ART. III.—Trichiniasis. By John D. Jackson, M. D., of Danville, Kentucky. (With four wood-cuts.)

By the observations of Zenker, in 1860, we have been enabled to add a new disease to the already long nosological catalogue, and what is certainly exceptional in medicine, coincidently with its isolation and description as an individual affection, we have a clear and demonstrable knowledge of its etiology.

The disease to which we allude is of parasitic origin, and has been called by its discoverer Trichiniasis, from the name of the eutozoon producing it—the trichina spiralis. The generic portion of the name of the animal is derived from the Greek word spiralis, a hair, in allusion to its filiform shape; the specific part—spiralis, from the Latin word spiralis, indicating the spiral, watchspring-like form it assumes when coiled up within its cyst.

Though a knowledge of the malady to which the parasite gives origin is but recent, yet the existence of the animal and to a certain degree its natural history, had long been previously known. Hilton, of Guy's Hospital, London, in 1832, while dissecting the body of an old man who had died of cancer, observed the pectoral muscles to be thickly sown with minute white specks; he published his observations in the London Medical Gazette in February of the year following, and was thus the first to put on record a notice of what subsequently was demonstrated to be the capsules or cysts of trichinæ; if a doubtful observation by Tiedemann, ten years previously, of what has been supposed by some from his description to have been the same thing, be excepted.

Be this as it may, neither had a true knowledge of what he viewed, and the credit of the discovery of trichina: must be given to James Paget, then a student at St. Bartholomew's, who, while dissecting a body early in February, 1835, and perceiving the muscles to be filled with what were supposed in the dissecting-room to be minute bony spicula, examined them with a leus and found that they were cysts, each containing a small worm coiled up in it. He was desirous of examining them microscopically, and for this purpose borrowed a simple dissecting microscope of Mr. Robert Brown, with which he was able to observe structures in the worm before invisible. As soon as the discovery was made known in the dissecting-room, portions of the maseles were distributed far and wide, and among others to the comparative anatomist, Robert Owen. As the discoverer of the eutozoon, Paget was invited to communicate his observations to the Abernethian Society, which he did on the 6th of February, and an abstract of them was recorded in the Transactions of the Society. On the 24th of the same month Professor Owen presented to the Zoological Society his

1 Vide Letter of Paget to London Lancet, March 5, 1860.
memoir containing a “Description of a microscopic entozoon infesting the muscles of the human body,” subsequently inserted in the Society’s Transactions, and in the London Medical Gazette, April, 1835. This was the first publication on the subject, and in it Owen gave the name which it has since retained—*trichina spiralis*. He, however, described the worm as destitute of intestinal canal and organs of generation, and classed it in a very inferior scale, among the helminthides. During the same year Dr. Farre published his observations upon a new subject in whom the trichinosas cysts were found. He discovered an intestinal tube and organs of generation, which placed the worm in a higher rank of organization, and enabled him to assign it a place among the class nematoides (τριχίνα, thread, and τρίχα, like). He also observed that the striated muscles, the heart excepted, alone contained the cysts. In May, 1835, Dr. Henry Wood, of Bristol, gave, in the London Medical Gazette, an account of a case of what he diagnosed a violent attack of rheumatic inflammation complicated with cough and dyspnoea. The patient, a young man aged twenty-two, had been sick a fortnight, and confined to his bed six days previously to his being brought on the back of his father to the Bristol Infirmary, where he died on the tenth day after his entrance. An autopsy exhibited pachymon in the first degree and extensive pericarditis; and upon examination trichinae were found in the muscular fibres of the chest and shoulders in great numbers, and in a less degree further from the thoracic region; “being most apparent in the pectoral and deltoid muscles, less so in those of the arm, and becoming still fewer in the legs. (Fritz.) The trichinae had not become encysted.¹

Though evidently now a case of *trichiniasis*, Wood was unable to detect the true cause of the affection, though in his paper he makes the very suggestive inquiry—whether in the subjects in which the trichinae described by Owen and Farre had been found, there had been observed any symptoms of rheumatism or inflammation of the muscles?

In the same year Harrison, in the Dublin Journal, placed on record six observations. In 1840, Kobelt and Bischoff published an account of an autopsy made at Heidelberg of a body infested with trichinae. Bischoff confirmed Farre’s observations upon the anatomy of the worm, though he fell into the same error with him in mistaking the attenuated end of the animal for its tail, and consequently describing the mouth as the anus. He, however, pointed out the true character of the fatty granules situated so frequently at the polar extremities of the capsules, and which it seems had been mistaken by Owen for trichinous germs. He also declared the capsules to be made up of two distinct envelopes, an internal spherical, and an external ovoidal one, and observed, besides, the tenacious vitality of the parasites, which exhibited their movements at the expiration of fifteen days, when the muscles inclosing them had become completely putrefied.

The development of trichinae he could only explain by supposing a spontaneous generation. From 1842 to 1845 observations were published in this country by Drs. Bowditch and Jeffries Wyman, of Boston, and in Copenhagen by Moaister and Soytzer.

During this time the origia of the worm was enveloped in mystery, Bischoff's theory of spontaneous generation in the mean while not being without supporters; Dujardin, in his work upon the helminthes, declaring — "l'apparition de ces trichina est encore an des plus paissant arguments en faveur de la generation spontane de certains helminthes." This explanation, however, was rejected by most physiologists, who, with Virchow at their head, contended for the truth of the ancient aphorism, "omne vivum ex ovo," and supposed the worm to be the development of the egg direct, or the transition state of some other animal, which latter theory derived the strongest support from the discoveries then recently made by the Danish naturalist Steenstrup, regarding alternate generation or equivocal reproduction. Some additional colour was given to such supposition by the discovery of trichina in the cat in 1845, by Herbst. (Fritz.)

