

symptoms, and may be very easily confounded with rachitis of the skull, or with simple hypertrophy of the brain and of the cranial bones. The main distinction between chronic hydrocephalus and rachitis of the skull consists in this, that the temporal bones in the former are always directed outward, while in the latter disease they stand perpendicularly, even when the anterior fontanel has become very large. All the hydrocephalic functional symptoms are absent here, and the attenuation of the skull itself generally is not found diffused over the whole surface, but confined to the posterior parts, while the frontal bones display the usual rachitic hypertrophy, and the remaining portions of the skeleton, thorax, and extremities, are similarly affected. Cerebral hypertrophy is likewise unaccompanied by any of the hydrocephalic symptoms. It almost always originates in consequence of rachitis of the skull, and the bones are markedly hypertrophied. But, after all, we are entirely unjustified in speaking of hypertrophy of the brain from mere eye measurements, so long as no accurate weighings of the brain, in comparison to the entire weight of the body, have been instituted, and the medium number fixed upon.

**Therapeutics.**—I know, indeed, certain children with chronic hydrocephalus, in whom no augmentation of the serous effusion has taken place for years, and who are in a tolerably good state of mental and corporeal development, but that an actual cure ever was accomplished, so as to secure the social usefulness of the patient, we have no proof. To keep these children alive as long as possible, they must be carefully nursed, and their diet accurately regulated. Though the action of diuretics in promoting the absorbing of the hydrocephalic fluid, and its subsequent elimination, seems to be extremely problematical, it appears proper to give them. For this purpose such only should be chosen as exercise no general weakening influence, for example, juniper, digitalis, acetate of potash; iodide of potassium, mercury, tartar emetic, and drastics generally, are to be avoided. A tonic and stimulating treatment cannot be injurious, particularly when proper attention is at the same time paid to the condition of the bowels. Locally, the most various ointments and fomentations have been employed, and, so long as the children are not tormented with them, they are not objectionable. The continuous strapping of the head for years with adhesive plaster, so warmly recommended by *Englemann*, as well as the puncturing and evacuating of the contents of the ventricles in those cases where the fontanels are still unclosed, has been tried by a few surgeons eager to operate, and has been abandoned because of its total inefficacy.

(6.) ENCEPHALOCELE (Congenital Hernia of the Brain).—Hernia cerebri is always congenital, and produced by an immoderate dis-

tion of the brain, as an effect of which the proper development of the cranial bones cannot take place. In these cases a tumor is found immediately after birth on some part of the skull, most frequently in the occipital region, and, on examining the parts more closely, the bones will be found to be annularly defective. The size of this tumor varies between that of a child's head and a small nut, and chiefly consists of the water which in all cases surrounds the prolapsed portion of the brain. The narrower the bony chasm, the more pediculated will be the tumor; and the wider it is, the more flattened the prolapsed part will be. Its covering consists of an atrophic, hairless cutis, which is united with the pericranium and the meninges. In large hernia, the integument may be so atrophied that the sac bursts from pressure at the delivery, whereupon death is the immediate result. Hernia cerebri occurs most frequently at the occiput, upon or beneath the posterior fontanel. It also occurs at the root of the nose, or angle of the eye, at the anterior fontanel, and very rarely through the temporal bones. When it makes its exit at the root of the nose, the nasal bones will be found forced asunder, and the distance between the eyes increased.

By compression the tumor may be entirely reposit, or considerably diminished, but the procedure always induces pain, and, when the pressure is kept up, may give rise to cerebral phenomena, such as convulsions, tetanic spasms, stupor, and syncope. In small tumors, with tough coverings, an early death is by no means an absolutely necessary occurrence. But the growth of the tumor, which always keeps pace with the other portions of the body, exposes it to almost unavoidable contusions and other injuries, which give rise to a chronic meningitis, and thus it happens that it is one of the rarest occurrences to meet with an adult or a child with hernia cerebri of several years' standing. Although life, with very great care and attention, may be preserved for a few years, still, the mental developments remain very much retarded, and imbecility is invariably the result.

