material of considerable size, undergoing caseous degeneration in parts, are met with, and occasionally the morbid process gives rise to abscess formation.

2194b.—Section of a tubercular liver. The cut surfaces show several deposits of caseous material, the largest measuring no less than two inches in its longest diameter, and causing a considerable projection upon the surface of the organ.

Notice the honeycomb appearance of the section, due to the breaking down of tubercular material at several points.

Microscopic sections showed the ordinary structure of tubercle, and the patient had suffered for a considerable time from tubercular disease of the urinary tract.

2196a.—Section of part of a liver containing a circumscribed tubercular abscess, the walls of which are covered with shreds of partially organized lymph. The patient died of pulmonary phthisis.

Tumours of the Liver.

Nævus or Angioma of the Liver is not very common. In a section of a liver containing such a tumour a circumscribed area of a deep-red colour is seen, and on microscopic examination the proper liver tissue is seen to be replaced by bloodvessels supported by a fibrous-tissue framework.

2224a.—A longitudinal section through a portion of the right lobe of the liver. At the free or inferior border is a large nævus, more or less globular in form, and measuring nearly two inches in diameter.

2225.—Portion of the liver of a man aged 28 years. Notice the

nævus occupying a third of the Spigelian lobe, and entirely replacing the liver tissue.

Gummata.—It has already been mentioned that syphilis may give rise to a form of cirrhosis of the liver which very closely resembles the alcoholic variety; but gummata are the more common form of syphilitic lesion of this organ, and are met with as the result of either the congenital or acquired form of the disease.

The contraction of the newly-formed connective tissue around a superficial gumma produces conspicuous sunken and puckered scars upon the surface of the liver, and in section the tumours appear as pale areas with caseating centres scattered through the substance of the gland. The caseous portion is surrounded by a grayish more or less translucent zone, and this again is surrounded by dense connective tissue which extends in the form of processes into the surrounding liver substance.

2202a.—Section of a liver containing gummata. The patient was a boy who exhibited other signs of congenital syphilis.

2202b.—Liver of a boy aged nine. Notice the great deformity of the liver produced by the disease, and the deep scars upon its surface in several situations. A section revealed the presence of several large gummata.

This patient, like the previous one, showed other signs of congenital syphilis.

2202c.—Section of a liver which weighed $4\frac{1}{2}$ lb. The surface is deeply scarred in places. The cut surface shows numerous gummatous tumours, which are mostly near the surface.

The tumours were yellowish in colour, and are surrounded by a zone of white connective tissue, which in places penetrates into the interior of the growths. They had given rise to some inflammation of the peritoneal covering, which over the lower part of the liver is covered with shaggy lymph.

Hydatids.—**Hydatid Tumours** are far more frequently met with in the liver than in any other part of the body.

The hydatid is the cystic form of *Tænia echinococcus*, a

tape-worm of the dog, which measures only a fraction of an inch in length, and consists of only three or four segments. The ova find their way into the human stomach, where the shell is removed by the action of the gastric juice. The active embryo, provided with hooklets, which is thus set free, bores into the intestinal wall, and, entering a radicle of the portal vein, is conveyed to the liver, where it becomes lodged in the hepatic tissue. Once settled there, it loses its hooklets and becomes cystic.

The cyst thus formed has a thin transparent wall, which is, however, double, consisting of an external cuticular and an internal parenchymatous layer, and also becomes surrounded by a fibrous capsule derived from the tissues of the host. In time there are developed on the internal surface a number of pedunculated vesicles, called **Brood Capsules**, upon the surfaces of which a number of **Scolices** are formed, which later become inverted, and so come to lie within the brood capsules. These scolices are provided with **hooklets**, and from them are derived the hooklets which are frequently found in the fluid derived from a hydatid cyst.

In addition to the brood capsules, the hydatid usually contains in its interior small free or "**daughter cysts**" which, again, may contain tertiary or "**grand-daughter cysts**."

The daughter cysts are partly formed between the layers of the cuticle of the hydatid, and partly by changes in the brood capsules, which become cystic and are detached.

Occasionally the daughter cysts are external to the main hydatid, and the surrounding tissues may thus become riddled with hydatids. This condition is by no means common in the human subject. The **Multilocular Hydatid** consists of a number of minute cysts, forming a dense mass, and each containing a jelly-like fluid.

The fluid contained in a hydatid cyst is clear or slightly opalescent, colourless, neutral in reaction, and has a specific

gravity of 1006 to 1015. It contains very little proteid, and the 1.2 to 1.4 per cent. of solids which it contains includes sugar and inosite, traces of urea, creatine and succinic acid, and salts (Halliburton).

The presence of the cyst causes considerable enlargement of at least a part of the liver.

Events :

(1) Sometimes the cyst dries up and shrinks, its contents becoming converted into a putty-like mass, and the capsule may become the seat of calcareous deposit.

(2) Again, suppuration may take place, and the cyst cavity become filled with pus.

(3) Rupture of the cyst into some adjacent cavity, such as the pleura or peritoneum, is not an uncommon event.

2229.—Shows a large hydatid cyst projecting from the fissure of the liver.

2231. — A large cyst, containing daughter cysts, which was attached to a liver. The walls of the cyst are thin, tough, and laminated, whilst the inner surface is uneven, pulpy, and shreddy.

2230a.—Portion of a liver in which lies an old shrivelled hydatid cyst, exhibiting many folds and convolutions, and containing a small quantity of caseous and cretaceous material.

2234.—A cyst of irregularly lobulated form, the walls of which are almost entirely composed of bone-like material.

2233.—Part of a liver, containing a large hydatid cyst, which occupies the upper part of the right lobe. Its wall is tough, and is the seat of calcareous deposit in places. Within it are the remains of numerous secondary cysts, shrivelled and contracted, giving rise to the tortuous lines seen on the cut surface. There is also a large amount of putty-like substance filling up the interspaces in the interior of the cysts.

Actinomycosis.—The **Ray Fungus** or **Actinomyces** is sometimes found in the liver, where it is apt to form a tumour consisting of a number of nodules, separated by trabeculae of fibrous tissue. The fungus occupies the centre of each nodule, and is surrounded by cells resembling a tubercle.

The nodules may become calcareous in their centres or suppuration may take place in them.

2239b.—Two portions of a liver affected with actinomycosis. The longer specimen is part of the right, the shorter part of the left, lobe.

The tumours seen in section consist of a coarse meshwork of white fibrous tissue, which has a spongy appearance. The masses have replaced rather than displaced the normal liver substance, and therefore there is but little bulging of the surfaces covering them. A portion of the diaphragm is seen to be firmly adherent to the upper surface of the liver, the capsule of which is not thickened.

Microscopic sections of the tumours showed abundant spores of the ray fungus (*vide* Spleen, No. 2306c).

Malignant Disease.

1. Primary malignant disease in the liver is rare. It does, however, occasionally occur in several forms:

a. Sometimes the liver is uniformly enlarged by diffuse carcinomatous infiltration. The surface may be hob-nailed, from the contraction of fibrous bands; and on section fibrous bands are seen to traverse the organ in various directions, enclosing islets of carcinomatous tissue. The capsule is thickened.

b. As discrete nodules, which frequently undergo central softening.

c. In a third variety small nodules of new growth are distributed along the course of the portal vessels.

d. Lastly, cancerous growths may extend into the liver from the large bile-ducts.

2. In striking contrast to the rarity of primary malignant tumours of the liver is the extreme liability of this organ to be affected secondarily in connection with disease of neighbouring or distant parts, such as the stomach, œsophagus, rectum, pancreas, breast, uterus or lung.

In some cases the disease spreads from adjacent organs, but in other cases it is met with in the form of metastatic nodules, having the structure of the primary growth. These nodules are apt to undergo softening in their central portions, and hence feel umbilicated during life.

Sarcoma.

2209a.—Section of a liver enormously enlarged by melanotic sarcoma. It weighed 16 lb. The surface of the section shows large black nodules, circular in outline and separated from one another by strong white septa. In places the growth is gray and diffuse, but there is nowhere any trace of the normal liver tissue. The growth in the liver was secondary to a melanotic growth in the eye. Similar growths were also found in the mesenteric glands and kidneys, and small specks of melanotic growth were present on the surface of the peritoneum and the skin of the axilla.

2215a.—Section of a liver containing multiple sarcomatous growths. The liver was greatly enlarged, and reached to the umbilicus in the middle line. Many nearly spherical masses of soft yellowish material are seen, varying from a quarter of an inch to an inch in diameter. The growths are so numerous that there is little liver substance left. The gland in the hilum and the lumbar lymphatic glands were also invaded by the growth.

Carcinoma.

2216b.—Section of a portion of the right lobe of a liver, which contains a large mass of dense, firm, encephaloid cancer, secondary to carcinoma of the rectum. The whole liver weighed 7 lb.

2216a.—Right lobe of a liver which is the seat of numerous secondary nodules of carcinoma. They are large and white, of firm consistence, and those upon the surface of the organ are umbilicated. The liver weighed 70 oz. Microscopic sections showed an infiltration with a growth of columnar carcinoma.

2216c.—Left, and part of a right lobe, containing several round masses of secondary colloid carcinoma. Notice the characteristic umbilication of the superficial nodules. The growths were

secondary to a tumour of the cardiac end of the stomach, involving the lower part of the œsophagus. The suprarenal capsules, and the lymphatic glands in their neighbourhood, were also affected.

2217.—Part of a liver which contains a large mass of colloid cancer. The remainder of the organ was natural.

Suppurative Pylephlebitis.

Inflammation and thrombosis of the portal vein may result from septic infection, arising in connection with suppuration about the intestinal tract, or in any organ from which branches of the portal vein originate. In this condition, to which the name of “suppurative pylephlebitis” is given, the vein becomes filled with a septic clot, its coats are acutely inflamed, and the inflammation spreads to the surrounding structure, so that diffuse suppuration of the liver itself may be produced.

2206.—Section through the right lobe of a liver showing the lesions of pylephlebitis. The portal vein at its entrance into the liver is thickened, especially the inner coat, which is strained and covered at one point by a patch of adherent lymph. The vein was filled with a purulent thrombus as far as its first and second divisions. The parenchyma of the liver generally is soft and pulpy; and in patches, chiefly distributed over the anterior surface and lower part of the organ, it is infiltrated with pus and broken down. The infiltration, which is of a dirty-yellow colour, is limited to a small area around thrombosed branches of the portal vein, as may be observed both in transverse and longitudinal sections of the veins. By the agglomeration of these areas large patches of broken-down parenchyma are formed.

The patient was a man aged 31. There was a circumscribed collection of pus around the attachment of the vermiform appendix. A thrombus extended from this along a mesenteric vein to the portal vein. No impaction or ulceration of the vermiform appendix was found.

2205a.—A liver with the portal vein plugged by a firm, partially decolourized clot. The organ is enlarged, and weighed 65 oz.

The Spigelian lobe is enlarged to four or five times its natural size, and there is much thickening of the gall-bladder. All the tissues in the transverse fissure of the liver are firmly matted together.

Thrombosis of the Portal Vein.

Apart from the condition described above, thrombosis of the portal vein is not very infrequent in connection with cirrhosis of the liver, owing to the interference with the circulation caused by that disease.

2204.—Illustrates this. The liver is that of a man aged 57, and is the seat of advanced cirrhotic change. The portal vein is completely obstructed by a granular, friable, soft coagulum, adherent to the lining membrane of the vein. This thrombus is no doubt formed some time, probably several weeks, before the death of the patient. It extended only a little way into the vessels which go to make up the portal vein, but for a long distance into the branches within the liver, especially those of the right lobe.

Affections of the Gall-bladder and Bile-ducts.

Biliary Calculi and their Effects.

Gall-stones are formed in the gall-bladder, and consist chiefly of cholesterin, bile pigments, and some calcium carbonate. Some consist almost entirely of cholesterin, whereas in others the bile pigments preponderate.

The calculi may be single or multiple. When single they are more or less spherical in form, but multiple calculi are facettèd, the facets representing the surfaces which are in contact with other stones. This fact has considerable clinical importance, for the discovery in the fæces of a facettèd calculus affords evidence of the existence of others.

The presence of calculi in the gall-bladder causes its walls to become thickened and indurated, as will be seen in several of the specimens presently to be referred to.

When a calculus passes from the gall-bladder into the cystic or common duct, it may cause more or less lasting

obstruction to the passage of bile, and leads to a variety of secondary effects, such as :

1. Dilatation, which may extend to the ducts within the liver itself (compare specimen 2204, in which, however, the obstruction was produced by a tumour) ;
2. Thickening and induration of the duct-walls ; or,
3. Ulceration into the intestine or peritoneum.

Calculi in the Gall-bladder.

2257.—Part of a liver with its gall-bladder. The coats of the latter are much thickened, and its cavity is occupied by a number of polygonal calculi consisting chiefly of cholesterin.

Obstruction of the Ducts.

2246.—A portion of the duodenum and the bile-ducts, dried. A large calculus is impacted in the common duct, and a smaller one in the cystic duct. All the ducts are dilated, especially the common and hepatic ducts.

2247b.—A gall-bladder, with the adjacent portion of the liver. The cystic duct is blocked by a small calculus which lies at its commencement. The walls of the gall-bladder are somewhat thickened, and show traces of inflammation.

2249.—A gall-bladder with large gall-stones impacted in its neck.

Dilatation and Thickening of the Gall-bladder and Biliary Ducts, due to Calculi.

2242.—A gall-bladder which has its coats thickened and indurated in consequence of the impaction of a calculus. The internal surface has lost its reticular structure, is rough, and at some points ulcerated. A piece of whalebone is passed into the cystic duct, which is very much contracted.

2243 and 2244.—Show similar changes resulting from the same cause.

Ulceration of the Gall-bladder and Perforation into the Intestine or Peritoneum.

2261.—Portion of liver with the gall-bladder, biliary ducts, and part of the duodenum. The gall-bladder is thickened and con-

tracted. A passage is formed by ulceration from the gall-bladder into the duodenum, through which a large calculus passed into the intestine. All the biliary ducts are much dilated. A glass rod is passed from the common duct into the duodenum. The communication of the cystic duct with the gall-bladder is obliterated.

Other Causes of Obstruction.

The impaction of gall-stones is only one of a group of conditions which may lead to obstruction of the bile-ducts, the more important of the remaining causes being the following :

- a. Catarrh, usually extending from the duodenum.
This is the condition which gives rise to simple jaundice. Probably the actual cause of the obstruction is usually a plug of mucus.
- b. Chronic inflammatory changes and thickening of the duct-walls.
- c. Malignant growths in the duct-walls.
- d. Pressure from without by tumours or enlarged lymphatic glands.

Simple inflammatory thickening, which so frequently attends obstruction, is uncommon as a primary cause of that condition.

2253.—The gall-bladder and biliary ducts of a woman aged 40. The cystic duct is obliterated, and its coats are nearly as hard as cartilage. The walls of the hepatic and common ducts are, in the greater part of their extent, a line in thickness, and are indurated. The gall-bladder is dilated ; it contained a yellowish fluid.

Cancer of the ducts themselves is far less common than cancer of adjacent structures, involving and compressing the ducts, but 2253 is an example of this condition. The specimen shows a portion of the duodenal wall, with a soft medullary tumour surrounding and closing the orifice of the common bile-duct. The tumour appears to grow from the mucous membrane. The adjacent parts are healthy.

The patient was a woman, aged 27, who was deeply jaundiced for three months before death. Shortly before her death she had copious hæmorrhages from several mucous surfaces.

The walls of the gall-bladder are occasionally the seats of malignant growths, of which the following specimens afford examples :

2264.—A portion of the pyloric orifice of the stomach, with the commencement of the duodenum, and, adherent to them, the gall-bladder. The wall of the latter is converted into a mass of medullary cancer. Its cavity contains four facettèd gall-stones, and several smaller calculi lie at the bottom of the bottle. The growth around the gall-bladder was continuous with a mass of infiltrated lumbar glands. The duodenum was compressed, and its walls were infiltrated with the new growth. A glass rod is placed in the common bile-duct, the walls of which are bile-stained. The cystic duct is obliterated. The stomach was enormously dilated. Secondary deposits were found in the peritoneum, pleura, and on the surfaces of the lungs. The other abdominal organs were not involved in the disease.

2265.—A gall-bladder exhibiting a growth of soft medullary cancer from its lining-membrane. Except at the seat of the growth the walls appear healthy.

Pressure from tumours in the neighbourhood of the biliary ducts is a not infrequent cause of obstruction. Thus, cancer of the head of the pancreas is attended with intense jaundice (see **2276a**). The following specimen affords an example of obstruction associated with malignant disease of the lymphatic glands in the neighbourhood of the ducts.

2255.—A gall-bladder and ducts with the adjacent lymphatic glands. The coats of the gall-bladder are seen to be much thickened, especially about the neck, and their section displays a dense grayish semi-transparent structure, resembling hard cancer. At the cystic duct the thickening is so great as to obliterate the channel. At this part also, and around the neck of the gall-bladder, the lining-membrane is thickened, rough, and tuberculated. At the base of the gall-bladder is a small circular growth consisting of numerous

close-set little processes upon slender pedicles. The lymphatic glands around the biliary ducts are much enlarged and indurated, and had the appearance of glands affected by carcinoma. The patient was a woman.

In the following example the duct was compressed by a Hydatid Cyst.

2256.—A duodenum with the common bile-duct and the adjacent lymphatic glands. The duct is compressed and partly obliterated by the pressure of a large hydatid cyst. The lymphatic glands in the gastro-hepatic omentum are enlarged and hard.

SECTION XI.

DISEASES OF THE PANCREAS.

Pancreatic Calculi

are by no means common. They are composed of calcium carbonate and phosphate; they are white, and are usually of more or less spherical or ovoid shape, and may reach the size of a nut. Their surface may be smooth or spiculated. Such calculi may obstruct the duct, causing it to become dilated. The dilated duct assumes a more or less sacculated form, and occasionally circumscribed cysts are formed.

2270.—In this specimen the pancreatic duct, which has been laid open, is seen to be greatly dilated, and it contains numerous spiculated concretions of various shapes and sizes. The branches of the main duct are filled by similar small concretions. The greatest dilatation of the duct is immediately behind its entrance into the intestinal wall. A bristle is passed through its orifice. The concretions consist of calcium carbonate. The patient was a man aged 40, who died of diabetes.

Fatty Changes.

The pancreas is liable both to fatty infiltration and to fatty degeneration. In the former condition the gland-tissue is apt to undergo atrophy, as is the parenchyma of other organs when similarly affected, whilst in the latter condition the glandular substance is replaced by fat.

2269.—Affords an example of fatty degeneration. The pancreas, of which a section is shown, was nine inches long and between two and three inches broad. The whole tissue appears to be converted into fat. The lobulated appearance of the gland is preserved, but nothing but fat-cells could be discerned in its structure.

Atrophy of the Pancreas

is occasionally met with in diabetic patients and in those who have died of wasting diseases. In some cases there appears to be an increase of fibrous tissue which has undergone contraction; in other words, a true fibrosis of the organ.

Inflammation.

The pancreas is rarely the seat of inflammation, but it may share in the affection of neighbouring structures, and is sometimes found to be slightly inflamed in cases of enteric fever, and less frequently in other fevers also. Suppuration of the pancreas in enteric fever has been described (Wilks and Moxon).

Hæmorrhage

into the pancreas is a well-recognised pathological event. In some cases no obvious cause of the condition can be made out.

Tubercular Disease

of the pancreas is occasionally met with, usually in cases of general tuberculosis, but this gland is not one of the commoner seats of such changes.

2272a.—Pancreas of a child who died of tubercular meningitis. At the lower end is a small white deposit of tuberculous material, and near to it is a small cavity formed by the breaking down of a similar nodule.

Malignant Disease

of the pancreas is not uncommon, the new growth affecting, in the great majority of cases, the head of the gland, and

leading to obstruction of the common bile-duct, and often to dilatation of the gall-bladder, the cystic and hepatic ducts remaining free. Such growths are primary, are usually hard, and may extend to the neighbouring structures. Secondary growths are also often found in other organs.

2276a.—Section of a pancreas with the duodenum attached. The head of the gland is infiltrated by a mass of new growth, which extends into the intestinal wall and presses upon the common bile-duct in such a way as to occlude it.

Less commonly cancerous growths are found in other parts of the organ, as is shown by the following examples.

2273.—Section of a pancreas, the whole thickness of which near its head is occupied by an oval mass of hard cancer, with a coarse fibrous texture. The portion of the organ between the tumour and the duodenum is healthy. The remainder of the gland is atrophied, and appears to have undergone fatty degeneration.

2274.—Portion of a pancreas. About its centre is a large mass of hard cancer, and in other parts of the organ are smaller deposits of a medullary character.

Malignant growths of a secondary nature are occasionally met with.

2276.—Section of a pancreas, in which are numerous round masses of medullary and melanotic growth. In many of them the morbid growth appears to have infiltrated the tissue of the gland, the cut surfaces presenting the same lobular arrangement as the surface of the normal gland. The patient had a melanotic growth in the eye.

SECTION XII.

DISEASES OF THE LYMPHATIC GLANDS AND VESSELS.

Atrophy occurs in general wasting, whether from age or wasting disease.

Hypertrophy only occurs as a result of chronic inflammation.

Inflammation

follows on absorption of poison from a wound. Red lines leading from the lesion to the gland mark the course of inflamed lymphatics. The gland becomes enlarged and tender. The ordinary processes of inflammation take place in it. Suppuration may result, in which case the inflammation spreads to the neighbouring tissues, and ulceration forms a passage to the surface. The process of inflammation in the gland may be regarded as protective in nature, the glands forming a second line of defence (the first being the wound surface), to prevent the poison entering the general circulation.

When inflammation is chronic, glands may become enlarged (**Hypertrophy**). This enlargement is generally due to a sclerosis or increase of interstitial tissue rather than of gland-pulp, and the fibrous tissue may increase so much as to squeeze and diminish the gland-pulp.

2277.—Sections of a lymphatic gland removed from the groin. It is enlarged to an inch and a half in length, and nearly an inch

in width. The whole of its natural texture appears to be replaced by a pale, obscurely fibrous, and very hard substance.

Obstruction of lymph-vessels produces effects which vary with the site of obstruction.

I. If the lesion affects lymphatics which lead from the surface of the body, the skin is affected in a way which is called **Elephantiasis**. It is enormously thickened, the surface becomes very uneven, and section shows that its deeper parts have become a mass of thick fibrous trabeculæ enclosing widely-dilated lymphatic spaces. This condition affects either the limbs or the scrotum, not the surface of the trunk. The reason probably is that from these parts comparatively narrow channels lead to the lymphatics of the trunk, and obstruction is therefore an easy matter. The lymphatics of the leg, for instance, pass through the femoral ring, and must therefore be at this point few in number. On the trunk there is no such constriction of the lymph-tracts, and therefore no place where obstruction could easily overcome the free anastomosis that exists.

As seen in these parts, obstruction is due—

1. To a recurrent inflammation resembling erysipelas. In a very slight degree this is also seen in the œdema of the eyelids, which is left by recurrent attacks of facial erysipelas.

2. To chronic ulceration when extensive enough to constrict a large area of lymphatic vessels, for instance, a large chronic ulcer of the leg.

3. Rarely to tumours compressing the thoracic duct or its larger tributaries.

4. Possibly to some congenital malformation.

2694a.—A hand affected with congenital elephantiasis. The patient, a man aged 34, said that the affected hand had always been larger than the other. A year before admission it began to increase in size, and nine weeks before he came under notice the ulceration over the thumb began.

5. To the parasite *Filaria sanguinis hominis* (*vide infra*).

II. When, on the other hand, the obstruction affects the thoracic duct or its main tributaries, the chyle, prevented from flowing upward, either bursts the mesenteric vessels, and produces **Chylous Ascites**, or runs back into the lymphatics of the urinary tract, bursts these, and causes **Chyluria**. Chylous pleural effusion sometimes occurs. The fluid in the peritoneum and pleura, or the urine, as the case may be, is milky. It coagulates, but again liquefies, and a fatty scum then forms upon its surface.

This condition may be due—

1. To tumour pressing on the duct, but is usually caused by
2. The *Filaria sanguinis hominis*.

Filaria sanguinis hominis

is a nematode worm, of which the female is three inches long and only $\frac{1}{100}$ inch thick. It is endemic in tropical countries. As a human parasite it lives in the lymphatic vessels. It discharges embryos both encapsuled and free. These may collect and, blocking the lymphatic vessels, produce any of the effects of obstruction noted above. They may also, being only as wide as a white blood-corpuscle (although longer), pass into the blood. This they do only during sleep. They are then drawn with the blood into the stomach of the mosquito, and by it transferred to water, whence, in some unknown way, they are again received by man. They do not appear to cause any symptoms, whether in the blood or in the lymphatics, except by the mechanical obstruction of these latter to which they occasionally give rise. If they do not happen to cause this, the host remains in health. **Elephantiasis**, **Bucnemia**, **Barbadoes Leg**, and **Lymph Scrotum** are names which have been given to the various forms of the disease.

2695a.—Portion of a scrotum, with thickening of the skin and

dilatation of the lymphatics ("lymph scrotum"). A filaria was found in one of the dilated lymphatics. From a native of Amoy.

2695b.—Portion of a lymph scrotum in the early stage of elephantiasis, from a case in which filariæ were found in the blood. The man was a native of Amoy.

2695c.—Prepuce of a negro, which is affected by elephantiasis.

2695d.—Section of the hypertrophied subcutaneous tissue from a Barbadoes leg (*Bucnemia tropica*).

Tuberculosis.

a. Primary.

In children the cervical glands are extremely obnoxious to the tubercle bacillus. They are very often attacked when no sign of tubercle can be detected elsewhere. If, as seems probable, they form in these cases the first resting-place for the bacillus, it is probably conveyed to them by the blood. For if they passed from the lung through the lymphatic channels, it seems likely that the bronchial glands would be involved, as they commonly are in children dying with diseased lungs.

b. Secondary.

Tubercle spreads readily along the lymphatics from diseased tissues to the neighbouring glands. Thus the bronchial glands are affected in disease of the lungs.

2281.—A trachea, adhering to which are some enlarged and caseous bronchial glands. The lungs were studded with miliary tubercles. The patient died of a caseous tumour in the medulla oblongata (Series xxx., No. 2492).

See also many cases under Tuberculosis of the Lungs.

The mesenteric glands are affected in tuberculosis of the intestine.

2284.—Mesenteric glands enlarged and infiltrated with caseous material. Adjacent portions of the ileum contain extensive tubercular ulcers.

The glands connected with the limbs are similarly liable to infection.

2284a.—A chain of lymphatic glands enlarged from the deposit of tubercle secondary to disease of the hip-joint. The lower portion to which the left common iliac artery is attached was situated round the brim of the pelvis, and led from the suppurating hip-joint. The upper part lay along the left side of the aorta, and extended as high as the diaphragm. They were firm and gritty when cut. There was no enlargement on the right side, either of the pelvic or lumbar glands.

The appearance of such glands on section is that of tubercle, miliary or caseous, elsewhere (see p. 65).

2283.—Sections of mesenteric glands, enlarged and nearly filled with tubercular matter. The injection displays the vascularity of the small portions of the healthy glandular tissue, which remain around the morbid deposit; but none of the injected fluid appears to have entered the tubercular matter.

Inflammation following the deposit of tubercle mats the gland and the surrounding tissues together. If they are subcutaneous, as in the neck, it tends to involve the skin, in which case ulceration will extend to the surface, and the caseating contents of the gland will be discharged.

Tubercle in glands, however, as elsewhere, may dry up and calcify.

2285, 2286.—Show calcareous deposits, which were once probably tubercular.

Syphilis.

A primary sore causes hard and chronic enlargement of the glands in its neighbourhood. There is nothing in the microscopic appearance to show that the process is other than that of simple inflammation. The fact, however, that other glands, notably the cervical, become enlarged, though they are in no immediate connection with a primary lesion, makes it likely that the syphilitic virus has a special action upon the lymphatics, as upon other organs.

New Growths.

Primary.

There are three varieties of tumour which infest lymphatic glands—**Lymphoma**, **Lympho-sarcoma**, and **Lymphadenoma**. In all three the new growth is very like the tissue of ordinary lymphatic glands, and they have often been confused together. **Lymphoma** is a non-infective growth of tissue exactly like ordinary lymphoid tissue; it originates in glands or in the lymphoid tissue of the viscera. **Lympho-sarcoma** is a malignant and infecting growth, beginning usually in the lymphatic glands or tissue of the viscera, and spreading thence into their substance. It is often multiple. In it the reticulum is thinner, and the endothelioid plates which lie on the reticulum are fewer than those of a normal gland. **Lymphadenoma** (**Hodgkin's Disease**) is also a malignant and infecting growth, beginning usually in those lymphatic glands which lie apart from viscera, as in the neck, and spreading thence to all other glands and lymphoid tissue. In it the reticulum is much thicker, and the endothelioid plates much more numerous (Woodhead, "Pract. Pathol.").

Other varieties of sarcoma may also originate in lymphatic glands.

2278a.—A mass of enlarged lymphatic glands removed from the axilla of a man aged 30, who died from lymphadenoma. The spleen was also affected.

Secondary.

