Lecture 28
Echinodermata and Chordata

Phylum Echinodermata

1. Echinoderms include common seashore animals such as seastars (also known as "starfish"), sand dollars and sea urchins, along with hundreds of more exotic forms. Their basic body plan is very different from other animals, but their closest living relatives are the Phylum Chordata (which includes the vertebrates).

2. Echinoderms are exclusively marine, and most are benthic. They are present in virtually all marine environments of normal salinity, from the shallow intertidal to the abyssal zone. Many echinoderms are suspension feeders, while others are predators, scavengers and herbivores. A few are deposit feeders.

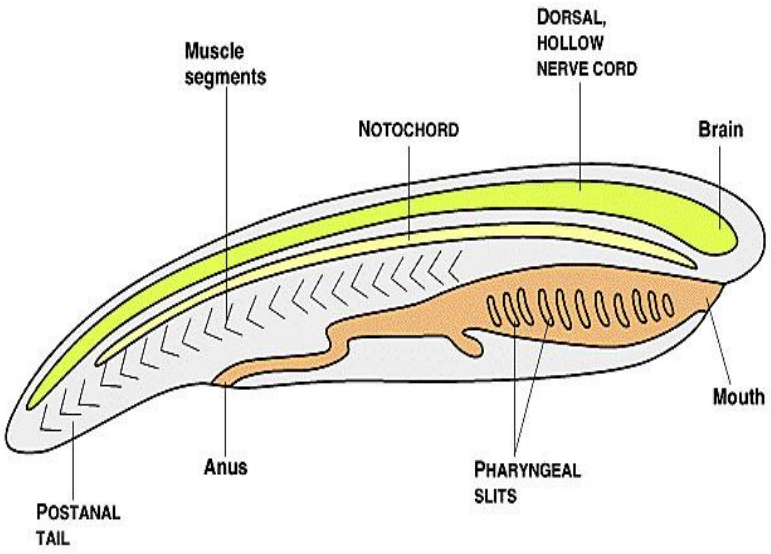
3. Although the phylum is quite diverse, echinoderm physiology and their body plan display a surprising uniformity. They are characterized by an internal skeleton (endoskeleton) composed of calcitic plates (ossicles), and a water vascular system. The ossicles have a porous microstructure that is distinctive.

Phylum Chordata

The Phylum Chordata includes the well-known vertebrates (fishes, amphibians, reptiles, birds, mammals). The vertebrates and hagfishes together comprise the taxon Craniata. The remaining chordates are the tunicates (Urochordata), lancelets (Cephalochordata), and, possibly, some odd extinct groups. With few exceptions, chordates are active animals with bilaterally symmetric bodies that are longitudinally differentiated into head, trunk and tail. The most distinctive morphological features of chordates are the notochord, nerve cord, and visceral clefts and arches. Members of the phylum Chordata are bilaterally symmetric, deuterostome coelomates, and the vertebrate chordates display segmentation.

Characteristics of the Chordates

1. Single, hollow nerve cord beneath dorsal surface; in vertebrates, it differentiates into brain and spinal cord
2. Notochord: flexible rod on the dorsal side of gut, present at one stage in all chordates; displaced in vertebrates by vertebral column that forms around the nerve cord
3. Pharyngeal slits (pouches) connect pharynx (between mouth and esophagus) with outside Gills in sharks, fish; present in terrestrial animal embryos but disappear later except Eustachian tube (connecting throat and middle ear)
4. Postanal tail extends beyond anus; present at least in embryo; regresses into tail bone in humans
5. Segmentation: reflected in arrangement of muscles (somites) and in vertebral column (both mesoderm)



A Chordate Anatomy

Invertebrate Chordates

<u>Sub-phylum Urochordata</u>

The tunicates are marine, filter-feeding animals. The most prominent tunicates are the sea squirts (class Ascidiacea), which show affinities to other chordates only in the juvenile stage. Adult sea

Squirts are sessile (attached), globular or tubular animals, often with prominent incurrent and excurrent siphons; many kinds grow in colonies. Most of the body of the adult is occupied by a very large pharynx with numerous gill slits that act as a sieve for food. Water taken into the incurrent siphon enters the pharynx and passes out through the gill slits, leaving food particles trapped in the pharynx. A groove in the pharynx called the endostyle secretes mucus that traps

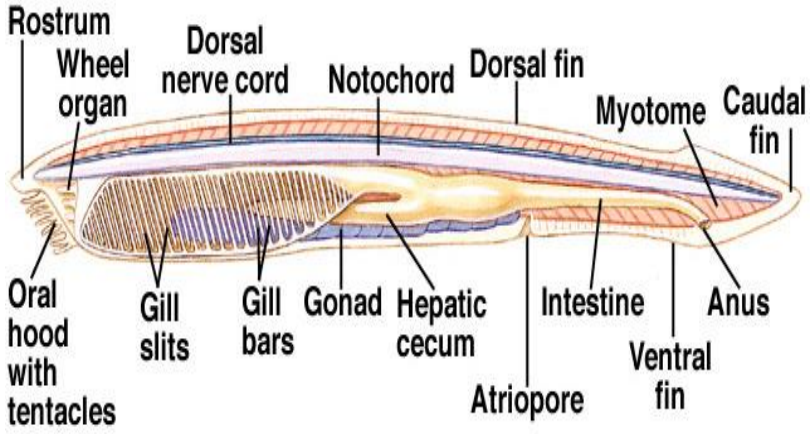
the particles and conveys them into the digestive tract; the movement of the mucus is caused by the action of cilia. Water leaves the atrium, a sac surrounding the pharynx, by way of the excurrent siphon. Thus the gill slits in tunicates serve a feeding function, not a respiratory function.

