accompanying neuralgia, by the absence of itching and discharge, and by the vesicles, unlike those of eczema, showing no tendency to spontaneous rupture.

It differs from simple herpes by its unilateral distribution, by the pain which precedes and accompanies the eruption, and by the infrequency of second attacks. Simple herpes is most apt to occur about the mouth and upon the genitalia, regions seldom invaded by zoster.

Prognosis.—The prognosis is in most case favorable, the disease usually terminating in from ten days to three weeks. In severe attacks, however, or when ulceration, deep-seated inflammation, or gangrene occurs, the duration may be greatly prolonged beyond the usual period. In elderly subjects, who are scattered here in the young, persistent neuralgia of a severe type may follow, lasting for months or years. In exceptionally severe cases of ophthalmic zoster disfiguring, scarring, loss of an eye, and even death may result.

Treatment.—In mild cases of herpes zoster only the simplest treatment is required. The vesicles should be protected from the friction of the clothing by covering them with two or three thicknesses of gauze or a thin layer of absorbent cotton, having first freely applied a simple dusting powder, such as equal parts of starch and oxide of zinc, to which, if there is burning or pain, camphor or morphine may be added. Internal remedies administered with the view of aborting or controlling the eruption are of more than doubtful efficacy. Phosphide of zinc, in doses of from one-sixth to one-third of a grain given every three hours, is recommended by Thompson and Bulkley for the relief of the pain and the control of the eruption, but other observers have not found it reliable. In cases in which the pain is severe, antipyrin, phenacetin, or acetanilid may be given in doses of from five to eight grains every three or four hours; when these fail to afford relief morphine, given hypodermatically, may be employed. Locally frequent application of ninety-five-per-cent. alcohol is often very useful; or, instead of simple alcohol, alcoholic solutions of resorcin fifteen grains to the ounce, or a solution of carbolic acid five to ten grains to the ounce, or of menthol ten grains to the ounce, may be used. Such lotions should be mopped on gently every three or four hours with a soft cloth, care being taken not to rupture the vesicles. Duhring specially recommends a lotion containing from twenty to sixty grains each of sulphate of zinc and sulphide of potassium to the ounce of water; he finds it very useful in relieving pain and drying up the eruption. Collodion, either alone or with one or two grains of morphine to the ounce added, may be painted over the eruption for the purpose of favoring its absorption and alleviating the pain. For the relief of persistent neuralgia, galvanism is perhaps the most useful remedy, mild currents being more useful than strong ones. Crocker finds repeated blistering over the root of the affected nerve very efficacious in some cases. An abundance of easily digested, nutritious food, and cod-liver oil are also indicated.

Milton B. Hartzell.

HESPERIDIN. See *Citrus.*

HETOCRESOL; HETOFORM; HETOL.—*Hetocresol* or cinnamyl-meta-cresol, *Hetoform* or bismuth cinnamate, and *Hetol* or sodium cinnamate are remedies introduced for the treatment of tuberculosis. *W. A. Bastedo.*

HEXAMETHYLENE-TETRAMINE. See *Urotropin.*

HIGHLAND SPRINGS.—Lake County, California.
Post-Office.—Highland Springs. Hotel and cottages.
These excellent springs are found within the edge of the mountains, about four miles from Kelseyville and seven miles from Lakeport. They are reached by the Southern Pacific Railroad, on the south to Calistoga, and thence by stage; also by the Northern Pacific road on the southwest to Cloverdale, and thence by stage. The drive from Calistoga or Cloverdale is exceedingly picturesque. The road leads through a romantic mountain region until an

elevation of 3,200 feet is gained. Here a grand panorama is revealed. As far as the eye can reach in every direction are mountains and valleys, peaks upon peaks, mountain streams and brooks, forest and shrubbery. The most picturesque of all is the view northward over Clear Lake and Lake County. This is a magnificent sheet of water twenty-five miles long and six to eight miles wide. It has an elevation of 1,200 feet above the Pacific Ocean, and lies peacefully smiling in the embrace of the mountains on every side, with the towering head of "Uncle Sam" above them all. The bright, cultivated fields appear like a checker-board in the valley below. The gigantic oaks, the largest in the State, are scattered here and there to lend variety to the enchanting picture. The descent to the springs is made in much less than half the time it takes to make the ascent, and the resort is soon seen lying in a level sequestered spot surrounded by hills and by trees of many years' growth. At Highland we find a commodious hotel and many elegant cottages built with a view to health and pleasure combined. A large, pure mountain stream which is well supplied with fish runs past the hotel. The usual mild, genial climate of Lake County prevails here. The altitude is about 1,700 feet, and it is claimed to be an excellent place for consumptives. There are about twenty springs at Highland, five of the most important having been examined by Anderson in 1888. These analyses show results practically identical with those of Professor Rising in 1882, except in the case of the "Neptune" spring, which seems to have lost greatly, especially in calcium salt, in the course of six years. The principal springs are the "Magic," the "Neptune," the "Seltzer," the "Dutch" or "Ems," and the "Diana" spring. The waters are chiefly of the alkaline-saline type, most of them containing a well-marked proportion of iron. Following are the analyses of two of the representative springs:

THE SELTZER SPRING.

