after intermittent or typhus fever, but then a tonic treatment, consisting of a meat diet, beer, wine, and small doses of iron, is to be recommended in addition. The ascites which comes on after scarlatina subsides more rapidly than any other.

(3.) Morbid Alterations of the Mesenteric Glands.—In all cases of enteritis folliculosa, the mesenteric glands become hypertrophied and indurated, and their impermeability most probably affects the atrophy that so frequently follows it, a detailed description of which has already been given in connection with that disease (p. 156). In addition, cheesy tubercles of the glands occur in older children; and, in those who perished by typhus fever, hypertrophy, or small abscesses of single glands, are sometimes met with.

The diseases of the mesenteric glands do not seem to give rise to any symptoms, but the nutrition, if a large number of the glands is involved in the hypertrophy, suffers very quickly. The glands, on the whole, are so small, and the bowels are always too tympanitic, to allow them to be felt.

CHAPTER III.

DISEASES OF THE ORGANS OF CIRCULATION.

A.—*HEART AND VASCULAR TRUNKS.*

(1.) Congenital Anomalies.—For the purpose of correctly understanding the congenital anomalies of the heart, this much of the embryology has to be premised: that the heart and roots of the vessels at the commencement of development are not hollow, but consist of a loose conglomerate mass of cells, without any chasm or channel, and without any cavities. At this period the heart still possesses the form of a straight cylinder, which above and below terminates in two prolongations; the two lower prolongations, the venæ omphalo-mesenterica, are the roots of the vessels which subsequently ramify in the germinal vesicle and conduct the blood from it to the heart; the two upper prolongations are the two future first aortic arches, which, in the embryo, carry the blood *from* the heart. The external upper surface, according to *Bischoff*, very gradually becomes firmer by the cells being deposited closer to each other, and thus the walls are formed, and a *cavity* is developed within, in which the fluid and cells, forming the first trace of the blood, accumulate. The cardiac cylinder then assumes an S-like shape, and begins to

contract and dilate in a slow rhythm, by which its fluid contents are propelled anteriorly and upwardly into the aortic arches, while that from the venous trunks, on the other hand, is sucked in from below and behind.

By-and-by this cardiac canal, by various curvings, dilations, and constrictions of single parts, becomes the heart proper, consisting of the aortic dilatation, *one* ventricle and *one* auricle. The septa do not become developed till a later period, by which the right and left ventricle and auricle are formed. Imperfect development or faulty insertions of these partition-walls are the most frequent causes of malformation of the heart.

Nevertheless, cases of malformation are also observed as the result of an embryonal inflammatory process of the muscle of the heart, and its consequent atrophy and cicatrizations.

The best compilations on the congenital anomalies of the heart are to be found in the text-books of *Rokitansky* and *Bamberger*, which have furnished the basis for the following summary:

(1.) *Absence of the heart* (acardia) occurs only in monstrosities, where the upper half of the trunk is at the same time wanting, and the nervous system consequently exists only in a rudimentary form. The converse of this is the duplex heart in double malformations (diplogenesis); this occurs especially in doubling of the upper half of the body, where two completely-separated hearts either occupy each a separate pericardium or a common one.

(2.) *Abnormal situation of the heart.*—Here we may have the fœtal heart occupying a central position in the thorax, or *transposed*, so that the cardiac impulse is felt at the right of the sternum. In this latter case we have generally an accompanying displacement of other organs, particularly the liver and stomach.

Again, the sternum may be absent and the integument wanting, and when this condition occurs we have the heart entirely exposed, or merely covered by the pericardium.

If a greater portion of the thoracic and abdominal walls is wanting, we have the condition called eventration, in which the abdominal organs lie without the body.

In very rare instances a defect or splitting of the diaphragm occurs, and the heart then penetrates through this opening into the abdominal cavity.

(3.) *Abnormal shape and size.*—Variations of the shape of the heart are often devoid of importance. It may be broad, cylindrical, or fissured at the apex. A pointed and a round heart may perform its functions naturally, whereas, on the contrary, abnormal bigness or smallness of the whole heart, or some of its parts, is complicated with

functional disturbances. The right ventricle is most frequently found enlarged in consequence of the fœtal circulatory passages having remained open.

(4.) *Abnormal formation of individual parts of the heart.*—Here we meet with abnormities (*a*) of the *septa*, (*b*) of the *roots* of the *vessels*, and (*c*) of the *ostia* (orifices) and *valves*.

