

FYUGP 2ND SEMESTER
ZOO-151: DIVERSITY OF CHORDATES

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Topic: **General Characteristics and Classification of Chondrichthyes** (up to order)

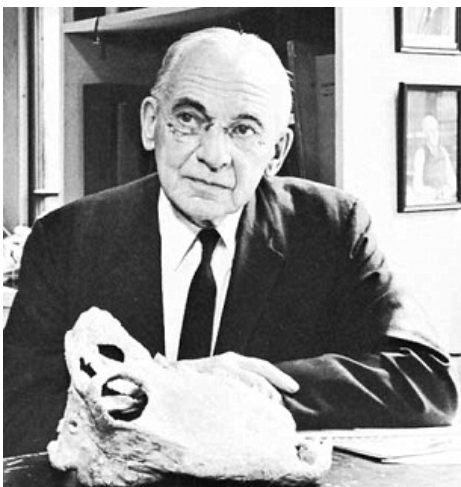
The Superclass Pisces (*L. Piscis* = fish) are the truly jawed vertebrates. They have organs of respiration and locomotion related to permanent aquatic life. The respiratory organs are the gills and the organs of locomotion are paired and unpaired fins. All are poikilothermous.

J. Muller (1844) gave the first classification of lower vertebrates and divided Class Pisces into 6 subclasses:

1. Dipnoi
2. Teleostei
3. Ganoidei
4. Elasmobranchii
5. Marsipobranchii (Cyclostomi)
6. Leptocardii (Amphioxini)

L.S. Berg (1940) classified the Pisces series into 7 classes:

1. Pterichthys
2. Coccostei
3. Acanthodii
4. Elasmobranchii
5. Holocephali
6. Dipnoi
7. Teleostomi



Alfred Sherwood **Romer** (1971) classified the super-class Pisces into four classes:

1. Agnatha (Jawless vertebrates)
2. Placodermii (armoured or plate-skinned fishes)
3. Chondrichthyes (Cartilaginous fishes)
4. Osteichthyes (Bony fishes)

*The classification followed here is based on that of Romer.

CHONDRICHTHYES

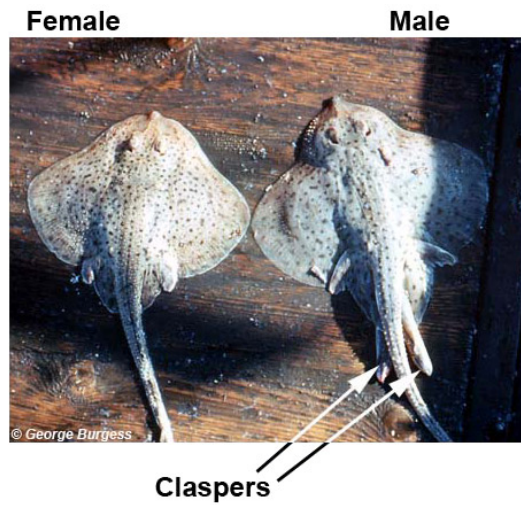
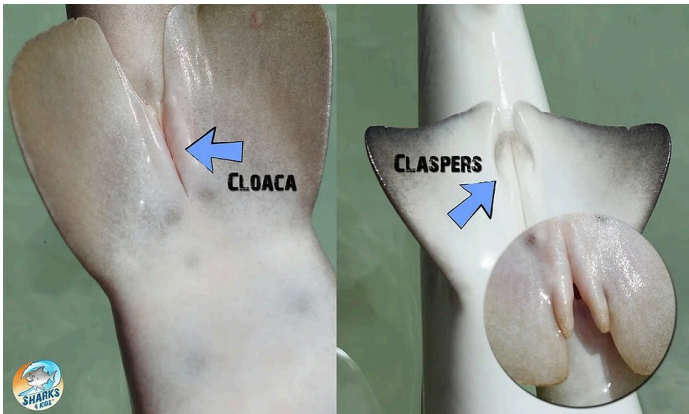
(Gr., *chondros* = cartilage; *ichthys* = fish)



Clearnose skate

General Characters:

1. They are mostly marine fishes.
2. The body is fusiform/spindle-shaped.
3. Fins both median and paired, all supported by fin-rays. The pelvic fin bears claspers in males (These are used to transfer sperm to the cloaca of a female). Tail heterocercal. The tail has two lobes, the upper lobe is elongated and vertebrae extend into it and a shorter lower lobe, giving rise to the distinct heterocercal tail.



