

**On the present state of our knowledge respecting entozoa, which are either known or are presumed to be introduced into the human body by the consumption of animal food / by T. Spencer Cobbold.**

### **Contributors**

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183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
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*Labey, Hogg, Esq.*  
*with the original*

ON THE PRESENT STATE

OF OUR

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KNOWLEDGE RESPECTING ENTOZOA,

WHICH ARE EITHER KNOWN OR ARE PRESUMED  
TO BE INTRODUCED INTO THE HUMAN BODY BY THE CONSUMPTION  
OF ANIMAL FOOD.

BY

T. SPENCER COBBOLD, M.D., F.R.S., F.L.S.

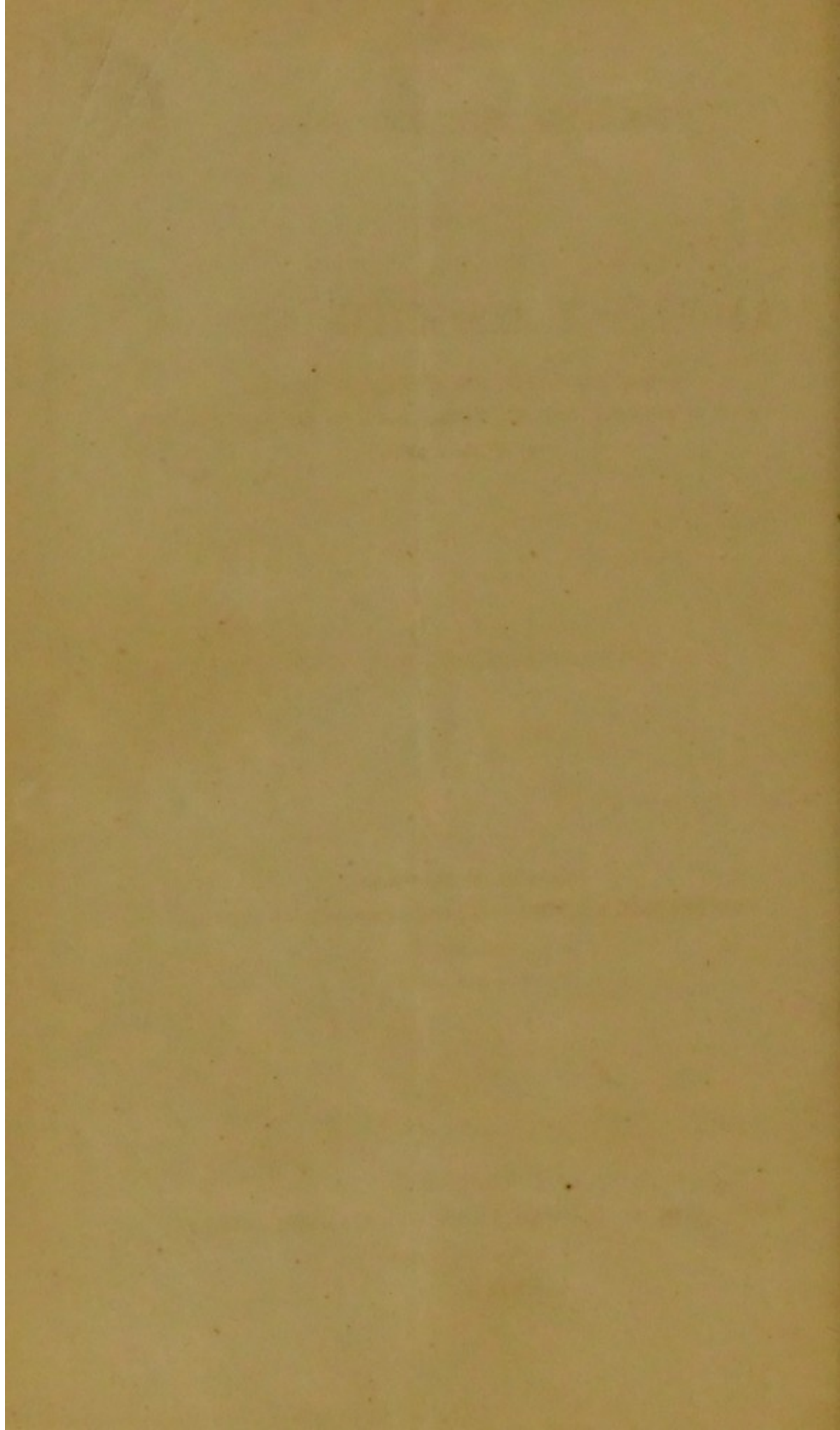
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# ON THE THEORY OF STATICS

BY J. H. COOPER

NEW YORK: JOHN WILEY & SONS, 1894.