(*a.*) If the formation of the septa has failed to take place, there will be but *one* ventricle and *one* auricle. Generally, however, the septa are indicated by projecting bands, or are fully developed in one or the other chambers, so that there may be two completely separated auricles and only one ventricle, or *vice versa*. As the foramen ovale, even in the physiological state, at first furnished a small communication between both auricles, so do we also here find the most frequent defects. It also happens, sometimes, that the left auricle communicates with the right ventricle, or, *vice versa*, through an oblique communicating passage. Most of the cases are then also complicated with extensive defects of the septa and faulty origin of the roots of the large vessels, which may also be produced by the insertions of the septa having left the median line. It thereby becomes possible for the inferior vena cava to terminate in the left instead of the right auricle, or for the aorta to originate from the right side of the heart.

(*b.*) As has been already stated, abnormities of the roots of the vessels depend, in a great measure, upon an imperfect development or faulty insertion of the septa. The most frequent deviations are:

(1.) The pulmonary artery is either entirely absent, or is very much constricted at its origin, and only becomes dilated beyond the duct. arter. Botalli, which conducts the blood to it from the aorta. When there is only one ventricle, the aorta supplies the place of the pulmonary artery.

(2.) What has been said of the pulmonary artery may also happen with the aorta—it may be misshaped or completely closed; it then receives its blood from the pervious remaining ductus Botalli.

(3.) The fetal type of the distribution of the blood is wholly retained, the aorta supplying the upper half of the body with blood, and the pulmonary artery, through the Botallian passage, the lower half of the body.

(4.) A transposition of the large vessels has taken place, the aorta springing from the right, the pulmonary artery from the left ventricle.

(5.) Both vessels originate from one ventricle.

(6.) The aorta has two equal or unequal roots, one of which springs from the left, the other from the right ventricle.

(7.) The bulb of the aorta is immensely enlarged and represents a third ventricle.

(8.) The ductus Botalli often remains permeable, or is absent altogether, or may become developed into a permanent vascular trunk.

The partial occlusion of the aorta at the other side of the opening of the Botallian passage deserves a more detailed description, an anomaly which has been closely investigated, especially by *Rokitansky*. A great constriction of the aorta occurs at this place, which may be but a few lines in length, and then terminates in an aorta descendens of a perfectly normal calibre. This anomaly is produced by the arteria pulmonalis in the fœtus forming an arch, is continued in the descending aorta, while the blood of the aorta is only transmitted into the arteries of the head and arms, the innominata, carotids, and subclavia sinistra. The blood of the pulmonary artery flows through the wide duct. Botalli into the aorta. A narrow vascular piece runs to the arch of the pulmonary artery, which may be regarded as a continuation of the aorta, and is described under the name of isthmus aortæ. After birth, the course of the blood is deviated from the duct. Botalli by the dilatation of the lungs; that passage soon becomes impermeable and obsolete, and, at the same time, the originally narrow vascular piece, the isthmus aortæ, becomes dilated to the diameter of the normal aorta. Now, if this dilatation of the aorta does not take place after birth, and the Botallian canal nevertheless becomes obliterated, a permanent constriction of the isthmus aortæ will be the result.

A collateral circulation then forms for the blood from the left side of the heart, the road for which to the lower half of the body has thus become obstructed, by which that section of the aorta below the constriction is nevertheless filled with blood. For this purpose, the branches of the subclavian artery become dilated, and assume a serpentine course. The most important branches which enter into the formation of this new connection are: the internal mammary, the rami intercostales, which conduct the blood into the rami intercostales posteriores, anastomosing with them, and which originate from, or, more correctly speaking in this case, terminate in the descending aorta. Further, the anastomoses between the internal mammary, superior epigastric, and the lumbar arteries; next the arteria intercostales suprema with the intercostal branches of the mammary; and, lastly, the arter. dorsalis scapulæ with the dorsal branches of the intercostal arteries.

In this manner, the descending aorta becomes completely filled; still it never acquires the normal calibre, whereas the arch of the aorta up to the place of constriction is seen to have become completely

dilated. These individuals are perfectly capable of living many years.

(9.) The venous terminations in the auricles may be transposed in the same manner as in the case of the arteries with the ventricles, or the vena cava and the pulmonary veins terminate in *one* auricle only, etc.

