HYDROA VACCINIFORME.—This affection was first described by Bazin in 1855, but for a long time thereafter was generally lost sight of. In 1888 Hutchinson described what is undoubtedly the same affection, under the title "summer eruption." A year later, Handford published in the *Illustrated Medical News* a series of cases which he proved were identical in nature with both Hutchinson's summer eruption and Bazin's hydroa vacciniforme. Since then numerous cases have been reported by English, German, and American writers, and it has been shown that the disease, although rare, is not so uncommon as had been supposed. In France, strangely enough, the affection escaped recognition after Bazin's original description, but of late it has been again described by Brocq and others.

The affection usually begins in the first years of life and has been found to be much more frequent in the male sex. The parts of the body chiefly affected are those that are unprotected and exposed to the rays of the sun, although in a number of instances it has been seen on other parts as well. The bridge of the nose, the cheeks, and the ears are most prominently affected, and next in order come the backs of the hands. Other parts of the body, if exposed to the sun, will be equally affected, as in one instance in which it appeared on the legs of a boy who went about with trousers rolled up. In a case seen by the writer, however, no lesions ever appeared on the lower extremities, although the child went barefoot during the summer. The affection comes in attacks, usually in the summer season and on exposure to the sun, although this cannot be laid down as an absolute rule, as in some instances there have been quite numerous attacks in winter. There is no itching, as a rule, yet in one of the writer's cases it was marked.

At the outset of an attack there may be slight constitutional disturbance. The first appearances are either vesicles or small red papules which rapidly become transformed into vesicles and bullæ of varying size and which often become confluent. A marked feature, which has given the affection a part of its title, is the umbilication that occurs in many of the lesions, so that a vaccination vesicle is closely simulated. The depressed centre is usually surrounded by a ring of fluid, while there is a red areola at the periphery. The centre is dark blue or black, due to the hemorrhagic and necrotic condition of the corium, which is seen through the overlying vesicle. The lesions frequently become purulent. As a rule the attacks last several weeks, but may be much prolonged by exacerbations. The centre of the lesions dries into a thick, black crust, extremely adherent, and which finally on dropping off leaves a distinct pit. In many of the cases the scarring is quite severe, and reminds one forcibly of that left by a severe variola. The tip of the nose and the edges of the outer ear are in some cases much deformed. The attacks become milder and less frequent toward puberty and usually cease by the time adult life is reached.

Histologically, according to the writer's examination, which has since been essentially confirmed by Mibelli, the small primary vesicle is shown to have its seat in the middle layers of the rete Malpighii. The upper portion of the rete is somewhat reticulated, but the fluid divides the middle from the upper layers so that a large chamber without network is produced. In the fully developed lesion, with dark umbilicated centre, there is found a necrosis of the central portion of the nodule. The outer horny layer is unbroken and stains well, while the lower horny layers have become necrotic. The middle and lower layers of the rete are converted into a reticular tissue, forming a network filled with granular detritus and leucocytes, and this network has become necrotic. This necrosis extends downward through the entire corium, ceasing just above the subcutaneous tissue. The corium has a distinctly abnormal appearance, the connective-tissue cells having lost in great part their capacity for receiving stains. The connective-tissue fibres are broken up and forced apart and contain in their interstices deeply staining granules and detritus. In the papillary layer are large necrotic blood-vessels filled with blood cells, together with some free hemorrhage into the tissue. The necrosis ceases abruptly at the sides and base of the lesion. There is some increase in thickness of the epidermis adjacent to the necrotic portion.

From these appearances it is seen that the disease begins with an inflammation in the rete and upper portion of the corium in a circumscribed area, and quickly produces a vesicle in the rete. Immediately after this a necrosis sets in, which affects the epidermis and almost the entire corium. The dilated and necrotic blood-vessels can be seen through the transparent vesicular covering, and give rise to the dark red hemorrhagic centre seen clinically.

The cause of this peculiar dermatosis is unknown. The most plausible theory is that of a vaso-motor neurosis, which in certain individuals causes, when they are exposed to the sun's rays, a circumscribed inflammation followed by necrosis.

White has described several instances which probably belong in this group, which presented some unusual features, so that it seems probable that the classical description ought to be enlarged somewhat. The exceptional features in these cases were the cessation of all activity during the warm months for ten consecutive years in one case, the continuance of the attacks throughout the whole year in another, together with failure to be influenced by exposure to sun or weather, and an extensive distribution of lesions covering a large portion of the body, instead of a limitation to the portions exposed to the influence of the sun. The lesions in these cases were also very large, and the scars left very prominent and disfiguring.

Dr. McCall Anderson has recently (1898) published two cases of this disease in brothers, in which the urine contained hæmatoporphyrin. In the other cases in which this symptom has been looked for it has not existed.