The theory of statics is a branch of mechanics which deals with the equilibrium of bodies. It is a subject of great importance in engineering and architecture, and one which has attracted the attention of many of the greatest minds of the world. The principles of statics are simple and elementary, but their application to the solution of problems is often very difficult. This book is intended to give a clear and concise statement of the principles of statics, and to show how they can be applied to the solution of practical problems. It is written for the use of students of engineering and architecture, and for the general reader who is interested in the subject.

The book is divided into two parts. The first part deals with the principles of statics, and the second part deals with the application of these principles to the solution of practical problems. The first part is divided into three chapters. The first chapter deals with the equilibrium of a particle, the second chapter deals with the equilibrium of a rigid body, and the third chapter deals with the equilibrium of a system of rigid bodies. The second part is divided into three chapters. The first chapter deals with the equilibrium of a structure, the second chapter deals with the equilibrium of a machine, and the third chapter deals with the equilibrium of a fluid.

The book is written in a clear and concise style, and it contains many examples and problems. It is a valuable book for the student of engineering and architecture, and for the general reader who is interested in the subject. It is a book which should be read by every student of engineering and architecture, and by every general reader who is interested in the subject.



## ON ENTOZOA.

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WHEN we attempt to discuss any subject having a direct relation to the welfare of our species, it is of the utmost importance that we seek to discriminate the true and the false, stating no more than our facts will fairly allow, and theorising as little as possible; for, although the diffusion of scientific information cannot but be fraught with the happiest results "in the long run," yet, meanwhile, the most serious harm may accrue if our leaders of public opinion permit themselves to be misled by the too ardent assurances of imperfectly informed individuals. To effect any real and permanent good, it is absolutely essential that our writers be animated with an entire singleness of purpose, that their statement be made with the modesty that distinguishes the true *savant*, and that they themselves be more or less practically acquainted with the subject which they propose to open up. In this attitude it is my desire to offer the following observations:—

CATTLE.—As a general rule it may be remarked that internal as well as external parasites are more commonly met with in the adult than in the young animal; but this arises from the circumstance that the juvenile "host" (*i. e.* the "bearer" or "entertainer" of the parasite) has necessarily had fewer opportunities of harbouring the parasitic "guests," since its period of exposure to their attacks has been comparatively brief. The body (or parasite territory) of a young calf, for example, is not likely to contain as many parasitic inhabitants as that of a full-grown ox; nevertheless, there is no natural unsuitability or inaptitude to entertain these guests on the part of the calf. Veal and beef, therefore, as sources of particular species of entozoa, stand precisely on the same footing.

The recent experiments of Leuckart and Mosler have incontestably proved that the larvæ of one of our human tape-worms (scientifically known as the *tania mediocanellata*) may exist in veal, since these gentlemen succeeded in rearing multitudes of the larvæ in three separate calves. In two instances such numbers of the larvæ or cysticerci were reared that the calves died. The irritation set up by the parasites was sufficient to induce severe febrile symptoms, producing a kind of leprosy, which Leuckart had been pleased to call the "acute cestode tuberculosis." As the third calf recovered notwithstanding that



