

the phosphate of soda in cases without diarrhœa, which is a contra-indication to its use. These remedies should be used persistently and for lengthened periods. The iodide of potassium, with a generous diet and iron, is a method of treatment strongly urged by Bartels, and with which he has, he says, succeeded in effecting a cure. A careful mercurial course, with or without conjoint or alternate administration of the iodide of potassium, may be useful in cases originating in the syphilitic cachexia. Dickinson, influenced by his theory of amyloid deposits, administers alkalies, which restore their solubility. Alkalies may be serviceable, but the depression caused by them should be prevented by the timely administration of iron and a generous diet.

ANIMAL POISONS.

HYDROPHOBIA.

Definition.—*Hydrophobia* is a specific disease due to the inoculation of a poison contained in the saliva of rabid animals, notably the dog, and characterized by pain and stiffness of the inoculated part; by exaltation of the reflex faculty; by spasms of the throat on the attempt to swallow, and subsequently at the sight of liquids; by delirium, exhaustion, and death. It is also known as *rabies canina*.

Causes.—The sole condition necessary for the causation of hydrophobia is the inoculation of man with a contagious principle contained in the saliva of the dog, cat, wolf, and some other rabid animals. This principle is not absorbed through the unbroken skin, but from a wound or abrasion. A certain predisposition is also necessary, it is probable, for, of all bitten by animals unquestionably rabid, but a small proportion are attacked by hydrophobia. The proportion is variously stated from five to fifty per cent., but, while the former is much too small, the latter is excessive. Accident more than predisposition is, however, the real cause of the exemption of so many who are bitten. The teeth, in inflicting the wound, pass through clothing, which removes the saliva, and hence the most of those bitten through the clothing escape infection. On the other hand, wounds of exposed parts, or an abrasion receiving the saliva, is very certain to be followed by the disease, unless there be a decided insusceptibility to the action of the poison. All ages and both sexes are liable, but more men than women are attacked,

because the former are more exposed. Various moral impressions favor the occurrence of the disease. These are apprehension, fear, excesses of all kind, fatigue, etc.

Pathological Anatomy.—There are but few changes found *post mortem* really typical, if any such exist, but are common to all the diseases of the same group. The cadaveric rigidity is well marked; there are extensive suggillations, and putrefaction soon begins; the coloring matter of the blood stains the vessel-walls, and the blood itself is fluid and has a violaceous color. These facts only indicate a changed state of the blood common to many maladies. The fauces are red and swollen, the salivary glands enlarged; the trachea and bronchi are hyperæmic and contain a quantity of frothy mucus; the lungs are also hyperæmic and sometimes œdematous. More or less congestion of the brain, effusion into the ventricles, and hyperæmia, with enlargement of the vessels of the medulla oblongata, have been observed. In some cases changes of texture, softening, etc., have been seen at the apparent origins of the seventh, eighth, and ninth nerves. The pneumogastric, phrenic, and sympathetic nerves have also been found in a more or less hyperæmic state.

Symptoms.—The period of incubation is by no means confined to fixed limits. In 214 cases collected by Jaccoud, the period of incubation was less than one month in one fourth of the number, from one to three months in 143, from three to six months in 30, and from six months to a year in 11. According to Gangee, in the large majority of cases, the period of incubation is four to eight weeks. Age apparently affects the duration of this period. Thus in nine new-born infants, the incubation period was thirteen to fifteen days. A very remarkable case has been reported of a man two years in prison, who had hydrophobia, and who had been bitten seven years before. During the period of incubation there is nothing in the wound, nothing in the state of the organism, to indicate the existence of any mischief. The wound or abrasion may be very slight, may have healed long since and been forgotten. At the termination of the incubation, the attention of the patient is attracted to the wound by some uneasiness felt in it. If it has not healed, the wound takes on a livid appearance, and becomes exceedingly painful, the pain shooting toward the trunk from the extremities if the wound is so situated. If the wound has cicatrized, the scar becomes painful, red, irritable, swollen, and sometimes exudes a bloody serosity. Sometimes a sensation of coldness and of numbness is felt in the bitten member, and occasionally the lymphatics of the limb are swollen, and marked by hard, red lines. The local symptoms are soon accompanied by systemic disturbances. The patient is depressed, apprehensive, peevish. So marked is the condition of melancholy that the first stage of hydrophobia has been called the *stadium melancholicum*. The skin becomes hot, the pulse rapid and bounding.