It is very difficult to classify hydroa vacciniforme, although there are several affections which seem to be somewhat related to it. Boeck's acne necrotica has numerous points in common with the affection we are considering, such as the circumscribed necrosis, the umbilication, and the enlargement of the blood-vessels with hemorrhage. The histological appearances in a case reported by Touton were also similar. It is still a matter of discussion whether acne necrotica and acne varioliformis are the same disease, so that the relationship of hydroa vacciniforme and acne varioliformis is also indicated. We have also a peculiar congenital bullous dermatitis, first described by Hallopeau and characterized often by the persistence of scars and epidermic cysts, which offers some analogy to hydroa vacciniforme, chiefly in the repeated occurrence of bullæ followed by scars and the fact that a favorite but by no means exclusive seat is the head and the backs of the hands. It may also sometimes be excited by the action of the sun.

It is possible that the chemical rays of the sun may play some part in this affection as they have been supposed to do in eczema solare, etc. Hutchinson has described cases of recurrent papular, pruriginous, and eczematous eruptions occurring chiefly on the exposed parts of the body during the summer months. Hence we have evidence that the sun's rays may cause not only superficial inflammatory cutaneous changes, but deep sharply bounded necroses.

Treatment.—The importance of prophylaxis is apparent—to guard the patient from the sun's rays, or from wind and storm. Protecting and soothing applications are indicated when the eruption is active. Veils of red and turmeric, which are supposed to neutralize the chemical rays, have been recommended by Unna in eczema solare and may be employed in this affection. Crocker recommends the trial of arsenic, quinine, and belladonna internally. *John T. Bowen.*

HYDROBROMIC ACID.—Hydrobromic acid, HBr, is a gaseous body which, in ten-per-cent. aqueous solution, constitutes the preparation official in the United States

Pharmacopœia under the title *Acidum Hydrobromicum Dilutum*, Diluted Hydrobromic Acid. This preparation is "a clear, colorless liquid, odorless, and having a strongly acid taste. Specific gravity about 1.077 at 15° C. (59° F.). Miscible, in all proportions, with water and alcohol. By heat it is completely volatilized"(U. S. P.).

Diluted hydrobromic acid ranks among the sour mineral acids, and is perfectly competent to fulfil the purposes described under diluted sulphuric acid. Its special application in medicine, however, is not the utilization of its sour qualities, but its employment on the one hand as a *bromide*, in substitution for the alkaline bromide salts, and on the other as a vehicle for quinine, claimed to lessen the disagreeable by-effects of the alkaloid, while not interfering with the medicinal activities of the same. As a bromide-bearing medicine, the diluted hydrobromic acid has proved itself efficient if given in adequate dose, and to have less tendency than the bromides to produce acne and the other symptoms of bromism. In using the acid for its bromine influence, its comparatively feeble strength must be borne in mind, and the dose made to correspond, in proportion of bromine represented, to the average dose of the alkaline bromides. This correspondence is no less than about seven to one, so that it takes nearly seven parts of the pharmacopœial acid to equal, in bromine strength, one part of potassium bromide. To get, therefore, the bromine effect of the moderate daily allowance of 4 gm. (℥ i.) of potassium bromide, from six to seven teaspoonfuls of the acid would require to be given. Such doses, however, are liable to irritate the stomach, and accordingly the medicine is used most commonly in association with some bromide salt, in cases in which a full bromine effect is wanted. The acid should be diluted, for administration, ten- or twelve-fold, and the mouth well rinsed after each dose. *Edward Curtis.*

HYDROCELE. See *Testes, etc.*

HYDROCEPHALUS, CHRONIC.—(Synonyms: Internal hydrocephalus; congenital hydrocephalus; hydrops ventriculorum cerebri.)

Definition.—An affection which may be defined as an abnormal accumulation of serous fluid within the cerebral ventricles, tending gradually to increase in amount, and to give rise to undue pressure on the cranial contents; in infancy and early childhood leading also to gradual enlargement of the head with separation of the cranial bones.

The term *external* hydrocephalus is sometimes employed to denote an abnormal accumulation of fluid in the subarachnoid space. It is a condition only rarely met with, and either is secondary to cerebral hemorrhage or pachymeningitis, or is associated with a congenital atrophy or defect of the brain. The effusion in this case is of a passive character, and does not give rise to pressure symptoms.

Etiology.—In the great majority of cases hydrocephalus makes its appearance in early infancy; sometimes, however, it is congenital, and the enlarged head presents a serious obstacle to the birth of the infant. Out of one hundred and three cases collected by Ruffer, in nine the enlargement was present at birth, and in ninety-three it began before the patient was six months old. As this list does not include infants born dead or destroyed during labor to save the mother, it is not to be regarded as representing the absolute relative frequency of the two classes of cases.

Instances occasionally occur in which an abnormal accumulation of fluid in the ventricles makes its appearance in adult age. These cases, however, form but an insignificant percentage, and in them there is seldom any enlargement of the cranium or separation of its sutures.

Many explanations have been offered for the presence of fluid in such abnormally increased amount in the ventricles, but we are still much in the dark and for the present it is better to regard hydrocephalus as a mere symptom associated with, or consequent upon, certain diseased conditions rather than as a distinct disease.

