medicine, and apparently indiscriminately gathered. Much of it is nearly devoid of its proper odor. The Pharmacopœia description is as follows: "In curved pieces of irregular fragments, one-twelfth of an inch (2 mm.) or more thick, outer surface greenish brown, or yellowish brown, smooth, and somewhat glossy, marked with transverse scars. If collected from old wood and deprived of the corky layer, the outer surface is nut-brown and uneven; inner surface somewhat striate or fissured. Upon maceration in water it develops a distinct bitter-almond odor; its taste is astringent, aromatic, and bitter. The bark of the small branches is to be rejected." The spurious bark of the choke-cherry is much thinner and tougher, consisting largely of bast fibres, which are lacking in the genuine.

Wild-cherry bark contains substances analogous to the *emulsin* and *amygdalin* of bitter almonds. Upon being macerated in water and subjected to distillation it yields *hydrocyanic acid*, and a *volatile oil* having the properties of that of almonds. It also contains *tannic acid*.

Wild cherry is used as a sedative bitter tonic and a sedative expectorant; the sedative property due to its hydrocyanic acid, the bitter probably to its amygdalin only. It is somewhat astringent.

The above qualities express its entire value as at present understood. As a substitute for quinine it is entirely obsolete. Dose from 2 to 4 gm. (ʒss. ad i.). The fluid extract (*Extractum Pruni Virginianæ*, strength $\frac{1}{4}$) and the infusion (*Infusum Pruni Virginianæ*, strength $\frac{4}{100}$) are official, and represent it well. The syrup (*Syrupus Pruni Virginianæ*, U. S. P., 15 per cent.) is frequently used as a basis for cough mixtures; its taste is rather pleasant.

Allied Plants.—See *Almonds, Bitter and Sweet.*

Allied Drugs.—Cherry-laurel leaves, Peach seeds, and also Almonds and Hydrocyanic Acid.

W. P. Bolles.

CHEST, DEFORMITIES OF THE.—The chest is a box or cage enclosing and protecting the heart, lungs, and great vessels; but it is also an organ, which by its rhythmical expansion and contraction plays an important part in the respiratory act. It consists of the thoracic skeleton and of the soft parts covering it; but the position of the clavicles, scapulæ, and shoulders is so closely related to the shape and development of the chest as to require some discussion in this article.

The size, shape, and mobility of the chest vary with the race, age, sex, development, occupation, and idiosyncrasies of the individual, and it is as difficult critically to define its normal limits as it is those of the nose, ear, or any other organ or part. It is often impossible to say when normality becomes peculiarity, or peculiarity deformity.

According to Vierordt,[1] one expects to find in a well-constructed thorax, bilateral symmetry, slightly marked supraclavicular depressions, and a barely recognizable prominence at the junction of the manubrium and corpus sterni. The true ribs should so leave the sternum that there is increasing obliquity from above downward, making the angle between their free borders almost a right angle. The thorax should be well developed, and the scapulæ should lie flat upon the back; only the lower intercostal spaces should be visible. The dimensions of the chest should be proportionate to the size and development of the body, and in adult life its transverse diameter should exceed its antero-posterior in the ratio of three to two or less. Vierordt's Tabellen[2] give various chest measurements according to the most reliable observations. The mean value of chest play, or the difference in chest circumference between inspiration and expiration, is thus given as three or four inches. According to Lee,[3] the average expansion of eight hundred United States recruits was three and four-fifths inches.

Departures from the typical standard are very frequent, and may be quite marked in perfectly healthy persons. The two sides are rarely perfectly symmetrical; indeed, Vierordt himself says in another place that in right-handed people the right semicircumference of the chest is the larger by .5 to 2 cm.; in the left-handed, on the contrary, the left semicircumference of the chest is equal to or but slightly greater than the right. The chest may be small above and wide below; the angle of Louis may be more than usually prominent, and the epigastric angle exceptionally acute. The supraclavicular fossæ may be marked, without disease; but if they are unequal, apical tuberculosis may be suspected. Certain ribs, as the second, third, and fourth, may project in front, or the lower ribs may be depressed. All these peculiarities are more or less atypical without being exactly abnormal.

The broad chest of man with the square shoulders, and scapulæ placed posteriorly, correlated with the upright posture and pendant, but freely mobile and active arms, is one of the most characteristic and striking peculiarities of the human skeleton. According to Hutchinson,[4] this position of the scapulæ is a very important factor in the development of respiratory power. Human respiration is, or should be, bellows-like, the fixed flap being the spine and posterior chest wall, rather than piston-like, as it often is in cramped or rigid chests.

In the human embryo at the fourth month the quadrupedal or deep chest, with the antero-posterior diameter exceeding the transverse, still persists; at birth these diameters are nearly equal. The infant is round-chested and round-bellied, and only after three or four years of age do the chest and abdomen begin to assume the more flattened shape characteristic of adult life. In adult man the proportions of the chest are the reverse of those in the quadruped, the transverse exceeding the antero-posterior diameter in the ratio of three to two or less. Of the quadrupeds only certain monkeys, moles, and bats, all animals possessing great power and freedom of motion in the anterior extremities, have broad chests. The evolution of the human chest may be arrested before it is complete, either from congenital defect in growth or vigor or from faulty habits in childhood; we then get a long, rounded chest, a degenerate or rudimentary type, and one often associated with other defects, as will be pointed out in the sections on the phthisical chest and on round back.

Chest deformities may be divided for convenience of discussion into four groups:[5] the congenital; those due to static conditions, whether pathological or not; those due to external constriction or pressure; and those due to conditions of the internal organs. Deformities of the chest due to violence, to new growths, to local disease, or to double or non-viable monstrosities, are beyond the scope of this article.

I. Congenital Deformities.

The individual bones of the chest may be imperfect or wanting, fissured, misshapen, or augmented, and the thoracic skeleton may be deformed as a whole.

