of the cercarian stage of *Fasciola hepatica* or the common fluke. A change of hosts is essential.

Scientific Club, April 5, 1880.

4. On the Rot in Sheep [1].

By Prof. G. Rolleston in Oxford.

The English Lake District presents us with as simple a case for the investigation of the cause of rot in sheep as any other portion of the wide area over which that disease has spread, with, perhaps, the exception of such isolated localities as the Faroe Islands.

Having occasion to visit the district in question last week, I used the opportunity for making a few inquiries of the farmers and shepherds there as to the natural history of this plague. These inquiries were of the simplest kind, anybody can repeat them, and I cannot but think that the answers he will receive will incline such an inquirer to think that a strong a priori case is made out in favour of the view put forward in »The Times« of April 7, to the effect of identifying the black slug (*Arion ater*) or the gray slug (*Limax agrestis*) as one necessary link in the chain of causes concerned. I found the natives as intelligent and observant as I have found them to be any time during the last 34 years upon natural history questions; and I very rapidly got the following facts deposed to by them without any prompting on my part: —

1) The fluke disease is a disease of low grounds, and notably of pastures liable to be flooded.

2) But not exclusively of pastures liable to be flooded; for, what is of special consequence as going some way towards eliminating the pond snails (*Limnaeus pereger*) and others from the charge of sharing in the causation of fluke disease, the pasturing of sheep in a stubble rich in the »melancholic poisonous green,« which a wet autumn often produces, is a very sure way for producing the disease.

3) The words just given in inverted commas are not the exact words employed by my informants; those which follow are, or pretty nearly so— »a single bellyful will give the disease.«

4) »A pasture will give the disease at the back-end of the year which won't give it after Candlemas.« This means that the winter cold and rains destroy or wash away the larval or other forms of flukes which the slugs brought with them in the autumn.

The first of these observations is confirmatory, as are all accurate observations on the subject, of the view which asserts that the presence

[1] »The Times«, of Wednesday, April 14, 1880.

of snail or slug is a necessary factor in the causation of rot. Snails and slugs are but scantily represented, if present at all, on mountain tops; there are no slugs in Forbes' and Tschudi's lists of high Alpine ranges; and these districts, like salt marshes, owe their character for considered »soundness«, as the phrase is as regards the most destructive of sheep diseases, to this abscence or paucity of, at least, certain mollusca.

I was first put in this pursuit upon the slimy trail of the slugs and snails specified by various well-known facts which it is here unnecessary to specify. The number of the mollusca which it is necessary to trouble about appears to me to be very distinctly and very conveniently limited by the fact pointed out by the late Willemoes-Suhm, as to the Faroe Islands. The Faroe Islands are afflicted by the rot, but they have only eight snails and slugs, all told, out of which to choose the guilty party or parties. These are, as enumerated in Siebold and Kölliker's Zeitschrift for 1873 — vol. XXIII, p. 339 — *Limax agrestis, Limax marginatus, Vitrina pellucida, Hyalina alliaria, Limnaeus pereger, Limnaeus truncatulus, Arion ater, Arion cinctus.* That the fluke of the Faroe Islands sheep spends a considerable part of its life as a parasite in one or more of these mollusca admits of about as much doubt as the statement that the »giddy« disease, the »sturdy« as the Lake District shepherds pronounce the French word ‚étourdi', of the sheep is similarly dependent upon a to-and-fro shuttlecock alternation of one animal between two others. I do not say that it is necessarily in one, and one only, of the specified eight mollusca. Undoubtedly the fluke, like other parasites, may, in its sporting tour, infest many hosts. As a matter of fact, this particular fluke (*Fasciola hepatica*) in its adult stage infests some dozen mammals besides the sheep and ourselves. But, as a matter of speculation, I incline to think that the fluke in its younger days is, like some other animals, a little, or indeed a good deal, more particular as to where it lodges than it is in later life. As a matter of practice, at any rate, there is no need to tell farmers to be on their guard against snails which do not infest their pastures, and of the eight just specified they need, usually in England, only look to the black slug and the gray slug. Willemoes-Suhm suspected the gray slug. I suspect the black slug, partly on account of its very wide distribution in space partly from the facts furnished to me by Mr. D. Gresswell, of Louth, to the effect that sheep which have been feeding on turnips harbouring »black jacks« will die of rot even when shifted on to salt marshes. Any inhabitant of the Shetland Islands who will inform us that the sheep-rot does infest his country, or any inhabitant of Siberia who will inform us that it does not infest his, will settle the question, in a preliminary way at least, in favour of the black slug. For »this very common, beautiful, and ex-

ceedingly variable slug«, as Forbes calls it, is not found in Siberia, and the *Limax agrestis* is; while in the Shetlands the case of distribution is precisely reversed. Whoever will furnish us with the information required will be indeed a »true farmers' friend«.

Oxford, April 12, 1880.

5. Zur Kenntnis der Bowerbankia-Larven.

Von W. Repiachoff in Odessa.

In No. 45 des Zoolog. Anzeigers (1879) wurde von mir eine vorläufige Mittheilung über die Embryonalentwickelung der *Bowerbankia* veröffentlicht. Fortgesetzte Beobachtungen über die Entwickelung des genannten Moosthierchens setzten mich in den Stand einige Lücken in meinen früheren Untersuchungen auszufüllen, so wie auch einen in dieselben eingeschlichenen Irrthum zu berichtigen. Die Hauptresultate aller dieser Untersuchungen habe ich in einem russisch geschriebenen und mit vier Tafeln begleiteten Aufsatze ausführlich besprochen, welcher hoffentlich im Laufe einiger Wochen in den Schriften der Neurussischen Naturforscher-Gesellschaft erscheinen wird. Einstweilen möchte ich nur folgende Puncte besonders hervorheben.

1) Das von mir in No. 10 des Zoolog. Anzeigers (1878) als Mund bezeichnete Gebilde, welches, wie ich später (Zool. Anz. 1879, No. 45) erkannt habe, seiner Lage nach dem Munde der Chilostomen-Larven (und dem »Urmunde« der *Bowerbankia*-Embryonen) diametral entgegengesetzt ist, ist keine in eine Verdauungshöhle führende Öffnung sondern nur eine bewimperte Vertiefung des äußeren Epitheliums. Es ist demnach weder physiologisch, noch morphologisch dem Munde der Chilostomen-Larven vergleichbar.

2) Die Untersuchung vollständiger Schnittserien der freischwimmenden *Bowerbankia*-Larven hat gezeigt, dass die innere Organisation derselben eine ziemlich complicirte ist. Von den inneren Theilen kann man erstens eine die ganze innere Fläche des äußeren Larvenepitheliums auskleidende, an gewissen Stellen besonders verdickte Gewebeschicht unterscheiden. Im eigentlichen Körper des Thierchens (d. h. nicht im Mantel) finden wir eine Zellenmasse, welche ich als Homologon des Mitteldarms (Darmdrüsenblatt) auffasse. Im unteren Theile des Körpers befindet sich eine paarige Gruppe birnförmiger Zellen, welche sich besonders intensiv mit Carmin, Indigocarmin und Haematoxylin färben lassen und welche ich als Homologon der sog. Kittdrüse der Entoprocten-Larven zu betrachten geneigt bin.

Odessa, den 8./20. April 1880.