its flesh was also extensively invaded by the cysticerci, it is quite clear that cattle can withstand a very considerable amount of parasitic invasion of the kind just mentioned.\* It is also certain that the presence of only a few larvæ of this tapeworm in any given animal would affect the beast so slightly as to render it impossible for the most experienced farrier to diagnose unhealthiness in the animal. Moreover, a well-intentioned flesher would not consider his meat diseased though he should here and there detect a larval parasite of this kind. Nor, indeed, do I think he would be justified in doing so on any grounds, whether of a practical or scientific character; for, viewing the matter philosophically, it may be averred that the parasites have as much right to invade their peculiar territory as we, ourselves, have a right to dwell on the British Islands; whilst, in a practical aspect of the question, it is clear that a few minute parasite-larvæ in the flesh of an animal, otherwise healthy, would offer no pathological appearances which one might legitimately describe as morbid or diseased structures. Here, therefore, let me, in effect, repeat (as a general proposition which extends itself to many other kinds of entozoa, in addition to the one more immediately under consideration) that it is only when parasites occur in very considerable numbers that their presence is inconvenient to the animal they infest; and, consequent upon this, it necessarily follows that neither the veterinary pathologist nor the flesher, and that neither the meat-inspector, nor any other authority, could arbitrarily fix the limits of health and disease.

Very considerable numbers of these particular cysticerci may be present in the carcass of any given animal and yet be overlooked; for not only are the larvæ in question much smaller than the so-called pork-measles, but, at the present time, very few people appear to be acquainted with them by sight. Full-grown examples of this cysticercus (which, in contradistinction, may very appropriately be called the "veal and beef measles") measure only three-tenths of an inch, whereas those derived from pork occasionally acquire a diameter of fully nine-tenths of an inch; commonly, the latter are about half an inch in length. Before concluding this part of the subject, I may also further say that, as a rule, the size of the larval tapeworm, or cysticercus, of cattle offers no relative correspondency of magnitude with that of its appropriate adult representative. If, moreover, we restrict our comparison

\* Only very recently Professor J. B. Simonds and myself have repeated Leuckart's experiment with entire success. See a paper in the Proceedings of the Royal Society, entitled "On the Production of the so-called 'Acute cestode tuberculosis' in the calf, by the administration of the *proglottides* of *tenia mediocnollata*."—T. S. C., August 25, 1865.



to the head of the worm, then, to a certain extent, we find a correspondence.

Practically, the most important consideration to be borne in mind lies in the fact that the presence of the *tænia mediocanellata* within the human body is owing to persons eating veal or beef in an imperfectly cooked state. On the whole, the prevalence of this formidable parasite amongst us is perhaps less marked than obtains in the case of the *tænia solium*; nevertheless, the relative difference of frequency is not so great as has been supposed. Admitting occasional exceptions, we may say that the hooked tapeworm derived from pork commonly infests the poor, whilst the hookless tapeworm obtained from veal and beef infests the rich. This circumstance accords with the general habits of the people; for the lower classes subsist chiefly upon pork, whilst the wealthier prefer mutton, veal, and roast beef. Thus it also necessarily happens that the prevalence of either tapeworm in any given neighbourhood, or amongst any race of people, or in any particular region of the habitable globe, will bear a strict relation to the flesh-eating habits of the community. If all partake of meat subjected to a temperature of 212° Fahrenheit, all are safe from invasion; but if, on the contrary, the meat be only incompletely cooked, then the development of these parasites will be efficiently promoted. There may be some persons whose strangely-constituted minds permit them to believe that, since "all creatures have been called into existence for wise purposes," we ought not to destroy these interesting parasites. Such benevolent persons, to be consistent, should resolve never to eat their meat thoroughly cooked; for, by following this rule, they will probably sooner or later enjoy the privilege of entertaining a class of "guests" who are sure to make their presence felt. If, on the other hand, a penalty were imposed upon all persons partaking of raw or underdone meat, then the human tapeworms would rapidly become extinct. The enthusiastic helminthologist might perhaps in this case be found lamenting the extinction of certain peculiar forms of animal life, whilst the result would at the same time supply the advocates of "natural selection" with a somewhat novel mode of accounting for the rather abrupt termination of the career of the *now* so-called "fortunate" species towards which all are still acting the part of host.