Spine.—The thoracic spine, like the cervical and lumbar, may contain too many or too few vertebræ. Dwight[6] states that since he has been looking for such anomalies, he has found them with surprising frequency. The commonest anomaly of number in the dorsal region is to have eleven or thirteen vertebræ present. Noble Smith[7] quotes a case in which four and one-half thoracic vertebræ were absent, namely, the right half of the third, the fifth, the sixth, the eighth, and the ninth. There were only two cervical vertebræ present in this case. Wedge-shaped half vertebræ on one side or the other, as in the above case, are not extremely rare; or a vertebral body may be made up of two unfused halves. The arches may be incomplete—spina bifida,—a condition which may extend to a great part or the whole of the spine, and is then called rhachischisis, with which, as with ordinary spina bifida, protrusion of a sac and various anomalies of the soft parts frequently occur. In these cases various abnormal and often extreme bendings and curves of the spine and accompanying chest deformities are often seen. The best recent article on rhachischisis is that by Thorndike.[8]

It is well for bone specialists to remember, and probably for others to forget, the possibility of anomalies in number when counting vertebræ in the living subject; also that one or more spinous processes may be bifid, or project to one side or posteriorly without pathological significance.

Sternum.—According to Dwight,[6] the sternum is about 9.5 per cent. of the total height for men and about nine per cent. for women. It may be entirely or partially absent, or more or less fissured longitudinally or perforated. These defects, like the unclosed arches of a spina bifida, are due to the failure of the primitive layers to unite in the median line. When large the gap is covered by a membrane; when small it may be entirely unnoticed during life. Holes, fissures, and defects are more common and of greater extent toward the upper part of the sternum. The xiphoid is often deflected, split, or perforated.

Ribs.—Supernumerary ribs may occur, especially in the lower cervical and upper lumbar regions. Cervical ribs on one or both sides may sometimes be palpated at the root of the neck during life, and may cause trouble by pressure on the brachial plexus and require removal. In these cases the pleural sac may rise abnormally high, and has been opened (Planet[9]). Ribs may also be absent or rudimentary. Hurtlet[10] reports five cases of rudimentary first ribs in English, and Helm[11] sixteen cases in general surgical literature. Cases occasionally occur in which several ribs on one side with their costal cartilages are imperfectly developed and fail to meet and unite with the sternum, or in the case of the lower ribs with the cartilage above, by varying intervals. They may end near the sternum or free border, below the axilla, or farther back, leaving a depression or furrow of greater or less extent to one side of the sternum, or in the lateral chest wall, covered only with skin and membrane, which may rise and fall with respiration, pulsate with the heart beats, and through which the underlying organs may be palpated. Through this unprotected area the lung may protrude, or if in the precordial region an ectopia cardis may take place. When such a tendency exists the gap

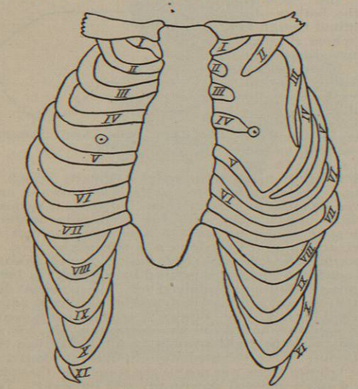

Fig. 1247.—Osborne's Case of Defect of Ribs. (From Haynes.)

should be protected by a celluloid, hard-rubber, or metal plate, and pulmonary hernias have been known to recede under such treatment, or to disappear spontaneously. These defects of the skeleton of the chest wall are due to an arrest of growth of fœtal structures, which fail to join by a larger or smaller interval.

The following cases are cited as examples of this deformity:

Abercrombie's[12] case was a boy of two months, with absence of the second and third costal cartilages, left side; the corresponding ribs ended free, leaving a small unprotected space. The fourth rib lay near its cartilage, but was not joined to it. There was a notch on the left side of the sternum near the third interspace.

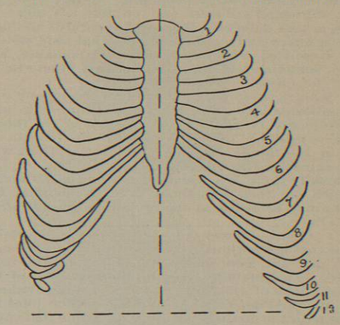

Fig. 1248.—Haynes' Case of Defect of Lower Ribs on the Left Side. (From Haynes.)

Bennett's[13] case was that of a man who died suddenly after an injury. The autopsy disclosed a defective third rib, right side, which failed to reach its cartilage by a considerable interval. This case and another reported by Bennett emphasize the danger of mistaking certain congenital chest deformities for the effect of injury, recent or remote.

Osborne's[14] case was a boy with a triangular depression on the left side of the chest due to defective development of the second, third, and fourth ribs, which were separated from their cartilages by a considerable interval. The extremity of the fourth rib was joined to the fifth costo-cartilaginous articulation.

In Townsend's[15] case the ribs of the left side, except the first two, were represented by short rudimentary processes.

Lallemand's[16] case was a man with a depression as big as a fist on the left side of the chest, due to a deficiency of the third, fourth, and fifth ribs.

Harold's[17] case was a backward boy of seventeen years, whose costal cartilages in the left side below the fifth rib were missing; at this level the left half of the sternum and xiphoid were deficient, and the pericardium was protected only by soft parts.

Homer Gage[18] reported a case of congenital absence of the sixth, seventh, eighth, ninth, and tenth ribs, left side, in a girl of seventeen years. There was severe lateral curvature, convexity to the right, with severe deformity of the chest, and a protrusion in the unprotected area, supposed to be due to a hernia of the stomach. The heart was displaced to the right, though the viscera were not transposed.

In Hayne's[19] case the cartilage of the seventh rib, left side, ended three-fourths of an inch from the sternum, and the seventh, eighth, and ninth cartilages were not joined, but ended free.

Sometimes the costal defect is accompanied by total or partial absence of the greater and smaller pectoral muscles of the same side, as in the case reported by Levy,[20] in which the third and fourth ribs of the right side ended below the axilla, leaving a marked depression. There was a well-marked lateral curvature with convexity toward the right.

