

BRAIN: HYDROCEPHALUS.—See *Hydrocephalus*.

BRAIN, HYPERÆMIA OF.—A term used to signify augmentation of the mass of blood in the vascular department of the brain. An equivalent meaning is conveyed by cerebral congestion. Both terms indicate in the main an extra-physiological accumulation in the circulation of the encephalon, and express the same cause united to different symptoms, although congestion seems to apply rather to the sudden or the so-called fluxionary hyperæmia resulting from pathological conditions in other parts of the body. Some writers claim that increase of arterial blood passing through the encephalon is the only true hyperæmia, and that fulness of the brain should more properly be described by "venous congestion," which is associated with the anæmia consequent upon impaired vaso-motor innervation of the neurasthenic state.

Like that of many questions in medicine, the history of cerebral congestion is old, and so completely chaotic that in recent times the possibility of its occurrence, and consequently its clinical importance, have been doubted. Putting aside its existence as a separate disease, or as a morbid entity having pathognomonic and regular symptoms, we will assume that the brain, like any other organ, may be the seat not only of anæmias but of hyperæmias either circumscribed or generalized. Analogical justification so obvious as that furnished by experimental investigation on the lower animals, having reference to venous hyperæmia, renders the possibility of increased vascularization of the brain admissible. Further evidence that the contents of the cranial cavity may vary in quantity is furnished by the intracranial pressure detected in infants in whom the fontanelles are open, the scalp being raised above the level of the skull, or depressed, according as the head is raised or lowered, or when the tension of the fontanelle is increased by compression of the jugular veins. When a portion of the brain is exposed, after an injury of the skull, it will be observed to enlarge and to contract in correspondence with the elevation or depression of the head, the presence or absence of sleep and emotional excitement, or with the action of any cause that accelerates the circulation. Any cause that constricts the neck may produce a sensation of fulness and pain about the head, with bleeding from the nose; and as a fact of pathological moment that should be emphasized, there may be mentioned the obstruction to the flow of venous blood resulting from insufficient removal of carbon dioxide. In dependent positions of the head, indications of congestion are noticeable in the bloodshot countenance and other evidences of imperfect return of blood. The existence of intracranial congestion in such circumstances is further demonstrated by the very red papillæ and much-congested vessels of the optic nerve. These changes at the fundus of the eye are not found in such gymnasts as trapeze performers and "fly walkers," because by constant training and habit the animal economy accommodates itself to the abnormal positions. Variability of the cerebral circulation is further shown in the pallor of the fundus of the eye, following the administration of drugs that are known to irritate the vascular nerve centres, as ergotin and belladonna. Finally, the existence of cerebral hyperæmia is revealed by the necroscopic appearance of the brains of persons or of animals who during life suffered from interruption to the perfect return of blood from the head.

PATHOLOGICAL ANATOMY.—It is quite difficult to recognize cerebral hyperæmia on the cadaver, since evident traces are not always left in the brain, and there may be sanguinary stases brought about by gravity and the position of the cadaver which do not exist during life. Venous hyperæmia is more easily recognizable after death than the arterial form. In a severe case of hyperæmia the tissues over the cranium are often found to contain an abnormal quantity of blood; drops of extravasated blood from ruptured vessels are seen on the dura after removing the calvarium; the dura, when detached,

is of a bluish tint; the sinuses of the dura, the veins emptying into the sinuses, the veins of the pia and the choroid plexuses are distended with blood; and degeneration of the vessels themselves has been frequently observed. The mass of the brain appears larger and swollen, the gyri are flattened, the sulci effaced, and the ventricles may be filled from subarachnoidean effusion; there is a reddening of the whole organ, and the membranes are dry and viscous. This reddish or deep-red tint is particularly noticeable in the intense hyperæmia of the new-born.