Both sarcoma and carcinoma, but especially the latter, grow in the glands. The very early involvement of the glands in carcinoma, and the great clinical importance of this, are familiar to all. Cells of the growth are apparently brought by the lymphatic vessels to the sinuses of the gland, settle there, and multiply.

2287.—Section of inguinal glands, from a man whose penis was removed on account of epithelial cancer. The glands are filled with opaque-white, soft and friable cancerous matter, which conceals or has superseded their natural structure.

From the patient from whom the specimen of cancerous lungs in Series xi., No. 1729, was taken.

2288.—A trachea, with the arch of an aorta, the pulmonary artery, and numerous lymphatic glands. The glands are enlarged, and the greater part of their natural texture appears to be occupied by a soft medullary substance, of which the natural pale colour is variously shaded by the black deposit in the glands. The diseased glands adhere closely to the trachea, and in some degree compress and project into it; the left recurrent nerve also is adherent to some of the glands, and appears compressed by them.

2239.—Sections of bronchial glands, which are greatly enlarged, and in which the place of the natural texture is occupied by a soft medullary substance. In one of them there are large cavities in the medullary substance, which were filled with blood. The right bronchus is compressed by the diseased glands.

2290.—Bronchial glands, with the trachea, heart, and large vessels. The glands are enlarged, and soft medullary matter is extensively formed in them.

From the same child as No. 2499 in Series xxx.

2291.—A large mass of morbid structure, which occupied the situation of the mesenteric glands. It is composed of a cluster of distinct tumours, of a soft, reddish-brown, vascular, and spongy medullary substance.

From the same patient as No. 2219 in Series xxi., and No. 2803 in Series xxxvi.

2292.—A larynx, by the side of which are several lymphatic glands greatly enlarged and filled by a morbid substance, which, on the cut surface of one of the glands, hangs in fine shreds, like part of a medullary growth. There is also a small flat growth on the mucous membrane lining the interior of the fold between the epiglottis and the arytaenoid cartilage just beneath the diseased glands.

Vide specimen in Series xviii., No. 2070.

SECTION XIII.

DISEASES OF THE SPLEEN.

Abnormalities in Health.

MALFORMATIONS of the spleen are uncommon, but occasionally the organ is unduly movable. Small supernumerary spleens are not infrequently met with, usually in the neighbourhood of the main organ (see 2301a).

Perisplenitis.

Thickening of the capsule of the spleen may result either from inflammatory changes in the organ itself, or in the neighbouring portion of the peritoneum. The thickened capsule may compress the spleen and cause it to undergo atrophy. The thickening may affect the entire capsule, or may be much more marked on some portions of the surface than on others.

2297.—Shows the thickening of the capsule, which has a pale glistening surface. Notice that the thickening is not evenly distributed over the organ, and is much more conspicuous upon its outer surface.

Atrophy of the Spleen

occurs in old people, and in the course of wasting diseases.

2295.—An atrophied spleen which, when fresh, weighed only 5 dwt. 15 grs.; otherwise it is apparently normal.

Hyperæmia of the Spleen

may be active or passive, the active congestion being met with in fevers, such as typhoid or ague, the passive form in cases in which there is backward pressure either in the portal vein or vena cava, as in cirrhosis hepatis and valvular disease.

1. **Active Congestion.**—The spleen is increased in size and the capsule is tightly stretched over its swollen contents. On section the cut surface is darker in colour than is natural, owing to the engorgement of both the blood-vessels and the spleen-pulp.

2. **Passive Congestion.**—Here the enlargement is less considerable, but the organ shows a similar engorgement. If the congestion has been of long standing, the fibrous tissue will be found to be increased in amount, so that the spleen will be unduly hard, and microscopically will show well-marked thickening of the trabeculæ.

Ague Cake.

In cases in which there have been repeated attacks of ague extending over a long period, the frequent renewal of acute congestion sets up a chronic inflammatory process, which leads eventually to a very great increase in the size of the spleen. In this condition, which has received the name of ague cake, there is an increase of both the lymphoid tissue and the fibrous framework, which latter change, when very pronounced, may lead to atrophy of the splenic pulp. In such malarial cases there is, as a rule, an abundant deposit of black pigment in the spleen.

Abscess of the Spleen.

This uncommon lesion usually results from the lodgment of an infective embolus in the course of ulcerative endocarditis (*q.v.*).

Infarction.

The spleen is one of the commonest seats of embolism, and the result of such an accident is the formation of an infarct, which may or may not assume a hæmorrhagic character. Not infrequently the extravasation of blood is confined to the external portion of the infarcted area. Since the arteries of the spleen are end-arteries, the arrest of the circulation in one of them leads to the formation of a wedge-shaped area of red or yellow colour, the tint depending upon the amount of hæmorrhage which takes place into the tissues, in consequence of the backward flow of blood from the veins and its extravasation from the capillaries.

The entire organ becomes increased in size in consequence of active congestion attending the embolism.

The infarcted area becomes the seat of coagulative necrosis, and the irritation of the surrounding parts leads to fibrous tissue increase. The newly-formed fibrous tissue gradually takes the place of the necrosed tissue of the infarcted area, which becomes absorbed, and thus a scar is formed, the place of which is marked by a more or less conspicuous groove or depression on the surface of the organ. Many such scars are often present, each indicating the lodgment of an embolus at some antecedent period.

2295c.—Illustrates the above points very well. The pale triangular area, the apex of which points towards the centre of the spleen, represents an old infarct, which has left a shrunken scar upon the surface of the organ.

2295b.—A spleen which is considerably enlarged, and shows numerous scars of the same kind, each of which results from an old infarction.

2298d.—Shows admirably the effects of infarction in an amyloid spleen.

Amyloid Spleen.

Amyloid spleens fall into two distinct types :

1. **Sago Spleen.**—In this variety the amyloid change is almost confined to the Malpighian bodies, which on section stand out conspicuously from the surrounding spleen pulp as translucent granules, which bear a certain resemblance to sago-grains. When an iodine solution is poured over the cut surface these granules take the stain readily.

Microscopically the homogeneous amyloid material is found to have partially or completely replaced the normal structure of the Malpighian bodies.

2. In the more generalized form, sometimes described as “**bacon spleen**,” the organ is considerably larger and firmer than in the previous variety. The edges of the organ also lose their sharp character and become rounded. The degeneration affects the walls of the bloodvessels as well as the trabeculæ, which become greatly thickened, and on section the Malpighian bodies, far from standing out as conspicuous granules, are usually indistinguishable.

Microscopically the thickened trabeculæ infiltrated with amyloid material occupy a large portion of the field, and when the change has reached an extreme degree the normal spleen structure may be limited to scattered areas of limited extent.

2298c.—Affords an excellent example of the “sago” spleen. The patient was a man who suffered from prolonged suppuration. No stain has been applied, but the amyloid Malpighian corpuscles stand out distinctly upon the cut surface as grayish translucent granules.

2298a.—In this specimen the amyloid portions are deeply stained with iodine.

2298d.—Another specimen of sago spleen, and the little accessory spleen below is similarly diseased. The large spleen shows also an infarction.

The Enlarged Spleen of Rickets.

2298b.—A large firm spleen from a well-marked case of rickets. Microscopically the increase of size is found to be due to hyperplasia of the normal elements.

The Enlarged Spleen of Leucocythæmia.

This disease is in its splenic form attended by an enormous enlargement of the spleen, which may reach down to the pelvis. The enlarged organ is much firmer than natural, and is, as a rule, firmly bound to the neighbouring parts by adhesions. The increase in size is mainly due to increase of the lymphoid tissue of the organ, but there is at the same time a fibrous increase manifesting itself by an increase in the thickness of the capsule and of the trabeculæ. On section the spleen is pale, but the Malpighian corpuscles do not usually stand out at all prominently. Hæmorrhages and infarctions are usually present.

Microscopically the changes are seen to be quantitative rather than qualitative, the sections showing mere increase of the elements which make up the spleen-pulp and trabeculæ of undue thickness.

The Enlarged Spleen of Hodgkin's Disease.

Here the enlargement of the spleen is much less marked than in leucocythæmia. It is usually the seat of lymphomatous growths originating in the Malpighian corpuscles, and appearing in section as pale nodules, varying in size from the dimensions of a pea to those of a walnut.

There may be at the same time thickening of the capsule, and adhesions may form between the spleen and the surrounding structures.

The changes are essentially different from those of leucocythæmia, in which disease the splenic pulp is affected, whereas in Hodgkin's disease the adenoid sheath of the vessels is first affected; the surrounding tissue becoming involved later (Sims Woodhead, "Practical Pathology").

2305.—The half of an enlarged spleen, the seat of lymphadenoma. The section was marbled by patches of soft whitish lymphoid tissue intermingled with the red splenic substance. The lumbar and

mesenteric glands, which were alone affected, formed a mass which was connected with the spleen.

2305a.—Section of the spleen from a case of osteitis deformans. It is seen to be studded with white nodules of lymphomatous growth.

Tubercle in the Spleen.

The deposits usually consist of miliary tubercles scattered through the substance of the spleen, and well seen upon the capsule. It is in cases of general miliary tuberculosis that the spleen is most apt to be invaded, and in such cases tubercle will be found distributed abundantly through the other organs of the body. In more chronic cases caseous nodules may be formed.

2299.—The spleen of a child showing deposits of miliary tubercles, many of which have undergone some softening in the centre, or present a small central cavity from which the softened substance has come away.

2301a.—Section of a spleen, with a small accessory spleen, both of which are infiltrated with tubercle. The spleen is much enlarged, and shows numbers of yellowish-white tubercular nodules.

2303.—Here masses of tubercle are present, some of which are undergoing softening in their centres. The patient from whom the specimen was taken died of tubercular meningitis. Tubercle was also present in the lungs, and there was a nodule about the size of a pea in the frontal lobe of the left cerebral hemisphere.

Gummata

in the spleen are not very common, but in some instances such growths may replace almost the whole of the natural structure of the organ, which may be greatly increased in size and have a nodular appearance.

Malignant Tumours.

Carcinoma of the spleen is uncommon, and when present is usually of the medullary kind. Sarcoma is also occa-

sionally met with. The growths are, as a rule, secondary to tumours in other situations.

2304.—Section of a spleen containing masses of a soft medullary growth. The tissue between the masses is healthy.

2304a.—Section of the spleen of a horse, infiltrated with a growth of melanotic sarcoma, secondary to a similar growth in the skin. The organ is much enlarged.

Parasites.

Parasites of various kinds are occasionally found in the spleen, such as :

1. *Pentastoma denticulatum*, an arachnoid, the remains of which are found enclosed in a small calcareous nodule.

No specimen.

2. *Cysticercus cellulosæ*.

No specimen.

3. Hydatid cysts.

2306.—A large hydatid cyst in the spleen, projecting from the upper surface of the organ. The cyst contained numerous daughter cysts. The patient had also hydatid of the liver.

2306a.—Calcified cyst-wall of a splenic hydatid.

4. The ova of *Bilharzia hæmatobia*.

5. The **Ray Fungus**, or *Actinomyces*, also occasionally forms tumours in this organ.

2306c.—Spleen of a woman aged 35, whose liver was infiltrated with actinomycosis. The spleen was enlarged, and weighed 12 oz. ; it was adherent to the neighbouring parts. The lower third is replaced by a pale growth with a well-defined border, and smaller masses are seen in other parts. Notice the small cavity near the centre of the organ which contained gelatinous matter similar to that found in the liver.

SECTION XIV.

DISEASES OF THE SUPRARENAL CAPSULES.

Atrophy.

1. Occurs as a senile change.
2. Occurs as a morbid change. In these cases it is
 - (a) apparently a simple wasting,
 - (b) the result of chronic interstitial inflammation of the same nature as that in a sclerotic kidney.

No specimen.

Hæmorrhage.

1. Due to injury.
2. Idiopathic. Sometimes due to an acute inflammation, sometimes to convulsive attacks stopping the flow of blood in the veins.

2320a.—The suprarenals of a child, into the substance of which extensive hæmorrhage has occurred. The glands have been laid open; behind and between them is a portion of the abdominal aorta. From a child, aged 7 months, who died of whooping-cough.

Amyloid or Lardaceous Disease.

Lardaceous deposit occurs in these as well as in other abdominal organs in cases of long-standing suppuration, of phthisis, and of syphilis.

2320.—Suprarenal capsule from a man who died of phthisis and albuminuria, with amyloid disease of liver and kidneys. This supra-

renal capsule is said to have been amyloid, but there is nothing in the specimen to show this.

Abscess is occasionally found, due to septic infection from some other part.

2326b.—A section through a kidney and suprarenal capsule. The latter has been converted into a globular mass, which measured three inches in circumference when it was fresh. The glandular substance has been completely destroyed, and its walls are thickened by a deposit of caseating material. The cavity was filled with thin sanious pus. From a man aged 67, who died of diabetes. There was no evidence of Addison's disease during life. The opposite suprarenal capsule was healthy.

Tuberculosis occurs both as—

1. Gray or miliary deposits.

2321a.—The kidneys and suprarenal capsules from a case of Addison's disease. The substance of both suprarenal capsules is completely destroyed by tubercular disease. Microscopical examination showed the presence of typical miliary tubercle, but no bacilli were discovered. The kidneys appear to be healthy. From a boy aged 14, who had been ill for twelve months. He had well-marked bronzing of his skin, but there was no evidence of tubercular disease during life.

2321.—Two suprarenal capsules from a man aged 20. The substance of both is destroyed by tubercular disease. Tubercle was also found in the lungs and mesenteric glands. There was general, but not deep, bronzing of the skin. The man had been delicate all his life, but had become much weaker during the last year of it.

2. Larger caseating masses.

2326a.—A kidney and a suprarenal capsule from a patient who died of Addison's disease. The capsule has degenerated into a mass of caseous material, and is considerably enlarged. A microscopic examination showed the existence of true tuberculosis. Sections are preserved (No. 90e).

2325 and **2326** are probably similar specimens.

2322.—The right suprarenal capsule from a man aged 34 years. It is somewhat increased in size, and the tissue is nearly wholly re-

placed by masses of cheesy matter, some very soft. Besides these cheesy masses there is a little translucent grayish material. The right semilunar ganglion was dissected and found natural; there was no matting together of the parts around. The left suprarenal capsule was diseased in precisely the same manner as the right. The face, neck, nipple, scrotum and penis were rather deeply tinted of a sooty colour. There were many small black spots on the face, but no pigmentation within the mouth. There were numerous cheesy masses at the apices of both lungs.

3. Calcareous concretions.

As in 2324.

In 2322a the deposits are described as horny in section and cutting like cartilage. The degenerating portions of the gland contained tubercle bacilli. From a married woman, aged 23 years, the mother of four children. She had been ailing since the birth of her first child, six years previously. On admission to the Victoria Park Hospital she was found to be suffering from phthisis. Her complexion was sallow, but the skin of her face, neck, arms and hands were tinted of a light brown. There were numerous bright brownish-black spots covering the tinted area. Two months after the admission of the patient she was seized with excessive vomiting, which lasted for four days, when she became comatose and died. At the autopsy a small consolidated patch was found at the apex of the right lung, but with this exception the lungs and all the other thoracic and abdominal viscera were healthy.

It appears to be sometimes primary, as probably in 2322a, but more often is secondary to tubercle elsewhere.

Carcinoma.

1. Occasionally originates in the suprarenals, or more commonly spreads to them from neighbouring structures.

2329.—Part of a suprarenal capsule in the substance of which is a large mass of new growth. Numerous similar deposits were present in the liver and lungs.

2330.—A suprarenal capsule in which nearly the whole of the natural texture is replaced by a mass of firm medullary substance.

The liver and other organs of the same patient were similarly diseased.

2330b.—The right suprarenal capsule, with a section of kidney attached to it, from a man who died of cancer of the head of the pancreas (see **2276a**). The adrenal is infiltrated with a carcinomatous growth, almost certainly by extension. His lungs were riddled with cancer, and he had numerous nodules in his kidneys. From a male adult who was treated for dyspepsia two years before his death, and who subsequently developed symptoms like those of phthisis. During the last fourteen days of his life he was deeply jaundiced and very delirious.

2. Secondary deposit is rare.

Sarcoma.

1. Occasionally primary, growing from the connective tissue.

2. Occasionally secondary.

2330c.—A section through the right kidney and suprarenal capsule. The latter is infiltrated with a round-celled sarcoma. From a man aged 18 years. The primary growth occurred in the left lung. (Series ix., **1728b**.)

2330a.—A round-celled sarcoma from a child $1\frac{1}{2}$ years old, who had sarcoma all over his body.

• **Cysts** containing colloid material have been found.

No specimen.

Addison's Disease,

the symptoms of which are (1) prostration, (2) nausea and vomiting, (3) bronzing of the skin and mucous membranes, occurs in two conditions of the suprarenal capsules—

1. In atrophy.

No specimen.

2. In tuberculosis, as in the specimens quoted above.

In some cases the sympathetic nerves connecting the suprarenal capsules with the semilunar ganglia have been found thickened or involved in fibrous tissue and showing the appearance of degeneration.

2323.—A left suprarenal capsule, seen from behind, with the aorta, the semilunar ganglion, suprarenal and renal plexuses. The great splanchnic nerve is seen coming down from above to the semilunar ganglion, and sending down a branch, which passes behind the suprarenal artery, to the renal plexus below. Near it and to the right a branch of the pneumogastric comes down and joins the ganglion. The suprarenal artery springs from the renal, which has been cut off short. The vein, with the renal vein, has been cut off to show the nerves. The outer surface of the capsule is rough and irregularly nodulated, one large nodule being especially prominent at the exact point where the nerves enter the organ. The peculiar features of the disease are well seen in the other half of the capsule, the cut surface of which is shown below. A fibrous band, continuous with the thickened fibrous investment, passes obliquely across the organ, dividing it into two unequal parts. No trace of the natural structure remains, but the whole organ is much enlarged, and converted into a moderately firm substance, in parts whitish, in parts of a dirty-brown colour, dotted here and there with small spots and streaks which are now white, but in the recent state had a tint of yellow. The capsule and all the surrounding nerves are imbedded in an unusually large amount of fibrous tissue, which matted together the plexuses. This fibrous thickening extended up the splanchnic and pneumogastric nerves, and became continuous with firm old adhesions, which surrounded the liver and spleen and bound the upper half of the omentum to the anterior abdominal wall. The right capsule was not quite so large, but in other respects similar to the left.

From a woman, aged 31 years, who died under Dr. Tuckwell's care in the Radcliffe Infirmary, Oxford, with well-marked general and local symptoms of Addison's disease of the suprarenal capsules.

In cases of malignant growth Addison's disease does not occur, probably for the reason that new growth displaces rather than destroys the tissues in which it flourishes, and that the adrenal is, in consequence, able to perform its functions even though it be the seat of malignant disease.

SECTION XV.

DISEASES OF THE KIDNEY.

Malformations.

1. Absence of one kidney.
2. Horseshoe kidney.

3649, and many others.

The isthmus connecting the kidneys may be either glandular or fibrous tissue.

3. Double ureter.

2367, 2368a, 2369a.

Malposition.

Movable (Floating) Kidney.—The kidney is turned so that its long axis is antero-posterior. It rarely has a meso-nephron, but the whole peritoneum is loosened over it. Post-mortem this condition is much rarer than it is in life, probably because the supine position tends to keep the kidney in its proper place, and the structural alterations of the peritoneum are really so slight as to escape notice.

Atrophy.

1. The kidney sometimes develops imperfectly, being smaller, and perhaps having fewer pyramids, than usual.

3666a.

2. Kidneys become contracted—

(a) From Bright's disease (*vide infra*).

(b) From occlusion of the ureter, either by calculus or by stricture.

(c) From disease of the bladder or urethra.

In the first class of cases the contraction is a simple sclerotic change, due to the contraction of fibrous tissue; in the two latter the result is due partly to constant pressure, which in all parts of the body causes atrophy; partly to inflammation and subsequent sclerosis, due either to the presence of a foreign body, such as a calculus, or to unwholesome and irritating change in the retained urine.

2361.—A kidney reduced to about one-fourth of its natural size by atrophy of its glandular substance. The ureter is obliterated at its commencement; the pelvis is as large as usual. The other kidney of the same patient was healthy in structure, but of nearly twice the natural size.

In most cases the pelvis and other passages above the obstruction are dilated, and these cases will be quoted under hydronephrosis.

2371.—Interstitial nephritis, with atrophy of both kidneys, associated with dilated, varicosely bulged, and thickened ureters, and dilated and hypertrophied bladder. This condition was probably due to obstruction to the outflow of urine from the bladder.

Hypertrophy, or, rather, **Hyperplasia** (the cells are multiplied, and not enlarged), is either—

(1) A compensatory change occurring in a sound kidney when its fellow has in early life been rendered useless.

2331.—A kidney illustrating compensative hypertrophy, such as takes place when the opposite organ has been destroyed, as in this instance it was by suppuration (compare 2361, *supra*).

Or (2) may result in both kidneys at once from over-use, as in persons who have drunk great quantities of fluid.

No specimen.

Congestion.

1. Active, from dilatation of the arteries; occurs in fevers. The kidneys are then large, soft, and red on section.

2. Passive, due to venous stasis from diseases of the heart and lungs. The kidneys are large and rather hard, the stellate veins engorged, the cut surface dark red or purple. If the condition is chronic, a certain amount of increase of interstitial fibrous tissue results, and the capsule becomes rather adherent owing to the thickening of its in-growing trabeculæ.

No specimen. These changes cannot be recognised except in fresh specimens.

Inflammation.

Acute Parenchymatous Nephritis.*—The kidneys are large and rather soft. The capsule is not adherent. The cut surface drips with blood. The cortex is slightly mottled with creamy patches, and the striæ are indistinct. Through the microscope the chief change is seen to be in the tubular epithelium, which is swollen and irregular. The central part of the cell breaks off into the lumen of the tube (hence the names **Desquamative** and **Tubular** nephritis), and, mixed with blood and inflammatory exudation, fills it up. The creamy patches are from fatty degeneration in the epithelium, due to the inflammation. If the inflammation has existed for more than a short time, increase of the interstitial tissue also is visible.

1. It is usually due to cold or wet.

2332.—Section of a kidney enlarged, and appearing very pale and soft in every part except those in which there are large blotches of effused blood. The principal branches of the renal vein are filled

* The pathology of nephritis is extremely confused and confusing. No classification is more than provisional, though necessary for purposes of description and reference.

by firm, dry coagula. The patient, a lad about 19 years old, died with acute dropsy and albuminous urine, which supervened on intemperance and exposure to cold a few weeks before his death.

2. It is caused by direct irritants, *e.g.*, cantharides.

3. It occurs in acute fevers. In scarlatina, which is by far the most common of these causes, the chief changes are inflammation of the epithelium lining the glomeruli, and covering the capillary tuft. In diphtheria there is often marked and early fatty change of the cortex, which makes it yellow, while the pyramids are congested. In both these cases the nephritis is probably due to special poisonous blood products which the kidneys remove, but which injure them in passing. Puerperal nephritis is probably a similar disease.

4. Often no cause can be found. Nephritis has been seen, for instance, to supervene in patients who have been in bed for weeks in a hospital owing to some other complaint quite without influence upon the kidneys.

Those changes which are visible to the naked eye vanish in preserved specimens.

Acute nephritis often recovers. In scarlatinal cases this is the most common event, and in the diphtheritic it is almost invariable.

It may, however, prove fatal by uræmia.

Or, lastly, it may issue in chronic nephritis.

Chronic Parenchymatous Nephritis.—Two forms occur:

1. The creamy opacity mentioned in acute nephritis increases both in degree and in extent. At the same time the proliferating epithelium, and the other products of inflammation within the tubes, squeeze the capillaries and lessen the blood in the renal cortex. Both causes turn this part of the kidney yellowish white. It remains for some time large, and for some time the capsule is not abnormally adherent to the kidney (**Large White Kidney**).

2333.—Section of a kidney, enlarged, and the cortical substance

of which is pale. A fine injection of size and vermilion through the renal artery shows that the whole organ, and especially the altered cortical substance, possesses less vascularity than is natural. The capsule of the kidney was stripped off more readily than usual, and the whole organ is large and soft. The other kidney was similarly altered. From a young woman who died with acute general dropsy, and whose urine was albuminous.

2. The interstitial tissue is, however, somewhat inflamed at an early date. Long continuance of tubular inflammation increases this, and after some time leads to the formation of fresh fibrous tissue, which, as usual, shrinks. Thus a kidney is produced which is small, whose capsule from thickening of the ingrowing trabeculæ is abnormally adherent, which is rough on the peeled surface, but not red in section (**Contracted or Small White Kidney**).

2335.—Section of a kidney contracted to half its natural size, and fissured and granular on its surface. Its whole substance appears pale and tough, and its cortical portion is reduced to a layer less than a line in thickness. The patient was a woman 30 years old. She appeared healthy till six weeks before her death, when she became anasarcaous and had albuminous urine. She died in a state of coma, with pleurisy and pericarditis.

2335c.—A kidney whose surface is granular, and whose capsule was adherent. The cortex is very narrow. The whole organ weighed 4 ozs. Microscopical examination showed abundant connective-tissue increase; many tubules were quite denuded of epithelium, others contained blood-casts; some of the glomeruli were natural, whilst others were shrivelled and degenerate. The arteries were greatly thickened. From a married woman, aged 28, who had no history of scarlet fever, but who had twice suffered from acute rheumatism. Thirteen months before her admission to the hospital she had been laid up with pleurisy and bronchitis, and six months later her legs began to swell. She had abundant albumin in her urine, and at the post-mortem examination her heart was found to be hypertrophied.

In an adult, chronic parenchymatous nephritis does not disappear; but children who have had albuminuria after

acute nephritis for many months may become quite free from it.

The disease may last many years, even in adults.

Granular Kidney (Chronic Interstitial Nephritis).

1. **Small Red or Cirrhotic Kidney.**—The kidney is small, red, and hard; the capsule is abnormally adherent, the peeled surface rough and granular. On section the cortex is red or gray, and narrower than it should be. The microscope shows that the projections, or granulations, on the surface are the less altered parts of the cortex. The depressions are fibrous bands running in from the surface. The chief change is in the intertubular connective tissue, which is first inflamed, then increased, and then shrinks. The glomerular capsule thickens, and by nipping the afferent vessels starves the tuft, which degenerates and becomes a structureless hyaline or granular mass. The external coat of the arteries also thickens. At the same time the tubular epithelium degenerates and desquamates.

This is a disease of middle life. It is very insidious in its origin, and chronic in its course. Its causes are not accurately known, but it is probably due to long-continued impurity of the blood, either from faults of diet, such as drink and high living, or from faults of the processes of digestion. The impure blood irritates the kidney while being filtered through it. This form of kidney is very common in gout.

2335d.—A kidney from a case of chronic interstitial nephritis. It was, when fresh, of stony hardness. It weighs 5 ozs. The surface, from which the capsule, which was very adherent, has been detached, is granular. The cortex is much thinned, and the structure obscured. From a man aged 38. The heart was enormously enlarged. (N.B. This is young for this disease.)

2335e. The kidneys from a case of chronic interstitial nephritis. They are small; the capsule was adherent, and on peeling left the surface rough. Here and there are small thin-walled cysts. On

the cut surface it is seen that the cortex is narrowed, and the apices of the pyramids rounded off and flattened. The two kidneys together weigh 6 ozs. From a man aged 56, who also had an enlarged and dilated heart (22 ozs.), atheromatous coronary arteries, a 'nutmeg' liver, emphysema of the liver, and effusion into the right pleura.

The two forms of contracted kidney which are due to the shrinking of fibrous tissue previously increased by inflammation, the small white kidney and the small red kidney, are in preserved specimens distinguishable only by the history. Both are small, both are hard, both have an adherent capsule and a granular surface. Both also may show on their surface the small cysts which are seen in 2335e. These are caused by the nipping and blocking of tubules by the shrinking fibrous tissue. The fluid accumulating behind the dam dilates the convoluted tubules between the dam and the glomerulus.

2381.—A kidney on the surface of which there are numerous small cysts containing a dark-coloured fluid. The reflection of a portion of the capsule shows that the cysts are situated beneath it.

2381a.—A similar specimen. From a man aged 59, who died of hæmorrhage into the pons Varolii.

2. Arterio-sclerotic Kidney, another variety of granular kidney, is due to obstruction of the arterioles by thickening of their inner coat. This starves the tissue they serve, and thus small atrophic areas are scattered through the cortex. These sink like collapsed lung below the surface, leaving the healthy parts to project. The thickening of the intima is the marked microscopical characteristic. There is hardly any fibrous increase. The kidney is not hard, and the capsule is not adherent.

This is especially the kidney of old age. It is also said to be produced by lead-poisoning.

Vascular Changes in Chronic Nephritis.—In a large number of cases, which are almost always cases of contracted kidney, the left side of the heart is hypertrophied (*vide*

1241a, 1241b, from patients whose kidneys are in 2335a, 2335d, respectively), and the blood-pressure in the arteries is increased, showing that obstruction exists either in the arterioles or in the capillaries.

For the explanation of these facts numerous theories have been proposed, none of which is universally accepted.

