

BIOLOGICAL BULLETIN

AN INTRA-NUCLEAR MITOTIC FIGURE IN THE
PRIMARY OÖCYTE OF A COPEPOD, CAN-
THOCAMPTUS STAPHILINUS JUR.

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The oögenesis and early development of the eggs of free living copepods has been studied by several investigators principally Häcker and Rückert. The former ('92, '95) has described the maturation processes in *Cyclops*, *Canthocamptus* and several other species. Rückert ('94) studied the polar-body formation in *Cyclops*, *Heterocope* and *Diaptomus*. The development of the eggs of parasitic copepods has also received the attention of embryologists (McClendon, '06).

As far as I have been able to learn none of these investigators has reported the presence of polar rays in the mitotic figure of the first maturation division. Rückert ('94) maintains that the centrosomes of the first maturation spindle (*Cyclops*) have an intra-nuclear origin; they pass to either end of the nucleus, but no polar rays were reported. Häcker ('95) in *Canthocamptus staphylinus* figures a spindle with chromosomes arranged in an equatorial plate lying entirely within the nuclear membrane of an oögonium which is undergoing its last division. Here also no astral fibers are evident. Parasitic copepods apparently do not depart from this rule for McClendon ('06) tells us that in *Pandarus sinuatus* the first maturation figure is "similar to that found in free living copepods having no polar rays." Centrosomes originate within the nucleus in the spermatocytes of *Ascaris megalcephala*, var. *univalens* (Brauer, '93) but wander outside of the membrane before the astral fibers appear. This is apparently the order of events in the half-dozen other cases where an intra-nuclear origin of the centrosomes has been asserted.

While collecting *Hydra* with Mr. C. T. Vorhies during the month

of January, 1908, a number of copepods was found scattered about in the vegetation which was gathered from the rocks on the bottom of Lake Monona, Madison, Wisconsin. These were identified as *Canthocamptus staphylinus* Jur.¹ I sectioned some

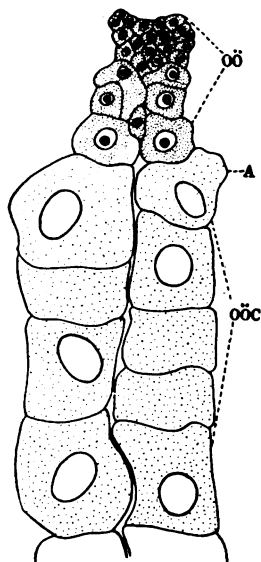


FIG. 1. Partially diagrammatic drawing of a longitudinal section through the two oviducts of *Canthocamptus staphylinus* Jur. *a*, oocyte shown enlarged in Fig. 2; *oö*, growing oocytes; *oöc*, primary oocytes.

of them and found a number of oocytes in process of division. A few of these contained mitotic figures which possessed distinct polar rays at either end of the spindle, and were entirely enclosed within the nuclear membrane. This, I believe, is the first instance on record of such a phenomenon in the cells of either plants or animals.

The ovaries of *Canthocamptus* lie in the dorsal cephalic region. The two oviducts extend posteriorly from them lying on either side of the median line of the body; each when filled contains a single row of eggs. The primary oocytes can readily be distinguished from the growing oocytes by the different staining capacity of their yolk laden cytoplasm. In the case of the latter the cytoplasm stains very deeply in hematoxylin, while that of the eggs in the processes of maturation is much less susceptible to this dye. An abrupt change in the chemical

character of the cell contents may thus be recognized where the growing oocytes end and the primary oocytes begin (Fig. 1).

In the present paper we shall consider only the primary oocytes in the equatorial plate stage of nuclear division. Several hundred females of *Canthocamptus* were sectioned, but only two of these contained eggs showing mitotic figures. Twenty-two of the eggs examined were in process of division; in each one, the entire amphiaser was found within the nuclear membrane. One of these eggs (Fig. 1, *a*) is shown enlarged in Fig. 2. The chromosomes have been drawn up about the spindle and form the equatorial

¹ I wish to thank Mr. C. Dwight Marsh for determining the species for me.

plate of the first polar mitotic figure. The number of chromosomes was not determined. The nucleolus, which stains very deeply in the growing oöcytes, is lighter in the primary oöcytes, and often has several vacuoles within it. In a few cases two nucleoli, one larger than the other, were found in a single nucleus. Fig. 2 shows the various cellular structures as they appear when magnified 850 diameters.

A discussion of the above described condition in its relation to amitosis and other nuclear phenomena is deferred in the hope that material collected later in the season may furnish stages which will enable me to follow the history of the formation and the fate of this unique mitotic figure.

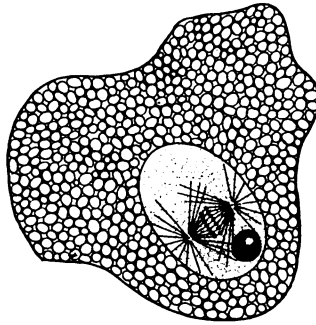


FIG. 2. A single oöcyte of *Canthocamptus staphylinus* Jur. enlarged from Fig. 1, a. The entire amphiaster lies within the nuclear membrane. $\times 850$.

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