fluid preparation of extractives could not have been due to a more massive dose in this instance.

These experiments are purely preliminary in nature. Further studies are necessary in order to determine the nature of the peptogoguic substance. Fractionation of the fluid extract and careful study of the action of each fraction will be required.

6897

On the Digestion of Animal Forms by the Oyster.

T. C. NELSON.

From the Department of Zoology, Rutgers University.

Numerous workers have interpreted living organisms in the faeces of oysters as proof of unavailability of such forms as food. Nelson[1] demonstrates that living organisms in the faeces of the oyster are the result of the incomplete separation of food particles from undigestible matter, inherent in the oyster's feeding mechanism. Protozoa, rotifers, nematodes, copepods and their larvae, larvae of polychaete worms, of snails, clams. oysters and tunicates and even small fish eggs comprise up to 80% of the stomach contents in summer. All of these organisms save the lamellibranch larvae were disintegrating, hence it was concluded that they were being digested. Savage[2] found only 10% organisms in the stomach contents of oysters in English waters. Yonge[3] reports extensive studies on the enzymes of the digestive tract of the oyster and of related molluscs. The extracellular enzymes are a powerful amylase and a glycogenase, both derived from the crystalline style. Berkeley's[4] finding of an oxidase in the style is confirmed, but no extracellular lipase or proteose could be demonstrated. Yonge confirms for the oyster the work of List[5] on the phagocytic activity of the "digestive gland" of Mytilus and he extends the observations of Vonk[3] on the importance of phagocytes in digestion in the oyster.

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[1] Nelson, T. C., *J. Morph.*, 1918, **31**, 53; *Rpt. N. J. Agr. Expt. Sta.*, 1920, **325**; PROC. SOC. EXP. BIOL. AND MED., 1923, **21**, 166; *Biol. Bull.*, 1925, **59**, 86.

[2] Savage, *Ministry Agr. and Fish*, 1925, **8**, Ser. 2. No. 1. London.

[3] Yonge, C. M., *J. du Cons. Internat.*, 1931, **6**, 175 (includes all other references).

[4] Berkeley, C., *J. Exp. Zool.*, 1923, **38**, 477.

[5] List, T., *Fauna u. Flora d. Golfes v. Neapel*, 1902, **27**.

Yonge concludes[3] that lamellibranchs are "specialized herbivores capable of the extracellular digestion only of starch or glycogen," and he accounts for the presence of living organisms in the faeces as due to "complete absence of extracellular protease and lipase".

Our own experiments on both the European oyster, *Ostrea edulis*, and on the American oyster, *O. virginica*, show that Yonge has not fully appreciated the power and the importance of the style enzymes in extracellular digestion in the oyster; and that his classing the oyster as wholly herbivorous is not in accord with the facts. Large diatoms, such as *Coscinodiscus*, and long filamentous diatoms, such as *Skeletonema* and *Melosira* are digested extracellularly by style enzymes. When *Skeletonema* dominates the plankton, the stomach contents of oysters are a veritable soup of this form in all stages of digestion. Both species of oyster, under conditions at Delaware Bay, N. J., show during summer months many disintegrating animal forms in the stomach. One outstanding case was an *O. edulis* which on August 22nd yielded 0.75 ml. of rich brown stomach contents, mostly the free-living nematode, *Chromadora* sp. Analysis showed 160 worms alive and active, 471 dead but intact, and 5,842 partially or wholly disintegrated. This oyster was feeding actively when taken, and the stomach contents were under observation less than 2 minutes later. The nematodes were swarming in the algal growths on the oyster's shell. Since oysters do not feed during the latter part of the night, this oyster had gathered these worms

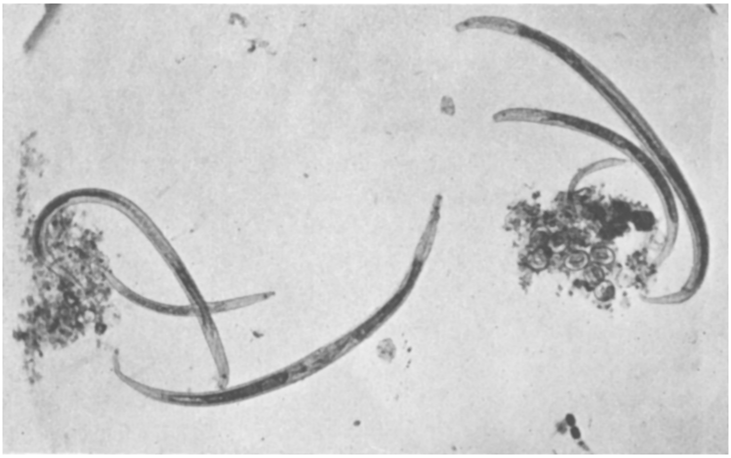

FIG. 1.
Chromadora sp., and embryonated eggs of the same nematode from decaying *Ulva*, ×96.

