

RESEARCH NOTES

Ultrastructure of the Hemizonid

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The hemizonid (6) is a ventro-lateral, commissure (7) which extends around the ventral side of nematodes between the hypodermis and the cuticle, stopping at the lateral fields (2, 4, 6, 8). Although the hemizonid has been recorded mainly from plant parasitic nematodes (1, 4, 6, 7, 8), Timm (11) reported its presence in a wide variety of nematodes and suggested that it may be present throughout the Nematoda. Observations on the hemizonid have to date, been at a light microscope level. However, Bird (2, his Fig. 3) suggested that his electron micrographs of second-stage larvae of *Meloidogyne javanica* (Treub.) may show a structure which is part of the hemizonid. Bird (3) also suggested that the ventro-lateral commissure described by Rogers (10) in *Haemonchus contortus* (Rudolphi) and situated posteriorly to the excretory duct, may have been a hemizonid.

Because of the uncertainty that clearly exists in interpreting observations made with the light microscope and the electron microscope, an attempt was made to characterize the fine structure of the hemizonid of the second- and third-stage larvae of the cat hookworm, *Ancylostoma tubaeforme* (Zeder) and third-stage larvae of the human hookworm, *Necator americanus* (Stiles).

The worms were fixed using the technique previously described (5) for small nematodes, and longitudinal sections of the oesophageal region were cut on an LKB ultramicrotome using glass knives, mounted on Formvar coated grids, stained with uranyl acetate and lead citrate and examined with a Philips EM 300 electron microscope operated at 60 and 80 kV.

The hemizonid (Fig. 1-4) was located just posterior to the excretory pore and was 2.4 μm wide in *N. americanus* and 2.9 μm wide in both the second- and third-stage larvae of *A. tubaeforme*. It appeared as a double row of about 20 subunits, although the exact number varied between individuals. These subunits contain microtubules and are similar in appearance to the nerve axons described by Rogers (10). After studying a large number of micrographs, I interpreted that the hypodermis separates the hemizonid from the cuticle, although this may not be totally clear in the figures. Rogers (10) reported that in *H. contortus* the cuticle was modified above the ventro-lateral commissure. No alterations, however, appeared in the cuticle adjacent to the hemizonid in *A. tubaeforme* or *N. americanus* larvae. The superficial transverse striations, 1.1 μm apart, continued above the hemizonid, the latter being 2-3 striations wide, the size quoted by Bird (3). Although the annular cuticular striations may be modified (10), the striated basal layer, often considered to be a diffusion barrier (9), is complete. The striated basal layer is also unaltered, each striation being 13 nm apart in third-stage larvae of *A. tubaeforme* (Fig. 1 & 2).

The function of the hemizonid is still an open question. The suggestion that it was a ventro-lateral commissure was confirmed by Goodey (7), and Anderson and Das (1) reported the existence of a large number of hypodermal commissures and suggested that these connected ganglia with nerves or with other ganglia. My Fig. 1-4 show for the first time the definite nervous nature of the hemizonid. Several other suggestions as to its function have been reviewed by Bird (3). Goodey (7) suggests that the hemizonid stops short of the lateral line. Bird (2), however, speculated that it may ramify into the lateral line. In third-stage larvae of *A. tubaeforme* and *N. americanus*, which both have very prominent lateral alae, the striated basal layer, considered to be a protective layer (9), disappears under the alae and this may present a good area for cuticular stimulation