Schlesinger[21] has shown that congenital absence of the pectoral muscles is frequently associated with defects of ribs or other thoracic anomalies, and cites the case of a man of twenty-two years who had in addition to a defect of the third, fourth, and fifth ribs, and of the costal portion of the pectoral, a congenital elevation of the shoulder—Sprengel's disease—all on the left side. It would seem that defects in the costal apparatus are more common in males and on the left side, that they are frequently associated with other thoracic anomalies, and that they sometimes occur in individuals otherwise or generally defective.

Other thoracic deformities sometimes accompany congenital malformations of the heart; there may be in such cases a projection or gibbosity of the front of the thorax above the xiphoid, "thorax en proue," or "thorax en carène," or the thorax may be prominent in front with flattened sides (see Charrin and Le Noir[22]).

Occasionally there is a fusion of ribs, usually the first two, which are then sometimes called a bicipital rib. Other ribs may be fused at one or more points (*Deutsche Chirurgie*[23]).

Stiller's Costal Stigma — Costa Fluctuans. — Stiller maintains that the majority of cases of enteroptosis begin in youth and are associated with abnormally movable tenth ribs. This mobility may approximate that of the two lowest pairs of ribs, and is due to a congenital and possibly inherited defect in the cartilage, which joins the tenth ribs with the cartilage above. He claims that enteroptosis and nervous dyspepsia are identical, and that children exhibiting the costal sign will always go on to have enteroptosis, atony of the stomach, constipation, and nervous dyspepsia or dyspeptic neurasthenia. He finds these conditions nearly as common in men as in women, and concludes that tight lacing and pregnancy have but little to do with enteroptosis.

Absence of the Pectoral Muscles.—This deformity occurs more frequently on the right side, and may involve both the large and small pectorals, but the pectoralis minor and the clavicular portion of the former often escape. The affected side of the chest has a flattened or excavated appearance, but the patient has full use of the arm and suffers no inconvenience, and may even be a good soldier or gymnast. An infant six weeks old with absence of the costal portion of the left pectoral was exhibited by the writer to the Orthopedic Section of the New York Academy of Medicine in January, 1898, and by a singular coincidence a boy of sixteen years with the same deformity on the right side was shown at the same meeting by Dr. Royal Whitman. In these cases there are usually certain anomalies of the neighboring soft parts such as deficient subcutaneous tissue, scanty hair over the affected area and in the axilla, imperfectly developed mammilla, breast, and anterior axillary border of the affected side. In certain cases defects of ribs and anomalies of the scapula may exist, as in a case reported by the writer,[25] and one described by Schlesinger,[21] who has collected one hundred cases of pectoral defect from medical literature, and who states that in about one-quarter of the cases the pectoralis minor is also absent; in one-tenth of the cases there is considerable anomaly of the thoracic skeleton, and in one case in twenty or twenty-five there is pulmonary hernia or displacement of the heart.

Funnel Chest, Funnel Breast, Trichterbrust, Thorax en Entonnoir.—This deformity is one of the most interesting of the congenital chest deformities, and has attracted considerable attention since Ebstein's[26] paper appeared in 1882, though the condition had been previously described. Stedman[27] gives the earlier references.

In these cases there is a considerable depression involving the lower portion of the sternum, and the adjacent cartilages and ribs. This depression may be large enough to contain a man's fist, and is usually congenital, but its etiology is obscure. Some authors suppose it to be due to a defect in development, others to the pressure of the fœtal chin or heels. Certain authors regard it as a stigma of degeneration, as it has been found in the insane, epileptic, and neuropathic; others have observed it in robust and well-developed individuals. It occurs more frequently in men; out of thirty cases twenty-three were males.

Arneill[28] reports six cases, of which five occurred in one family. These were a student, his brother, father, and two paternal uncles. This patient was twenty-five years old, six feet tall, and weighed one hundred and seventy-four pounds; he was well developed and in excellent health. In his case the antero-posterior diameter of the thorax was, at the right nipple 17.5 cm., at the left 16.8, and at the depression in the median line 11.4. The greatest depth of the depression was 6.5 cm. In the brother the depth was 4.7, and in the father 3.75. There was one sister who was free from defect. Of Klemperer's[29] three cases two were brothers. The writer has recently reported the cases of a mother and daughter.

A number of cases of acquired funnel chest have been reported. The deformity may be acquired by traction from within, from adhesions, or bronchiectasis, or by pressure from without, as in certain occupations. An excellent account of this and other chest deformities may be found in an article by Marie.[30] As already noted, there is little or no interference with function, and some individuals are able to take violent exercise, as respiratory capacity does not seem to be diminished. Ebstein[26] has described some cardiac displacement upward and to the left.

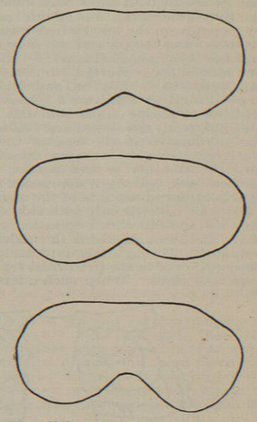

Fig. 1249. — Funnel Chest. (Arneill's cases.)

Thorax en Gouttière.—Somewhat similar to funnel chest is the "thorax en gouttière" of Féré and Schmidt,[31] where the sternum forms the bottom of a longitudinal trough or gutter whose sides are the incurved costal cartilages. These authors claim that ten per cent. of epileptics show this deformity.

Clavicles.—The clavicles may be wholly or partly absent on one or both sides. In partial absence it is usually the outer extremity which is wanting. The shoulders drop forward and inward, and may even be made to meet in front, but there is surprisingly little interference with function. The writer's clavicle splint[32] may be used to keep the shoulders in position, acting on the principle of artificial clavicles.