**Treatment.**—In very small, entirely reducible herniæ, a radical cure is said to have been effected by the continuous maintenance of the sac within the aperture till it is closed by bony deposit. When the reposition is not complete, as is generally the case, and when severe cerebral symptoms are induced by the reduction, we must be content with simply protecting the dangerous spot from external injuries by a hollow piece of lead, or a properly-constructed leather covering. By this means the sufferer may live to an advanced age. Among the anatomical collections in this place, is a skull of an adult, on the occiput of which is an opening the size of a penny. The edges of this opening are round and smooth, and its history states that dur-



ing life a cerebral hernia protruded through it. The removal, or the deligation of such a hernial tumor, according to *Bouchut*, always gives rise to a fatal meningitis. Consequently, the operation should be totally discarded. Better results may be expected from puncturing the tumor with a trocar, or, still better, with a simple needle introduced a number of times, and thus evacuating the contents. By this means we may often succeed in so diminishing the size of the tumor that a protective instrument may be applied, which otherwise would have been almost impossible. Though the secretion accumulates again after the puncture, the hernia, after the operation has been repeated six or eight times, remains permanently reduced in size, and a marked improvement in the whole condition is brought about.

(7.) SCLEROSIS OF THE BRAIN.—Induration of the brain in children is extremely rare. *Rilliet* and *Barthez*, and *Weber*, have reported single instances only. The sclerosis of children, like that of adults, either involves the whole brain, or only small portions; the degree of induration fluctuates between an almost imperceptible hardness and a cartilaginous consistence. In the latter case, it is always combined with atrophy, loss of substance, and textural alteration. A slight degree of general induration occurs more frequently than any of the other forms, such as is sometimes found at the autopsy of fatal cases of scarlatina and typhus fever. The rarity of the partial induration is readily explained by the circumstance that cerebral apoplexy in childhood is extremely rare, and that its resolution is the principal cause of this induration. In somewhat extensive meningeal hæmorrhage, or purulent meningitis, the adjacent parts of the brain usually participate, and the sclerosis then forms the *finale* of these processes. These cases are characterized by an almost cartilaginous hardness, the indurated portions presenting a dirty, grayish-yellow color, which, to a great extent, takes the place of the gray substance, though the white substance also becomes more or less affected. Carcinoma of the brain, whose nature will be discussed in one of the following sections, should not be confounded with this induration. This cerebral sclerosis possesses little else than anatomico-pathological interest, for the symptoms produced by it are not characteristic, and, consequently, no one is capable of diagnosing it. The symptoms it may occasion are epilepsy, idiocy, and neuralgia of various kinds.

**Treatment.**—This must naturally be directed to the symptoms. The cure of the induration has never, to my knowledge, been accomplished. Narcotics, nervines, and tonics, will be the agents, according to circumstances.

(8.) NEOPLASMS OF THE BRAIN.—Adventitious growths are by no means of rare occurrence in the infantile brain. This is especially

true of tubercles, whose effects are the more marked as they increase in size, and according to the rapidity of their growth. By the pressure produced in this manner upon the surrounding cerebral parts, a general increase in bulk of the affected hemispheres takes place, and disturbances of the circulation are apt to ensue, which ultimately lead to cerebral œdema or effusion into the ventricles; however, they are apt to occasion softening or small apoplexiæ in their immediate vicinity. The various forms of neoplasms, arranged in the order of their frequency, are—

(a.) *Tubercle.*—The number of large tubercles in the brain is very limited, for usually they occur in twos or threes, and seldom more than five or six. The size varies according to the number, and usually fluctuates between a hazel and walnut. On the other hand, when a large number are found together, they are not apt to exceed the size of a pea. In form they always approximate more the round or oval, very rarely become agglomerated into irregular nodular masses, and, from this fact, it is supposed that tubercles probably embrace a certain space from the beginning, and do not subsequently become enlarged by external accretions. Tubercles have been found in all parts of the brain, still it cannot be denied that they are more frequently located in the gray substance than in the white. Hence, they are found either entirely at the periphery, or deep in the centre, where, as in the corpus striatum and optic thalami, much gray substance exists. It is very rarely met with in the medulla oblongata, or in the septum or crura cerebri. Peripheral tubercles may be situated so superficially that they touch the meninges and adhere to the dura mater, and so be confounded with tubercles of the meninges, which, however, never occur in this manner. If the tubercle itself is examined accurately, it will be found to present no differences from the large cheesy tubercle of the bronchial glands or of the lungs. It consists of a yellow, lardaceous, tough, friable mass, which, under the microscope, exhibits no cell-formation, but only amorphous granules and masses, in short, nothing but detritus. The parts by which they are immediately surrounded are vascular, and the union between them and the cerebral tissue is not very intimate, for they may be entirely enucleated without any particular dexterity or trouble.

