TYPE OF SCALES IN FISHES

Dr. R. Prasad
Department of Zoology,
Eastern Karbi Anglong College,
Sarihajan

Scales form an exoskeleton in fishes but some fishes are "naked" devoid of scales, e.g., freshwater catfish. Scales are derivatives of mesenchymal cells of dermis. Certain species exhibit an intermediate condition that are generally naked but possess scales on restricted areas. Such condition is found in paddlefish (*Polydon*), in which scales are present in region of throat, pectoral and base of tail. In some fishes, 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.

Fig.2.5: Fossil of a primitive rayfin with ganoid scales (Courtesy: Xocolatl, Wikkipedia)

There are few type of scales based on their structure and shape. The different types of scales are often characteristics of the species. On the basis of shape, scales are of four types:

1. Plate like or placoid scales, which develop from epidermis and dermis and commonly found in Elasmobranches.
2. Non-placoid scales, which develop from the dermis.

These scales are following different types:

a) Cosmoid Scales found in Latemeria.

b) Ganoid scales, common among gars and sturgeons.

c) Cycloid scales found in Burbot and soft-rayed fishes

d) Ctenoid scales, characteristics of spiny-rayed bony fishes (Acanthopterygii).

The Cycloid and ctenoid scales are also known as bony ridge scales.

PLACOID SCALES

Placoid scales are present in sharks and other Elasmobranches. They are small dermal denticles that remain embedded in the skin. Each scale consists of two parts: (i) an upper part, known as ectodermal cap or spine. Outer most covering of the spine is made of enamel, like substance, known as vitrodentine, it is hard and transparent, similar to human tooth.

The inner layer is the dentine that encloses a pulp cavity follows the vitreodentine. (ii) The lower part of placoid scale is a disc-like basal plate, which is embedded in dermis with cap or spine projecting out through epidermis. The basal plate has a small aperture through which blood vessels and nerves enter into pulp cavity. The placoid scales are modified in jaw teeth in sharks; in spines in dorsal fins; in *Squalus* (spiny dogfish); in sting in the stingrays and in saw teeth in the *Pristis*.

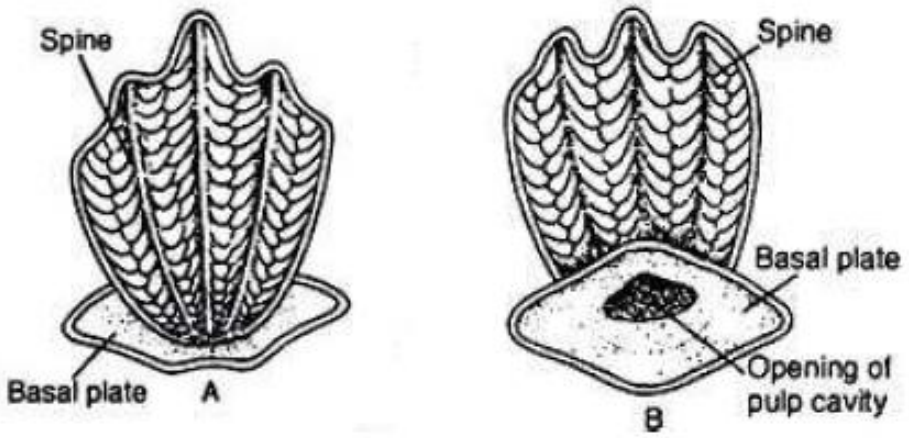

Fig.2.6: Placoid Scale: A. Dorsal View and B. Ventral View

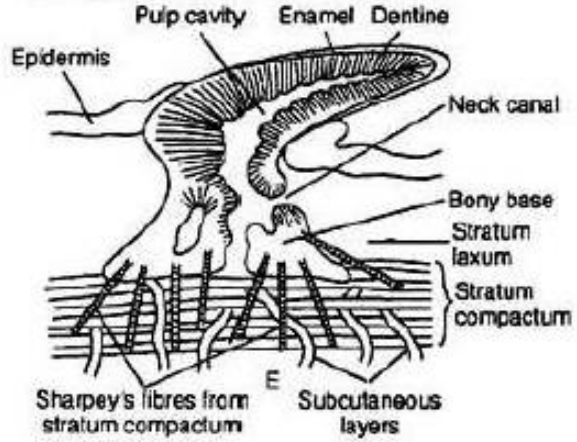

Fig.2.7: Digrammatic sectional view of Integument and the Placoid Scale Embedded in it

The placoid scales do not overlap each other and are closely arranged in the skin. Like the teeth of vertebrates, they are partly dermal and partly epidermal in origin and resemble teeth in basic structure.