1. The most reasonable recognises that the kidneys are the filter by which the blood is kept pure, and assumes, what there is no evidence to support, that the blood supply to them is regulated by some central mechanism to suit the state of the blood, so that, with more impurity to be removed, arrangements are made for more filtration, and the contrary. When by contraction the filter has become smaller, the blood must pass it the quicker; and since for greater speed of the current greater force is required, the heart hypertrophies under the continual over-exertion which the central mechanism imposes upon it. The blood-pressure in the rest of the body is then heightened, in the small red kidney by active contraction of the arterioles which help the heart to keep up the pressure, and in the arterio-sclerotic kidney by the passive obstruction which the disease of the intima naturally produces.

2. Other men believe that the disease of the kidney renders the blood impure; that the arterioles actively contract to prevent impure blood passing to the tissues; and that the heart hypertrophies from the overwork which their resistance imposes upon it.

3. A third view places the resistance in the capillaries, and looks upon the arterial contraction as auxiliary, not inimical, to the heart.

The result of this great increase of blood-pressure is degeneration of the arterial wall. Cerebral hæmorrhage is a very common form of death in cases of contracted kidneys, and of cases of cerebral hæmorrhage at this Hospital three-quarters have contracted kidneys.

Compare 2381a, *supra*, p. 182.

Acute Suppurative Nephritis is a disseminated inflammation due to the sprinkling of septic material through the kidney. Round the centres of infection all tissues are alike attacked (it is not, that is, a systematic disease of either epithelial or connective tissue), and it rapidly leads to the formation of small abscesses. The small red spots, or points of pus, on the surface of the section form the characteristic sign to the naked eye. Through the microscope the red spots are seen to be areas of inflammatory effusion crowded with leucocytes.

Septic material may be conveyed to the kidney by the bloodvessels, or up the urinary tracts. In general pyæmia the first is the channel of infection. But the disease is very much more commonly associated with inflammation of the lower urinary passages, and in these cases the poison passes by extension from below upwards. The site of original inflammation may be as high as the pelvis of the kidney, or as low as the urethra. Its poisonous character may be due to retention of, and putrefaction of, urine in the body, or to introduction of germs from without. The disease used to be not uncommon after surgical operations upon the bladder and urethra, and was hence called **Surgical Kidney**.

Specimens are shown of its origin :

1. From pyelitis due to calculus. (*Vide* 2358, *infra*, p.197.)
2. From stricture of the ureter and retention of urine.

2365.—The kidneys, ureters, and bladder from a woman aged 43 years, who died from suppression of urine. The kidneys are in a state of commencing suppuration. Three inches below the kidney the right ureter is greatly thickened, and its calibre narrowed but not obstructed. A short distance lower the walls of the ureter again become thickened, and continue so until its entrance into the bladder. The left ureter is affected in a similar manner. The bladder is hypertrophied.

3. In cystitis from retention of urine.

2338b.—The bladder and left kidney from a patient who fractured his spine at the junction of the fourth and fifth dorsal vertebræ five months before death. The bladder is considerably hypertrophied, and its mucous membrane is ulcerated. The ureters are dilated. The kidney is inflamed, and contains numerous small abscesses scattered throughout the cortex and pyramids. From a man, aged 54, who fell sixteen feet from a scaffold across a wall. On admission he was sensible, but had total anæsthesia and akinesia in his lower limbs, and in his trunk to the level of the sixth rib. Two months after the accident he had complete atony of the bladder and rectum.

4. From operation.

2371a.—A 'surgical kidney.' It is rather smaller than natural. Its surface is irregular, and in parts torn where the capsule was adherent; the pelvis and calices are slightly dilated, and the mucous membrane lining them is discoloured and thickened. The gland as a whole is softened, and scattered throughout its substance, but more particularly in the cortical portion, are numerous abscesses, varying in size from a pin's head to a nut. From an old man, who died a few days after lithotomy had been performed. The middle lobe of the prostate was enlarged, the mucous membrane of the bladder showed signs of recent and old inflammations, and the opposite kidney was in a similar condition to the present specimen.

Lardaceous (Amyloid, Waxy) Kidney.

The kidney is large and hard, the capsule not adherent, the surface smooth. The section is pale and spotted with translucent patches like boiled bacon, due to the amyloid deposit, and staining a deep brown with iodine. It becomes in time complicated with chronic fatty degeneration of the epithelium, such as that of the large white kidney, which produces opaque creamy patches, and sometimes with increase of the interstitial connective tissue.

Microscopically there is seen a hyaline degeneration, beginning in the glomeruli, and spreading to the afferent

arteries, and next to the interlobular. The degenerate patches stain reddish with methylaniline violet, the natural tissues blue.

It is due to—

1. Prolonged suppuration, especially of tubercular origin, as in phthisis ;

2. Syphilis ;

but no one knows why.

2331a.—A kidney affected with amyloid degeneration. It is somewhat enlarged, especially the cortical portion. Its surface is smooth, and the section has a translucent, homogeneous, and wax-like appearance.

2331b, 2331c, 2331d are similar specimens stained with iodine, of which **2331c** is the best.

Infarction

is the process resulting from the plugging of one of the terminal arterioles in the cortex. The area served by the artery is cut off from the blood-stream, so that no fresh blood is sent through it. That part of the arteriole which lies on the peripheral side of the plug contracts on the blood already there, and passes that onward into the veins in the regular manner. Thus the part is left empty of blood, and a triangular pale area is formed whose apex is towards the centre at the plugged spot, and whose base is on the surface of the kidney. The condition of pallor remains a variable time. It is then replaced by a condition of engorgement. To understand this it is necessary to remember that in any terminal capillary system the force of the heart is pressing the blood both forwards into the veins and sideways into the lateral channels of anastomosis. Thus the force in each artery tends to flood the area of the neighbouring arteries. It is opposed by the same force exerted in the neighbouring arteries themselves, which fills their own capillaries, and prevents their being filled from outside. But if one artery be plugged by an embolus the force of the heart is removed

from this area of service, and not only, therefore, will the neighbouring capillaries discharge their blood unopposed into this area, but when the blood is there, there is no force to drive it out again, while the slight pressure that exists in the veins tends to retain it in the capillaries, and even to add more blood by back-flow. The blood will therefore stagnate there, and will thus produce the dark-red triangle which corresponds to the stage of engorgement. But venous engorgement when long continued produces increase of fibrous tissue in small areas just as much as in the kidney as a whole (*vide supra*, p. 178). Fibrous tissue is therefore formed in the part. This after a time contracts, and eventually the original infarct becomes a whitish fibrous mass puckering the surface of the kidney, and traceable thence for some little distance inward.

Infarction is almost always due to emboli from valvular disease on the left side of the heart, especially to the ulcerative form of endocarditis. The embolus may, however, proceed from a diseased artery between the heart and the kidney, the aortic or renal.

2331e.—A kidney showing numerous depressed and puckered scars, the result of infarcts. The other kidney was similarly affected, but neither was materially enlarged. From a woman, aged 25, who died of ulcerative endocarditis. She was in the hospital for three months, and the urine always contained a considerable amount of albumin. There were similar infarcts in the spleen. (See the Heart series, vii. **1299d**, and the Spleen series, xxv. **2295b**.)

Abscess—when larger than the tiny spots of a surgical kidney—

1. Is usually due to tubercle (*q.v.*); but
2. May arise from septic infection:
 - (a) By the coalescence of small disseminated abscesses in a surgical kidney.
 - (b) By a poisonous infarction either in ulcerative endocarditis or in general pyæmia.

No specimen.

Cysts.

Minute cysts are often seen in contracted kidneys. Their origin is explained *supra*, p. 182.

Large cysts are found—

1. Solitary, or but few, in an otherwise healthy and usually elderly kidney.

2378. 2379.—From an old man.

2. As a collection of large cavities almost replacing the kidney (**Cystic Degeneration**). The little tissue between them is sometimes natural, sometimes sclerotic.

These occur sometimes in children who are still-born, or who die very shortly after birth. In the cases which occur in adults—the owners usually die comparatively early—the disease may have been congenital, but insufficient to kill so quickly.

The disease is ascribed—

1. To inflammatory occlusion of the tubes in the papillæ.

2. To mal-development of the Wolffian tubules.

2382.—An injected specimen of cystic degeneration of the kidney. The kidney is seven and a half inches long, four inches broad, and weighs $21\frac{1}{2}$ ozs. The surface is irregularly lobulated from the projection of cysts of various sizes, in the walls of which numerous minute vessels are seen ramifying. The pelvis is much dilated, and the calices are elongated, and extend nearly to the surface of the organ. The parenchyma is converted into a congeries of cysts, of various sizes, from that of a walnut to a pea, enclosed in a matrix of connective tissue, which is extremely vascular. The cysts contained a dirty brown fluid, having the odour of decomposing urine. No trace of the normal tissue of the kidney is visible. An attempt was made to inject the uriniferous tubes from the ureter with prussian blue. Here and there a blue streak shows the existence of a tube, and nearly all of these lie immediately within the wall of a cyst. The injection had nowhere penetrated a cyst. The ureter was well developed, patent, and not dilated.

Microscopic Examination.—In the least altered portions of the

kidney, the tubuli uriniferi were found generally dilated and tortuous, and the stages of transition from simple dilatation to the formation of cyst-like cavities could be traced.

Normal Malpighian bodies were visible in places, but many were compressed, and undergoing degeneration. Nowhere could a glomerulus be traced in transition into a cyst. The interstitial tissue was greatly increased, more in some sections than in others. Microscopic specimens are preserved, No. 94.

2383.—The opposite kidney, showing a similar change.

The specimens were taken from a man aged 47 years. He had been well until a week before his admission to the hospital, when he was attacked by hæmaturia. When admitted, he passed a considerable quantity of urine, which was of sp. gr. 1010, pale, and contained a large amount of albumin. Two days later uræmic coma developed itself, from which he died.

2384.—Section of a kidney, in the whole substance of which membranous cysts, of various sizes, varying from that of a pin's head to that of a hazel-nut, are thickly scattered. They contained a yellow, viscid and transparent fluid. Their walls are thin and in close apposition. Only thin layers of the proper substance of the kidney could be discovered intervening between some of the cysts, and forming part of the exterior cortical layer. The vessels of the kidney are injected.

2385.—A section of the other kidney of the same person, uninjected. It is similarly and equally diseased; and, like its fellow, nearly three times as large as a kidney of ordinary size.

2384a.—The left kidney, whose substance is transformed into a large number of thin-walled cysts. The cysts vary in size from a small shot to a pigeon's egg. They were filled with a yellow viscid and transparent fluid. From a married woman, aged 59, who suffered with ascites.

2384b.—The right kidney of the same patient.

Pyelitis (Inflammation of the Pelvis)

may be due to one of several causes—

1. Rarely to the excretion of irritating substances, *e.g.*, copaiba, in the urine.
2. Occasionally to extension of inflammation from the bladder.

3. To tubercular disease.

4. To calculus.

In the first case it usually subsides in a short time. When due to calculus it may become suppurative. When due to tubercle or to extension from the bladder it always becomes suppurative.

Suppurative pyelitis may have one of several effects upon the kidney :

1. It may extend up the tubes and produce small disseminated abscesses in the cortex, as in surgical kidney.

(*Vide* 2338b, *supra*, p. 185.)

2. It may lead to the formation of large abscesses in the kidney substance, separate from the abscess in the pelvis. This condition is usually caused by tubercle, and is probably due to fresh deposit within the kidney of tubercle derived from the original focus in the pelvis.

3. It may dilate the pelvis and the kidney, and form a large abscess within them (**Pyonephrosis**).

2345a.—The bladder and kidneys from a patient who had numerous renal calculi. The kidneys are much enlarged, especially the right. Both organs contain numerous calculi in their calices. In the pelvis of each kidney, and extending downwards into the upper part of each ureter, is a branched calculus. The kidneys are little more than membranous sacs owing to the distension which they have undergone. They contain a considerable quantity of glutinous pus. From a woman, aged 25, from whose bladder in early childhood a calculus had been removed.

2352.—Kidneys from a woman aged 52 years. The left kidney is very small. The ureter is natural throughout. The right kidney is enlarged; its pelvis is greatly dilated, and was filled with ropy pus; it also contained four small loose calculi. The kidney structure is atrophied in places. The ureter is thickened.

Pyelitis may issue in the following ways :

1. The pus may dry up.

2338.—A collection of thick yellowish fluid, like liquid mortar, which filled the pelvis and sacculated remains of a wasted kidney.

It is probably pus, degenerated and thickened by the absorption of much of its liquid part.

2338a.—Kidney enlarged and in an advanced condition of pyonephrosis. The cavities were filled with inspissated pus of the consistency of cream cheese.

2337.—Section of a kidney of which nearly the whole of the glandular structure is absorbed. In its place, and in the pelvis and ureter, there is a soft white substance like mortar, consisting of phosphate of lime, with small proportions of carbonate of lime and of animal matter. From a woman, 62 years old, who for twelve years before her death had no symptoms of renal disease.

2. It may continue to discharge by the urine.

3. It may cause inflammation of the surrounding parts, so that the kidney becomes adherent to them, and may ulcerate through the renal pelvis into the abdominal wall behind.

2348.—Left kidney and ureter from a woman aged 38 years. In the ureter, where it crossed the brim of the pelvis, is an impacted calculus, the size of a horse-bean. The pelvis of the kidney is distended, and contains about twenty stones, three of which are large and faceted. They are probably composed of uric acid coated with phosphates. The pelvis also contained pus, and the abscess communicated by a fistulous passage passing through the left wing of the diaphragm near the ribs, with a left empyema. The right kidney was large, but otherwise natural.

2358b.—The right kidney, which is sacculated and distended to about twice its natural size. A sinus in the groin led into the pelvis of the organ. The greater part of the renal tissue is absorbed. A calculus which sent its branches a short distance up the calices was firmly wedged into the ureter and pelvis, which it completely occluded. From a girl, aged 20, who suffered from pyonephrosis. An incision was made into the kidney, and the patient died six months later from chronic pyæmia.

2359.—A kidney having a large calculus impacted at the commencement of the ureter. The pelvis and the calices are dilated, and the excretory structure of the organ is destroyed. In the dilated pelvis was a quantity of purulent fluid. Perforating the

tissues which intervened, this pus had made its way to the surface and discharged in the loins by means of the sinus seen in the preparation. The other kidney presented a natural appearance.

See also 2355 *infra*.

Or it may ulcerate into part of the intestines, usually the colon.

2351.—A kidney in the pelvis of which are large and irregular calculi. The inflammation and suppuration resulting from the presence of the calculi were followed by adhesion of the kidney to the adjacent portion of the descending colon, and the discharge of the contents of its pelvis into the intestinal canal through an ulcer.

2355.—A kidney which is much enlarged in consequence of the lodgment of a calculus at the commencement of the ureter. The infundibula are dilated, their mucous lining and the proper substance of the organ are indurated, and appear to be the seat of a purulent deposit. Bits of glass are introduced through two ulcerated holes leading directly from the kidney to the descending colon. The part of the colon which thus communicates with the interior of the kidney exhibits numerous small ulcers of its mucous membrane. The capsule of the kidney, a part of which is reflected, is thickened, indurated, and consolidated with the surrounding tissues. The patient was a young man who had suffered from attacks of pain in the loins, which were always relieved by the discharge of pus from the rectum. A quantity of pus was found also to have passed from the lower part of the kidney to the back of the psoas muscle.

Or ulceration may take place into both at once.

2351a.—The lower specimen is a left kidney containing several calculi. Though not much enlarged, it is greatly disorganized, and, owing to the long-continued irritation and inflammation, is surrounded by dense fibrous tissue, which has firmly united it to the neighbouring structures. A light green glass rod has been placed in a sinus ulcerated through into the descending colon. The upper specimen is a portion of the lower lobe of the left lung, firmly united to the diaphragm, which, again, was adherent to the kidney. A blue glass rod shows where a sinus led through the diaphragm into the substance of the lung, there causing the formation of an abscess

which proved fatal. Since each sinus led into the pelvis of the kidney, there was a direct communication from the abscess in the lung through the diaphragm and kidney into the descending colon.

Carcinoma,

when primary, which is rare—

1. Most often originates in the lymphatic glands or parts of the hilum, invading the kidney substance later or not at all.

2. Occasionally begins in the renal epithelium.

2390a.—A carcinoma with a very large fibrous stroma. From a woman aged 48. There were cancerous deposits in the liver and lungs.

2390b.—A section of a large and soft cancerous mass involving the right kidney. The tumour is almost pulpy in consistency; it is contained within the capsule of the kidney, and involves about a third of the lower portion of the organ. The ureter opens into a sort of cavity formed by the breaking down of the tumour. Microscopically the growth is a carcinoma, the constituent cells exactly resembling those in the renal tubes. The matrix is alveolar. From a patient, aged 49, who had suffered for a year from hæmaturia, with gnawing pain in the right lumbar and inguinal regions. An exploratory operation was performed, but it was deemed inadvisable to remove the tumour. The patient died a fortnight later.

2390c.—Carcinoma undergoing colloid degeneration. From a woman aged 21.

As a secondary deposit it is not common.

Sarcoma

occurs as a primary growth both in adults and more often in children, originating in the fibrous tissue. A not uncommon form is lympho-sarcoma, beginning in the glandular tissue of the hilum.

2390d.—Section of a kidney containing a small mass of melanotic sarcoma at its upper part. From a man, aged 47, who had melanotic sarcoma of the skin with secondary deposits in most of the abdominal viscera. (Series xxi. 2209a.)

2390e.—The anterior half of the left kidney showing numerous patches of new growth, which during life were of a bright green colour, and on microscopical section proved to be of a sarcomatous nature. From a boy, aged 10 years, who had multiple tumours of the orbits, internal ear, cerebral dura mater, and other parts.

Calculus.

1. Crystalline deposits of sodium biurate are formed in the convoluted or in the straight tubules in gouty patients (gouty kidney *).

2. True calculus forms—

(a) Usually in the pelvis and infundibula.

2344.—A section of the kidney of a female child, 5 months old, the pelvis of which was nearly filled by a calculus. The substance of the kidney itself is healthy.

2345.—A kidney the pelvis and infundibula of which are dilated and filled by calculi. One large calculus fills the pelvis, and branches from it are continued into many of the infundibula. Smaller calculi fill the other infundibula. The glandular substance of the kidney is nearly absorbed.

(b) Occasionally in the kidney substance.

2344a.—A kidney having a good-sized rough calculus imbedded in its cortex; the substance of the kidney does not appear to be inflamed, and except in the immediate neighbourhood of the stone, where the parenchyma has been absorbed by pressure, the gland is uninjured.

There are three chief varieties :

(a) Uric acid, or urate of ammonia, smooth and roundish, as probably

2344, 2346, 2346a, 2358a, 2359.

(β) Oxalate of lime or mulberry calculus.

(γ) Rarely cystin, xanthin, or indigo.

* This name is often given loosely and erroneously to small red kidneys.

Any of these may become coated with triple phosphate of ammonium and magnesium from decomposition of the urine in the renal pelvis.

There are apparently no specimens of the last two classes, but 2355 looks like a uric acid calculus on which a deposit of calcium oxalate is forming, 2347 looks like a uric acid calculus coated with phosphate, and 2345b might very well be a uric acid calculus, coated first with oxalate and then with phosphate of lime. Without section or chemical tests it is impossible to be certain of the character of stones.

Effects of Calculi.

1. They produce suppurative pyelitis by irritating and inflaming the mucous membrane. This is followed by distension of the renal pelvis, and ultimately by inflammation and atrophy of the gland tissue.

2345a.—The bladder and kidneys from a patient who had numerous renal calculi. The kidneys are much enlarged, especially the right; both contained numerous calculi in their calices. In the pelvis of each kidney, and extending downwards into its ureter, is a branched calculus. The kidneys are little more than membranous sacs, owing to the distension which they have undergone. They contained a considerable quantity of glutinous pus. The bladder is normal. From a woman, aged 25, from whose bladder in early childhood a calculus had been removed. She had increasing symptoms of renal calculus, and died a few hours after admission to the hospital.

2345b.—The left kidney, which has been converted into a series of cysts, which were filled with pus and urine. A large branched stone extends from the pelvis into all the calices. The organ itself is dilated to about three times its ordinary size, while the ureter is much thickened and dilated. From a man, aged 30, who was admitted to the hospital with a suppurating bursa patellæ. His urine was found to be loaded with pus, but he did not complain of any urinary trouble. About a week after his admission he had suppression of urine and died.

2. They sometimes produce chronic inflammation and

rarely fatty degeneration of the kidney without apparent distension of the pelvis.

2353.—A kidney which has undergone complete fatty degeneration. The pelvis is occupied by a large branched calculus; the larger branch extends down the ureter. Microscopic examination showed that the kidney was converted into adipose tissue intermixed with delicate connective tissue. In one or two places the remains of atrophied gland structure could be detected. A microscopic section is preserved (No. 91). Removed from a woman who was killed by an accident and brought to the hospital for examination.

3. They become impacted either at the upper orifice or at some part of the course of the ureter, producing obstruction of urine.

4. They reach the bladder, and there may produce cystitis. They increase in size while resting in the bladder.

5. They may pass out or become impacted in the urethra.

A rare and curious result of irritation from a calculus is a large growth of fat either in the kidney itself (compare **2353**, *supra*) or in its pelvis.

2355a.—The right kidney from a case in which suppurative nephritis occurred in both organs, owing to the presence of calculi. The kidney is enlarged to nearly three times its normal size. The glandular portion is converted into a number of cysts, while the pelvis is completely obliterated by a dense growth, which is found on microscopic examination to consist of inflamed fat and fibrous tissue. A small oblong calculus of uric acid completely blocks the upper part of the ureter. The ureter near the kidney is constricted, but as it passes downward it gradually dilates, until it attains nearly four times its natural diameter. The left kidney is **2345b**.

Or the fat may form in the tissues surrounding the kidney or ureter.

2354a.—A large mass of fat formed round a ureter which contained a calculus. The adjacent tissues were thickened by chronic inflammation. The opposite half of this specimen is in the museum of the Royal College of Surgeons.

Obstruction of Urine may occur at any point below the kidney, and its effects vary accordingly.

I. It is caused by closure of the upper orifice of the ureter. The pelvis and infundibula become dilated, the mucous membrane inflames and sometimes suppurates, the cortex of the kidney undergoes an interstitial inflammation which is usually chronic, and leads to atrophy by shrinkage of fibrous tissue, but may be acute and suppurative. Closure of this orifice of the ureter is caused by calculus.

2347b.—A dilated sacculated kidney. The orifice of the ureter is entirely occluded by a stone about the size of a small bean. The calices are destroyed, and only a very thin piece of the cortex remains.

2354.—A kidney exhibiting the obstruction of the commencement of the ureter by a large calculus, and the consequent dilatation of the pelvis and infundibula, and diminution of its glandular substance.

2356.—A kidney with a large calculus obstructing the commencement of the ureter. Immediately below the obstruction the ureter is completely obliterated. Above it the whole kidney is dilated into one large sac, its glandular substance appearing in some places as a thin layer spread over the surface of the dilated infundibula. From a lady, 74 years old, who had been subject for thirty-two years to attacks of renal disease, which were complicated towards the end of life by cancer of the intestines and other parts. The dilated kidney was adherent to the front of the abdomen, and had long been felt as a painful deep-seated tumour.

2358.—A kidney with a large calculus impacted in the commencement of the ureter. The kidney is much increased in size, and its substance appears indurated, and in parts infiltrated with pus. The pelvis and infundibula are greatly dilated, and their mucous membrane is thickened and made rough by the copious deposit of lymph and pus, or of tubercular matter, upon its surface.

2358a.—The right kidney in a condition of acute inflammation, resulting from the presence of calculi in its substance, and the obstruction of its duct by the impaction of a calculus. The organ is greatly dilated, so that it forms a lobulated cyst; and its parenchyma has undergone diminution until there remains only a thin tough coating of the consistence of leather. In the fresh state the interior

of the cyst was of a bright inflammatory colour, spotted with flakes of pus, and it still appears shaggy from the deposit of lymph upon its inner surface. The calculus blocking up the ureter near its commencement is oval and dark-coloured. Several small dark-coloured calculi of oxalate of lime lay in the infundibula of the kidney. From a woman, aged 31, who suffered long-standing and severe pain of a wearing character in the right side, which she dated from her last confinement, two years previously. She never had any attack of renal colic, hæmaturia or vesical irritability. A swelling below the liver, noticed for six months, gradually increased until it was as large as a foetal head. The urine contained pus. An exploratory puncture into the tumour let out thick greenish pus. Nephrectomy was performed, and the patient made a good recovery.

II. Obstruction may be due to closure of the ureter during its course or at its opening into the bladder. Besides the effect upon the kidneys above described, the ureter itself is dilated above the obstruction and often acutely inflamed.

This may be caused by—

1. Impacted calculus.

2360.—Left kidney of a man aged 26 years. In the ureter, about three inches from the kidney, a dark conical calculus is impacted and adherent to the inner surface of the canal. The ureter above the stone was full of pus, as was also the thickened and dilated pelvis of the kidney. The parenchyma of the organ is atrophied, but its interstitial tissue and capsule are obviously much thickened. The right kidney was greatly enlarged, the capsule rather adherent, and the cortex greatly swollen. The texture was confused, translucent, with a little opacity here and there. The pyramids were pale, feathered out, and indistinct at the bases. The bladder was natural. The left ventricle of the heart was hypertrophied. Small ulcers were present in the mucous membrane of the stomach and duodenum.

2. Stricture of ureter, or of its opening into the bladder.

This is apparently sometimes congenital.

2366.—A kidney, elongated in form, with dilatation of the pelvis and some thinning of the parenchyma. The ureter is irregularly dilated, and opens into the bladder by a pinhole aperture, through

which a probe could be passed when the ureter was straightened out, but not otherwise. From a rickety child aged 8 months.

2363.—A bladder, with the ureters and one kidney, of a boy about 10 years old. The muscular coat of the bladder is hypertrophied, and its mucous membrane is thickened, indurated, and very deeply wrinkled. Just before their terminations in the bladder, both ureters are so contracted that they would only admit the passage of a probe. Above these contractions they are both in the rest of their extent widely dilated. The pelvis and infundibula of the kidney are also dilated, and its glandular substance diminished.

2364.—The kidneys from a girl aged 4 years. The left kidney shows an advanced stage of hydronephrosis; the pelvis is distended and the parenchyma almost destroyed. The pelvis of the right kidney is also dilated, but the parenchyma appears increased in quantity, and is swollen, pale and opaque. The right ureter is dilated to the size of a quill, the left is not dilated. On passing a probe along the ureters in either direction, it was evident that there was a decided constriction at a point half an inch distant from the bladder; the constriction was more marked in the left ureter. When laid open, the right presented nothing definite at the point noted, but in the left the constriction was marked by a very narrow whitish line. The bladder and urethra were quite natural. The liquid taken from the kidneys was of a pale brown colour, sp. gr. 1012, with a faint trace of albumin and flocculent sediment.

It may be a sequel of gonorrhœa, as probably in—

2361a.—The kidneys, ureters and bladder. The kidneys are enlarged and sacculated, and their pelves are dilated. The right ureter, immediately beyond the pelvis of the kidney, presents a very tight and tortuous stricture about an inch in length. The stricture is so tight that it was barely possible to inject water through it. Two inches lower down the ureter is again constricted, but the second stricture is not so narrow, and is annular in form. The left ureter is also constricted in two places, about two inches apart. All the strictures are tough and fibrous, and appear to be of long standing. The bladder is very much hypertrophied. From a man aged 44, upon whom urethrotomy was performed for the relief of an impassable stricture of the urethra.

(The urethral stricture is strong evidence of gonorrhœa.)

It may be due to ulceration caused by a calculus.

In the following cases it is unexplained.

2361, 2362, 2365 (p. 184) which have no history of the cause attached.

3. The ureter may be compressed by an external tumour.

2373a.—Kidneys, bladder and portion of the rectum of a child. The pelvis and calices of the right kidney are dilated, and considerable diminution of the glandular substance has taken place. The left kidney is less altered. The ureters are dilated and pervious. The bladder does not appear thickened. From an infant aged 14 days who had imperforate anus. At the autopsy the sigmoid flexure was found to be much distended. It turned across the sacrum to the right side, and ended in a blind dilated rectum. The bladder contained a drachm of healthy urine. The dilated condition of the kidneys may have been due to the distended and abnormal sigmoid flexure impeding the flow of urine along the ureters.

4. A kink in the course of the ureter may be the only cause.

III. Obstruction may be caused by disease in the bladder. In addition to the effects previously described, the mucous membrane in the bladder is sometimes inflamed, and its muscular walls always hypertrophied.

Inflammation (cystitis) and tumour of the bladder may produce this effect. They belong rather to surgical than to medical pathology.

Retention due to paralysis is an occasional cause of obstruction (*vide* 2338b, *supra*, p. 185).

IV. Or it may be due to closure of the urethra. The effects upon the bladder, ureters, and kidneys are those above described. It is caused—

1. By prostatic enlargement.

2369.—Right kidney, showing dilatation of the pelvis and ureter. The kidney is atrophied, indurated from increase of its interstitial tissue, and it contains cysts. From a man who died in Matthew Ward in May, 1869. He had long suffered from enlarged prostate and difficulty in micturition. Death took place from extravasation

of urine. Several false passages were found at the vesical orifice of the urethra.

