THE RAT FLEA AS THE INTERMEDIATE HOST OF A RAT TAPEWORM.

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A LARVAL tapeworm was brought to me by Professor Minchin for identification, and it was suggested that it bore a close resemblance to the scolex of *Hymenolepis diminuta*, one of the commonest tapeworms of the rat. The cysticercoid was found during the dissection of some rat fleas (*Ceratophyllus fasciatus*), and apparently occurred free in the body cavity. Further investigation showed that it was present in about 4 per cent. of the fleas, and usually only a single specimen in each, although three were found on one occasion.

The most characteristic feature of the cysticercoid is its small rostellum, devoid of hooks. This at once suggests *Hymenolepis diminuta*, but that is not the only unarmed tapeworm infecting rats. Several other less common species have been described—for example, *Hymenolepis relicta* (Zschokke), *H. horrida* (v. Linstow), and *Catenotaenia pusilla* (Goetze), along with a number of imperfectly described forms, such as *Taenia ratti* (Rad) and *Taenia umbonata* (Molin).

With the view of determining what tapeworms were present in the stock of rats from which the fleas were obtained an extensive examination of the faeces was made. The ova of *Hymenolepis diminuta* were found in great abundance, and the only other tapeworm eggs which were found were similar to those but considerably smaller. A number of rats were then dissected, and *Hymenolepis diminuta* was found in moderate numbers in several. Another smaller, undetermined, tapeworm was found on one occasion. It was also unarmed, and resembled *Hymenolepis diminuta* to some extent, but its eggs were considerably smaller.

The common occurrence of *Hymenolepis diminuta* amongst the rats rendered the identity of the cysticercoid in the flea almost certain, but in order to establish it a series of feeding experiments were undertaken. Five young rats, newly weaned, were isolated. Their cages were protected, as far as possible, from the entrance of insects, and they were fed on boiled bread and milk. Three of them received nothing else, but the other two were fed daily with 20 fleas. The faeces were examined daily, but no ova were observed until at the end of nineteen days one of the two rats died, and eight specimens of *Hymenolepis diminuta*, in various stages of development, were found in the intestine. On the twentieth day ova of the tapeworm were found in the faeces of the other rat. No other species was present. The faeces of the remaining three rats were examined daily for a fortnight further, but no ova were obtained from them, and at the end of two months the faeces were still free from ova. A similar experiment was conducted later with the same result. There can be, therefore, little doubt that the cysticercoid in *Ceratophyllus fasciatus* is the larva of *Hymenolepis diminuta*. That the rat kills and eats fleas is a matter of common observation.

The cysticercoid (*Cercocystis*) of *Hymenolepis diminuta* was first described by Grassi and Rovelli¹ in 1892 (under the name *Taenia leptoccephala*). The cysticercoid which they describe corresponds precisely with that in the rat flea. It is a small ovoid body measuring, when fully grown, about 0.31×0.25 mm. The unsegmented tail on which the embryonic hooks remain visible is longer and narrower than the body, and may reach a length of 0.8 mm. In the invaginated state the body wall consists of four layers—an outer radially striated cuticular layer, a layer of columnar cells, a layer of connective tissue cells continuous with those in the tail, and a layer of cells forming an internal membrane. Within this is a small lacuna which separates the posterior part of the scolex from the cyst wall. The scolex itself measures about 0.075 mm. in length and 0.09 mm. in breadth. The suckers have a diameter of 0.055 mm. The rostellum is small but distinctly prominent. When the scolex becomes evaginated the wall of the cyst is rapidly replaced by paren-

chymatous cells like those in the tail, and the lacuna, which is at first rendered more obvious by the evagination, is also filled up by cells.

This is the first record of the occurrence of this cysticercoid in the rat flea. Grassi and Rovelli found it in four different insects, but do not appear to have examined the rat flea. They established the identity of the cysticercoid, which they found, by means of feeding experiments not only in rats but also in the case of man. The adult tapeworm is an occasional parasite of man, and has been recorded several times from America, and in a few instances from Denmark, France, and Italy.

Only two instances are yet known of fleas serving as the intermediate hosts of tapeworms. The first of these is the well-known *Dipylidium caninum*, the larval stage of which is passed in the dog flea and the human flea. The other has been described quite recently by Dampf from the flea *Mesopsylla eucta*, which is parasitic on the jerboa (*Alactaga (Dipus) jaculus*). No corresponding tapeworm is known from the jerboa, but the cysticercoid bears a certain resemblance to *Hymenolepis nana*. It is evident that fleas and lice form very convenient intermediate hosts, and it would not be surprising if a much larger number of instances were recorded in future, especially amongst the *Hymenolepididae*. Tapeworms of this family, however, usually pass their larval stage in small crustaceans.

REFERENCE.

¹ Ricerche embriologiche sui cestodi. *Atti Accad. di sci. nat. in Catania*.

Memoranda : MEDICAL, SURGICAL, OBSTETRICAL.

ARE POLIOMYELITIS AND HERPES ZOSTER THE SAME DISEASE?

DURING August and September, 1910, when acute anterior poliomyelitis was epidemic in Maryport, Cumberland, I noted that we were also having an unusual number of cases of herpes zoster. The appearance of these diseases simultaneously in epidemic form struck me at the time as being rather remarkable; I pointed it out to four colleagues here during the first week of September, and argued that there was possibly some etiological connexion between the two diseases on the following grounds:

1. The lesion in poliomyelitis is situated in the anterior cornual cells, and in herpes zoster in the posterior root ganglia—that is, in morphologically equivalent parts of the motor and sensory nerve paths.
2. The nature of the lesion is in both diseases essentially the same—it is variously described by different writers as "inflammation," "haemorrhage," "thrombosis"—it is not yet definitely settled what the exact nature of the pathological process is, but, at any rate, it is in both cases a vascular lesion.
3. The constitutional symptoms are in both diseases the same.
4. Both diseases were distinctly epidemic here at the same time.

The suggestion that there might be some connexion between the two found no favour, and the matter dropped from my mind. But recently, in reading Dr. Henry Head's article on Herpes Zoster in Allbutt and Rolleston's *System of Medicine*, vol. vii, p. 473, I came across the following passage:

A typical attack of herpes zoster arises without any obvious peripheral or central cause, and must be considered as an acute specific disease of the nervous system analogous to acute poliomyelitis. For it starts with a prodromal period of varying length, during which, in the majority of cases, the temperature is raised. During this period the patient feels ill, and has more or less pain, but it is impossible then to make a diagnosis. If a child, he is supposed to be sickening for an acute febrile disease. Suddenly, after a variable period, the rash comes on, and the disease declares itself. Thus in their onset herpes zoster and acute poliomyelitis closely resemble one another. Moreover, the lesion is in the one case an acute inflammation in the region of the motor cells of the anterior horns, followed by more or less secondary degeneration in consequence of the destruction of these cells; in the other an inflammation or haemorrhage into the posterior root ganglia, also followed by secondary degeneration due to the destruction of the ganglion cells of the posterior root. Now the cells of the posterior root ganglia are the morphological equivalents of the large cells of