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# Scales of Fishes

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# Scales in Fishes:

Scales form an important exoskeleton of most species of fish.

Scales are derivatives of mesenchymal cells of dermis. Some fishes devoid of scales, e.g., freshwater catfish.

Certain species exhibit an intermediate condition that are generally naked but possess scales on restricted areas. eg: paddlefish (*Polydon*), in which scales are present in region of throat, pectoral and base of tail.



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**Scales** are modified into teeth, bony armour plates (Sea horse) and spiny stings (sting ray).

In fresh water eel (*Anguilla*), scales are very small and so deeply embedded that the fish appears to be naked.

Mostly scales are arranged in imbricate manner and overlap with free margin directed towards the tail that minimizes friction with water.



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# On the basis of shape, scales are of four types



A. Placoid



B. Ganoid



C. Cycloid



D. Ctenoid



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# Scales are two types according to their origin:

1. Placoid scales, which develop from epidermis as well as dermis found in elasmobranchs.

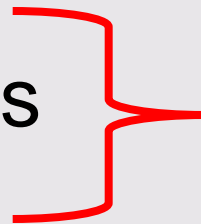
2. Non-placoid scales, which develop from the dermis only as the scales of teleostean fishes.

1. Placoid Scales-plate like

Ganoid scales

Cosmoid scales

Bony ridges



2. Non-placoid scales



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# 1. Placoid Scales

- They are dermal denticles that remain embedded in the skin.
- Each scale consists of a basal plate and a spine projecting out, giving a rough surface to skin.
- The basal plate is made up of a substance resembling cement of teeth secreted by dermis.
- Spine develops from the malpighian layer of the epidermis.
- In structure the placoid scale resembles a tooth.
- The outermost covering of the spine is hard transparent, it is made of enamel, like substance, known as vitrodentine
- The inner layer is the dentine which encloses a pulp cavity.



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The basal plate has a small aperture through which blood vessels and nerves enter into pulp cavity.

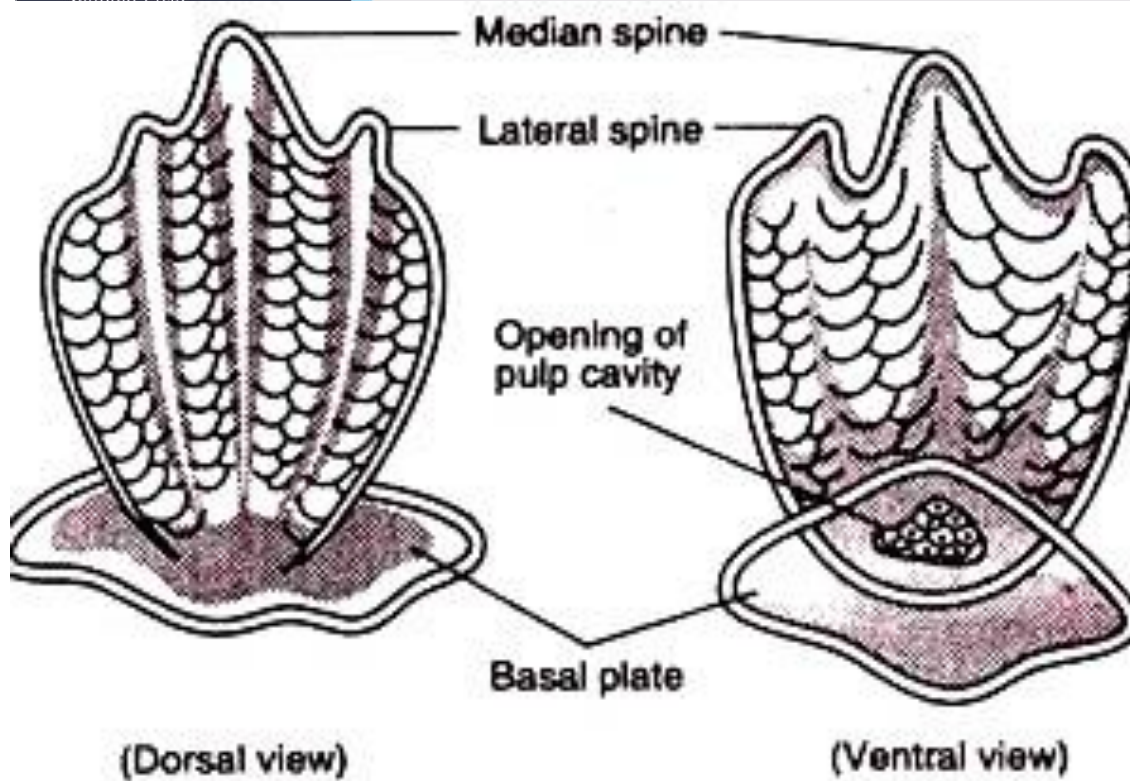
The placoid scales never overlaps each other and are closely set in the skin.

