

## Structure of the ovary in *Argulus japonicus* (Crustacea: Branchiura)

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The branchiuran crustaceans, all ectoparasites of fishes, are classified near the ostracods, copepods and barnacles. Recently, a close affinity between the branchiurans and the phylum Pentastomida is supposed on the basis of some spermatological (Wingstrand, 1972; Storch and Jamieson, 1992) and molecular phylogenetic (Abele *et al.*, 1989; Winnepennickx *et al.*, 1992) studies.

In many crustaceans and other mandibulate arthropods, the oocytes grow in the ovarian lumen, but in most chelicerate arthropods and pentastomids, they grow in the hemocoel protruded from the ovarian surface (Nørrevang, 1983; Makioka, 1988). Although a few studies have been done on structure of the branchiuran female reproductive system (Grobben, 1908; Martin, 1932; Avenant-Oldewage and van As, 1990), the basic structure of the ovary, especially in relation to the nature of a space including the growing oocytes, has remained to be ascertained.

The branchiurans, *Argulus japonicus*, were obtained mainly from the body surfaces of some live carp by kind assistance of the staff of the Ibaraki Prefectural Freshwater Fisheries Experimental Station. The female specimens of various sizes were fixed with Bouin's solution, and then made into serial paraffin sections in 5 $\mu$ m thickness. These sections were stained with hematoxylin-eosin, azan or PAS-hematoxylin.

The adult female *A. japonicus* has a single median ovary in the thorax above the alimentary canal (Fig. 1).

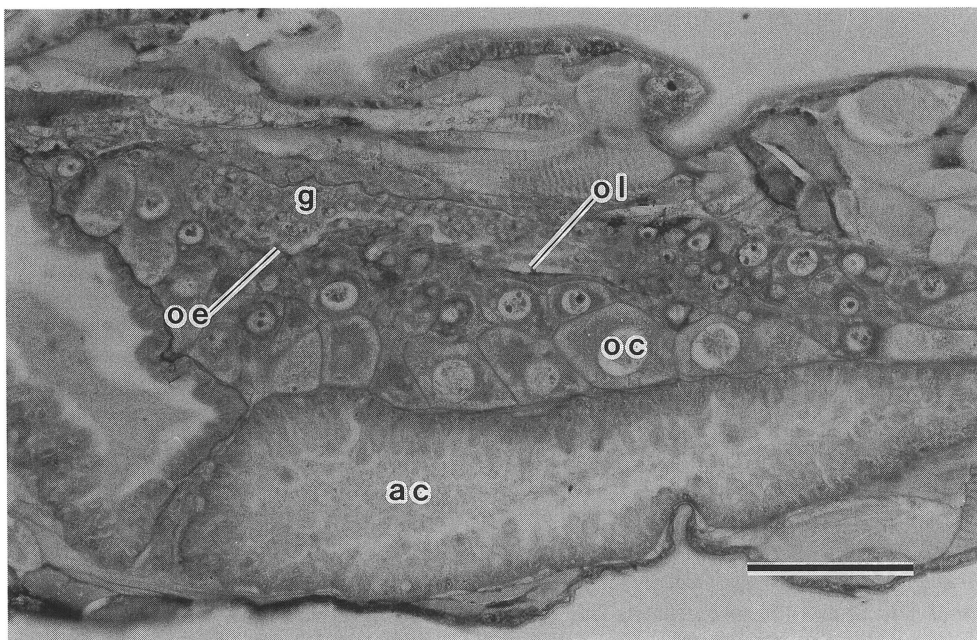


Fig. 1 Structure and locality of adult *Argulus japonicus* ovary. Sagittal section. PAS-hematoxylin. Scale=100 $\mu$ m. ac: alimentary canal, g: germarium, oc: oocyte, oe: ovarian epithelium, ol: ovarian lumen.

At the dorso-anterior end of the ovary, a pair of oviducts are connected with the ovary *via* a short median oviduct.

A longitudinal germinal ridge or germarium including many oogonia runs through the ovary along the dorso-median inner surface of the ovarian epithelium. A number of growing oocytes of various sizes are swarming around the outer surface of the repeatedly folded lateral and ventral ovarian epithelia. They are protruded outward from the ovarian epithelium into the hemocoel, raising the basement membrane of the ovarian epithelium. The growing oocytes are followed by neither follicle cells nor nurse cells. No growing oocytes have been found in the ovarian lumen.

In the adult ovary of *A. japonicus*, growing oocytes are found protruded in the hemocoel, not included in the ovarian lumen. It seems similar to the cases in many chelicerates (Makioka, 1988) and pentastomids (Nørrevang, 1983) rather than to those in other crustaceans. Some adaptive or phylogenetic meanings of this similarity between the branchiurans and the chelicerates or pentastomids are shortly to be discussed in some detail.

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