4. Skin is covered with placoid scales (aka dermal denticles) or naked or bear mucous glands.
5. They have cartilaginous endoskeleton, often calcified, without true bones. Notochord is persistent throughout life. Vertebrae complete and separate. Pectoral and pelvic girdles are present.
6. The mouth is present ventrally. Jaws are present. Teeth are modified placoid scales and are not attached to the jawbones. They are embedded in the tissue. Old teeth fall and are continuously replaced by the new teeth formed behind them.
7. Respiration by gills. They contain 5-7 pairs of gills. Operculum/gill cover absent. Gaseous exchange occurs through the water current that passes over the gills.

8. They lack air bladders so they swim actively to avoid sinking.

9. They are poikilotherms or cold-blooded animals and cannot regulate their internal body temperature.

10. They are predatory fishes, they feed on other fishes, crustaceans and molluscs. Some species filter food particles like plankton from the water

current that passes through the mouth, pharynx and gills.



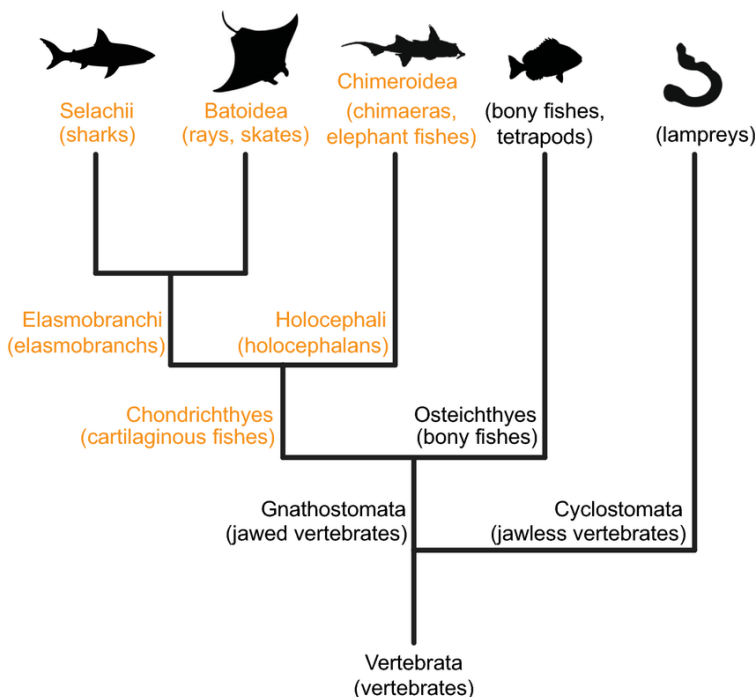
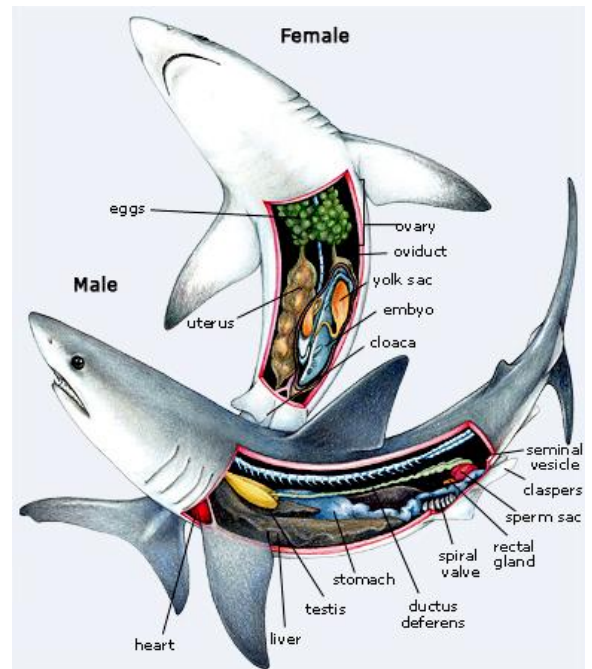
Cetorhinus maximus (Basking shark) - Planktotropic

11. The heart is two-chambered and contains one auricle and one ventricle.
12. Excretion is ureotelic.
13. Brain with large olfactory lobes. Ten pairs of cranial nerves. Sense organs are well developed. They can detect their prey electrically. Among cartilaginous fishes, electric organs are found only in skates and electric rays. Ampullae of Lorenzini are a network of small jelly-filled pores called electroreceptors that help the fish sense electric fields in water. This aids in finding prey, navigation, and sensing temperature.



