



Animals: The Vertebrates

Animals with backbones:

Fishes, Amphibians, Reptiles,
Birds, Mammals



Outline

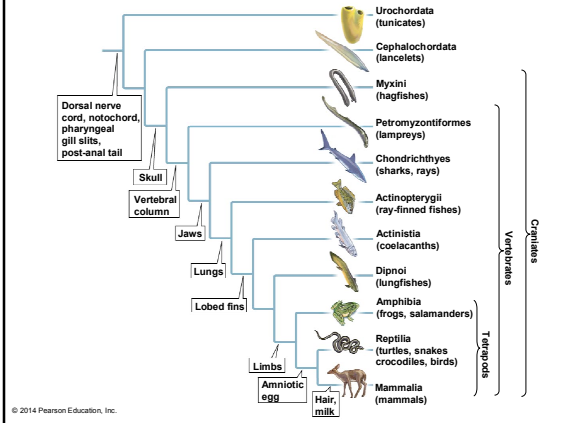
1. Key concepts
2. Evolution of the Vertebrates
3. Overview of the Chordata
4. Classification
5. Major groups and representatives
6. Conclusions

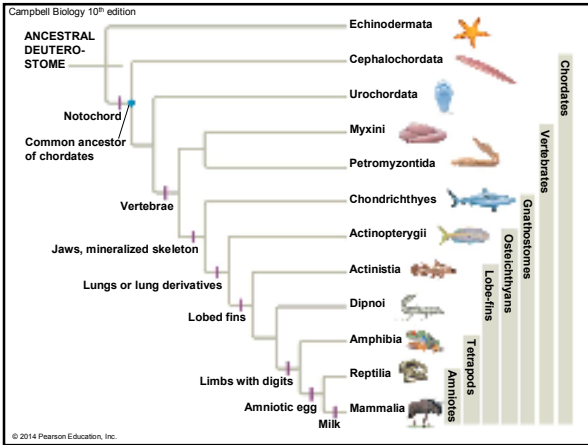


Key Concepts:

1. The Chordates include invertebrate and vertebrate species
2. Existing invertebrate chordates include the tunicates and lancelets
3. There are several groups of vertebrates with living representatives

Figure 24-1 An evolutionary tree of the chordates





Overview of the Chordata

1. Some invertebrates
2. Vertebrates
 - Backbone
 - Brain in skull or chamber
3. features in embryos
 - Notochord - a stiff but flexible rod (for muscle attachment); In vertebrates, the notochord develops into the vertebral column
 - Nerve chord (dorsal, hollow)
 - Pharynx with slits
 - Tail that extends past anus



Chordata Classification

Three subphyla

1. **Urochordata**
Tunicates
2. **Cephalochordata**
Lancelets
3. **Vertebrata**
Craniates

Seven classes of vertebrates

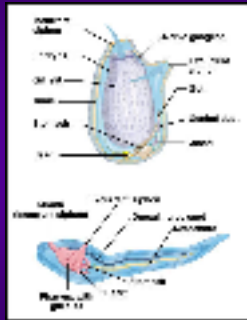
1. Agnatha (Jawless fishes)
2. Chondrichthyes (Cartilaginous fishes)
3. Osteichthyes (Bony fishes)
4. Amphibia
5. Reptilia
6. Aves ???
7. Mammalia



Invertebrate Chordates

Tunicates

1. Living sacs
2. Gills slits
3. Nerve cord
4. Notochord
5. Tail

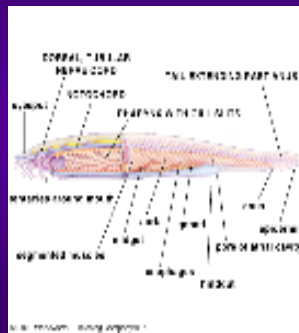


Larva -----> Adult



Lancelets

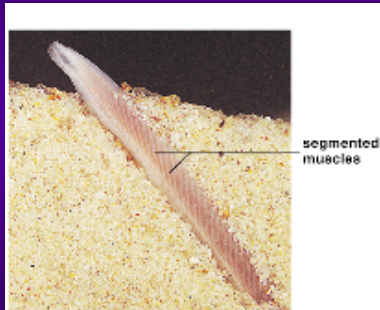
1. Live offshore
Seafloors
2. Features
 1. Segmented pattern of muscles
 2. Notochord
 3. Closed circulatory system
 4. Nerves





