forty degrees. It is sometimes called pronation (which turns the toes in), and supination (turning them out), but is not produced by the same mechanism as the motions of the same name in the elbow-joint. The movements of flexion and extension do not exceed an arc of one hundred and sixty degrees.

The joint is copiously supplied with vessels from the femoral, popliteal, and anterior tibial arteries. The nerves are from both the sacral and the lumbar plexuses, the former through the sciatic, the latter through the anterior crural and obturator. It is interesting to note that interference with these nerves at any part of their course, or centrally, is followed by pain in the knee. The phenomenon known as "hysterical knee-joint," in which there is pain accompanied by no lesion in the joint proper, is usually thus explained. *Frank Baker.*

KNEE-JOINT, CONGENITAL DISLOCATIONS OF. See *Hip-joint, Congenital Dislocations of.*

KNOCK-KNEE.—(Synonyms: Genu Valgum, In-Knee.) In the erect posture the femora whose upper extremities are separated by the pelvis, incline slightly inward to the knee, forming angles at this point opening outward of about one-hundred and seventy-two degrees. The angle varies with the breadth of the pelvis, and in adult females, what may be called normal genu valgum, is often present. In compensation for the inclination of the femur the internal condyle is slightly longer than the external; thus the plane of the knee-joint is horizontal.

If the inward projection of the knees is increased to deformity the tibiæ are no longer perpendicular, and in the erect posture the feet are separated when the knees are in contact. In other words, the knees are in contact when the feet are in the proper attitude for walking, hence the term knock-knee.

In the slighter grades of knock-knee, due in great part to laxity of the ligaments, the deformity appears only in

FIG. 3089.—Typical Rachitic Knock-knees.

the upright posture, but in more marked cases it persists when the weight of the body is removed because it is caused by distortion of the bones.

As has been stated, in the normal subject the inward inclination of the femur is compensated by the greater length of the internal condyle; and in the deformity of knock-knee the plane of the knee-joint is still preserved by what is apparently a further elongation of this part of the bone. In fact, it was thought at one time that the cause of knock-knee was hypertrophy of the internal condyle, but it is now generally accepted that the apparent lengthening is caused by deformity of the lower extremity of the shaft of the femur. This is bent with the convexity inward, so that the epiphyseal line has an increased obliquity. Thus it is apparent that the internal condyle is lowered by a deformity of the shaft of the femur and not by a change in the epiphysis itself.

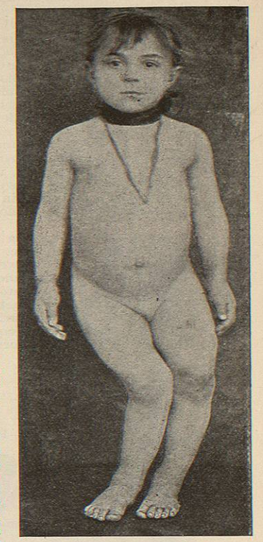

FIG. 3090.—Knock-knee and Bow-leg.

In most instances there is a similar, although usually slighter, deformity of the upper extremity of the tibia, so that when the bone is placed in the perpendicular position its internal condylar surface is higher than the external. In rather unusual cases the deformity may be confined practically to the tibia.

In addition to these direct deformities there is a more or less constant change in the relation of the two bones, the femur is rotated inward and the tibia is rotated outward. In some instances there is a certain degree of over-extension at the knee; this is more often observed in the adolescent type, which is more directly dependent upon laxity of ligaments. In the ordinary form of rachitic knock-knee in childhood, however, the typical attitude is one of slight flexion of the knees, and in well-marked cases there may be limitation of the range of extension at the knee and at the hip also.

The deformity of knock-knee is most marked when the limb is fully extended, because the shortened tissues on the outer aspect of the joint become tense and because the outward rotation of the tibia is increased. As the leg is flexed the deformity lessens, and in complete flexion it disappears. This is explained by the fact that the posterior surface of the condyles is not affected by the deformity of the shaft, while the relaxation of the ligaments and the outward rotation of the femora permit the tibiæ to become parallel with one another. Thus slight flexion at the knees, which lessens the deformity, is the attitude which is often unconsciously assumed by patients.