2. By stricture.

2368.—The urinary organs, showing the effects of stricture. There is a firm, fibrous stricture in the membranous portion of the urethra. The bladder is slightly dilated and its walls much thickened. The ureters are largely and irregularly dilated. The pelvis and calices of the kidneys are dilated, and the parenchyma of the organs is atrophied. These changes are much more advanced in the left kidney. There are two ureters on the left side, one of which communicates with the upper, the other with the lower half of the pelvis of the kidney, each conducting away the urine from corresponding portions of the organ. They unite at their vesical extremities to form a single duct.

From a boy, aged 15 years, who had long suffered from symptoms of stricture, due to an injury eight years before admission to the hospital. Death took place from suppurative nephritis and acute cystitis.

A curious condition is shown in—

2367.—The bladder and a portion of the ureters, from an old case of stricture of the urethra with a history of two years' duration. The specimen shows the ordinary effects of urinary obstruction, as well as an unusual prolapsed condition of the vesical end of both ureters into the bladder, with extreme hypertrophy and dilatation of the tubes themselves. Their vesical orifices are reduced to pinhole apertures. The prolapsed pouch of the right ureter contains a calculus. On the posterior wall of the bladder a sacculus of mucous membrane is thrust out between the muscular fibres.

The prolapsus of the ureters seems to be due to the disproportion of size between the ureters themselves and their vesical orifices, as if, in the efforts to micturate, the urine, being unable to escape freely from the bladder and distended ureters, the abdominal walls had compressed and borne down the ureters themselves.

3. By phimosis.

2370.—The bladder, ureters and kidneys of a boy 13 years old. The bladder is contracted, its muscular coat hypertrophied, and its mucous coat ulcerated. The ureters are very tortuous, widely

dilated and thickened. The mucous membrane of each is rough, and lymph and pus are in some parts deposited upon it. The pelves and infundibula of both kidneys are also widely dilated, thickened, and rough on their internal surfaces from similar deposits. The kidneys appear enlarged by the dilatation of their pelves and infundibula, but their glandular substance is thinned. The patient had phimosis, and had suffered for four years from incontinence of urine. For three months before death he had severe symptoms like those of stone in the bladder. The operation for phimosis was performed, but he died exhausted.

2370a.—The bladder, ureters and kidneys of a boy aged 17 years. The bladder is enlarged and greatly hypertrophied, and its mucous coat is ulcerated. The ureters are enormously distended and thickened, except at their entrance into the bladder, where they are of the normal size. The pelves and infundibula of the kidneys are widely dilated, thickened and rough from a deposit of lymph upon their inner surface. The glandular substance has entirely disappeared. From a railway porter who had phimosis. The constriction was so considerable that the point of a hairpin could not be passed through it to the meatus urinarius. The patient died three days after he was circumcised. For twelve hours preceding his death he suffered from uræmic convulsions with suppression of urine. Until the operation was performed he was able to do his work.

Hæmorrhage into the pelvis is a rare condition of which little is known.

2389.—The right kidney of a man, aged 25 years, who died of purpura. The section displays a large clot of blood which fills the whole of the pelvis and the calices.

A drawing is preserved, No. **328**.

2389a.—The kidneys of a child into the substance of which considerable hæmorrhage has occurred. The effused blood lies beneath the lining membrane of the pelvis of the kidney. A similar condition was found in the bladder (Series xxix., No. **2405a**; Drawings, Series lvii., **328b**, **330a**). From a child who died of tubercular meningitis.

Tuberculosis.

The kidneys are not uncommonly the seat of primary tuberculosis, the deposits being larger and older in them than in the other organs. It then originates either in the renal substance, or in the pelvic submucous tissue.

If in the former place, the latter is soon involved.

The deposit runs the same course as in other organs. It enlarges, softens, liquefies, and the substance surrounding it ulcerates. Thus by the coalescence of neighbouring spots of softening, abscess cavities are formed in the gland substance, and in the pelvis the mucous surface is extensively ulcerated.

Purulent pyelitis is thus set up, and if the ureter becomes blocked by inflammatory or tubercular swelling the pelvis and the whole organ become distended and pyonephrosis results. Large suppurating tracts are formed in the kidney substance.

The poison is carried by the urine down the pelvis and ureter to the bladder, and involves the surfaces of these.

2339.—A specimen in which there is abundant tubercular deposit on the mucous membrane of the pelvis, and in the cavities of the dilated infundibula.

2341a.—A tuberculous kidney from a child who died of phthisis. The organ is much enlarged and its papillæ partly destroyed. In the gland tissue are many abscess cavities, each lined by a thick white pyogenic membrane, and not communicating with the pelvis of the organ. The ureter is much thickened and dilated; its mucous membrane is almost entirely removed, and on its inner surface are many tubercular ulcers. The mucous membrane of the bladder is the seat of a similar ulceration, which in this situation seems to be of more recent date. In the left kidney there was one large patch of tubercle; otherwise it was of normal size.

2341d.—The bladder and kidneys from a case of tuberculosis of

the urinary tract. The kidneys are greatly enlarged. The right is converted into a series of cavities containing caseous matter, in one of which is a small piece of adherent calculous material. The left kidney is less diseased, but it contains numerous cavities which are filled with caseous matter. The ureters are greatly distended, and their walls are covered with tubercular and caseating material. The bladder is only slightly hypertrophied, but its mucous coat behind the trigone is studded with recent gray tubercles, whilst the rest of its surface is coated with caseous material and ragged shreds of lymph.

The disease is often confined to one kidney.

2340, 2341, 2341b, 2341c, 2342, are similar specimens.

2342a is the same disease, and due to the same bacillus, in an ox.

2343.—Portions of a right ureter on the mucous membrane of which there are several large patches of tubercular matter which have not commenced to break down, and also beneath the mucous membrane small nodules of a similar material can be observed. The right kidney was affected with tubercular disease (the left is not mentioned as involved), the bladder (No. 2412) was ulcerated, and the lungs contained miliary tubercles.

The above specimen shows also the submucous situation of the deposit at first.

Secondary miliary deposits in general tuberculosis are not uncommon.

No specimen.

Syphilis

affects the kidney in two ways—

1. As gumma—rare.

No specimen.

2. By lardaceous degeneration (*q.v.*).

Parasites.

Echinococcus.

2393.—Portions of numerous acephalocyst hydatids which were discharged with the urine.

Bilharzia hæmatobia.

The worm, which is endemic in Africa, is found in the portal system and in the urinary veins. It is about a quarter of an inch in length. The hæmaturia, cystitis, and other symptoms are due to the ova which are discharged with the urine. They are oval bodies $\frac{1}{170}$ inch in length (*i.e.*, more than ten times longer than a leucocyte), with a spine projecting sometimes from one end, sometimes from the side. It is not known how the worm obtains admittance to the human body.

2393b.—The urinary organs from a case of *Bilharzia hæmatobia*. The bladder is contracted, and its mucous membrane is thickened by a number of papillomatous masses, which are found microscopically to contain enormous numbers of *Bilharzia* ova. The ureters are dilated and thickened. Their mucous surface is covered by a slate-coloured membrane, also containing large numbers of ova. The pelves of the kidneys are lined with a similar layer. From an old Arab who came into the hospital at Alexandria suffering from dreadful and continuous pain, and passing almost pure blood mixed with enormous quantities of débris containing the ova of *Bilharzia*. Perineal urethrotomy was performed for the relief of the pain, but the man died a week later from uræmia.

2393c.—From a case of *Bilharzia hæmatobia*. The bladder is small and contracted, and its mucous membrane is raised into numerous soft swellings which contain abundance of *Bilharzia* ova. The ureters are dilated, and their mucous surface is studded with small soft projections, which are also full of ova. The kidneys are in a condition of pyonephrosis, and the mucous membrane of the pelves is covered with little granulations, each containing numberless ova. From a country Arab who was admitted into the hospital at Alexandria. He was passing bloody urine mixed with débris, which swarmed with ova, was in a wretchedly emaciated condition, and was suffering agony. By examination above the pubes and per rectum the bladder was found to be reduced to a small tumour, and it was very painful on pressure, so that it gave the impression

of cancer. Perineal urethrotomy was performed to relieve the sufferings of the patient, after which he lived for a week or two in perfect ease, dying from chronic uræmic poisoning.

2393d.—Ten specimens of the adult female worm obtained from the portal vein of the preceding case.

SECTION XVI.

DISEASES OF THE BRAIN AND ITS MEMBRANES.

Malformations are of interest rather to anatomists than to physicians, except—

Meningocele, in which from want of union of the skull the membranes project from it and lie beneath the skin. The sac may contain fluid (hydro-meningocele) or brain (encephalocele). The commonest site is at the glabella, between the two halves of the frontal bone; the next commonest is between the two upper centres of the tabular part of the occiput.

No specimen.

Meningeal Hæmorrhage is seen in three situations :

1. Subcranial, due to rupture of one of the arteries, or of one of the sinuses, of the dura mater by external violence.

2446.—A large clot of blood between the dura mater and the lateral part of a skull. The blood was effused from the arteria meningeal media, which was ruptured by external violence.

2446b.—A portion of the calvaria, which has been fractured on the right side in the temporal region. The fracture has led to rupture of the middle meningeal artery. As a result of the rupture a free hæmorrhage has taken place between the dura mater and the skull, and this has formed a large and very dense clot. From a woman, aged 65, who was run over by a van.

2. Subdural.

(a) This may be due to external violence. The blood generally comes from the arachnoid and pia.

2448.—A large clot of blood adhering to the internal surface of the dura mater, which covered the upper part of one of the hemispheres of the cerebrum. The effusion was in consequence of external injury.

(b) It may occur as a chronic disease (**Hæmatoma of the Dura Mater, Hæmorrhagic Pachymeningitis**). Between the dura mater and arachnoid is found a thick mass of what is apparently altered and partly organized blood-clot. It is usually separable into layers, which sometimes are thin and membranous, and which sometimes enclose a cavity containing recent blood or a yellow fluid derived from old clot. Sometimes a single thin membrane is alone present.

2449a.—A portion of a calvaria, showing a blood-cyst in the subdural space. The cyst is situated a little below the right parietal eminence; its walls are thick, and are lined by organized blood-clot. It is evidently of long standing. When the cyst was laid open it contained 6 ozs. of blood-stained fluid. From a man aged 68 years. No history of an injury to the head was obtainable.

It is disputed whether this is a peculiar membranous inflammation very liable to bleed, or a mere result of hæmorrhage from organization of the outer parts of the clot. English opinion is in favour of the latter view, for some cases are distinctly due to injury, and the history of others points to a rapid effusion of blood, for instance—

2449.—Portion of dura mater, exhibiting a newly-formed thin and nearly transparent membrane, closely adhering to its internal surface, and consisting of two layers, which form a large sac containing coagulated blood. The patient was a young man, who had an attack of apoplexy, followed by paralysis of the right side and occasional convulsions, a short time before death.

Most cases, however, are accompanied by no symptoms, and occur in the insane or in drunkards. In them the

hæmatoma seems to result not from a large single hæmorrhage, but from small and repeated bleeding. The earliest stage is that the dura mater, which itself seems healthy, has a few spots of blood sticking to it. In other cases it is splashed with blood. The source of bleeding is supposed to be the arachnoid membrane (Wynne, *Path. Trans.*, vol. xliii. 1).

2450.—The patient had been deranged for three years before his death. He had had no sign of inflammation of the membranes of the brain, but shortly before his death had hemiplegia of the left side. The dura mater has a newly-formed membrane upon its internal surface. The arachnoid beneath this layer of membrane was thickened.

2451.—The patient had suffered for many years with disease of the urinary organs. He died with fever attended by pain in the head and delirium.

2452.—No history.

3. Subarachnoid hæmorrhage occurs in the interstices of and between the pia and arachnoid—in the situation, that is, of the cerebral arteries. (The two membranes are connected together over the convexity of the brain, but in two places below, between the optic commissure and the pons at the base, and between the cerebellum and medulla at the back, are separated by a considerable interval. These are the anterior and posterior basal subarachnoid spaces.)

Hæmorrhage in or between these membranes is due—

1. To disease of the meningeal arteries, either arteritis or large aneurysm.

2. To intra-cerebral hæmorrhage bursting the cortex.

3. To hæmorrhagic diseases.

4. To external violence. One form of this is injury to the foetal head during birth. This gives rise to what is known as infantile meningeal hæmorrhage, which, by its effect on the cortex, is one cause of the disease known as cerebral birth palsy, or **congenital spastic paraplegia**.

2447b.—From a man who had cirrhosis of the liver ; is probably caused by disease of the arteries.

Pachymeningitis (Inflammation of the Dura Mater).

A. External.

Occurs usually in connection with injury or disease (caries or necrosis) of the skull.

2455.—Portions of dura mater and pia mater. Blood and lymph are copiously effused upon the external surface of the dura mater. The pia mater is thickened, opaque, and indurated both in that part which covers the external surface of the brain, and in that which penetrates between the convolutions. These changes were consequent on external injury.

2456.—A portion of dura mater, of which all that part which covered the upper surface of the left hemisphere was thickened. In some situations it is nearly half an inch thick, and its substance throughout is hard and tough, and appears irregularly laminated. From a man who, eleven years before his death, had a violent blow by which it was supposed that his skull was fractured.

2457.—Sloughing of dura mater. About its centre is a considerable portion soft and flocculent, on the surface next the bone. When recent it was of a brownish colour, the discoloration extending through to its arachnoid surface. At two points perforations existed. The petrous bone subjacent was carious, and the tympanum was full of pus. The arachnoid was slightly inflamed. From a case of scarlet fever.

A rare cause is poisonous disease, such as erysipelas, of the scalp spreading inward by the diploic veins.

B. Internal.

a. Simple.

2453 and 2454.—No history.

b. Purulent—very rare.

Usually due to extension either from the outer surface, as in such a case as **2457** (*vide supra*), or from the inner membranes.

Leptomeningitis.

Inflammation of the pia mater and arachnoid, with which the ependyma of the ventricles is usually included. Both the outside and the inside of the brain may be affected. On the outside the chief part of the effusion takes place between the arachnoid and pia mater, both in the basal subarachnoid spaces and over the convexity of the hemispheres where the two layers are attached to each other. In the former parts there is room for a small amount of fluid to collect; in the latter the effusion occupies the lymph spaces round the arteries, and forms yellow streaks by their sides. The membranes are thickened and opaque. The outer surface of the arachnoid is also affected. It looks dull, or may be even covered with pus. The surface of the brain inside the pia mater is also inflamed, and looks redder than natural.

Within the ventricles the inflammation spreads to the ependyma. This looks thick, or even granular, and fluid may collect therein to a large amount. The pressure of the fluid effusion flattens the convolutions, and thins the cortex.

Inflammation may be general, occupying convexity, basal spaces and ventricles, or may be confined to any one or any two of these three parts. The site varies somewhat with the cause.

A. Acute Leptomeningitis (Acute Meningitis, Acute Hydrocephalus) is sometimes purulent, sometimes not.

Purulent meningitis:

1. Is due to disease of neighbouring parts—

(a) Injury, caries, or necrosis of the skull, or erysipelas of the scalp. In these cases communication probably takes place by the emissary veins.

(b) Inflammation in the orbit. This probably spreads along the sheath of the optic nerve.

(c) Abscess of the brain rupturing the cortex.

2. It is due to acute general diseases—

(a) Rarely to the infectious fevers, chiefly small-pox and scarlatina.

(b) Rarely to rheumatism or pneumonia.

(c) Not uncommonly to septicæmia. It is then probably caused by poisonous emboli.

Non-purulent meningitis :

1. Is due to disease of neighbouring parts.

Those instanced as causing purulent may also cause non-purulent meningitis. Abscesses deep in the brain, and tumours of the brain, cause a simple but not a purulent inflammation.

2. Is due to acute general diseases, as given above. It is also caused by—

3. Sunstroke.

4. Tubercle or syphilis (*q.v.*).

A few cases occur here yearly, for which no cause can be found.

Epidemic cerebro-spinal meningitis.—This does not differ from other forms of meningitis in appearance. It tends to become purulent. That it involves the spinal membrane does not distinguish it, for any of the above varieties may do the same. Its epidemic character alone separates it from these.

Acute meningitis limited to the base is nearly always tubercular (*vide* Tubercle, *infra*, p. 223). A non-tubercular form sometimes, though rarely, occurs.

Acute meningitis limited to the ventricles (acute internal hydrocephalus) is rare, and is nearly always a disease of childhood.

2513.—A case of ventricular effusion of eleven weeks' duration in a woman of 27, who had been confined six months previously. The lining membrane of the ventricles (ependyma) was thickened and

opaque, and the cavities contained a slightly turbid serous fluid. There was also a local meningitis at the posterior basal subarachnoid space.

Some rare cases of ventricular effusion occur spontaneously, and show little sign of inflammation.

B. Chronic Leptomeningitis may occur inside or outside the brain.

Outside the brain the membranes on the surface are thick and opaque, there are white lines of lymph along the vessels, and there may be some slight amount of fluid in the subdural space or in the subarachnoid spaces. The pia mater is unusually adherent to the brain, the ingoing trabeculae being thickened. The ependyma shares in the process and becomes thick, but there is hardly any increase of fluid in the ventricles.

This form occurs in mental disease, especially in general paralysis of the insane, and in chronic alcoholism.

A brain from a general paralytic showed these changes when fresh, but they cannot be traced in preserved specimens.

There occurs, chiefly in early childhood, a chronic leptomeningitis limited to the posterior basal subarachnoid space and the parts about the medulla oblongata. It is associated especially with retraction of the head. It is due certainly in many cases to syphilis (*vide infra*, p. 225), and perhaps to other causes as yet unknown.

Inside the brain: **Chronic Internal Hydrocephalus, Dropsy of the Ventricles.**

There is great, sometimes enormous, increase of the ventricular fluid. The ventricles, or some of them, or parts of them, are dilated. The surrounding brain is stretched, the convolutions flattened, and the cortex thinned. The ependyma, which is the source of the fluid, may in old cases look soft and rough like wash-leather.

This occurs as a primary disease in early infancy. Then the skull, which is not yet united, is forced open, the bones

of the vault separated, and the bones of the base, especially the orbital plates, depressed. Very rarely a similar disease occurs in later life, but in that case the skull resists pressure.

For the effect on the skull see 2519, 2521, 2521a, case D.

For the effect on the brain see 2515, 2516 (from a child 15 months old).

2514.—Part of the brain of a man 28 years old, who had hydrocephalus in his infancy, and whose head was enlarged and somewhat deformed in consequence of that disease. The whole of the internal surface of the ventricles is finely granulated, and appeared to be indurated. The mind of the patient appeared in no degree affected by this disease; he was a very skilful furniture-painter, and died of a disease independent of the state of his brain.

2517, 2518, show rupture of the septum lucidum from the dilatation.

Cases of ventricular effusion in later life are almost always secondary, and are caused by tubercular or malignant tumours of the brain, and by abscesses. The method by which these causes act is not certain. Some ascribe it to irritation and slight inflammation of the ependyma, others to pressure on the bloodvessels of the brain and on the lymphatic sheaths which surround them.

2499c, from a case of sarcoma, and **2502,** from a case of carcinoma, illustrate this form of dilatation.

Tumours of the Membranes.

1. Bony growths.

Nos. 2459, 2459a, 2460, 2461, 2462, 2463, 2464.

2. Fibrous tumours.

Nos. 2465, 2465a, 2466.

3. Sarcoma.

Fibro-sarcoma, 2466a; psammoma, 2466b; round-celled sarcoma, 2468a.

4. Carcinoma.

No. 2468.

For tubercular and syphilitic deposits see *infra*.

No. 2466c is a rare case of angioma.

Inflammation of the Brain (Cerebritis, Encephalitis, one form of Red Softening).

A. Acute.—The brain is red, soft, and swollen. Is only known as a secondary affection, and is due to—

1. Injury.

2. Disease of neighbouring parts, meningitis, disease of the skull, necrosis of neighbouring parts of the brain, as in vascular obstruction.

3. Infective diseases—the acute fevers and septicæmia. In this case the cerebritis is insular, and is probably caused by poisonous organisms carried thither by the blood.

B. Chronic (Sclerosis of the Cortex).—The cortex is hard and the membranes adherent; the fibrous tissue is increased both between the nerve fibres and around the vessels; the ganglion cells are few and small.

This occurs in general paralysis of the insane.

2511b.—The brain of a woman, aged 37, who died from general paralysis. The lateral ventricles are dilated, the pia mater is thickened, and the convolutions are shrunken. There are small cysts on the choroid plexus. The perivascular spaces are dilated and are seen in the cut surface as minute orifices, not larger than those caused by the point of a fine needle.

These changes are not shown in preserved specimens.

Anæmia, Hyperæmia, and Congestion of the brain are states which are not represented in the Museum.

Hæmorrhage in the Brain occurs—

1. Very rarely in general hæmorrhagic disorders, purpura, scurvy, hæmophilia, etc. It is not known where the blood escapes.

2. From local disease (or occasionally injury) of blood-vessels. These are nearly always arteries. Hæmorrhage in young children, when brought on by convulsions or

violent cough, as in whooping-cough, is ascribed to rupture of veins. (Apoplexy means rapid loss of consciousness. It is usually due to hæmorrhage, or to occlusion of an artery.)

The diseases of cerebral arteries are as follows :

1. Simple endo-arteritis, with its later stages, atheroma and calcification. These two last occur only in the larger arteries outside the brain. The first stage alone invades the small arteries which enter the brain, and these are, in the great majority of cases, the site of hæmorrhage. They are infiltrated and softened, then bulge under pressure, forming minute or "miliary" aneurysms. This condition may cause occlusion of the vessel or rupture. Occlusion takes place by thrombosis ; rupture occurs either at an aneurysm or at a softened but not aneurysmal part of the artery.

This is generally a senile change.

2. Syphilitic endo-arteritis. This, like the preceding, causes both occlusion by thrombosis and aneurysm. It affects the small arteries inside the brain itself as well as the large arteries in the meninges, but though it undoubtedly gives rise to large solitary aneurysm of the arteries at the base, it has not yet been proved to cause the multiple miliary aneurysms within the brain substance.

3. Infective endo-arteritis caused by a poisonous embolus (*vide infra*).

4. Embolism. The plug may be poisonous or simple.

A simple embolus is derived nearly always from a diseased valve on the left side of the heart, possibly from a thrombus in a pulmonary vein, or from some diseased arteries between the heart and the embolus which have become thrombosed.

A poisonous embolus is nearly always derived from a heart affected by "ulcerative" or "infective" endocarditis. It might possibly come from a pyæmic focus in the lung which had opened into a vein.

A simple embolus usually has only the effect of depriving

that part of the brain of blood (compare Softening, p. 219). Sometimes an embolus also irritates and inflames the artery wall, which then yields and forms an aneurysm. These have only been recognised as occurring in the larger arteries while still in the meninges. Probably when this occurs the embolus has been of a septic character.

5. Aneurysms; which are of two kinds,—

(a) Minute or “miliary” on the small arteries inside the brain, due to simple endo-arteritis. These when ruptured cause cerebral hæmorrhage. They are generally multiple.

No specimen.

(b) Large, on the larger arteries outside the brain, usually due to syphilitic or to infective endo-arteritis. These when ruptured cause meningeal hæmorrhage. They are generally solitary.

2471.—An aneurysm of the anterior communicating artery. The aneurysm, about the size of a hemp-seed, had ruptured, and blood was poured out into the pia mater of the brain and spinal cord. The left ventricle of the heart was much hypertrophied, the left kidney much atrophied, the cause of atrophy being not apparent. No thrombi were discovered anywhere. No atheroma of aorta or of meningeal arteries. From a man aged 20 years.

2472.—From a man aged 45 years. Upon the basilar artery was an aneurysm the size of a grain of wheat, which had burst. The blood had broken through the lamina cinerea into the ventricles. The pia mater from the optic chiasma down to the cauda equina was full of blood. The arteries at the base of the brain were rigid, the heart natural.

6. Thrombosis, due to—

(a) General conditions causing change in the blood, child-birth, gout, acute or wasting disease, etc.

(b) Endo-arteritis—simple, syphilitic, or infective.

The only known disease of cerebral sinuses and veins is thrombosis, which may be—

(a) Primary, from the general conditions which cause in

other cases arterial thrombosis, aided by the fact that the walls of the sinus are not contractile.

(b) Secondary, from disease of neighbouring parts, caries or necrosis of skull-bones, meningitis, suppurating diseases outside the skull, etc., causing inflammation of the inner wall of the sinus.

Diseases of the cerebral arteries lead either to rupture or occlusion. The first causes hæmorrhage. The second causes necrosis or softening. Hæmorrhage is—

1. Meningeal, which is almost always due to the rupture of a solitary aneurysm. The blood is effused over the surface of the brain, and kills by compression. The commonest site is the base of the brain. The age is often below forty years.

For specimens *vide supra*, p. 217.

2. Cerebral, which is almost always due to the rupture of a vessel affected by miliary or multiple aneurysm. The blood

(a) Destroys the brain substance (as in 2473, 2475) and often ruptures into the ventricles.

(b) By its pressure flattens the more distant parts.

(c) If life continue, the clot shrinks, fades (as in 2474, 2476) and liquefies. The surrounding parts inflame, and form a wall round the clot. Ultimately a cyst, filled with yellow fluid, is left, and a deposit of hæmatoidin crystals may be found in the surrounding tissue.

The commonest site is outside the corpus striatum, from the perforating branches of the middle cerebral artery.

The age is usually above forty, and liability increases with increasing years.

2479.—Portions of cerebrum, in the substance of which are the two parts of a cavity which contained a serous fluid, and which was probably formed by the complete removal of an apoplectic effusion, such as is shown in earlier stages in the preceding specimens. The

form of the cavity is irregular, but its interior is smooth, and the adjacent surface of the brain appears healthy. The patient was 40 years old, and had an apoplectic attack about four months before his death.

2480.—A similar specimen.

Softening of the Brain

(it must be remembered that the term is used by laymen as a synonym for dementia) occurs—

1. In acute inflammation (*q.v.*). It is then due to inflammatory œdema, and is red in colour.

2. As the result of occlusion of an artery. It is then due to infarction. This is much the commonest form. It may be red or white, according as the blood from neighbouring areas has overflowed it or not. It is usually red in the cortex, because anastomosis is free between the arteries in the pia mater, and white in the white matter because anastomosis is there scantier. Yellow softening is merely a later stage of red.

3. As the result of occlusion of a vein or sinus, in which case it is due to venous engorgement, and is deep red or purple (**Mulberry Softening**).

Softening is commonest in the cortex, because the middle cerebral is the artery most often plugged. It is not confined to any age, since its chief cause, heart disease, appears early in life.

The results of softening from occlusion of vessels is either—

1. Sclerosis, or increase of connective tissue with disappearance of the nerve elements ; or,
2. Liquefaction, with formation of a cyst.

No specimen.

Abscess of the Brain

is most common in males ; is most common between ten and thirty years of age ; is most common in the cerebrum.

1. It may be due to injury.

2. Its most common cause is disease of neighbouring parts: caries or necrosis of the skull, especially about the ear, suppuration in the orbit, disease of the scalp, etc. The communication between the diseased bone and the abscess may be direct, or they may be separated by healthy brain tissue. In the latter case the channel of infection is probably either the veins or the perivascular lymph sheaths.

2486.—Portion of cerebrum, in the left hemisphere of which there is a cavity an inch and a half in diameter, which contained pus. The cavity is situated immediately over the fissura Sylvii; its walls are distinct, thin, smooth on both surfaces, and easily separable from the surrounding substance of the brain. The patient had purulent discharge from the left ear for five weeks before his death. He died suddenly. The petrous portion of the temporal bone, over which the abscess was situated, was extensively diseased. The portion of brain between the abscess and the bone was dark and sloughy.

2486a.—The left cerebral hemisphere, showing an abscess in the temporo-sphenoidal lobe, which resulted from the extension of an inflammation into the brain substance. The inflammation originated from necrosis of the mastoid cells. M., aged 5, admitted with a mastoid abscess, from which offensive pus was evacuated, one month before death. At the autopsy no diffused meningitis was found, but there was a localized patch of inflammation of the meninges corresponding with the diseased bone.

2486c.—The anterior halves of the lateral hemispheres of a brain. Beneath the left frontal convolutions the substance of the brain has been excavated by a large abscess, a part of the wall of which has been removed to show the cavity thus formed. This tracked backwards toward the lateral ventricle, and the two spaces now communicate, the thin separation between them having been broken since the brain was removed. There is also marked bulging of the left frontal convolution on the inner aspect of the hemisphere, accompanied by a corresponding depression on the right side. The patient was a man aged 25, who was admitted into the hospital suffering from erysipelas of the left side of the forehead. The

inflammation spread to the frontal bones, and thence to the frontal sinuses, causing a localized necrosis of the orbital plates (see 2486d), and spreading through the former to the dura mater and the brain, with the formation of the abscess described.

2487.—Portion of cerebrum, exhibiting an abscess in the upper part of one of its hemispheres, with the dura mater which covered it. The abscess communicates with the lateral ventricle by the aperture through which a bristle is passed. The internal surface of the abscess is rough, and that of the ventricle is lined by lymph. Lymph is deposited upon the dura mater, and there is an ulcerated aperture in it which communicated with the cavity of the abscess, and through which a bristle is passed. The patient, a child 4 years old, had an extensive scalp-wound of the right side, followed by suppuration, sloughing, and exposure of the cranium. It died a month after the injury.