The manner in which they originate is by no means clear, since only the fully-formed yellow cerebral tubercle is found, without any gray, crude, semi-transparent granules, such as it is possible to demonstrate in almost every tuberculous lung. It is true that *Rokitansky* has occasionally found some portions of tubercles in this crude, jelly-like state, but he believes that the transformation must progress very rapidly. Usually the whole tubercle forms a homogeneous mass,



without any differences in consistence or color; still, occasionally, the commencement of softening may be detected, whereby the liquefied centre, or perhaps even the entire nodule, will represent a capsulated cavity with sanious purulent contents. Microscopically the purulent mass which occurs here is distinguished from genuine pus by the absence of all cell-like structure, and the presence of simple detritus. No cretaceous tubercle is ever found in children, for a period of many years is necessary for the calcification of large tubercular masses. The most common complication, and at the same time most common cause of death, is acute miliary tuberculosis of the meninges, with acute hydrocephalus, which appears to originate through a direct absorption of the primary tubercles. The next complication as to frequency is tuberculosis of the bronchial glands and lungs. The reason why large, yellow, cerebral tubercles are found oftener in children than in adults is, that the adventitious growth, which probably is congenital, or acquired immediately after birth, may remain latent for some time, even for several years, without displaying any well-marked symptoms, though death commonly occurs during childhood, and on this account this pathological condition is but exceptionally seen in the adult. Cerebral tubercles produce no symptoms that are not produced by other neoplasms of the brain, and, in order to avoid repetition, all the symptoms occurring with them will be described at the conclusion of this anatomico-pathological *exposé* of their character.

(b.) *Carcinoma*.—Carcinoma of the brain, like carcinoma in general, is of itself extremely rare in children. I have met with it twice only in infantile cadavers. According to the statements of all authors, the medullary cellular form, "fungus medullaris," is the predominating variety; the hard fibrous cancer scarcely ever occurs. Cerebral carcinoma either infiltrates the brain, gradually disappearing in the normal cerebral substance, or it is sharply defined, of a round or oval form, and in these cases may be entirely enucleated with great ease. Usually it is a mass of considerable dimensions, and exists only in one hemisphere; still, instances are related where nodules of cancer were found scattered throughout the entire brain. They have no preference, as in the case of tubercle, for the gray substance. These carcinomata usually grow very rapidly; they become somewhat flattened when they have reached the vault of the cranium, and may even cause atrophy of the bone, and make their appearance on the scalp; or they may grow along the optic nerves into the orbit and attack the bulbs. They are often primary in the brain, and remain isolated in it without simultaneously occurring in other organs.

(c.) *Entozoa*.—A few solitary cases are reported of encysted worms having been found in the brains of children. *Echinococcus* has been

found in the cerebral substance in the shape of large or small cysts. *Cysticercus cellulosa* occurs somewhat more frequently, and in most instances is at the same time present in large numbers in the muscles. The *cysticercus*, according to *Rokitansky*, is found almost exclusively in the gray substance, and preferably in the peripheral layers of the cerebral portion, where the cysts project above the level of the brain, and partly elevate the meninges. The animals may perish, and the cysts undergo calcareous degeneration, and a cretaceous substance will then be found enclosed in a capsule, and can be distinguished from cretified tubercles with great difficulty.

**Symptoms.**—It is one of the most inexplicable phenomena in pathology, that the symptoms of these neoplasms are by no means constant, and still more that, in a great number of cases, none at all are observed. Apparently perfectly healthy children are taken sick with acute hydrocephalus of the usual form, succumb to it in two or three weeks, and the autopsy reveals one or more large yellow tubercles in the brain, which may even be undergoing softening, having existed many months, perhaps years, without producing the slightest symptom indicating their presence. In other cases, a prolonged and distinctly pronounced prodromatory stage is noticed, and the general signs of a chronic cerebral compression supervene. The child loses its appetite, vomits, and is attacked by unilateral or bilateral paralysis. The organs of sense become abolished, amaurosis, deafness, violent headache, convulsions, and contractions of the muscles, come on, and then the symptoms of meningitis usually terminate the sufferer's life. In most of the cases affected with the various kinds of carcinoma, there is intense headache, quickly followed by incessant restlessness, stuttering, weakness of the organs of sense, movements resembling St. Vitus's dance, onanism, convulsions, sleeplessness, paralysis, and exhaustion. In encysted entozoa, epilepsy, and chorea in particular, is frequently observed, and, in addition, the symptoms just described. The diagnosis of probable *cysticercus* can only be formed when, with the existing cerebral symptoms, the cysts of this entozoa can at the same time be found in the muscles, eye, and other parts of the body. Neoplasms of the brain are beyond the reach of therapeutics. They can, at the utmost, call for a symptomatic treatment only.

(9.) CONGENITAL MALFORMATIONS.—Besides congenital hydrocephalus and hernia cerebri already spoken of, a few other arrests of development occur, which are of interest to anatomy and to embryology only, as most of them are mere monstrosities.

