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Lipoma in the eel *Anguilla anguilla**)

by

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1. INTRODUCTION

The lipoma has been reported in the following fish species: in the plaice (*Pleuronectes platessa*) by BERGMAN (1921), in the pike (*Esox lucius*) by BERGMAN (1921), in a flatfish (*Paralichthys olivaceus*) by KAZAMA (1924), in the halibut (*Hippoglossus hippoglossus*) and the dragonet (*Callionymus lyra*) by WILLIAMS (1929), in the Japanese samlet (*Plecoglossus altivelis*) by TAKAHASHI (1929) and in the coalfish (*Pollachius virens*) by THOMAS (1933).

In addition, SCHLUMBERGER and LUCKÉ (1948) mentioned the enormous subcutaneous fat stores which were found in a specimen of the catfish *Pygidium* (= *Trichomycterus*) *totae*.

We can therefore conclude that the lipoma in fishes must be considered to belong to the rare tumours.

In the amphibians and the reptiles the lipoma appeared to be even of rarer occurrence. No case is known in the amphibians, whereas in the reptiles only one is observed, viz. a lipoma in an adult male of the lizard *Lacerta muralis* (STOLK, in the press).

Recently we were in a position to study a subcutaneous lipoma in an adult female of the common eel (*Anguilla anguilla*), measuring 43.5 cm in length.

The tumour was fixed in Bouin d'Hollande fluid and embedded in paraffin. The transverse serial sections (4—6 μ) were stained with haematoxylin and eosin, haematoxylin and phloxin, and moreover according to the Van Gieson method and the azan method. The fat staining was performed with osmic acid and Sudan III.

2. DESCRIPTION

The lipoma of the adult *Anguilla* female was situated as an irregular, nodular tumour, which was situated on the left side, caudally of the

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left operculum (figs. 1, 2 and 3). The tumour appeared to consist of large and small nodules.

The cut surface of the tumour had locally an oily appearance, was pale yellow in colour and had the consistency of cheese. Strands, trabeculae and areas of fibrous connective tissue were distinctly visible between the areas of adipose tissue.

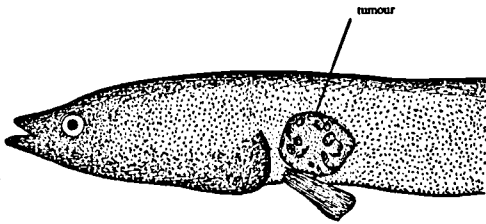


FIGURE 1. Lipoma in an adult female of the eel *Anguilla anguilla*. Irregular, nodular tumour on the left side, caudally of the left operculum and consisting of large and small nodules.

Histologically, the adipose tissue was composed of well differentiated adult fat cells, which varied much in shape and size (figs. 4, 5, 6, 8 and 9). These fat cells were arranged in small compact lobules and held together by strands of fibrous connective tissue.

Most of the adult fat cells showed the characteristic picture, viz. an eccentric nucleus, which is considerably flattened; a peripheral cytoplasm, which had grown to a thin membrane; and a large central fat mass, staining black with osmic acid and orange with Sudan III (fig. 8). The chromatin of the nucleus was generally densely structured and stained heavily dark blue with haematoxylin.

Between the adult fat cells the smaller young fat cells were observed, in which the fat mass was present in some cytoplasmic vacuoles (fig. 8). Also in these cells the eccentric nuclei appeared to be already somewhat flattened. Between the young fat cells and the adult fat cells all transition stages were present.

Mitoses were rarely observed. The growth of the tumour will therefore probably have been slow.

The fibrous connective tissue was present as strands and trabeculae between the fat cells and groups of the fat cells, as well as extended

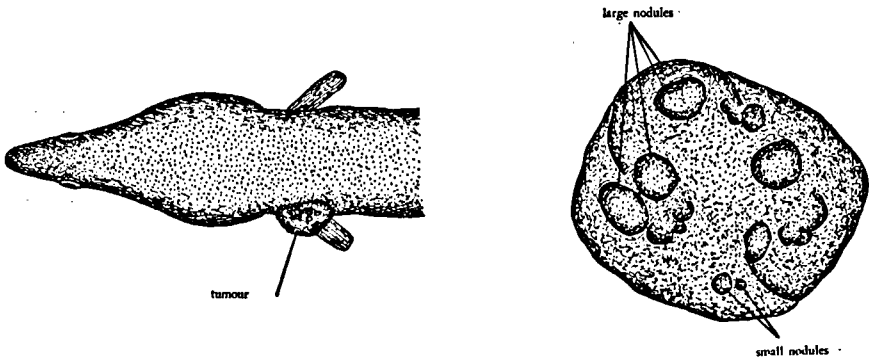


FIGURE 2. Lipoma in an adult female of the eel *Anguilla anguilla*. Dorsal view.