The outward inclination of the leg increases the strain upon the foot and tends to induce the attitude of valgus, and rachitic knock-knee in the progressive stage is almost always accompanied by flat-foot. After recovery from the local or constitutional weakness the efforts of the patient to restrain the abnormal separation of the feet may induce the opposite attitude of inversion. In fact, extreme knock-knee is usually accompanied by a slight degree of fixed varus, and in the mildest type of knock-knee this compensatory effort of nature, shown by the so called pigeon-toed walk, may be the most noticeable symptom of the deformity.

As a rule, genu valgum is bilateral, but not infrequently it is unilateral, and again unilateral knock-knee may be accompanied by outward bowing of its fellow.

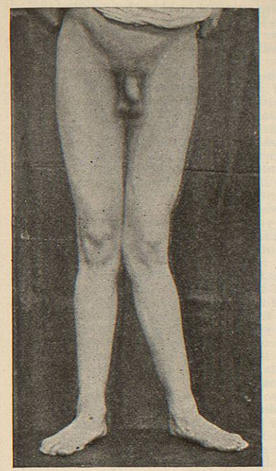

FIG. 3091.—Adolescent Knock-knee.

In the slighter degrees of rachitic deformity outward bowing of the tibia may accompany inward inclination at the knee. Thus, in-knee and bow-leg may be present in the same limb. In the marked distortions of the lower extremity that are the result of rachitis the bones may be bent and twisted in various directions. For example, the femora may be bent forward and outward, above and inward, and backward below; the tibiæ may be bent inward above and outward and forward below. This is sometimes called "cork-screw" distortion, of which the outward expression is knock-knee.

In the more extreme deformities caused by rachitis the shape as well as the contour of the bones is changed. For example, the internal border of the tibia may become very prominent at its upper extremity and project beneath the skin like an exostosis. A change in the contour of the fibula accompanies and corresponds to that of the tibia, but it is, as a rule, less marked.

PATHOLOGY.—In rachitic knock-knee, the changes in the bones and in the epiphyseal cartilages are characteristic of that disease. In the milder degrees of deformity, however, aside from the change in shape and the accompanying transformation of the internal structure of the bones, there is little that is noteworthy. The tissues on the internal aspect are relaxed, those on the outer side, the lateral ligaments, the capsule, and the biceps muscle, are contracted. Within the joint slight changes in the articulating surfaces of the bones and evidences of chronic irritation of the synovial membrane are sometimes seen.

SYMPTOMS.—The deformity and the effects of the deformity on the gait and attitude are the most important symptoms, as they are of other distortions of similar origin. The gait of the patient with well-marked genu valgum is peculiarly awkward and shambling. The knees "interfere" and must be assisted, as it were, in the effort to pass one another in walking. In the slighter cases the thigh is abducted and rotated outward at the moment of passing its fellow, the movement being then reversed, as it, in its turn, supports the weight; but in the more severe type this voluntary effort of the muscles of the leg is not sufficient, and the body is swayed from side to side, the legs being alternately swung outward and lifted past one another.

In unilateral knock-knee, the leg being shortened by the distortion, a limp replaces the swaying gait.

ETIOLOGY.—Knock-knee is a deformity characteristic of weakness. The distortion is an exaggeration of the attitude of rest, and it may be assumed that in many instances the more or less constant assumption of the passive attitude, induced probably by weakness of the supporting muscles, is the cause of the deformity, the changes in the contour and in the internal structure of the bones being simply adaptations to the habitual posture. In the great majority of the cases the direct cause of the distortion is rachitis, and it develops therefore when the erect posture is assumed. In such instances a common attitude of the weak child is slight flexion at the three joints of the lower extremity, the knees being in contact with one another. To the habitual assumption of a somewhat similar attitude is ascribed the frequency of knock-knee among adolescent and adult bakers. It is probable also that postures assumed by the weak child in sitting and creeping before it begins to walk may determine the character of the subsequent distortion when weight is thrown upon the limb. One of the explanations of combined bow-leg and knock-knee is that the child has been habitually held upon the mother's arm in a manner to induce the deformity by direct pressure. Typical knock-knee is a deformity of childhood, but under favoring circumstances it may develop in adolescence. It is probable, however, that in many of these cases a slight degree of deformity was present in childhood, which later developed to noticeable distortion. Genu valgum may be induced directly by traumatism or by disease, and it may be a secondary or compensatory effect of deformity at the hip- or ankle-joint. These causes are, however, relatively insignificant.