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Sodium chloride	0.67
Sodium carbonate	2.06
Sodium bicarbonate	12.72
Potassium bicarbonate	.50
Magnesium bicarbonate	33.95
Calcium bicarbonate	52.25
Manganese bicarbonate	Trace.
Ferrous carbonate	1.43
Silica	5.13
Alumina	1.75
Organic matter	Trace.
Total	110.46

Free carbonic acid gas, 98.41 grains.
Temperature of water, 60.4° F.

The water is antacid, laxative, and diuretic, and has been used with much satisfaction in dyspepsia, neuralgia, kidney and bladder troubles, calculi, etc., and in rheumatism, gout, and skin diseases.

THE "DUTCH" OR "EMS" SPRINGS.

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Sodium chloride	1.76
Sodium bicarbonate	17.50
Sodium carbonate	2.45
Potassium bicarbonate	.78
Magnesium bicarbonate	66.55
Magnesium carbonate	1.63
Calcium bicarbonate	57.32
Manganese bicarbonate	Trace.
Ferrous carbonate	1.53
Silica	7.32
Alumina	.12
Organic matter	Trace.
Total	156.86

Free carbonic acid gas, 58.90 grains.
Temperature of water 77° F.

This water is more diuretic and laxative than the Seltzer. The Highland bathing water is artificially heated.

It is also an alkaline-saline fluid with considerable carbonic acid gas and some iron. The baths are used for rheumatism and joint affections. *James K. Crook.*

HIGHLAND SPRINGS.—Androscoggin County, Maine.
Post-Office.—Lewiston. Cottages.
Highland Spring is located in Highland Park, comprising over sixty acres of elevated and wooded land, about two miles from Lewiston station. The spot offers exceptional advantages to persons wishing to camp during the summer. The waters of this spring have enjoyed a considerable reputation for a long time past. They are bottled and sold extensively for table purposes. The following analysis was made by Richard C. Stanley, Ph.D., State assayer of Maine:

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Iron carbonate	1.10
Iron oxide	.31
Potassium and sodium carbonate....	.83
Magnesium carbonate	1.23
Potassium and sodium sulphate....	.31
Sodium chloride	1.00
Total	4.78

This is an excellent, palatable water and possesses the properties of a mild ferruginous tonic.

James K. Crook.

HIP-JOINT.—The development of the pelvic limbs into organs for support and propulsion has given to the joints by which they are articulated with the trunk a peculiar character of strength and solidity. While movement is free in every direction, and the femur can be circumducted as well as rotated, yet these movements are much less extensive than at the shoulder. The head of the distal bone is more completely enclosed, and the capsular ligament is stronger and narrower at its distal insertion, so as to offer a resistance to luxations. Besides this, certain modifications have been caused by the strain and pressure occasioned by the erect position. It would naturally be supposed that in a ball-and-socket joint the surfaces of contact would be perfectly spherical, and, indeed, the head of the femur is usually described as presenting from two-thirds to three-fourths of the surface of a sphere fitting closely the acetabular cavity. Aeby [1] and Schmid [2] have, however, shown that this is not quite correct, as there is a slight flattening of the surfaces and a thickening of their encrusting cartilages where they are subjected to the greatest pressure. This is more marked in the adult.

The liability of the articulation to disease and injury is considerable, both on account of its size and of the pressure upon the surfaces. It is therefore important to determine its precise position and relations—and this is by no means easy, as it lies buried under thick masses of muscle. In front is the reflected tendon of the ilio-psoas, a bursa (*B. subiliaca*), which sometimes communicates with the joint cavity, intervening. Above, the reflected tendon of the rectus femoris and the gluteus minimus are firmly united with the capsule (see Fig. 2645). Internally lies the pectineus above, also united with the capsule, and the obturator externus below. The tendon of this latter muscle also lies posteriorly, together with the obturator internus, the gemelli, the pyriformis, and the quadratus femoris.

All these form an immediate investment for the joint, and are themselves partially covered by a second mass composed of the tensor vaginæ femoris, the gluteus maximus and medius behind and externally, the biceps group behind, and the adductor group internally.

Over these muscles there stretches the fascia belonging to the different groups, and in several situations this notably strengthens the joint capsule, especially where the iliac fascia comes down from the ilio-psoas, where the pectineal fascia passes outward upon the capsule from the pectineus, and, externally, where a strong process

passes inward between the tensor vaginæ femoris and the rectus femoris.