FIGURE 3. Lipoma in an adult female of the eel *Anguilla anguilla*. A few times enlarged. Irregular nodular tumour consisting of large and small nodules.

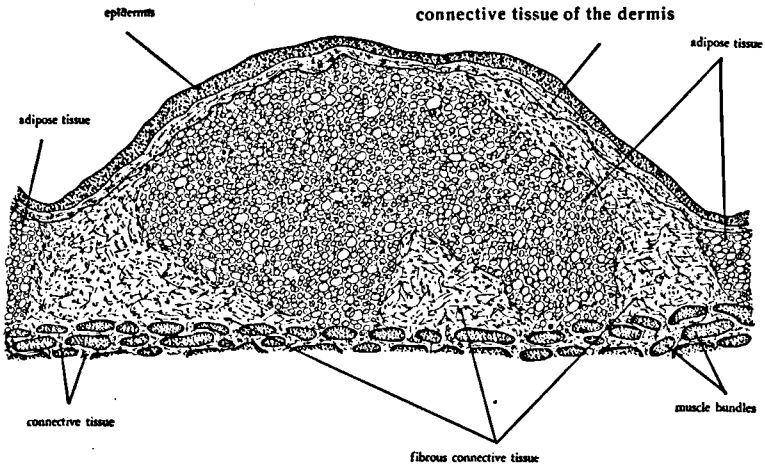


FIGURE 4. Lipoma in an adult female of the eel *Anguilla anguilla*. Transverse section, low magnification. The tumour, which is covered by an intact skin, is composed of areas of adipose tissue. The skin consists of the epidermis and the connective tissue of the dermis. On the bottom of the figure muscle bundles, which are separated by connective tissue.

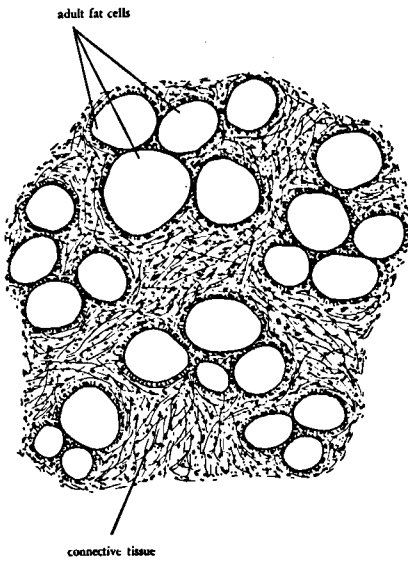


FIGURE 5. Lipoma in an adult female of the eel *Anguilla anguilla*. Transverse section, higher magnification. Adult fat cells varying much in shape and size, which are separated by strands of fibrous connective tissue.

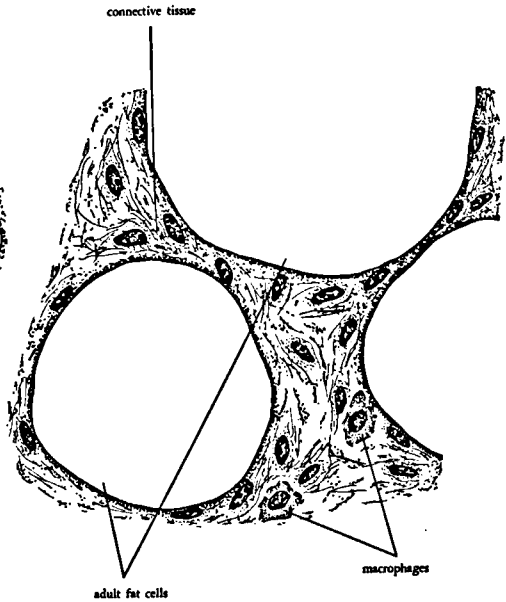


FIGURE 6. Lipoma in an adult female of the eel *Anguilla anguilla*. Transverse section, very high magnification. Adult fat cells and macrophages, embedded in a fibrous connective tissue stroma.

areas. The connective tissue consisted of fusiform or asteroid cells and interlacing bundles of collagenous fibres (figs. 5, 6, 7, 8 and 9). Some areas had a completely fibromatous appearance (fig. 9). In the connective tissue locally typical macrophages were observed (figs. 6, 7 and 8).