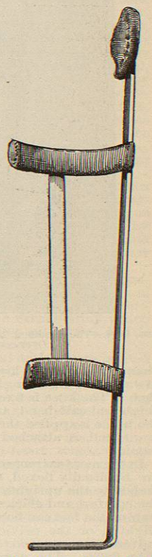

FIG. 3092.—The Thomas Knock-knee Brace.

TREATMENT.—Treatment of the deformity may be characterized as expectant, mechanical, and operative. During the expectant treatment the cause of the deformity, in most instances rachitis, should receive proper medicinal and dietetic treatment. If possible the direct exciting causes of the deformity should be removed; that is to say, the improper attitudes or the predisposing occupations should be discontinued.

In the slighter degrees of deformity, more particularly in weak or rachitic children, the limbs should be vigorously massaged at morning and at night, and forcibly straightened. The latter procedure is conducted as follows: The patient is seated in a chair; the leg is fully extended in order to make the deformity as extreme as possible; one hand then clasps the knee, the palm lying against its inner aspect; the calf is grasped firmly, and the limb is gently straightened over the fulcrum formed by the palm of the hand. This manipulation should be continued with gradually increasing force, although not to the extent of causing pain, for ten minutes, at least twice a day, and oftener if possible. This type of knock-knee, which is in itself an indication of weakness, is usually accompanied by flat-foot; thus the soles of the shoes should be made thicker on the inner border, as is described in the treatment of weak foot. If possible the patient should be instructed to walk with the feet parallel with one another, and tip-toe or other exercises in which the limbs are fully extended should be encouraged. A careful record of the deformity should be kept during this tentative treatment, and if there is some

improvement one is justified in delaying more radical measures.

There is, practically speaking, no spontaneous outgrowth of knock-knee deformity, such as is not infrequently observed in the opposite distortion of bow-leg.

Treatment by Braces.—The most efficient brace in the treatment of genu valgum is the simple straight steel bar or splint extending from the trochanter to the heel of the shoe, without joint at the knee. The greater efficacy of the rigid bar as compared with the jointed brace is explained by the fact that the rectifying force acts constantly when the joint is fixed, preventing the attitude of flexion so characteristic of the deformity.

The simplest and cheapest brace is that of Thomas (Fig. 3092), which consists of a light steel bar provided with a pad at its upper end for pressure against the trochanter, while the lower rounded extremity is turned inward at a right angle, to pass through the heel of the shoe. The knee is fixed by a posterior bar attached to a thigh and calf band, as illustrated in the figure. When the brace is applied the knee is drawn backward and outward, and is attached firmly to the brace by a roller bandage.

Fig. 3093.—The Modified Thomas Brace with Pelvic Band, showing Over-correction of Deformity.

In the more extreme cases, in which the knees and thighs are habitually flexed, the addition of a pelvic band attached to the uprights by a free joint at the hips, adds to the comfort and efficiency of the apparatus, as the attitude of the feet can be regulated by twisting the uprights slightly, or the pelvic band may be divided, the two halves being attached to one another by straps and buckles (Fig. 3093). The uprights may be bent somewhat inward at first, and as the legs become straighter they are straightened and finally bent outward to allow for the over-correction of the deformity. Twice a day the braces should be removed to allow massage, manipulation, and voluntary exercises of the legs. In most cases the braces are not employed at night, although the rectification of the deformity may be hastened by their constant use. It is of course evident that mechanical treatment would be more effective if the child were not allowed to stand; as a rule, however, the brace must be employed as an ambulatory appliance.

If the deformity is unilateral so that a brace is required for one leg only, the other shoe should be raised by a cork sole about three-quarters of an inch in thickness to make walking easier. Children soon become accustomed to the braces and walk easily in spite of the absence of joints.

The duration of the brace treatment depends of course upon the degree of the deformity and the age of the child; from six months to a year is the ordinary period. Cure is assured by the gradual adaptation of the parts to the new static conditions, and by the transformation of the internal structure of the bone which accompanies the rectification of the deformity. When the braces are discarded attention should be paid to the attitudes, and exercises and massage should be continued with the aim of strengthening the muscles of the limb.

If the bones are very flexible, as in deformity due directly to rachitis in young children, it may be corrected rapidly by the repeated application of plaster bandages. This method is not often employed except in dispensary practice.

Operative Treatment.—Immediate correction of deformity, when it is at all marked, is as a rule indicated after the age of three or four years. For although it may be possible to correct the distortion by mechanical treatment in cases far beyond this limit of age, yet the time required and the incidental discomfort exclude it from consideration in all but very exceptional cases. Immediate correction of the deformity may be attained by osteotomy or by osteoclasis.