The depth at which the articulation lies makes it difficult to obtain any positive knowledge as to the condition of the joint by direct manipulation, but a fairly accurate notion of its situation may be had by noting the surface
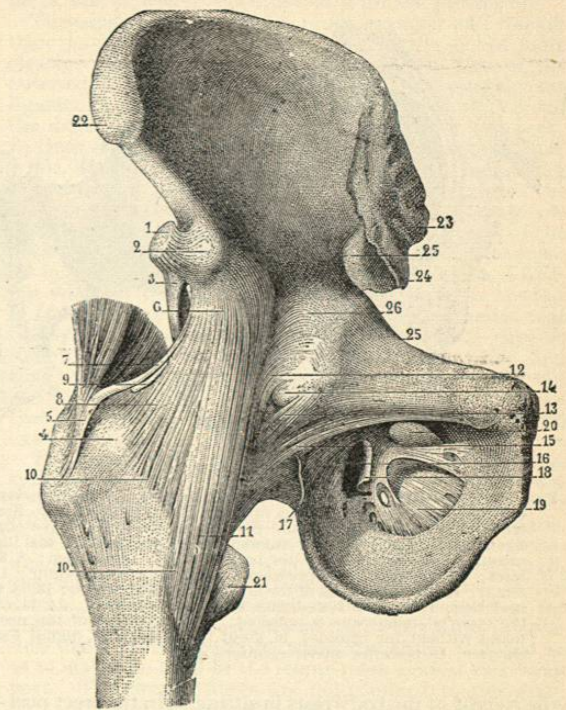

FIG. 2645.—Front View of the Hip-Joint. (From Sappey.) 1, Tendon of rectus femoris, cut; 2, its attachment to the antero-inferior iliac spine; 3, reflected portion of the tendon; 4, tubercle of the trochanter major; 5, tendon of the gluteus minimus; 6, the attachment of the ilio-femoral ligaments to the antero-inferior iliac spine; 7, fibrous union of the capsule with the tendon of the gluteus minimus; 8, superior ilio-femoral ligament; 9, section of a very thin fibrous lamella which covers over and crosses the ligament obliquely; 10, 10, thinner portion of the capsule between the two ilio-femoral bands; 11, anterior ilio-femoral ligament; 12, 13, thin portion of the capsule arising from the ilio-pectineal eminence, and from the horizontal ramus; 14, orifice in the capsule communicating with the bursa beneath the tendon of the ilio-psoas; 15, pubo-femoral ligament; 16, 17, 18, 19, fibrous bands relating to the obturator membrane; 20, the obturator foramen or subpubic canal; 21, lesser trochanter; 22, antero-superior iliac spine; 23, postero-superior iliac spine; 24, postero-inferior iliac spine; 25, ilio-pectineal line; 26, ilio-pectineal eminence.

forms and bony points of the region. As to the bones, note first the anterior superior spine of the ilium, always marked even in the fattest subjects; then the spine of the pubis, which can easily be found by abducting the thigh and then running the finger along the strong tendon of the adductor longus which starts up. Joining these two points is Poupart's ligament, which may easily be felt. The muscular prominence on the outer side of the leg is caused by the tensor vaginæ femoris, on the inner by the abductor muscles, and the triangular interval between, which reminds one distantly of the axillary space, is the *fossa subinguinalis*, or Scarpa's triangle. It is through the middle of this that the great vessels pass down the thigh, and the beating of the femoral artery, which lies nearest the joint, may be felt by pressing just below Poupart's ligament. The joint is about half an inch external to this, and in a very lean person (easier in cadaver) the head of the femur may be felt rolling under the fingers by pressing deeply here while an assistant extends and rotates the limb. This is impossible, however, when the subject is even moderately fat. A fulness and tenderness here are noted in the early stages of hip dis-

ease, when there is effusion into the joint. Pus forming around the joint is always confined, and burrows extensively along the lines of fascia above mentioned. An abscess pointing below Poupart's ligament, and external to the vessels, usually comes from the joint.

Two other bony points should be noted. First, the tuberosity of the ischium, which is the part upon which
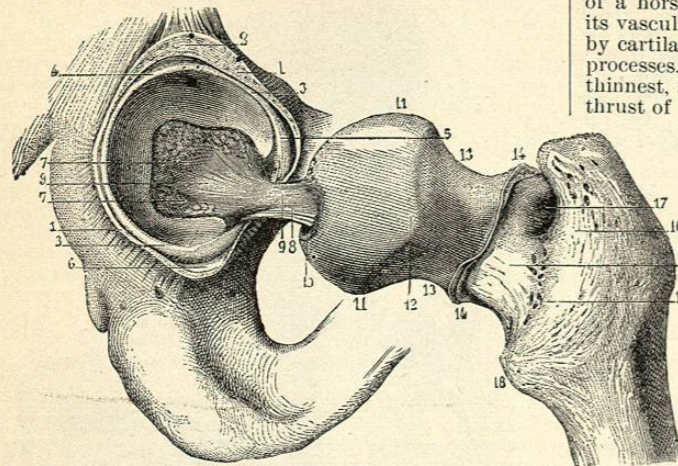

FIG. 2646.—The Hip-Joint Opened. (From Sappey.) 1, 1, Transverse section of the capsular ligament, showing its variations in thickness; 2, section at the situation where it is strengthened by the ilio-femoral bands; 3, 3, free edge of the cotyloid ligament; 4, 5, 6, semilunar interspaces which separate that ligament from the capsule; 7, 7, pad of fat at the bottom of the acetabulum; 8, 9, the ligamentum teres; 10, the umbo, or depression on the head of the femur; 11, 11, head of the femur; 12, farthest extent of the articular surface behind; 13, 13, that portion of the neck behind that is invested with synovial membrane; 14, 14, oblique line where the synovial membrane is reflected; 15, that portion of the neck behind that remains without the capsule; 16, great trochanter; 17, digital fossa; 18, lesser trochanter; 19, posterior intertrochanteric line.