(*c.*) Congenital abnormities of the valves, and ostia in general, are comparatively rare, and can more readily be attributed to fetal inflammatory processes, fetal myocarditis, than to an actual arrest of development. The most frequent occurrences are:

(1.) Stenosis of the conus of the pulmonary artery, or of the aorta, a condition in which the muscular structure forming the conus has become converted into a white callous mass. This stenosis occurs more frequently at the pulmonary artery than at the aorta, and, according to *Bamberger*, is one of the most frequent causes of congenital cyanosis. The foramen is invariably found open, or the septum of the ventricle has not even become completely developed.

(2.) The valves may be cartilaginous, hypertrophied, or the auriculo-ventricular valve thickened, and numerous columnæ papillaries, and falsely-inserted chordæ tendinæ, occur; or, on the contrary, the valves are transparent, very much attenuated and perforated. In rudimentary construction of the large arteries or false insertion of the septa, the tricuspid or semilunar valves may also be completely absent.

(3.) The valve of the foramen ovale may be absent altogether, or become prematurely closed; various malformations have already been observed on the Eustachian valve too.

Symptoms.—Numerous descriptions of the congenital malformations of the circulatory apparatus are to be found in the dissertations and larger monographs, but the symptoms accompanying them are seldom pictured sufficiently in detail, and, even where this is the case, they will be found, as a rule, not to harmonize in one and the same anatomical condition. According to *Bamberger*, all the malformations in reference to their symptoms may be comprised in three groups:

(1.) To the first group all the malformations belong which produce an absolute incapacity for living, such as monstrosities, ectopia of the heart, with absence of the integument, complete univentricular heart, and transposition of the large vessels.

(2.) In the second group may be included all those malformations with which children may indeed live, and laboriously or even normally continue to develop throughout the first few years, still with every additional year they experience an aggravation of their disturbances of the circulation, so that death ensues in the course of the first, at

the latest in that of the second dentition. To this class belong congenital constriction of the conus of the pulmonary artery, and that of the aorta, extensive communications of the ventricles, or of the auricles, or of a ventricle with its opposite auricle, the origin of the aorta from both ventricles, and the remaining previous state of the duct. Botalli.

(3.) There is a number of minor anomalies, by which the circulation is in no way impeded, and consequently no hinderance whatever is offered to the development of the child. To this group belong particularly the external alterations in the form of the heart, the splitting of the cardiac apex, and the conical, cylindrical, broad, and circular form. The transposition of the heart to the right side, generally complicated with transposition of the liver and stomach, is devoid of any influence upon the continuation of life. The remaining open of the foramen ovale is likewise entirely unimportant, as has already been proven by numerous *post-mortem* examinations, nor is there the least plausibility for regarding it as the cause of cyanosis, to which, however, we will recur once more, further on.

The time of the appearance of symptoms is extremely variable. It is certainly true that the disturbances of the circulation produced by congenital defects of the heart may, at first, be insignificant, and may very gradually increase from month to month, but the statements of some authors seem very improbable, who maintain that congenital defects of the heart do not give rise to any symptoms till after many years, even not till after puberty. Those authors undoubtedly have fallen into some error, and certain acute diseases of the heart have been overlooked. Many children, on the whole, have displayed the most distinct signs of marked disturbances of the circulation immediately after birth. They come asphyxiated into the world, and soon after perish by atelectasis of the lungs. They cry but lowly and discontinuously, are always cool, somewhat cyanotic, sleep a great deal, and suffer from convulsive attacks of coughing, by which the cyanosis rapidly increases, and the protruded tongue especially assumes a dark, bluish-red color.

Cyanosis is always the most constant and reliable symptom, but concerning its origin partially incorrect views still exist. Formerly, it was assumed that cyanosis in congenital malformations of the heart was produced by the mixing of arterial and venous blood, as thus, when dark-red blood, in the normal condition, found its way into the arterial system of vessels. That this view is incorrect is seen from the forms of cyanosis, in which the anatomical conditions of the heart are perfectly normal, for example, in cholera or in poisoning with carbonic-oxide gas. In these cases, as is well known, the cyano-

sis is of an intense degree, and yet no traces of any morbid lesions are found about the heart at the *post-mortem* examination. The foramen ovale, on account of this same fallacious supposition, has also received altogether too much attention, and it was a matter of no consequence, when a probe could be passed from one auricle into the other, whether the valve was perfect or not.