In the tumour tissue no inflammatory processes, necrotic areas, calcified areas, dilated blood vessels and haemorrhages were found. Vascularization was moderate.

The tumour was encapsulated by a fibrous capsule of connective tissue and was covered by an intact skin (fig. 4). The epidermis and the connective tissue of the dermis showed no peculiarities.

The adjacent musculature was not infiltrated, but locally some muscle bundles were found to be somewhat flattened owing to a pressure atrophy.

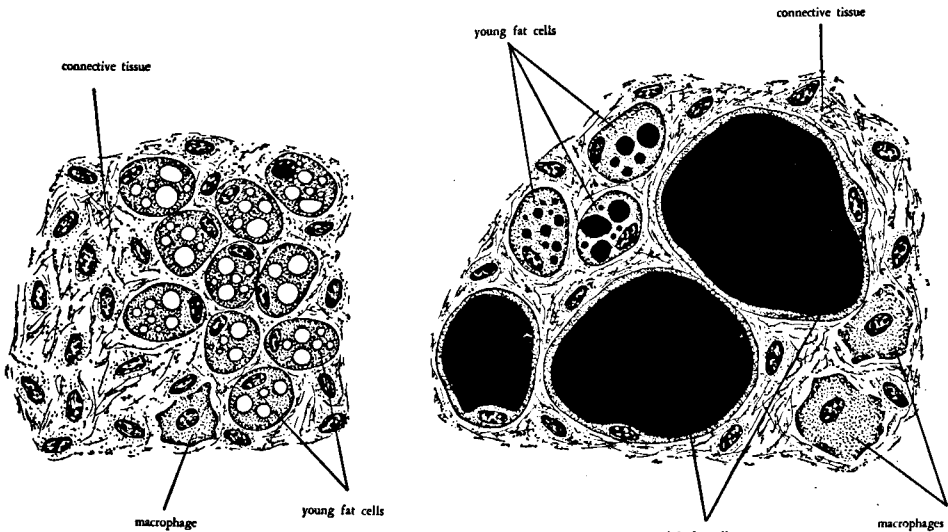


Figure 7.

Figure 8.

FIGURE 7. Lipoma in an adult female of the eel *Anguilla anguilla*. Transverse section, very high magnification. Young fat cells and macrophages embedded in a fibrous connective tissue stroma. The young fat cells have an eccentric nucleus, which is already somewhat flattened, and a number of cytoplasmic vacuoles, varying in size.

FIGURE 8. Lipoma in an adult female of the eel *Anguilla anguilla*. Transverse section, very high magnification. Osmic acid stain. Young fat cells, adult fat cells and macrophages, embedded in a fibrous connective tissue stroma. Young fat cells with eccentric, somewhat flattened nuclei and with fat (black) filled cytoplasmic vacuoles. Adult fat cells with eccentric, flattened nuclei, peripheral cytoplasm and large, central fat mass.

3. DISCUSSION

Concerning the localization of the fish lipomas reported in the pertaining literature, it can be stated that four tumours were situated in the subcutis, two tumours in the trunk musculature and one tumour in the liver.

The subcutaneous lipoma in the plaice, *Pleuronectes platessa* (BERGMAN, 1921) was observed beneath the skin on the pigmented side of the

animal and measured $6.5 \times 3.5 \times 3.0$ cm. At autopsy the tumour was easily separated from the surrounding tissue. Owing to pressure atrophy the tumour had produced a groove in the back muscles. The firm and elastic tumour, which floated in water, weighed 25 g. Histologically, the parenchyma of the tumour was composed of adult fat cells.

The subcutaneous lipoma in the pike, *Esox lucius* (BERGMAN, 1921) was present on the trunk as a large tumour, which had the size of a man's fist.