the weight of the body rests in sitting. In the erect posture it is concealed by the gluteal fold behind, but may readily be made out by palpation. Second, the great trochanter, which is situated on the outer part of the upper thigh, about four inches below and behind the anterior superior iliac spine. The top of it is on a level with the pubic spine, and about three-fourths of an inch below the head of the femur. When the leg is abducted the trochanter will be found at the bottom of a depression; when adducted and rotated inward it makes a prominence. The anterior superior iliac spine, the tuberosity of the ischium, and the pubic spine are all about equally distant from the bottom of the acetabulum. A line connecting the first two is known as Nélaton's line. It grazes the great trochanter and passes directly over the middle of the acetabulum when the thigh is slightly flexed. By noting the extent of displacement of the trochanter with reference to this line, much can be made out as to dislocation or fracture. Upon rotating the femur the trochanter will be seen to describe the arc of a circle, with a radius equal to the length of the head and neck; in case of fracture the arc is much less, the bone rotating merely upon the axis of the shaft. The patient being in the recumbent position, a fracture of the neck may also be detected by noting the displacement of the trochanter toward a line dropped vertically from the anterior superior spine of the ilium (Bryant).

Of the articular surfaces the acetabulum is the more liable to disease, because it is composed of a greater variety of elements. The three primitive bones, the ilium, ischium, and pubis, which unite to make the innominate bone, all participate in the formation of the cavity. Up to the age of puberty the component bones are separated by a Y-shaped strip of cartilage. It is probably on account of the unusual activity required by the osteogenic process here that the joint is so prone to disease in childhood, hip disease rarely occurring after ossification is completed. The primitive divisions of the

cavity are still indicated in the adult by notches on the edge of the acetabulum. The lower part of the cavity is not covered with cartilage, but offers a rough depression filled in with fat and processes from the synovial membrane, in which vessels pass to supply the joint (Haversian gland) (Fig. 2646). It results from this that the part of the joint covered with cartilage has somewhat of a horseshoe shape. The lower part, both because of its vascularity and on account of its want of protection by cartilage, is usually the first attacked by inflammatory processes. It is also in this situation that the walls are thinnest, as it is necessary to buttress above against the thrust of the femur in the erect position. The thinness here explains the case with which inflammatory processes may be propagated, an arthritis giving rise to a pelvic cellulitis, and a pelvic abscess occasioning inflammation of the joint. Perforation of the acetabulum is not very common, as the pressure is but slight.

Within the pelvic cavity the situation corresponding to the acetabulum is covered in part by the obturator internus. When the perforation occurs it must therefore be in one of three positions—either upon the muscle, behind it, or in front of it. In the first instance the pus passes out with the tendon of the muscle at the lesser sciatic notch, and points upon the nates. When the perforation occurs behind, the pus goes into the ischio-rectal fossa, and discharges through the perineum or into the rectum. When it occurs in front, the pus passes upward along the sheath of the obturator vessels and makes its appearance in the groin.[3]

The acetabular cavity is not quite an inch in diameter and does not comprise an entire hemisphere. It is made up by fitting to the rim an elastic structure of fibro-cartilage called the cotyloid ligament. This is triangular on section and spans over the notch at the bottom of the cavity, being there known as the transverse ligament. The cavity thus deepened, is somewhat more than a hemisphere. The cotyloid ligament is applied closely to the surface of the femur, and helps to retain it in position—acting, however, as a valve, as it is easily stretched sufficiently to disarticulate the bones. Both the head and the neck of the femur should be regarded as taking part in the articulation, the first by actual contact, the second by its inclusion in the capsule. The
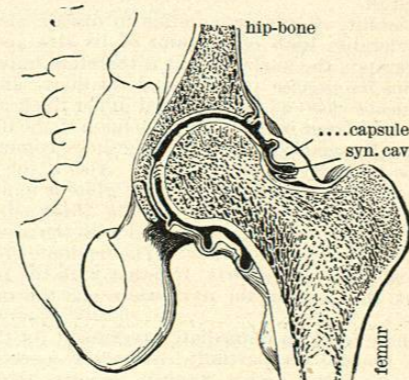

FIG. 2647.—Section through the Left Hip-Joint.

articulating surface of the head has been estimated at nine and a half square inches, and when to this is added the surface of the acetabulum and capsule, there are about twenty square inches of synovial surface subject to inflammation.[3] It is not, therefore, surprising that

the joint should be susceptible to injury. The cartilaginous covering extends farther from front to back than from side to side, indicating the direction of the greatest excursion of the articular surface. A short distance below the summit of the head, and a little nearer the posterior than the anterior surface, there is a slight depression, termed the umbo, for the insertion of the ligamentum teres (see Figs. 2646 and 2647). The neck is obliquely set upon the shaft at an angle which varies according to the age of the individual, but not so much as is generally supposed, being about an average of 131° for the child and adult, and 128° for the aged.[4] Individual variations are more pronounced, lying between 121° and 144°, or more. The angle is less in females than in males. These facts explain the greater frequency in women and aged people of fracture from shocks delivered upon the neck in a vertical direction, as the nearer the angle between the neck and the shaft is to a right angle the greater would be the shearing stress under such circumstances. The compact tissue is mainly at the lower part, where the most bracing is required. Caries, therefore, works much more rapidly upon the upper surface.[2]

