all capillary electrical phenomena, seem to be present in *Nitella*.

The difficulty encountered in this explanation is the relatively high conductivity of the protoplasm. The E. M. F. of the streaming current is inversely proportional to the conductivity of the liquid. In *Nitella* the conductivity of the protoplasm is equivalent to a .04N KCl solution.[5] According to Kruyt,[6] in a 10^{-3}N KCL solution, the stream potential is equal to four millivolts. In higher concentrations no measurable potentials were observed.

The production of the observed E. M. F. would, therefore, only be possible if the ζ, or electric double layer potential, to which it is directly proportional, were relatively great. This factor, however, is not known for the ecto-endoplasmic surface. A test might be made were it possible to apply the formula for the stream potential, but very little or nothing is known, for protoplasm, of some of the physical constants which are factors in the formula.

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STUDIES ON THE PHYSIOLOGY OF ASCARIS LUMBRICOIDES

FOR three years past the writer has been engaged in work on the physiology of *Ascaris lumbricoides,* part of which, because of its practical significance, may well be announced at this time, although the complete report of these investigations will be brought out within the near future. Much of the older work in the form under consideration has been critically repeated, with a resulting revision of accepted views.

Comparative studies on the so-called excretory system have shown that in the forms of the subfamily Anisakinae the supposed excretory system is probably a salivary gland for the secretion of an anticoagulin, and this fact has been reinforced by the demonstration of fragments of the tissues of the host, together with large quantities of blood-corpuscles in the intestine of worms previously not known to have blood-sucking habits. On the other hand, in members of the genus Ascaris, evidence has been adduced to show that the so-called excretory system probably serves some as yet unsuggested function. It can not have any important part in the excretory processes, however. In the first place, it would not be expected that the same fundamental structure would in different closely-related worms have such diverse functions as salivary secretion in one case, and the excretion of waste products in the other. In the second place, conclusive experiments prove that the cuticula, which throughout the literature of helminthology seems to be regarded as a very impermeable membrane, is permeable to excretory products and is the channel through which the end-products of metabolism are carried to the exterior. Thus the nematodes have a cutaneous type of excretion.

Experiments also show that substances may pass in through the cuticula. Sugar in high concentration passes in appreciable quantities through the body wall. Chloroform, in water-solution or suspension, passes into the worm directly through the cuticula and the same is true of carbon tetrachloride. Not only is the rate of ingestion on the part of the worm too slow to account for the rapid toxic effect of these substances, but experimental evidence shows that under unfavorable conditions the movement of the alimentary tract ceases altogether.

Observations with the polarizing microscope demonstrate the sparsity of lipoid in the tissues of the worm and show that the aggregates of fatty globules immediately surrounding the nuclei of the muscle cells are true lipin, and not lipoid, as was thought by von Kemnitz. The presence of large quantities of fat in the subcuticula and the occurrence of clusters immediately surrounding the nuclei of the worm are sufficient to account for and enhance greatly the effect of anthelmintics, the most effective of which are usually either fatty in character, or fat soluble.

In contradiction of Weinland's conclusions and confirming those of Slater, it is certain that these worms can and do live aerobically. On the assumption of anaerobic life, fat-storage and oxidation can not be regarded as economical processes, and previous workers have regarded fat oxidation as impossible in the worm, and its storage as a mystery. Part of the past misunderstanding on this point has been due to the difficulty of keeping these worms alive under culture conditions long enough to make any careful experiments. I have succeeded in demonstrating by tissue-culture methods that stored fat is burned by the tissues in the usual manner.

Detailed work has been done in connection with the cytological background of the above-mentioned facts, and some further investigations have been made into the tissue chemistry of the worm. The complete evidence for these findings will be discussed at length in my later paper.

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[5] Paper giving these results in press.

[6] Kruyt, H. R., *Kolloidzeitschr.*, 22, 81, 1918.