ward. A transverse curve, sometimes called Harrison's groove, passes outward from the level of the ensiform cartilage toward the axilla and may be deepened at each inspiration. It is rendered more prominent by the eversion and prominence of the costal border. The sternum projects, particularly in its lower half, forming the so-called pigeon or chicken breast. These changes in the thorax are not peculiar, however, to rickets, and are much more commonly associated with hypertrophy of the tonsils, or any trouble which interferes with the free entrance of air into the lungs. Posteriorly the spine is usually curved, the processes are prominent, and lateral curvature may be produced.

The head of a rickety child usually looks large, and the fontanelles remain open for a long time. There are areas, particularly in the parieto-occipital regions, in which ossification is imperfect; and the bone may yield to the pressure of the finger, a condition to which the term *cranio-tabes* has been given. The relation of this condition to rickets is still somewhat doubtful, as it is very often associated with syphilis—in 47 of 100 cases recently studied by George Carpenter. Coincidently with this, hyperplasia proceeds in the frontal and parietal eminences, so that these portions of the skull increase in thickness, and may form irregular bosses. In one type the skull may be large and elongated, with the top considerably flattened. In another, and perhaps more common case, the shape of the skull, when seen from above, is rectangular—the *caput quadratum*. The skull looks large in proportion to the face. The forehead is broad and square, and the frontal eminences marked. The anterior fontanelle is late in closing and may remain open until the third or fourth year. The skin is thin, the veins are perceptible, and the hair is often rubbed from the back of the skull. In contradistinction to the cranio-tabes is the condition of cranio-sclerosis, which has also been ascribed to rickets.

On placing the ear over the anterior fontanelle, or in the temporal region, a systolic murmur may frequently be heard. This condition, first described by Fisher, of Boston, was believed by him to be peculiar to rickets. While unquestionably heard with the greatest frequency in this disease, its presence and persistence in perfectly healthy infants have been amply demonstrated.* The murmur is rarely heard after the fifth year. A knowledge of the existence of this systolic brain murmur may prevent errors. A case in which it was well marked was reported as an instance of supposed gummy tumor of the brain, in which the murmur was thought to be due to pressure on the vessels at the base.

Changes occur in the bones of the face, chiefly in the maxillæ, which are reduced in size. The normal process of dentition is much disturbed; indeed, late teething is one of the marked features in rickets. The teeth which appear may be small and badly formed.

* Osler, On the Systolic Brain Murmur of Children, Boston Medical and Surgical Journal, 1880.

In the upper limbs changes in the scapulæ are not common. The clavicle may be thickened at the sternal end, and there may be thickening near the attachment of the sterno-cleido muscle. The most noticeable changes are at the lower ends of the radius and ulna. The enlargement is at the junction-area of the shaft and epiphysis. Less evident enlargements may occur at the lower end of the humerus. In severe cases the natural shape of the bones of the arm may be much altered, having to support the weight of the child in crawling on the floor. The changes in the pelvis are of special importance, particularly in female children, as in extreme cases they lead to great deformity and narrowing of the outlet. In the legs, the lower end of the tibia first becomes enlarged; and in slight cases it may alone be affected. In the severe forms the upper end of the bone, the corresponding parts of the fibula, and the lower end of the femur become greatly thickened. If the child walks, slight bowing of the tibiæ inevitably results. In more advanced cases the tibiæ and even the femora may be arched forward. In other cases the condition of knock-knee occurs. Unquestionably the chief cause of these deformities is the weight of the body in walking, but muscular action takes part in it. The green-stick fracture is not uncommon in the soft bones of rickets.

These changes in the skeleton proceed slowly, and the general symptoms vary a good deal with their progress. The child becomes more or less emaciated, though "fat rickets" is by no means uncommon. Fever is not constant, but in actively progressing changes in the bone there is usually a slight pyrexia. The abdomen is large, due partly to flatulent distention, partly to enlargement of the liver, and in severe cases to diminution of the volume of the thorax. The spleen is often enlarged and readily palpable. The urine is stated to contain an excess of lime salts, but Jacobi and Barlow say this has not been proved. No special or peculiar changes, indeed, have as yet been described. Many rickety children show marked nervous symptoms; irritability, peevishness, and sleeplessness are constantly present. Jenner called attention to the close relationship which existed between rickets and infantile convulsions, particularly to the fits which occur after the sixth month. Tetany is by no means uncommon. It involves most frequently the arms and hands; occasionally the legs as well. Laryngismus stridulus is a common complication, and though not, as some state, invariably associated with this disease, yet it is certainly much more frequent in rickety than in other children. Severe rickets interfere seriously with the growth of a child. Extreme examples of rickety dwarfs are not uncommon. The disease known as acute rickets is in reality a manifestation of scurvy and will be described with that disease.

