Accordingly, the ratio of brain to plasma concentration of sodium and chloride in the fish in dilute sea water increased above ratios found in control fish. Simple dilution by intake of water does not explain these findings.

1969 #25

OBSERVATIONS ON THE SPINE OF Squalus acanthias

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In 1924, Evans described in detail a poisonous gland located in the deep concave groove of the dogfish (Philos. Trans. Royal Soc., London, Series B 212:8-16, 27, 1924). This report has been cited from time to time by other authors despite considerable doubt that such a gland exists.

In the spiny dogfish a typical posterial dorsal spine is 3.2 cm long and about 0.1 cm in diameter at the tip (Figure 1). At the level of the epidermis the shaft has a diameter of 0.4 to 0.5 cm. Below the epithelial surface the shaft extends for another 4.0 cm to articulate with the ver-

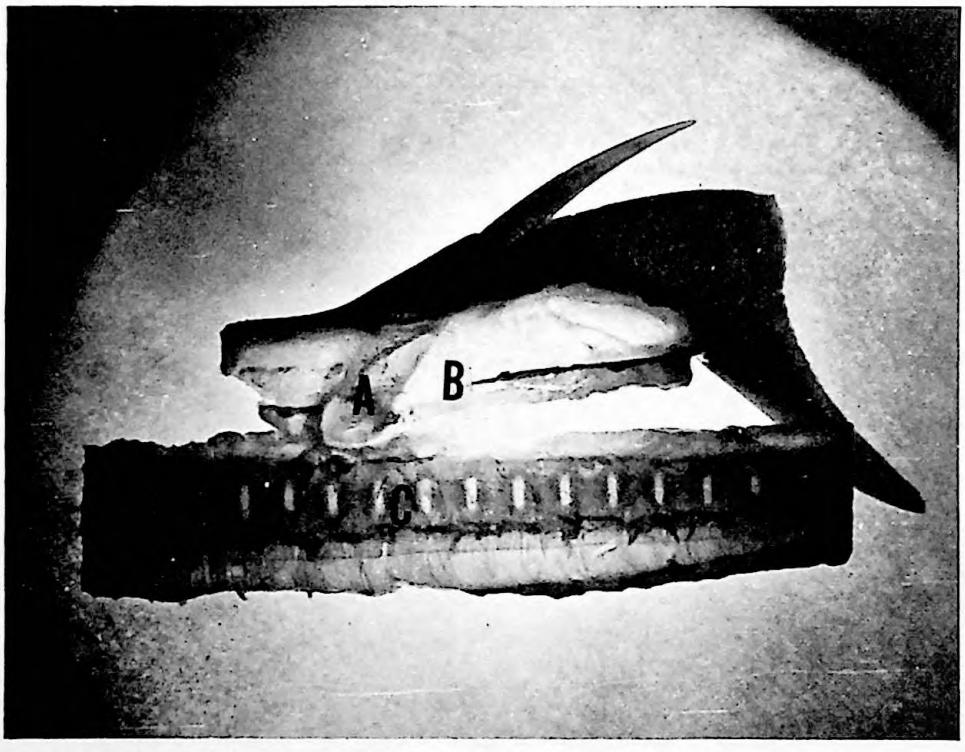

Figure 1. Posterior dorsal fin and dorsal spine of the dogfish. (A) Dorsal spine. (B) Dorsal fin cartilage. (C) Vertebral column.

tebral column and posteriorly with the dorsal fin cartilage. The anterior dorsal spine is similar to the posterior spine but is a centimeter or two shorter (Figure 2). The anterior dorsal fin, however, has a much longer articulation with the vertebral column than the posterior dorsal fin.