The only test-bearing reason for the cyanosis is to be found in an imperfect oxidation of the blood in the lungs, combined with a stasis in the peripheral venous system. But this process may be produced by various conditions; either an impediment exists at the left side of the heart, and conjointly with this there is stagnation of the blood in the pulmonary veins, or the supply of blood to the lungs is diminished in consequence of a stasis in the right side of the heart, and hence less blood is arterialized, or the circulation meets with impediments in the lungs, the effects of structural lesions, or, lastly, the inhaled air is poor in oxygen, and in that case the blood is likewise but imperfectly oxidized. The blood may also become so altered in consistency that its flow will thereby be retarded, and this is especially applicable to the inspissation of the blood in cholera. Thus we see that the causations of cyanosis are tolerably numerous, and are by no means solely to be sought for in mechanical alterations of the heart.

The degrees of cyanosis vary exceedingly, and fluctuate between a slight bluish discoloration of the lower eyelids and a bluish redness of the whole body, and all supervening congestions produce an aggravation of the existing cyanosis. Too high and too low temperatures, excitement, crying, laughing, bodily exertions, are therefore the most frequent causes of this aggravation.

When children with congenital malformations of the heart survive the first few years, various other symptoms of disturbance of the circulation become superadded. Almost all of them suffer from imperfectly-developed pectoral muscles and pigeon-breast. The extremities are always cold and moist, very much like the skin of a frog, the tips of the fingers swell up bulbous, over which the nails, curved like claws, project; the cutaneous veins are preternaturally large; the patients are unable to exert themselves in any manner, whether to run or climb, or to cry continuously, for all these efforts cause them severe pain in the præcordia, dyspnœa and palpitations. Hæmoptysis, also, in rare instances, is observed in larger children; epistaxis, on the contrary, is a symptom which occurs tolerably often, and as a rule gives momentary relief. Finally, general dropsy of the cellular tissues and of the serous sacs, with which albuminuria becomes associated, terminates the distressful existence of these children.

The physical examination of congenital cardiac malformations is

attended by extraordinary difficulties. Hypertrophy of the heart is almost unexceptionably demonstrable, and is usually due to a marked enlargement of the right side of the heart. In this condition the heart's impulse is felt over a larger space, and stronger than usual. Distinct cardiac murmurs can seldom be elicited by auscultation; in most instances a confused sound is only heard instead of the one or the other, or even in place of both cardiac sounds. Prolonged loud murmurs allow one to conjecture the existence of a marked abnormal communication between the cardiac moieties, a perforation of the septum for example; a strong systolic murmur heard most distinctly over the pulmonary artery indicates a constriction of this vessel, one of the most common malformations that occur. Sometimes, however, the auscultatory phenomenon is not adaptable to the one or to the other evil, and no nearer approach to an accurate diagnosis can be made than of congenital defect in general. The periods of the first and second dentition, according to statistical compilations by *Friedberg* and *Aberle*, are especially dangerous for children with congenital defects of the heart. Out of 139 cases, 53 died in the first year, 51 between the second and eleventh year, 30 between the eleventh and twenty-fifth, and 5 only attained to an age of over forty-four years.

Treatment.—A direct treatment, of course, is altogether out of the question; we have to limit our efforts to the prevention of all possible injuries, and to institute an appropriate dietetic *régime*. The restrictions concerning the necessary rest are easily enforced in these children, for they are soon taught by experience how injurious and painful any accelerated action of the heart is to them. As regards the diet, no particular precautionary measures need be prescribed; all heating and alcoholic drinks, however, must be absolutely prohibited. Warm clothing is extremely advantageous in these cases, and a flannel shirt should therefore be particularly recommended to be worn next the skin. All antiphlogistic treatment, with calomel, leeches, cantharides, etc., must under all circumstances be avoided, for dropsy and the fatal end are perceptibly accelerated by it. Active congestions, which in these cases are liable to occur extremely often, must be relieved by the external application of cold, acidulous drinks, and strict diet.

If the children come asphyxiated into the world, the methods of animation already recommended for asphyxia should be resorted to, but in these cases they almost always prove fruitless.

(2.) Endocarditis, Pericarditis, and Rheumatismus Acutus.—We include here three morbid pictures in one frame, which anatomo-pathologically have no similarities whatever to each other; clinically, however, they can scarcely be separated, if it is desired to avoid the