An apparatus connected with the synovial membrane of the joint is the so-called ligamentum teres, or round ligament—which is not round, nor, properly speaking, a ligament, being a flattened band quite similar to the synovial processes with which it is united at both ends (see Fig. 2646). It passes from the fossa at the bottom of the acetabulum to the umbo upon the head of the femur. It does not, like interosseous ligaments, extend in the shortest direction from one bone to the other, but is in a manner rolled around the lower part of the head (Fig. 2647). It is composed of loose connective tissue and contains vessels.

Various surmises have been made as to its use. It was formerly held to be for the purpose of limiting outward rotation and adduction during flexion[5], [6], [7]. It has been shown, however, that if the capsule is left intact, these motions are more closely limited than when it is severed, and the strain comes alone upon the ligamentum teres. Tillaux[4] thinks that it tends to break shocks delivered by the femur upon the top of the acetabular cavity in jumping, etc. Sappey[8] supposes that its principal function is the protection and conveyance of vessels to nourish the head of the femur; but Hyrtl[9] finds that, upon careful injection of the arteries, only the round ligament and the fatty cushion at the bottom of the acetabulum become reddened, and that at the insertion of the round ligament upon the femoral head the capillary arteries loop back and unite with veins. An injection of the superior nutrient artery, on the contrary, fills the capillaries of the cancellous tissue of the head. This explains the well-known pathological fact that an intracapsular fracture of the femoral neck is likely to be followed by non-union of the fragments, notwithstanding that the ligamentum teres may be left intact. Langer,[10] however, finds that, in young subjects, vessels of considerable size pass through directly into the proximal epiphysis of the femur, and suggests that its function is connected with the nourishment of that epiphysis. When this becomes united, its vascular system is connected with that of the nutrient artery, and the branches received through the ligament gradually atrophy, until in old age they are almost entirely wanting.

Welcker[11] has made a careful examination of this ligament in the animal series, as well as in human embryos, and considers it a process of synovial membrane originating as a fold at the side of the articular surface, and gradually detached by the twisting of the limbs. In some animals quite near man, as the orang (occasionally also in man), it is wanting, but it may be said to be generally present when there is much differentiation of the hind limbs. In the tapir it is reduced to a process attached only at the side, a condition occasionally found in the human shoulder-joint.

One of the most interesting views as to the nature of this puzzling structure is that of Sutton,[12] who thinks it a vestige of a tendon, probably a former attachment of

the pectineus. The ambiens muscle of ostriches, homologous with the pectineus, carries its tendon into the joint to the head of the femur. In the lizard *Sphenodon*, the pectineus has two heads, one going to the femur, the other to the pubic bone, reminding one of the biceps brachialis. In the horse the ligamentum teres has two parts, one of which is continuous with the pectineus.

The capsule of the joint is much stronger and thicker than that at the shoulder, and confines the bones more closely. It is united above just beyond the base of the outer edge of the cotyloid ligament, and to the transverse ligament. Upon the femur it passes considerably beyond the articular surface, taking in a portion of the neck. In front it reaches to the anterior intertrochanteric line, while behind, because of the numerous muscles coming to be inserted into the trochanter, it does not reach the posterior line, but covers only about the inner two-thirds of the neck. It follows from this that all fractures of the neck are intracapsular in front, that they are intracapsular in front and behind when situated at the internal half, but when at the external half they may be intracapsular in front and extracapsular behind. Tillaux[4] notes that the synovial membrane is reflected within the capsule somewhat in advance of the fibres of the capsule, and shows that a fracture might be intracapsular and still not involve the synovial membrane. He therefore proposes that the fractures of the neck be divided into intra- and extra-articular.

The innermost layer of the capsule, not including the synovial membrane, is a thin layer of circular fibres. These become more apparent behind and at the lower part, where they are known as the zona orbicularis. This is the weakest part of the capsule, and, consequently, the point where pus usually bursts through, and where spontaneous dislocation takes place in hip disease. A blow on the great trochanter forcing the head of the bone downward and backward is apt to occasion dislocation, especially when the thigh is flexed so as to make the head of the femur press against this weak part. The circular fibres are not confined to this spot, but are found intermingling with others in all parts of the capsule. They undoubtedly exercise a restraining influence against dislocation of the bone by constricting the capsule at its femoral insertion.

