Fine Structure of Photoreceptors in *Deontostoma californicum*

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Ocelli and pigment spots have been reported in several of the Platyhelminthes and Aschelminthes. Among nematodes the pigment spots with, as well as without, a "lensatic" body (ocelli) occur in Chromadorida and Enoplida. The marine nematode, *Deontostoma californicum* Steiner and Albin, has paired photoreceptors located laterally on each side of the esophagus with a hyaline body, measuring 6–8 μ in diameter, appressed to the anterior end of a pigment cup (Fig. 1-C). This hyaline structure has been referred to as a "lens" (4), "crystalline lens" (6) or, "lensatic unit" (3) in the literature. As early as 1916, Steiner (5) speculated that these structures were photoreceptors. To date, information on the ultrastructure of nematode "photoreceptors" is lacking.

Our studies on the ultrastructure of *D. californicum* photoreceptors revealed a sensory body located at the anterior end of the pigment cup (Fig. 1-A). The sensory body appears to be unicellular; only one nucleus, located outside the pigmented area, was observed. It is filled with stacks of convoluted lamellar structures having two morphological forms. In the distinctly lamellar form, several lamellae run parallel to each other and at high magnification can be resolved into two electron dense bands separated by a hyaline zone approximately 60–120 Å wide (Fig. 1-A, B). These lamellae join the second form consisting of compressed lamellae, which appear as electron dense bundles at low magnification. However, high magnification electron micrographs reveal that they are conglomerations of convoluted and twisted lamellae (Fig. 1-B). The later type resembles the structures described by Fahrenbach (1) as phaosomes in the nauplius eye of *Macrocyclops albidus*. Anteriorly from the sensory body a process, which appears to be an axon, extends to the lateral cephalic nerve.

The pigment cup is filled with electron dense pigment granules, usually spherical, of varying sizes, each measuring 0.2–1.3 μ in diameter (Fig. 1-A). Differences in size, shape and osmiophilic properties of pigment granules appear to reflect different stages of development. Occasionally, the cut surfaces of pigment granules present a rough surface, possibly caused by the fracture of pigment granules in sectioning; such a pattern was not noticed on unsectioned granule surfaces. The granules are embedded in an amorphous matrix in the marginal cells of the esophagus with many mitochondria present below the pigment region in the esophagus. The outer wall of the esophagus appears uninterrupted between the sensory body and pigment cup (Fig. 1-A).

The presence of pigment granules around

Received for publication 22 December 1969.