Congenital Elevation of the Scapula—Sprengel's Disease.—This condition was first described by Sprengel in 1891, and is not yet thoroughly understood. An excellent discussion of the subject may be found in the recent paper by Nové-Josserand and Brisson,[34] who report twenty cases in literature and their own observation of a girl of nine years with the right scapula 3 cm. higher than the left. Besides being elevated the scapula was rotated so that the inferior angle was nearer the spine, and the spine of the scapula pointed downward and outward. The upper border of the scapula pointed upward into the neck, producing a noticeable deformity. The right scapula was somewhat smaller than the left, but the clavicles were equal. The movements of the shoulder joint were free, but the arm could not be raised as high as on the opposite side. The muscles responded normally to electric stimulation. The above description is typical, and applies to most cases. In about half the cases there is a slight scoliosis, of which the convexity may be from or toward the affected side.

In some cases there is facial asymmetry, the side of the elevated scapula being the less developed. There is little disability, sometimes none, and when treatment is required remedial gymnastics are sufficient. The writer[25] has reported a case of small scapula with absent pectoral muscle on the right side. This case seems to belong in this group, though the elevation of the shoulder was slight.

A peculiar form of congenital high shoulder, in which the scapula was joined to the spine of the seventh cervical vertebra by a bony process, has recently been described by Wilson and Hugh.[35]

Congenital Scoliosis.—This deformity involves more or less all the bones of the thorax. The cases in which lateral curvature is congenital are rather rare, though Marie[30] thinks that many cases of lateral curvature which develop in childhood may be due to congenital defects of the thorax or spine, which remain latent or without visible effect for years, but finally produce a visible curvature. He includes such cases under the term "déformations thoraciques congénitales tardives." In a recent study Hirschberger[36] attributes a certain number of cases of congenital lateral curvature with defects of the spinal column to intra-uterine pressure, with scanty amniotic fluid. Another group is associated with other anomalies, showing a widespread developmental fault. A few cases only are due to paralysis.

The chest deformities associated with lateral curvature will be more fully described in a subsequent section.

II. Acquired Deformities.

(*a*) *Chest Deformities Due to Static Conditions.*—This group comprises the chest deformities due to the various forms of lateral curvature of the spine, weak and round

Fig. 1250.—Chest Deformity in Severe Scoliosis.

back, to spondylitis, and in part to certain constitutional diseases affecting the bones, such as acromegaly, osteitis deformans, and spondylitis deformans.

Lateral curvature of the spine, or scoliosis, is the name of a striking symptom, whose causation varies widely in different cases, and in many is exceedingly obscure. The list of diseases and conditions with which lateral curvature is more or less frequently associated is a long one, but in all the efficient cause is an asymmetrical or unilateral weakening of the skeleton or muscles, often due to a one-sided incidence of stress, as an habitual faulty or one-sided posture, loss of an arm, short leg, congenital defects of spine or chest, torticollis, Sprengel's disease, sacro-iliac disease; in other cases to asymmetrical soft-

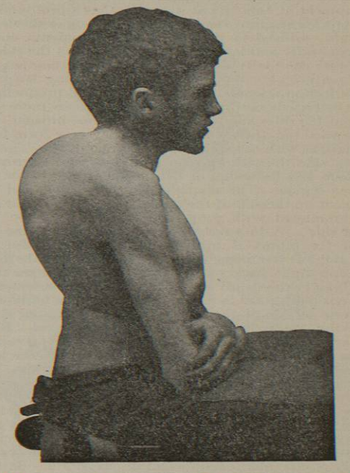

Fig. 1251. — Antero-Posterior Chest Deformity in Severe Scoliosis. The posterior boss is on the right side only.

ening, hardening, or distortion of certain parts of the skeleton as in rickets, cretinism, achondroplasia, acromegaly, diffuse hyperostosis (leontiasis), osteomalacia, rheumatism, spinal osteo-arthritis, osteitis deformans (Paget's disease), pulmonary osteo-arthropathy, and often tuberculous spondylitis; also in certain nervous and paralytic disorders which affect the spinal and trunk muscles in an asymmetrical manner, such as poliomyelitis, sciatica, Friedreich's ataxia, syringomyelia, hysteria, athetosis, paralysis of certain spinal muscles, and some of the chronic muscular atrophies and dystrophies. The commonest and most important class, however, is that in which the lateral curvature is attributed to muscular weakness and habitual faulty postures, but in which no very obvious predisposing cause is evident and about the causation of which very little is really known.

The distortion of the spinal column is probably the most important but by no means the only element in the deformity. The entire thorax becomes by degrees warped and twisted, and while the different varieties of lateral curvature vary in their characteristics, and the ordinary or postural deformity in the degree of distortion finally reached, it is not too much to say that the severer grades are among the most distressing, and, unfortunately, the most common of severe chest deformities. In many cases the distortion or debility affects not only the trunk, but the pelvis, head, and extremities.

The spine usually has a dorsal and a lumbar curve in opposite directions. The convexity of the dorsal curve is to the right in a large majority of cases. The spine is also twisted on or near its axis in the same direction in which it curves, owing to its lying free from support in the thoracic and abdominal cavities: the line of the ver-