The strongest support to the doctrine, however, was derivable from the discovery of trichinea in pork (lunm) in 1846, by Professor Leidy, of Philadelphia. This may be deemed the most important discovery since that of Paget, 1

1 Boston Medical and Surgical Journal, 1842, 43, 44.
2 Dujardin. Histoire naturelle des helminthes, 1845, p. 293.
3 The observations about that time published by Steenstrup are to the naturalist very curious, and exceedingly interesting. He found at certain periods of the year in the viscera of one of our fresh-water mollusks, the Limnea, a quantity of little worms with well-marked head and two posterior projecting limbs; these, under the microscope, were discovered to contain within the cavities of their bodies masses of other little worms recognized by the naturalist as young Cercariae. The Cercariae increasing in size would distend the worms containing them, which seemed to have for their office the protection and development of the cercariae within them, and hence called the nurses. After growing to a certain size the cercariae would leave the body of the nurse and move freely in the natalinai cavity of the mollusks; or, escaping into the water, fix themselves in turn upon the body of another mollusk, and dropping the tail, now no longer useful to them, he converted into encysted larvae, known as Distoma, and thus were ready to begin their transformation anew. The nurses in turn bo demonstrated to be the offspring of little worms of another kind, termed grand nurses. These were supposed to be immediate offspring of the Distoma, the larval state of the Cercariae; four generations and a metamorphosis being requisite to complete evolution—the parent animal finding no resemblance to itself in its progeny until it comes down to its great grand offspring. Among the plant lice (Aphides), the number of reproductions is still greater, for it is sometimes not until the eighth or ninth generation that the animals, previously asexual, appear as males or females. At this period the sexes are for the first time distinct, and the males provided with wings. Vide Steenstrup's Alternation of Generations, Ray Society, 1845. Also Gould and Agassiz's Zoology, Chapter on Alternate and Equivocal Reproduction.
since by means of it a direct connection between the entozoon and the food of man was deducible. During several years succeeding, however, the researches seemed to be confused to the anatomy of the worm. In 1851, Lusehka pointed out the attenuated filiform portion of the animal as its head, and further minutely described its structure, though he could not observe any genital organs, which were subsequently demonstrated, together with other points in its minute anatomy, by Leuckart, and Bristowe, and Rainey.

In 1855, Leuckart, Zenker, and Küchenmeister commenced experimenting upon different animals, forcing them to swallow human trichinous flesh. The experiments were but partial in their results, for some reason the muscles of the subjects of their experiments not being penetrated. From his experiments Leuckart nevertheless demonstrated the freeing of the trichinae from their capsules, and a development, three days after entrance into the intestines, to thrice their primitive length; and from the previous discoveries made by Siebold, Van Beneden, and himself, upon the metamorphosis of the Cysticerci, came to the conclusion that trichinae represented an inferior grade of development of Tricocephalus dispar, which error seems to have been generally entertained, until, by his experiments in 1860, observing the trichinae to undergo complete sexual development and give birth to living young, he thus demonstrated the erroneousness of the opinion. Leuckart's observations had been made upon the dog, an animal which has been since found, as a rule, to be insusceptible to trichinous infection, though the worms will readily undergo development within the intestines and give birth to their young. He supposed that before transmission to man, possibly the young intestinal trichinae must be ingested by another animal—a conclusion readily drawn by analogy from the result of the studies of the mode of propagation of tania. With this view he gave a dog's intestines which contained trichinae to a pig, an animal which he knew, by the observations of Leidy, to be susceptible of trichinization. By his experiments upon the pig and other animals he learned that the young trichina commenced their migrations from the intestines, when they were developed, toward the muscles, about the eighth day after the food containing them had been ingested, and that in the intestines of the hog, cat, rabbit, mouse, and barnyard fowl, trichinae would attain their complete sexual development.

It was while Leuckart was in the midst of his experiments that Zenker made his ever memorable discovery, and sent a portion of the trichinous muscles of his patient to Virchow. This he fed to rabbits, and the results following were fully confirmatory of those arrived at by Leuckart. Says Virchow:

Zeitschrift fur Rationelle Medicin, III., R. VIII. Bd. 1860, 5 Mars. Quoted by Fritz in Gazette Hebdomadaire, 20 April, 1866.

"It was upon rabbits that I was able to follow the development of trichinae. Upon making a rabbit eat flesh containing trichinae, the animal was seen to grow poor; in three or four weeks thereafter its forces diminished sensibly, and it died toward the fifth or sixth week which followed the ingestion of the food containing the cestozoa.

"By this alimentation I have obtained five generations of cestozoa. I at first made a rabbit eat living trichinae occupying human muscle; it died at the end of a month. I then caused the muscles of the first rabbit to be ingested by a second; it died also a month after. The muscle of this served me to infect three others: two of them dying three weeks after, and the third at the end of a month. With these last I fed two others, one with much, and the other with but little of the flesh. The first died at the end of the eighth day without my autopsy revealing anything but an intestinal catarrh; the second succumbed six weeks from the time of performance of the experiment.

"With all of these animals, with the exception of the one before the last, all the red muscles, save the heart, inclosed a great quantity of trichinae, so that each parcel examined under the microscope contained many, sometimes even a dozen."

Until 1860, although trichinae had been so frequently observed in the human subject, as far as we are aware, if we except the case of Wood, there seems to have been no suspicion entertained of their hurtfulness, their presence and development having been investigated purely in the light of scientific curiosity.

It was on the 12th of January, 1860, that a young woman, a servant, aged 20 years, entered the hospital of Dresden. She had taken sick about Christmas, and had taken to her bed on the first of January. She had at first suffered with great weakness, heat, thirst, loss of appetite, sleeplessness, and constipation. When admitted into the hospital she presented, besides intense fever, a tympanitic and painful abdomen, the tout ensemble of symptoms, in brief, indicating typhoid fever. Very soon there appeared violent pains of the muscular system, pains such that the patient groaned day and night; then there was a contraction of the knees and elbows, rendering all efforts at extension impossible, so great was her pain; later there was oedema of the members, especially the legs, a typhoid pneumonia manifested itself, and finally, on the morning of the twenty-seventh of February, she died. Upon holding an autopsy Zenker found the whole of the striated muscles filled with trichinae, which gave unmistakable signs of vitality in their active movements. To such a degree had they penetrated that a magnifier of low power exhibited as many as twenty in the field of the glass, the primitive muscular fascia had lost their striae and were friable. There was no other lesion which could be attributed to typhus."

He also found male and female trichinae which had undergone complete sexual development in the jejunum, together with a number of embryos. On investigating the case, and tracing its origin, Zenker found that at the house in the country where the young woman had been serving as a domestie, there had been a hog killed on the twenty-first of December, which had been used as food by the family, and the ham and sausages made from it, he found filled with vast numbers of trichinae, and, finally, that the butcher, who had killed the hog, and eaten of the sausages while fresh, together with many others, had fallen ill, though none ultimately succumbed, save the unfortunate woman who had been sent to Dresden. The persons

2 Fritz, Gaz. Hebdom., 20 Avril, 1866.
affected presented different symptoms more or less grave, which had been interpreted as gastro-intestinal catarrh, rheumatism, or typhoid fever, as the different phenomena predominated. The butcher's case was the one of most severity, and among other symptoms from which he suffered were pains and stiffness of the neck and extremities, which became, as it were, paralyzed, and which were supposed at the time to be an abnormal form of gout.

