Surface Ultrastructure of the Acanthocephalan Lemnisci

RICHARD D. WRIGHT
Laboratory of Parasitology, Department of Biology, Tulane University, New Orleans, Louisiana 70118.

ABSTRACT: The pseudocoelomic lemniscal surface of Moniliformis dubius Meyer, 1933 exhibits ultrastructural features similar to the basal surface of the metasomal tegument. These include a 100 Å thick plasmalemma associated externally with an amorphous basement lamina, and internally with half desmosome-like structures. The trilaminar membranes are extensively infolded into channels spacially continuous with the body cavity. Glycogen-like particles and deposits of lipoidal material are prominent cytoplasmic inclusions. This morphology is consistent with concepts of lemniscal development, and suggestive of a similar role in physiological processes.

The lemnisci of acanthocephalans are outgrowths of the subcuticula of the neck, which extend back into the pseudocoel. Crompton (1963) and King (1965) felt they are concerned with the movement of fluid when the proboscis is active. Bullock (1949) and Pflugfelder (1949) suggested a possible role of the lemnisci in lipid metabolism. Crompton and Lee (1965) thought they excreted absorbed lipids into the body cavity, whereas Hammond (1967, 1968) alternately suggested the reverse process occurs with lipids being discharged as a waste product at the surface of the proboscis. In conjunction with current studies of the body wall structure and function (Wright and Lumsden, 1968, 1970), the lemnisci of Moniliformis dubius Meyer, 1933 were examined by electron microscopy. Surface features of these organs are described in the present paper.

Materials and Methods

Adult female Moniliformis dubius were recovered from albino rats and transferred to ice cold 6% glutaraldehyde in Millonig’s (1961) 0.12M phosphate buffer (pH 7.4) containing 2 mM calcium chloride and 3% sucrose. The lemnisci were immediately excised and left intact during subsequent tissue preparation. The anterior portion of the metasoma was cut into small pieces, and both tissues fixed for two hours. After washing overnight in 0.12M phosphate buffer containing 2mM calcium chloride and 5% sucrose, both tissues were post-fixed 90 min using ice cold phosphate-buffered 1% osmium tetroxide, dehydrated in ascending concentrations of cold ethanol and embedded in epon. Ultrathin sections were cut on diamond knives using a Sorvall MT-2 ultramicrotome, collected on uncoated grids, and stained with aqueous uranyl acetate (Watson, 1958), and lead citrate (Reynolds, 1963). Electron microscopy was carried out with a Siemens Elmoskop 1A operated at 80 kv.

Observations and Discussion

The basal surface of the metasomal tegument is illustrated in Figure 1. As described by Wright and Lumsden (1970), it is limited by a 100 Å thick plasmalemma intimately associated with an externally positioned amorphous basement lamina approximately 0.2 μ thick. Invaginations of the membrane form channels penetrating the hypodermis to a depth of approximately 1 μ. Half desmosome-like structures appear to line the cytoplasmic side between the inpocketings. The lemnisci exhibit similar morphology (Fig. 2). The tri-

Figure 1. Electron micrograph illustrating the basal surface of the metasomal hypodermis. The basal plasmalemma is characterized by numerous invaginations (i) between the half desmosome-like structures (hd) lining the cytoplasmic side of the membrane. The cytoplasm contains extensive deposits of glycogen (g) and lipoidal material (L). Externally positioned to the membrane is the basal lamina (bl) and associated connective tissue (ct). × 50,000.
laminate plasmalemma measures approximately 100 Å in thickness and is extensively infolded. Half desmosome-like structures are spaced between the invaginations along the cytoplasmic side of this membrane. A “basal” lamina is associated with fibrillar connective tissue on the coelomic side of the plasmalemma. Abundant glycogen-like particles are scattered throughout the cytoplasm of the lemniscus and body wall, and extensive deposits of lipoid material are a prominent feature of both tissues.

Moore (1946) observed that the lemnisci develop as evaginations of the hypodermal layer. The lemniscal nuclei, before migrating into the developing buds, constitute the lemniscal ring, formed from nuclei of the hypodermal primordia. The similar ultrastructural morphology of the lemnisci and hypodermis is consistent with the idea that both tissues develop from the same anlage.

The prominent invaginations of the lemniscal plasmalemma greatly amplify the free surface area exposed to the pseudocoel. Spacial conflux between these invaginations and the body cavity is indicated in images such as Figure 3 where the limiting plasmalemma is seen to be continuous with that lining the infoldings. This surface amplification would be expected to enhance the efficiency of molecular interchange involving any diffusion process across this membranous interface. It might therefore be suggested that, in view of their common ultrastructure, the pseudocoelomic surfaces of the
body wall and lemnisci both have an important physiological role in transporting material relative to the metasomal cavity.

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Literature Cited