The subcutaneous lipoma in the dragonet, *Callionymus lyra* (WILLIAMS, 1929) was a spherical, encapsulated tumour with a smooth surface.

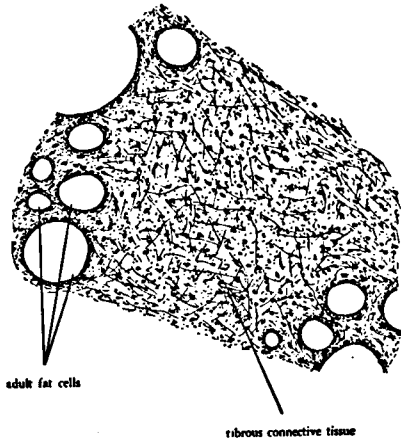


FIGURE 9. Lipoma in an adult female of the eel *Anguilla anguilla*. Transverse section, higher magnification. Fibrous connective tissue with adult fat cells.

The right eye appeared to be displaced. The tumour was composed of fat cells and a myxomatous connective tissue stroma. According to the author the fat cells had undergone a malignant transformation.

The subcutaneous lipoma in the Japanese samlet, *Plecoglossus altivelis* (TAKAHASHI, 1929) was a lobulated tumour in the subcutaneous connective tissue and was situated behind the left eye. The tumour had the size of a small nut.

The lipoma in the trunk musculature in the flounder *Paralichthys olivaceus* (KAZAMA, 1924) was situated ventrally and had about the size and the shape of a little finger. The soft tumour, which was encapsulated, appeared to consist of fat cells.

The lipoma in the trunk musculature in the halibut *Hippoglossus hippoglossus* (WILLIAMS, 1929) protruded into the posterior portion of the celom and measured 27.6×12.5 cm. The tumour appeared to originate between the muscle bundles of the trunk. At autopsy the cut surface of the tumour, which was pale yellow, had an oily appearance and the consistency of cheese. The fat cells of which the tumour tissue consisted, were well differentiated.

The lipoma of the liver in the coalfish *Pollachius carbonarius* (THOMAS, 1933), was observed in an animal approximately seven years old. The tumour was localized on the lower border of the liver and measured $3.0 \times 2.5 \times 2.0$ cm. The tumour, which was smooth and greenish, was covered by a perfectly normal peritoneum. When cut, the soft tumour

appeared to be homogeneous and without apparent fibrous trabeculae of connective tissue. Histologically, the tumour tissue was composed of adult fat cells and islands of haematopoietic tissue.

The enormous subcutaneous fat stores in the catfish *Trichomycterus totae* (SCHLUMBERGER and LUCKÉ, 1948) were observed in an animal found in Lake Tota, Columbia. The fat tissue was made up of adult fat cells and covered by a normal overlying skin without evidence of atrophy. An invasion of the subjacent trunk muscles by the tumour tissue was not found. It is not certain whether the adiposity is characteristic of this species, or whether it represents an abnormality. The authors believed that "if this subcutaneous accumulation of fat is pathologic for the fish, it should probably be classified as a lipodystrophy rather than as a true lipoma".

The lipoma in the lizard *Lacerta muralis* (STOLK, in press) was situated in the dorsal skin, caudally of the left eye and dorsally of the left tympanic membrane. The tumour originated from the subcutaneous connective tissue of the skin and belonged to the type of fibrolipoma. Histologically, the tumour consisted of areas of adipose tissue with adult and young fat cells and areas of fibrous connective tissue.

Summarizing, we may conclude that the lipoma of *Anguilla* shows a striking resemblance with the lipoma of *Lacerta*. Both tumours belong to the fibrolipomatous type. However, there is little agreement between the lipoma of *Anguilla* and the fat storage depots as for instance found in the catfish *Trichomycterus totae*.

4. SUMMARY

In an adult female of the common eel *Anguilla anguilla* a large lipoma was found, situated on the left side, caudally of the left operculum.

Microscopically, the tumour, which originated from the subcutaneous connective tissue, was composed of areas of adipose tissue and areas of fibrous connective tissue.

The tumour belongs to the fibrolipomatous type and shows a striking resemblance with the lipoma, described by STOLK (in press) in the lizard *Lacerta muralis*.

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