SHEEP.—I have already incidentally alluded to the possibility of mutton harbouring the larvæ of one of our human tapeworms. We all know that the sheep supplies the larvæ of two tapeworms which infest the dog, and also that it is itself invaded by several other parasites in the sexually mature condition,—such, for example, as the liver-fluke (*fasciola hepatica*) and the lung-worm (*strongylus filaria*). For the present I am only prepared to



discuss the question of meat-unwholesomeness in so far as it relates to the direct introduction of entozoa into the human body; nevertheless I may remark, in passing, that mutton procured from sheep affected with "rot" necessarily supplies a comparatively innutritious, if not positively unwholesome food. I do not myself believe that the "rot" and the "lung diseases," though far advanced, render the flesh totally unfit for human consumption; since, to bring this matter to a practical test on my own person, I recently ate the heart of a hogget which died from extensive parasitic disease of the pulmonary organs. The lungs were completely choked, other parts of the body being also extensively invaded. A person who assisted me in dissecting this sheep declared he would not eat any part of it though he were offered fifty pounds reward; nevertheless I determined to run the risk, and suffered no inconvenience whatever. From a like motive Dr. Möller purposely swallowed a number of the great measles (*cysticercus tenuicollis*) found in the epiploon of the sheep, in order to ascertain if he could rear its appropriate dog-tapeworm in his own body. He did not succeed in giving himself the parasite-disease, simply because the tapeworm-species in question (*tænia marginata*) is not a proper inhabitant of the human territory. Whether or not, the larvæ of the *tænia medio-canellata* are capable of residing in the flesh of sheep is a point as yet not positively determined; nevertheless I am inclined to believe that its possible presence or continual absence in mutton will, ere long, be satisfactorily demonstrated.

Like other meats, mutton undoubtedly harbours young nematodes or larval round-worms, which may or may not turn out to be referable to one or other of the adult ascarides known to infest the human body. At all events it is unadvisable to eat this meat in an imperfectly cooked condition, although there is probably less risk of procuring entozoa from mutton than obtains in the case of any other meat yielded by our common domesticated animals. Perhaps I cannot better illustrate the necessity of enforcing this rule than by briefly calling attention to some of the most striking facts which modern discovery has recently brought to light. According to Dr. Kaschin, of the Russian army, the Burätes, or native Cossacks of the Baikal region, are nearly all of them infested with tapeworms. These people feed almost exclusively upon the flesh of calves, sheep, camels, and horses. They neither clean the meat properly, nor cook it completely. Fat, liver, and kidneys are eaten quite raw; diseased animals being as much relished as half-rotten carcasses. So voracious, moreover, are these persons, that any two of them can demolish a one-year-old lamb at a single meal. The entozoological result of all this is strikingly exhibited by the fact



that in 130 *post mortem* examinations Dr. Kaschin found only two instances where tapeworms were absent; whilst amongst 500 persons, treated in the hospital for other diseases, every individual entertained one or more tapeworm guests. As the Burätes seldom eat pork, there can be little doubt that the tapeworms in question are referable to the so-called *tænia medio-canellata*; and, as mutton forms a principal article of diet, it is not improbable that the sheep, in common with the other herbivora just mentioned, has supplied the larvæ or measles so characteristic of this tapeworm. Lastly, I may mention that the *cœnurus cerebrealis*, which gives rise to the "gid" or "staggers" in the sheep, is incapable of developing into its tapeworm condition within the human body.

SWINE.—Every one is well aware that the flesh of the common hog and its congeners proves a fertile source of entozoa, and yet it is not so fully understood that there are certain other sources of food and nourishment, of a non-animal kind, which prove much more fatal to our welfare. Speaking entozoologically, however, it must be admitted that, so far as meats go, pork is the most injurious food we possess. As to its supplying us with the larvæ or "measles" (*cysticercus cellulosæ*) of the common tapeworm, this is a point so clearly settled by the researches of all modern helminthological authorities that I need do little more than allude to it as a well-established fact; yet, notwithstanding the knowledge thus attained, and which one would suppose must, by this time, be pretty widely distributed, whole communities of our poorer brethren continue to enjoy their underdone rations to the manifest advantage of the tapeworm-species (*tænia solium*). If the evil stopped here we might treat this raw-flesh-eating propensity with entire indifference; but, unfortunately, this encouragement of tapeworm life leads to the generation and dispersion of multitudes of tapeworm-embryos which not unfrequently prove fatal to the neighbours of those suffering from tapeworm. Manifestly therefore, in a social point of view, we cannot treat this matter with indifference, especially since it lies within our power to remedy the evil. Why should not the poor of these islands be induced to abandon those habits which elsewhere characterise an incompletely civilised community? It only requires some persons with authority to place the matter before them, more particularly through the pages of the press.