2487b.—The cerebellum, showing the site of a localized abscess in the left lobe, resulting from a fracture which extended transversely through the external auditory meatus and tympanum, as well as through the petrous and mastoid portions of the temporal bone. Pus was also diffused through the temporal bone, and the internal auditory meatus, with the seventh pair of nerves, was implicated in the suppuration. The membrana tympani was entirely destroyed. From a man aged 43, who fell off a mail-cart on to his head, sustaining a fracture of the base of his skull. Three days after the accident the discharge from his ear became purulent and subsequently foetid, and the patient died a fortnight later.

3. It may be caused by a distant disease, suppuration (*e.g.*, empyema), pyæmia, etc. Some cases have been due to *oidium albicans*, the fungus having been actually found growing in the abscess.

It is generally single. It tends to enlarge, or burst either into the ventricles, causing purulent ependymitis, as in 2487, or through the cortex, causing purulent meningitis. It may, however, become encapsuled, and remain stationary.

Tumours of the Brain

are most commonly tubercular or syphilitic (*q.v.*) ; they are most common in males ; they are most common in the cerebrum ; next in the cerebellum.

Sarcoma.—Glioma, proliferation of tissue resembling the healthy neuroglia, is the most common form. It is distinguished from all other malignant growths in that it infiltrates the brain tissue. Other sarcomata do not infiltrate, but press aside the tissue in which they are growing.

All forms are usually single.

2497.—Glioma of the optic commissure and nerves.

2497a.—Glioma of the middle lobe of the cerebellum.

Other sarcomata are shown in Nos. 2499 (secondary to tumour of testis).

2499a, 2499b, 2499c, 2499d, 2500, 2501, 2501a.

Psammoma is a sarcomatous tumour containing calcareous particles. It grows only in the brain and meninges, and usually from the pineal body or the choroid plexus.

2501b.—A psammoma from the pons.

Carcinoma of the brain is rare. It, too, compresses, but does not infiltrate.

See Nos. 2502, 2502a, 2502b.

Except in No. 2499, all these growths appear to have been primary.

The descriptions of these specimens are of clinical rather than of pathological interest.

Cysts, when in the brain substance, are usually due to old hæmorrhages.

Simple serous cysts sometimes occur in the choroid plexuses.

No. 2511, 2511a, 2512.

Parasites.

Nos. 2507 and 2508. A hydatid, and the cavity which contained it.

Cysticercus cellulosæ is also found, usually in the meninges, but both these parasites are very rare.

Tuberculosis of the Membranes of the Brain

is nearly always of the miliary form, and is then due to infection from some old focus elsewhere. It usually begins in the anterior basal subarachnoid space. It may spread over the meninges on the surface down the spinal cord, and on the ependyma of the ventricles. It is often visible on the surface of the dura mater both in the skull and in the spine. The tubercles are seen as minute whitish specks. Flocculent lymph collects in the subarachnoid space, and a thinner fluid within the ventricles.

No specimen.

Sometimes a large tubercular mass is found on the membranes.

2458.—Portion of a parietal bone, showing a papillated growth about the size of a shilling, springing from the inner surface of the dura mater. The opposite surface of the brain was infiltrated with tubercles. The growth consisted of tubercle, containing well-marked giant cells. From a child, aged 3 years, who died with general tuberculosis; the brain, with the exception of the portion described, was not affected. A portion of the intestine is preserved in Series xviii., No. 2008.

2491.—A cerebellum, on the upper surface of which an irregularly oval mass, rather more than an inch in diameter, is deeply imbedded. The mass was connected with the inferior surface of the tentorium cerebelli, and has been in part detached from the cerebellum, to which it was very loosely attached; it presents a few scattered points of softening. From a lad, 18 years old, who had severe pain in the head, together with strabismus and impairment of speech. The first two symptoms subsided during the rapid

development of tubercular disease in the lungs and small intestines.

Tuberculosis of the Brain Tissue

is very rarely miliary. (Probably, however, this was the form of infection described in the last specimen.) On the other hand, massive tubercle is the commonest form of tumour either in the cerebrum or cerebellum. It occurs in the brain substance, generally unconnected with the membranes, and forms roundish masses, not infiltrating, but separate in the nervous tissue, caseating in the centre. They run a chronic course, but may give rise to miliary tuberculosis in the membranes, or elsewhere in the body.

2488, 2489.—In these cases there was also tuberculosis of kidneys and penis.

2490.—From a case of phthisis, aged 20.

2492.—The tumour consisted of tubercular material, in parts reticular, and containing giant cells with processes continuous with the reticulum; in others cellular, and again, in other parts, the elements were almost indistinguishable owing to caseous degeneration. From a child aged 2 years. She had a strumous finger. Miliary tubercles were found in the lungs but not in the brain or other organs. The bronchial glands were caseous. See No. 2281, Series xxiv.

2492a, 2493, 2494. 2502c.—From a boy, aged 13, who had strumous disease of the distal end of the metacarpal bone of the left thumb.

Tuberculosis of the Membranes of the Cord

is miliary, and is common with tubercular meningitis of the brain. It gives rise to hardly any symptoms.

Tuberculosis of the Spinal Cord

itself is very rare. Tubercle is, however, sometimes deposited in the tissues surrounding the dura mater.

2535.—Part of the dorsal portion of a spinal cord, with a thick, irregular layer of lymph and tubercular matter surrounding the

dura mater, and slightly compressing the cord. Both the cord and the dura mater appear healthy in their texture. Tubercular matter was deposited in and upon the adjacent vertebræ.

Syphilis.

This affects the central nervous system in many ways.

1. It produces gelatinous-looking gummata of the dura mater. The skull may be ulcerated over them.

2456a.—The dura mater covering the upper part of the brain. The under surface of the right side is much thickened by numerous flat nodulated growths, some of which are attached by a thin pedicle only. They are probably due to syphilitic inflammation of the dura mater. A large mass, which was more loosely connected than the rest, and became detached during the removal of the cranium, is hung above the specimen already described. It also occurred on the right side.

2457a.—Portion of a dura mater taken from the same case as the skull-cap, No. 322a, Series i. Roundish gummatous deposits, about the diameter of a pea, are situated upon the dura mater, along the course of the superior longitudinal sinus. They correspond in position to patches of increased vascularity in the inner table of the skull-cap.

2. It occasionally causes acute cerebral meningitis.

No specimen.

3. It also gives rise to chronic cerebral meningitis, which occurs especially in children, and usually in the posterior basal subarachnoid space (whereas tubercle occurs in the anterior, and is acute). The membranes there become thickened at first by lymph, later, if life continue, by fibrous tissue. The cerebellum is glued to the medulla, and the nerve-roots rising from this and from the pons are involved.

No specimen. (*Vide* Gee and Barlow, *St. B. H. Reports*, vol. xiv.)

4. Gummatous tumours in both brain and spinal cord also occur. In the former case the gumma is usually connected with and grows inwards from the pia mater. They are rare in the cerebellum, the commonest site of tubercular tumours ;

their surface tends to be more irregular, and the section to show more irregular caseation than tubercle. These, however, are uncertain distinctions; the only satisfactory evidence of their nature is the history of syphilis and the existence of gummata elsewhere. These gummata are very rarely seen postmortem, probably because they are cured.

5. It not infrequently precedes myelitis, either—

(a) Acute, which is then usually focal, and sometimes disseminated both in cord and brain, looking very like disseminated sclerosis.

No specimen.

(b) Chronic, especially sclerosis of the posterior columns. Syphilis is a very frequent antecedent of locomotor ataxia.

No specimen.

6. It is a common cause of endo-arteritis of the cerebral arteries, causing either occlusion or aneurysm. Frenchmen have lately described a similar disease in the arteries of the spinal cord. They regard it as a frequent cause of acute myelitis.

SECTION XVII.

DISEASES OF THE SPINAL CORD AND ITS MEMBRANES.

Inflammation of the Dura Mater (Pachymeningitis).

I. THE external form begins outside, and usually involves the outer surface only. It is due to disease of neighbouring parts.

1. It may be acute, usually purulent, caused by abscess or bed-sores spreading.

Or 2. Chronic, caused by caries.

II. The internal form may be

1. Acute, occurring with acute leptomeningitis.

2. Chronic, most common in the cervical region. The membrane thickens, usually involves the arachnoid and pia, and sometimes causes sclerosis of the cord.

This is due to—

(1) Injury or exposure.

(2) Syphilis.

(3) Alcoholism.

(4) Extension from neighbouring inflammation.

2531a.—A spinal cord exhibiting in the dorsal region (about the middle of the preparation) that condition of the membranes known as pachymeningitis. The membranes are fused to form a tough white, leathery mass about a fifth of an inch in thickness. This thickening involves rather more than one-third of the circumference

of the sheath, and is closely adherent to the cord along the posterior half of its circumference. The cord at this point is much flattened out, twisted and distorted.

Inflammation of the Pia-arachnoid (Leptomeningitis).

1. Acute ; often purulent.

It may be due to—

- (1) Injury or exposure.
- (2) Acute fevers.
- (3) Tuberculosis (*q.v.*).
- (4) Epidemic or simple cerebro-spinal meningitis.
- (5) Extensions from neighbouring parts.

2532.—A spinal cord and its membranes from a case of rapidly progressive spinal meningitis. Thick greenish lymph extends from the cauda equina to the cervical enlargement. It lies between the pia mater and arachnoid. The cord itself appeared softened, but not otherwise altered. The inflammation is thought to have extended from an abscess (from which the patient had suffered for many months), along the sacral or lumbar nerves, through the intervertebral foramina, and so along the cord.

See also **2543**, p. 230, in which it is secondary to myelitis.

2. Chronic.

Due to the same causes, and usually occurring with chronic pachymeningitis.

In all cases of meningitis the nerve-roots may be irritated and compressed. It is this which causes most of the symptoms.

Meningeal Hæmorrhage—

1. Is most often due to injury, fracture of spine, or concussion.

2. Is occasionally found after convulsions.

3. Occurs rarely in hæmorrhagic diseases, and in the hæmorrhagic forms of acute fevers.

4. Is sometimes due to intra-cranial hæmorrhage, the blood forcing its way downwards.

It occurs sometimes in newly-born children, probably from injury during birth.

It differs from intra-cranial hæmorrhage in the fact that it does not appear to depend upon vascular disease.

2531.—Hæmorrhage into the arachnoid and pia mater. The patient, an elderly woman, had also a recent attack of hæmorrhage in the cerebral meninges. (It is not stated whether, as seems probable, there was a connection between the two.)

Anæmia and Hyperæmia of the cord are not represented in the Museum.

Hæmorrhage into the Spinal Cord (Hæmatomyelia)

is extremely rare as a primary disease except as the result of injury. Most cases that have been reported as spontaneous are now thought to have been cases of acute inflammation, in which secondary hæmorrhage is not uncommon.

2546.—Section of the cervical portion of a spinal cord. Its exterior appears unchanged, but in its interior there is an extravasation of blood, with laceration of its gray substance.

This injury was produced by a forcible bending forwards of the head. One of the lower cervical vertebræ was fractured and displaced.

2547.—Portion of a spinal cord, from a case of dislocation and fracture of the spine. The substance of the cord, in two inches of its length and in its whole thickness, is softened, and mixed with blood effused from its vessels. The altered portion of the cord was situated opposite to the injured vertebræ.

2548.—Portion of a spinal cord laid open by an incision to show crushing, with extravasation of blood into its substance produced by a fracture of the fifth cervical vertebra.

From a man who was thrown out of a cart backwards on to his head, and was admitted to the hospital with a fracture of the upper part of the spine. He died a few hours after the injury.—See *Kenton Ward Book*, vol. vi., p. 295.

Vide Nos. 1146 and 1160 in Series v.

The following, which is catalogued as "softening," was probably a similar case, in which the effused blood had been partially absorbed :

2549.—The lower extremity of the spinal cord of a man, aged 65 years, who fell from a height of twelve feet, striking his loins, twenty-four days before death. The injury was followed immediately by paralysis of the sphincter ani, and anæsthesia of the surrounding skin. After an interval of seventeen days there was partial loss of sensation of the lower extremities. The nerves of the cauda equina show no damage, but a portion of the cord, half an inch from the commencement of the filum terminale, and about one-third of an inch in length, was, through its whole thickness, soft, almost diffuent, and of a brownish-yellow colour. Above and below this part the cord was healthy.

Vide No. 1157 in Series v.

Inflammation of the Spinal Cord (Myelitis).

I. Acute Myelitis.

The cord is soft, even to fluidity ; the cells and fibres are either swollen and indistinct, or have died and broken down. The vessels are dilated, the perivascular sheath infiltrated, and there is often hæmorrhage.

(a) The inflammation may occupy all systems of the cord indifferently. Then it will either be spread across the whole cord (**Transverse Myelitis**), or be restricted to a small part (**Focal**), or occur in several small spots at once (**Disseminated**).

2543.—Lower half of a spinal cord the whole substance of which is softened. It is surrounded by a layer of lymph deposited in the tissue of the pia mater. This layer is in parts nearly a quarter of an inch thick ; the lymph had a greenish, gelatinous aspect, but is now pale, contracted and wrinkled. At one part the cord is crossed by a narrow band of firm yellow substance, and its whole natural structure seems here to be destroyed. The patient was 12 years old. Nearly six months before death he began to have signs of paralysis of the lower extremities ; and these in the following five weeks almost imperceptibly increased till he had complete loss of sensation

and motion in the parts below the umbilicus with retention of urine and incontinence of fæces. After this time signs of acute inflammation of the membranes, of the spinal cord, and of the base of the brain ensued. The cause is apparently unknown.

These forms of myelitis are due to—

- (1) Exposure.
- (2) Injury, including over-exertion and compression.
- (3) Disease of neighbouring parts.
- (4) Acute fevers.
- (5) Syphilis.

2544.—Part of a spinal cord from the dorsal region. A portion of it, about half an inch in length, is soft, and reduced to less than half its natural size. From a case of paraplegia, with angular curvature of the spine, in a lad 18 years old. The spine is No. **1098** in Series v.

2545.—Spinal cord from the level of the seventh cervical to that of the third dorsal vertebra. Medullary cancer involving the muscles of the back made its way through the arches of the second dorsal behind the transverse process on the left side, and compressed the cord.

See also **2540, 2541.**

In the lower animals the division of the cord may be repaired, and it has been inferred from some cases of compression that man has some similar power of repair.

2550.—Part of the spine and spinal cord of a pigeon. The spinal cord was divided transversely, just above the level of the ossa innominata, two months before death. Complete paraplegia was produced by the division of the cord, but in the succeeding two months the healing was nearly completed, and the pigeon regained the power of standing and walking slowly. The division was made by Dr. Brown-Séquard.

(b) The inflammation may very rarely occupy the central gray matter only (**Central Myelitis**).

(c) The inflammation is very commonly confined to the

anterior cornua, and then causes granulation and shrinking of the ganglion-cells therein (**Cornual Myelitis, Anterior Poliomyelitis**). This is common in young children. Occasionally it is due to exposure or injury, but usually the cause is unknown.

II. Chronic Myelitis. The connective tissue increases, the cells and fibres swell, then shrink, then disappear. Like the acute it may be—

(a) Transverse, focal, or disseminated. This is either a sequel of acute myelitis, or is chronic from the beginning. Its causes are those of acute myelitis. Alcoholism also produces it.

(b) Cornual (**Chronic Anterior Poliomyelitis**, one form of **Progressive Muscular Atrophy**). This occurs chiefly in adults. There are two forms—the subacute, which usually improves, and the chronic, which does not. Its causes are for the most part unknown. It is occasionally ascribed to exposure or injury.

Degenerations of Nerve Fibres and Cells in the Brain, Spinal Cord, and Nerves.

The changes are the same as in inflammation: Increase of the nuclei of the nerve sheath, swelling and breaking up of the myelin, withering of the axis-cylinder in the nerve fibres, cloudy swelling and then shrinking of the ganglion-cells, increase of the interstitial fibrous tissue.

Primary degeneration occurs—

(a) In the posterior roots and posterior columns (**Tabes Dorsalis, Locomotor Ataxia**).

(b) In the lateral pyramidal tracts (**Primary Lateral Sclerosis**).

(c) **Chronic Cornual Myelitis** is sometimes reckoned as a degeneration rather than inflammation.

Secondary degeneration occurs—

(a) In the motor tract. The motor tract is divided into

two segments, the first from the cortex of the brain to the ganglion-cell in the anterior cornu of the cord; the second from this ganglion-cell to the nerve-ending in the muscle. The cortical ganglion-cell is the trophic centre for the upper segment, the cornual ganglion-cell for the lower. Degeneration takes place when a nerve fibre in either segment is, either by injury or by disease, cut off from its trophic centre. It begins just below the interruption, and runs downwards. Thus, after a lesion (*e.g.*, infarction), destroying the cortical arm centre, or (*e.g.*, hæmorrhage) interrupting the motor tract for the arm anywhere above the cervical enlargement, the fibres will degenerate in the anterior and lateral pyramidal tracts down to the enlargement. The cornual cell and the peripheral nerves will remain healthy. After a lesion (*e.g.*, acute cornual myelitis) which destroys the cornual cells, or (*e.g.*, a cut) which interrupts the motor tract below this, the fibres will degenerate below the lesion, while the upper segment will remain healthy.

2550b.—Section of a cord and pons, hardened in bichromate of potassium, from a case in which the posterior two-thirds of the right internal capsule were softened. The sections of the cord are viewed from above, those of the pons and medulla from below. Gray matter and degenerate areas are light-coloured, normal white matter is dark. The motor tract is seen degenerate in the right half of the pons, the right anterior pyramid of the medulla, in the right direct or anterior tract, and the left crossed or lateral tract of the cord.

(*b*) In the sensory tract. The cells of the ganglion on the posterior root are the only trophic centres for the whole tract. Destruction of or separation from these causes degeneration in the upper segment when the lesion is above the ganglion, and in the peripheral nerve when below this. Above the ganglion degeneration spreads upwards in definite tracts. Thus, section of a posterior nerve-root, or myelitis,

will cause degeneration (*a*) for a short way along the postero-lateral columns, (*b*) for the whole distance between the lesion and the medulla, along the postero-median columns, along the antero-lateral ascending tract, and, when the lesion is above the first lumbar nerve-root, along the cerebellar tract. A peripheral sensory nerve when cut degenerates downwards from the lesion.

2550a.—Sections of a spinal cord, hardened in bichromate of potassium, from a boy, aged 18, who had a tumour of the cord which extended from the eighth to the tenth dorsal vertebra. The areas of degeneration and the gray matter are of a lighter colour than the healthy white matter. One section shows the tumour and the softened cord, whilst the other four are made at various levels in the cervical region. The degenerate tracts are the posterior median, the direct cerebellar, and the ascending antero-lateral.

Disseminated Sclerosis (Insular Sclerosis).

There are gray spots, chiefly in the white matter, dotted irregularly up the spinal cord and in the brain. They are not limited to any system of cells or fibres. In these spots the interstitial tissue is increased and the nerve elements shrunken. The disease probably originates in the connective, not in the nervous, tissue, whereas in "system degenerations" it originates in the nerve fibres, and the sclerosis is secondary.

Tumours of the Meninges.

1. Cartilaginous or bone-like plates in the arachnoid are not uncommon.

2536, 2537, 2538.

2. Fibrous tumours.

2539.

3. Sarcoma is commoner than carcinoma.

No specimen.

4. Carcinoma.

2540, 2541.

Tumours of the Cord are chiefly sarcomata and gliomata.

2541a.—The spinal cord from a case of multiple sarcomata affecting the brain and cord. From the lumbar swelling down to the cauda equina a tumour has grown from the cord, implicating the membranes, spreading down the nerves, and slightly eroding the bodies of the vertebræ. It is a round-celled sarcoma.

Syringo-myelia.

The cord contains a cavity reaching for part or the whole of its extent. It is usually in the position of the central canal, sometimes behind it. It is surrounded by gliomatous tissue. The condition is found in children and in adults. It is probably a mal-development, the gliomatous being an embryonic stage of the nervous tissue. In adult cases it is often more than this, the gliomatous tissue having increased to the extent of forming a new growth.

2542.—A portion of a spinal cord, of which the central canal is so extremely dilated that the cord is a mere tube of nerve substances. The dilatation was greatest in the cervical region, and gradually diminished, not extending to the lumbar enlargement. The ventricles of the brain were dilated, and contained a large quantity of clear fluid. The membrane of the cord was normal. From a woman aged 22 years. Symptoms had existed two years.

For Tuberculosis and Syphilis of the Cord and its Membranes, *vide ante*, p. 223 *et seqq.*

SECTION XVIII.

DISEASES OF THE NERVES.

THESE are usually classed together as neuritis. This name probably includes many different diseases, some degenerative, some inflammatory, and of these last some probably begin in the nerve elements and others in the interstitial tissue.

As mentioned above (p. 232), the results seem through the microscope to be the same, multiplication of the nuclei of the sheath, swelling and breaking up of the myelin, and, lastly, disappearance of the axis-cylinder.

Some cases are apparently primary, and form one class of cases of muscular atrophy.

Most cases are secondary, and follow—

1. Injury, exposure (as often sciatica), or neighbouring disease (*e.g.*, inflammation of the left vagus when stretched by aortic aneurysm).
2. Acute fevers, especially diphtheria.
3. Plumbism (**Lead Palsy**) and alcoholism (most cases of **Multiple Neuritis**).
4. Certain specific affections (*e.g.*, leprosy), and the foreign epidemic beri-beri.

Tumours of the Nerves,

often called **Neuromata**, are nearly always fibrous.

2555.—A fibrous tumour of the posterior tibial nerve.

2555a and 2556.—Fibrous tumours of the median nerve.

2557 to 2560a are similar specimens.

They are sometimes multiple, and scattered all over the body.

Both Sarcoma (2561, 2561a) and Carcinoma (2562) occur.

After injury or amputation dividing a nerve, **Bulbous Enlargements** are apt to form on the proximal part.

2563.—The ulnar nerve and adjacent parts from a man who had received a severe wound at the junction of the middle and lower thirds of the fore-arm, fourteen years before death. The nerve had been completely divided. The upper end of the nerve appears little less than its normal size, and under the microscope showed very little atrophy; about three-quarters of an inch above the point of division there is a well-marked bulbous enlargement. The lower end of the nerve is much atrophied; and was found to consist almost entirely of connective tissue, with a few axis-cylinders. The lower end of the nerve is attached to the under surface of the tendon of the flexor carpi ulnaris; its upper end to the upper and inner aspect of the same tendon. The two portions of the nerve are not on the same plane, and much scar-tissue intervened between them. There was complete atrophy of all the muscles of the hand supplied by the ulnar nerve, with contraction of the little and ring fingers. Sensation was, however, perfect in the skin supplied by the nerve.
—See *Harley Ward Book*, vol. iii., p. 46.

2564.—Part of a humerus, with the several nerves of the arm, from a stump. The nerves present bulbous enlargements at their extremities, which are firmly united together, and to the end of the bone, by dense cellular tissue.

2565.—Nerves of a fore-arm, with the bones, from a stump. The extremities of the radial, ulnar, and median nerves form very dense,

bulb-like swellings, two of which are closely, and one more distantly, connected with the cicatrix in the skin.

2566.—The first bone of a middle finger, from a stump. The digital nerves present bulbous enlargements at their extremities, which are firmly united to the bone.

Vide also Series xlix., Nos. **3210** to **3213**.

SECTION XIX.

DISEASES OF THE FEMALE GENITAL ORGANS.

Tumours of the Vulva.

Fibro-cellular Tumours.

It is difficult to draw any sharp distinction between hypertrophic enlargement involving the labia or preputium clitoridis and the formation in the vulva of definite fibrous tumours. Enlargement involving one or other labium is often spoken of as elephantiasis, but the anatomical result is a fibro-cellular mass of varying size. Mechanical irritation and syphilitic infection seem to play an important part in the production of this hypertrophic condition. The skin is thickened and the papillæ hypertrophied. The mass of the tumour is made up of bundles of fibrous tissue, considerable quantities of serous fluid often existing between the bundles. Sometimes muscular tissue forms part of the mass. The tumours grow slowly, and may attain a large size, and usually possess a pedicle. They become larger, and often painful, during menstruation. True elephantiasis, which is an endemic disease occurring in many tropical countries, may affect the vulva. It is comparable to "lymph scrotum" affecting the male, and is probably due to blocking of the lymph channels by *Filaria hæmatobia*.

3020.—A nympha removed from a middle-aged woman. It is enlarged, so as to form a deeply-lobed spheroidal mass with a

wrinkled and warty surface between three and four inches in diameter. A section of it shows that it is composed of a firm, compact and elastic tissue, like skin infiltrated with serous fluid.

3024.—A pendulous tumour which was attached to a labium by a narrow pedicle. The surface is covered by a mass of pedunculated lobules and folds. The tumour is composed of firm fibro-cellular tissue, from which a large amount of serous fluid exuded on section.

3021.—Elephantiasis of nympha excised in Brazil.

Lipomata.

Fatty tumours are rare. They may attain a great size, are often lobulated, and generally grow rapidly. They may form in either the labia majora or minora.

Carcinomata.

Cancer of the vulva almost always appears as a squamous-celled epithelioma, though cases of ordinary spheroidal-celled carcinoma have been observed. Epithelioma may commence in any part of the vulva, and generally appears first as a slightly raised, hard, warty growth, the surface of which soon ulcerates. The disease spreads superficially, involving the various parts of the vulva, and sometimes spreading to the perineum and adjacent parts of the thigh. It is rare for the growth to spread up into the vagina. The inguinal glands become involved.

3034.—The labia pudendi affected with cancer. They are both enlarged and indurated. In the left labium, which is the most diseased, the cancer forms an elevated, circumscribed and superficially ulcerated swelling.

3035.—A labium on the surface of which is an oval, elevated, warty growth of moderately firm texture, and with a finely-granulated surface very similar to the chimney-sweep's cancer of the scrotum.

Sarcomata.

Sarcoma of the vulva is very rare. The disease is seen most frequently in young patients, and is often very

malignant; occasionally it is of the melanotic variety. It forms a rounded mass, the skin covering it being often closely adherent to the tumour.

Lupus.

Whether lupus of the vulva is or is not identical pathologically with lupus of the face is not accurately determined, the term being used in a clinical rather than a pathological sense. It is a disease which is met with during the child-bearing period of life. Two forms are described: (1) *Lupus minimus* and (2) *lupus maximus*.

In the former the disease shows itself as small sensitive red spots of ulceration, about the size of a pin's-head, scattered over the vestibule and along the edges of the hymen. These little ulcers heal and reappear, but have never been observed to pass into the form described as *lupus maximus*, though they probably do so. In *lupus maximus* both ulceration and hypertrophy occur, sometimes one and sometimes the other predominating. The process of ulceration extends superficially or deeply, and the whole ano-perineal region may be eaten away. Stricture of the rectum or urethra may result. No nodules or tubercles are seen as in lupus of the face. On histological examination, young growing fibrous tissue is seen, with collections of leucocytes around the bloodvessels, and this growth of fibrous tissue is diffused, and does not form nodules.

Condylomata.

Condylomata generally occur as the result of gonorrhœal or syphilitic infection. They grow rapidly during pregnancy, and may shrivel up during the puerperal period. They are said sometimes, especially during pregnancy, to develop independently of venereal infection. They form soft, flat pedunculated masses, and grow on all parts of the vulva, often spreading on to the perineum and adjacent parts of the thighs.

Cysts.

Cysts of various kinds are met with in the vulva. Sebaceous cysts and small mucous cysts occur as the result of blocking of the orifice of gland-ducts. The vaginal prolongation of the peritoneum, or canal of Nuck, may be nipped off from the general peritoneal cavity and become distended with fluid. The cyst in this case is situated at the upper and outer part of the mons veneris. The commonest cysts, however, are the cysts of the duct of Bartholin's gland. These ducts are 2 cm. in length, and run obliquely forwards from the glands, and open just outside the hymen, close to its base of attachment, at a point midway between the anterior and posterior margin of the vagina. Obstruction of the orifice leads to distension of the duct with retained secretion, and the formation of a tumour situated in the posterior third of the labium majus. The tumour so formed varies in size from a pigeon's to a hen's egg. It contains brownish mucus. The contents of the distended duct sometimes become purulent. The following is probably a specimen of a distended Bartholin's duct.

3035b.—A cyst of the labium removed by operation. It was situated on the left side, and contained muco-gelatinous material. It had been noticed for three months.

Urethral Caruncle.

The tumour grows from the lower margin of the urethral orifice, is bright-red in colour, and its shape is rounded or flattened from side to side like a cock's comb. The tumour varies in size from a hemp-seed to a pea, but occasionally is larger. The base of attachment is sometimes wide and sometimes narrow. The tumour consists of loose connective tissue with a large number of bloodvessels, and is covered with stratified squamous epithelium. The tumour

is very sensitive, but no nerve fibres have been demonstrated in it.

3036.—A soft spongy tumour which was removed from the margin of the orifice of a woman's urethra.

Tumours of the Vagina.

The vagina is lined by stratified squamous epithelium, and the lining membrane is thrown into numerous folds or ridges which are for the most part transverse. Glands have been described, but most observers have been unable to detect them. Tumours of the vagina are rare, but four varieties deserve mention :

1. *Cysts*.