tebral bodies thus comes to be much more curved than the line of the spinous processes—in other words, the deformity is much severer and more complicated than it appears to be from external inspection. After the deformity has lasted some years, the bodies of the vertebræ become wedge-shaped and twisted, the intervertebral discs compressed, and the deformity becomes fixed. The development of this spinal distortion has a profound effect upon the shape of the chest, which becomes shortened in height, reduced in most of its measurements, and is rendered stiffer and less flexible. The ribs on the side of the dorsal convexity become more bent at their angles, making a projection under the corresponding scapula; this projection is sometimes very prominent, producing a large posterior bosse. The ribs on this side are more separated at the sides and in front and become broader, but are crowded together behind, where they may form false articulations with the spine and with each other. On the concave side the ribs become straighter and narrower, and there is a flattening or depression in and below the scapular region. The scapula is usually lower and less prominent on the side of the dorsal concavity, higher and more prominent with projecting inferior angle on the convex side. With a right dorsal convex curve, the left side of the thorax is prominent in front, and the left breast and left free margin of the ribs protrude; the diagonal from right back to left front is much longer than normal, and exceeds all other horizontal measurements; the opposite diagonal is much shortened, and a horizontal transverse section of the chest shows an irregular ellipsoid, lying in the direction of the long diagonal. Both lungs are cramped, the right the most, breathing capacity is much diminished, the heart is displaced to the left, and the abdominal and pelvic organs are crowded. The direction of the sternum is changed, and the whole thorax and trunk are strangely shortened and twisted. It is strange that chronic pulmonary disease is so seldom met with in these severe cases of lateral curvature. They are, however, not strong, and do suffer from their deficient respiration and imperfect circulation in a delicate organization, poor blood, and defective nutrition. Satterthwaite[37] has specially studied the displacements of the heart due to lateral curvature, and Faber[38] the respiratory difficulties.

The foregoing description may serve to indicate the principal characteristics of the chest deformities accompanying the commonest form of lateral curvature. In the lateral curvature due to morbid processes affecting the osseous system, the bones of the chest will present, besides the deformities of lateral curvature, those due to the special morbid process, such as softening, hypertrophy, or local distortion. In paralytic lateral curvature there is less rigidity, and there may even be increased flexibility, and paralysis of certain muscle groups will be found.

For the symptomatology and treatment of lateral curvature, and for its effects on other parts of the body, the reader is referred to other sections of this work.

Chest Deformities Associated with Paralytic Affections.—The commonest is lateral curvature and its accompanying thoracic distortions as mentioned in the preceding paragraph, and the commonest variety of paralytic lateral curvature is that associated with a certain number of the severe cases of acute poliomyelitis, in which the trunk or spinal muscles are asymmetrically involved.

In the progressive myopathies of the scapulo-humeral type, and of the facio-scapulo-humeral type, and in pseudo-hypertrophic paralysis, there often occurs, according to Marie,[30] a flattening of the upper part of the thorax. Atrophy of the pectorals in connection with this deformity causes the upper part of the chest in front to have an excavated aspect. In some cases this depression is found in the lower part of the chest giving an appearance similar to funnel chest, and these deformities may be combined with scoliosis. Certain of these atrophic affections produce a wasp figure, the obliquity of the ribs being increased, and the chest being straight at the sides and cylindrical, with a marked depression or constriction between the lower ribs and the thoracic crests, owing to atrophy of the waist muscles.

Round back, kyphosis, round shoulders, stoop shoulders, are faulty postures or deformities, in which the head, shoulders, and upper chest fall or sag forward, from improper poise and muscular weakness. The result is a rounded back, and consequent changes in the shape of the chest, position of the head and shoulders, and, indeed, a general fault of attitude, a de-energized position in which the principal stress is shifted from the muscles to the ligaments. There has been considerable confusion in the nomenclature and in the description of this affection, or rather symptom. Round shoulders is a term in common use, but is unsatisfactory since the faulty position of the shoulders is a secondary symptom, largely due to the shape of the back and chest, for which reason the term round back is preferred by the writer, though this term also fails to indicate the general disturbance of poise which is usually present. The term kyphosis is unfortunate, since it is also used to designate the deformity due to Pott's disease of the spine, from which it is exceedingly important to distinguish it.

Round back or weak back, then, is that position of relaxation into which the body falls when the upper trunk is no longer held up by weakened spinal muscles. Excluding the angular projection of Pott's disease, which becomes rounded only in the latest stages, the affection may be divided into several varieties, namely, those due to: (1) Imperfect development of the chest: (2) congenital or acquired weakness—convalescence; (3) old age; (4) paralytic affections; (5) certain diseases which affect bone and general nutrition, such as rickets, scurvy, cretinism, spondylitis deformans, osteitis deformans (Paget's disease), acromegaly, pulmonary osteo-arthropathy. The list is very similar to that given for scoliosis, but whereas in that case the bony or muscular support was weakened on one side, in this the weakening is approximately symmetrical.

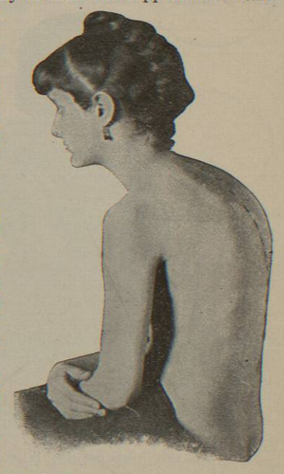

FIG. 1252.—Severe Round Back. (Original.)

Most of these kyphotic conditions have in common the forward sagging of the spine for lack of bony or muscular support or both. The head and upper chest fall forward, the spine becomes more or less rounded, the chest becomes compressed at its upper part, but may become narrower rather than flatter as a whole; the ribs drop downward, the shoulders and scapulæ downward and forward, their inner borders receding from the spine and their inferior angles becoming more prominent. The position of the pelvis is changed, the feet are weak or flat and everted, and there is a tendency to knock-knee. The chest is usually less flexible than normal, respiratory capacity and power are diminished; there is often a transverse furrow at the upper border of the abdomen. The attitude is that of fatigue, weakness, debility, relaxation. It is doubtless an attitude which may be produced or intensified by habitual faulty positions, such as those assumed for many hours daily by school-children or clerks at their desks. This factor, however, must usually be associated with fault of structure or inherited or acquired vice of nutrition, muscle tone, or skeletal resistance, in order to be effective. It is to be noted that the non-pathological form of round back often affects children as early as the fourth or fifth year, and that, as already remarked, it is rather a general than a local affection. Weak and pronated feet, week eyes, and slight degrees of lateral curvature often accompany it. These children are often physically delicate and mentally unstable. They may inherit an imperfect physique, or their life is so precocious or intense, as to interfere with ample and symmetrical development. In other words, a good many of these children are degenerates or bordering on degeneracy, and present the rounded back and drooping shoulders as striking symptoms, but usually show other unmistakable signs of imperfect development. The writer believes that in a certain proportion of these round-backed children, the evolution of the chest has been retarded or arrested at a certain stage either from inherited tendency or from causes acting in early childhood, irrespective of faulty attitudes, and that this rudimentary chest stands in close relation with the pre-tuberculous type of chest described by Hutchinson. It is probable that in a certain class of cases the faulty attitude is in large measure dependent on the long, narrow, and deep chest, which favors drooping shoulders and abducted scapulæ, and to the instinctive desire of the delicate, under-nourished, and over-stimulated child to shift the strain of bodily weight from the tired muscles to the insensitive ligaments.