The gray substance, increased in consistence, presents a reddish-gray color, and if the hyperæmia has been intense, small punctiform hemorrhages are observed. The white substance, also increased in consistence and in density, is of a uniform rose color. On section the brain, without being œdematous, shows numerous sanguinary points which are larger than usual, owing to increased size of the capillaries. The meninges are usually filled, and the veins of the cortex are tortuous. If the case has been a chronic one, uniform widening and tortuosity of the vessels are much more pronounced, showing the development of small aneurismal dilatations, and sequela conditioned by the increased vascularization, such as vascular development of the cellular tissue which enters into intimate relations with the glia. The cribriform or sieve-like appearance observed on making a transverse section of the hemispheres is usually regarded as a consequence of long-standing stasis, especially if found in the brains of old people, of chronic drunkards, of opium-eaters, or of maniacs. There are also reasons for believing that cerebral atrophy may be developed in old people in consequence of continuous venous stasis. The pathological changes of arterial hyperæmias peculiar to the cranial cavity are rarely observed on the cadaver, as they usually disappear, with its causes, after death. When we take into consideration the imperfect knowledge both of its mechanism and of its anatomical details, and the difficulty to establish the relations existing between its numerous symptoms and the lesions that determine them, it is not surprising that the existence of cerebral hyperæmia is not always easily demonstrable. The condition may sometimes be studied on the large arteries of the pia, but no one has yet distinguished an arterial from a venous hyperæmia in the cortical portion of the brain. It is only in such processes as Basedow's disease that chronic arterial hyperæmia is recognized. The difficulty of recognition is increased by the inflammatory changes and simple hyperplasias that are often present, and often overlooked after frequent and long-continued attacks of chronic arterial hyperæmia. According to recent researches, when the disorder has run a rapid course pathological changes may be found in the ganglion cells, or in the cortical connective tissue, with nuclear proliferations in the walls of the vessels, and in the fibrillary plexus of the cortical substance.

ETIOLOGY.—If there exists a disproportion between the clinical and the post-mortem phenomena of cerebral hyperæmia, it must be admitted that the mass of the blood within the skull varies according to certain circumstances, and that the brain, like other organs of the body, is subject both to anæmia and to hyperæmia; indeed, it would be surprising if it were not. The question of hyperæmia resolves itself into that of a liquid circulating in tubes, in which repletion or engorgement can be produced in but two ways, namely, by increase of the inflow, or by diminution of the outflow. Active fluxionary hyperæmia may be caused by the augmentation, and passive hyperæmia, or that of stasis, by diminution of the sanguinary flow. The force and abundance of the inflow of blood into the vessels of the brain are influenced by the general increase of pressure, and by diminution of local resistance, and it seems as if the greater number of active congestions should be brought under the first category. For a long time the congestive influence of certain exciting drinks, as tea, coffee, and alcohol, has been admitted; and violent muscular exertion, general plethora, cardiac hypertrophy, emphysema of the lungs,

the effects of strong emotion, and the exaggeration of normal functional activity, are believed to take great part in the production of cerebral congestion. But the general increase of blood pressure plays simply a secondary part in the production of hyperæmia, which it can facilitate or augment only when there exist local alterations, such as inflammations or vascular lesions. Hypertrophy of the heart can scarcely be said to cause congestion of the brain, except in cases in which the cerebral vessels have become weakened on account of other causes, and the same may be said of other agents that increase the cardiac impulse.

Other conditions that tend to produce congestion of the brain, by excess of arterial tension and too considerable afflux of blood, are chronic Bright's disease, Basedow's disease, intermittent fever, extremes of heat and cold, and the tension produced in the vessels of the head and neck when the aorta is constricted or strongly compressed by a thoracic or an abdominal tumor. This increased arterial tension may also be brought about by the suppression of the normal or pathological secretions, as the menses at the menopause or other period, by the sudden stoppage of hemorrhoidal bleeding when general plethora exists, by the checking of a chronic diarrhoea of long standing, or by stopping the hemorrhages in hæmorrhophilia, and it may result from facial erysipelas, or any cerebral or meningeal phlegmasie, from diverse peripheral irritations, from extended lesions of the skin produced by burns and eruptive diseases, as variola, scarlatina, and measles.

An important and considerable class of congestions may result from local increase of pressure or collateral fluxions, by means of which the entrance of blood is shut out from the organs. The pathological phenomena susceptible of giving place to collateral fluxions are acute inflammations, thromboses, and embolisms, and the infarctions resulting therefrom. Interstitial hemorrhage may have the same result; and the energetic local compression excited on the skin by the application of thick layers of collodion also produces a considerable local hyperæmia. Fluxionary hyperæmias from exaggeration of pressure result from general pressure only, not from local, and the greater part of them result from the pathological causes above mentioned.