Osteotomy.—The so-called subcutaneous osteotomy is the operation of choice. The limb having been prepared in the usual manner is semiflexed and the inner surface of the knee is placed on a sand bag. With the fingers the femur is firmly grasped just above the condyles so that the size and position may be accurately determined, and a sharp osteotome about the size of a lead pencil is forced, with its cutting edge parallel with the axis of the leg, down to the bone, at a point about one and a half inches above the tuberosity of the external condyle. While it is held firmly in position against the bone, it is turned to the transverse direction and is then driven through the cortex. When it enters the medullary canal, as is made evident by the lessened resistance, it is partly withdrawn and moved slightly to one side and the other and driven through the cortical substance, until with gentle force the bone may be fractured. The osteotome is then withdrawn, the minute wound is covered with a pad of dry gauze, or, if the oozing be profuse, it may be closed with a catgut suture. The deformity is then overcorrected by bending the cortex on the inner side and opening a wedge-shaped gap in the bone, sufficient to make the patient somewhat bow-legged when the plaster bandage is applied. If the deformity is double, both limbs are operated upon, and, in order to assure better fixation, it is the rule to apply a spica bandage, double or single as the case may be, which includes the foot as well.

The plaster bandage is continued for from four to six weeks, and it is then usually supplemented by a brace. This may be worn with advantage for several months, because of the laxity of the ligaments of the knee-joint which is usually present in this type of marked deformity of rachitic origin. In less marked cases, particularly those in older subjects, the support is unnecessary. Massage and exercises during the stage of recovery should be employed if possible.

In the more extreme cases of general rachitic deformity of the lower extremity in which the tibia is implicated, in addition to the femoral osteotomy it may be necessary to remove a cuneiform section of bone from the inner side of the tibia just below the epiphysis. In such cases it is better to perform the second operation at a later time in order that the effect of the first procedure may be observed.

Osteoclasis.—Osteoclasis by means of the Grattan osteoclast is, from the standpoint of the result, an equally efficient treatment. With this instrument the bone may be broken above the condyles at the desired point.

The adolescent type of genu valgum is not often extreme, and as a rule the distortion of the bone is comparatively slight, the deformity being exaggerated by laxity of ligaments and by the habitual attitude. In the more chronic cases osteotomy above the condyles may be performed in the manner described, but in Berlin and Vienna where the deformity is more common than in New York, other procedures are often employed.

One method is that of Wolff, who by means of the "Etappen Verband," gradually corrects the deformity.

The patient is anæsthetized, and the limb having been carefully protected with cotton, particularly about the malleoli, the patella and the inner condyle are enveloped in a firm plaster bandage reaching from the malleoli to the pubes. When the plaster begins to harden one assistant steadies the pelvis, another holds the inner condyle, while the operator draws the leg inward with moderate but persistent force against the fulcrum formed by the hand of the second assistant and holds it firmly in the partly corrected position until the bandage is hard. About three days later a wedge-shaped section of the bandage, about one inch in width, is removed from the part that covers the inner half of the knee, the other half of the bandage being simply divided. The leg is then forced inward until the two sections are again brought into contact. The position is retained by an additional plaster bandage about the weakened part. This procedure is repeated at intervals until the leg is completely straightened, a result that is often accomplished in a few weeks. No anæsthetic is required for the secondary treatment. When the deformity has been corrected the patient is allowed to walk about, and for convenience the plaster bandage is divided into a thigh and leg part, which are attached by lateral joints incorporated in the substance of the plaster, so that movement is allowed. This apparatus must be worn for several months, and is of course to be supplemented by massage and exercises.

Another means of correction of deformity without open operation is that employed by Lorenz, what he calls "Intraarticuläre modelirende Redressement." In this operation the deformity is reduced under anæsthesia at one sitting, by the gradual application of force by means of his osteoclast. The distortion is corrected partly by stretching the external ligaments and partly by straightening the bones. A plaster bandage is worn for six weeks when it is replaced by a jointed brace. As a rule, the patient is alowed to walk about in a few days after the operation. *Royal Whitman.*