The dorsal spine consists of a central core of hyalin cartilage bordered by a zone of loose connective tissue (Figure 3). Surrounding these elements is a hard shell of dense acellular

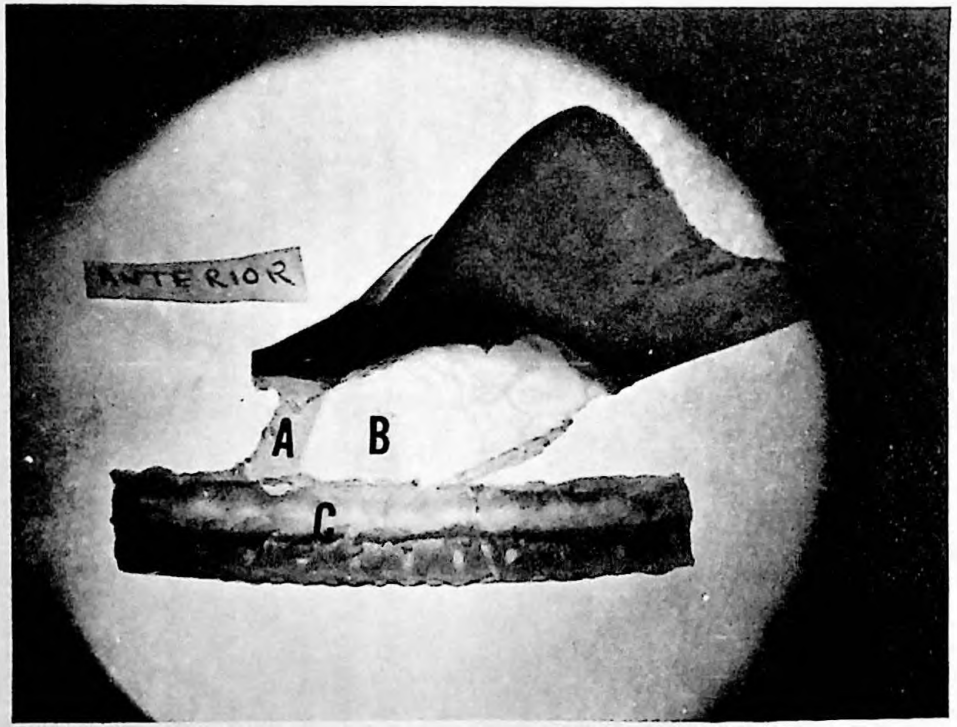

Figure 2. Anterior dorsal fin and dorsal spine of the dogfish. (A) Dorsal spine. (B) Dorsal fin cartilage. (C) Vertebral column.