Chordate Metamerism

The repetition of organs and tissues at intervals along the body of an animal, thus dividing the body into a linear series of similar parts or segments (metameres). It is most strikingly seen in Annelida. Essentially, metameric segmentation is an internal, mesodermal phenomenon, the body musculature and coelom being the primary segmental divisions; this internal segmentation imposes a corresponding segmentation on the nerves, blood vessels, and excretory organs. In some metameric animals the segmentation is visible externally but in others (e.g. Chordata) external segmentation has been lost and internal segmentation is best seen in the embryo. Metameric segmentation is thought to have arisen as an adaptation to more efficient locomotion.

Sub-phylum Cephalochordata

This class includes the several species of lancelets, or amphioxi, small, fishlike, filter-feeding animals found in shallow water. A lancelet has a long body, pointed at both ends, with a large notochord that extends almost from tip to tip and is present throughout life. At one end is a mouth surrounded by prominent bristles and leading into a pharynx. The pharynx has gill slits, an endostyle similar to that of a sea squirt, and an atrium surrounding the pharynx. Water enters the mouth and leaves through the gill slits, and food is trapped in the pharynx. The dorsal, tubular nerve cord is slightly enlarged in the anterior region, forming a rudimentary brain. Nerves extend from the nerve chord to other parts of the body. The muscles, as in fishes, are a series of cone-shaped blocks that fit into each other like stacked paper cups.



Sub-phylum Vertebrata

General Characteristics

• Usually well cephalized, including a number of anterior sensory structures.
• Brain is in a skull.
• Mostly, the embryonic notochord is replaced by a *vertebral column***.**
• Possess a distinctive endoskeleton consisting of vertebral column, limb girdles, two pairs of jointed appendages, and a head skeleton
• Muscles are attached to the skeleton to provide movement
• Closed circulatory system with a well-developed muscular heart.
• Blood is oxygenated as it flows through vascularized skin, gills or lungs.

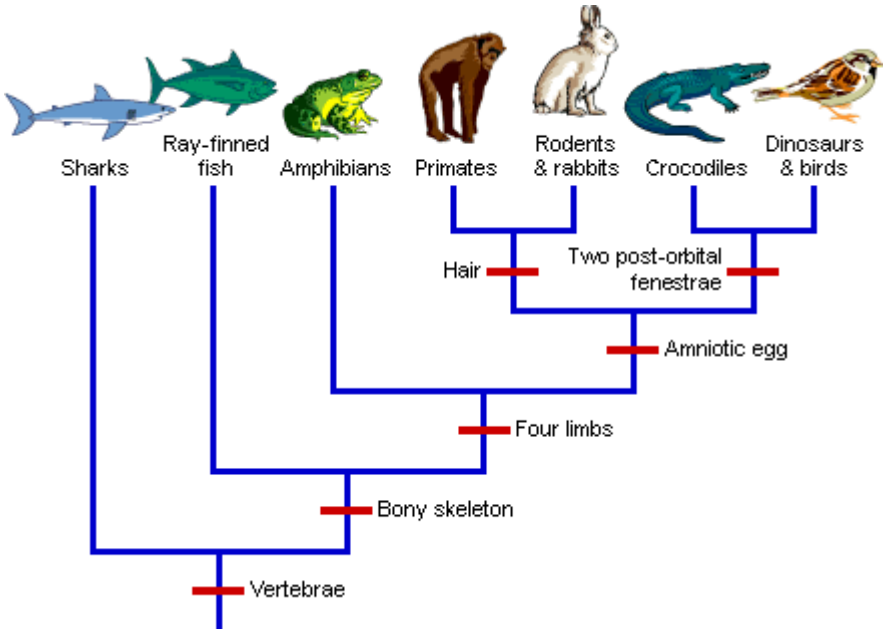
Evolutionary Relationships of Vertebrates

1) Vertebrate animals have come a long way since their tiny, translucent ancestors swam the world's seas over 500 million years ago.

2) The major vertebrate animal groups, ranging from fish to amphibians to mammals, with some notable extinct reptile lineages (including archosaurs, dinosaurs and pterosaurs) in between.

3) This idea is supported by the discovery of a fossilized mid-Cambrain invertebrate chordate from the Burgess Shale formation – *Pikaia*

4) A ribbon shaped, somewhat fish-like creature about 5 cm in length
5) It possessed a notochord and the V-shaped myomeres.
6) Resembles Amphioxus, and may very well be an early cephalochordate.



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