KOLA (or **COLA**) **NUT.**—(*Semen Kolæ* or *Colæ; Guru* or *Gooroo Nuts; Bichy* or *Bissy Nuts; Soudan Coffee.*) The fresh or dried cotyledons of *Cola vera* Schum. or of *C. acuminata* (Beauv.) Schott. (fam. *Sterculiaceæ*). These plants are medium-sized trees of western tropical Africa, cultivated there and elsewhere in tropical regions and extensively naturalized in the West Indies. The commercial product is obtained from both cultivated and wild trees and both from the West Indies and from Africa. The seeds grow from one to three in each of the four to eight cells of a large woody capsule, the cells of which split open at maturity. The seeds possess a thick, softish testa, which is allowed to soften by partial decay for some days, when it is removed. The cotyledons, two in the first-named species, three or four in the second, constitute the whole of the kernel. This kernel is very thoroughly washed in the purest of water. If to be exported in an undried condition, those which are still entire are then enwrapped in the large leaves of a related species, and packed carefully in baskets. If kept carefully, they will remain fresh for many weeks and, thus imported, they constitute our "fresh kola." Otherwise, they are dried in the sun, when the cotyledons usually separate. There can be little doubt of the greater activity and superior properties of the undried kernels.

For native consumption, they are used entirely in the fresh condition, and are mostly caused first to enter the incipient stage of germination. Opinion differs as to whether this operation changes them only by a sweetening process, due to the conversion of some starch into sugar, or whether, as claimed by the natives, their nervine action is thus increased.

Description.—The fresh kernels are irregularly oblong, or ovoid, somewhat inclined to be bluntly angled, slightly compressed one way, usually with a slight fissure indicating the division of the cotyledon; about one to one and one-half inches long, not quite so broad and about two-thirds as thick. The surface is smoothish, somewhat granular, the color purple to brown, the texture tough-fleshy, the odor somewhat aromatic, the taste aromatic, bitterish, and astringent. In the dried condition, the above bodies are mostly separated into halves, reduced about a third in size by drying, each somewhat bent, thus becoming irregularly plano-convex, or the flat side even a little concave. The edge is thin and quite sharp, the color dark-brown, the outer surface granular, the inner smooth, the consistency hard and quite tough. They have almost no odor and the bitterness and aroma are nearly lost, the astringency being mostly retained.

Constituents.—Much effort has been bestowed upon attempts to determine the presence of constituents which can explain the remarkable statements which have been made concerning the effects of the native use of kola, but, as usual in such drugs, these constituents, if they exist, are elusive. Besides about one-tenth per cent. of volatile oil, forty per cent. of starch, and from two to four per cent. of tannin, the important constituents are alkaloidal, to the extent of about two to four per cent. A very slight amount of this alkaloid is theobromine, the remainder caffeine. About half of this caffeine exists free, the remainder combined with the tannin (*kola-tannin*) as *kolanin*. Although the latter compound is said not to be a glucoside, yet it is decomposed by a special enzyme, after the manner of glucosides in seeds. A peculiar coloring matter, *kola red*, is also yielded.

Action and Uses.—Kola is to the native of Africa what coca and maté are to the South American, and marvellous tales are told of the amount of work and fatigue that the African is enabled to endure when supported by the stimulating properties of this seed. It has been held in the greatest esteem from time immemorial, and is now looked upon almost as a necessity.

In addition to its ordinary use, it has acquired a reputation as a specific in counteracting the depressing and debilitating effects of alcoholic intoxication. Experiments have been made with it in the French army which prove that it has decided stimulating properties, but is in no sense a food.

The kola nut and its physiological action were treated in a thorough manner by Dr. Monnet in 1884, under the direction of Dr. Dujardin-Beaumetz, and an abstract of his thesis was published in the *Therapeutic Gazette* in the following year. The physiological and therapeutic actions are summed up by him in the following conclusions:

1. Kola, by virtue of the caffeine and theobromine which it contains, is a tonic of the heart, whose pulsations it accelerates, while it increases its power and regulates its contractions.

2. A second phase of its action, similar to that of digitalin, proves it to be a regulator of the pulse, which revives under its influence, the pulsations becoming fuller, and less numerous.

3. In consequence of its action upon arterial tension, diuresis is increased, and, consequently, kola can be employed to good advantage in cases of dropsy with cardiac lesion.

4. It might be deduced from observation that kola, which acts energetically upon cardiac contractions, and upon the contractility of muscles of organic life, would, on the other hand, have a paralyzing influence upon the striated muscles, when it is used in toxic doses.

5. It retards tissue metamorphosis and diminishes the