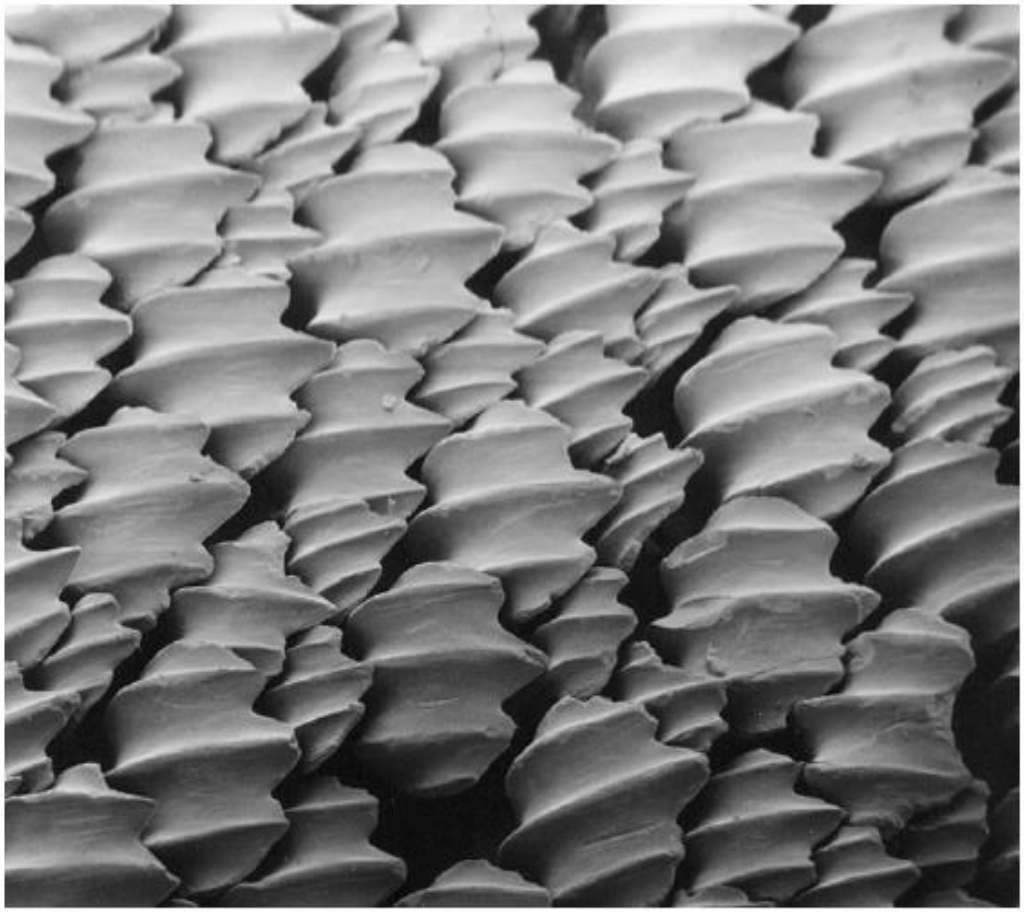

Fig.2.8: Placoid scales (Dermal denticles) of a lemon shark viewed through a scanning electron microscope

COSMOID SCALE

The cosmoid scales were found in the extinct crossopterygii and Dipnoi. In the extant fishes they are found in living *Latimaria* (crossopterygii) and extant Dipnoi. In Dipnoi, the cosmoid scales are highly modified and appear like cycloid scale. The cosmoid scale is a plate-like structure and consists of three layers. An outermost layer is known as vitreodentine. The vitreodentine thin, hard and enamel like substance. The middle layer is made up of hard non-cellular and a characteristic material, called cosmine and is provided with many branching tubules and chambers. The innermost layer is composed of vascularized perforated bony substance, called isopedine. These types of scales grow at the edges from beneath by addition of new isopedine material.