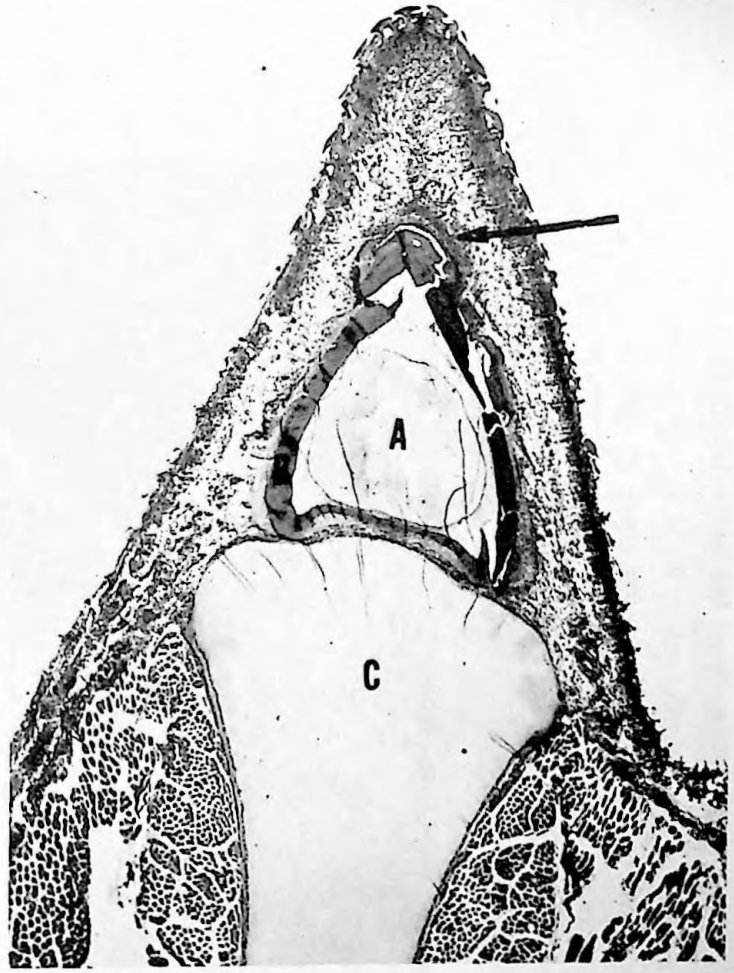

Figure 3. Section cut perpendicular to the axis of the anterior spine near its exit through the epidermis. (A) Dorsal spine with core of hyalin cartilage. (B) Shell of enamel-like material. (C) Dorsal fin cartilage. Black arrow points to groove lined by epithelial cells and melanocytes. Hematoxylin and Eiosin (x 11).

enamel-like material, which apparently arises from the peri-chondrial mesenchyme and from adjacent denser fibrous tissue. The enamel-like material is similar in structure to the material found in the placoid scales of the epidermis. The dorsal spine is oval in cross section at its base where it articulates with the vertebral column but develops a concave posterial surface higher up. There is also a channel, lined by columnar epithelial cells and melanocytes, located at the spine's sharply convex anterior surface (Figure 4). The groove is probably continuous with the

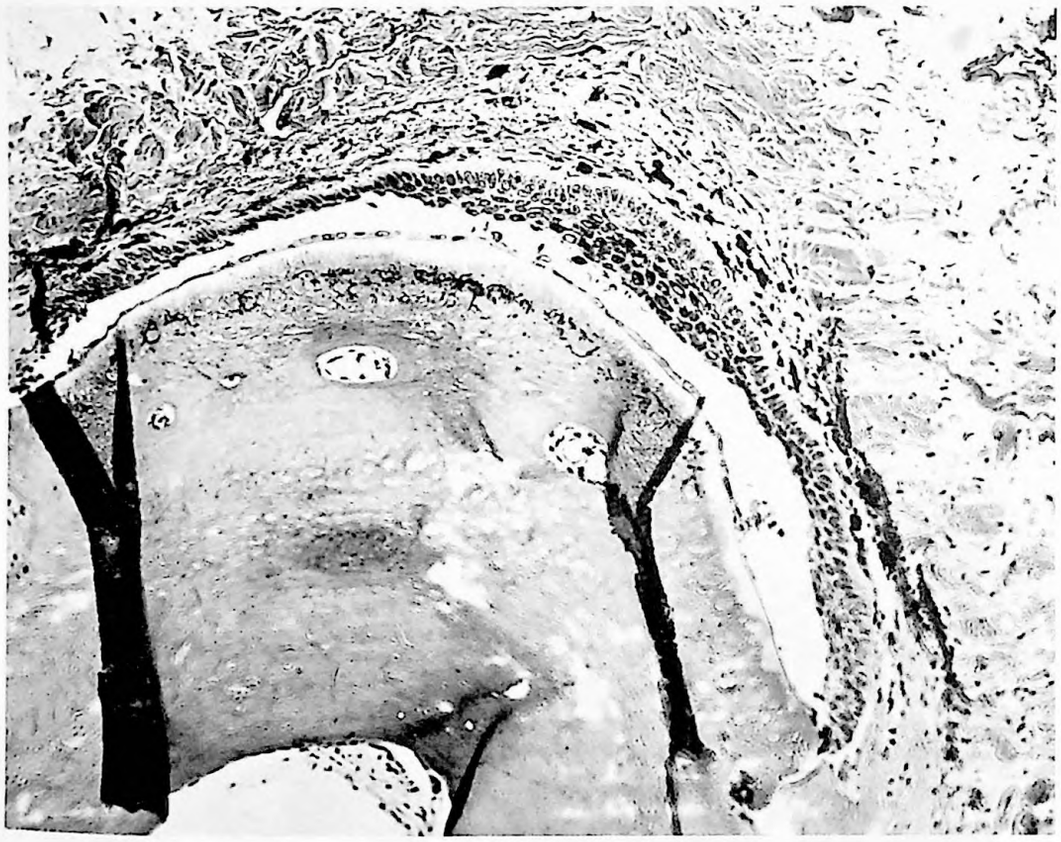

Figure 4. Enlargement of area indicated by the arrow in Figure 3. There is a channel lined by epithelial cells adjacent to the dorsal spine. The epithelial cells are squamoid in appearance and the basal cells are oriented perpendicularly to the supporting connective tissue. Many melanocytes are seen in the subepithelial tissue. Hematoxylin and Eosin (x 135).