Zenker's observations being immediately reproduced by the medical journals, the attention of all Germany was at once directed to the subject. This terrible, and hitherto unknown source of disease, naturally placed every one on the alert, and since then to the present, counting isolated cases and epidemics, as they have not altogether inappropriately been called (for unfortunately from the nature of things, as it may readily be supposed, where the sources of infection exist, frequently a large number of persons become affected), there have been published in Germany alone more than two thousand cases of trichinous infection. Among the most noted records may be counted that of the outbreak at Plauen and its environs, and published by Boehler and Koenigsdoerfer, there being between thirty and forty cases and one death. The account of a case at Heidelberg, by Friedrich, Professor of Clinical Medicine, from the graphic relation of the symptoms, together with the apparent success of a remedy then for the first time tried, besides being the first case in which the diagnosis had been made and confirmed in an indisputable manner during life, attracted much attention in Germany. The epidemic of Magdeburg, Neustadt, and Buckau (1858—1862), described by Sendler, in which between three hundred and four hundred were said to have been ill. Those of Blankenburg, studied by Scholz and Griepenkerl (1859—1862), in which two hundred and seventy-eight cases were said to have existed, with one death in the garrison of the place, and a large number in the civil population. That of Calbe, described by Herbst and Simon, in which there were thirty-eight cases with eight deaths. The epidemic at Hettstadt, described by Rupprecht, the first having one hundred and fifty-nine cases with twenty-eight deaths; the last eight cases. And, finally, not mentioning a great number of smaller ones recorded, we have yet fresh before us, occurring in October of last year, the terrible epidemic of Hedersleben, the most widespread and fatal of any yet recorded, there having been three hundred and fifty cases, and eighty deaths.

As presenting lucidly the characteristic phenomena of trichiniasis we give Professor Friedrich's case in detail. 1

1 It is said that a single hog produced the outbreak at Hettstadt, and the terrible epidemic of Hedersleben was from two slaughtered hogs.

2 Virchow's Archiv, 1862, t. xxi. p. 399.

3 Griepenkerl, in April, 1864, had one of the sufferers of 1859 to submit to a muscular exploration. He found numerous encysted trichina, and thus fully confirmed a diagnosis founded on the history of the rational symptoms.

George Mischler, a butcher boy, aged twenty-two years, well formed and enjoying excellent health, after having eaten of raw minced-meat made from pork, was seized, on the 14th of April, 1862, with an extreme lassitude of the limbs, and great pain in the muscles, especially the gastrocnemii. This he was inclined to attribute to a drinking bout during the evening. About the same time, and without any initial chill, he experienced headache, heat, thirst, abundant perspiration, and loss of appetite. The man wished to work, and continued to carry around his meat in the city, but he mounted the stairways with great difficulty, the symptoms of his disease continuing to become aggravated. Each day he passed a liquid stool without colic; the muscles of the arms, and the loins and back, became painful, but there was no vertigo, nor pulmonary trouble. At last, however, being greatly enfeebled, he desired to enter the hospital.

At the time of his admission, the 24th of April, he presented the following symptoms: Violent pains in the muscles of the extremities, and at the nape of the neck, which were increased by any movement, pressure, or even the touch. The muscles were turgid and elastic, yielding something of the sensation furnished to the touch by India-rubber. There was a stiffness and numbness of the members, with the articular loosing free and painless; he besides had a general feeling as if blunted (d'enfure). He could not sit up in bed, and if he made efforts to do so, experienced pain and stiffness in the inguinal region. Mastication, deglutition, and speech were perfectly intact. The abdomen was soft and painless. Neither the tongue, liver, spleen, lungs, nor heart exhibited anything particular. There was no bronchial catarrh, nor exanthematous rash. On the evening of the day of entrance, there was intense fever—visage red and hot, anorexia, tongue a little coated, feebly moist; urine acid, not albuminous; the pulse 108 pulsations per minute; temperature of the skin 106° F.

From the 25th to the 27th of April the same symptoms; the sleep was often interrupted, and there was slight delirium; two liquid stools without effort. The 28th, a feeling of profound weakness; pain in the muscles persistent, especially in the calves of the legs; slight epistaxis; two diarrhoeal stools. The 29th he passed some joints of tenia; sweating abundantly for an hour.

The 1st of May muscular affection continues; the patient can neither sit up nor turn himself in bed; elbows demi-flexed; great pain on an effort being made to extend the arm; the inferior extremities extended and immobile. Sweating profuse and continuous, hoarseness commencing, a dry cough, no rale, pain in speaking, vertigo disappeared, intelligence clear. Heat and thirst less marked than on the day preceding, loss of appetite, urine for the first time albuminous.

The 2d, no change.

The 3d, feebleness increased; sweating abundant, following the profuse transpirations; there have appeared upon the neck, chest, and abdomen innumerable milia sores, containing a clear liquid fluid.

The 4th, the same state.

The 5th, sweating persisting; numerous minute pustules, containing a milky fluid, surrounded by a red areola, show themselves beyond the milia sores, upon the chest and abdomen. The pulse is less frequent, heating 90 strokes per minute; the temperature of the skin has fallen to 100° F.

Friedrich having diagnosticated trichinous infection, administered for the first time picronitrate of potash. 1 E.—Picronit. potas. 5; ext. glyce. glab. pulv. glyce. glab. ad 83; m. ft. pl. No. 1x. S. Five pills three times daily.

May 7th.—Stiffness of muscles, contraction of arms, feebleness and sense of fatigue, hoarseness and sweating all continue; eruption extended over the whole of the back; head free; tongue normal; one yellow liquid stool; sleep and appetite good; no albuminuria. The same day, by means of Middledorff's

1 A double salt, composed of picrozinc potassa and nitrate of potassa—$[\text{C}_2\text{H}_2\text{N}]^2\text{O}_4\text{SO}_4$. 2 A three-quarters explorer, terminating in a sort of harpoon, designed to bring up some muscular fibres, which are easily cut as the stem re-enters the sheath.
A little morsel, scarcely the size of a hemp-seed, was extracted from the right gastrocnemius muscle, and upon being subjected to the microscope, seven trichinae were counted, most of which were enrolled "en spirale," and interposed between the muscular fibrilla. The picronitrate of potash is continued in the same dose.

May 9th. Movements less painful; the patient can, with some effort, sit up in bed; the resistance of the muscles is less, the contraction of the arms yet remains, but there is less pain upon effort being made to stretch them; the sweats persist day and night, and the last pustules extend over the body. A furuncle, the size of a pea, has formed at the inferior angle of the shoulder-blade; the skin has mortified, just beneath this point, to the extent of an inch and a half. In the pus of the furuncle there was found a large and well-developed trichina. Heart, lungs, liver, and spleen remain sound; stools normal. The urine has taken on deep yellow colour, under the influence of the picronitrate of potash, and the conjunctiva has commenced colouring; appetite returning. Ordered strong soups and a little roast meat. Pulse 84 per minute; temperature of body 100° F.