Lancelets

Lancelet burrowed in sediments



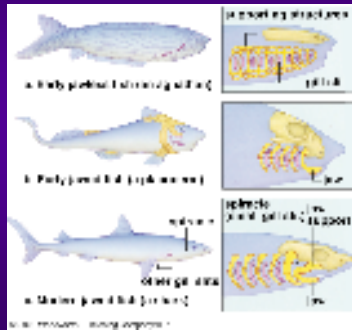
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Evolutionary Trends Among the Fishes

Fishes

1. Notochord ---> vertebrae
2. Endoskeleton
3. Jaws are modifications of the anterior gill supports



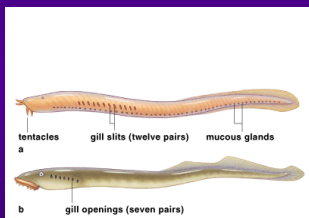


The First Vertebrates (Jawless fishes)

Body Plan of Hagfish and Lamprey

Two kinds of fishes

1. Jawless
Agnatha
Hagfish
lamprey
2. Jawed



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Existing Jawed Fishes

1. Dominant vertebrates
2. Cartilaginous fishes (ca. 1,000)
Sharks, rays, chimaeras
3. Bony fishes (30,000 species)
Most numerous and diverse



Cartilaginous fishes Shark

Blue-spotted reef ray

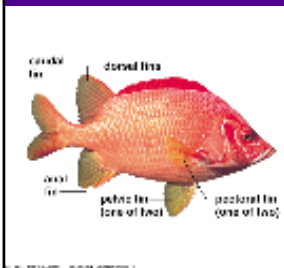


Chimaera, sometimes called a ratfish

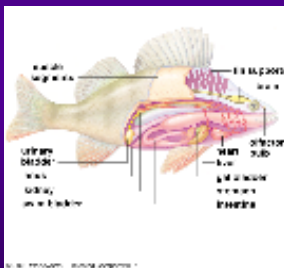


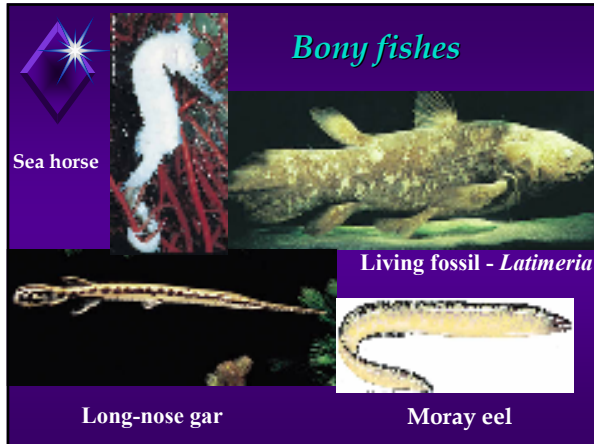
Common Features of Bony fishes

Fins of a soldierfish



Internal organs of a perch





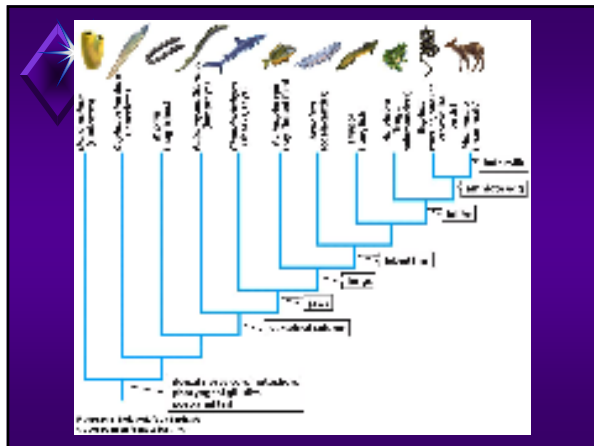
Amphibians

•Amphibians Are Terrestrial Animals That Begin Their Lives in Water (6,500 species)