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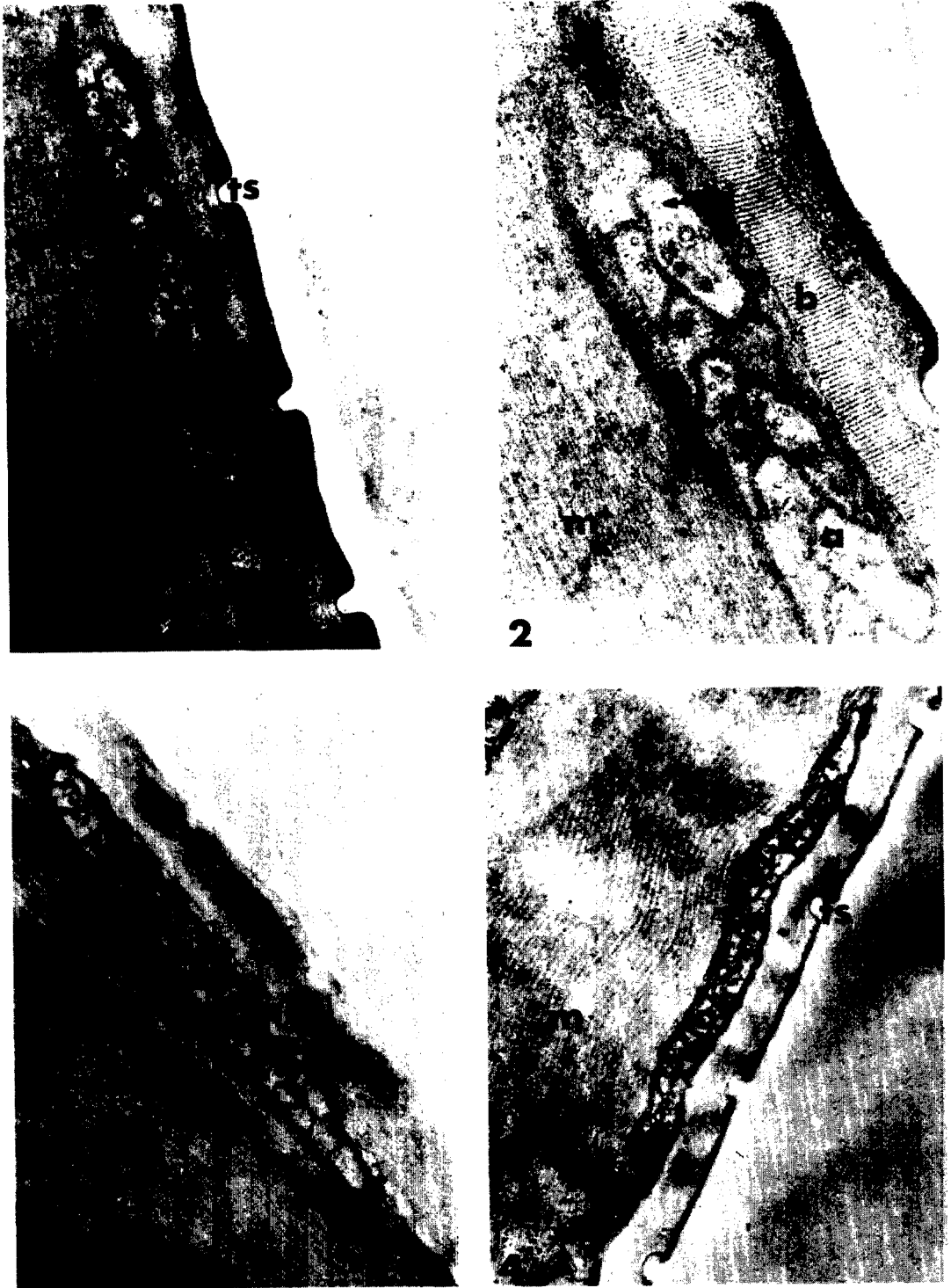


FIG. 1-4. 1. Electron micrograph of a longitudinal section of third stage larvae of *Ancylostoma tubaeforme* showing hemizonid. ($\times 32,000$). 2. Higher magnification of a section of Fig. 1. showing microtubules. ($\times 66,460$). 3. Hemizonid in longitudinal section in second stage larvae of *Ancylostoma tubaeforme*. ($\times 22,870$). 4. Hemizonid in longitudinal section in third stage larvae of *Necator americanus*. ($\times 29,970$). a = axons, b = striated layer, m = muscle, mi = microtubules, ts = transverse striations.

with the hemizonid providing the nervous connection to the circum-oesophageal ganglia.

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