A frequently fatal helminthiasis or parasitic-disease, dependent upon the consumption of pork, is that which is caused by the little fleshworm scientifically known as the *trichina spiralis*. On the other side the channel, our German friends have suffered their ranks to be annually thinned by this malady, simply because they have persisted in their habit of eating chopped



raw pork. The European public owe a debt of gratitude to Professor Leuckart, of Giessen, and other helminthologists, who have thoroughly worked out this subject; and, independent of its important practical issues, the phenomena connected with the rapid development and migrations of the *trichina* are amongst the most remarkable which modern physiological research has brought to light. In our own islands, undoubtedly, not a few deaths have occurred from the trichina disease; but as yet we have no evidence to show that any of our towns have been visited by the so-called fleshworm epidemic or trichiniasis. It is possible that this so-called trichina-visitation has never shown itself epidemically in this country at any period; but if, after the clear enunciation of these helminthological discoveries, people will deliberately persist in eating raw pork, they must not be surprised at the occurrence of any sudden outbreak of the trichina malady. In the name of common sense, however, let it not in that case be said that the epidemic was a "visitation" over which the people had no control.

GAME.—Although helminthologists are acquainted with an astonishing variety of entozoa liable to infest different kinds of game, yet I am not aware that any one of these numerous parasite-species is capable of developing itself within the human territory. It is true that the common liver-fluke occasionally takes up its residence in the human body, as it does also in that of the deer, the hare, and the rabbit; but this is not the question at issue, seeing that we do not ourselves obtain these entozoa by eating venison, or by consuming the flesh of hares and rabbits. It is not improbable, as formerly hinted, that the cysticercal condition of the hookless human tapeworm may exist in venison, though it is quite unlikely that it should occur in any very great abundance. The pea-shaped cestode larvæ found in hares and rabbits are known to be referable to a *tænia* inhabiting the dog; but neither this dog-tapeworm, nor any other species (unless we may possibly except the *tænia cucumerina*), are believed to be capable of taking up their residence within the human body. On the whole, therefore, it may be averred that the flesh of game, so far as entozoa are concerned, is almost absolutely harmless; and, doubtless, the same proposition may with almost equal cogency be advanced in relation to poultry, properly so called. Partridges, pheasants, wild duck, and other fowl, are no doubt extensively invaded by entozoa; but, so far as I am aware, no one single parasite species, be it larval or adult, is common to ourselves and them. Eventually it may turn out that their flesh harbours a larval nematode capable of further development after transportation to the human territory; yet, at present, our evidence on this score is entirely negative. My attempts, by



artificial experiment, to rear young trichocephali in a chicken did not prove successful.

FISH.—Amongst the inhabitants of the water, entozoa are even more abundant than obtains in the case of birds and mammals; yet, notwithstanding this helminthic abundance, we have every reason to believe that the flesh of most fishes, whether well cooked or otherwise, may be eaten with impunity. Occasionally, tricky patients have been known to deceive their medical advisers successfully by substituting fish-entozoa for their own, but a very little acquaintance with these creatures enables us to detect the imposture. As a food question, however, the only parasites which we are liable to entertain by fish-eating are the *bothriocephali*, and perhaps also *ascarides*. The piscivorous habits of the people inhabiting the shores of North Greenland unquestionably point to certain species of fish as the source of the larvæ of a newly-known cestode (*bothriocephalus cordatus*); whilst it is not altogether improbable that the common and gigantic broad tapeworm (*B. latus*) is derived from a similar source. What particular species of fish may yield the larvæ of these two separate forms of human tapeworm we cannot at present determine; but I am inclined to regard some member of the trout and salmon family as responsible for at least one of them. To settle these and many other knotty points connected with the practical bearings of helminthological science we must continue our experimental and other researches, for it is only in this way that we can confer any permanent advantage upon our fellow-creatures.