- Amphibians are only partially adapted to a terrestrial life.
- Most amphibian life begins at fertilization in water.
- The fertilized egg develops into an aquatic tadpole which obtains oxygen through its gills.
- Lungs, smooth skin for gas exchange as adults; gills as tadpoles. Limbs in adult stage instead of fins.
- External fertilization.
- The tadpole undergoes **metamorphosis** to become a terrestrial adult.

Amphibians

Evolution of skeletal elements



Amphibians

1. Salamanders walk like fish swim
Bending side to side
2. Frogs and toads are most successful amphibians
Powerful muscles
3. Caecilians
No limbs
Live in soil

The complex block contains three numbered points describing amphibians. Each point is accompanied by a small photograph. Point 1 shows a bright red salamander. Point 2 shows two images: a green frog leaping and a brown toad. Point 3 shows a blue, worm-like caecilian.

The Rise of Reptiles

8,200 + species

1. From amphibians
2. Escape from aquatic habitats
3. Adaptation
 1. Tough, dry, scaly skin (prevents water loss)
 2. Internal fertilization
 3. Reptilian kidneys conserve water
 4. Production of amniotic eggs



The Rise of Reptiles

- ◆ The **amnion** is a membrane within the egg that encloses the embryo within a fluid environment.

- ◆ The amniotic egg eliminated the need for an aquatic stage of the life cycle.

The amniotic egg was so successful that it is seen in all reptiles as well as their descendents.

- ◆ For example, all **birds** and **mammals** contain an amniotic egg.



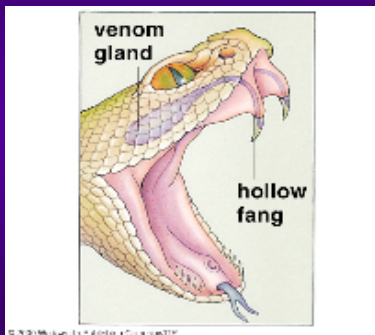
Reptiles

1. Crocodylians
Crocodyles and alligators
2. Turtles
3. Lizards and snakes
95% of reptiles
4. Tuataras
2 species exist
New Zealand





A Rattlesnake in Mid-Strike



Reptiles

marine turtle Galapagos tortoise

frilled lizard rattlesnake

Birds

10,000 species

Traits shared with reptiles: scales on feet, amniotic eggs

- Beaks
- Feathers (flight, heat conservation and social displays)
- Light, hollow bones
- Digestive organs called gizzards

Birds

Descended from reptiles

Lay eggs

Diagram of an Egg



Birds



hummingbird



ostriches



The Rise of Mammals

1. 5,000 species
2. Hair (aids in heat conservation)
3. Mammary glands
4. Care of young
5. highly developed cerebral cortex



New World monkeys



Old World monkeys





Mammals



A female koala and her albino baby in the San Diego Zoo



Spiny anteater (*Tachyglossus*)



Tasmanian devil



In Conclusion

- 1. Chordate embryos have a notochord, a dorsal nerve cord, a pharynx with gill slits, and a tail*
- 2. There are several groups of vertebrates with living representatives*
- 3. The earliest vertebrates are the jawless fishes*
- 4. Amphibians were the first vertebrates to invade land but they never fully escaped the water*

In Conclusion

- 5. Reptiles escaped the water*
- 6. Birds alone have feathers, which they use in flight, heat conservation, and social displays*
- 7. Mammals have milk-producing mammary glands, hair, and a highly developed cerebral cortex*



See you later