Ampullae of Lorenzini of an immature female winter skate (*Leucoraja ocellata*), visible on the surface of the skin as small black pores.

14. It also has sensory cells in the lateral line organ, which detect all kinds of vibration, motion, and water pressure surrounding them.
15. The digestive system comprises a mouth, pharynx, stomach, intestine (straight) and cloaca present on the ventral side. Cloaca has a dual function in females and also acts as a reproductive organ apart from excretion.
16. Sexes are separate and have internal fertilization. Skates and some sharks are oviparous, most of the sharks are ovoviviparous and a few are viviparous. Eggs are large and yolky. Development is direct without metamorphosis.



CLASSIFICATION:

Chondrichthyes is subdivided into 2 subclasses:

Subclass 1: Elasmobranchii

Order: Pleurotremata (sharks)

Order: Hypotremata (skates, rays)

Subclass 2: Holocephalii

ELASMOBRANCHII

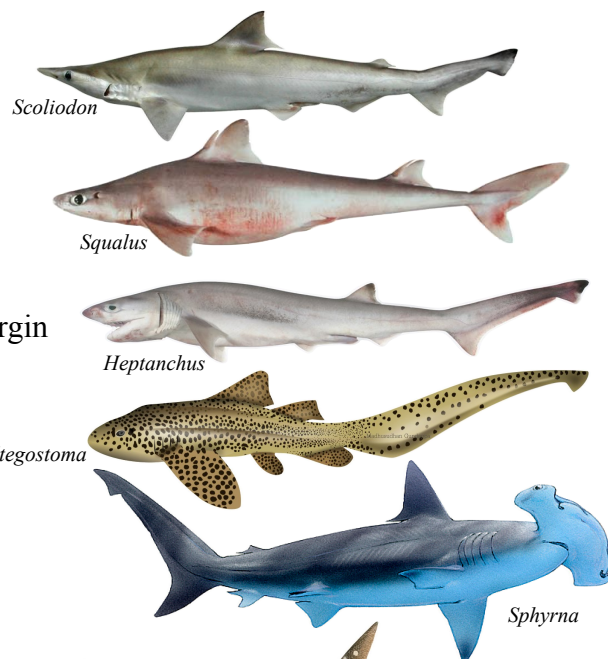
The skeleton is made of cartilage rather than bone. Five to seven-gill openings on each side. Rigid dorsal fins (and spines if present). Spiracles to aid in breathing. Placoid scales (dermal denticles). The upper jaw of elasmobranchs is not fused to their skull. Elasmobranchs have several rows of teeth which are continually replaced. They don't have swim bladders, but instead, their large livers are full of oil to provide buoyancy. Elasmobranchs reproduce sexually with internal fertilization and either bear live young or lay eggs.

Pleurotremata / Squaliformes

(Gr., *pleuro*=side; *trema*=opening)

1. Body typically spindle-shaped.
2. Gill slits lateral. 5-7 pairs.
3. Spiracles small.
4. Pectoral fins moderate, constricted at the base. Anterior margin of the pectoral fins free.
5. Hyomandibular bearing branchial rays.
6. Two halves of pectoral girdle are dorsally separated.
7. Tail heterocercal.
8. Examples:

Dogfishes (*Scoliodon*, *Chiloscyllium*, *Mustelus*, *Carcharinus*)
 Spiny dogfish (*Squalus*)
 Seven-gilled shark (*Heptanchus*)
 Zebra shark (*Stegostoma*)
 Hammerhead shark (*Zygaena* or *Sphyrna*)
 Whale shark (*Rhincodon*)