In this class we find *acephalia*, or brainless and headless monsters. This condition is generally accompanied by spina bifida, ectopia of the heart, absence of the lungs and abdominal viscera, and distorted



extremities. There may, however, be only a *deficiency of the brain*, which may exist either in the longitudinal or transverse diameter. Thus hemicephalia may exist of various grades; almost the entire brain may be wanting, from the small remnants of which the cranial nerves originate. The hemispheres may be wanting, with the exception of a small portion at the base. Conjointly with this, the cranial bones are defective, or of a rudimentary formation, and the meninges primarily distended into a bladder containing water, but which, having burst very early, hangs in atrophic folds over the shapeless cerebral masses. Again, only a small portion of the brain may be wanting—the anterior lobes, for example, and olfactory bulbs, the optic thalami and optic nerves, pons Varolii, etc. Along with this, a corresponding malformation of that part of the face destined for the reception of these absent structures exists. The cranial bones in these cases, though small, may yet exist. The most striking of all defects in the longitudinal diameter is the single *cerebrum*, combined with cyclopia, and absence or deformity of the face. Next is a coalescence of the optici thalami and corpora striata; or still again, an absence of the commissures, thus splitting the brain by this condition of the parts. In these cases the formation of the bony case may have taken place normally; but idiocy and bodily defects always exist. Again, the brain, though existing, may be very *small*, but in all other respects perfectly formed; *microcephalia*. This condition occurs independently of that in which partial absence of some part exists. The vertex in these cases is low, the forehead flat, and the entire head pointed. Children so affected are capable of life and development, and, singularly enough, are not tardy in their mental development.

Excessive growth of the brain is extremely rare, and the numerous splittings of the lobes which here and there occur are to be looked upon rather as anomalies of form than excessive formations.

#### B.—DISEASES OF THE SPINAL CORD AND MEMBRANES.

(1.) SPINAL MENINGITIS AND MYELITIS.—The diseases of the spinal marrow are still in a state of obscurity, and all that is positively known of them could be stated in a few lines, if we were only to confine ourselves to the distinctly demonstrative anatomico-pathological alterations. First of all, as regards the much-abused hyperæmia; all *post-mortem* appearances must be excluded as spurious where the cadaver was not placed upon its face immediately after death, and the autopsy was performed later than twenty-four hours after life terminated. Without this precaution there will be found in every case, even in the

most normal, extensive *post-mortem* hypostasis, imbibition of the coloring matter of the blood, and putrid softening, by which it becomes totally impossible to establish the previous existence of any actual disease in the medulla spinalis. Although the anatomico-pathological condition is different in kind, still inflammation of the spinal cord and its membranes may be comprised in one group of symptoms, for the phenomena in both processes are almost identical, and hence a differential diagnosis becomes extremely problematical.

**Pathological Anatomy.**—The sac that is formed by the dura mater does not completely fill out the canal of the spinal column, but is secured there by adipose tissue, which accumulates more toward the vertebral laminae, anteriorly against the vertebral bodies by loose cellular tissue, and all around by venous plexuses. This sac of the dura mater, on its inner side, is firmly united with the external lamella of the arachnoid; while the internal lamella of the latter hangs loosely, together with the pia mater. Between these external and internal plates or lamellæ, is contained the cerebro-spinal fluid, which mingles with that of the meninges and ventricles of the brain, and even in small children may amount to a drachm. The pia mater of the cord is richer in vessels than that of the brain, and in the new-born child can readily be pulled off. Having thus briefly recapitulated the normal condition of the spinal meninges, we may proceed to the investigation of the character of the hyperæmia and of the hæmorrhage. In young children the cerebral arachnoid and pia mater, and the veins within the spinal canal, are always plethoric; in fact, the vessels are so full that, even when the precaution is taken of turning the body on its face immediately after death, extravasations are not of unfrequent occurrence. These pathological phenomena were first explained by *Weber*, of Kiel. It is not always easy to determine whether the blood found *external* to the dura mater was extravasated during life, or whether the blood was poured out upon the dura mater, from veins that have been severed during the removal of the vertebral laminae. The best means of guarding against an error is not to attempt the removal of very long sections of the vertebral laminae at one time, but to remove small portions, at different places, and then allow a feeble stream of water to play upon the exposed dura mater. The blood exuded from the veins after death is entirely washed away in this manner, while that extravasated during life is always somewhat coagulated, and adheres rather firmly to the dura mater. These hæmorrhages are most frequently found in the cervical and lumbar regions, sometimes extending but a short distance, or lining the whole spinal canal, forming a complete sheath of coagulated blood. Small extravasations are sometimes seen more distinctly upon the disarticulated vertebral laminae