May 12th. Less pain of muscles, stiffness diminished, can almost straighten the arms; sweats continue, especially at night; edema of limbs no longer present; marked icterus extending over the whole surface, from the use of the picronitrate of potassa.

May 13th. Can make a few steps in the ward; symptoms all improving. Epidermis detached in flakes from the toes and soles of the feet.

May 20th. Artificial icterus everywhere intense, pulse and temperature normal; the patient takes a warm bath daily.

May 25th. The picronitrate of potassa suppressed. A second exploration of the gastrocnemius by the harpoon furnished a free and living trichina.

May 29th. Continued improvement; the urine, which had become almost black, has returned to its normal state; appetite satisfactory. A renewed experiment from the same place gave a spirally curved trichina, living, and already inclosed within a thin and oval capsule.

May 30th. Icterus sensibly diminished.

June 15th. A new exploration did not furnish trichina.

June 30th. The patient quit the hospital completely cured, after an illness of two months and a half.

This case of Friedrich's was remarkable for being the first in which the diagnosis was confirmed during the life of the patient by extracting trichinae. It was also the first in which this picronitrate of potash was used, and which, from the results apparently following, was, until further use of it demonstrated its inefficacy, deemed a specific. Edema of the eyelids and face, which has since been found to be so constantly present as to be deemed one of the most characteristic symptoms of trichiniasis, is not mentioned either because so slight as to have escaped notice, or as is most probable, because the phenomenon, which usually sets in towards the close of the first week of infection, had appeared and subsided before the patient had entered the hospital.

As further exhibiting the clinical phenomena of the disease, we give the following cases observed by Beobler1 and Königsdorffer.

Louise Schneider, servant, aged 22 years, of a delicate constitution, chlorotic, had been suffering some days previously with pains in her extremities, which were manifest about the 17th of March, 1862. In the mean time, there was great lassitude in the members, and a rather sudden swelling of the face.

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1 Beobler, Die Trichinenkrankheit und die Behandlung derselben in Pflanen, 1863. Also, Scoutetten, Sur les Trichinose, and Kestuer, from whom we translate.
Dr. Königsdorffer, her physician, after having last sight of her for some days, saw her again on the 24th and could scarcely recognize her, so generalized had become the oedema.

The eyelids are markedly edematous, as well as the extremities. Sweating continuous and abundant. The patient remains immobile in bed, the thighs and legs in a state of demi-flexion. The least movement occasions the most violent pains. Even the lightest pressure upon the muscles is equally painful. There is insomnia, cephalalgia, acceleration of the pulse, intense thirst, difficulty in opening the mouth, and protruding the tongue, which is moist.

Königsdorffer, having made his diagnosis, made at first an observation of the gums, but without finding trichina. He repeated his trial four days after upon the biceps, and found for the first time living trichina.

Calomel and jalap, with santonin, were prescribed plentifully with a view of acting against intestinal trichina.

A peculiarity observed in the case was constipation and vesical tenesmus.

The symptoms, after having been intense, amended rapidly. By the 8th of April the oedema had diminished to a degree sufficient to permit the patient to walk a little, and by the 4th of May she was in a state to quit the hospital.

Caroline Nenner, servant, aged 25 years, entered the hospital at Plauen, the 16th of March, 1862. The affection from which she was suffering had made its appearance eight days previously, by great weakness, anorexia, and a sudden oedema of the face which rendered the patient scarcely recognizable.

The symptoms present upon entrance were—face red, eyes injected, tongue dry and moist; thirst intense; sweats; pulse 120; pains, and great lassitude in the arms and legs.

Diagnosis.—Rheumatismal fever. Prescribed aconite.

17th and 18th. Pains go on increasing; muscles of forearm seem tense and hard; the least touch and effort at movement increase the pains.

19th. The symptoms take on a mild typhoid character; cephalalgia, dryness of mouth and nose, insomnia, liquid stools. Morphia and emollient drinks now prescribed.

The following day, same symptoms, persistence of fever, insomnia and diarrhoea; the pains are general; oedema has appeared in the calves; sweating continued and abuudaat. Prescribed morphin and ipecane.

It was only on the 24th, eight days after admission, that a true diagnosis was made, and which enabled M. Königsdorffer to discover the real nature of the epidemic thus prevailing at Plauen. This he had been enabled to do by having read an article giving an account of Zenker's case, the similarity of which to the unusual symptomatology of several cases then sick in Plauen, put him on the right track of observation. At this time, the oedema, at first limited to the arms and legs, successively invaded the whole body. Arsenic was administered.

28th. The dropsy had become general; the pains were intolerable and rendered all movement impossible. The diarrhoea is complicated with a violent tenesmus; sloughing over the sacrum is commencing. Arsenic continued.

29th and 30th. Slight improvement, except the perspiration, which remains profuse. The typhoid symptoms are gradually disappearing.

April 1st. An increase of the anasarca; the epidermis is broken in different places. The general state is otherwise satisfactory.

2d. A first exploration is undertaken upon the biceps; it furnished free, living, well-developed trichina.

A slight improvement going on. The arsenic is substituted by sulphur, then digitaline.

May 1st. The patient can lie upon his side, which facilitates the dressing of his hædoses.

7th. A pleuritic effusion, abundant on the left side, is manifest.

10th. A second exploration of the biceps yielded encysted trichina in great numbers. Many cysts inclosed two, and even three.

On the 14th of July, although the pleuritic effusion had not been entirely absorbed, the patient demanded her discharge, after four months' sojourn in the
hospital. She had lost all her hair within the last few weeks; but at the time of going out, it was commencing to grow again.

Nearly two years after, Feb. 1st, 1864, the subject of this observation died, and M. Böchler found the muscles filled with living encysted trichinae.

The cases given above may be deemed typical of trichiniasis. Though cases may differ more or less from each other individually, and certain symptoms assume a prominence in certain epidemics, or certain individuals, which may be lacking in others, yet taken in connection with each other, the disease may be said to be as well marked as almost any in the nosology. The palpebral oedema may be deemed especially diagnostic. In the Plauen epidemic, just alluded to, so constant and marked was it that the common people designated those suffering from the affection by the expressive German word Dickköpfe.

The epidemic of Plauen differed from many others in most of the sufferers being constipated.

The fatal epidemic of Hettstadt, according to Rupprecht, in the beginning simulated cholera; and the recent and more fatal one at Hedersleben was mistaken at first for Asiatic cholera, so that it is said many persons fled to the country and died. (London Med. Times and Gaz., Jan. 6, 1866.)