It has been likened to ascites, an affection in which we meet with either a direct obstruction to the venous return of the blood or a chronic inflammation of the peritoneum, and in confirmation of this theory we were told that in some cases the fluid which distends the ventricles is clear, resembling transudation fluid found in other serous cavities, while in other cases it is turbid and contains fibrinous flakes and even pus. In the latter case the lining membrane of the ventricles will be found more or less thickened and its vessels distended. On this account Huguenin proposed to make the fluid itself the test as to whether the action was of a passive or of an inflammatory character. With increased knowledge, however, this comparison is not at present regarded as entirely satisfactory.

Many years ago Hilton advanced the theory that this affection was due to an obliteration by inflammation of the channels of communication between the fourth ventricle and the subarachnoid space interfering with the outflow of fluid from the ventricles of the brain, and in recent years this view has received much support. Halliburton (*Jour. Physiol.*, vol. x., p. 232) has demonstrated that normal cerebro-spinal fluid is a clear, colorless, faintly alkaline fluid with a specific gravity of about 1.005, and is to be regarded as a distinct secretion differing from the mere transudative fluids met with in other serous cavities, in the presence of a distinct copper-reducing agent, at one time thought to be sugar, but now regarded as pyrocatechin, and in the character of its proteïds which he found to consist of globulin, albumose, and occasionally peptone, rarely of albumin and never of fibrinogen. More recently Vaughan Harley examined the fluid present in hydrocephalic cases and stated that in many it closely resembled cerebro-spinal fluid in its specific gravity and in its reactions. In others, however, indications of a distinctly inflammatory process were superadded, albumin was present, and the specific gravity had risen to 1.008 or 1.009.

Following out the thoughts suggested by these investigations, Drs. Barlow and Lees regard the choroid plexuses as a special apparatus for the secretion of the cerebro-spinal fluid, and in proof of their view point to the following facts: Each ventricle is provided with its own vascular plexus, those in the lateral ventricles having a double arterial supply indicating a function of special importance, and the epithelium of the ventricles, where it covers these plexuses, changes its character from columnar to one similar in structure to that of a secreting epithelium. From these plexuses a continuous secretion, they think, takes place of the bland fluid on which the delicate structures of both brain and spinal cord rest. As this secretion is constant, means must be provided for the removal of any excess, either by absorption or by drainage. Absorption through the plexuses would appear impossible, for the supply of blood in the arteries must be kept at a higher pressure than that of the ventricular fluid, else circulation would cease; and the veins are far withdrawn into the interior of the velum interpositum. To provide drainage, therefore, communication is provided from the lateral ventricles, through the third into the fourth ventricle by means of the several foramina; thence into the subarachnoid space through the foramina of Magendie and the lateral foramina, and along the lymphatic sheaths of all outgoing nerves. The small diameter of these passages insures that the outflow shall not be too rapid. The careful experiments of Key and Retzius would indicate that this is the only way of escape for fluid from the ventricles.

In what way is obliteration of these channels of communication brought about? In the opinion of these writers it is invariably the result of some inflammatory action and not infrequently of a previous attack of basic meningitis. Attacks of posterior basic meningitis, in their opinion, may occur at a very early period of infancy, and in some cases the symptoms may be of so indefinite a character as to be overlooked or forgotten.

In illustration the authors mention the following case: George A——, seen first when ten months old, with large hydrocephalic head; was an eight-months' child. When one week old had jaundice and frequent convulsions; at three weeks would not allow his head to be raised and was comfortable only when lying; at two months the head was observed to be abnormally large, and since then it has progressively increased in size. They state that in many cases of congenital hydrocephalus the post-mortem examination has revealed the presence of adhesions, evidently of inflammatory origin, blocking the channels of exit. In some of these cases constitutional vice, more especially syphilis, plays an important part. Dr. Lewis Smith referred many of his congenital cases to this cause, and a recent writer considers that the greater number of them are due to chronic inflammation of syphilitic origin.

In a small percentage of cases compression of the veins by a tumor, either in the cerebellum or in the neighborhood of the aqueduct of Sylvius, appears to play an important rôle. Drs. Barlow and Lees consider that mere compression of the veins, without blocking of the channels of exit, cannot by itself account for the accumulation. Both Gibson and Collins, however, within the past few years have reported cases in which a tumor pressing on the aqueduct of Sylvius was apparently the chief cause of the hydrocephalus.

Although an occlusion of these foramina of exit is the very frequent condition met with in hydrocephalus, a few instances have been reported in which this affection has existed, and yet the post-mortem examination, although revealing traces of what appears to have been a previous meningitis, has not shown the presence of any obstruction. No thoroughly satisfactory explanation of these cases has yet been given. Drs. Barlow and Lees advance the suggestion that owing to the previous inflammation a paretic dilatation of the basilar and its branches has taken place, leading to an augmented blood supply to the choroid plexus and, as a consequence, to a more rapid secretion of fluid than can escape through the foramina of exit.