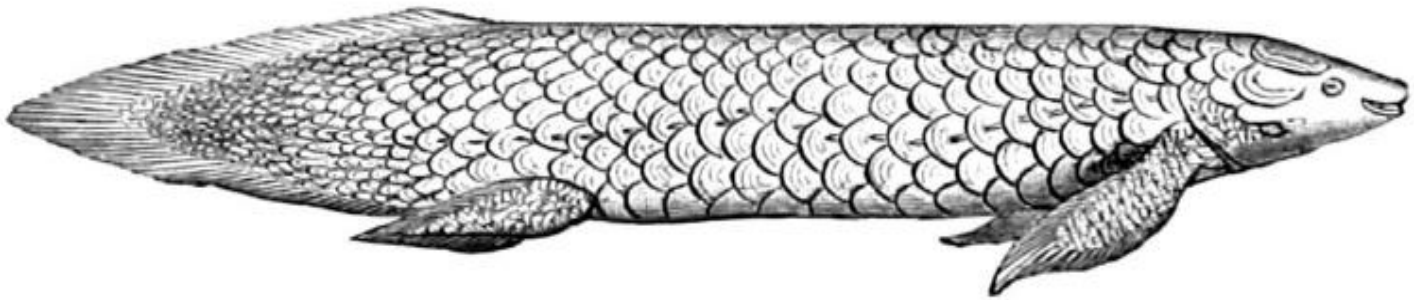

Fig.2.10: Extinct Australian lung fish (Courtesy: W H Flower)

GANOID SCALE

The ganoid scales are thick, heavy and rhomboid. The outer layer of the scale is made up of hard inorganic substance called ganoine. The middle layer is formed of cosmine-like layer provided with many branching tubules. Bony isopedine is the innermost layer. These scales grow at the edges as well as 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*. In these fishes ganoid scales are rhombic plate-like, fitting edge to edge and invest the entire body. In *Acipencer*, the ganoid scales are modified into large bony scutes, arranged into five rows.