Hyperæmias of fluxion, by diminution of local resistance, may result when atmospheric pressure is diminished or defective, the simplest type of which is furnished by the application of the large exhausting apparatus used to produce cutaneous revulsion. The opposite condition may bring about the hyperæmias peculiar to workmen in condensed air (see *Caisson Disease*). The congestive phenomena brought about by the rapid disappearance of a considerable effusion, as ascites, and even by the extirpation of certain tumors, belong to the same category. The condition is also brought about by direct or reflex paralysis of the vaso-motors which influence the dimensions of the vessels in the brain cavity. The innervation of the vascular walls may be directly diminished by any pressure whatever, as that of a tumor, or they may be paralyzed by reflex action in consequence of an irritation of the sensitive nerves of a part, as observed in inflammation and in lesions of the nerve centres. Direct paralysis of the muscular walls of vessels may be brought about by variations of temperature. Extreme heat and cold and insolation are capable of producing intense congestion, and the action of rubefacients is analogous. Direct insolation doubtless acts by raising the temperature of the cranium to such a degree as to cause incipient paralysis of the muscular action of the vessels, and consequent diminution in the tonic force of their walls. The same nervo-vascular phenomena are asserted to be brought about by the action of such substances as opium, alcohol, belladonna, hyoscyamus, hashish, stramonium, and amyl nitrite. Fatty or amyloid degeneration of the vascular walls, especially in old people, transforms the vessels into inert and dilatable tubes, which may favor hyperæmias of this order. The presence of entozoa, or of any pre-existing focus of

disease in the brain, is also an etiological factor. Finally, all the processes that decrease intracranial pressure favor the creation of cerebral hyperæmia. Among them must be reckoned such causes as intense excitement, no matter whether produced by imagination, temperament, or thought. Intellectual work that consists in logical combinations of ideas seems to be less hurtful in this respect than the more exciting results of a heated imagination, or the depressing effects of sadness, sorrow, and sudden shocks.

Passive hyperæmia, or the hyperæmia of stasis, may result from the active or fluxionary form. It happens that the capillary vessels do not regain their first tonicity after the enormous distention of an active hyperæmia, so that the stases become confused with the preceding fluxions. The causes of hyperæmia by stasis are principally those that retard the return of blood from the brain, either by diminution of the local pressure or by increase of the obstacles opposed to the returning circulation. The former exists in the case of alterations of the arterial walls, or when their contractility and elasticity are lost, and in obliteration of the arteries; the second is seen in the hypostases of certain congestions resulting from the long continuance of one position of the body, or in those following certain maladies, and in the compressions of the venous system by tumors or any neoplasm whatever. Venous congestion or hemorrhagic stasis may result from thrombosis, or it may result from congestion of the vena portæ, from compression of the jugular, from a stasis in the region of the lesser circulation, from mitral insufficiency, emphysema, and stenosis of the larynx, from all forced expiratory efforts made with closed glottis, and from all processes that invade the abdominal cavity, especially in plethoric individuals. Chronic constipation and flatulence, blowing wind instruments, violent vocal efforts, parturition, epilepsy, hysteria, and chlorosis—these causes are all at fault in producing this variety of hyperæmia.

SYMPTOMS.—Although no one sign of cerebral hyperæmia is of absolute diagnostic value, yet its existence is often established by the symptoms alone. Fluxionary hyperæmia constitutes rather a phenomenon superadded to various morbid states, but in certain cases of mental alienation over-activity of the mind, though always secondary, is very nearly the only pathological manifestation. As in anæmia, the symptoms met with in exaggerated distention of the vessels of the brain are those arising from derangements of the sensorium, the organs of special sense, and of the sensitive and motor nerves. The manifestations of cerebral hyperæmia are perhaps better known to alienists and neurologists than to other physicians. They are most important as throwing light on the general pathology of insanity, many cases of which, having unknown or undetermined lesions, are doubtless owing to encephalic congestions. Of the cerebral functions the most strongly affected is the intelligence. Delirium is the prominent symptom of cerebral hyperæmia. It is generally that of excitement, and in many cases in no way connected with general paralysis there are found to predominate the delusions of grandeur, riches, ambition, and the like, characteristic of congestive mania. The superactivity of the cerebral circulation, as well as that of thought and well-being, may be recalled in the rosy excitement produced by wine and good cheer, in the artificial excitement of poetic frenzy, in the beatific visions of psychopathic women, and in religious ecstasy. Insomnia is one of the surest signs of hyperæmia of the brain. In many cases mania and certain hallucinations are connected with a notable hyperæmia of the gray layer. The delirium of febrile congestion, which is of a more distressing character, is owing less to quantity than to the quality of the blood, which is warmer, and besides charged with pyrogenic substances, as miasms, pus, and the like.