As a very exceptional cause of hydrocephalus in the adult, we may mention the case reported by Kratz in which hemorrhage from an aneurism in the internal carotid artery closed the foramen of Magendie by causing an adhesion of the telea choroideæ to the floor of the fourth ventricle.

Morbid Anatomy.—The results of such an increasing intraventricular pressure will be modified by the amount of resistance presented by the cranial bones, and by the quantity of the fluid present. In congenital cases, and in those in which the hydrocephalus began soon after birth, the resistance offered by the sutures is slight, and great enlargement of the head may result. In these cases, the effusion may reach the amount of several pints. In the majority of instances, however, it does not exceed a pint. As a result of the pressure exerted by this fluid the cranial cavity is expanded in all directions, but the parts entering into the formation of the vault suffer most; the fontanels become prominent, the sutures are gradually opened, and the vertical plate of the frontal and the upper part of the squamous, parietal, and occipital bones are increased in size and become thin, even to the point of transparency. To the hand of the observer the head feels soft and fluctuating, and with electric light may be seen to be distinctly translucent.

The enlargement goes on slowly, but is not always continuous. Periods of quiescence may occur, during which nature may attempt to cover in the open places not only by new growth along the edges of the bones of the vault, but also by islets of new bony tissue which are occasionally found filling in the fontanels.

The bones at the base of the brain are seldom much affected. A few instances are reported in which the bones of the middle fossa have been displaced, and in extreme cases the orbital plates of the frontal bone are not infrequently depressed by the fluid, thus altering the direction and position of the eyeball.

Though the face in these cases looks small, on account of the enormous distention of the skull, Ruffer states that it will generally be found to be quite as large, if not larger than normal.

On the soft structures of the brain the effect of this pressure is disastrous, the convolutions become flattened, the sulci obliterated, and the cerebral substance owing to compression is gradually absorbed. This absorption and thinning is especially noticeable toward the vertex, where in extreme cases it may be found not more than a few lines in thickness. The lateral ventricles are enormously distended, their ependyma is thickened, and the choroid plexuses are engorged. The structures at the base of the brain suffer in general less than those of the cortex, but in advanced cases the large ganglia, the pons, and the cerebral peduncles are altered in shape and their nutrition is impaired.

A hydrocephalic cranium is always an unsymmetrical one; measurements show that one lateral half of the head is always larger than the other. Keen and Robinson have reported cases in which the hydrocephalus was partial and the distention limited to one side. In some the anterior half may be increased out of all proportion to the posterior, or vice versa, and instances are recorded in which the expansion has been limited to one or more bones.

Associated with congenital hydrocephalus it is not infrequent to meet with other vices of conformation. One of the most frequent is spina bifida. Among other deformities occasionally encountered are hare-lip, cleft palate, and the various forms of talipes.

Symptoms.—In some cases the first symptom to attract attention is the slow, gradual enlargement of the head, which may go on for some months before any indication of pressure on or irritation of the nerve ganglions makes its appearance. Bastien reported a case in which the head had gone on enlarging for eighteen months without the intervention of any other notable morbid symptom. In other cases, however, symptoms of irritation of the nerve centres are present from the very beginning and sometimes even precede the enlargement of the head. West states that in twelve out of forty-five cases, recurring convulsions were the earliest symptom; in four more the enlargement was preceded by other indications of irritation such as squinting, severe headache, and nystagmus. In a third class the affection begins with symptoms resembling cerebellar disease, and in a fourth class the symptoms are acute from the onset.

As the disease advances, however, the prominent feature in all becomes the gradually enlarging head, the fontanels, instead of closing, increase in size, the sutures open, and the head assumes more or less a spherical shape. The amount of the enlargement is indicated by two measurements: that of the maximum circumference, and that over the vertex from the centre of one auditory meatus to the centre of the other. As a guide to the amount of the enlargement the following average measurements obtained from the heads of eight healthy male infants may be taken:

	Circumference.	Over vertex. From meatus to meatus.
At birth	13½–14 in.	9 in.
At two months	15 –15½ in.	10 –10¼ in.
At four months	16¼–17 in.	11 –11½ in.
At six months	17 –17¼ in.	11½–11⅝ in.
At twelve months	18 –18½ in.	12 –12½ in.
At two years	20 –20½ in.	13 –13½ in.

Owing to the enlargement of the bones of the vertex the face assumes a triangular appearance with the base at the forehead and the apex formed by the chin; the root of the nose is flattened and broadened, and the upper eyelids are stretched. The nutrition of the hair follicles suffers owing to the continuous tension of the scalp, and the hair becomes scanty, and through it can be seen the large veins ramifying over the scalp especially in the region of the temples.