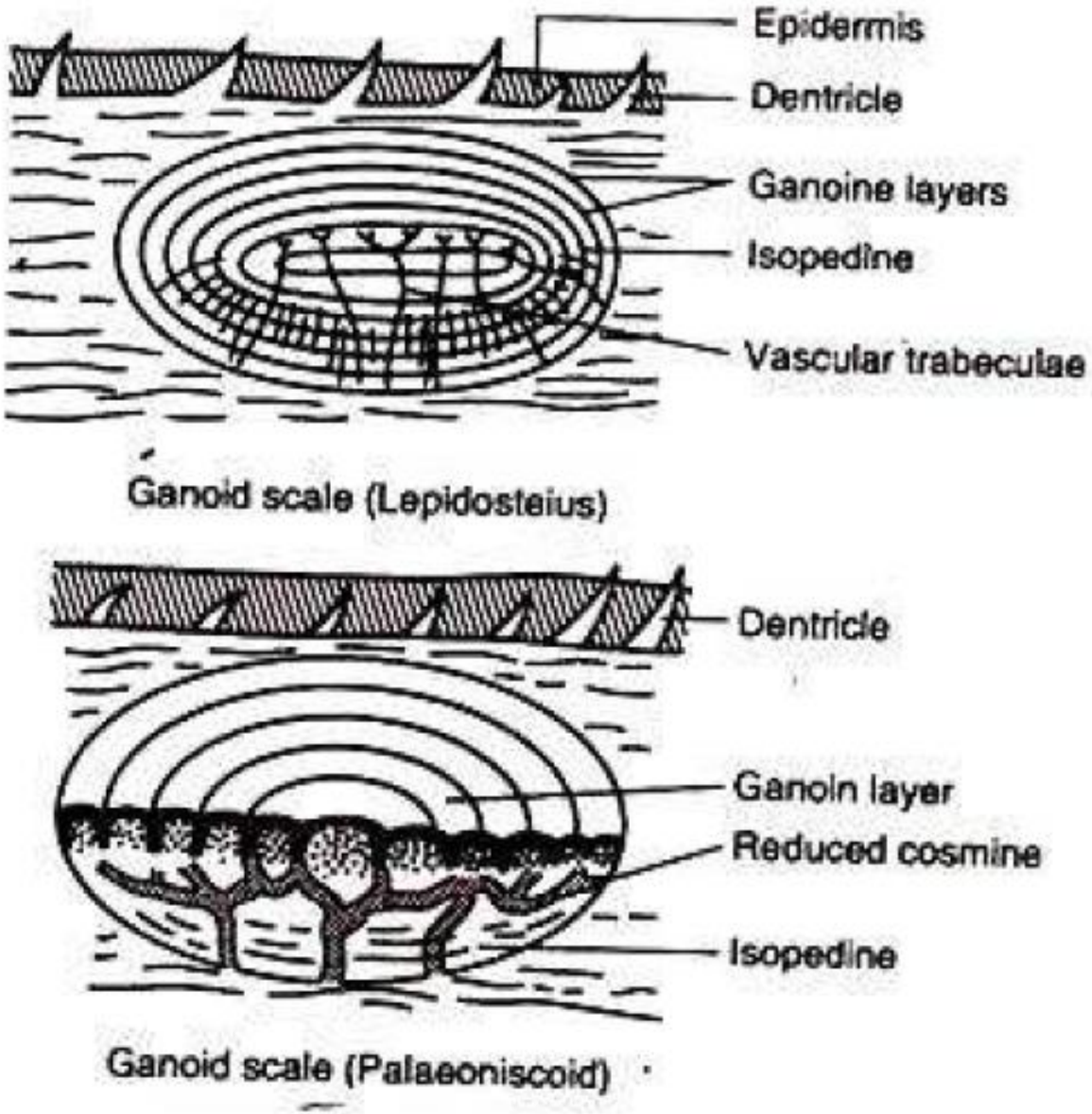

Fig.2.12: Ganoid Scale (Lepidosteius)

BONY-RIDGE SCALE

Bony ridges characterize the bony fishes, Osteichthyes. Due to the absence of dense enamel and dentinal layers these scales are semitransparent and thin. There are of two types of bony ridge scales: cycloid and ctenoid scales. The outer surface of these scales has bony ridges that alternate with groove-like depressions. The ridges are arranged in the form of concentric rings. The inner part of the scale is composed of fibrous connective tissue. The central zone of scale is known as focus of the scale. During the development, focus appears first and lies in the central position. When growth of scales takes place in anterior or posterior parts, it causes shifting of the focus anteriorly or posteriorly, respectively. Later the groves radiate from the focus towards the margin of the scales.