The appetite goes, and the bowels are confined. In some few cases the wound continues unaffected, and the feelings of anxiety and alarm are absent, the only symptoms coming on being the fever and the general distress belonging to the feverish state. What form soever this initial stage assumes, it is of short duration, continuing but a few hours or a day or two. The peculiar reflex paroxysms then come on: the breathing is sighing and jerking, the epigastrium is elevated by the forced depression of the diaphragm, and the shoulders are rendered prominent by the overaction of the levator and trapezius, while at the same time there is experienced a sensation of præcordial oppression and of tension in the anterior wall of the thorax. The neck grows stiff, the throat feels constricted, and the movements of the head are constricted. Now are experienced the peculiar sensations which are so distinctive of the disease. A spasm seizes the pharyngeal muscles when any attempt is made to swallow. The patient has an intense thirst, but whenever he approaches the cup to his lips his countenance assumes a strange expression, the eyes stand prominent, the features contract, the limbs tremble, and especially his hand carrying the cup, and he tries with a sudden movement to gulp down the liquid, but he can not pass it into the pharynx; it is violently rejected with a suffocative spasm, and he falls back on the bed exhausted. Presently, the appearance of water, the reflection from a mirror, any impression suggesting the act of swallowing, throws him into a state of apprehension or excites pharyngeal spasm. Meanwhile a sense of constriction continues at the throat, the mouth is dry and parched, and he is continually impelled to eject from his fauces, with a harsh, barking hawk, some viscid saliva. It is this hawking which is vulgarly supposed to be the bark of a dog. It must be admitted that this is a peculiar, unearthly hawking, which, under the circumstances, might seem like the bark of a dog. The appearance of the patient at this time is most striking. He is restless, his countenance anxious, his eyes bright and wandering; he becomes garrulous, and his mind presently wanders, and every few minutes he hawks and pulls at his throat as if to remove some obstruction. He will not tolerate the suggestion of liquids, much less their approach, and assumes a hostile attitude if there is a persistent attempt to induce him to try to drink. On the other hand, the mind may be clear, but this must be regarded as exceptional, for, in all the cases seen by the author, the patients, if not maniacal, were at least disordered in mind. Cases have been reported, however, in which the faculties of the mind were preserved, in which the patients not only were fully aware of their desperate condition, but expressed the greatest solicitude for their families and for those about them. The author has heard of one case in which the patient voluntarily asked to be restrained during the paroxysm, that he might not do injury to his attendants. There ensues such an exalted condition of the reflex faculty, at last, that a breath of air will

excite the paroxysms, which are not unlike those of tetanus. When they come on, respiration is jerking, and then fixed, the voluntary muscles are rigid, breathing is suspended, the surface becomes red and cyanosed, and the action of the heart is rapid and weak. They last but a few seconds at first, but increase in duration and severity, and are excited by less and less powerful impressions toward the end. Sometimes there are severe and persistent erections (priapism), and in women there is nymphomania. Difficult urination is not uncommon, and in some cases strangury is present.

Course, Duration, and Termination.—Hydrophobia is a very acute disease. The first stage does not exceed two or three days, and may be but a few hours in duration, the average being about one day. The duration of the second or hydrophobic stage is similar; it may last two days, possibly three, but it is usually ended in one, sometimes in a few hours. The termination may be by exhaustion, the under jaw drops and the saliva flows from the corner of the mouth; the pulse becomes small, weak, and thready, the body is covered with a cold sweat, the pupils are dilated, the eyes fixed, the voice fails, and the patient, after a short, convulsive trembling, passes into collapse, and dies. In other cases the patient dies asphyxiated in the paroxysm. In still others, general convulsions end the case. The whole duration of the disease is comprehended in about three days. The prognosis of hydrophobia is most unfavorable, no cases of the genuine disease having ever recovered, unless we may except two, treated with *woorara*, lately reported.

Diagnosis.—There is a strong resemblance between tetanus and hydrophobia: in both the reflex function of the spinal cord is highly excited, in both slight peripheric irritation excites spasms; but they differ in that hydrophobia follows a bite of a rabid animal after a long period of incubation, and tetanus is caused by a wound; in hydrophobia there is a sense of constriction of the fauces—in tetanus there is trismus; hydrophobia is of much shorter duration than tetanus, is invariably fatal, while a considerable proportion of the cases of tetanus get well. Hydrophobia may be confounded with an hysterical malady simulating it, but the latter is accompanied by other hysterical symptoms, does not prove fatal, and there is no history of the bite of a rabid animal. There are those who maintain that hydrophobia—as a disease due to a peculiar poison contained in the saliva of the rabid dog—has no real existence; that the poison is a fiction, and that the symptoms supposed to be produced by it are really due to the influence of sympathy, to the faculty of imitation, and to the imagination, the whole being intensified by morbid fears. It would seem impossible, on this hypothesis, to account for the occurrence of this disease in infants after being bitten. As, however, the imaginary disease is just as fatal as the supposed genuine affection, the practical

physician will be indifferent to the theories, and will be as loath to encounter the one as the other.