While the enlargement of the head goes on, other symptoms show themselves. The general nutrition becomes defective even though the appetite may remain good and symptoms of indigestion be wanting. The development of the body is retarded, growth is stunted, and the muscular system becomes soft and poorly nourished. Efforts at walking are long delayed, and if at last the endeavor is made, the infant's gait is more than ordinarily tottering and uncertain. The increased weight of the head throws an abnormal strain on the poorly nourished muscles of the neck. In young infants the power to raise it from the pillow may be altogether lost and assistance may be required even to turn it. Older children frequently rest the head by supporting it with both hands.

Loss of control over the sphincters and complete paralysis are of rare occurrence. Sometimes at the onset of the affection a more or less spastic condition of the limbs may exist. Pain in the head is not an infrequent complaint, and judging by the moaning and crying of the child is often severe.

Clifford Allbutt regards ischæmia papillæ as an early symptom; nystagmus and strabismus are often seen in advanced cases. Blindness the result of complete atrophy is, however, infrequent. When depression of the orbital plates takes place, the direction of the eyeball is altered and more or less exophthalmos may be observed. Convulsions occur as an occasional symptom; in some instances they are limited to one side, but more frequently they are bilateral. Not uncommonly they are followed by a temporary paralysis.

As the disease progresses to its close symptoms of pressure become more manifest, drowsiness may set in, and finally coma, from which the child cannot be roused, may end the case. Hydrocephalic children, however, offer but a feeble resistance to infection, and death is more frequently due to intercurrent disease, such as pneumonia, bronchitis, intestinal catarrh, or to one of the eruptive fevers.

When the disease runs a prolonged course, all degrees of impairment of the mental powers may be met with, from slight backwardness to more or less complete idiocy. In nearly every case periods of remission are noticed. The cephalalgia seems to cease, general nutrition improves, and for the time the head ceases to enlarge. The duration of these periods varies much. Sometimes they are so prolonged that the anxious mother indulges the dream of permanent recovery. In a few instances this does appear actually to take place. The effusion remains stationary, the sutures ossify, and the fontanels close by means of additional plates of bone, while growth increases and nutrition improves in the trunk and the extremities. Such patients may live many years. Dr. Bright's patient, Cardinal, died at the age of twenty-nine. His mental faculties shortly before his death were said to be "very fair"; his memory was tolerable. He was able to read and write and was fond of society. A few cases are reported in which a spontaneous evacuation of a large quantity of watery fluid has taken place from the nose with immediate relief to the symptoms which may have become very grave. In one or two cases the relief has been permanent. In one case in which the child eventually died, a small passage conducting from the cranium to the ethmoid bone was found at the autopsy.

In *hydrocephalus of later years* the symptoms are very obscure. It would appear to be almost impossible to distinguish between it and other chronic affections of the brain. The enlargement of the head, which in the hydrocephalus of infancy makes the diagnosis comparatively easy, is in these cases absent. Among the symptoms that have been recorded are the following: vomiting, more or less persistent headache and slow pulse, numbness of the hands and feet, attacks of petit mal, strabismus, dilated and sluggish pupils, and optic neuritis. Unconsciousness sometimes supervenes suddenly and death takes place by coma. The post-mortem appearances are similar to those of the hydrocephalus of infancy, with the exception that the amount of fluid rarely exceeds eight or twelve ounces.

Duration.—The duration of the disease is very variable. The course is sometimes a rapid one and fatal symptoms supervene in the course of a few months. Few congenital cases survive two years. Many cases in which the affection made its appearance in the later months of infancy or in early childhood live for four or six years.

Prognosis.—The prognosis in this affection is necessarily very unfavorable, but if the quantity of fluid is not great and the tendency to accumulate has at no time been very active, it may happen that one of the periods of remission may be prolonged, the general nutrition may improve, and as the body grows the size of the head may become less disproportionate. Cases of permanent recovery are, however, extremely rare, and in some of them in later life symptoms of grave mental trouble develop. We should remember, however, that a few instances of complete and permanent recovery from the earlier stages of the disease have been recorded.

Diagnosis.—In the absence of any enlargement of the head hydrocephalus cannot be diagnosed with certainty. On the other hand, when the head becomes distinctly enlarged, with widely separated sutures and open bulging fontanels, there can be no room for any uncertainty. When the head is only slightly enlarged and the sutures are not distinctly opened, it may be difficult to distinguish it from the enlarged head met with in rachitis. The following points may assist us: In rachitis the head is square rather than round, the vertex is flattened, the frontal eminences are prominent, but the frontal bones themselves are not bulging and the sutures are closed; there is no deviation in the direction of the eyeballs, and palpation fails to communicate any sense of fluctuation. In hypertrophy of the brain the increase is very gradual, the skull is firm and unyielding, and the enlargement is more marked at the vertex than elsewhere. Occasionally we have a thickening of the bones of the skull cap due to syphilis, but no great difficulty should be experienced in distinguishing this.

In hydrocephalus of adult life the diagnosis must always be extremely difficult. Martin Prince lays much importance upon the variation in the intensity of the symptoms from day to day in this affection as compared with their uniformity in cases of brain tumor.