They are partly dermal and partly epidermal in origin and teeth in basic structure.

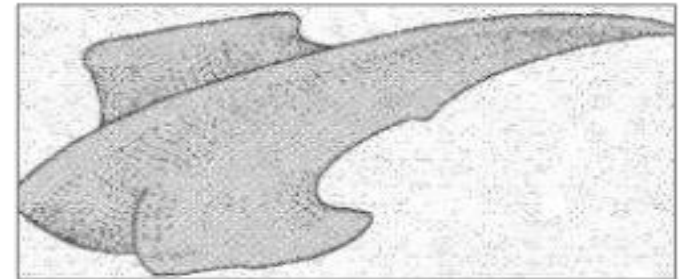
Placoid scales occur among the sharks and their relatives (chondrichthyes)



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**Fig. 3.3(a) : Placoid**



**Figure 19. Placoid Scales**





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# Non-placoid scales

## 1. Cosmoid scale

The cosmoid scales are found in living (Latimaria). The cosmoid scale is a plate-like structure and consists of three layers!

An **outermost** layer is thin, hard and enamel like, called **vitreodentine**.

The **innermost** layer is composed of vascularized perforated bony substance, called **isopedine**.

The middle layer

is made up of hard non-cellular and a characteristic material called **cosmine**

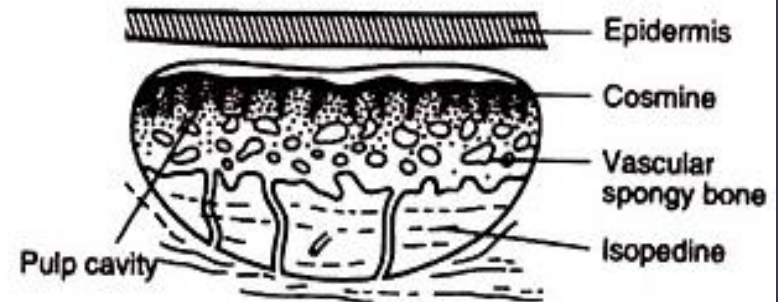


Fig. 3.3(b) : Cosmoid scale (extinct crossopterygians)



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## 2. Ganoid scales

The ganoid scales are thick and rhomboid.

They consist of an outer layer of hard inorganic substance called **ganoine**, which is different from vitreodentine of placoid scales.

The ganoid layer is followed by a cosmine-like layer provided with many branching tubules.

A bony layer of **isopedine** occupies the innermost layer.

These scales, not only grow at the edges but also grow at the surface.

The growth takes place by the addition of new layers of isopedine.

The ganoid scale is best found in the *Polypterus* and *Lepidosteius*.

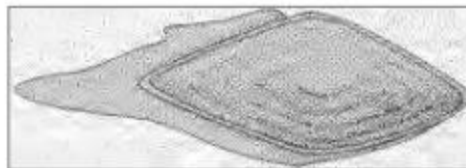
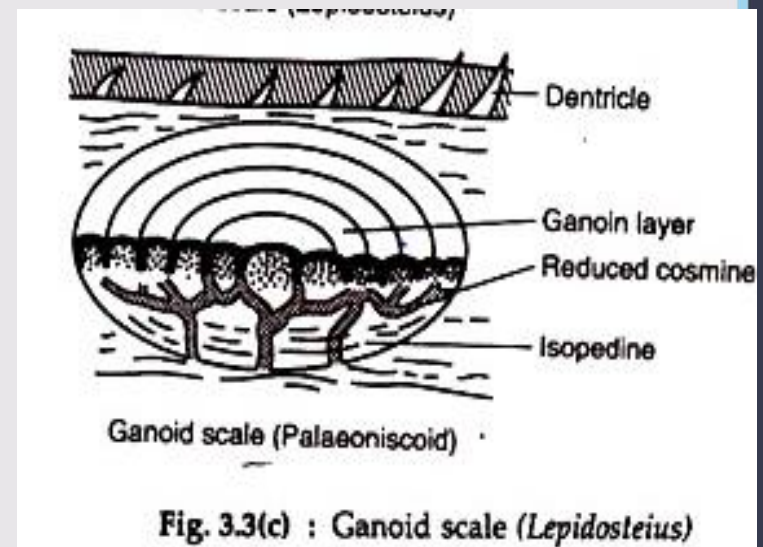


Figure 20. Ganoid scales





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## 3. Bony Ridged Scales:

Bony –ridged scales are typically thin and translucent **lacking** both dense enameled and dentinal layers of the three other kinds.

