

Sexual Difference in Histology of the Ultimobranchial Gland of Mature Japanese Eels (*Anguilla japonica*)

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ABSTRACT The ultimobranchial glands of artificially matured Japanese eels (*Anguilla japonica*) were examined histologically. The sexual maturation of male and female fish was induced by injections of synahorin and a salmon pituitary extract, respectively. In mature males, the gland cells were low in height with ovoid nuclei. In contrast, cellular hypertrophy and hyperplasia of the gland was observed in mature females. The gland of the mature female had an epithelium with complex enfoldings into the central cavity, tall gland cells with elongated nuclei and well-developed blood capillaries surrounding the parenchyma. The higher blood calcitonin concentration observed by others in mature female and the hyperactivation of the ultimobranchial glands described here lead to the conclusion that the gland plays a significant sex-related role. (*Zool. Mag.* 86: 261-263, 1977)

The ultimobranchial glands of fishes is currently believed to secrete a hypocalcemic hormone, calcitonin (Otani *et al.*, 1976), but it is still unsettled whether the fish calcitonin has the same function in fishes as in mammals. Histological investigations of the ultimobranchial glands in goldfish and *masu* salmon (*Oncorhynchus masou*) have shown that there is a marked difference between male and female gland cells at the sexual maturation stage; the gland cells in females are more active than in males (Oguri, 1973; Yamane

and Yamada, 1977). Also, the blood calcitonin concentrations of coho, chinook, and sockeye salmon and the Japanese eel were found to be remarkably high in females compared with in males (Deftos *et al.*, 1974; Watts *et al.*, 1975; Yamauchi *et al.*, 1976). This paper reports a distinct histological difference detected between male and female ultimobranchial cells in the Japanese eel (*Anguilla japonica*) which was experimentally induced to be sexually mature.

Immature two male and three female eels in sea water were injected with synahorin and a chum salmon pituitary extract, respectively, according to the procedure reported by Yamamoto *et al.* (1972, 1974). Sexual maturation was successfully induced in males (BW. 170 and 175 g) and females (BW. 645, 900 and 1030 g), as evidenced by discharges of sperm in males and their high gonad-somatic index (32.6, 34.0 and 35.6) in females. The gonad-somatic index was calculated by the gonad weight/BW \times 100. The ultimobranchial gland was dissected out with the surrounding tissues, fixed in Bouin's fluid for 48 hr, and embedded in paraffin by the routine method. Serial sections were cut at 7 μ m and stained with Delafield's hematoxylin and eosin.

The ultimobranchial gland was observed as a pair of single follicles in the connective tissue beneath the ventral wall of the esophagus. The follicle had the central ductless cavity lined with the pseudostratified epithelium. In mature males, the gland was ellipsoid in shape, and the epithelium was smooth being not enfolded into the central cavity which was larger than in the female glands (Fig. 1). The gland cells having the ovoid nuclei were low in height measuring about 15 μ m (Fig. 2). Blood capillaries bordered by the basement membrane were poorly distributed. In contrast to these features of the male glands, cellular hypertrophy and hyperplasia characterized the gland of mature females. The follicular epithelium was complicated by enfoldings into the central cavity