Until the true etiology and pathology of the disease was learned, the cases now known to have been trichinous infection seem to have been as usually pronounced gastro-inestinal flux, rheumatismal fever, or typhoid fever, just as a certain variety of symptoms were prominent, or the medical observer, from any preconceived ideas, may have seized and dwelt upon any phase of the disease.

Clinical observers have generally divided the phenomena attending trichiniasis under several heads, founding their divisions upon the pathological conditions presenting as the parasites progress towards their ultimate destination. We have—

1. The period of gastro-intestinal irritation (stadium ingressis, Rupprecht). This period is comprised within the first week or ten days of the affection, and has its symptoms depending upon the irritation of the intestinal canal by the development and movements of the larval trichinae of the food ingested. The severity of symptoms being dependent upon the amount of the food taken, the difference of time in the access of trouble after taking the trichinous viands—after making allowance for difference of temperament in patients—being explicable on the supposition of a difference of encapsulation of the trichinae in different instances, in certain ones the covering being very thin and easily soluble, while in others, where

1 It is said that Friedrich did not hesitate, in the case recorded, to make a diagnosis based on the rational symptoms, in the face of twelve cases of typhoid fever which simultaneously presented themselves.

2 The epidemic of Magdebourg was described as an epidemic of acute oedema of the subcutaneous cellular tissue (scleroma adultorum), and the one at Blankenbourg as the gripppe. Vide Sendler und Scholz, Deutsche Klinik, 1862.
the covering has undergone calcareous degeneration, a much longer time being required for the intestinal juices to act upon the envelope to a sufficient degree to liberate the worm. Most individuals do not suffer the first day after taking infected food. The sufferers of Hettstadt were usually taken within the first forty-eight hours after a repast, and most generally in the night, says Rupprecht, with vomiting, diarrhoea, and violent colic; the disease being marked by nausea, cardialgia, a fetid breath, eructations, and anorexins, a general feeling of malaise and great weakness, rigors and flashes of heat, a heaviness of head, and vertigo. In some cases the symptoms had all the intensity of cholera. The first period has nothing in it which might especially distinguish it from a case of gastro-intestinal irritation produced from any other cause.

2. The period of muscular irritation (stadium immigrationis, Rupprecht). This period is marked by an oedema of the eyelids and face, which, in the majority of cases, appears about the end of the first week. Occasionally it seems to have been absent, or to have been so slight as to have escaped observation, though these cases are certainly exceptional. Accompanying the oedema of the eyelids is a tension in the frontal region and at the root of the nose. The maximum of intensity is exhibited in lymphatic persons with a clear skin, especially girls and children, in whom the swelling invades successively the forehead, temples, and finally the whole face. The eyes become injected and watery, their movements painful, and very frequently photophobia and mydriasis exist. It is said that an ophthalmoscopic examination has exhibited the fundus of the globe, especially at the papilla of the optic nerve, as the sent of a characteristic oedema, and that the vessels of the retina are enlarged, and may be seen pulsating. There is also pain upon movement of the eyeball, and a diminution of the faculty of accommodation. Sometimes there is oedema of the tongue and glottis, or the cerebral meninges. The cellular tissue of the neck is hard and the veins swollen, which, by the stasis of blood thus produced, bring about the cerebral congestion. The hoarseness which is so commonly observed is produced by the immigration of the entozoa into the larynx; and, when the connective tissue of the pharynx is invaded to a great extent, there may be deafness from temporary closure of the Eustachian tube. The fever which has been lighted up about the end of the first week increases until the pulse ranges from 84 to 120 strokes per minute, the respiration 30 to 36, and the temperature of the body to 101 to 106° Fahr., as we saw in Friedrich’s case. The bowels, if previously constipated, remain so; but if the affection set in with diarrhoea, it continues. The activity of the skin is great, the amount of perspiration being sometimes astonishing; the vesicular eruption which is frequently present being due to and in proportion with the amount of transpiration, as we know is the case with the sudaminal eruption in typhoid fever. The sweating is generally profuse for several weeks, and may continue in one part of the
body—sometimes a single arm—after it has ceased elsewhere. The phe-
nomenon is explicable on the supposition of those parts being especially
infected. The excessive sweating is generally supposed to be due to stimu-
lation of the sudoriparous glands, from the hyperemia resulting from the
entozoa locating within the superficial muscles. The muscular contraction
usually shows itself within the second week, and is the most marked
symptom for the two or three following weeks. The muscles become
swollen, hard, and painful, the patient suffering agony upon pressure or
any endeavour being made to extend his limbs. The swelling is centrifugal,
commencing at the roots of the members and extending to their extremi-
ties. The sense yielded to the touch by the muscles is compared to that
furished by caoutchouc. A tetanic rigidity is frequent in the muscles of
the neck, back, and limbs; upon dissection of rabbits, Kestner found the
temporal, masseter, and pterygoid muscles those most thoroughly infiltrated.
Patients usually lie upon the back, unable to move, during the height of
this period, and the agony endured renders sleep either impossible, or at
best very much troubled. A peculiarity has been observed in children
however, in strong contrast with adult cases, for they generally lie upon
their sides, and sleep most of the time. About the third or fourth week,
the diaphragm, intercostal, and other muscles of respiration becoming
invaded, a greatly impeded action, followed by their partial paralysis, may
ensue, ending in death. It is seldom that death occurs from this cause
sooner than the fourth or later than the fifth week. In the gravest cases,
about the fourth week frequently typhoid symptoms set in; there is in each
case a reaccession of fever, the pulse rises to 112 to 144, the respiration
increases to 40 or upward. If constipation has previously existed, it is
now succeeded by diarrhoea. The tongue becomes dry. The abdomen is
tympanite, and, in those instances in which a fatal result falls, there is
involuntary emission of urine, a feeble, thready, rapid pulse, when finally
delirium, carphologia, and hiccup close the scene. In the majority of
cases, however, the fifth week marks the beginning of improvement. This
may be deemed the—

3. Third period, or that of convalescence (stadium regressionis, Rap-
precht). During this period there is usually a gradual improvement
manifest, which is announced by a fulling of the pulse and diminished
frequency of respiration. When the fever is not diminished in intensity
by the fifth week, it is generally because pleurisy or pneumonia sets in
to complicate the case. On a subsidence of fever, the sweats diminish,
the secretion of urine is increased, and sleep returns, while at the same
time the patient can commence moving his limbs. The appetite, how-
ever, is usually slow in returning, and the feebleness is very great. It
is about this time that we see a new oedema exhibiting itself, quite different
from that of the second week, and which usually lasts not longer than from
five to eight days. The oedema of this period commences with swelling at
the malleoli, and extends upwards, and at rare times assumes the proportions of general dropsy. The effusion at this stage is the consequence of anemia, and it has been called by some authors the period of anasarca or anemic edema. It is during the sixth week that the patients begin to use their members, the extreme sensibility now disappearing. Yet, for some time, walking is described as very painful, from the extreme sensibility of the plantar muscles. During convalescence the hair falls off, as frequently the nails, and sometimes the skin is detached in large flakes.