The mode of origin of cysts of the vagina is not clear, and probably is not in all cases the same. Crypts or depressions of the lining membrane exist, and retention may occur from the blocking of the orifice of such a crypt. It is possible that some cysts may originate from distended lymphatic spaces, and others may originate from distension of the unobliterated ducts of Gärtner. The duct of Gärtner is the name applied to the terminal portion of the Wolffian duct, and is in relation with the lateral and anterior wall of the vagina.

Vaginal cysts vary in size from a hazel-nut to a hen's egg, are generally solitary, and are most common in the lower half of the vagina, growing from either the anterior or posterior wall. The epithelial lining of the cyst usually consists of columnar or cubical epithelium, but sometimes it is squamous and stratified. In other cases no epithelial lining at all is found. The fluid contained in the cyst is generally viscous, transparent or yellowish.

2. *Fibroma*.

Fibrous tumours of the vagina are rare. Muscular fibres are sometimes present as well, in which case the term fibro-

myoma would be more appropriate. They are always solitary, and vary in size from a pea to a foetal head. They may be pedunculated or sessile. The causes which lead to their development are unknown.

3028.—A flask-shaped fibro-cellular tumour pendulous from the right wall of the vagina and right nympha. The patient was 34 years old, and had noticed the disease for three or four years. It began as a tumour projecting into the vagina from beneath its external wall, and in this situation acquired a large size before it protruded externally. It was loosely connected with the surrounding tissues, and was easily removed. There was no return of the disease within two years and a half of the operation.

3029.—A small tumour, having in section a fibrous appearance, removed from the anterior wall of the vagina. Histologically it is composed of fibrous tissue intermixed with a large proportion of organic muscular fibre.

3. *Sarcoma.*

Primary sarcoma of the vagina is a very rare disease. The relative frequency with which the disease occurs in early childhood is noteworthy, but it is met with at all ages. It generally forms a rounded or flattened tumour growing from beneath the vaginal epithelium, but sometimes it forms a polypoidal or papillary mass. It is commoner in the lower than in the upper half of the vagina. The round, spindle-celled or mixed varieties are met with. The disease is very malignant, and grows with great rapidity. The following specimen is probably one of sarcoma.

3030.—A large cluster of polypoid growths removed from the nymphæ and walls of the vagina of a child. The largest growth is of oval shape, and nearly three inches in its chief diameter; the others are various in size and shape. They are grouped without order; the largest is attached to the anterior wall of the vagina and to the nymphæ, and at its upper part is traversed by the urethra; the others are attached to different parts of the vagina. The largest was soft, elastic, and opaque white; the others more like gelatinous polypi of the nose. At birth, a growth "like a

bunch of small grapes " was observed projecting from the vagina. It appeared to be connected with the right wall of the vagina, and was removed when the child was 6 weeks old. It was probably soon reproduced, but the next growth was confined within the vagina, and it did not protrude till the child was 3 years old. Its base was ligatured, and it sloughed away, but a fresh growth quickly took place and increased rapidly. The mass here shown was excised six months after the second operation. Rapid recurrence took place, and destroyed life by exhaustion in about three months.

3033.—The labia and part of the vagina, removed by operation on account of a large mass of melanotic disease, which, arising at the front part of the vagina, encroaches equally upon either labium.

4. *Carcinoma.*

Primary cancer of the vagina generally presents the characters of a squamous-celled epithelioma. Like sarcoma, it is a very rare disease. It is most often met with in women over thirty years of age, but it has been observed in children. It forms a hard raised growth, the surface of which soon ulcerates, spreading superficially. If the lower part of the vagina is involved, the inguinal glands soon become implicated.

SECTION XX.

DISEASES OF THE UTERUS.

Uterine Fibroids.

FIBROIDS are the commonest form of tumour of the uterus. They are essentially a disease of menstrual life, and are most often met with between the ages of thirty and fifty, but of the causes which lead to their development nothing is definitely known. They are composed of unstriated muscle and fibrous tissue in varying proportions, and therefore are more correctly described as fibro-myomata. They grow almost invariably from the body of the uterus. They may be divided into two main classes—(1) hard fibroids, (2) soft fibroids.

Hard Fibroids are much commoner than soft fibroids, and are usually multiple. Their hardness depends on the great excess of fibrous over muscular tissue. On section they show glistening white bands of fibrous tissue arranged more or less concentrically around one or more centres, with islets of muscular tissue in between. These tumours are much less vascular than the surrounding uterine tissue, and are separated from it by a bed of loose connective tissue so that they can frequently be easily shelled out. Large blood channels exist in the uterine tissue in the neighbourhood of the fibroid, and from thence a few bloodvessels pass into

the substance of the fibroid and nourish it. The loose connective-tissue bed is spoken of as the capsule.

2992.—Section of very large fibrous tumour from a uterus. One surface of the section is rough and shreddy from sloughing, the others show the characteristic structure of the fibrous tumour, a grayish dense and tough basis traversed by circling and wavy shining white bands.

2981.—Portion of a uterus with a fibrous tumour imbedded in it. The tumour is composed of a firm dense grayish substance partitioned and variously intersected by white shining bands. It is but loosely connected with the substance of the uterus, and has been partially separated from the uterine wall.

Hard fibroids may further be divided, according to their situation, into (1) interstitial, (2) subperitoneal, and (3) submucous.

All fibroids originate in the substance of the uterus, and therefore are primarily interstitial; but as they grow in the direction of least resistance, they may subsequently become subperitoneal or submucous.

2980.—Section of a uterus with a firm fibroid tumour imbedded in the anterior wall. The vessels of the uterus are minutely injected, but none of the injection appears in the morbid growth.

2987.—A uterus the upper half of which is enlarged by the growth of numerous fibrous tumours in its walls. One tumour, larger than the rest, projects into the dilated upper part of the cavity of the uterus, and completely fills it; five others are shown, by the section, imbedded in the anterior wall, and many others project upon the external surface of the uterus. The lower half of the uterus is healthy, but elongated. The walls of the portion occupied by the tumours are thick and laminated, like the walls of the uterus in pregnancy.

It must be borne in mind that this classification is approximately but not absolutely correct, as certain fibroids may start midway between the peritoneal and mucous surfaces, and as they grow project inwards beneath the mucous surface, and also outwards beneath the peritoneal surface.

Subperitoneal Fibroids may be pediculated or sessile. When pediculated, the peritoneum is closely adherent to the surface of the tumour, and no layer of uterine tissue can be made out between the peritoneum and the tumour. Such a tumour, if it attains a large size, may grow up into the abdomen, dragging the uterus with it, or it may fall down into Douglas's pouch.

The pedicle of a subperitoneal fibroid sometimes, though rarely, becomes twisted, and sometimes it gives way, so that the tumour becomes separated from the uterus, and may either lie free in the peritoneal cavity or may be found attached to other of the abdominal viscera.

2978.—A uterus showing a minute subperitoneal fibroid and a smaller pedunculated fibroid.

Submucous Fibroids project inwards towards the uterine cavity. They are covered not only by the mucous membrane of the uterus, but also by a layer of muscular fibres which they have pushed in front of them. They are at first sessile, but ultimately, by the contractions of the uterus, which they excite, they may be forced further and further towards the cervical canal. As they are thus driven downwards, a stalk is developed, and the mucous membrane covering them becomes thinned, and generally finally disappears. These pediculated tumours can therefore be no longer spoken of as submucous fibroids, but are now called fibrous polypi. In other cases the mucous membrane over the fibroid may ulcerate, and the tumour become loosened from its bed, partly by uterine contractions and partly by suppuration in the capsule. Spontaneous enucleation and expulsion may thus be brought about. During this process the lowest part of the tumour may become gangrenous.

2964.—A uterus in the walls of which many fibrous tumours have grown. One more than an inch in diameter is enclosed in the upper and posterior wall, and projects far into the cavity, covered

with a thin layer of muscular and mucous tissue. Three of small size are situated near the right Fallopian tube just under the peritoneum. Another polypus, probably mucous, is suspended by a narrow pedicle from the anterior wall, just within the internal os. This last, projecting and pendulous beyond the os uteri, is elongated, oval, and apparently softened and changed in texture in consequence of its pedicle having been tied shortly before death.

Soft Fibroids are composed mainly, if not entirely, of muscular fibres. They are generally single, and grow from the fundus of the uterus. They pass insensibly into the uterine tissue. They are redder in colour than the hard fibroids, and often contain large bloodvessels. When cut into, an abundant escape of serum may occur. They grow more quickly than hard fibroids.

2983a.—A section of a large tumour which grew from the uterus. The tumour was a soft and rapidly-growing myoma. It differs from the usual form of large fibroid in not consisting of a number of smaller tumours of similar structure.

Fibroid tumours grow slowly, and do not attain a large size until after many years. After the menopause they gradually shrink and become harder, and may in some cases completely disappear. During pregnancy they grow more quickly than before, but after delivery they undergo involution like the rest of the uterus. This may lead to their becoming smaller than they were before pregnancy began, or to their complete disappearance.

Changes occurring in Fibroid Tumours.

1. **Induration** with atrophy, which occurs after the menopause, has already been mentioned.

2. **Calcification** occurs chiefly in pediculated subperitoneal fibroids or in polypi. Irregular, coral-like masses composed of phosphate and carbonate of lime are scattered through-

out the tumour, and in some rare cases a complete shell is formed around the tumour.

2996.—A uterine fibroid calcified *en coq* and partially enucleated.

2996a.—A uterine fibroid which has undergone calcification upon its outer surface. Its inner portion is degenerated and atrophied.

2997.—A large lobed fibrous tumour which was spontaneously expelled from a uterus. Its texture was softened, and on its surface are numerous thin plates of bone-like substance.

2998.—Portions of substance like very hard bone, in coral-like masses, which were deposited in a fibroid of the uterus.

3. **Gangrene** occurs chiefly in submucous fibroids. It generally follows injury or ulceration of the mucous membrane covering the tumour. Suppuration in the capsule is usually found in association with gangrene.

2992.—Section of a large fibrous tumour of the uterus, one surface of which is rough and shreddy from sloughing.

2991.—The uterus of a woman aged 37. To the anterior portion of the fundus a large pedunculated fibroid is attached. When she was admitted into the hospital the tumour filled the vagina, and presented a sloughing surface. The lower half of it was removed, and the woman died a week afterwards of peritonitis. The uterus itself is very much enlarged.

4. **Cystic Changes** may occur in a fibroid, giving rise to the so-called fibro-cystic tumour. These cyst-like spaces seem to be sometimes due to dilatation of lymphatic vessels, and are therefore lined with endothelium, and the fluid contained in them coagulates when exposed to the air. Collections of serous fluid sometimes occur between the fibrous tissue trabeculæ and form cyst-like cavities independently of enlargement of the lymphatic vessels.

3000a.—Small cystic fibroid of the uterus.

2992a.—Portion of a fibroid of the uterus showing cysts which have developed in its substance. They are lined by a distinct membrane composed of degenerated products. There is no epithelium lining the cyst wall.

5. **Malignant Degeneration.**—In rare cases fibroids appear to undergo sarcomatous changes, and cystic spaces may develop in such tumours. Whether the presence of fibroids ever causes carcinoma of the mucous membrane of the uterus is doubtful.

Changes in Uterus and Appendages.

The presence of fibroids in the uterine wall leads to a larger blood supply, and with this increased vascularity the muscular coats of the uterus become hypertrophied, and the whole uterus increases in size. The mucous membrane also undergoes certain morbid changes, interstitial or glandular endometritis being met with. The former variety is said by Wyder to occur when the fibroids are situated near the mucous membrane, the latter when the fibroids are subperitoneal. Similar inflammatory changes seem sometimes to involve the lining membrane of the tubes, and the muscular walls may become hypertrophied.

2903a.—A much-hypertrophied and elongated right ovary, which contains a small unilocular cyst at its outer extremity. The Fallopian tube is enormously thickened and enlarged, the thickening being chiefly due to an increase in the muscular tissue contained in its wall. The specimen shows the changes in the ovary and Fallopian which are often found in cases where large myo-fibroma of the uterus have existed.

Uterine Polypi.

Under the head of polypi are classified many tumours which have in common the peculiarity of possessing a stalk, but pathologically are widely apart. Four kinds of polypi may be described: (1) Mucous or Glandular, (2) Fibrous, (3) Placental or Fibrinous, and (4) Malignant.

1. *Mucous or Glandular Polypus.*

Mucous polypi nearly always grow from the cervical canal, especially the lower part, but occasionally they

spring from the mucous membrane above the level of the internal os. They originate as a local hypertrophy of the mucous membrane and its glands. They occur as small, soft, red, stalked tumours, generally about as big as a pea, but sometimes attaining the size of a cherry. They are often multiple. The polypus is made up of gland tubes of the racemose type and nucleated interglandular tissue, and is covered with columnar epithelium. Sometimes glands predominate and sometimes interglandular tissue. If the orifices of the glands are blocked, small retention cysts are formed. Sometimes the surface of the polypus is deeply grooved, the grooves probably representing the grooves and ridges normally met with in the cervical canal. Such polypi are called channelled polypi. The columnar epithelium covering the surface occasionally becomes stratified.

2963.—A mucous polypus of the cervix uteri.

2963a.—Portion of the cervix uteri and upper part of vagina. A pedunculated mucous polypus grows from the cervix and projects through the os tincae, downwards into the vagina.

2967a.—A channelled and pedunculated polypus removed from the uterus. The peduncle is solid, but the polypus itself is hollow, and is lined by a smooth membrane. The wall is deficient at one part, and presents a large oval aperture.

2944b.—An anteflexed uterus, from an old woman aged 63. The walls are very thin, and the whole organ much atrophied, though not diminished in length. The posterior surface is the seat of a subperitoneal fibroid as large as half an egg, while attached to the mucous membrane of the fundus uteri, close to the Fallopian tubes, are two small mucous polypi.

2. *Fibrous Polypus.*

Fibrous polypi spring from the body of the uterus and project into the dilated cervical canal, or, having passed through it, hang into the vagina. They probably originate in the substance of the uterus a little way beneath the mucous membrane, and, growing inwards into the cavity

of the uterus, they push before them a layer of muscular tissue as well as the mucous membrane. By the contractions of the uterus the tumour is driven further and further down towards the vagina, the cervix dilating to allow it to pass. The substance of the tumour is similar in appearance and structure to an ordinary uterine fibroid, and it is frequently surrounded by a definite capsule of muscular tissue. The mucous membrane is generally atrophied over the tumour, but may clothe the stalk. The stalk is composed chiefly of muscular fibres continuous with the muscular capsule, and in it are a limited number of blood-vessels. If the tumour attains a great size, the lower part lying near the vaginal orifice may slough. If the stalk of the polypus is broad and attached near the fundus, partial or complete inversion of the body of the uterus may result.

2969.—A uterus with a fibrous polypus. The form of the tumour makes it probable that it is composed of two fibrous tumours, which were developed in the wall of the uterus and protruded into its cavity enveloped by a part of the uterine wall, which now forms the pedicle or neck attaching them to its fundus. The larger portion of the tumour lay in the vagina.

2970.—A uterus having attached to its partially inverted fundus a true fibrous polypus, the body of which is in the vagina. Similar tumours of a smaller size have formed, some near the peritoneal surface, and others in the substance of the uterus. The vessels of the uterus have been injected, and the injection has entered the tumours.

2971.—A large fibrous polypus of the uterus. Its pedicle passes through the cervix.

2973.—A uterus with a very large intra-uterine sessile fibroid attached by a base of nearly two inches in diameter to the fundus and side wall of its cavity, and thence extending into the vagina. Ulceration has taken place on the most dependent part of the polypus. The walls of the uterus are dilated and thickened around it.

3. *Placental or Fibrinous Polypus.*

After labour, but more often after a miscarriage, portions of placenta may be left behind. Such a portion of placenta, if attached over only a small area, may project as a stalked mass into the cervical canal. Its bulk may be increased by deposits of fibrin on its surface, and in this way a placental or fibrinous polypus is produced. A fibrinous polypus may also be formed by deposits of fibrin occurring around retained shreds of decidua or chorion. Fibrinous polypi appear in certain rare cases to occur independently of retained products of conception.

2976d.—A fibrinous polypus of the uterus, three inches in length, which was removed by operation. It consists chiefly of blood-clot, but at one part there is to be seen a collapsed amniotic sac with chorionic villi.

2976a.—A uterus enlarged to more than twice its natural size, and containing a large fibrinous polypus attached to the posterior wall over a surface measuring two and a half inches in length. The lower portion of the polypus lies free in the uterine cavity, and extends through the internal os, at which point it has a well-marked constriction, to within half an inch of the external os. The polypus has been bisected vertically, and its external portion may be seen to be much paler in colour than the more central part, which appears to consist chiefly of recent blood-clot. There is no trace of any foetal or placental structure.

4. *Malignant Polypus.*

Malignant polypi may grow from the cervix or body of the uterus. Those growing from the cervix may be either sarcomata or carcinomata. A carcinomatous polypus may result from malignant changes occurring in a mucous polypus, or the polypoidal mass may be malignant from the first. Malignant polypi growing from the body of the uterus are generally sarcomatous.

2976c.—A large and irregular bilobed mass which hung by so long a pedicle as to project through the vulva of a nulliparous

woman aged 17. Microscopically, the growth is a fibro-sarcoma which is undergoing mucoid degeneration. There are numerous cysts lined with columnar epithelium, and in some parts there are islets of cartilage which are not always well differentiated from the surrounding tissues.

Malignant Diseases of the Uterus.

The uterus may be the seat of several forms of malignant disease. These are: (1) Carcinoma, (2) Sarcoma, and (3) Adenoma.

Carcinoma of the Uterus.

Carcinoma may begin in (1) the squamous epithelium covering the vaginal portion of the cervix; (2) any part of the mucous membrane of the cervical canal from the os externum to the os internum; (3) the mucous membrane of the body of the uterus.

Cancer of the Vaginal Portion.

Cancer of the vaginal portion is rare. It commences in the deepest layers of the squamous epithelium covering the part, and therefore belongs to the variety of carcinoma called squamous-celled epithelioma. Ruge and Veit, however, declare that the disease begins in the connective-tissue cells beneath the epithelium, and not in the epithelial cells themselves. Cancer commencing in this part may cause a uniform enlargement of one or both lips of the cervix, or may lead to the formation of a cauliflower-like mass which projects into the vagina. In other cases the surface of the growth ulcerates. This form of cancer nearly always attacks the patient before the menopause, and spreads superficially downwards along the vagina. It does not seem prone to spread up towards the body of the uterus, but in the later stages it may involve the deeper parts in the neighbourhood of the uterus.

3005.—A fungating epithelioma springing from the cervix uteri, which was excised.

3005a.—The vaginal portion of a cervix uteri, which is much enlarged, and has been divided mesially to expose the cervical canal. A large area of the surface is ulcerated, the limit of the healthy and ulcerated tissue being unusually clearly defined. The disease is an early form of epithelial cancer, and is limited to the surface of the ulcerated portion and to the lowest part of the cervical canal.

Cancer of the Cervical Canal.

Of all parts of the uterus, the cervical canal is the part most often attacked by cancer. It seems to occur most commonly in patients between forty and fifty years of age. There is no satisfactory evidence that erosions or lacerations predispose to its development. Cancer may begin in any part of the cervical canal, but it is much more common in the lower than in the upper part. The disease commences in the deeper portion of the cervical glands, with proliferation of the lining epithelium, so that the lumen of the glands becomes filled up with cells. The growth of cancer in the cervical canal may lead to the formation of an exuberant mushroom-shaped mass of new growth occupying the situation of one or both lips of the cervix; or in other cases, where ulceration and excavation predominate, the greater portion of the cervix is eaten away, leaving only a hard-edged ulcer, with a rough, friable surface, in its place. In an early stage the disease may appear simply as a hard nodule in the walls of the cervix, and occasionally it takes the form of a polypoidal mass.

Cancer commencing in the cervical canal tends chiefly to spread outwards into the parametric tissue. Probably in most cases the extension of the disease up into the body of the uterus does not occur until late. The disease may also spread downwards, so as to involve the vesico-vaginal and the recto-vaginal septa. The lymphatic glands earliest involved are those situated in the pelvis along the course of the internal iliac vessels.

3008.—A uterus in which the lower two-thirds of the walls are enlarged by the infiltration of a soft medullary substance. The natural texture of the organ can hardly be discerned. The disease forms a large spheroidal mass, of which the lower surface projecting into the vagina is ulcerated and flocculent.

3003.—A uterus of which the lower half has been destroyed by ulceration, probably of a cancerous nature. The adjacent part of the vagina is superficially ulcerated. The vesico-vaginal septum is greatly thinned. The disease has spread up into the body of the uterus.

Cancer of the Uterine Body.

Cancer of the body of the uterus is a comparatively rare disease. It most frequently occurs in patients between the ages of fifty and seventy. It commences in the glands or surface epithelium, and microscopically presents the characters of a columnar-celled epithelioma. The whole of the mucous membrane lining the body of the uterus is generally affected, but in some cases the disease is localized to one part, and may then form a polypoidal mass. When diffuse, it leads to excavation of the uterine cavity, hard irregular masses often projecting inwards on the ulcerated surface. The disease may dip deeply into the uterine substance and lead to great enlargement of the uterus, but in other cases it remains superficial, and the uterus is then only slightly or not at all enlarged. If it extends deeply, the peritoneal surface becomes involved, and adhesions to adjacent viscera result. In this way fistulous openings may be formed between the uterus and bowel. The lumbar glands become involved, and secondary deposits may occur in the lungs, liver and other parts.

3010.—An enormous cancerous enlargement of the body of the uterus, without change of shape.

3012.—A uterus; its interior, laid open from the anterior aspect, is rough from the presence of a cancerous deposit. The encroachment of this deposit upon the walls can be traced along the margin of the incision, being most conspicuous towards the fundus. Here,

somewhat to the right side, the entire uterine wall, infiltrated with the morbid growth, has softened, and to some extent has been completely removed, leaving a large aperture by which the interior of the organ would have communicated with the sac of the peritoneum but for the firm adhesions established around the margin of the opening. The patient sank under an attack of general peritonitis.

Sarcoma of the Uterus.

This is a rare disease, and, unlike carcinoma, much more often affects the body than the neck of the uterus. Sarcoma of the body of the uterus may commence in the mucous membrane or in the substance of the uterine wall. In the former case the mucous membrane becomes greatly thickened, and forms a series of bosses projecting into the uterine cavity. More rarely the disease leads to ulceration and excavation. Sarcoma commencing in the uterine wall appears as localized nodules, which generally project on to the peritoneal surface. Such nodules grow rapidly, and often show cystic degeneration, the contents of the cysts being blood. Sometimes these nodules grow inwards, and form large polypoidal tumours which project into the cervix or upper part of the vagina. Secondary nodules may occur in the vagina. In diffuse sarcoma of the mucous membrane of the body the uterus sometimes becomes inverted.

3015a.—A myo-sarcoma of the uterus. The upper part of the body of the uterus is much enlarged by a red, vascular, softened and diffuse growth. The patient was 23 years old, and had had one child seven months before her death. She had suffered from menorrhagia, followed by dyspnœa and hæmoptysis. At the autopsy the lumbar glands and lungs were studded with new growth, and a small secondary sarcomatous tumour was found growing from the lower part of the anterior vaginal wall.

2950a.—An inverted uterus with portions of the Fallopian tubes removed by the ecraseur. The fundus of the uterus is affected with myxo-sarcoma.

Adenoma of the Uterus.

Small benign growths, formed by the multiplication of the gland-tubes, are often found attached to the mucous membrane of the body of the uterus. They are usually flattened from side to side, and attached by a stalk (see Mucous Polypi of the Body of the Uterus). Malignant adenoma of the body of the uterus is also described. The gland-tubes, still lined by a single layer of epithelium, become greatly enlarged and coiled on themselves, and are seen to be separated from each other by a very scanty amount of interglandular tissue. Later the glandular growth penetrates into the muscular wall. Histologically and clinically no sharp distinction can be drawn between malignant adenoma and glandular epithelioma.

SECTION XXI.

DISEASES OF THE FALLOPIAN TUBES AND PELVIC PERITONEUM.

Salpingitis.

SALPINGITIS is generally preceded by endometritis, the inflammation spreading from the uterus into the tubes; but in the case of tubercular disease the inflammatory process may be primary in the tubes. This inflammation may be catarrhal, septic, gonorrhœal, or tubercular. Of the nature of catarrhal inflammation very little is known, but from analogy with the nasal and bronchial mucous membrane it may be assumed that a similar process may affect the lining membrane of the cervix and body of the uterus, and extend thence into the tubes. Owing to the fact that inflammation, whether catarrhal, septic, or gonorrhœal, extends into the tubes from the uterus, it will be readily understood that salpingitis is generally bilateral, though sometimes one tube alone is affected. The tubal mucous membrane and fimbria become swollen, and if the inflammation be septic or gonorrhœal the lining membrane may be covered with pus. The walls of the tubes are often much thickened by infiltration with inflammatory material. The abdominal ostium generally becomes obliterated, this obliteration being, for the most part, due to the escape of some of the inflammatory exudation from the tube into the

abdominal cavity. A local inflammation of the peritoneum is set up, and the swollen fimbriæ become adherent to each other and to the ovary or broad ligament. Sometimes the end of the tube becomes swollen and the fimbriæ retracted, and the abdominal ostium is thus closed without the help of perimetritic inflammation. As the result of salpingitis, the wall of the tube may become greatly thickened, whilst the cavity of the tube only contains a small quantity of fluid exudation. This condition is called parenchymatous salpingitis. The thickening of the wall of the tube is due to the infiltration of the muscular and mucous coat with inflammatory cells, the proper tissue of the tube being in this way partly destroyed. If the tube becomes distended with pus, the condition is called pyosalpinx ; if with watery mucus, hydrosalpinx.

1. *Pyosalpinx*.

If the inflammation of the tube is severe, and the abdominal ostium becomes blocked, the pus secreted from the surface of the mucous membrane will accumulate in the tube, distend it, and lead to gradual thinning of the wall. This distension is most marked in the outer half of the tube or ampulla. As a result, an elongated pear-shaped swelling is formed, which may sometimes attain a large size. The elongated tube burrows between the layers of the broad ligament. The epithelial lining of the tube is destroyed, and both the mucous and muscular layers are greatly thinned. Adhesions frequently form between the tube and adjacent structures. Pyosalpinx seems to be moderately common in cases of cancer of the uterus, and the rupture of such a tube is an occasional cause of death.

2. *Hydrosalpinx*.

The tube in this case is distended with watery mucus. The abdominal ostium is blocked, but the uterine opening

is frequently patent. A swelling similar in shape to that produced by pyosalpinx is formed. The walls become thin and translucent, though in cases of very long standing the walls may be thickened. The longitudinal folds of the mucous membrane are obliterated and the superficial epithelium destroyed. Intermittent escape of the fluid contents through the uterine ostium is said occasionally to occur, and this condition is spoken of as "hydrops tubæ profluens," or intermitting hydrosalpinx. Whether such a thing ever does take place or not is very doubtful.

2935.—A Fallopian tube, the extremity of which is distended into a pyriform sac, which contained upwards of half a pint of transparent fluid. The rest of the tube is dilated, but in a much less degree, and is elongated and tortuous. The walls of the sac appear to have been very vascular.

2937.—Dropsy of left Fallopian tube. A delicate layer of false membrane connects the posterior wall of the uterus with that of the dilated portion of the tube.

2937b.—The female pelvic organs, of which the uterus and ovaries are normal, while the Fallopian tubes have become uniformly and symmetrically distended. The extremities of the distended tubes lie in Douglas's pouch, where a thin band of peritoneal adhesion, passing from the uterus to the rectum, forms a septum between the tubes; another band fixes the end of the right tube to the rectum. The end of the left tube is free. The abdominal orifices are closed, but the uterine ends appear patent. On careful examination, the lumen of the left tube was throughout visible to the naked eye. Under the microscope the folds of the lining mucous membrane were found to be partially destroyed. There were no symptoms during life pointing to any pelvic mischief.

Tubercular Salpingitis.

Tubercular disease of the tubes may be primary or secondary. In cases of primary disease the tubercular inflammation spreads from the tubes to the uterus, and also to the peritoneum. The abdominal ostium generally becomes closed, but leakage of tubercular material from the

tube into the peritoneal cavity usually occurs before this closure is completed. Infection of the peritoneum, local or general, is thus brought about, and the tubes themselves become firmly bound down by adhesions. In tubercular salpingitis the tubes become enlarged, tortuous and irregular in shape, and the cavity is dilated and stuffed with caseous material. The mucous lining is replaced by granulation tissue, and nodules having the histological character of tubercle are found scattered through the walls. Bacilli can be demonstrated. The mucous membrane of the uterus, which is frequently affected, shows changes similar in nature to those met with in the tube, and its cavity may likewise contain cheesy tubercle. Tubes involved secondarily to pulmonary phthisis show changes similar to those above described.

2938.—The uterus, laid open, and the Fallopian tubes of a woman aged 53, who died from tubercular disease of the lungs and intestines. The Fallopian tubes are the seat of tubercular disease. To the external wall of the uterus, on the left side, a pedunculated fibroid tumour is attached.