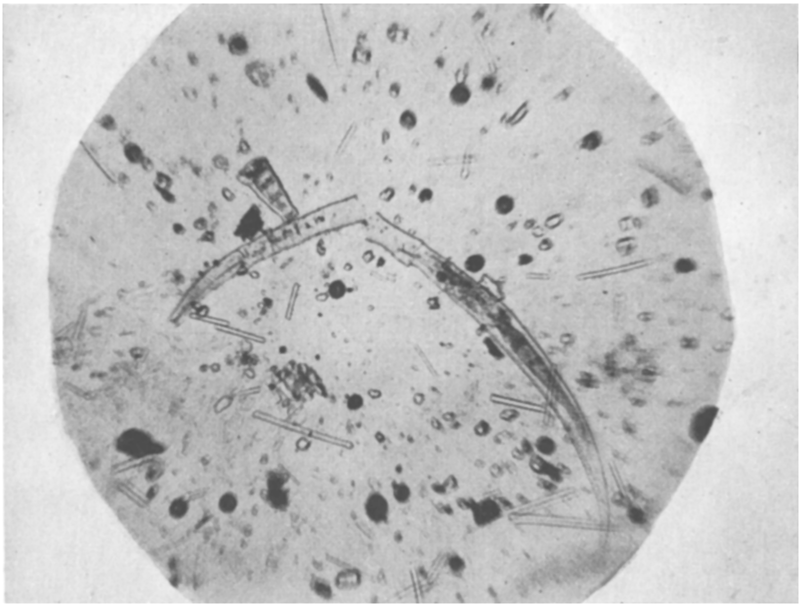

FIG. 2.

One of more than 5000 disintegrating *Chromadora* from the stomach of *Ostrea edulis*. A small portion of the anterior end of a second worm also is present, ×144.

between sunrise and 11:00 a. m., when the test was made. The stomach contents were kept at room temperature for 24 hours but no further disintegration of the worms occurred, indicating cessation of enzyme action. Death due to oxygen lack, followed by bacterial action cannot account for the disintegration of these nematodes, the process was much too rapid. In every instance disintegration was preceded by wrinkling and subsequent bursting of the integument of the worm, liberating the body contents as small granules. These were of such size as readily to admit of phagocytosis.

It is evident, therefore, that some substance or substances present in the stomach of an oyster with a well formed style can penetrate the chitin of crustacea and the cuticle of nematodes resulting in death and disintegration of the animals. This serves the same purpose as the crushing action of the gizzard-like stomach of carnivorous Septibranchs so admirably demonstrated by Yonge, since it reduces the prey to particles small enough to be engulfed by phagocytes. Animal forms both in the plankton and on the bottom at times become very numerous during the warm months when the oyster's ciliary currents are of such strength as to capture these active organisms. That such acquisition of protein is important to the oyster in the late summer after its exhaustion due to repeated spawning cannot be doubted.

6898

Age and Resistance to Ether in Mice.

E. F. BARROWS.* (Introduced by A. M. Banta.)

From the Biological Laboratory, Brown University.

Wide variations have been observed in the length of time necessary to anesthetize mice by means of ether. Active adults as well as old and rather feeble animals reacted in perhaps one-tenth of the time of young a week or less in age. Two groups of mice were available for testing this observation, and a series of experiments was made with each group.

The first of these groups (here designated the K Strain) was a genetically heterogeneous lot, containing various combinations of the following mutant types: chinchilla, extreme-dilution, albinism, white-bellied-agouti, non-agouti, brown, short-ear, piebald, silver, dwarf, flexed-tail, and several new types of which the genetics is not fully worked out. A number of these mice were from the stocks of Dr. G. D. Snell of the University of Texas, to whom the author is greatly indebted for assistance in many ways. The second group (here designated the Inbred Strain) was, on the other hand, relatively homogeneous genetically, as a result of some 25 generations of inbreeding, and contained only the wild agouti type. These mice were kindly sent to the author by Dr. L. C. Strong of the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine.

The apparatus consisted of several 3-liter flasks with rubber stoppers; fresh "Ether Squibb"; a graduated pipette; platform scales; thermometer. The procedure was as follows: Into one of the flasks at room temperature (23°-26°C.) was introduced 2.4 cc. of liquid ether, which was allowed to vaporize while the stopper was loosely in place. Then with the stopper tight, the flask was inverted for one minute, after which it was allowed to stand for a further 10 to 15 minutes, when the temperature within the flask

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