It follows that purely local treatment rarely fulfils the indications, and that management with a view to general development and a proper regulation of the life is of primary importance. The chest should be amply developed in early years by a free, open-air life, with plenty of tree and hill climbing, romping, rambling, swimming, running, and ball-throwing, sports that involve well-distributed and vigorous exercise, and especially develop arm action and respiratory power.

The habits should be regulated and over-stimulation avoided. When the chest deformity is pronounced, special corrective and gymnastic exercises are of great benefit. Remembering that the faulty attitude is general, it is often necessary to begin by strengthening, placing, and shoeing the feet, in order to secure a correct pose. Thus the pupil should be drilled in the proper poise of the body, chest forward and up, abdomen and hips back, weight on balls of feet. After these matters have been attended to, breathing and corrective exercises may be successfully applied to the chest. Supporting apparatus is seldom, and shoulder straps are never, required. The senseless admonition to throw the shoulders back without attention to these preliminaries would be productive of much harm if it were not almost invariably disregarded.

The round back of certain occupations and of convalescence are varieties of the round back of weakness. The round back of old age is accompanied by changes of form in the chest similar to those described. It is due to the gradually increasing muscular weakness and ligamentous rigidity due to advancing age. The spinal muscles, whose tonus is diminished, no longer suffice to hold the spine erect and the chest free. The drooping spine compresses the intervertebral discs anteriorly; their elasticity is impaired, and the false attitude finally becomes fixed. The only efficient prophylactic is an active and well-distributed muscular life in youth and manhood with the avoidance of debilitating influences.

In round back due to paralytic disorders the spine is often extremely flexible, though respiratory power is diminished from muscular weakness. The chest often remains collapsed, and the breathing may be abdominal. The management is usually that of the disorder upon which the round back depends. Special exercises and supports are sometimes of service, and the writer has found the prone position on an inclined padded board or mattress to have an excellent influence in stimulating the spinal erector muscles to action, and in correcting the deformity.

The round back of paralysis agitans is similar to that of old age.

The round back or so-called kyphosis of rickets, infantile scurvy, cretinism, and marasmus usually comes on in infancy before the child is able to walk, and consequently before the evolution of the normal antero-posterior curves of the spine. The sitting posture probably has much to do with its production, and the projection is of a different character from that described in the first part of this section. It is rounded and situated in the middle or lower part of the back, though it may involve nearly the whole spine, which is more or less flexible and free from muscular spasm; there is no characteristic pain. It differs in all these respects from the kyphosis of spondylitis, with which it is sometimes confounded, and which it is exceedingly important to differentiate. Mechanical support is rarely required, as the deformity usually recedes under recumbency for longer or shorter periods, together with the treatment appropriate for the dyscrasia. In the rare cases in which the deformity persists and becomes rigid after the cure of the disease, the treatment is difficult, and mechanical support may be required.

FIG. 1253.—Rounded Kyphos of Cured Pott's Disease. (Original.)

In acromegaly the dorsal spine may become rounded, and the ribs, sternum, and clavicles hypertrophied, giving a massive, deep chest. The bent back and exaggerated senile attitude may occur in osteitis deformans (Paget's disease) and in osteo-arthritis of the spine.

Angular Kyphosis.—In Pott's disease the integrity of the spinal column is destroyed by local tuberculous ulceration, and the upper section of the trunk falls forward until it finds support, giving rise to a kyphos, or hump of the back, which is at first always angular, and to various changes in the shape of the chest, especially if the disease affects the thoracic vertebræ. In disease of the upper dorsal region the upper part of the chest is flattened in front. In disease of the mid-dorsal region the ribs become more sloping, in severe cases resting on the

ilium or within the pelvis; the chest becomes shortened and laterally compressed; the sternum and lower ribs become prominent, and the antero-posterior diameter of the chest is increased. The chest also becomes very rigid, and the breathing abdominal and accelerated.

The changes in the shape of the chest take place very slowly, and are only fully developed after several years.

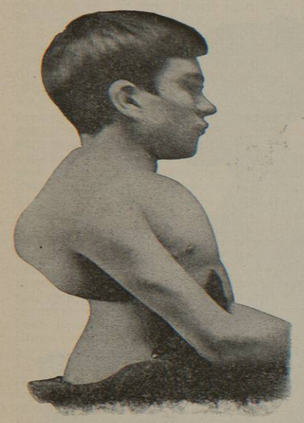

FIG. 1254.—Kyphos and Chest Deformity of Cured Pott's Disease. (Original.)

There are always rigidity and spasm of the spinal muscles during the active stage, and often restlessness or crying at night, abdominal pain, and a characteristic attitude. These points and others differentiate it from the rachitic spine already described. The treatment is that of Pott's disease, which includes attention to hygiene and nutrition, long-continued spinal support by special appliances, the avoidance of exercise, and more or less recumbency.

The Rachitic Chest.—Besides lateral curvature and kyphosis there are other deformities of the chest so frequently found in rickety children as to merit separate mention.