DIAGNOSIS.—General hyperæsthesia most often coincides with furious delirium, and headache also exists in a great number of cases. The troubles of the organs of sense are characterized by excitement and irritability.

It is claimed that paræsthesia may be detected with the aesthesiometer. Generally the pupil is contracted. This has been noted in the greater proportion of cases. Paralysis of the dilator or irritation of the sphincter is met with. Photophobia, ocular spectra, and ringing in the ears are symptoms peculiar rather to cerebral anæmia or to the venous variety of hyperæmia. The ophthalmoscope teaches but little in regard to cerebral hyperæmia. Its use has, however, justified the supposition of a transitory vaso-motor paralysis during frequent and severe attacks of cerebral congestion in a case of hysteria with paralysis and other symptoms. Diplopia and illusive transformations of hearing are often present with the other derangements of the special senses. Recent observations point to the connection between tympanic congestion and cerebral hyperæmia. Examination of the membrana tympani appears to indicate the state of the cerebral circulation, a fact demonstrated by comparing the state of this membrane before and after the administration of quinia or amyl nitrite. It is remarked, in connection with this circumstance, that evidences of congestion are noticed in the vessels over the handle of the malleus, and that the membrana tympani is of a light pinkish color. There is also a rise of temperature in the external auditory canal.

Motor disorders are seen in the agitations and struggles of the patient. There may be numbness and formation of the extremities, but paralysis does not in any way belong to arterial hyperæmia. Convulsions are most common in infants, and belong rather to anæmia or venous stasis than to arterial hyperæmia, and they may be confounded with epilepsy. The vomiting sometimes met with belongs also most often to anæmia. The circulatory apparatus is more or less disturbed in cases of active congestion. There are palpitation and a sense of oppression; the pulse is full and rapid and the carotids pulsate. This morbid excitability of the heart is particularly influenced by emotional disturbance. There is, however, a difference of opinion as to its symptomatic importance. Reflex excitability is preserved.

The phenomena of *venous or passive congestions* are in reality those that commonly relate to anæmia of the brain, and in a given case of anoxihæmia it is difficult to recognize whether the condition be owing to want of blood in totality or to venous stasis. In a venous stasis from thrombosis of the sinuses or from embolism the symptoms present are similar to those of congestion, namely, derangements of the intelligence, the sensibility, and the motility, and sometimes there is an agitated state of mind, with dilated pupils. Vertigo, photophobia, auditory subjective phenomena, and incoherence of ideas exist, however, to a less degree in this form than in the fluxionary, and in the case of delirium it is rather of the mild or demented kind. The symptoms may vary according to age, sex, and other circumstances. Men are more subject than women. The different periods of life known as increase, maturity, and decline are modifying influences, but it does not appear that season exerts any influence. The symptoms may be light or severe, and they may be acute or chronic.

In a case of acute *fluxionary hyperæmia* the patient may, after a short premonitory headache and dizziness, fall senseless, with or without convulsive movements. The face is red, the conjunctivæ are injected, the pupils contracted, the temporals and carotids pulsate vehemently, the pulse is hard and strong, the respiration stertorous. There are often convulsive movements and twitchings, especially in children, combined with slight paresis, and the condition often ends in stupor and death. If the case does not terminate fatally, the symptoms decrease in severity and disappear entirely, or they may pass into the chronic form. The latter is characterized by a sense of fullness and heaviness in the head, by continuous or paroxysmal headache, dizziness, and pulsations of the temporal and carotid arteries. These symptoms become worse by lowering the head, and by the influence of alcohol, if the hyperæmia is still active. The frame of mind is rarely serene, the patient is morose,

excitable, and explosive. There is a disinclination to mental labor, with confusion of thought, the combinations of which are illogical, morbid, and exaggerated; and symptoms of morbid apprehension, like those common to agoraphobia, are often present. A morbid fear of impotence is a predominant idea in this condition. Other symptoms arrange themselves according to the fundamental conditions that originate the exaggerated distention of the cerebral vessels.

The symptoms of *passive hyperæmia* are not entirely identical with the foregoing. There is more apathy, and the patient is more depressed. It should be taken into account that the poisonous influences of carbon dioxide obtain in this condition: it is the defect of oxygen in the venous blood, and not its quantity, which causes the characteristic phenomena.