Bony ridged scales characterizes the many living species of bony fishes (**cycloid or ctenoid**) scales.

The outer layer of there scales is marked with bony ridges alternate with depression.

The inner part or plate of the scale is made up of layers of criss – crossing fibrous connective tissues. The growth of the scales is both on the outer surface and from beneath.



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For ridges on the scale two terms are used **ridges** and **circuli** changes in the growth pattern of the individuals fish is reflected in the character and distribution of ridges.

“Breeding” and “Yearmarks” can be identified on this basis in many species. In both cycloid and ctenoid scales, a nuclear central zone can be recognized.

This zone may be called as “focus” the scale.

However this central position shifts due to differential growth of fore or after part of the scale, shifting the focus to more posterior and anterior margin.

In many species grooves or radii radiate from or near focus towards one or more margins of the scale. The ctenoid scales have teeth on its posterior margins.



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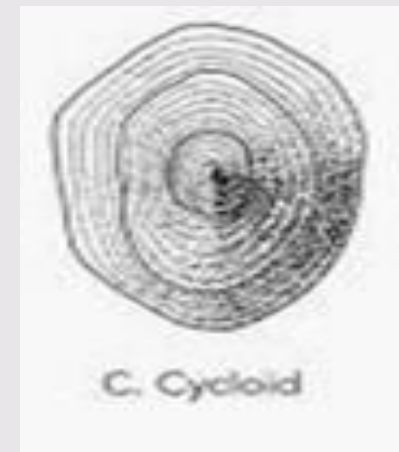
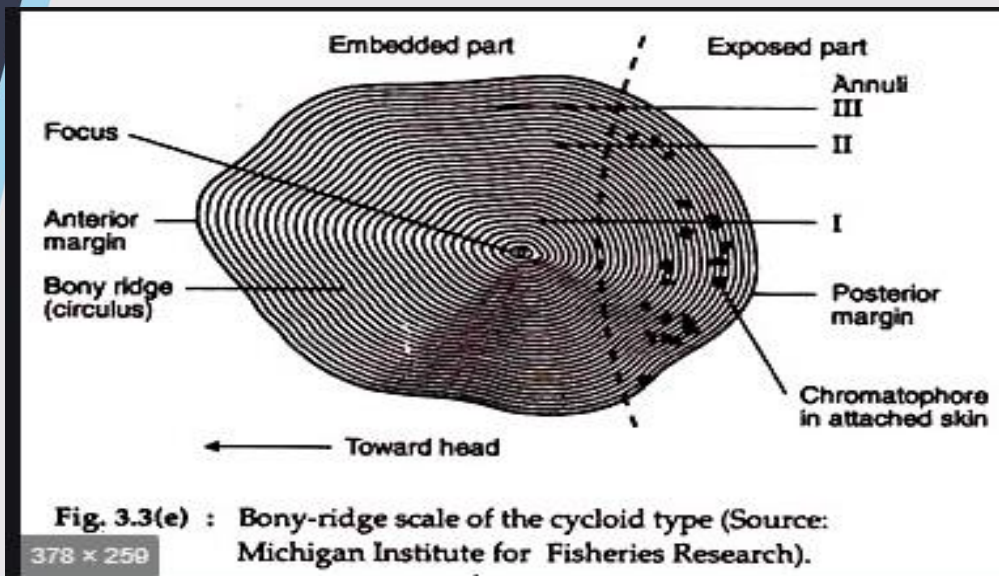
# 3. Cycloid scales

The cycloid scales are devoid of teeth or spines, hence they seem cyclic

They are found in soft-rayed teleost and modern lobe-finned fishes. Eg: Indian Major Carps

But some spiny-rayed fishes, i.e., *Lepidosteius* show presence of cycloid scales.

In *Micropterus*, both cycloid and ctenoid scales are found.