Harrison's Groove.—The greatest softening in the rachitic chest takes place in the cartilages of the lower ribs, where the chest is unprotected by the lifting action of the upper and lateral chest muscles. Just below the nipples there is nearly always a depression, which in severe cases extends upward near the costo-sternal junction or outward toward the axillary line. It has often been thought that this depression was due to the traction of the diaphragm, but it lies above the diaphragmatic attachment. The free border of the ribs is usually prominent, owing to enlarged liver and spleen and distended abdomen. These lateral depressions of the chest are in such a position that they are comfortably filled by the flexed forearms of the child, but it is improbable that the pressure of the arms has anything to do with their production. According to Stone,[39] flattening of the sides of the chest is less common than the formation of a transverse groove and occurs in about a quarter of the cases. The enlargement of the costo-chondral junctions, which forms the rachitic rosary, is often so great as to be plainly visible.

Pigeon Breast, Pigeon Chest, Chicken Breast, Keeled Chest, Pectus Carinatum.—The submammary flattening, the formation of a transverse sulcus, the flattening of the sides of the chest, and the flattening of the upper anterior chest enter into the formation of pigeon breast, which is simply the final outcome of a process of which the flattening is the first stage (Stone). In pigeon chest the sternum, and especially its lower part, is prominent, and the costal cartilages slope away abruptly at the sides. The antero-posterior diameter of the chest is increased, the lateral diminished, and the chest is much narrowed in front; it is also shorter than normal.

The reverse condition with a depression over the sternum may occur as the result of rickets. Both these deformities may be more pronounced on one side. These rickety chests are not only misshapen, but after the subsidence of the rickets they may remain unduly rigid and dwarfed.

Besides impeding respiratory movements, these rachitic chest deformities cause very little trouble, and when fully developed are practically incurable. Amelioration may sometimes be obtained by respiratory and general exercises. During the stage of development the treatment of the rickets is very important.

Similar conditions are sometimes due to obstruction of the air passages by adenoids, swollen turbinates, enlarged tonsils, polypi, or hypertrophic rhinitis. Tubby[40] relates several such cases, giving illustrations of the deformities produced. He says the proof of the dependence of the chest deformities upon the conditions named is given by their rapid improvement after the removal of the obstruction to respiration. A mild grade of these conditions is not uncommon in school-children, and is often accompanied by mouth breathing, and by inattention and apparent mental dulness, which clears up when the cause is corrected.

(*b*) *Chest Deformities Due to Lacing.*—Certain chest deformities are due to pressure from without, and of these the commonest is the constriction of the waist and lower chest by corsets among civilized women. The use of corsets, even when loosely laced, prevents the proper expansion of the lower ribs in respiration, and forces the breathing into the upper thorax. This effect has been so universal that the exaggerated upper

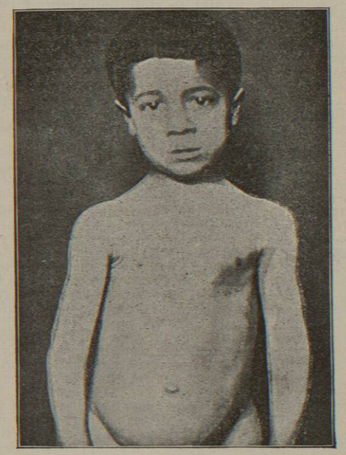

FIG. 1255.—Rachitic Chest, Showing Pigeon Breast and Harrison's Groove. (Hospital for Ruptured and Crippled.)

thoracic breathing of women is usually described as a normal peculiarity of the sex, but it has been pretty well established that boys and girls breathe alike until the girls put on corsets, and that women who do not wear corsets breathe very much like men, that is, with a bellows action of the whole chest, and not with a piston action of part of it. The evil effects of this abnormal constriction are seen not only in respiration, but even more in the crowding and displacement of the viscera. The liver may be deeply indented with the marks of the compressing ribs, and the ribs themselves

are often misshapen about the waist. The stomach, intestines, and pelvic organs are frequently displaced downward, with many resulting ills. The rigidity and compression of the stays weaken the waist, back, and abdominal muscles, and interfere with the natural support and normal mobility.

Cobbler's Chest.—Some occupations cause special chest deformities, such as the cobbler's chest, due to the pressure of the last against the end of the sternum, producing a depression similar to funnel chest, but lower.

Tailors who sew in a bent-over attitude often have a hollow chest.

(*c*) *Deformities Due to Changes in the Thoracic and Abdominal Contents.*—The last division of chest deformities includes those that are due to changes in the thoracic or abdominal contents.

The Inflated, Distended, or Emphysematous Thorax.—The typical chest of emphysema is large and rounded or barrel-shaped. It is, in fact, a chest which permanently retains the shape of extreme inspiration, owing to the ballooning of the enlarged and dilated lungs, or, according to Campbell[41] to overaction of the inspiratory muscles, the antagonistic pulmonary elasticity being impaired. The ribs are strong and leave the sternum nearly at a right angle, making the thorax appear short. The sternum is prominent, especially at the angle of Louis, and the epigastric angle is large. The supraclavicular depressions are shallow or effaced; they may even be converted into elevations, if the pulmonary apices are markedly emphysematous. This is by no means always the case; they may even be deepened. The chest is immobile, and the breathing abdominal. While one may safely infer the presence of emphysema from the rigid, inflated chest, one should not call the large, deep chest of well-built and active men emphysematous, nor should one forget that in many cases of emphysema the lungs are not enlarged, and the chest fails to present the above-described characteristics.

One-sided distention of the chest, particularly in its lower part, may occur in pleuritic effusion and empyema of one side, in which conditions there may be bulging of the lower intercostal spaces. In proportion as the breathing is crippled on the affected side, there will be inflation and overaction of the well side, especially at the upper part in front. Hypertrophy of the heart, pericardial effusion, and aneurism may cause enlargement in the precordial region, and marked enlargement of the liver or spleen may cause a bulging of the ribs on the corresponding side. Chronic distention of the stomach and bowels may cause prominence of the lower ribs on both sides. Effusions and enlargements of the internal organs will affect the shape of the chest in proportion to its flexibility. These deformities are therefore most marked in children, less in adults, and least often observed in the aged. In individuals with rigid chests changes in the internal organs may produce but slight effect.