DIAGNOSIS.—The diagnosis of cerebral hyperæmia is often not clear, because of the likeness of the symptoms to those of anæmia. The question here concerns the symptoms that have already been mentioned in connection with the excitations of the three great faculties of the nervous system, another enumeration of which would be tedious. In the delirium of anæmic origin, as in grave fevers and inanition, the aspect of the patient is quite the opposite of the flushed face, the brilliant eye, and general rugged appearance so often associated with hyperæmic delirium. The essentially transitory character of the excitement met with in these cases, the syncope and convulsions, leave no doubt as to the anæmic cause of the delirium. Delirium tremens and a certain kind of delirium from lead-poisoning resemble in some points the delirium of cerebral hyperæmia, but the discrimination is easy when attention is directed to the history of the case and a knowledge of the patient's habits. Elevation of temperature is of use in distinguishing inflammatory diseases of the brain from hyperæmia. The latter condition is usually apyretic, but at times it is possible to detect an elevation of one or two degrees above the normal by means of the differential calorimeter applied to different regions of the head. Vertigo, epilepsy, uræmia, embolism, thrombosis, softening, and hemorrhage may be confounded with cerebral hyperæmia; but each of these affections may be distinguished after careful examination into the condition of the urine, heart, lungs, and blood-vessels, and on comparing the symptoms of the afore-mentioned diseases with those of hyperæmia.

PROGNOSIS.—The prognosis of cerebral hyperæmia depends upon the intensity and duration of the symptoms as well as on individual circumstances. Children are more liable to succumb to the intensity of congestion, and in old people cerebral congestion is particularly dangerous because of the tendency to rupture in the degenerated vessels. Strong cerebral congestions are as grave as cerebral hemorrhage, and may lead to death. They may also prove the immediate cause of death in such chronic conditions as tumor of the brain and senile degeneration of its vessels. The tendency to such secondary lesions as hemorrhage, softening, cerebritis, and the like is greatly increased by the frequency of the paroxysms. Active cerebral hyperæmia, being more amenable to treatment, is consequently more favorable to recovery than is the passive variety.

TREATMENT.—The chief therapeutic indication in acute fluxionary hyperæmia is to diminish the sanguineous afflux, and this is perhaps best done by judicious inaction and careful watching of the symptoms. The condition is not one either of pressure or of œdema, but of an over-active circulation, and the treatment must vary according as the causes are primary or secondary. The nature of the treatment of active congestion from such causes as extremes of temperature, insomnia, or other irritable condition of the brain will, of course, differ from that required by the secondary congestions caused by suppression of the menses, by gout, or by rheumatism. Rest and position are of primary importance during an attack. The head should be elevated and the arms stretched upward. Quiet surroundings, fresh air, and a

darkened room are advisable. Local bleeding is recommended by most practitioners, but it should be done with a certain amount of discretion and caution. As a rule it is contraindicated in children and old people, and in hysterical or chlorotic persons. The so-called derivation and revulsion, in which a considerable congestion of the whole or part of the intestinal canal is produced by the administration of a drastic purgative, may diminish the afflux of blood to the brain. In fact, main reliance is to be placed upon the derivative effects of croton oil, colocynt, and irritating enemata, as of vinegar; the irritation of hot or mustard baths for both the hands and feet; and the production of diuresis. Reflex action is further brought about by the application of a mustard plaster to the epigastrium, and of the actual cautery to the nape of the neck. Cold vigorously applied to the head, in the form of ice, or cold douches upon the head, combined with a hot bath, are adjuncts in the treatment too valuable to be overlooked. When there is a heart complication it may be met with cardiac medicaments. Among the internal remedies that it is advisable to employ as agents in relieving the cerebral congestion are the bromides, ergot, oxide of zinc, eucalyptus, and hydrobromic acid. When the symptoms of congestion have disappeared, strychnia, phosphorus, and cod-liver oil may be administered with advantage, and at the same time the patient's nervous system is to be carefully nursed. This is particularly to be enjoined in the case of chronic hyperæmia. Complete intellectual rest, fresh air, regular habits, and the disuse of tea, coffee, alcohol, and tobacco should form part of the hygienic treatment. The milk cure and the grape cure may be mentioned as valuable dietetic measures. If the congestion arises from stoppage of a hemorrhoidal flow, leeches may be applied to the anus. Wonderful effects have been thus brought about. Like results have been obtained by applying leeches to the mouth of the uterus in secondary hyperæmia caused by suppression of the menses. In this condition the electric brush applied to the thighs, with douches to the loins and perineum, has been found efficacious in restoring the menses. Galvanization of the head and of the sympathetic nerve, having the power to contract the cerebral blood-vessels, may often be used with good effect. A systematic course of hydrotherapeutics is often advantageous.