Since 1860 the interest in the habits and development of the trichina spiralis, which up to that time was simply of a scientific nature, as naturally may be supposed, has been greatly intensified by the practical bearing lent to the subject by Zenker's discovery. Among the large number of investigators who have enlisted in the subject may be mentioned Virchow, Leaekart, Kückenmeister, Leisering, Hnaber, Kestner, Scoultamen, Turner, Davaine, Tommasi, and especially Pagenstecher and Fuchs.

We would give a résumé of their observations by saying: The trichina is from $0.15$ to $3$ millimetres in length, and $0.03$ to $0.05$ in thickness. When in the larval or encysted state, it is asexual (Fig. 1), but on being taken into the stomach it undergoes full development, the female (Fig. 3)

Fig. 1. — A muscular trichina, after complete development. M. E. Gros-Reauand. Magnified 320 diameters.

Fig. 2. — An intestinal trichina, grown male, with generative organs exhibited at tail. Magnified 150 diameters.

1 Vide Kestner, pp. 22, 23. Pietra Santa, La Trichina Spiralis D'Owen, Paris, 1866, p. 9; gives $0.6$ a 1 millimetre. Dalton, Observations on Trichina Spiralis, Transactions N. Y. Acad. of Med., 1864, gives length $\frac{1}{2}$ inch, breadth $\frac{1}{2}$ inch.
being of greater length than the male (Fig. 2), and always being found, in proportion to the latter, in much greater numbers, by some observers it

Fig. 3.—An *intestinal* trichina, grown female, full of eggs and embryos, a number of which are seen escaping by the utinar orifice, situated and opening towards the head of the animal.—Kestner.

having been seen to be seven or eight times as numerous. Besides an alimentary canal, the female has an additional tube opening towards the mouth, which latter is situated at the most attenuated end of the worm, contrary to what the early observers supposed. This tube is the receptacle for its eggs, which are developed within her previous to extrusion; the animal is consequently viviparous, and produces according to Virchow 200, to Gerlach 400, and according to Leackart 1,000 embryos. The young thus born, as stated above, are without sex. It would seem that reingestion by the stomach or bowels is necessary to their development, for if they remain in their encysted state, they ultimately perish. Immense numbers of them may be found within a very small space. Dalton observed twelve trichinae in a piece of muscle the one-twelfth of an inch square and one-fiftieth of an inch thick, which would give 7,200 to the square inch; and we ourselves have, in a piece of muscle weighing one-tenth of a grain, been able to distinctly count 11, giving thus 52,800 to the ounce; a few mouthfuls of food infested at such a rate would afford females enough to generate millions.

The parent trichinae, after giving birth to their young, are expelled from the intestines. About a week, usually, after trichi nous food has been taken into the stomach, the young animals have been hatched, and commence boring into the walls of the intestines, though Fiedler's experiments upon rabbits show that the trichinae may become sexual during the second or third day, and the embryos quit the mother to commence their peregrinations on the fourth day. They seek the striated muscles as their destination.

A number of observers have supposed that the young worms reached their ultimate habitat by the torrent of the circulation. Dr. Dalton expresses himself as of that opinion, and in some observations was led to conclude that the cysts were formed within the walls of the capillaries.
He thinks the oedema of trichiniasis lends confirmation to his observation, which, he says, "it would be very difficult to explain on any other supposition, but is easily understood by an arrest of the circulation taking place simultaneously in so many capillary blood vessels as must necessarily be obstructed when 7,000 trichinae are contained within the space of a cubic inch."

The great mass of observers, however, and Virchow and Leukenart among them, believe the parasite to work its way to its destination purely by vermicular action. In confirmation of their opinion is the fact that we have no recorded observations of the animal being found in the blood. Reaching the muscles, they commence undergoing encapsulation, the capsules having their long axes running parallel with the muscular fibrille.

Fig. 4.

The attachments of the muscles, where the muscular fibrille become converted into tendon, seem to furnish an obstruction to their progress, for it is here that they are found to be encysted in the greatest numbers. As said, the striated muscles—the heart excepted—are their seats of election. They have not been discovered in the brain, liver, kidneys, bladder, or in the fat. Usually but a single worm is contained within a cyst, though occasionally two and sometimes three are found. As time advances, the capsules become thickened and hardened, minute fatty globules are frequently found deposited around the two polar extremities (Fig. 4), and in time the whole cell seems to undergo calcareous degeneration. After encapsulation, the entozoon no longer produce trouble, consequently patients who survive encystment very generally recover. It has been noticed that, after recovery, patients frequently become excessively corpulent. When encysted, the worm remains in its dormant state, or hibernation, so to speak, until the death

Fig 4.—A cyst, around the poles of which fatty granules have commenced depositing. Photographed by M. E. Gros-Renaud, under the supervision of Kestner. Magnified 300 diameters.

2 Althans, in speaking of Hilton’s subject being cancerous, and Langenbeck and Blasius each operating upon a trichinous subject for cancer, suggests cause and effect as existing between the two affections. We notice another by Von Thaden, and a recent case of cancer in a trichinous patient operated on by Middledorpf.
of its host, when, if chance favours its entrance into the stomach of another animal, it commences anew its cycle of development, otherwise it perishes. Scootetten gives a case where the muscle of a subject, who had been infected thirteen years previously, promptly developed and gave forth young upon being swallowed by a rabbit; and in the London Medical Times and Gazette for June, 1866, is the record of a case from Virchow's Archives, in which living trichinae within calcareous capsules were found in a patient who had become trichinosed twenty-four years previously.

In 1864, Pagenstecher, aided by Fuchs, devoted nine months to experimenting on Artificial trichinization upon animals of various classes, viz: Mammifers; birds; cold-blooded animals: amphibia, fishes, mollusks, and even insects.