Prognosis.—The disease is never in itself fatal, but the condition of the child is such that it is readily carried off by intercurrent affections, particularly those of the respiratory organs. Spasm of the larynx and

convulsions occasionally cause death. In females the deformity of the pelvis is serious, as it may lead to difficulties in parturition.

Treatment.—The better the condition of the mother during pregnancy the less likelihood is there of the development of rickets in the child. Rapidly repeated pregnancies and suckling a child during pregnancy seem important factors in the production of the disease. Of the general treatment, attention to the feeding of the child is the first consideration. If the mother is unhealthy, or cannot from any cause nurse the child, a suitable wet-nurse should be provided, or the child must be artificially fed. Cows' milk, diluted according to the age of the child, should constitute the chief food. Care should be taken to examine the condition of the stools, and if curds are present the child is taking too much, or it is not sufficiently diluted. Barley-water or carefully strained and well-boiled oatmeal gruel form excellent additions to the milk.

The child should be warmly clad and should be in the fresh air and sunshine the greater part of the day. It is a "vulgar error" to suppose that delicate children cannot stand, when carefully wrapped up, an even low temperature. The child should be bathed daily in warm water. Careful friction with sweet oil is very advantageous, and, if properly performed, allays rather than aggravates the sensitiveness. Special care should be taken to prevent deformity. The child should not be allowed to walk, and for this purpose splints applied so as to extend beyond the feet are very effective. Of medicines, phosphorus has been warmly recommended by Kassowitz, and its use is also advised by Jacobi. The child may be given gr. $\frac{1}{100}$ two or three times a day, dissolved in olive oil. Cod-liver oil, in doses of from a half to one teaspoonful, is very advantageous. The syrup of the iodide of iron may be given with the oil. The digestive disturbances, together with the respiratory and nervous complications, should receive appropriate treatment.

X. SCURVY (*Scorbutus*).

Definition.—A constitutional disease characterized by great debility, with anæmia, a spongy condition of the gums, and a tendency to hæmorrhages.

Etiology.—The disease has been known from the earliest times, and has prevailed particularly in armies in the field and among sailors on long voyages.

From the early part of this century, owing largely to the efforts of Lind and to a knowledge of the conditions upon which the disease depends, scurvy has gradually disappeared from the naval service. In the mercantile marine, cases still occasionally occur, owing to neglect of proper and suitable food.

The disease develops whenever individuals have subsisted for prolonged periods upon a diet in which fresh vegetables or their substitutes are lacking.

In comparison with former times it is now a rare disease. In seaport towns sailors suffering with the disease are occasionally admitted to hospitals. In large almshouses, during the winter, cases are occasionally seen.* On several occasions in Philadelphia characteristic examples were admitted to my wards from the almshouse. Some years ago it was not very uncommon among the lumbermen in the winter camps in the Ottawa Valley. Among the Hungarian, Bohemian, and Italian miners in Pennsylvania, cases of the disease are not infrequent. This so-called land scurvy differs in no particular from the disease in sailors. An insufficient diet appears to be an essential element in the disease, and all observers are now unanimous that it is the absence of those ingredients in the food which are supplied by fresh vegetables. What these constituents are has not yet been definitely determined. Garrod holds that the defect is in the absence of the potassic salts. Others believe that the essential factor is the absence of the organic salts present in fruits and vegetables. Ralfe, who has made a very careful study of the subject, believes that the absence from the food of the malates, citrates, and lactates reduces the alkalinity of the blood, which depends upon the carbonates directly derived from these salts. This diminished alkalinity, gradually produced in the scurvy patients, is, he believes, identical with the effect which can be artificially produced in animals by feeding them with an excess of acid salts; the nutrition is impaired, there are ecchymoses, and profound alterations in the characters of the blood. The acidity of the urine is greatly reduced and the alkaline phosphates are diminished in amount.

In opposition to this chemical view it has been urged that the disease really depends upon a specific micro-organism.

Other factors play an important part in the disease, particularly physical and moral influences; overcrowding, dwelling in cold, damp quarters, and prolonged fatigue under depressing influences, as during the retreat of an army. Among prisoners, mental depression plays an important *rôle*. It is stated that epidemics of the disease have broken out in the French convict-ships *en route* to New Caledonia, even when the diet was amply sufficient. Nostalgia is sometimes an important element. It is an interesting fact that prolonged starvation in itself does not necessarily cause scurvy. Not one of the professional fasters of late years has displayed any scorbutic symptom. The disease attacks all ages, but the old are more susceptible to it. Sex has no special influence, but during the siege of Paris it was noted that the males attacked were greatly in excess of the females. Infantile scurvy will be considered in a special note.

Morbid Anatomy.—The anatomical changes are marked, though

* Henry, Philadelphia Hospital Reports, vol. i, 1890.