Somatic Centrioles in the Parasitic Nematode, Capillaria hepatica Bancroft, 1893

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Nematodes, along with acanthocephalans and rotifers, have classically been considered as being characterized by the developmental phenomenon of eutely (cell or nuclear constancy) (4). Recently, however, an increase in numbers of somatic muscle cells during post-embryonic development of at least some nematodes (e.g. 6) has been indicated. Centrioles, the organelles classically associated with cell division in animal cells, have been described only from sperm of nematodes (2, 5, 7). Recent studies have determined the morphology (cylinders of nine triplets of tubules with a cartwheel pattern of material radiating from the center to each of these triplets) and sequence formation of centrioles, especially from vertebrates and protozoa. Unfortunately, these studies have not determined what essential role, if any, centrioles play in nuclear division (3, 8, 9).

Over the past several years, we have examined most tissues of the adult parasitic nematode, *Capillaria hepatica* Bancroft, 1893. Pieces of worms dissected from the livers of experimentally infected mice were fixed in 5% glutaraldehyde in 0.066-M cacodylate (osmolality 300-350 mOsm.), post-fixed in 1% osmium in cacodylate and embedded in an Epon 812–Araldite 502 mixture. Sections were stained either with a sequence of uranyl acetate and lead citrate, or with potassium permanganate and lead citrate.

Only six examples of centrioles were found: two in nonglandular cells of the body wall hypodermis, a pair (at right angles to each other—a diplosome) in a lateral hypodermal gland cell, one in an unusual binucleate muscle cell, one in a myoepithelial cell ensheathing the muscular esophagus, and one in an epithelial cell of the *vas deferens*. Except in the last two instances, the centrioles lay close to the nucleus. One of the centrioles found in a nonglandular cell of the hypodermis gave the clearest resolution of its tubule structure after the section was tilted 15° (Fig. 1). The centriole showed nine pairs of doublet tubules embedded within a dense matrix, but the usual central cartwheel pattern was lacking. The centriole was about 0.13 μm in diam to the outer edge of the doublets. Other centrioles measured about 0.10 μm in length. These dimensions are smaller than those quoted by Fulton (3). The doublet angle (angle of the doublets to a tangent) was about 33°. The diam of the A tubule was about 20 nm, whereas the B tubule was about 22 nm.

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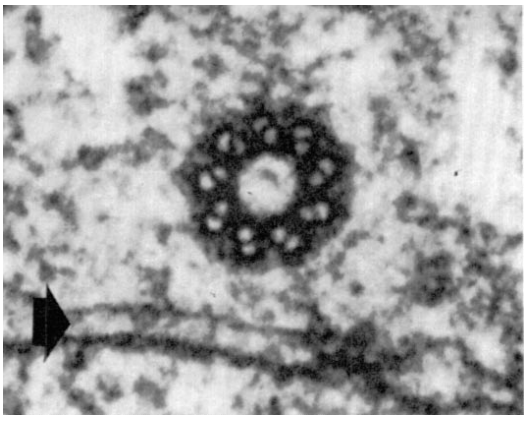

FIG. 1. Centriole lying close to nucleus in a nonglandular cell of the body wall of *Capillaria hepatica*. Arrow notes nuclear envelop. (X 139,000).

Somatic centrioles in *C. hepatica* are rare. If present, they are unusually small, incompletely formed, and contain only doublets. Also, the B tubule is larger than the A. Centrioles present throughout spermatogenesis in the same nematode are of similar size, but they consist of a circlet of nine single tubules (7). Similar centrioles occur in the amoeboid sperm of the nematodes *Nippostrongylus brasiliensis* (5) and *Ancylostoma duodenale* (2). Centrioles were not located in the sperm of a marine nematode, *Deontostoma californicum,* although two instances of an irregular bundle of six and eight single tubules that could represent rudimentary centrioles (11) were found. Centrioles do not generally occur elsewhere in nematodes except in modified form within sense organs. Sensory processes contain a variety of patterns related to centrioles, but none contain triplets of tubules. For example, centrioles in sensory dendrites of *Capillaria hepatica* have nine doublets (10), whereas those of *Syphacia obvelata* have a high number of doublets arranged around the irregular periphery of the sensory process (1). Zmoray and Guttekova (12) indicate the exceptional presence of functional cilia (presumably with centrioles) in the intestine of a saprophytic nematode.

Although the role of somatic centrioles in nematodes is unknown, their rare occurence and incomplete structure should be remembered in future considerations of the status of eutely in these animals.

LITERATURE CITED

1. DICK, T. A., and K. A. WRIGHT. 1973. The ultrastructure of the cuticle of the nematode, Syphacia obvelata (Rudolphi, 1802). II. Modifications of the cuticle in the head end. Can. J. Zool. 51:197-202.
2. FOOR, W. E. 1970. Spermatozoon morphology and zygote formation in nematodes. Biol. Reprod. Suppl. 2:177-202.
3. FULTON, C. 1971. Centrioles. Pages 170-221. *in* J. Reinert and H. Ursprung, eds. Origin and continuity of cell organelles. Springer-Verlag.
4. HYMAN, L. H. 1951. The Invertebrates: Acanthocephala, Aschelminthes and Entoprocta. The pseudocoelomate bilateria. McGraw Hill, Vol. III.
5. JAMUAR, M. P. 1966. Studies of spermatogenesis in a nematode, Nippostrongylus brasiliensis. J. Cell Biol. 31:381-396.
6. MCLAREN, D. J. 1972. Ultrastructural studies on microfilariae (Nematoda: Filarioidea). Parasitol. 65:317-332.
7. NEILL, B. W., and K. A. WRIGHT. 1973. Spermatogenesis in the hologonic testis of the trichuroid nematode, Capillaria hepatica (Bancroft, 1893). J. Ultrastruct. Res. 44:210-234.
8. PITELKA, D. R. 1974. Basal bodies and root structure. Pages 151-192. *in* M. A. Sleigh, ed. Cilia and Flagella. Academic Press, New York.
9. WOLFE, J. 1972. Basal body fine structure and chemistry. Pages 151-192. *in* E. J. DuPraw, ed. Advances in Cell and Molecular Biology. Vol. 2.
10. WRIGHT, K. A. 1974. Cephalic sense organs of the parasitic nematode, Capillaria hepatica (Bancroft, 1893). Can. J. Zool. 52:1207-1213.
11. WRIGHT, K. A., W. D. HOPE, and N. O. JONES. 1973. The ultrastructure of the sperm of Deontostoma californicum, a free-living marine nematode. Proc. Helminthol. Soc. Wash. 40:30-36.
12. ZMORAY, I., and A. GUTTEKOVA. 1969. Ecological conditions for occurrence of cilia in intestines of nematodes. Biologia 24:97-112.