surface epithelium of the dogfish, which the lining cells closely resemble. Examination of material scraped from the concave grooves of several dogfishes revealed tissue somewhat similar to that described by Evans in 1924. The tissue consisted of a thin layer of connective tissue supporting a much thicker layer of epithelium. The epithelium had a single row of basal cells oriented perpendicularly to the connective tissue, and the basal cells matured gradually through a transitional stage into mature non-keratinizing squamous cells, which formed the surface layer. Small intra-epidermal cysts were frequently seen, especially in the outer epithelial zone. These cysts were often empty but sometimes contained material resembling the enamel-like substance of placoid scales. The tissue scraped from the concave groove of the dorsal spine appears to be almost identical to the surface epithelium of the dogfish.

No poisonous glands, or ducts leading from such glands, were found at the base of the spines or along its course, either during gross dissection or histologic examination. Injections of soluble dyes (bromphenol blue and methyl blue) around the base of the spines (both in vivo and after dissection) resulted in no diffusion of the dye along the course of the spine either with or without the aid of gravity. The morphologic structure of the spine is essentially the same in the newborn dogfish pup as it is in the adult dogfish.

1969 #26

SPLENIC VEIN BLOOD FLOW AND HEMATOCRIT RESPONSES TO SYMPATHOMIMETIC DRUGS IN Squalus acanthias

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The following observations show that in contrast to mammals Squalus acanthias does not possess a readily mobilizable reserve of normal erythrocytes which are released into the general circulation in response to sympathetic receptor stimulation. The effects of two classic sympathomimetic drugs, L-epinephrine and isoproterenol, on arterial pressure (dorsal and/or ventral aorta), hematocrit (systemic or splenic vein), splenic vein blood flow and heart rate were observed both before and after sympathetic alpha or beta receptor blockade in 23 lightly anesthetized (pentobarbital sodium, 20 mgm/Kgm) fish whose gills were perfused with seawater. Central venous hematocrits (sinus venosus) were obtained from 6 fish 1-10 minutes after injection (ventral aorta) of L-epinephrine or isoproterenol (2×10^{-5} mgm/Kgm). The spleens of 4 fish were exposed and stimulated electrically (0.5-20 volts, 2-50 cycles/sec) without observable evidence of a contractile response.

Central venous sampling revealed no significant change in hematocrit in response to L-epinephrine or isoproterenol although ventral aortic pressure increased to 149% of control.

Tables 1 and 2 show the responses to L-epinephrine and isoproterenol before and after blockade by phentolamine, an alpha blocker, and propanolol, a beta blocker. No significant effects on heart rate were observed. L-epinephrine increased arterial pressure significantly both before and after alpha or beta receptor blockade. Splenic vein hematocrit was significantly decreased by L-epinephrine. This effect was blocked by phentolamine but not by propanolol. Phentolamine blocked the decrease in splenic vein flow elicited by L-epinephrine but propanolol did not.

Isoproterenol, a beta receptor stimulator, decreased arterial pressure. Propanolol, the beta receptor blocker, reversed this effect, but the isoproterenol response was not affected by phentolamine. A barely significant decrease in splenic vein hematocrit occurred in response to isoproterenol in the presence of phentolamine block. Isoproterenol tended to increase splenic vein blood flow, but the response was too variable to make the result significant. However, after beta blockade (propanolol) a significant increase in splenic blood flow was observed. However, control arterial pressure and blood flow were so very low that the slight increase in actual arterial pressure and blood flow which occurred resulted in a large percentage increase.

The decrease in the hematocrit of splenic vein blood following L-epinephrine injection is of considerable increase because in mammalian species an increase is observed (to 85-90%) in