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OBSERVATIONS ON GUT pH AND ABSORPTION OF METHYL RED AND NEUTRAL RED IN THE INTESTINAL WALLS OF *PELODERA* AND *MESODIPLOGASTER*

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The literature on gut pH in nematodes is reviewed; early work was on free-living marine nematodes and later, on animal parasites. Except for *Ascaris lumbricoides* and *Strongylus edentatus* the nematodes tested showed acid gut reactions. The free-living soil nematodes, *Pelodera lambdiensis* and *Mesodiplogaster* sp. had oesophageal and intestinal contents that were just acid and the granular contents of cells of the intestinal wall were acid to different degrees. In *Pelodera,* cells just behind the anterior tip of the intestine were usually most acid. Methyl red and neutral red pH indicator dyes were absorbed selectively by different regions of the intestinal wall and by the two species.

Studies on digestion and pH in the alimentary canals of nematodes have mostly been on animal parasites since Rauther (1907) confirmed Schneider's (1906) finding that the intestines of certain free-living marine nematodes, including *Chromadora baltica,* were acid.

Of ten different pH indicator dyes that Enigk (1938) tested on the trichostrongyl, *Graphidium strigosum,* bromcresol green and methyl red showed a pH of 4.4 to 4.8 in the anterior quarter of the intestinal lumen and in the oesophageal bulb, but bulb contents could have been regurgitated from the intestine. Litmus was the only indicator whose colour persisted beyond the first half of the intestinal lumen and this indicated a pH below 7.0. The culture medium before ingestion and that in the anterior part of the oesophagus was about pH 7. Neutral red was absorbed by the intestinal wall, but litmus, thymol blue, bromphenol blue, bromcresol green, methyl red, bromcresol violet, phenol red and cresol red were not.

Van Someren (1939) observed *Trichinella spiralis* ingesting 0.01% neutral red saline solutions during the 30 minutes the nematodes continued to feed after removal from their host, the golden hampster. He found that glandular cells and globules within the intestine and rectum readily stained pink or red, indicating acidity, and two large cells at the junction of oesophagus and intestine stained orange-yellow and thereby demonstrated alkalinity. He suggested that these cells were glandular. Rogers (1940) found that extracts of amylolytic enzymes from the intestine of *Strongylus edentatus* were most active at pH 8 and those from *Ascaris lumbricoides* at a higher pH. Rogers (1947), Yamao (1951) and Chow-

dhury, Dasgupta, Ray & Bhaduri (1955) found that regions of the intestine of *Ascaris lumbricoides* were rich in acid and alkaline phosphatases. From this they concluded that, in these parts, absorption of simple sugars could occur against a concentrated gradient. However Fairbairn (1960) stated that phosphatases are

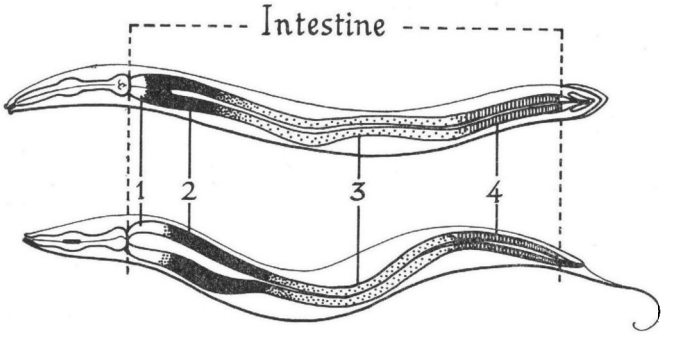

Fig. 1. Four intestinal regions (defined by different staining properties) in *Pelodera* (above) and *Mesodiplogaster* (below).

not essential for glucose absorption, because glucose concentration in the intestine wall can be brought below that of the lumen by the intracellular synthesis of the disaccharide trehalose. By puncturing the caeca of excised intestines of *Leidynema* in indicator solutions, D. L. Lee (1963, personal communication) found the pH of the gut contents was between 4 and 5.

Several workers have suggested that intracellular digestion, as well as absorption of the products of digestion, occurs in the intestinal wall; Hyman (1951), Chowdhury *et al.* (1955). It was therefore thought worth recording observations on the pH of the wall and lumen of the intestine in two free-living soil nematodes.

METHODS

Pelodera (*Cruznema*) *lambdiensis* (Maupas) and a *Mesodiplogaster* sp. (probably *Mesodiplogaster lheritieri* (Maupas)) were cultured in Nigon's (1949) nutrient agar in 9 cm Petri dishes at 24° C and pH 7. The cultures were strongly coloured red and yellow by neutral red and water soluble methyl red respectively, but no attempt was made to standardise the dye concentrations. After 2-3 days, adult nematodes were picked at random from the cultures and examined in water under a dissecting microscope. *Pelodera* cultures appeared most vigorous at about 21 days old and survived about 12 weeks. Those of *Mesodiplogaster*, had most large, active individuals at 10-14 days and were declining at 4 weeks. Each culture was started with about 24 adult nematodes. Because the intestinal wall frequently stained differently along its length, four regions were defined (Fig. 1): the anterior tip (region 1) was especially distinct in *Pelodera*. Region 2 was much