2938a.—Two specimens of tubercular disease of the Fallopian tubes. In the upper specimen the right ovary, with its Fallopian tube and broad ligament, is alone preserved. The Fallopian tube is greatly thickened and enlarged for the outer three-quarters of its extent, and is filled with a caseating material. The specimen was taken from a patient aged 22, who died with advanced pulmonary phthisis and tubercular ulceration of the bowels.

In the lower specimen a uterus, with its appendages, is preserved. The Fallopian tubes are greatly distended, and filled with fine caseating material, except at their fimbriated extremities, which are filled with a thick cheesy pus. The uterus is healthy. From a woman aged 19, who died of pulmonary phthisis.

Hæmato-salpinx.

By hæmato-salpinx is meant distension of the Fallopian tube with blood. In the great majority of cases of hæmato-

salpinx it is found to occur in association with a tubal pregnancy, and under these circumstances the abdominal ostium of the distended tube is open. A tube the abdominal orifice of which is closed may sometimes be found distended with blood-stained fluid. Such a condition is probably due to hæmorrhage having taken place into a tube previously distended with serum.

New Growths of the Tubes.

New growths of the tubes are extremely rare, but three forms may be mentioned: (1) Adenoma, (2) Myoma, (3) Carcinoma.

1. *Adenoma.*

This condition has also been described as papilloma. It is very rare, and only a few cases have been recorded. The growth, which forms cauliflower or grape-like masses, springs from the lining membrane and distends the tube. The free surface of the growth is covered with columnar epithelium, and the glandular depressions and cystic spaces are lined with similar cells. The connective tissue stroma is scanty. The abdominal ostium of the tube remains open, and fluid, often in large quantities, is generally found in the peritoneal cavity.

2. *Myoma.*

Myomata are very rare, and nearly always are quite small. In structure they resemble those met with in the uterine wall.

3. *Carcinoma.*

Primary carcinoma of the tube, like myoma, is also extremely rare. In cases of cancer of the body of the uterus, the disease occasionally extends into and involves the tube; but this also is rare.

Tubo-ovarian Cysts.

In a so-called tubo-ovarian cyst a dilated tube communicates by a free opening with a cyst, generally unilocular, of the ovary. In most of these cases there is evidence of past perimetritis, and, as is well known, cystic degeneration of the ovaries is common in cases where pelvic peritonitis has existed. The first factor in the development of this condition is probably salpingitis, and from the escape of some of the contents of the tube into the abdominal cavity, perimetritis, often only slight, follows. The abdominal ostium of the tube becomes sealed up and closely adherent to the ovary. Cystic degeneration occurs in the ovary, the cyst or cysts being formed from distended Graafian follicles, or corpora lutea, the stroma having undergone degeneration. The tube becomes distended with fluid, owing to a continuation of the inflammatory process in its interior, and the tube and ovary are thus reduced to thin-walled cysts. The septum separating the two becomes absorbed, and an aperture of communication is thus formed. If the dilated tube contains pus, a tubo-ovarian abscess results.

2924a.—A tubo-ovarian cyst, from the body of a nulliparous single woman aged 27. The uterus and left appendages are normal. The right ovary is converted into a thin-walled unilocular cyst five inches in length, to which the ovarian ligament is attached. At the point of attachment traces of ovarian substance are seen. The Fallopian tube measures nine inches in length, and the outer half is distended as in ordinary hydro-salpinx; it is adherent, and opens into the ovarian cyst, the opening having a diameter of two inches. No remains of the fimbriæ are visible. The adhesion of the tube appears to be due to inflammation, a piece of omentum being attached to the right cornu of the uterus.

2924c.—A specimen showing the formation of a tubo-ovarian cyst. The uterus is anteflexed, and the pouch of Douglas is occupied by the distended Fallopian tubes, which, with their

ovaries, are bound down by peritonitic adhesions of long standing. The left Fallopian tube, which encircles an otherwise healthy ovary, presents the usual characters of hydro-salpinx. Its uterine extremity appears to be obliterated at a point which is just external to the uterus. The right Fallopian tube is adherent to, and communicates with, a cyst which was originally bilocular. The cyst is of very small size, but it involves the whole of the ovary. No trace of the free ends of the fimbriæ can be found, but the tube is patent throughout its course. It is dilated up to the uterine extremity, its interstitial part remaining normal.

Perimetritis.

By perimetritis is meant inflammation of the pelvic peritoneum. It is always due to infective material escaping into the peritoneal cavity, and in the vast majority of cases this escape takes place through the abdominal ostium of the tube. It will therefore be readily understood that perimetritis is almost always secondary to salpingitis, and that the peritonitis depends on the leakage of irritating material from the inflamed tube into the peritoneal cavity. The causes of salpingitis are therefore the causes of perimetritis. Sepsis, gonorrhœa and tubercle, inasmuch as they cause salpingitis, may also cause perimetritis. The inflammation of the peritoneum will vary in intensity and extent according to the nature and amount of the irritant which escapes into the cavity. The inflammation which is set up may lead simply to adhesion of the affected parts, or may be accompanied by the pouring out of serum or pus. Three forms of perimetritis are therefore recognised: (1) Simple adhesive, (2) serous, (3) purulent. Pus and serum generally accumulate in the pouch of Douglas, but collections may also occur between coils of intestine or between the anterior abdominal wall and the intestines. When the inflammation is most intense in the region of the utero-vesical pouch, the condition is spoken of as anterior perimetritis. The collections of pus or serum are shut off from the

general peritoneal cavity by adherent intestines. Collections of pus tend to discharge themselves in various directions; when posterior, escape generally takes place into the rectum. In cases of simple adhesive perimetritis, many of the adhesions between adjacent coils of intestine get worn away by constant peristaltic movements, though generally the adhesion between the tube and ovary remains. Some of the adhesions become organized, and thin bands or septa persist which bind down the tubes and ovaries, and permanently limit the mobility of the pelvic organs. Such adhesions are frequently found on post-mortem examinations in women who have previously borne children.

2952.—A uterus, with one of the ovaries and the corresponding Fallopian tube turned round and adherent to its surface. The Fallopian tube and ovary are themselves closely united by old adhesions. The opposite ovary and the extremity of its Fallopian tube are also similarly connected, but are not adherent to the uterus.

2951a.—(Two specimens.) The bladder and uterus, with part of the vagina, rectum and sigmoid flexure, from a case of perimetritis. In front is the bladder, bisected vertically and apparently healthy. The orifices of the urethra can be seen, one in each segment. Between the segments is the uterus, with its anterior wall divided vertically, exposing the cavity of the fundus, which is normal. The cavity of the cervix is two and a half times its natural length. The internal os is well marked, and in the middle of the posterior wall of the cervix is a large oval slough almost perforating it, and forming one of the openings by which the perimetritic effusion which occupied Douglas's pouch would have escaped. In the anterior wall of the uterus are several small and nodular myomata. Below the cervix and in the upper part of the vagina, just posterior and to the left of the external os, is another slough, not so large or so far advanced as the other, and leading into the apex of Douglas's pouch. Immediately behind the vagina is the rectum, which has been laid open and part of its posterior wall removed. At first it is in its normal relation to the vagina, but afterwards it is deflected towards the right cornu of the uterus, being separated from

it and deflected to the right by the perimetric effusion. Its calibre is small. About three inches from its lower part, and six or seven inches from the anus, is a large irregular slough, also leading into the cavity of the effusion. The bowel, which is probably the sigmoid flexure, passes upwards and to the left, forming the upper boundary of the cavity towards the left iliac fossa. From nearly the attached border of this fold of intestine to the upper border of the uterus and left broad ligament is a tough fold of membrane, about two inches wide, which has been divided along its whole extent so as to show the cavity of the effusion. This can only be organized lymph which has entangled some masses of fat. It forms part of the anterior wall of the cyst. It can be seen also that the left broad ligament forms part of the anterior wall, whilst the right is probably bent backwards, forming the right lateral margin. Neither ovary can be distinguished, but the round ligament on both sides and the Fallopian tube on the left remain. The cavity is lined with lymph, ragged and shreddy in parts.

2945a.—Anterior perimetritis. A large abscess cavity is situated behind and above the bladder in front of the uterus and right broad ligament. It extends above the right half of the fundus uteri; below, it passes between the bladder and vagina to within two inches of the orifice of the urethra and two inches below the external os. It is bounded above by a pyogenic membrane and by the right ovary, which is seen to be much enlarged. The peritoneum which normally lines these parts has disappeared entirely, and has been replaced by a pyogenic membrane. Some of the structures of the broad ligament are thereby exposed, to wit, the round ligament and a Fallopian tube, which form a band crossing the upper part of the cavity. The abscess cavity measures five and a half by four inches. It has no external openings, its wall being everywhere thick. The left ovary is cystic; it is situated above and posterior to the left cornu of the uterus. The patient had been ill since the birth of her last child, twenty months previously.

SECTION XXII.

DISEASES OF THE OVARY.

Inflammation of the Ovary.

ACUTE inflammation of the ovary may commence in the parenchyma or in the interstitial tissue. Two forms of ovaritis are therefore recognised: (1) **parenchymatous**, and (2) **interstitial**. In some cases the two forms of inflammation may be combined.

Parenchymatous ovaritis generally occurs after typhoid, typhus, or scarlet fever. Occasionally it results from septic infection. The ovary increases in volume and becomes hyperæmic, especially around the Graafian follicles. In slight cases the primordial follicles are alone attacked, but in more acute cases the developed Graafian follicles are also involved. The liquor folliculi becomes opaque. The inflammation often spreads to the connective tissue around the follicles, and blood extravasations are frequently met with in this situation. The affected follicles perish, and leave no trace behind except a cicatrix. Interstitial ovaritis may be diffuse or circumscribed. Diffuse interstitial ovaritis is only met with in the puerperal period as one of the results of septic infection. It runs a very acute course. The ovaries become enlarged to two or three times their normal size, their tissue being soft and hyperæmic. Small miliary abscesses may be found scattered through the ovary,

or these may run together and form an abscess as large as a nut. Microscopic examination shows colonies of micro-organisms. The surface of the ovary is generally covered with lymph, and this may lead to the formation of adhesions between it and the neighbouring parts.

In circumscribed interstitial ovaritis the inflammatory process is much less intense, and localizes itself around the follicles. It is generally due to septic infection, but is said also to result from gonorrhœa. The follicles may be destroyed, but in some cases they may be converted into small cysts. Slavjansky believes that cystic degeneration of the ovary, the ovary being converted into a mass of small cysts, is due to circumscribed interstitial ovaritis. The same condition has been described by Virchow under the name of "catarrh of the Graafian follicles." Chronic interstitial ovaritis will lead to sclerosis of the ovary. The ovary is small and shrunken, and many of the Graafian follicles are converted into little fibrous nodules.

2903.—Sections of two ovaries. They are contracted, and their structure is dense and fibrous; Graafian follicles are visible.

Peri-ovaritis.

In many cases where the ovaries are inflamed the tubes are inflamed also. In some of these cases the inflammation may involve the surface of the ovary only. This arises from irritating material escaping from the tube and setting up pelvic peritonitis. The surface of the ovary shares in the inflammation of the adjacent peritoneum, and becomes covered with lymph, thickened, and adherent to adjacent parts. This may interfere with the rupture of ripe Graafian follicles, so that the ovary becomes enlarged.

2903b.—A greatly enlarged ovary which is covered by old adhesions. There are numerous cysts on the surface, probably dilated Graafian follicles.

Ovarian Cysts.

The ovary consists of two parts: (1) the ovary proper, or oophoron; and (2) the hilum. In the ovary proper may arise simple unilocular cysts, multilocular cysts with or without glandular growths, and dermoid cysts. In the hilum of the ovary, papillomatous cysts develop. The mode of origin of ovarian cysts is obscure. Those developing in the oophoron may arise from distension and coalescence of Graafian follicles, or from degenerative changes affecting undeveloped follicles.

1. *Simple Unilocular Cysts.*

Unilocular cysts of the ovary are very uncommon. They are generally thin-walled, and do not often grow to be bigger than a hen's egg. They probably arise from a dropsical distension of a mature Graafian follicle. Many unilocular cysts that are met with are dermoids.

2904f.—An ovary in an early stage of cystic degeneration. A portion of the cyst wall has been removed, showing that the whole gland has been transformed into a unilocular cyst of about the size and shape of a turkey's egg.

2904d.—A large absolutely unilocular ovarian cyst. The interior of the cyst is free from any trace of septa. The fluid was viscid, like that usually found in the multilocular variety.

2. *Multilocular Cysts.*

Multilocular ovarian cysts are far commoner than any other kind of cyst of the ovary. They are composed of many cysts, but it often happens that one of these cysts is much larger than any of the others. The main cystic cavity generally develops by the fusion of several cysts with each other, and the intervening walls, which have become absorbed, are represented by bands or projecting folds. The smaller secondary cysts may break into each other or into

the main cyst, and small cysts may develop in the thickness of the wall of the main cyst. Multilocular ovarian cysts are smooth or irregular in outline, and may attain an immense size. The walls of the cysts are mainly fibrous, and appear glistening and silvery, but are not covered with peritoneum. Bloodvessels run in the cyst walls. The smaller cysts are lined with columnar epithelium, and may sometimes show a definite mucous membrane, which can be stripped off; but in the large cysts the epithelial lining usually disappears. In the secondary cysts are sometimes seen soft, solid outgrowths projecting from the lining membrane into the interior. These masses, which are spoken of as glandular growths or adenomata, are composed of numerous small cystic cavities lined with columnar epithelium, and a scanty stroma of young connective tissue. The fluid contained in the multilocular ovarian cysts varies in character, but it is frequently greenish-yellow in colour and glairy in consistence, and, if glandular growths are present, the fluid may be very thick or jelly-like. In some cases it is reddish-brown, from the presence of extravasated blood.

2912a.—A large proliferating cyst of the ovary, removed by operation. The cyst has been turned inside out. On its walls are numerous small cysts containing clear fluid. There are numerous bands of fibrous tissue attached to its walls and spreading from one point to another.

2904a.—Section of the wall of an ovarian cyst, showing the Fallopian tube stretched over the surface so as to have a length of fifteen inches.

3. *Dermoid Cysts of the Ovary.*

Dermoid cysts of the ovary may occur at all ages. The cyst may be unilocular or multilocular. The surface of the cyst is often a dull-brownish colour, and rough or shaggy from the presence of adhesions. These cysts are lined with skin or mucous membrane, and, in multilocular tumours,

some may be lined with skin, and others with mucous membrane. When the lining is composed of skin, as is the more usual, large sebaceous glands are seen, and hair, which is often abundant, is also found, as well as other epidermal structures, such as teeth and bone. The contents of a dermoid cyst are greasy, and usually resemble the material found in sebaceous cysts. The larger cysts may contain a greasy fluid of a chocolate colour, and cholesterine crystals are frequently met with.

In rare instances, soft white growths, resembling sarcomatous tissue in structure, have been found growing within the cavities of dermoid cysts.

2915.—A dermoid cyst, containing fat, hairs and teeth.

2915a.—A small dermoid cyst, situated in the position of the right ovary. It contains hair matted together by white caseous material. The Fallopian tube is normal.

2915c.—A uterus with its appendages. On each side, the substance of the ovary is replaced by a cyst measuring almost three inches in diameter. Portions of the cyst walls have been cut away, and the contents, which consisted of thick sebaceous material mixed with hairs, have been removed. Some of the material, with a few hairs, still remains adherent to the interior of the cysts.

Papillomatous Cysts.

The hilum of the ovary contains remnants of the mesonephros or Wolffian body, and is situated at the line of attachment of the ovary to the posterior surface of the broad ligament. Cysts developing in this situation contain firm, exuberant, very vascular papillomatous or warty growths, and generally burrow between the layers of the broad ligament. For this reason they are generally covered with peritoneum, and are often sessile. These warty growths are covered with columnar epithelium, and possess a scanty connective-tissue basis. If the cyst is not very large, the ovary may be able to be made out on the surface. Sometimes the exuberant warty growth breaks through the

cyst and forms a large irregular cauliflower mass, and may spread to the adjacent peritoneal surfaces.

The fluid contained in these cysts is clear, and not glairy. Wolffian relics may be met with between the layers of the broad ligament, and thus papillomatous cysts may develop independently of the hilum of the ovary. They have the same characters as those developing in the hilum.

2911.—An ovary of which one half appears healthy, while in the place of the other half there are three cysts, completely partitioned from each other and mutually compressed. A papillary growth springs from the wall of the lowest cyst.

2921.—Portion of a large cyst which was connected with the ovary of an old woman. The walls of the cyst are composed of several layers of very dense tissue. Its internal surface is thickly set with papillary growths, and groups of small pedunculated and very thin wall-cells containing limpid fluid. Its cavity was filled with thick brown fluid of the consistence of cream, mixed with numerous short stiff hairs.

Parovarian Cysts.

The parovarium consists of a series of tubules lying between the layers of the broad ligament close to the hilum of the ovary. As already mentioned, the hilum of the ovary contains remnants of the Wolffian body, and these tubules represent the ducts of this body, and are homologous with the vasa efferentia and epididymis of the testis. The parovarium consists of ten or twelve vertical tubules converging towards the hilum, opening into a horizontal tube which runs towards the uterus, but which generally speedily becomes obliterated. If the horizontal tube is traced outwards, it is seen to split up into several tubules, free at one extremity and known as Kobelt's tubes. The vertical tubes are lined with cubical epithelium. One of these vertical tubes may become distended, and form a parovarian cyst. Such a cyst burrows between the layers of the broad ligament, and is consequently covered with

peritoneum. It is almost always unilocular, and contains a clear fluid of low specific gravity. The greatly-elongated Fallopian tube is spread out over its surface, and the ovary, flattened, but not otherwise altered, is seen attached to its posterior aspect. The lining membrane of small cysts consists of cubical or columnar epithelium; in large cysts the epithelium has become atrophied by pressure.

2923a.—A specimen of parovarian cyst. The cyst is of considerable size; the outline of its wall can be easily traced quite distinct from the ovary and Fallopian tube.

2923b.—Some of the fluid from the preceding specimen. It is perfectly clear and translucent, and contains no albumin.

2942c.—A large parovarian cyst of the right side, situated between the layers of the broad ligament, and measuring six inches in its long diameter. Its walls are rather thicker than usual. The Fallopian tube is elongated, and extends along the top of the cyst, which has been laid open. The ovary is the seat of a dermoid cyst, and contains hair and sebaceous material.

Twisting of Pedicle.

The pedicle of an ovarian cyst is made up of the Fallopian tube and adjacent parts of the broad ligament, with the ovarian artery and veins and the ovarian ligament.

This pedicle may become twisted from rotation of the cyst, but the mechanism by which this twisting is brought about is not clearly understood. Posture, the pressure of the viscera, or unequal growth of the tumour, may have something to do with its production. The torsion may occur suddenly or gradually, and the symptoms produced are most severe when the torsion is sudden.

If the torsion is gradual, arrest of growth, followed by atrophy, may result, and in some cases the cyst may even become detached. Hæmorrhage into the cyst, sloughing or rupture, may occur in those cases where the torsion is more acute. The surface of the cyst becomes dark and lustreless, and the contents become mixed with altered

blood. Adhesions between the cysts and adjacent parts are frequently formed. Dermoid tumours seem to be most liable to twisting of the pedicle.

Solid Tumours of the Ovary.

Solid tumours of the ovary are rare. Three kinds of tumours are met with: (1) Fibroma, (2) Sarcoma, and (3) Carcinoma.

In **Fibroma of the Ovary** the whole ovary is generally converted into a homogeneous mass, and is mainly composed of fibrous tissue, the bundles being disposed irregularly, and not concentrically, as in fibroid tumours of the uterus. Tumours of the ovary, composed partly of fibrous tissue and partly of unstriped muscular fibres, are also met with. Cyst-like spaces, containing a thin albuminous fluid, may occur in tumours of this kind. The walls of the cysts appear to be devoid of any lining membrane.

2925.—A spherical fibrous tumour connected to the left ovary by a narrow pedicle. It is divided by a longitudinal section. Before removal the tumour lay in the peritoneal pouch between the uterus and the rectum. There were no symptoms of its presence during life. It was taken from a woman aged 55 years.

2926.—One-half of a tumour which was removed from the situation of the left ovary of a woman aged 55 years. It is composed of loose fibrous tissue. A similar but somewhat smaller growth occupied the situation of the right ovary.

2927a.—One-half of a large solid tumour of the ovary, removed by abdominal section. The tumour consists of connective tissue of the same type as the stroma of the ovary, but in every stage of development into pure connective tissue. Some parts are much less dense and of looser texture than others, which are hard and nodular. The less dense portions are undergoing mucoid degeneration, and are probably the first stages of the formation of cysts. The cysts are simply cavities bounded by dense connective tissue. They have no epithelial lining, and contained a large quantity of thin greenish straw-coloured alkaline fluid, which coagulated

spontaneously. The patient was a multipara, aged 47, and the tumour had been noticed for five years before removal.

Primary Sarcoma of the Ovary may lead to the formation of tumours of various sizes. The mass is generally oval and smooth. Both ovaries may be attacked, though one often is larger than the other. Secondary growths in the peritoneum and other parts usually do not occur until a late stage of the disease.

Primary Carcinoma of the Ovary may form a tumour the size of an adult head. The tumour is white, soft and juicy. One ovary alone is usually involved, but the other may be attacked in a less degree. The pelvic peritoneum and the great omentum are always invaded, so that ascites generally forms a prominent symptom of the disease.

Tubercle of the Ovary.

There is no good evidence to show that tubercle ever occurs primarily in the ovary, but it seems always to be associated with general infection. The tubes are nearly always affected as well. Tubercle may occur in the ovary in the form of miliary tubercles, caseous masses, or an abscess. Abscess of the ovary may occur in association with septic salpingitis, but when it is met with apart from salpingitis, it appears to be always tubercular.

Hæmorrhage into the Ovary.

1. Follicular Hæmorrhage.

When a ripe Graafian follicle bursts, blood is extravasated into it. A ruptured follicle, thus distended with blood-clot, may attain the size of a cherry, though usually it is much smaller. Such a condition is often described as follicular hæmorrhage. Hæmorrhage into ovarian follicles is also met with in association with acute fevers, scurvy, phosphorus-poisoning and also after burns, and in such cases many follicles contain blood. In acute fevers, hæmorrhage

may occur into the ovarian stroma instead of into the follicles.

2908d.—A right ovary and Fallopian tube removed from a woman aged 35. The ovary is considerably enlarged, and is much indurated. It contains in its substance a good-sized clot of blood. There are traces of old and tough adhesions upon the greater part of its surface. The Fallopian tube is adherent to the ovary, and its walls are much thickened by chronic inflammation.

2938a.—Two specimens of tubercular disease of the Fallopian tubes. The ovary in the upper specimen contains two follicles distended with blood.

2. *Hæmatoma of the Ovary.*

If the amount of blood poured out into an ovarian follicle be unusually large the walls of the follicle may rupture, and the blood invading the stroma converts the ovary into a cyst which may attain the size of an orange. This condition is spoken of as hæmatoma or apoplexy of the ovary. Such blood cysts may occur in connection with uterine fibroids or perimetritis, but they may also occur apart from either of these two conditions. Such cysts occasionally burst, and may thus lead to fatal hæmorrhage or to the formation of a pelvic hæmatocele.

2910a.—A uterus with the right ovary. The latter is occupied by a cyst the size of an egg, which in the recent state contained dark fluid blood. The uterus is the seat of interstitial and sub-peritoneal tumours. The surface of the uterus is covered by numerous old adhesions.

SECTION XXIII.

DISEASES OF THE PELVIC CELLULAR TISSUE.

Parametritis.

THE peri-uterine cellular tissue is most abundant at the sides and in front of the supravaginal cervix. It exists in smaller quantities between the rest of the broad ligaments and also behind the supravaginal cervix, extending between the folds of the sacro-uterine ligaments. The great cause of inflammation of the pelvic cellular tissue is septic infection. For the septic organisms to gain an entry, a tear or abrasion is necessary. If such a tear or abrasion becomes infected with septic matter, a localized inflammation of the pelvic cellular tissue will result. Child-birth or operations about the cervix are therefore important predisposing causes of parametritis. It is noteworthy that during gestation the parametric tissue becomes markedly increased in amount. Two forms of parametric inflammation are met with: (1) parametric phlegmon, and (2) parametric abscess. In parametric phlegmon there is extensive infiltration of the cellular tissue with inflammatory exudation, but this is followed by absorption, and not by breaking down. If the inflammatory exudation breaks down and suppurates, a parametric abscess results. In parametritis the inflammation starts in the cellular tissue beneath the peritoneum, but the peritoneum immediately adjacent to

the inflamed cellular tissue will be affected to a greater or less extent by the inflammation. The inflammation, commencing in the cellular tissue close to the cervix, may spread outwards to the sides of the pelvis and then upwards along the psoas, or downwards and forwards to the anterior abdominal wall, or it may spread immediately forwards beneath the anterior layer of the broad ligament to the anterior abdominal wall. A parametric abscess opens generally either externally in the iliac region or internally into the bladder. When the cellular tissue between the supravaginal cervix and the bladder is affected, the condition is spoken of as anterior parametritis.

2951d.— A sagittal section of the uterus and bladder, from a case of parametric abscess of the right broad ligament and iliac fossa. The uterus and ovaries are displaced towards the left side of the pelvis. The abscess cavity is seen to extend into the cellular tissue between the uterus and bladder.

SECTION XXIV.

DISPLACEMENTS AND ATRESIA OF THE UTERUS, ETC.

Inversion of the Uterus.

DIFFERENT degrees of inversion of the uterus are recognised. The inversion may be partial, the inverted portion of the uterus not descending below the os internum, or it may be complete, in which case the whole body of the uterus is turned inside out, and projects through the dilated cervical canal into the vagina. The process of inversion rarely extends beyond the os internum, though, in cases where the inversion is associated with prolapse, the cervix may in time become turned inside out, like the body of the uterus. In the great majority of cases inversion of the uterus is puerperal in origin, and generally occurs shortly after the birth of the child. Partial or complete inertia of the uterus is necessary for its production. When the inertia is partial, contractions of the rest of the uterus, aided by intra-abdominal pressure, bring about the inversion; and when the inertia is complete—that is, when the whole body of the uterus is flaccid—the inversion is produced by pressure from above or traction from below. At the time of its production the condition is spoken of as acute inversion, but after involution is complete—that is to say, in six or eight weeks after delivery—it is called chronic inversion.

The turning inside out of the uterus does not appear to delay involution.

Inversion of the uterus may also be caused by fibrous polypi growing from the fundus. As the polypus is driven further and further down into the cervix and vagina, the fundus of the uterus may be dragged down with it, partial or complete inversion resulting. Sarcoma of uterine mucous membrane is occasionally followed by inversion.

The body of the inverted uterus is shaped like a flattened pear; the mucous membrane is vascular and bleeds easily, and sometimes becomes ulcerated. The peritoneal surface of the uterus forms a cup-shaped depression, in which lie the Fallopian tubes, and occasionally an ovary. Adhesions between the adjacent peritoneal surfaces very rarely occur, a fact which accounts for re-inversion being possible, even in cases of many years' duration.

2949.—A uterus and its appendages, with part of the vagina. The uterus is entirely inverted, with the exception of the cervix, which, however, does not cause any constriction, the finger passing easily between it and the uterine wall. The openings of the Fallopian tubes into the uterus cannot be discovered on its inverted surface. The peritoneum at the point of inversion is thickened and uneven. The uterine appendages are drawn into the cul-de-sac formed by the inverted uterus. The inversion was irreducible, and the displacement of the uterus caused death, in consequence of frequently recurring hæmorrhage, twenty-nine months after its occurrence.

2950.—A uterus and its appendages. The fundus is inverted, and in the sac thus formed a portion of the broad and round ligaments and the Fallopian tubes were found. It occurred after delivery.

2950a.—An inverted uterus removed by the ecraseur. The fundus is affected with myxo-sarcoma.

2970.—A uterus, having attached to its partially inverted fundus a true fibrous polypus, the body of which is in the vagina.

Atresia of the Genital Canal.

Atresia (non-perforation) may affect (*a*) the vulva, (*b*) the hymen, (*c*) the vagina, (*d*) the cervix.

Atresia of the Vulva.

Atresia of the vulva may occur in young children as the result of severe inflammation or gangrene affecting the labia. Adhesion of the adjacent surfaces occurs, though this is not complete, owing to the stream of urine separating the labia in front.

Atresia of the Hymen.

Most of the cases described under this title are really cases of atresia of the vaginal orifice.

Atresia of the Vagina.

The lowest part of the vagina is that usually affected with atresia, the atresia being almost always congenital in origin. A thick membrane blocks the lower orifice of the vagina, and, lying on the outer surface of this, the hymen, with its central perforation, can often be demonstrated: sometimes the lower third of the vagina is congenitally absent.

Atresia of the upper part of the vagina may be acquired as the result of sloughing after delivery. The whole vagina may be congenitally absent, but under these circumstances the uterus is generally imperfectly developed. The result of atresia of the vaginal orifice or hymen is, that after puberty menstrual fluid, unable to escape, accumulates in the vagina, and this condition is known as *hæmato-colpos*. The vagina becomes greatly distended with the retained secretion, and the cervical canal sometimes also becomes dilated. In rare cases the body of the uterus shares in this dilatation (*hæmato-metra*), and the tubes also may contain blood. The retained fluid, which consists of altered blood and large quantities of ropy mucus, is dark-brown in colour, and has the consistence of thick treacle. The following specimen well illustrates the changes produced

by atresia of the hymeneal (? vaginal) orifice and the accumulation of fluid in the vagina.