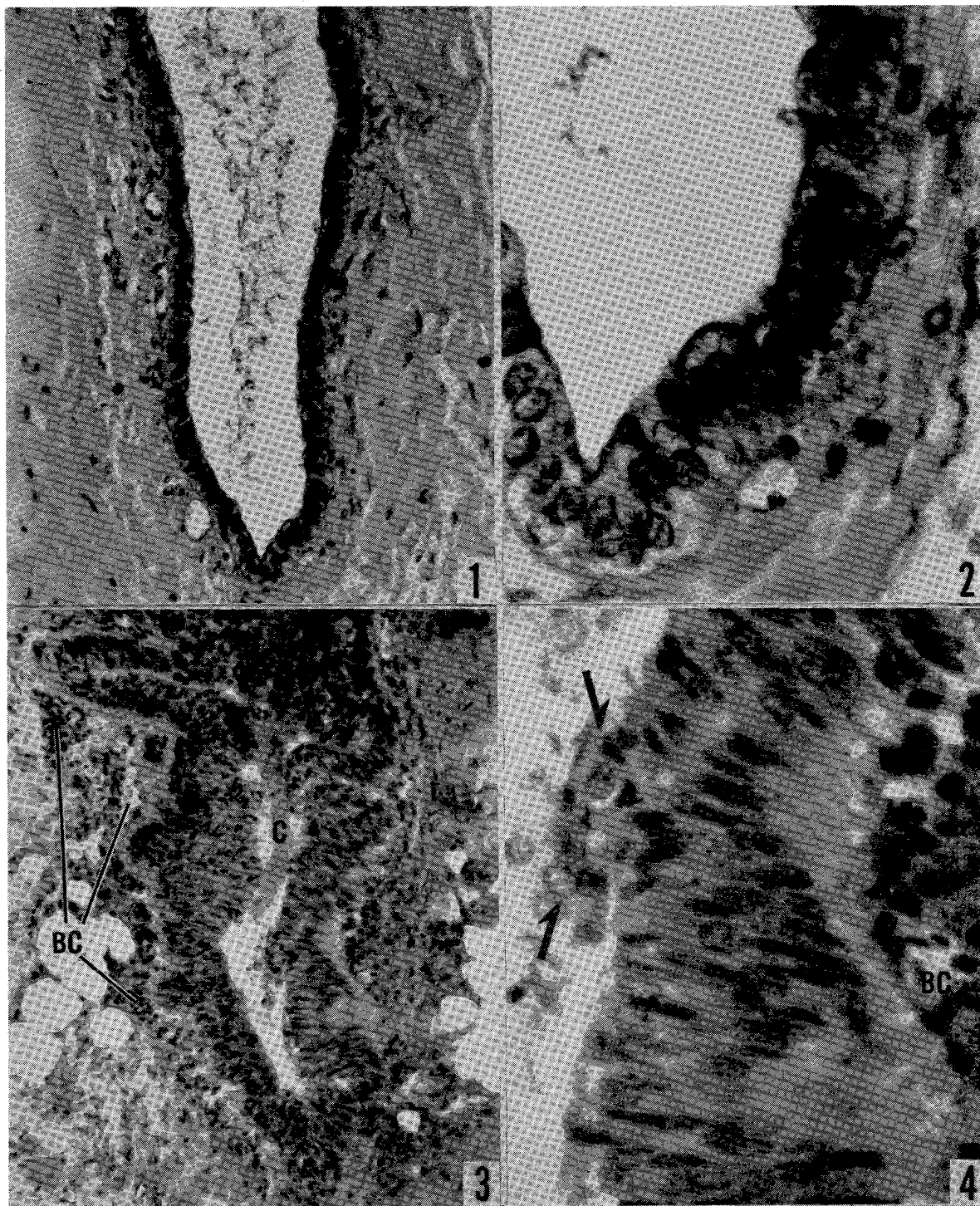


Fig. 1. Ultimobranchial gland of an artificially matured male. $\times 220$.

Fig. 2. Enlargement of Fig. 1. The epithelial cells are low in height with ovoid nuclei. $\times 890$.

Fig. 3. Ultimobranchial gland of an artificially matured female (GSI=32.6). The epithelium is complicated by enfoldings into the central cavity. BC: blood capillaries; C: colloidal substance. $\times 220$.

Fig. 4. Enlargement of Fig. 3. Note the tall and compact epithelial cells and their elongated nuclei. Some degenerating cells are found in the cavity (arrows). $\times 890$.

which, therefore, became small and narrow (Fig. 3). There was often a colloidal substance and some degenerating cells were in the cavity. The gland cells showing their elongated nuclei were tall (about 30 μ m) and compactly arranged (Fig. 4). The paranchyma was surrounded by well-developed blood capillaries.

The present observation has strongly suggested that in the Japanese eel the glandular activity is much higher in mature females than in mature males. Similar observations are available in the goldfish (Oguri, 1973), *Oncorhynchus masou* (Yamane and Yamada, 1977), and *Brachydanio rerio* (Yamane, unpublished). Peignoux-Deville *et al.* (1975) reported that maturation of immature females of the European eel (*Anguilla anguilla*) induced by injections of a carp pituitary extract was associated with cellular hypertrophy and hyperplasia in the ultimobranchial glands. Moreover, the blood calcitonin concentration in the Japanese eel was reported to be remarkably higher in mature females than in matured males (Yamauchi *et al.*, 1976). Comparable results have been obtained from three salmonids at the spawning stage (Deftos *et al.*, 1974; Watts *et al.*, 1975). The present histological results are consistent with the previous observations in eels and other species. It is highly possible that an activation of the ultimobranchial gland can take place only in mature females.

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