Treatment.—In a disease such as this, in which the prognosis is so grave, if is impossible to speak with any confidence of the treatment by drugs. In congenital cases in which there is a distinct syphilitic history the administration of mercury and potassium iodide has in a few cases appeared to be of much service. Their administration should be commenced as early as possible and pushed energetically, and it is to be remembered that young children bear both of these drugs proportionately much better than do adults.

External compression of the skull by means of strips of adhesive plaster may in congenital cases produce some slight diminution in the circumference of the skull, but its employment without aspiration of some of the fluid appears to be irrational and is not free from danger. Aspiration of the lateral ventricles, if performed antiseptically and the fluid drawn off slowly with the head well depressed, is an operation which does not appear to be attended with much danger, and is one which in many cases will be followed by temporary improvement. With the infant under an anæsthetic a small trocar may be thrust downward and inward into one of the outer corners of the anterior fontanel, care being taken to avoid the longitudinal sinus. This little operation often gives good results in those cases in which the symptoms of compression are advancing rapidly, but have not existed for a long period, removing the tendency to convulsions, relieving pain, and leading to a general improvement of both bodily and mental functions. The chief dangers associated with it are the introduction of infectious material and the possibility of inducing a state of collapse, both of which may be avoided with care. After the aspiration it is well to use some compression over the vault. Ewart, of London, at the meet-

ing of the British Medical Association (1901), advised the introduction of aseptic air into the ventricles at the same time that the fluid was drawn off. This he accomplished by the introduction of two cannulæ into the right sphenoparietal region, allowing the fluid to escape by the one, and permitting carefully filtered air to enter by the other. He claimed for this method a more complete evacuation of the ventricular fluid, and an avoidance of the danger resulting from the sudden and complete removal of pressure. In one of the cases which he reported he removed in ten separate tappings fluid amounting in all to eleven pints. At the time the report was made the condition of the child was greatly improved. Any such operation, however, rarely affords more than a temporary benefit.

Lumbar puncture, advocated in this affection some years ago by Quincke, has in a few cases appeared to be of some benefit, but it offers a hope of service only in those rare cases in which there is no blocking of the channels of exit. Considering the excellent temporary results obtained in many cases by aspiration during the past few years, efforts have been made by some surgeons to establish permanent drainage of the ventricles by establishing an artificial communication between them and the subarachnoid space. Sutherland and Cheyne report three cases in which a small opening was made in the dura, and one end of a number of strands of catgut tied together was passed into the ventricle while the other end was retained in the subdural space. The results, however, were unfortunate, although temporary improvement followed in two cases. Drs. Barlow and Lees, however, report one case treated in this way as a remarkable success.

More recently Mr. McAdam Eccles reports continuous improvement in a case on which he operated, using horse hair instead of catgut as a drain, passing one end of the strands under the dura mater and the other into the right lateral ventricle. The possibility of thus replacing the natural channels of exit from the ventricle into the cavity of the subarachnoid or even into the subcutaneous spaces appears, by the results obtained in these operations, to be feasible, and we are hopeful that with improved technique we may yet be able to do much in the way of relief for this very unfortunate class of cases.

Alexander D. Blackader.

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HYDROCHLORIC ACID.—Muriatic Acid, HCl. Under the title *Acidum Hydrochloricum*, Hydrochloric Acid, the United States Pharmacopœia recognizes "a liquid composed of 31.9 per cent., by weight, of absolute hydrochloric acid, and 68.1 per cent. of water." Such grade of acid is "a colorless, fuming liquid, of a pungent odor, and an intensely acid taste. Specific gravity: about 1.163 at 15° C. (59° F.). Miscible, in all proportions, with water and alcohol" (U. S. P.). Hydrochloric acid must be kept in glass-stoppered bottles and protected from the light.

The physiological effects and therapeutic applications of hydrochloric acid so closely resemble those of nitric acid that a separate description is unnecessary (see *Nitric Acid*). For medicinal use, proper, the following official preparation is established by the United States Pharmacopœia:

Acidum Hydrochloricum Dilutum. Diluted Hydrochloric Acid.—This preparation is a simple dilution of the strong acid of the Pharmacopœia with distilled water. It represents ten per cent. of absolute hydrochloric acid, is a colorless and very sour fluid, irritant though not corrosive, and of the specific gravity 1.050. Dose, from ten to thirty drops, largely diluted with water, and the mouth to be rinsed well after the taking of each dose.

Edward Curtis.

HYDROCOTYLE. See *Umbelliferæ*.