In passive hyperæmia the causes are to be made the special objects of treatment. Generally, it is a question of restoring vascular tonicity and combating symptoms that in many respects resemble those of cerebral anæmia. Stimulants may be administered in many cases. Satisfactory results have been obtained from ether inhaled in small quantities. The use of cardiac tonics, as digitalis, when the stasis results from some vascular or cardiac lesion, or when there is cirrhosis of the kidney, is a question that still admits of a satisfactory solution.

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BRAIN: LESIONS OF THE CORPORA QUADRIGEMINA.—In discussing the lesions of the corpora quadrigemina in man our material is scanty, and it is often impossible to distinguish between the results due to injury of one portion of the brain and those due to the destruction or irritation of neighboring parts.

The corpora quadrigemina of mammals correspond in structure to the optic lobes of frogs, birds, and fishes. Little is known about purely destructive lesions of the corpora quadrigemina in man. Experiments on animals would lead us to suppose that destruction of the whole corpora quadrigemina would result in complete blindness, and unilateral lesion in hemianopsia. In man, however, this does not always occur. In a case related by Eisenlohr, a revolver bullet entering through the forehead passed directly into the right corpus quadrigeminum and there remained. The power of sight was only partially lessened at first—R. $\frac{2}{3}$, L. $\frac{2}{3}$; later, R. $\frac{2}{7}$, L. $\frac{2}{7}$ (Monakow). Monakow concludes that the destruction of a whole anterior corpus quadrigeminum in man causes only moderate affection of sight and leaves the color

sense intact. Local lesions of the corpora quadrigemina may cause dilatation of the pupils in one or both eyes and the pupillary reaction to light and accommodation may be much impaired. As the process advances toward the base, disturbances of the ocular muscles become prominent. Total ophthalmoplegia is rare, but there is paresis of the various muscles, not homologous, incomplete, and developing unevenly. The posterior corpora quadrigemina have nothing to do with sight; after isolated lesion of them no effect on vision is observed. Paralysis of the fourth nerve (unilateral or bilateral) and disturbances of chewing have been found in such cases. Lesions of the corpora quadrigemina also produce both ataxia of movement and cerebellar ataxia. Tremor resembling that of paralysis agitans and sometimes choroid movements either of the opposite extremities or bilateral may exist.

An important symptom in cases of lesion of the posterior corpora quadrigemina is a *diminution of hearing* in the opposite ear.

In cases of tumor or foreign growth in the corpora quadrigemina or their neighborhood the adjacent regions are liable to be affected and symptoms strictly referable to the disturbance of these regions are apt to occur. These symptoms, as well as the general, that is non-localizing, symptoms of cerebral tumor cannot be discussed here, but must be considered as of much importance in forming the diagnosis. William N. Bullard.

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BRAIN: LESIONS OF THE CORPORA STRIATA.—By corpora striata is designated the lateral portion of the collection of gray matter called basal ganglia; these are further subdivided into two parts, the nucleus caudatus and nucleus lenticularis.

These parts of the brain are rarely if ever the seat of independent states of disease. The lesions found in this region of the brain are almost exclusively vascular or tumors.

The symptomatology of disease of the corpora striata is very obscure, and reports of pathological without distinct clinical findings are often met with.

The main symptoms to be expected from lesions in this neighborhood will be dependent upon implication of the adjacent capsular structures. As symptoms pointing with some probability to involvement of the corpora striata, these motorial irritation phenomena are cited: choreatic and athetotic twitchings and spasms or convulsive laughter or crying. Joseph Fraenkel.

BRAIN: MALFORMATIONS. See Teratology.

BRAIN: METHODS OF REMOVING, PRESERVING, DISSECTING, AND DRAWING.—§ 1. This article has no direct reference to microscopical or pathological requirements, which are provided for elsewhere in this work and in special papers.* Neither is it designed for neurological specialists, or for those who may have the benefit of their counsel, or access to large libraries; but physicians and students at a distance from medical centres, who desire to attain a real and personal acquaintance with the gross anatomy of the human brain as an aid to the comprehension of its minute structure, its functions, diseases, and mental relations, may profit from an account of the methods found useful in a laboratory where many students have prepared for a medical course.

* For example, that of Donaldson, 1894; see the Bibliography at the close of this article.