# Ctenoid scales

Ctenoid scales are similar to the cycloid scales, with growth rings.

They have characteristic teeth at its posterior part

Ctenoid scales are found in spiny-rayed teleost. Eg: perciforms

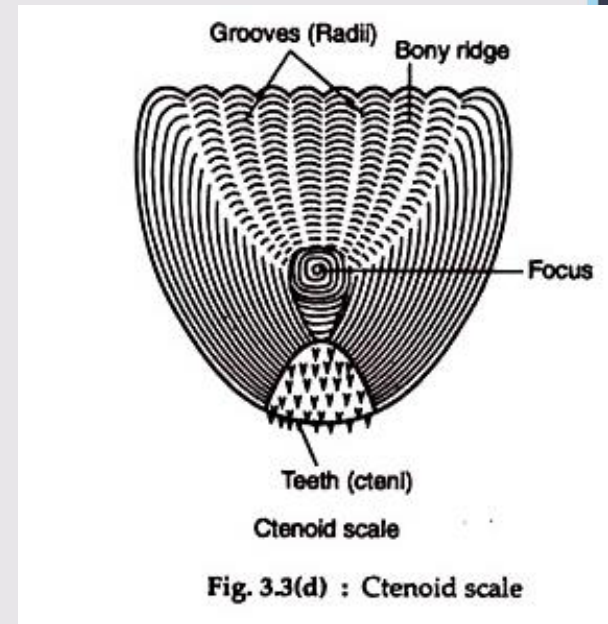
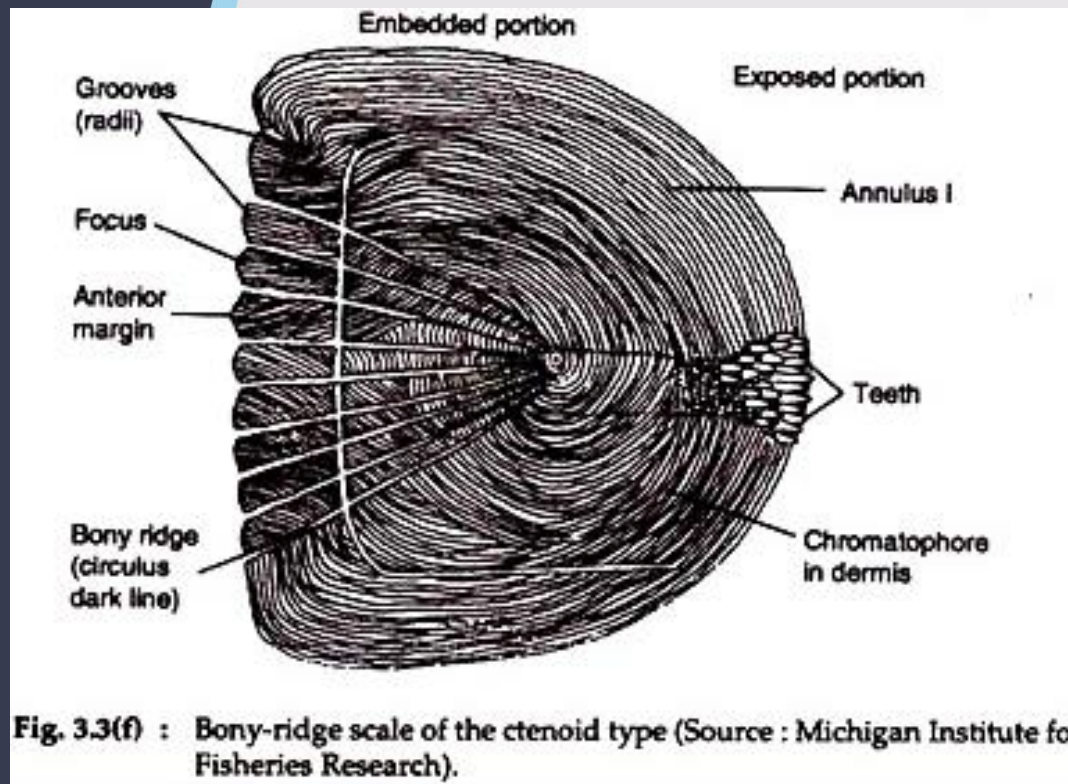


Fig. 3.3(f) : Bony-ridge scale of the ctenoid type (Source : Michigan Institute for Fisheries Research).



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*Thank you*