HYDROCYANIC ACID.—Hydrocyanic, or, as it is so commonly called, *prussic* acid (HCN), is, in pure or anhydrous condition, a thin, colorless, very volatile, very unstable, and fearfully poisonous fluid. Being so unmanageable in the concentrated state, the acid is used in medicine only in dilute solution in water or in alcohol and water. In continental Europe solutions of various strengths are to be met with, ranging from two to twenty-five per cent. What is known as *Scheele's* acid is an aqueous solution from four to five per cent. in strength. Under the title *Acidum Hydrocyanicum Dilutum*, Diluted Hydrocyanic Acid, the United States Pharmacopœia establishes "a liquid composed of two per cent., by weight, of absolute hydrocyanic acid, and ninety-eight per cent. of water." This preparation is made by distilling a mixture of potassium ferrocyanide and diluted sulphuric acid, receiving the distillate in a receiver containing water. The product is finally brought to standard strength, as determined by assay, by the addition of distilled water. Diluted hydrocyanic acid may also be prepared extemporaneously by the following process, officially authorized: "Silver cyanide, 6 gm.; hydrochloric acid, 5 c.c.; distilled water, 55 c.c. Mix the hydrochloric acid with the distilled water, add the silver cyanide, and shake the whole together in a glass-stoppered bottle. When the precipitate has subsided, pour off the clear liquid." In this process double decomposition ensues between the silver cyanide and the hydrochloric acid, with the formation of hydrocyanic acid which remains in solution, and silver chloride which precipitates.

Diluted hydrocyanic acid is "a colorless liquid, of a characteristic odor and taste, resembling those of bitter almonds. As it is very poisonous, great care should be taken in tasting it. It is completely volatilized by heat" (U. S. P.). The acid is more or less prone to decompose, thereby losing strength, and in such decomposition commonly turns dark, even getting in time to look like a thin ink. This decomposition will certainly and rapidly go on under exposure to the air in an open vessel, and is also hastened by the action of light. The preparation must, therefore, be put up in small, dark, amber-colored vials and kept in a cool place protected from the light. An important point is to have the vials *cork*-stoppered, and not *glass*-stoppered, since, for some reason, the preparation deteriorates much faster in glass-stoppered bottles than in those closed by cork. The acid will keep better, furthermore, according to Squibb, if, in dispensing, quantities be drawn from the stock bottle by a pipette instead of by pouring.

Physiologically, hydrocyanic acid is remarkable for deranging, swiftly and strongly, the functions of nerve apparatus, apparently irritating and quickly exhausting certain nerve centres, and also tending to destroy the conducting power of nerves and the contractility of muscles generally. Probably by virtue of these actions, hydrocyanic acid is a peculiarly speedy and powerful poison. (See *Hydrocyanic Acid: Toxicology.*)

The application of hydrocyanic acid in *therapeutics* does not amount to much. By reason of its poisonous nature, the medicine can be used only in insignificant doses, and the only medicinal virtues that such doses possess are to allay pain or irritability of the stomach, and, less certainly, the irritability of the air passages in disease that leads to dry cough. The local use of hydrocyanic acid solutions as lotions in skin disease, to allay pain and itching, is not without danger of inducing constitutional poisoning by absorption through unobserved abrasions.

Hydrocyanic acid in the form of the dilute solution of the United States Pharmacopœia is commonly prescribed in doses of from two to four drops only, but there certainly is no danger in doses of 0.50 gm. (℥ vij. or viij.), and such doses are used by many practitioners. Furthermore, since the effect of the drug is very evanescent, and there is no evidence of any so-called cumulative

action, there is no objection, physiologically, to the repetition of even a full dose so often as every hour. The dose may be administered in water, or syrup and water, and may be combined with alkaloidal salts, but not with salts of the metals. For a skin lotion, the pharmacopœial acid is variously diluted from ten- to fifty-fold by different practitioners.

Quite recently there has been published * an account of some interesting experiments by Jacques Loeb and Warren H. Lewis in the Hull Physiological Laboratory of the University of Chicago, on the prolongation of the life of the unfertilized eggs of sea-urchins by potassium cyanide. Ordinarily such eggs, kept in sea-water at a temperature of about 20° C., lose their power of development, on fertilization, in from twenty-three to forty-eight hours, or less. But if to the sea-water be added a certain percentage of potassium cyanide (one part of an "$\frac{n}{10}$" cyanide solution to 100 parts of sea-water), the time during which the capacity for fertilization persists is very materially lengthened—from one hundred and twelve to one hundred and sixty-eight hours, according to degree of development attainable. And such prolongation obtains for parthenogenetic as well as for sexual development. The experimenters account for these results by the theory that normal death of the unfertilized eggs is due to "specific mortal processes" which "are checked or modified by the process of sexual or osmotic fertilization," and which also may be checked by potassium cyanide, "which substitutes for the destructive action of these processes a condition of suspension of life ('vie latente' of Bernard)."

Edward Curtis.

HYDROCYANIC ACID. (TOXICOLOGICAL.)—As the various cyanic poisons—hydrocyanic acid, the cyanids, impure oil of bitter almonds, cherry-laurel water, etc.—all owe their poisonous qualities to the presence in them, or liberation from them, by the action of the liquids of the economy, of hydrocyanic acid, their action is in the main the same. The rapidity of their action depends upon the proportion of hydrocyanic acid which they contain, and is modified somewhat in kind by the nature of the substance with which the acid is combined, as in the case of potassium cyanid.

