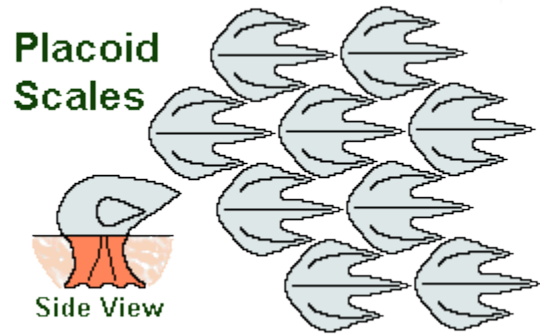


# Dermal and Epidermal Derivatives I: Scales

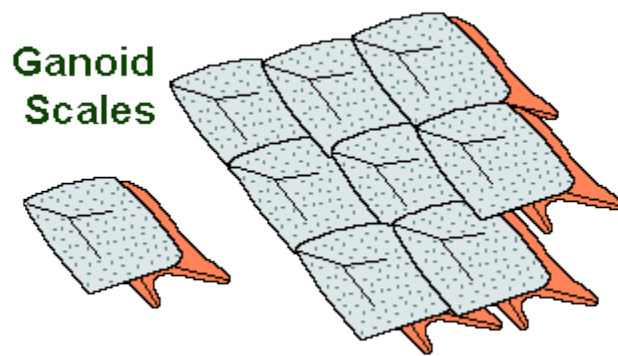
Among the fishes, lampreys and hagfish lack scales; the skin is smooth. Scales evolved separately in the cartilaginous and bony fishes. The scales of sharks and rays are made of bone and resemble teeth. They have a soft central area called the pulp, a middle layer of dentine and a hard outer layer of enamel. These “denticles” and are known as placoid scales.



Placoid scales do not grow with the animal; they are of a single size. Instead, when the animal grows, space opens up and new denticles grow to fill. The scales/denticles of cartilaginous fish are discrete, they do not overlap as do the scales of bony fishes.

Most sharks have a complete covering of denticles arranged in a repeating diamond pattern, sharks also have a thick fibrous dermis that supports the scales and helps protect the animal. Other cartilaginous fishes that swim like sharks, such as the Guitarfish (Rhinobatidae) and the Saw-fish (Pristidae) also have a complete covering of denticles.

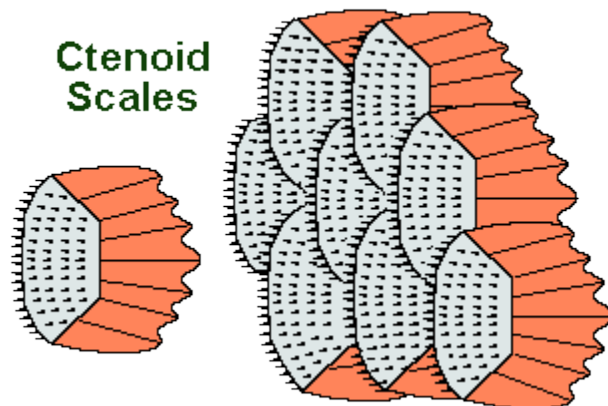
However, those species that are dorso-ventrally flattened such as the rays tend to have many fewer denticles. In the Skates (Rajidae) they are scattered in patches across the pectorals and on the head. In the Eagle Rays (Myliobatidae) they are very few in number and in the Electric Rays (Torpedinidae) they are absent except in the modified form of the tail spines. The Devil-fishes (Mobulidae) have none at all.



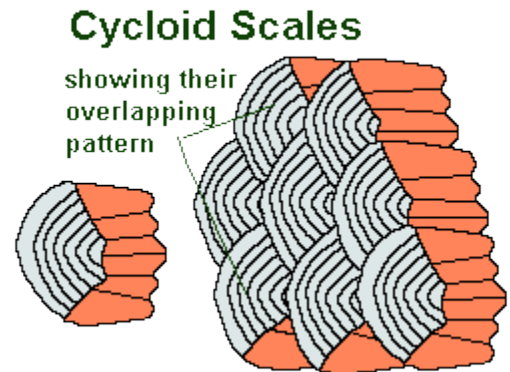
In their primitive form, scales of bony fish they had four layers, one of dense bone, one of spongy bone, one of dentine and one of enamel. Such scales are called 'Cosmoid' and today they only found on the Coelocanth (*Latimeria sp.*) or as fossils.

The remaining bony fishes have scales with only two layers, one calcified and fibrous. There are two main types 'Ganoid' and 'Elasmoid'. Ganoid scales are derived from cosmoid scales and are found on Bichirs, Gars, and Sturgeons. They are hard solid scales.

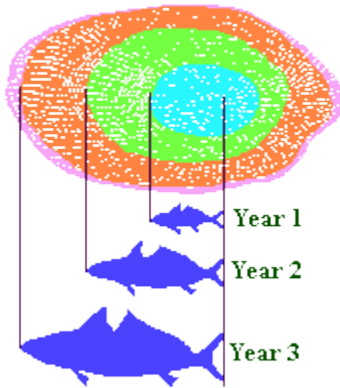
The most common form of scale is the elasmoid scale. It is the thin plate that you find on most fishes. There are two types of elasmoid scales: ctenoid, which



have a set of fine teeth along the posterior edge, and cycloid, which are simply rounded on the outer/posterior edge. However, there are intermediate forms and these two terms are really just adjectives that represent the extremes of a continuum. The scales of a fish may be all of one kind. For example, perch have ctenoid scales while herrings, minnows and trout all have cycloid scales. Or, both type of scales may be found on the same fish. Sea Perches, (*Epinephelus sp.*), have mostly ctenoid scales above the lateral line and cycloid below while Dabs (*Limanda sp.*) have ctenoid scales on the upper coloured surface and cycloid scales on the lower white surface.



**A Diagrammatic Representation of the relationship between the annual growth of a Fish's body and of its scales.**



The scales of modern fish are embedded in, and grow out of, the dermis and are covered entirely by the epidermis. They grow as the fish grow, thus, in many cases, they reflect a history of the fish's life. Experts in scale patterns can not only tell you how old a fish is from its scales, but also how many times it has spawned and if it has been seriously ill.