The Phthisical, Phthinoid, Alar, Paralytic, or Rudimentary Chest.—This is partly a rudimentary and partly an atrophied chest. It has usually been described as flat or flattened, but Hutchinson[42] has shown that it may be not only relatively but absolutely longer, narrower, deeper, and rounder than normal, approximating the quadrupedal type. It is apparently a chest whose evolution has been arrested at a lower stage. In the chest of phthisis the ribs are depressed, and the intercostal and supraclavicular spaces may be sunken. The epigastric angle is diminished; costal breathing is lessened on the affected side.

If chest development is arrested in childhood or adolescence, the liability to phthisis is increased, and one may infer a certain predisposition to pulmonary tuberculosis from the existence of this chest in the young. The investigations of Gabrilowitch[43] confirm these views. He found that the ratio of the circumference of the best-shaped chest to the total height was as 1 to 1.6. The ratio of the mean antero-posterior diameter to the transverse was as .70 to 1 in normal individuals, but in phthisical individuals the proportion was .73 to 1. Rothschild[44] criticises Gabrilowitch's methods and conclusions, and gives the ratio of chest depth to chest breadth as 1 to 1.8 in healthy individuals, and as 1 to 1.5 in phthisical subjects with thorax paralyticus. He gives the chest circumference as one-half the total height, and the length of the sternum as one-fifth the chest circumference in the healthy, less in thorax paralyticus. He also states that the angle of Ludovici and the angular movement of the sternum in respiration are less in phthisis (see measurements by De Giovanni[45]). The whole subject apparently requires more exact and extensive study.

During the destruction of lung tissue atrophy of the muscles of the chest takes place, and is most pronounced on the side most seriously involved, and unilateral if the disease is unilateral.

Carcasonne[46] finds that atrophy of the scapulo-thoracic muscles takes place early and independently of general emaciation; it may even precede auscultatory signs. This atrophy is not accompanied by functional changes in the muscles, nor is their electric excitability altered; it advances with the progress of the pulmonary lesion, and is of considerable diagnostic value. The analogy of this concomitant atrophy of the muscles of related areas with the primary atrophy in joint disease is evident. In the latter case, however, the tonus and mechanical and electric excitability are said to be increased.

The very great importance of an active out-of-door life, of exercise stimulating deep breathing, and of free use of the arm and shoulder muscles for the round-shouldered and alar-chested, is apparent. Swimming, running, climbing, and throwing are particularly indicated.

Unilateral shrinking of the chest occurs in phthisis of one side. The deepening of one supraclavicular fossa is an evil symptom. Over a shrunken cavity the chest may present a depressed appearance, with hollow intercostal spaces. From the atrophy already mentioned, as well as from the traction of adhesions, there may be depression of the chest wall without cavity. After pleurisy and empyema, if the lung does not expand, the affected side of the chest may become markedly shrunken, and the whole thorax deformed with a scoliosis, whose convexity is toward the well side. *Henry Ling Taylor.*

BIBLIOGRAPHICAL REFERENCES.

[1] Medical Diagnosis, Philadelphia, 1898.
[2] Anatomische, physiologische, und physicalische Daten und Tabellen, Jena, 1885.
[3] Medical Record, July 29th, 1899.
[4] Journal American Medical Association, September 1st, 1897, p. 512.
[5] Encyclopedia Medica, Edinburgh, 1899.
[6] Medical Record, September 8th, 1894.
[7] Clinical Sketches, London, 1895.
[8] Transactions American Orthopedic Association, vol. xii., 1899.
[9] Thèse de Paris, 1890.
[10] Journal of Anatomy and Physiology, vol. xxx., London, 1896.
[11] Anatomische Anzeiger, 1894–95, p. 540.
[12] Transactions Clinical Society of London, vol. xxvi., 1893, p. 225.
[13] Transactions Academy of Medicine of Ireland, vol. i., p. 163.
[14] Archives of Pediatrics, vol. viii., p. 346.
[15] Boston Medical and Surgical Journal, vol. lxxxv., p. 114.
[16] Ephémèris médicale de Montpellier, 1826, p. 144.
[17] Lancet, February 19th, 1898.
[18] Transactions American Orthopedic Association, vol. ii., p. 233.
[19] American Medical and Surgical Bulletin, November 15th, 1894.
[20] British Medical Journal, May 13th, 1899.
[21] Wiener klinische Wochenschrift, January 4th, 1900.
[22] Cyanose et déformation thoracique. Société de Biologie, November 8th, 1899.
[23] Deutsche Chirurgie, vol. xlii., Stuttgart, 1888.
[24] Berliner klinische Wochenschrift, August 28th and September 4th, 1899.
[25] Pediatrics, February 15th, 1900, p. 154.
[26] Deutsches Archiv für klinische Medicine, April, 1882, p. 411.
[27] Reference Handbook of the Medical Sciences, vol. ii., p. 80, 1886.
[28] Philadelphia Medical Journal, March 11th, 1899, p. 559.
[29] Deutsche medicinische Wochenschrift, 1888, No. 36.
[30] Gazette hebdomidaire, February 16th, 1896.
[31] Journal de l'Anatomie et Physiologie, xxix., 1893, p. 564.
[32] Pediatrics, December 1st, 1899.
[33] Archiv für klinische Chirurgie, vol. xlii., p. 545.
[34] Revue mensuelle des maladies de l'enfance, March, 1900.
[35] Annals of Surgery, April, 1900.
[36] Zeitschrift für orthopädische Chirurgie, vol. vii., p. 129, 1899.
[37] New York Medical Journal, September 30th, 1899.
[38] Jouré et Boyer, Paris, 1899.
[39] Transactions American Orthopedic Association, vol. xi., p. 337, 1898.
[40] Deformities, a Treatise on Orthopædic Surgery, London, 1896, p. 24.
[41] Respiratory Exercises, New York, 1899.
[42] British Medical Journal, October 28th, 1899.
[43] Berliner klinische Wochenschrift, May 22d, 1899.