Among the Mammifers, they studied first the domestic, then savage animals, and of the former class, the dog was the first subject of observation. They found, as Virchow, that trichinae within the intestines of the dog would undergo development and propagate, but that they would not penetrate the intestines and enter the muscles. One or two other observers speak of having infected dogs, but the cases were certainly exceptional, and it has been thought that the entozoon producing infection, was of another species than the trichina spiralis, as has been found in the case of the mole. The cat is easily infected, and the rabbit more so. All efforts to trichinize a he-goat were unavailing, though he was made to swallow large quantities of the infectious viands during several weeks. The she-goat was very difficult to infect, though this could sometimes be done. The hog, as before known, he found excessively easily infected. The calf was found susceptible of infection. One was experimented upon which was exclusively fed upon milk; it was fed for several days upon rabbit flesh containing, as calculated, about 70,000 trichina. It was killed 19 days after, and the intestines were found to contain a great quantity of trichine, and a part of them had already commenced their migrations into the muscles. The bull, ox, and cow, were tried, but, although some of the trichinae were developed and gave forth young, none of them penetrated the muscles. The sheep could be trichinosed, though with difficulty.

On experimenting upon wild animals, it was found that in the fox, a similar result took place to that which happened with a dog—the trichina, developing in the intestines, but then dying. The wild boar was as easily trichinized as the domesticated porker; stags, and roe-bucks were susceptible, though the infection was produced with difficulty. Guinea-pigs, a few days after ingestion of trichinous food, evinced symptoms of great suffering, and died within eight or nine days. The hare seemed a little more difficult to infect than the rabbit. Mice died about ten days after ingestion of the food; rats resisted infection a little more than mice. As to badgers and martens, the question remained doubtful.

In birds, they never succeeded in the production of muscular trichiniza-
tion, though they experimented with the barn-yard fowls, the cock, the
hen, the goose, the turkey, and the pigeon, besides the carnivorous ones, the
starling, the crow, the jackdaw, the jay, the peacock, and turkey-buzzard.
The entozoa increased and became sexual, but were expelled by the alvine
evacuations; in the magpies no trace of intestinal trichinae could ever be
found four days after swallowing the meat.

In fish, especially the carp, which eat trichinous meat readily, the
trichinae never underwent development. In the amphibia the result
was the same, the experiments having been made upon frogs and many
species of salamanders. In frogs sometimes the trichinae had left their
cysts, though development was never observed to have proceeded further.
Once in the heat of summer, July 22d, a male trichina was found in the
intestine of a Triton.

Among the crustacea, the crab alone was experimented upon; the
result was negative.

Among the the insects fed, were flesh-flies, and beetles: the organs of
the former were never found to contain trichinae, though among the beetles
the Dyticus Marginalis, five days after eating the food, was found to con¬
tain living trichinae within its stomach.

They give as the result of their conclusions, that of all the animals which
came to our table we need fear trichinous infection from the hog alone. Dr.
Percy, of New York, has recently given a case occurring under his obser¬
vations, in which beef had infected a family, and which upon examination
was found to have trichinae in it, though in nothing like such numbers as
he had found in pork. Simon cites the cases of two patients who were
trichinosed by beef in the epidemic of Calbe; Rupprecht reports two others
in the Hettsstadt outbreak, and subsequently the falling ill with trichiniasis
from eating raw beef, of six persons during the epidemic of Leipsic. These
contradictions to the observations of Pagenstecher and Fuchs, as also the
experience of Leuckart, who fed 1220 grammes of trichinaized pork to a
young beef which he killed at the expiration of two months, and could find
no trichinae within the muscles, it has been attempted to remove by saying
that the beef had been cut with the butcher's shearing-knife and had laid in
contact with trichinaized pork in the stall. Dr. Percy was informed by the
butcher that the beef in question in his case had been fattened at the dis¬
tillery stables at Newton, Long Island. Even admitting the possibility of
trichinizing beef, doubtless it is so rarely infected, and then through acci¬
dental circumstances in the way of unnatural feeding or otherwise, that it
need not much be feared. Our real fears should rest with pork, and with
this view, attention has been especially directed to the food of the hog, to
find out if possible what may have been the original source of infection.
Professor Schacht, of Germany, discovered in the beet-root—a regular article
of food for swine in that country—what seemed to be trichinae, a minute
kind of worm inclosed in cysts; and hence this was thought at the time
to be the prime source of infection. Stein subsequently examined with care these supposed trichinae, and found them to be of an entirely different character from *trichina spiralis*, confirming in full an antecedent observation of Virchow, and which received further confirmation by Dr. Kuhne, of Halle. Prof. Langenbeck thought that the earth-worm was naturally infested by trichinae, asserting that he once found between 500 and 600 in a single annelida. It has been proved, however, that he was in error, and that as in the case of Schnuch, the parasite belonged to a species in every respect different from the trichina. The mole, according to Herbst, is more generally found trichinosed than any other animal. Virchow and Leuckart doubt the identity of the *entozoon* with the *trichina spiralis hominis*.

All experiments upon the encysted muscular trichinae coincide in demonstrating their extraordinary tenacity of life. Leuckart submitted trichinous flesh for three days to a temperature of thirteen degrees below zero F., after which he fed it to a rabbit, which died trichinosed at the end of four weeks, and it has been ascertained that they will hear, for a time, with impunity, a temperature up to 169° F., but heated above that point they are infallibly destroyed. (Kestner.) Tomassi says that they can be vivified after desiccation. (Pietra Santin.) Hertwig boiled trichinous meat, cut in slices the size of one's thumb, for twenty-two minutes without killing the trichinae, though a continuation of the boiling three minutes longer destroyed them. Virchow demonstrated the difficulty of destroying them by soaking trichinous meat in a solution of chromic acid so strong as to coagulate the muscular tissue, and yet after eight days of digestion, on denuding them of their capsules, they showed by their movements that they had not been injured. It has been asserted that salting may be relied upon as a destructive means. Accurate investigations demonstrated that the effect of salting is so uncertain that it cannot be relied upon; a person has been infected by pork which had been submitted to a salting of thirty-five days. Smoking is equally doubtful.

With a view to the destruction of trichinae while in the intestines, many experiments have been made upon muscular trichinae with medicinal substances, and observing their power of resisting the effects of them. The picronitrite of potash, from which so much was expected after Friedrich's cases, has been demonstrated by Fiedler and others to be of no avail. Mosler demonstrated that trichinae were killed after thirty hours immersion in rectified oil of turpentine.