In those situations where special stress occurs, longitudinal bundles of considerable strength have been formed upon the surface of the capsule. These form four tolerably distinct bands. Two of these are caused by the necessity of supporting the trunk in the erect position. These pass from the anterior inferior spine of the ilium downward, diverging from each other like the branches of an inverted Y (ʎ), one going to the base of the trochanter major, the other to just above the trochanter minor. They have usually been described collectively as the ilio-femoral ligament, ligament of Bertin, or Y ligament of Bigelow. Welcker[11] has, however, suggested that, as the two bands are distinct and perform different physiological functions, they should receive separate names, and proposes to call them the superior and anterior ilio-femoral ligaments. They are both exceedingly strong. It is because of this that, in the barbarous punishment of "drawing" a criminal, by means of four horses attached to his limbs and proceeding in opposite directions, the separation at the hip-joint had usually to be completed with a knife, the ligaments resisting after several hours of trial—as was the case at the execution of Ravaillac, the assassin of Henry IV., and of Damiens, who attempted the life of Louis XV.

The superior ligament is perhaps the strongest ligament in the body, being from one-fourth to one-half an inch thick (7 to 14 mm. Welcker), and stronger than the tendo Achillis. Its action is to limit the extension of the femur upon the pelvis. In the erect position the weight of the body falls behind the hip, and the pelvis is accordingly tilted backward, putting this band on the stretch, and it then sustains the whole weight of the trunk, head, and arms, a great economy of muscular force being thus effected. It also limits outward rotation and adduction.

The anterior ligament is also very strong, being nearly one-fourth of an inch thick (4 to 5 mm.), and the longest strengthening band of the capsule. It assists the superior ligament in limiting extension, but not, in the same plane, the plane of limitation for the superior ligament being nearly parallel to the axis of the femoral neck, that of the anterior with the axis of the shaft.

The two ligaments are but slightly developed before the erect position is attained. Indications of them are found early, but they increase with the growth. In animals that can stand partially erect, such as apes and some marsupials (kangaroo), the ligaments are strong; in others slight.[12]

They have an important influence in determining the deformity which results from dislocations of the femur, and may be used as a fulcrum in reducing them.[14] Thus, it is the superior ligament which holds the neck fixed, and hence causes the inward turning of the toes in dislocation backward. In thyroid dislocation the anterior ligament causes in a similar way an eversion of the toes.

Another strengthening band of the capsule is the pubo-femoral ligament, which stretches from the pectineal eminence of the pubic bone to the lesser trochanter. It is from 2 to 3 mm. thick, and limits abduction. The ischio-femoral band is of about the same size, and stretches in a similar way from the tuberosity of the ischium to the digital fossa of the great trochanter, along the line of the tendon of the obturator internus, with which it is somewhat blended. It limits rotation inward. It is sometimes described as ending upon the capsule, and therefore called ischio-capsular (Henle); but Welcker and others find the arrangement described the usual one.

The action of these four bands is such that in passing from the flexed to the extended position they wind around the neck in such a way as to shorten the capsule, which, being closely united with the zona orbicularis, is drawn up against the edge of the acetabular cavity and surrounds the lower part of the head as with a ring. It may be said that the contraction is such that dislocation is impossible in the extended position.

The brothers Weber made the discovery that the head of the femur is held in position by atmospheric pressure, the amount of weight thus lifted being somewhat greater than that of the limb. This greatly economizes the muscular force required for walking. The closely fitting cotyloid ligament assists this greatly, and dislocation is very unusual, if not entirely impossible, without injury to it. Men and animals that ascend mountains to a height where the air becomes sufficiently rarefied to be of less effect in upholding the weight of the limbs suffer from weakness in the joints. Hyrtl[9] states also that mountaineers, who have trained their muscles by long use in a rarefied atmosphere, are somewhat inexpert in the use of their legs when they descend to the valleys.

The arterial supply to the joint is, as has been stated, through the notch in the lower part of the acetabulum, some collateral circulation being imperfectly effected by means of capillary branches from the nutrient artery of the femur. The capsular ligament is remarkable for the number of vessels and nerves which ramify in it.

The joint is usually said to be supplied with nerves from the sciatic and from the obturator trunks, but recently the nervous supply has been carefully reinvestigated by Chandelux, who finds it to be as follows: In front, a twig from the musculo-cutaneous branch of the anterior crural is given off a short distance from the point where the nerve is lost in the pectineus. This passes behind the sheath of the femoral vessels, and reaches the internal half of the anterior part of the capsule. Behind there is a branch of somewhat variable origin, but always emanating either directly or indirectly from the sacral plexus. It descends upon the posterior part of the articulation, reaches the capsule behind and above, and is distributed to the internal half of the posterior portion. No nerve was found from the obturator trunk.

It is believed that this distribution explains certain phenomena connected with coxalgia. In certain forms the propulsion of the head against the acetabular cavity by percussion upon the knee is hardly felt, although a direct pressure upon the internal part of the femoral head in front is very painful, as are also forced movements of outward rotation. In this case it is supposed that there is a coxalgia of capsular origin.

Again, the characteristic attitude is also explained. Often adduction of the leg is accompanied by inward rotation, but in some patients outward rotation occurs. As the anterior articular nerve is only a bifurcation of the branch going to supply the pectineus, it may easily be imagined that a neuritis, arising perhaps from the synovial membrane, affects the pectineal branch and causes the muscle to act.