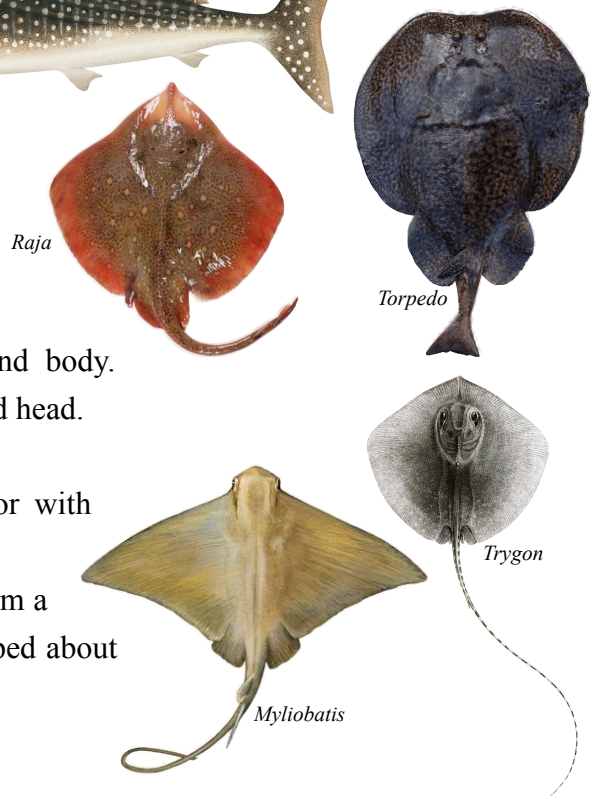


Hypotremata / Rajiformes (Batoidea)

(Gr., *hypo*=below; *trema*=opening)

1. Body depressed, flattened dorso-ventrally.
2. Gill slits ventral, 5 pairs.
3. Spiracles large and functional.
4. Pectoral fins enlarged, fused with the side of the head and body. Anterior margins of the pectorals fused with sides of the body and head.
5. No branchial rays on hyomandibular.
6. Two halves of pectoral girdle are joined with each other or with vertebral column.
7. In stingrays and bat rays, the tail contains a spine modified from a placoid scale with a venom gland at its base. The spine is whipped about by the tail in defence against large predators such as sharks.
8. Examples:

Skate (*Raja*), Stingray (*Trygon*), Electric ray (*Torpedo*)
 Eagle ray (*Myliobatis*), Guitar fish (*Rhinobatos*), Sawfish (*Pristis*)



HOLOCEPHALII

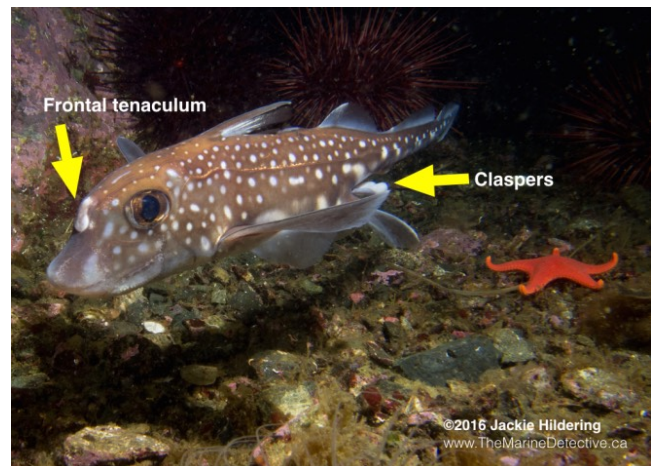
(Gr., *holos*= entire, *kephale*= head)

1. Single gill opening on either side covered by a fleshy operculum.
2. No scales, spiracles and cloaca.
3. Jaws with tooth plates.
4. Nasal opening single.
5. Lateral line system with open groove.
6. Males with claspers (behind pelvic fins). Also, the presence of a cephalic clasper on the head of the male (known as tentaculum), and also a pair of claspers covered with denticles, situated anterior to the pelvic fins.
7. Tail long and thin. It is generally heterocercal but in *Chimaera*, it appears to be diphyrcal.
8. Examples:

Rat fishes or Chimaeras (*Hydrolagus*)



Male spotted ratfish



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Harriotta avia (a new species of ghost shark discovered in 2024, Sept.)