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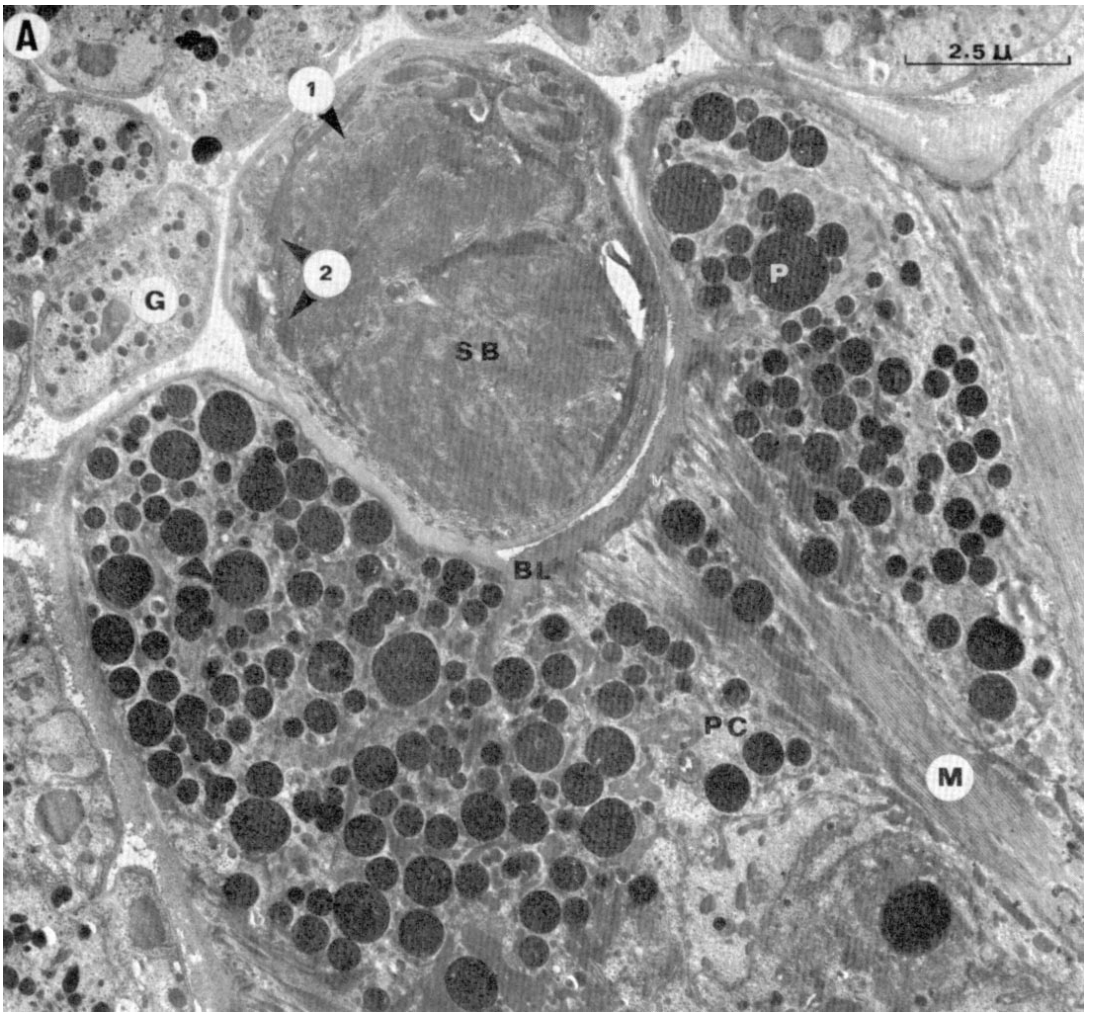
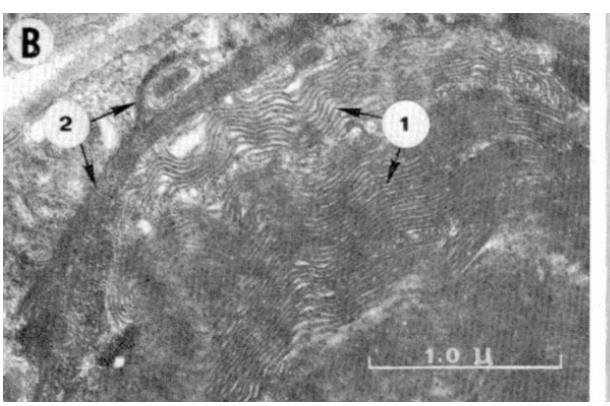
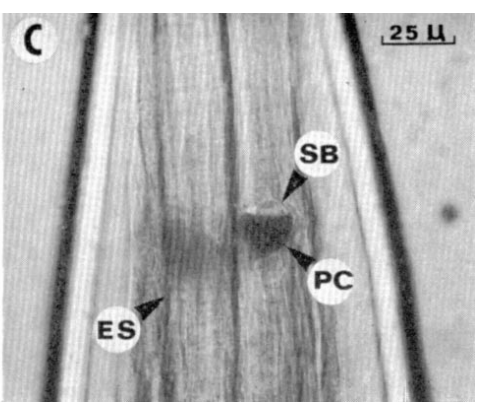
FIG. 1. Photoreceptors of *Deontostoma californicum*. **A.** Electron micrograph showing cross section of the pigment cup (PC) and sensory body (SB). Note the convoluted but distinct lamellae (1) and compressed lamellae (2) in the sensory body, the basal lamina (BL) and radial muscles (M) of the esophagus, the glial cell (G) around the lateral nerve axons, and pigment granules (P) in the pigment cup; **B.** Highly magnified view of the double layered distinct lamellae (1) and compressed lamellae (2); **C.** Esophageal region (ES) showing the ocelli (one out of focus) with pigment cup (PC), sensory body (SB).


A
2.5 µ
1
2
G
SB
P
BL
PC
M


B
2
1
1.0 µ


C
25 µ
SB
PC
ES

the sensory body, as is the case in many invertebrate photoreceptors, appears to provide shielding for the photosensitive structure. *D. magnificum* is reported to have a pair of marginal nuclei posterior to the "ocelli," which possibly regulate the production of pigment granules (6). However, ocelli of *Parasymplocostoma formosum* (4) and *Acanthonchus rostratus* (3) are reported to possess both the sensory cell and the pigment cup, independent of the esophagus, in a tubular structure, which opens anteriorly to the outside through the body wall.

The presence of double walled lamellar structures in the sensory body, a common feature shared by the photoreceptors in both invertebrates and vertebrates, suggests its photoreceptive function. However, the lack of structural complexity in *D. californicum,* as is noticed in the photoreceptors in higher invertebrates and vertebrates, may indicate an early stage in the evolution of photoreceptors as suggested by Kennedy (2) and Wolken (7). Further studies on the ultrastructure of photoreceptors in *D. californicum* are under way in our laboratory.

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