The pain in the knee, which is an almost constant symptom in hip disease, has usually been considered to be caused by the reflex action through the articular branch from the obturator nerve. It may, however, be caused by a neuritis extending to the internal saphenous nerve, or, as is more likely, by the pressure which the effusion into the joint makes upon the obturator nerve where it lies upon the anterior part of the capsule.[8]

Frank Baker.

BIBLIOGRAPHICAL REFERENCES.

[1] Aeby, Chr.: Sphäroidgelenke am Extremitätengürtel. Zeitschr. f. rat. Med., iii., R., xvi.—*Ibid.*: Die Gestalt des Femurkopfes. Med. Jahrb., pp. 75-564, Wien, 1877.
[2] Schmid, Fr.: Ueber Form und Mechanik des Hüftgelenkes. Deutsch. Zeitschr. f. Chir., v., 1, Leipzig, 1874-75.—Albert, E.: Zur Mechanik des Hüftgelenkes. Med. Jahrb., p. 105, 1876; p. 291, 1877, Wien.
[3] Clippingdale, S. D.: An Essay upon Hip-joint Disease. Med. Press and Circ., xxxiv., 436, London, 1882.
[4] Tillaux: Anatomie Topographique.
[5] Struthers: On the True Function of the Round Ligament of the Hip-joint. Lancet, February, 1863.
[6] Savory, W. S.: On the Use of the Ligamentum Teres of the Hip-joint. Jour. Anat. and Physiol., viii., 291, London, 1873-74.
[7] Morris, H.: The Ligamentum Teres and its Uses in Man and Animals. Brit. Med. Jour., ii., 1036, London, 1882.
[8] Sappey, Ph.: Anatomie Descriptive.
[9] Hyrtl, J.: Topographische Anatomie.
[10] Langer, C.: Lehrbuch der systematischen und topographischen Anatomie.
[11] Welcker, H.: Ueber das Hüftgelenk. Zeitschr. f. Anat. und Entwickgsch., i., 41; ii., 98, 231, Leipzig, 1875-76.
[12] Sutton, J. B.: The Ligamentum Teres. Jour. Anat. and Physiol., xvii., 191, London, 1882-83.
[13] Arens, F.: Beitrag zur Anatomie des Ligamentum ileo-femorale, Greifswald, 1878.
[14] Bigelow, H. J.: The Mechanism of Dislocation and Fracture of the Hip, Philadelphia, 1869.
[15] Chandelux, A.: Sur les nerfs de l'articulation coxo-femorale. Lyon médical, ii., 551, 1886.

HIP-JOINT, CONGENITAL DISLOCATION OF THE.

—Congenital dislocation of the hip-joint, or perhaps more properly misplacement, is by far the most common and the most important of this class of disability.

It is much more common in females than in males, as is illustrated by the following statistics: In 671 cases collected from different sources by Lorenz 589 (87.8 per cent.) were in females and 82 (12.2 per cent.) in males. Of 1,039 cases seen at the Polyclinic in Milan, 867 (83.4 per cent.) were in females, 172 (16.6 per cent.) in males. In 500 cases recorded at the Hospital for Ruptured and Crippled, 413 (82.6 per cent.) were in females and 87 (17.47 per cent.) in males.

The dislocation is more often unilateral than bilateral. In Lorenz's series of 671 cases, 421 (64.4 per cent.) were single; 225 of the right, 196 of the left side. In 245 cases (36.6 per cent.) the displacement was bilateral. In the statistics of the Hospital for Ruptured and Crippled 353 (71.3 per cent.) were unilateral; 135 of the right and 218 of the left side; 136 (27.87 per cent.) were bilateral.

The dislocation at the time when the patients are brought for treatment is usually posterior, upon the dorsum of the ilium. In other instances it is anterior, the head of the bone lying below the anterior superior spine. Occasionally the displacement appears to be a subluxation due to laxity of the capsule; in such cases it may be directly upward, supracotyloid. This form is more often seen in infancy, and it represents possibly the primary displacement of a much larger proportion of the total number, which changes to the ordinary form under functional use.

PATHOLOGY.—The degree of abnormality of the joint and of the surrounding parts varies with the age of the patient and with the strain and friction to which the displaced parts have been subjected. At birth it may be assumed that the head of the bone lies in close proximity to a somewhat rudimentary acetabulum. At a later time, when the joint is exposed at operation at the age of four years or more, the rudimentary acetabulum may be partly filled with cartilage, fat, and fibrous tissue. As a rule, however, a well-marked ridge indicating its posterior and upper margin can be made out and in many instances it appears to be of fair size and depth, but always misshaped to a greater or less degree, smaller and shallower than normal, and in older subjects contracted at its upper margin to a somewhat triangular form.

The capsule is elongated to accommodate the upward dislocation of the femur. It is hypertrophied, especially where it covers the upper part of the head of the bone, and it is often drawn into a shape like an hourglass; the upper part contains the head of the bone; the anterior wall is drawn tightly across the acetabulum, forming at its upper border a narrow, slit-like communication, through which the ligamentum teres passes, if it be present. The interior of the capsule is in part lined with synovial membrane, and it often contains more synovial fluid than is found in the normal joint.