Treatment.—When the bite of a rabid animal has been received, the wound should be scarified, cauterized with a hot iron, or every part of it touched with nitrate of silver. The success of Mr. Youatt has been so great with the nitrate of silver that severer applications would seem to be unnecessary. Permanganate of potassium, having succeeded so well in the bites of venomous snakes, should be tried. There is no specific to prevent the disease, and we are equally ignorant of a remedy to cure it, unless Pasteur's inoculations with the modified virus prove to have the effect which he claims for the method. Of all the remedies hitherto proposed, curare is the only one which seems to possess any power over hydrophobia. Two cases have been reported recently—one in Italy and one in New York—in which a disease, diagnosed as hydrophobia by eminent practitioners, got well under the hypodermatic injections of curare. Chloral, chloroform, gelsemium, nicotine, etc., may be used to alleviate the distress.

PARASITES.

TRICHINÆ AND TRICHINOSIS.

Trichina.—This dangerous parasite is found in two forms, as the *intestinal trichina* which is sexually mature, and as the *muscle trichina*, not fully developed, or sexually immature. The name given by Professor Owen (*Trichina spiralis*) is based on the hair-like appearance of the parasite and the spiral form assumed by it in the muscular tissue. It is a very small, hair-like worm, having a head smaller than the rest of the body, while the caudal extremity is rounded. The females are three or four millimetres long, and contain a sexual apparatus consisting of an ovary, a uterus, and a vagina. Only a part of the sexual apparatus exists in the muscle-trichina, the rest being developed after the parasite has entered the intestinal canal of its host. It is viviparous, and discharges from the vaginal outlet about one hundred embryos a week, and the birth of the embryos begins in about a week after the female enters the intestine. As more females than males are

born, and as successive formation of embryos from the eggs may take place,* the number developed becomes enormous. The male trichina is one half the size of the female, and contains at its caudal extremity the sexual apparatus. The viable embryos discharged from the female are in lively motion. They do not remain in the intestine, but begin a process of migration which only terminates when they have reached their habitat in the voluntary muscles. The manner of reaching their destination is not known—whether by the blood-vessels, by the lymph-channels, or by direct effort boring through the intervening tissues until the muscles are reached. As they have repeatedly been found in the blood and lymph,† and in the connective tissue only adjacent to muscles,‡ and as the rate of migration is so rapid, it seems pretty certain that the distribution is chiefly passive by the blood and lymph-streams. Endowed with a strange instinct, these parasites, when they reach the muscular tissue, stop their wanderings, pierce the muscles, and force their way into the primitive fasciculi, where they coil up. The sarcolemma of the primitive fasciculus now undergoes thickening, a quantity of granular matter surrounds the parasite, and a number of "oval, vesicular-shaped muscle nuclei" § develop on the inner surface of the capsule formed by the thickened sarcolemma. In the process of transplantation of the parasite from the intestinal canal to the muscle, the parasite grows; but it reaches the greatest size in fourteen days after it is established in the muscle. In the intestinal canal the embryos have a very short lease of life (five to eight weeks); but, safely deposited in the muscle, they continue during the life of their host and for a short period after his death. In the muscles, after a time, the trichinæ undergo a further change. Lime-salts are deposited in and about the capsule, and ultimately in the parasite itself, when minute bits of lime, just visible to the eye, are seen more or less thickly distributed through the muscular tissue. The distribution of trichina is determined by the migrations of its hosts—the hog, the rat, and man. This parasite has been found in the cat and other animals, and has been artificially reared in rabbits and Guinea-pigs. In the dog, however, it appears to develop no further than intestinal trichina, migration of the embryos not taking place in this animal. As man and the other hosts of the parasite are to be found everywhere, so this parasite is universal. It is especially frequent in this country in the great West, because of the enormous extent of the pork-traffic. The proportion of hogs infected in the West is variously stated, but it is prob-

* Cohnheim, "Zur pathologischen Anatomie der Trichinenkrankheit," Virchow's "Archiv," Band xxxvi, p. 163.

† Virchow, *ibid.*, Band xxxii, s. 332, "Zur Trichinenlehre," contains also a full historical account of progress of discovery.

‡ *Ibid.*, Band xxxiv, s. 469.

§ Heller, Ziemssen's "Cyclopædia," article "Migratory Parasites," vol. iii.