3016a.—The urino-generative organs of a female infant aged 7 weeks. The large fibrous sac, which has been divided by a mesial section, is the vagina; it has been enormously distended by puriform fluid owing to an imperforate hymen. The uterus, the cavity of which is slightly distended, is situated at the upper part of the distended vagina. The cervix is dilated, and forms part of the sac. The lower part of the ureters has been compressed, so that they and the calices of the kidneys are dilated.

Atresia of the Cervix.

This is rarely congenital. It may result from cicatrization following labour, or amputation or repeated cauterization of the cervix. It frequently occurs in women after the menopause. It is generally the lower part only of the cervical canal which is obliterated. Cancer of the cervix, the growth of a fibroid in the lower part of the uterus, or sometimes sarcoma of the uterine mucous membrane, may destroy the patency of the canal. Strictly speaking, the state of affairs produced by a fibroid should rather be described as stenosis than atresia, as the canal is obstructed, but not obliterated.

As a result of atresia of the cervix, the body of the uterus may become distended with pus (*pyo-metra*) or blood (*hæmato-metra*). In cases where the cervix becomes obliterated after the menopause, the uterine cavity generally does not become dilated, though occasionally a drachm or two of mucus may be found occupying its cavity (*hydro-metra*). The circumstances which produce *pyo-metra* or *hæmato-metra* after occlusion of the cervix are not certainly known, but probably if the occlusion occurs before the menopause, *hæmato-metra* results, and if after, *pyo-metra*. *Pyo-metra* will only occur after occlusion if the mucous membrane of the uterine cavity is in a morbid condition;

and the reason the uterus does not generally become distended after the atresia which so often follows the menopause is that simultaneous atrophic changes occur in the mucous membrane of the uterine body.

2957.—A uterus exhibiting atresia of the cervix. The rest of its cavity is dilated. The extremities of the Fallopian tubes are adherent to the ovaries.

2965b.—A specimen of hæmato-metra from an old woman aged 60. The lower part of the cervical canal is obliterated.

2955.—A uterus. The cervix is affected with epithelial cancer, by which the canal is obliterated. The cavity of the body of the uterus is greatly dilated, and was filled with pus.

2956.—A uterus, in the side wall of which a large fibroid is embedded. In its growth the tumour has bent the uterus laterally, and so encroached upon its cavity that the cervical canal was shut off from the body. (A portion of glass now shows their continuity.) The cavity of the body of the uterus, which is greatly dilated, was filled with pus; its walls are thinned; its mucous membrane was intensely vascular.

SECTION XXV.

DISEASES OF THE OVUM AND ITS MEMBRANES.

Hydatidiform Mole.

A HYDATIDIFORM mole is always the result of conception, but no satisfactory cause for its occurrence has been discovered. It consists in a proliferative degeneration of the chorionic villi. Chorionic villi have two essential portions: (1) the epithelial covering, or exochorion; and (2) the connective-tissue substratum, or endochorion. This latter at first is non-vascular, but later is supplied with bloodvessels by means of the allantois. A hydatidiform mole results from a mucoid or myxomatous degeneration of the endochorion, the surface epithelium being but little affected. As the result of this myxomatous degeneration, local swellings occur at intervals along the villi, and the vesicles thus formed vary in size from a millet-seed to a cherry. These vesicles are filled with a fluid not unlike the liquor amnii in composition, but containing a larger proportion of mucin. This degenerative process generally commences at an early stage of development, when the chorion is still covered all over with villi, and never originates after the end of the third month. Under these circumstances the embryo soon dies, and becomes absorbed, and the vessels of the villi are obliterated. When the disease does not occur until the third month, some only of the villi forming the placental

mass may be attacked, and if the number of villi affected be not large the fœtus may survive. As the result of this morbid growth, the uterus may be distended so as to attain a size equal to a pregnancy at full term. In some cases the altered villi dip deeply into the uterine substance, and lead to an extensive absorption and atrophy of the uterine walls.

Occasionally the mucoid degeneration of the cells of the endochorion may cease, and these cells may be converted into fibrous tissue, and so lead to the formation of the so-called *myxoma fibrosum*.

3039.—Hydatidiform disease of the chorion. A large mass formed by clusters of small pellucid cysts or vesicles attached to very slender branching cords. At the upper part of the specimen are portions of thin membrane like an amnion, by which the several clusters of cysts were connected.

3042.—A similar specimen.

3042a.—An example of hydatidiform degeneration of the chorion, with cysts somewhat larger than usual.

3043a.—Myxoma fibrosum. A portion of a kidney-shaped mass which measured eight inches in length, and which had the appearance when fresh of a mixed fleshy and hydatid mole. It consists almost entirely of chorion. The amnion is collapsed and compressed, and measures four inches in length. No remains of fœtus or cord are visible. It is covered by a thin layer of decidua, and in parts by blood-clot. The stems are branched, and appear as bundles of solid rods, which interlace. The thickening of the stems is due to an increase of the normal myxomatous core tissue. All the rods, examined microscopically, are devoid of bloodvessels; the exochorionic epithelium has in places disappeared, but in general appears normal. In some places cystic degeneration has occurred, but cysts are not numerous.

Carneous Mole.

A carneous mole is a blighted ovum, the walls of which are greatly thickened by extravasated blood. Blood is poured out into the substance of the decidua serotina or vera, or into the chorion. Blood-clot may also accumulate

in the decidual cavity—that is to say, in the space between the decidua vera and reflexa—and the ovum thus becomes converted into a firm, thick-walled, fleshy mass. The amniotic cavity shrinks, and the embryo, which has died, generally entirely disappears or is represented merely by a small knob or projection. Looked at from the interior, the walls of the amniotic sac present numerous rounded bosses which are due to extravasated blood, and it occasionally happens that the blood bursts through the amnion and distends its cavity. The blood extravasations, which lead to the formation of a carneous mole, may be due to previous morbid conditions of the endometrium or to partial separation of the ovum as the result of uterine contractions.

3044.—An ovum which was separated from the uterus in an abortion about the middle period of gestation. Its substance is unnaturally firm, and its foetal surface is deeply and irregularly lobed.

3045.—An ovum which was expelled in an abortion. The decidua and chorion together form a tough, thin, coarsely granulated layer. In the place of the placenta there appear only two distinct round masses, apparently of some firm substance, which project into the cavity of the amnion. The umbilical cord is small. The embryo is nearly two inches long, and well formed, but all its parts appear united as if by thickening of its amniotic covering.

Tubal Gestation.

An ovum may be impregnated and arrested in any part of the tube. In all cases when the gestation is extra-uterine, it appears to be tubal, and there is no satisfactory evidence of the occurrence of primary ovarian or abdominal pregnancy. When the impregnated ovum develops in that part of the tube which runs through the thickness of the uterine wall it is called *tubo-uterine*, or *interstitial*; when it develops close to the abdominal ostium it is called *tubo-ovarian*, and when in any intermediate part it is called simply tubal.

Little is known about the cause of tubal gestation, but it seems to be unusually frequent in women who have remained sterile for some years, and it has been suggested that some morbid condition of the tube resulting from a mild degree of salpingitis predisposes to its occurrence.

Changes in the Tube.—At the point where the developing ovum is arrested, the tube undergoes a transitory thickening, but this seems to be due to increased vascularity rather than to any actual hypertrophy of the muscular fibres. This is speedily followed by stretching and thinning both of the mucous and muscular walls of the tube. No decidua is formed in the tube. If the ovum is situated in the outer third of the tube, the abdominal ostium becomes gradually closed, and this process is completed by the end of the eighth week, unless the tube ruptures before this date. In all cases where the ovum continues to grow, the tube ultimately ruptures, and this rupture may occur either into the peritoneal cavity or in between the layers of the broad ligament. This rupture, which occurs for the most part between the fifth and tenth week, is generally due partly to distension by the growing ovum, and partly to absorption of the walls of the tube by the chorionic villi. Sometimes sudden hæmorrhage into the tube from partial detachment of the ovum may be the immediate cause of rupture. In some cases the ovum becomes detached, and this detachment may cause hæmorrhage, or the detachment may be the result of hæmorrhage. If the ovum lies in the outer part of the tube, and the abdominal ostium is not yet closed, it may be expelled through this aperture into the peritoneal cavity (*tubal abortion*). In other cases the ovum becomes surrounded by layers of blood-clot, and thus becomes converted into what is called a *tubal mole*, or apoplectiform ovum. This mass, consisting of a withered ovum surrounded by laminated clot, may be subsequently discharged through the orifice of the tube into the peritoneal cavity, and to this

also the term 'tubal abortion' is applied. Such a mole may be retained in the tube, and often excites bleeding, and the blood poured out may escape into the abdominal cavity, or may be retained in and distend the tube. In all cases where the primary rupture of the tube is into the peritoneal cavity the ovum dies. If the hæmorrhage is not fatal to the mother, the blood poured out through the rent accumulates in the cavity of the pelvis and becomes encysted from inflammation and adhesion of the adjacent coils of intestine. A collection of blood encysted in the pelvic peritoneal cavity is called a *pelvic hæmatocele*.

3072.—Portion of a broad ligament of a uterus with the Fallopian tube and ovary. In the middle of its course the Fallopian tube is distended by the development of an embryo within it. On the surface of this part there is a small irregular aperture through which fatal hæmorrhage into the abdomen took place. The ovary is large; at its lower part is a very large corpus luteum with a central cavity.

2940.—The right Fallopian tube and adjacent portion of the uterus, showing a tubal mole. The outer third of the tube is dilated into a globular cyst the size of a walnut, the cavity of which is chiefly filled with recent blood-clot. On the anterior aspect of the cyst are two small recently-formed irregular openings. The patient died with symptoms of internal hæmorrhage, and at the post-mortem examination five pints of blood were found in the peritoneal cavity.

3072c (in first gallery in flat case). — A uterus, ovaries and Fallopian tubes from a case of tubal pregnancy which terminated fatally about the end of the second month. The cyst containing the fœtus has formed in the ampulla of the right tube, so that it lies in the pouch of Douglas. The cyst has ruptured, and a hæmatocele has thus been formed in the recto-uterine cavity, which has pushed the uterus forwards. The hæmatocele was enclosed above by the adhesion of the intestines. The right ovary is seen intact. The right tube has been laid open; it is much dilated and convoluted for two inches beyond the cyst. A red glass rod has been pushed into its fimbriated extremity. The half

of the cyst, which has been divided to show the included foetus, is seen lying by the side of the specimen.

Changes in the Uterus.—In cases of tubal gestation the uterus becomes hypertrophied and the mucous membrane swollen and thickened, so that a decidua is formed. If the tube ruptures, or if hæmorrhage occurs into the tube around the ovum, this decidua is separated, and bleeding from the uterus results. The decidua may be thrown off entire, or else expelled piecemeal.

3071.—A specimen of ruptured tubal gestation. Rupture took place in the seventh week of gestation, and caused death from hæmorrhage. The middle of the right Fallopian tube is dilated into a sac which contains the foetus and its membranes. In one side of this sac is a small lacerated opening through which the flocculent chorion protrudes. From this opening a gallon of blood was discharged into the cavity of the abdomen. On its other side a large portion of the sac has been removed to display the foetus and membranes. The right ovary contains a large corpus luteum; there is also a large cyst of this ovary which contained a watery fluid. The cavity of the uterus is lined throughout by a perfect and thick decidua.

The tube may rupture between the layers of the broad ligament, and the ovum may then also die. Blood is poured out into the connective tissue, and the layers of the broad ligament are separated. A collection of blood situated between the layers of the broad ligament is called a *pelvic hæmatoma*.

In some cases, however, when rupture takes place into the space between the layers of the broad ligament, the ovum still continues to grow. If the placenta is situated below the embryo, the former becomes displaced downwards until it reaches the pelvic floor. If the placenta lies above the embryo, the latter burrows between the layers of the broad ligament, and the placenta is pushed high up into the abdomen. The villi are well formed, and decidual cells are

seen in the spaces between them. The tubal mucous membrane takes no share in the formation of the placenta. Owing to the displacement to which the placenta is subjected, the villi become compressed, and its functions are seriously interfered with. The damage to the placenta is greater when it lies above the embryo than when it lies below it. Various accidents may happen to a gestation sac developing between the layers of the broad ligament: (1) The placenta may be partially separated. As a result of this, hæmorrhage occurs into the sac, or the blood poured out may burst through the sac and escape into the peritoneal cavity. (2) The sac may rupture. If the placenta lies below the foetus, the peritoneum forming the roof of the sac may finally give way, and the foetus, either free or enclosed in its amniotic sac, will then be found lying among the intestines. This is called *secondary intraperitoneal rupture*, and in spite of its occurrence the foetus may continue to live and develop. If the placenta lies above, it may be involved in the tear, in which case fatal hæmorrhage generally occurs. (3) The foetus may die from damage done to the placenta. As a result of this the sac generally suppurates, and may open either externally or into the rectum or bladder. Sometimes the sac shrinks, and the foetus becomes mummified; and if lime salts are deposited in its substance it will become converted into a *lithopædion*.

If the foetus reaches full term without rupture of the sac, spurious labour ensues. Shortly after the foetus dies, and this is generally followed by suppuration of the sac.

3077c.—The contents of the pelvis from a case of extra-uterine gestation where abdominal section had been unsuccessfully performed. The right half of the bladder and vagina have been removed, and the sac has been opened, above which the foetus is suspended. The sac is situated in the right broad ligament, and occupies the right half of the pelvic cavity, pushing the uterus to the left side. On the left the ovary, round ligament, and Fallopian tube are easily traced. The Fallopian tube is thickened, and its

peritoneal orifice is closed. On section its mucous membrane is seen to be partially destroyed by inflammation. The round ligament on the right side can be traced, as also can the uterine end of the Fallopian tube; immediately behind this, rupture of the sac occurred. The sac has been divided mesially, and beneath it, in the line of section, is seen the left ovary, enclosed in a pouch of peritoneum, to which it is loosely adherent. It contains a corpus luteum. Masses of blood-clot are also seen in the loose connective tissue beneath the sac. From a patient aged 32, married eleven years without any previous pregnancy. This, the first, had reached the early part of the fourth month.

Tubo-uterine or Interstitial Pregnancy.

This variety of tubal pregnancy requires some additional remarks. As above mentioned, the ovum develops in that part of the tube which runs through the thickness of the uterine wall, so that the walls of the gestation sac are formed by the uterine muscle. The uterine substance forming the walls of the gestation sac hypertrophies, so that rupture occurs later than in other forms of tubal gestation, sometimes being delayed until the end of the fourth month. Rupture may occur into the peritoneal cavity or into the cavity of the uterus. In the former case the patient generally dies from hæmorrhage, but in the latter case the foetus may be expelled through the natural passages, and the patient recover. Pregnancy never reaches full term in these cases.

3075.—An extra-uterine foetation, apparently interstitial. Sudden death occurred from rupture of the cyst.

Cornual Pregnancy.

The uterus is formed by the development and fusion of the two Müllerian ducts. Sometimes only one of these ducts develops, and the other one, which should have formed part of the uterus, is represented by a small hollow tube opening into the uterine cavity. Such a malformed uterus is called *uterus unicornis*. Pregnancy may occur in

this undeveloped or rudimentary horn, and in such a case gestation may go on to full term, or rupture may take place any time after the second month. In cases of cornual pregnancy the round ligament is found to be inserted on the outer side of the sac, and, in cases of tubal pregnancy, on the inner side of the sac. If the sac does not rupture, the foetus becomes mummified.

3078.—From a case in which death occurred in the third month of gestation. The left horn, which contained the foetus, is dilated into a sac. On one side of this sac is a lacerated opening, through which the foetus escaped into the cavity of the abdomen, and to the edges of which the membranes of the foetus remained attached. The left ovary contains a corpus luteum. The cavity of the right uterine horn is lined with decidua.

SECTION XXVI.

RUPTURES OF THE GENITAL CANAL.

ANY part of the genital canal may be ruptured during parturition.

Rupture of the Uterus.

During labour the upper part of the uterus contracts and the lower part dilates. The lower portion of the uterus thus becomes continuous with the dilated cervical canal, and no sharp line of demarcation between the two is visible to the naked eye. If there is any obstruction to the expulsion of the child, the lower passive dilating portion of the uterus becomes progressively thinner and thinner, while the upper active part becomes shorter and thicker. Under these circumstances a well-defined ridge exists at the line of junction of the upper and lower uterine segments, to which has been given the name of the 'retraction ridge,' or 'ring of Bandl.' In almost all cases of rupture of the uterus the tear commences in the lower uterine segment, though it may extend thence upwards into the uterus, or downwards into the cervix. Rupture of the uterus may be due to: (1) Abnormal stretching and thinning of the lower uterine segment, which is generally the result of contracted pelvis, shoulder presentation, or hydrocephalus; or (2) abnormal weakness of the uterine tissues. This unusual degree of vulnerability of uterine tissue is seen chiefly in women who have borne many children at short intervals.

The presence of fibroids in the uterine wall or a previous Cæsarean section may also cause it.

The tear may be transverse or longitudinal in direction, and may be situated on the anterior or posterior wall or at the side. Owing to the obliquity of the uterus towards the right, the tear is most often met with on the left side. This tear generally involves the peritoneal coat as well as the muscular wall, a ragged lacerated wound resulting. Sometimes the muscular wall alone is torn through, and then blood is poured out beneath the peritoneum and strips it up. Owing to the pressure exerted by the blood, the peritoneum may subsequently give way. Ruptures of the uterus have been described as complete or incomplete, according as the peritoneum is or is not torn through at the same time as the muscular wall.

3081.—A uterus showing a transverse laceration of the lower uterine segment. The laceration involves nearly two-thirds of the circumference, and occurred during parturition. The child was born with hydrocephalus. Death ensued shortly after the rupture of the uterus.

Lacerations of the Vaginal Portion of the Cervix.

Slight tears in this situation are extremely common. They are commonest on the left side, but both sides may be torn. The tear may extend up to or beyond the vaginal junction, though it generally stops short of it. The tear is nearly always longitudinal in direction, but transverse tears have been observed in the anterior lip.

Lacerations of the Vagina.

Lacerations commencing in the uterus may extend downwards and involve the vagina. Independent tears may, however, occur in the vagina from contraction of the pelvis or the careless use of instruments. Such tears are generally transverse in direction, and involve the posterior vaginal

wall. The posterior margin of the vaginal orifice is always torn through at the first full-time labour; such lacerations are longitudinal in direction.

3082.—A semicircular laceration is seen passing across the posterior surface of the vagina near the cervix uteri.

3083.—A uterus and vagina. During parturition the vagina was torn through half its circumference, close to the part connected with the uterus. The body of the uterus presents many peritoneal sulci.

Laceration of the Perineum.

It is important to note that the term 'perineum' is often used indifferently to mean the perineal body and the skin covering its base. The perineal body is a mass of tissue, pyramidal in shape, which fills in the space between the rectum behind and the lower part of the vagina in front. It consists of muscular insertions and fibrous tissue. Lacerations of the perineum generally commence as tears of the vaginal orifice. This tear, which is nearly always in the middle line, though occasionally it is oblique, varies greatly in extent, and is due to transverse strain. During the expulsion of the head the perineum is greatly elongated antero-posteriorly, so that the distance from the anus to the anterior margin or fourchette, which generally measures about an inch, may be increased to as much as six inches. As the result of this longitudinal strain, central rupture of the perineum may take place. The skin of the perineum may alone give way, but in other cases a complete perforating rupture may occur, through which the child may be born. A bridge of skin may then separate the rupture from the vulva. An ordinary (or peripheral) and central perineal laceration may occur in the same patient. Central rupture hardly ever occurs, except in primiparæ.

3086.—Specimen showing laceration of the perineum nearly to the anal margin.

SECTION XXVII.

CONTRACTED Pelves.

SOME forms of contracted pelvis are comparatively common, others are extremely rare. Of the commoner forms we have :

1. *The Generally-Contracted Pelvis.*

In this form of pelvis all the diameters are uniformly diminished. Two varieties of generally-contracted pelvis may be distinguished—(a) the child-like or juvenile, and (b) the dwarfish. The child-like variety is due to arrest of development, and is sometimes found associated with imperfect development or absence of uterus and ovaries. The sacrum is narrow, and the alæ imperfectly developed; its antero-posterior curvature is lessened, and the pubic arch is not fully expanded. The dwarfish pelvis is of the ordinary feminine type, but small, like all other parts of the patient's skeleton.

3109. A generally-contracted female pelvis. Conjugate, $3\frac{1}{2}$ inches; transverse, $4\frac{1}{4}$ inches.

2. *The Simple Flat Pelvis.*

This is the commonest form of contracted pelvis. The antero-posterior diameter of the brim or conjugate is alone diminished, the other diameters remaining unaltered. Two varieties are recognised—(a) the non-rachitic, and (b) the rachitic. The non-rachitic flat pelvis is probably due to

carrying heavy weights in childhood, or to increased pelvic inclination. The whole sacrum sinks downwards and inwards, so that the antero-posterior diameters of the pelvis are lessened throughout the entire length of the cavity. The pelvis presents none of the other signs of rickets. The flat rachitic pelvis is a small shallow pelvis with a relatively narrow inlet and a relatively wide outlet. The promontory of the sacrum sinks more deeply inwards, and is rotated somewhat forwards, so that the anterior surface of the sacrum looks more directly downwards than usual. The shape of the brim is generally reniform, though occasionally it is elliptical. The distance between the tuberosities of the ischia is increased and the pubic arch is widened. The iliac fossæ look more directly forwards, and the distance between the iliac spines is greater than that between the crests. The bones of the pelvis are small and thin, the ileo-pectineal line well marked, and prominent ridges are seen at the points of muscular attachment. The inclination of the pelvis is generally less than normal.

3103.—A flat non-rachitic pelvis, contracted only in a slight degree in the conjugate diameter. Conjugate, $3\frac{3}{4}$ inches; transverse, $5\frac{3}{4}$ inches.

3129a.—A rickety pelvis, showing a high degree of antero-posterior contraction. There is scoliosis to the left. Conjugate, $1\frac{3}{4}$ inches; transverse, 5 inches.

3. *The Generally-Contracted Flat Pelvis.*

In this case all the diameters of the pelvis are diminished, but the antero-posterior diameter is diminished out of proportion to the others. It is generally the result of rickets.

3118.—A cast of a generally contracted flat pelvis. Conjugate, 1 inch; transverse, $4\frac{3}{4}$ inches.

Rarer Forms of Contracted Pelvis.

4. *The Obliquely-Contracted Pelvis.*

Three varieties of obliquely-contracted pelvis are recognised: (a) Naegele pelvis, (b) scoliotic pelvis, (c) pelvis

where the obliquity is due to disuse or shortness of one leg.

The Naegele pelvis is due to the defective development of one wing of the sacrum and ankylosis of the corresponding sacro-iliac joint. The acetabulum on the affected side is pushed inwards and the pubes displaced to the opposite side. On the affected side the pelvis is elevated and the ilium short and thick. The anterior face of the sacrum looks towards the affected side. The tuberosity of the ischium is pushed in on the affected side, and the pubic arch is narrowed. The oblique diameter measured from the unaffected sacro-iliac synchondrosis is diminished, and the other oblique diameter is increased.

3126a.—An oblique pelvis of Naegele, with the fourth and fifth lumbar vertebræ attached. The synostosis is on the right side of the pelvis, which is flattened, and the symphysis pubis is opposite the middle of the left ala of the sacrum. The right ala of the sacrum is imperfectly developed. The right ilium is united to the three upper segments of the sacrum, corresponding to the normal articulation on the left side. There is no sign of a joint below or in front, but above and posteriorly the line of junction is distinct.

3126.—A cast of an oblique pelvis of Naegele.

The scoliotic oblique pelvis is due to lateral curvature of the spinal column. The convexity of the dorsal curve is generally to the right, and therefore the convexity of the lumbar curve looks to the left. Under these circumstances a greater proportion of the body-weight is transmitted to the left leg than to the right. The acetabulum on the over-weighted side is pushed inwards, and the symphysis pubis is displaced to the right. The pelvic brim is elevated on the over-weighted side, and the wings of the sacrum and ilium are thickened on the same side. There is often some flattening.

272 (case on ground-floor).—A specimen of scoliotic oblique pelvis.

If one hip-joint is ankylosed in a position of considerable flexion, the function of the leg on that side may be destroyed. The sound leg is thus overweighted and obliquity produced. The acetabulum on the sound side is thrust inwards.

3132.—A cast of a pelvis with an ankylosed right hip-joint.

If one leg is shorter than the other the body weight is displaced towards that side. The shortened leg is overweighted, and obliquity of the pelvis results.

5. *The Transversely-Contracted Pelvis.*

Four varieties are met with : (a) the funnel-shaped pelvis, (b) the pelvis of Robert, (c) the kyphotic pelvis, and (d) the spondylolisthetic pelvis.

The funnel-shaped pelvis is very rare, and the causes which produce it are imperfectly understood. There is progressive narrowing from the inlet to the outlet. The contraction is most marked in the transverse diameter. The tuberosities and spines of the ischia are approximated, and the pubic angle is lessened.

3123.—A funnel-shaped pelvis, the outlet being small.

The pelvis of Robert is very rare. There is defective development of both wings of the sacrum, and ankylosis of the sacro-iliac joints. The sacrum is very narrow and deeply pressed between the innominate bones. The transverse contraction of the pelvis is highly marked.

3124.—A transversely-contracted pelvis of Robert.

The kyphotic pelvis is due to antero-posterior curvature of the spinal column (kyphosis), following caries of the body of the vertebræ. The changes in the pelvis are most marked when the caries involves the lumbar spine. If the kyphosis occurs in the dorsal region it may be compensated by a lumbar lordosis, so that no pelvic deformity results.

Owing to the body-weight being thrown forwards, the pelvis is tilted, so that the plane of the pelvic brim may be nearly horizontal, instead of being inclined at an angle of 60° . The tubera ischii are driven inwards, and the pubic arch is narrowed. The upper part of the sacrum is driven backwards, and its longitudinal concavity diminished. The transverse diameter is diminished, especially at the outlet.

1113 (case on ground-floor).—A spinal column and pelvis, showing kyphosis and the resulting changes in the pelvis.

In the spondylolisthetic pelvis there is dislocation of the last lumbar vertebra forwards on the sacrum. The other lumbar vertebræ come forward with it. It is generally due to injury at an early period of life. Owing to the body-weight being displaced forwards, the inclination of the pelvis is diminished. The tuberosities and spines of the ischia are driven inwards, and the transverse diameter of the pelvis becomes diminished, especially at the outlet.

3130.—Spondylolisthesis. The lowest lumbar vertebra is dislocated forwards on the sacrum and encroaches on the brim.

6. *The Crumpled-up Pelvis.*

This form of pelvis is generally due to the disease known as osteo-malacia. It may sometimes follow on severe rickets. We may, therefore, describe two varieties: (a) the malacosteon pelvis, and (b) the pseudo-malacosteon pelvis.

Osteo-malacia, or mollities ossium, is a disease much more often met with in females than in males. Repeated pregnancies, insufficient food, and bad hygienic surroundings predispose to it. It is a form of osteo-myelitis. The periosteum is thickened, the medullary tissue soft, the lime salts are absorbed, and the bones become light, porous and soft. All the bones of the skeleton may be affected, but the most advanced changes are generally seen in the pelvis and spine.

The acetabula and tubera ischii are driven inwards, and bending takes place at the junction of the pubes and ischium. The sides of the pubic arch are approximated, and the sacrum sinks inwards. The iliac crests are folded in. Owing to the bending which occurs at the junction of the pubes and ischium, the pelvis has a beaked shape. The pelvic cavity in advanced cases may be nearly obliterated.

3117a.—A malacosteon pelvis. The pelvis is extremely light, and the bones are very porous.

3116.—A cast of a pelvis deformed by mollities ossium.

In the pseudo-malacosteon pelvis the deformity produced is very similar to that which results from osteo-malacia. There are, however, signs of rickets in other parts of the body, and the iliac fossæ look forwards instead of being folded up.

7. *Pelvis of Hip-joint Dislocation.*

Generally congenital and double. It is due to faulty development of the acetabula, the heads of the femora being displaced backwards. The pelvic inclination is increased, and, as a result, there is transverse widening, often associated with slight antero-posterior contraction.

1050 (case on ground-floor).—A pelvis of double dislocation of the hips.

8. *Tumours of the Pelvis.*

Multiple exostosis may affect the pelvic bones and project into the pelvis. Osteo-sarcomata are also met with in very rare cases. They generally grow from the sacrum.

3134.—A pelvis with an exostosis projecting from the promontory of the sacrum. The pelvis is generally contracted.

3135.—A pelvis with a large exostosis projecting from the anterior surface of the sacrum and nearly filling the cavity.

9. *The Cleft Pelvis.*

This results from a failure of development, and is generally associated with ectopia vesicæ and imperfect development of the organs of generation. The pubic bones are united by a fibrous band. The pelvis is generally wide and slightly flattened.

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