On the Yellowish Brown Pigment Granules in the Interrenal Cells of Anglerfish and Leopard Shark*¹

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Yellowish brown pigment called lipofuscin is included in the adrenal gland of various mammalian species and appears as abundant granules in the cortical cells of its zona reticularis. Among many fish species examined by the present author, the yellowish brown pigment granules were abundantly detected only in the interrenal cells of the anglerfish *Lophius litulon* and the leopard shark *Triakis scyllia*. For this examination, three large-sized specimens of the anglerfish were used and their body weights were 2.5 to 8.6 kg. In the leopard shark, appearance and accumulation of the pigment granules were remarkable in four large-sized specimens (118-123 cm in body length) among ten specimens (60-123 cm) investigated. Accordingly, it was suggested that the yellowish brown pigment granules appeared and revealed conspicuous accumulation in the interrenal cells of large-sized fishes with advanced age.

Yellowish brown pigment called lipofuscin appears as pigment granules in various types of cells, especially in hepatocytes, myocardial fibers and nerve cells in the animal body.¹⁻³⁾ The pigment is age-related and increases with age.³⁾ Furthermore, the lipofuscin pigment is present in the cortical cells of adrenal gland, especially in

those of its zona reticularis, and its accumulation has been described in the gland of various mammalian species.⁴⁻⁶⁾

I have hitherto performed histological investigations on the piscine adrenal gland using many species of Osteichthyes and Chondrichthyes. During the course of this study, I found that the

Fig. 1. Ventral view of the kidneys in anglerfish *L. litulon*. $\times 2$.

Specimen No. 1, body weight: 2.5 kg, kidney weight: 3.7 g (right) and 3.2 g (left). A: adrenal gland, S: corpuscle of Stannius.

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Figs. 2 and 3. Adrenal gland of the anglerfish *L. litulon*. Specimen No. 3, body weight: 8.6 kg. Figs. 4 and 5. Interrenal cells of the leopard shark *T. scyllia*. Fig. 4. specimen No. 1, body length: 123 cm, Fig. 5. specimen No. 8, body length: 82 cm.

Yellowish brown pigment granules are abundantly seen in the interrenal cells of Figs. 3 and 4. Zenker-formol fixation and Mayer's acid hemalum and eosin stain. Fig. 2. $\times 120$, Figs. 3-5. $\times 670$.

yellowish brown pigment granules were abundantly present in the interrenal cells of two species, the anglerfish *Lophius litulon* and the leopard shark *Triakis scyllia*. So, the present report deals with this finding on the pigment granules.

Materials and Methods

The fishes used in the present study are the anglerfish *L. litulon* and the leopard shark *T. scyllia*. Three specimens of the anglerfish, ranging in body weight from 2.5 to 8.6 kg, were obtained at the Misaki Marine Biological Station, the University of Tokyo. Ten specimens of the leopard shark were collected at the same marine biological station. These varied in body length from 60 to 123 cm.

The kidney tissues including adrenal glands were removed from the anglerfishes and fixed in Zenker-formol fluid. Interrenal glands of the leopard shark were also fixed in the same fixing fluid. These fixed tissues were embedded in paraffin after dehydration in ethanol. Then, tissue sections were made from the paraffin blocks and stained with Mayer's acid hemalum and eosin.

Results and Discussion

As shown in Fig. 1, the kidney of the anglerfish consists of two separate renal masses like bean in shape. The portion called head kidney is not distinguishable. However, brown-colored tissue was detected in the cephalic area of the ventral surface of each kidney (Fig. 1). After histological examination this colored tissue was identified as the adrenal gland (Fig. 2). The adrenal gland of the anglerfish is composed of interrenal cells and less numerous chromaffin cells. In all three specimens examined, yellowish brown pigment granules were abundantly detected in the interrenal cells of the gland (Fig. 3). Thus, it was clarified that the brown coloration of the adrenal gland in this fish was due to the remarkable deposition of the yellowish brown pigment granules in the interrenal cells.

In a previous paper,⁷⁾ we described the presence of the yellowish brown pigment granules in the interrenal cells of *Prionurus microlepidotus*, *Pterois lunulata* and *Paralichthys olivaceus*. Nandi⁸⁾ also reported that the interrenal cells of *Holocentrus ensifer* were filled with pigment granules. In my further studies on the adrenal gland of teleostean fishes, I have noticed the appearance of the pigment granules in the interrenal cells of the follow-

ing three species, *Lateolabrax japonicus*, *Argyrosomus argentatus* and *Lepidotrigla microptera*, among many fish species investigated.* However, the accumulation of the yellowish brown pigment granules was most conspicuous in the interrenal cells of the anglerfish among the Osteichthyes examined.

These yellowish brown pigment granules were also found in the interrenal cells of the leopard shark *T. scyllia*. These granules were abundant in the interrenal cells of four specimens of larger size from 118 to 123 cm in body length (Fig. 4). Also, in another six specimens of smaller length from 60 to 88 cm, these granules were detectable, but not so numerous as in the former specimens (Fig. 5). Appearance of the pigment granules was reported in the interrenal cells of *Raja clavata*.^{9,10)} Furthermore, I have hitherto examined on the histological structures of the interrenal glands using several species of Chondrichthyes. However, accumulation of the yellowish brown pigment granules was most remarkable in the interrenal cells of the leopard shark among the Chondrichthyes investigated.

In a previous paper,¹¹⁾ I reported the appearance of the yellowish brown pigment granules in the atrophic interrenal cells of goldfish raised in 0.1% thiourea solution for 42 or 50 days. Judging from this result in thiourea experiment and also from the abundant occurrence of the pigment granules in the interrenal cells of the leopard sharks in larger size and of the large-sized anglerfishes with advanced age, the pigment included in the granules seems to be age-related pigment, namely lipofuscin, which is known to appear widely in the mammalian adrenal cortex, especially in its zona reticularis.⁴⁻⁶⁾

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