

Fine Structure of Penetration Gland Cells in the Genus *Metagonimus*

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(Received for publication; July. 18, 1975)

Introduction

A characteristic feature of the cercarial stage of trematodes is the presence of the penetration gland cells in the body. The number and arrangement of these cells at this stage is generally constant in a species. Light microscopic studies by various investigators, including Takahashi (1929), Ito and Watanabe (1958a), and Saito (1972), have been reported on the morphology and development of cercariae belonging to the genus *Metagonimus*. Most ultrastructural studies on cercariae have dealt with the body wall or muscle cell. Although some studies of penetration glands of trematodes have been reported by Inatomi *et al.* (1970), Tongu *et al.* (1970), Dorsey and Stirewalt (1971), Ebrahimzadeh and Kraft (1971), and Erasmus (1972), little attention has been given to those of the genus *Metagonimus*. The present study was, therefore, undertaken to observe the ultrastructure of penetration gland cells of *Metagonimus takahashii* and *M. yokogawai*.

Materials and Methods

Cercariae of *Metagonimus takahashii* and *M. yokogawai* were allowed to escape from their molluscan host, *Semisulcospira* spp. collected in Hiroshima prefecture. The cercariae were fixed in 2.5% glutaraldehyde with phosphate buffer at pH 7.4 for 1 hour, followed by post-fixing in 1% osmium tetroxide solution with phosphate buffer at pH 7.4 for

2 hours. The specimens were dehydrated in ethanol series by routine methods and embedded in an epoxy resin mixture after passing through N-butyl glycidyl ether. The specimens were thin-sectioned with Porter-Blum and Reichert ultramicrotome and stained by uranyl-acetate and lead citrate. Hitachi HS-8 electron microscope was used for observations.

Results

Cercariae observed in the present studies possessed seven pairs of penetration gland cells arranged in the center of the body. Each cell was elongated and included a large nucleus (Photo 1, N) near the center or sometimes near the bottom of the cell. A nucleolus was clearly seen at the center of the nucleus in some specimens (Photo 1). The free ribosomes appeared only in areas around the nucleus (Photos 1, 7). The major part of the cytoplasm were occupied by many electron-dense granules (Photos 1, 4, 8), other organelles, for example, mitochondria and Golgi complex, were not visible. These granules were in contact with the nuclear membrane at some points. The granules were various in shapes and sizes and seemed to be covered by a thin limiting membrane. The matrix of the granules was finely granular, of varying electron density, and was often dotted with very dense areas (Photo 8). The granules sometimes had crystal-like structures in the periphery of the granule (Photo 4, arrows). In some

cases, masses of less-dense granules were found fused. It was, however, not possible to classify the gland cells systematically by granular pattern.

The penetration gland duct was separated into four groups (Photo 2, PGD) consisting of an inside group with four ducts and an outside group with three ducts. These ducts were surrounded by an outermost basement membrane and lined longitudinally with a row of microtubules along the inner surface of the cell membrane (Photo 3, BM, CM, Mt). The duct ran toward the head and opened at the anterior lip of the oral sucker. The microtubules were sometimes found in double rows at some areas. The duct was usually filled up with granules of varying sizes, shapes and densities (Photos 2, 5, 6). The granules with an average-dense matrix, other with a denser point in the center were common in the duct. Less-dense types appearing like vacuoles were also located in the duct.

Discussion

Cercarial gland cells have been studied by various investigators. Krudenier (1953 a, 1953 b, 1953 c, 1953 d), Ito and Watanabe (1957, 1958 a, 1958 b), and Yokogawa and Yoshimura (1958, 1959) have examined mucoid gland cell which is believed to form a thin coat surrounding the outer surface of the body. Some studies have been made on the penetration glands. In *Schistosoma* species the gland cells were differentiated into the anterior and posterior groups by their histological and histochemical characteristics (Stirwalt, 1963, Stirwalt and Fregeau, 1966). Two types of gland cells were also found in Strigeoid cercariae in which they located anterior and posterior to the ventral sucker (Bogitsh, 1963). These cercariae have been examined histochemically and histologically, but the function of the gland cell is far from clear. In ultrastructural investigations of penetration gland cells, Inatomi *et al.* (1970), Ebrahimzadeh *et al.* (1971), and Dorsey *et al.* (1971) have reported that two types of granules were present in

Schistosoma japonicum and *S. mansoni*. In *Cercaria longissima*, however, only one kind of granule was packed in the gland (Tongu *et al.*, 1970). The granules of *Metagonimus* cercaria contained one type with a similar shape and density but the presence of less-dense area or sometimes less-dense granules in these cells seemed to suggest that granules are forming in their areas. This cercaria has microtubules around the duct as in the case of *S. japonicum* and *Cercaria longissima* but the shape of granules differed from those in the genus *Schistosoma*. Although the duct of *S. japonicum* is separated into two groups, that of *Metagonimus* was comprised of four groups.

Summary

The penetration gland cells of *Metagonimus takahashii* and *M. yokogawai* were examined by electron microscopy. Seven pairs of penetration gland cells were present. These cells contained a large nucleus and were packed with many electron dense granules of varying density. Granules were found in the cytoplasm in various shapes and sizes. The cell ducts consisted of four groups. Each inside group contained four ducts and each outside group three ducts. These ducts were surrounded by a row of microtubules running longitudinally along the long axis on the inner surface of the cell membrane. Each duct was covered with a limiting membrane and opened to the anterior lip of the oral sucker.

Acknowledgment

The authors wish to thank Assistant Professor Susumu Saito of Hiroshima University for providing many samples.

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***Metagonimus* 属吸虫のセルカリアの侵入腺細胞の微細構造について**

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Metagonimus yokogawai と *M. takahashii* の侵入腺細胞の構造を電子顕微鏡で明らかにした、これら吸虫のセルカリアの侵入腺は7対からなっており、核は通常長楕円形をした細胞の中心に位置しているが、時には細胞の底部にも見られる。細胞質は核の周囲のわずかな部分を除き大部分は電子密度の高い不定形の顆粒で満されている。この顆粒は限界膜を持つているように思われるが明確ではなく、形も電子密度もさまざまである。導管

部は4つのグループに分れて前進し、内側の1対はそれぞれ4本の導管からなっており、外側の1対はそれぞれ3本の導管によって構成されている。いずれの導管も最外側に基底膜を持ち、細胞膜の内側には1列に並んだ微小管が走っている。導管内の顆粒は電子密度の低いものや顆粒の形態をなさないような変化したものなど種々の像が観察される。

Explanation of Photos

- Photo 1 Penetration gland cells packed with many granules. N: nucleus, PGD: penetration gland cell
- Photo 2 A cross-section of penetration gland ducts consisting of four groups. PGD: penetration gland duct
- Photo 3 A cross-section of a part of penetration gland duct showing a row of microtubules. BM: basement membrane, CM: cell membrane, Mt: microtubules
- Photo 4 Showing the granules in some specimens. Crystal-like structures (arrows) are arranged regularly in the peripheral portion of granules. N: nucleus
- Photo 5 A cross-section of penetration gland ducts including many types of granules. PGD: penetration gland duct
- Photo 6 Showing penetration gland ducts with fused materials. PGD: penetration gland duct
- Photo 7 Showing many kinds of electron-dense granules. N: nucleus
- Photo 8 Granules with dense areas in the penetration gland cell.
- Photo 9 Showing an opening of penetration gland duct. PGD: penetration gland duct