1 Vide Gazette Hebdomadaire, 9 Mars, 1866.
2 This discovery was deemed so important, that the Prussian Minister of Agriculture made a request of Dr. Kuhne to examine the question; which he did, and came to the same conclusion as Virchow and Gerstaecker, who placed the parasite in a different class.
3 Scoutetten.
4 Gaz. Hebdomadaire, 18 Mai, 1866.
That they could resist pure chloroform about five hours.
They were found by him alive after an immersion of thirty hours in Fowler's solution of arsenic.
They were found living after lying for forty-eight hours in a mixture of two grammes of santonine, and eight grammes, each, of olive and castor oil.
Extract of male fern four grammes, and fifteen grammes, each, of gum arabic and distilled water, did not destroy them in thirty hours.
A strong decoction of pomegranate bark gave the same result.
In iodide of potassium two grammes, and water thirty grammes, they were living at the expiration of thirty hours.
In a solution of carbonate of potassa eight grammes, and distilled water thirty grammes, they ceased to live beyond twenty hours.
Colberg found a concentrated solution of chloride of sodium to kill them within a quarter of an hour; and Rupprecht at the end of two hours; though, as Fritz remarks, how can we deem kitchen salt an antidote, when we have salted meat, and especially ham, so frequently communicating trichiniasis.
The only reliance against infection by trichinized meat seems to be to raise it to a temperature above 170, at which point the albumen in the tissues of the worm will become coagulated, and the parasite thus be certainly destroyed.
It is a little singular that trichiniasis seems to be almost entirely confined to Northern Germany and Prussia. But our wonder ceases when we come to learn of the culinary habits of the population, and we are no longer astonished at saeb outbreaks as those of Hettstadt and Hedersleben, when we know of the common German custom of eating rostewärsf, after only twenty-four hours smoking; and when we learn that butchers when cutting up mince-meat are not unaccustomed to eating titbits raw from the block.
The population of the French departments bordering on Germany consume pork derived from the same source as that used by the Germans, but only after being well cooked. Trichiniasis among them is unknown, while with their neighbours it is prevalent. So terrible has the affection become to the German people, that in several of the principalities the sale of pork is illegal, until it has been inspected microscopically, and branded by constituted authority. Recently, the French Government, alarmed by the fearful sufferings experienced in Germany, deputed M. Delpech, of the Academy of Medicine, and M. Reynal, of the Veterinary School at Alfort, to proceed to Germany to study the affection and report upon the propriety of requiring inspections previous to the sale of pork within the French empire. The result of their observations was the opinion that the German people's sufferings were entirely due to the habit of not properly cooking their food, and that as long as the present mode of preparing pork for the table in France should continue, the danger of infection was nil, and that consequently inspections were unnecessary.
As a result of the compulsory inspection of pork in Germany, some knowledge of the proportion of trichinous hogs to those free from infection has been gained, and it has been found to vary very much in different localities, e.g., at Brunswick, according to Otto Muller, since the 1st of Dec. 1863, 19,747 slaughtered hogs have been inspected, with the result of finding but 2 which were trichinized. At Blaukenbourg, from 21st of Oct. 1864 to 21st of Oct. 1865, 700 hogs were examined microscopically, 4 being found trichinized. At Zinton, of 45 hogs examined, by M. Risse, 3 were discovered to be trichinized. And at Fulda, 1 hog in 412 contained trichinae.

The *trichina spiralis* does not seem to be confined to Europe, but observations recently made in Chicago show that some sections of North America would seem to have the swine inhabiting them as frequently infected as any port of Germany. By Scoutetten's account, the entozoon is also found in South America. He relates the case of a ship coming into Hamburg from Valparaiso, Chili, with several sailors sick, two of whom died in hospital with the symptoms of trichinisis, and the muscles of one of whom were examined, and found infiltrated with living non-cysted trichinae. Upon tracing the malady to the source of infection, it was found that a hog had been bought at Valparaiso, and subsequently killed on board ship, and that its flesh, part fresh and part salted, had been a portion of the sailors diet; upon examining with the microscope a piece of that which had been salted away, it was found infiltrated with trichinae.

In the United States, thus far, there have been but few cases of trichinisis recorded. The first, of which we are aware as being diagnosed as such in this country, were those occurring in the practice of Dr. Schnetter, of New York City, in Feb. 1864, in the case of a German family who had been eating raw ham, which upon a microscopic examination, made subsequently, was found filled with trichinae, and which resulted in the dangerous infection of the whole family, and the death of one of its members. Dr. Voss, a short time subsequently, was called to see the captain, first mate, and cook of a Bremen ship, then lying ill in the harbor of New York. The symptoms were of an anomalous kind, but such as to induce Dr. Voss to suspect trichinosis infection. To satisfy himself, he cut down upon the deltoid muscle of the second mate, and upon removing a portion of its tissue and subjecting it to the microscope, by the calculation of Dr. John C. Dalton, who examined a piece given him by Dr. V., it contained a little over 7000 trichinae to the cubic inch. Dr. Lothrop, of Buffalo, has also reported a case. Recently in Linn County, Iowa, we have an account of 9 persons in a family eating raw ham, with the serious illness of all of them, and the death of five. The cases thus far recorded in

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Mitchell, Cold in Physiological Investigations. [Jum.

this country have been nearly all among the foreign population among whom the custom of eating raw meat prevails.

Dr. Leidy says that the inhabitants of the United States appear to be less infested with entozoa than those of any other part of the world, and accounts for it by the fact, that an abundance of wholesome food being at the command of the poorest labourer, there is produced a high organic activity which is unfavourable to parasitic development. He gives the cooking of food, by destroying the germs of parasites, as the reason for man, notwithstanding his liability to the latter, being less infested than most other mammalia; and very pertinently asks: "Did instinct originally lead him to cook his food, to avoid the introduction of parasites?"

Be this as it may, if the promptings of instinct are not sufficiently strong within us, the teachings of science of the last few years ought certainly to lead us in future to eat our pork well cooked.

Danville, Ky., August 7, 1866.

Art. IV.—On Retrogressive Motions in Birds produced by the Application of Cold to the Cervical Spine, with remarks on the use of that Agent as an aid in Physiological Investigations. By S. Weir Mitchell, M. D.

At long intervals during several years, I have made use of various degrees of cold as means of research in experiments upon the nervous system, and, especially, its central ganglia.

Until recently I have been unable to control it, so as to secure from its employment all the advantages which at one time I was led to look for.

Of late, however, the interesting and valuable method of causing local anaesthesia by cold, invented by Dr. B. W. Richardson, of London, has enabled me so to improve upon the plans which I formerly followed, as to lead, in one direction, at least, to results of the utmost interest, and I believe of entire novelty.

Were my time completely at my own disposal, I should have preferred to wait until I had developed and explained these results more perfectly to my satisfaction. Unfortunately I should have been obliged in this case to await the return of another summer, and I have therefore thought best to lay before my fellow-workers, in this branch of science, the conclusions already attained; trusting to them and to my own future labours to complete what I have in part effected.

Various methods have been made use of to study functions by injuring or destroying the organs to whose integrity they have been supposed to

1 A Flora and Fauna within Living Animals, Smithsonian Institute, 1851.