The ligamentum teres, although probably present at birth in a large proportion of the cases, becomes attenuated and ribbon-like with the increasing elongation of the capsule, and after the age of five years it is usually absent or very rudimentary.

A shallow depression formed in part by the direct pressure of the head of the bone through the adherent capsule, and in part the result of irritation of the periosteum is usually found upon the ilium, but as it is not often of sufficient depth to assure a secure support for the head of the femur its upper margin usually recedes or two distinct depressions may be formed one above the other. The upper extremity of the femur is usually somewhat atrophied. The neck is often shorter than normal, its angle may be lessened and in many instances its forward inclination is increased (anteversion). The head of the bone may be nearly normal, although usually it is somewhat flattened on its inner and under surface, or it may be somewhat conical, or again compressed from side to side to assume an almond shape or otherwise distorted.

There are also secondary changes in the bones of the pelvis. In unilateral dislocation the pelvis is usually somewhat atrophied on the affected side, and a lateral inclination of the spine may be present. The final changes in the pelvis caused by the bilateral dislocation are more important; its inclination is increased, the lumbar lordosis is exaggerated, the sacrum is forced forward and downward so that the antero-posterior diameter is lessened; the tuberosities of the ischia are everted and the transverse diameter of the pelvic outlet is increased.

The long muscles of the thigh are shortened, while those attached about the trochanter are changed in direction and are usually lengthened. There is also a slight general muscular atrophy that is particularly marked on the gluteal group. The changes become more marked with increasing age, and in some of the adult specimens but little resemblance to the normal parts remains.

As a rule, congenital dislocation of the hip is not accompanied by defective development or deformity elsewhere; although cases are sometimes seen in which a general laxity of ligaments is present or in which the dislocation may be one of a series of deformities and malformations.

ETIOLOGY.—Nothing positive is known of the etiology of the dislocation. In a small proportion of the unilateral cases it may be due to violence at birth, but the fact that nearly eighty-five per cent. of the patients are females indicates that the primary cause can be neither injury nor disease.

Hereditary influence can be established in a few instances and the displacement may be present in more than one of the same family. The writer has examined three female children, in a family of nine, in each of whom there was dislocation of the left hip, the order being the third, eighth, and ninth child; also twins, one having single and the other double dislocation. In but two instances in a large number of observations, was it certain that congenital displacement was present in the mothers of the patients.

Of the various theories that have been advanced to account for the condition, the most reasonable seems to be defective development either of the entire acetabulum or of its posterior margin. This defective development may be primary or it may be secondary to a fixed position of the limb in adduction and flexion.

Heusner has endeavored to explain the greater liability of females to the dislocation by disproportionate laxity of the capsule which he thinks is characteristic of the sex. It is probable that the dislocation in many instances is at birth a subluxation only and becomes complete through muscular action and by the use of the limb in standing and walking.

FIG. 2848.—Unilateral Dislocation Showing the Inclination of the Body Toward the Shorter Limb.

SYMPTOMS.—The displacement does not as a rule attract attention until the child begins to walk; although in some cases the mother may have noticed a peculiar breadth of pelvis, or a "lump" on the buttock, or a "snapping" about the hip-joint, or a peculiar attitude of the limb before this time.

Unilateral Dislocation.—If the displacement is of one side, a limp is immediately apparent, and this becomes more noticeable as the child grows older. The limp is characteristic of the affection, for the limb is not only shorter than its fellow but owing to the laxity of the capsule it becomes still shorter when weight falls upon it. Thus in walking there is a peculiar lunge of the body toward the affected side. In most instances the dislocation is upon the dorsum of the ilium, the head of the femur being displaced upward and backward. In compensation the pelvis is tilted toward the short leg and its inclination is increased. It is also rotated forward so that the anterior superior spine lies on a lower plane, and in advance of that of the opposite side.

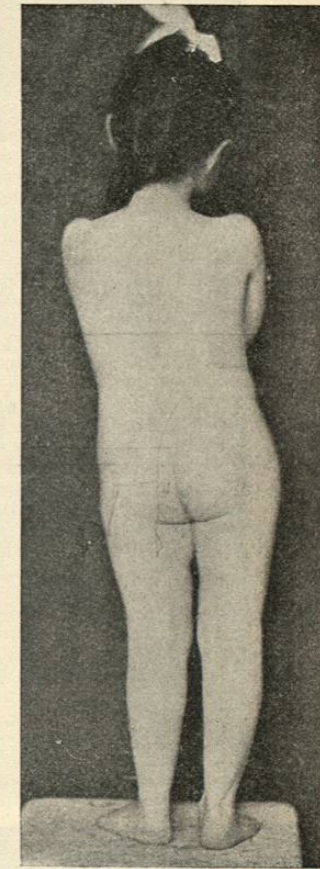When the child begins to walk the shortening of the limb is from one-half to three-quarters of an inch. In adolescence it is from one and a half to three inches or