Although Dioscorides casually mentions the poisonous nature of bitter almonds, and Madden, in 1731, called attention to the toxic powers of cherry-laurel water, the toxicological history of hydrocyanic acid itself begins with the year 1803, when its poisonous nature seems to have been first recognized by Schrader. The existence of the acid had been discovered twenty years earlier (1780) by Scheele, whose death has been frequently attributed to accidental inhalation of its vapor. It would seem, however, from the account given by Crell at the time (*Annalen*, 1787, i., 192) of Scheele's last illness, that his death was due to disease and not to poison.

According to Stillé, Borda (1804) first suggested the use of the artificially prepared hydrocyanic acid as a remedy in cases in which cherry-laurel water had been previously used. A few years later (Hufeland's *Journal*, 1813, p. 113) occurred the first case, of which we have been able to find record, of death of a human subject by the action of this poison. This was the case of a child who swallowed a quantity of the dilute acid which a physician had prescribed for the mother. Within the few succeeding years deaths occurring in a similar manner, from misadventure, or by reason of the varying degree of concentration of the medicinal acid used, became very numerous, and in consequence the drug fell into disrepute.

In more recent years the extensive use of the cyanids of potassium, silver, etc., in the processes of photography, electroplating, and gilding has placed these active poisons at the easy disposal of many, has led to numerous cases of poisoning through carelessness and misadventure, and has brought potassium cyanid into prominent notice as one of the most frequently employed of poisons.

* The American Journal of Physiology, January 1st, 1902.

The statistics of poisoning in different countries afford somewhat contradictory information as to the degree of frequency of the use of the cyanic poisons. Tardieu gives a table of criminal poisonings in France from 1851 to 1863, including 617 cases, of which there is none by the cyanic poisons. The Reports of the Registrar-General of Great Britain for 1863–67 include 2,350 poisonings from all causes, of which 151 were caused by hydrocyanic acid and potassium cyanid, a number only exceeded in the cases of laudanum and the salts of lead. During the same period there were 6,696 suicides, of which 673 were by poison, and of these the cyanic poisons head the list with 121 cases. Of 1,263 murders 19 were by poison, and of these, 5 were by laudanum and 4 by the cyanic poisons. Lesser gives a table of 431 cases of poisoning occurring in Berlin, from 1876 to 1882, of which 74 were by potassium cyanid and 12 by hydrocyanic acid, while the only substance which caused a greater number of deaths than the former is carbonic oxid, 185. In our own country statistics of poisonings are exceedingly meagre, and such as exist are valueless by reason of insufficient and inaccurate data.

Murder by the cyanic poisons does not seem to be frequently attempted. By suicides hydrocyanic acid is often the agent selected, because, probably, of its rapid action, while the facility with which potassium cyanid can be obtained by any one is a reason of its frequent use for the same purpose. Accidental poisonings by the cyanic poisons are the result of carelessness or ignorance. A solution of potassium cyanid has been hastily drunk in mistake for water. The same substance in the solid form, bought to clean brass buttons, has been swallowed in mistake for another solid purchased at the same time. Numerous poisonings by oil of bitter almonds used for flavoring articles of food are recorded. Instances of death or serious poisoning caused by the medicinal administration of hydrocyanic acid are by no means as infrequent as they should be. In several cases the intent of the physician has been called in question, and a trial for murder or manslaughter has resulted.

Experiments on Animals.—*Method of Action.*—As in the great majority of cases in which the human subject has succumbed to the action of the cyanic poisons, the clinical history has reached the last chapter before, or shortly after, the arrival of the physician, what knowledge we possess concerning their mode of action has been derived mainly from experimentation. Unfortunately the experimental method has, in the hands of different observers, led to widely varying opinions regarding the mode of action of these poisons.

The following is the usual train of appearances following the administration of a lethal, yet not overwhelming dose of hydrocyanic acid to a warm-blooded animal: There is dyspnœa, beginning with a few hurried respiratory movements, the animal staggers and falls in a powerful tetanic spasm, with opisthotonus, during which the diaphragm is fixed in contraction; the pupils are dilated; the tongue and eyeballs protruding, the latter glassy; there is involuntary evacuation of urine and fæces; the pulse rapidly diminishes in force and frequency, and, if the dose be large, the animal dies without any further symptoms. If the animal do not die at this point, the muscles relax; the condition of tetanus passes into one of general paralysis, with total loss of reflex irritability; respiration is resumed, the expiratory acts being quite long and the inspiratory very short, and the intervals between the movements being very long. The pulse is irregular, frequent, and barely perceptible. If the animal recover, the respiration and pulse gradually return to the normal; if it die, the intervals between the respirations increase in length, the pulse becomes imperceptible. No further convulsive movements are observed, except, immediately preceding death, a single convulsive expiratory effort attended by a piercing cry or shriek.

That hydrocyanic acid destroys life by the disorders of respiration which it produces may be regarded as certain; but concerning the underlying causes of these disorders no such certainty can at present be said to exist.