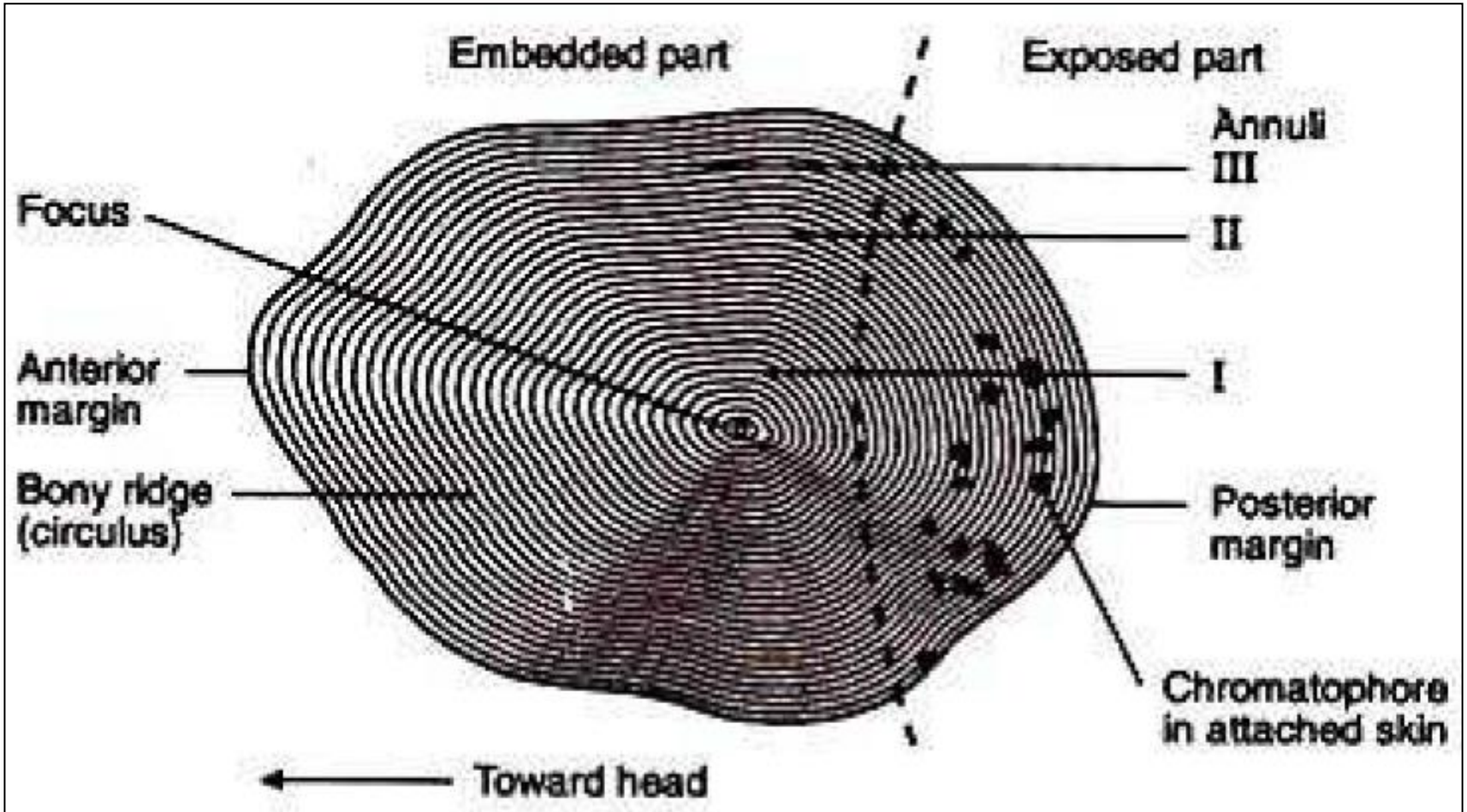

Fig.2.13: Bony Ridge Scale of Cycloid Type

CTENOID SCALE

They have characteristic teeth at its posterior part. Ctenoid scales are found in spiny-rayed teleost eg. Sunfish, Perches etc. They are arranged obliquely in such a manner that the posterior end of one scale overlaps the anterior edge of the scale present behind. The chromatophores are present at the posterior part of these scales.

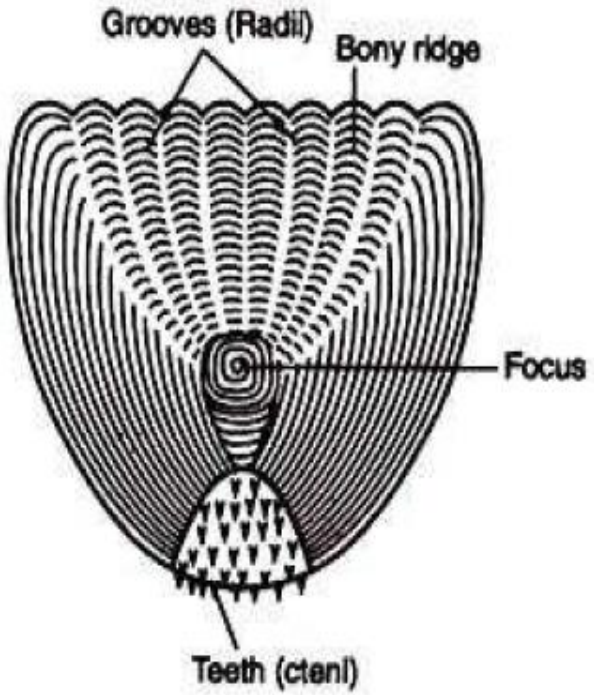

Fig.2.14: Ctenoid Scale

USES OF SCALES

Following are the uses of fishes:

1. Scales play very important role in the identification and classification of fish.

2. Scales are used in calculating the age of fishes and rate of their growth. The age of fish could be determined by measuring space in annual rings of the scales.

3. In some species like Atlantic *Salmon*, the scales exhibit the presence of spawning marks on them. These marks indicate how many times the fish has spawned and the time of first spawning also.

4. Scales provide important information about extinct fishes and are useful in identifying food habits of piscivorous animals.