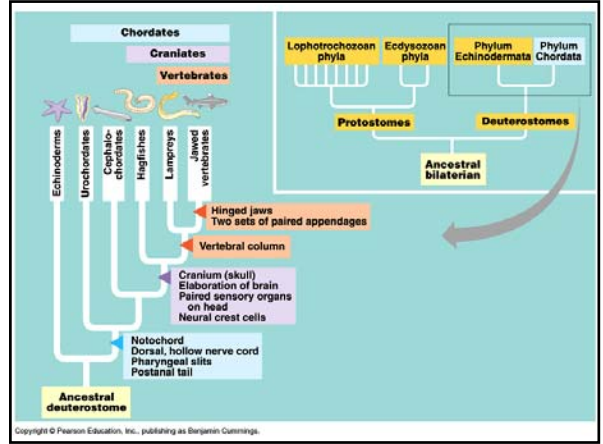




Ch 34 Vertebrate Evolution and Diversity

AP Biology
Mrs. King



Overview

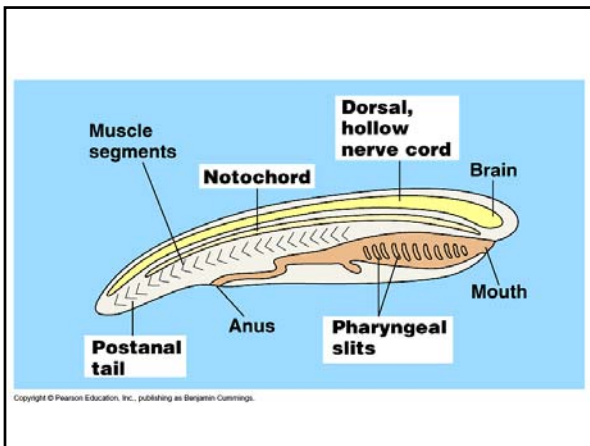
- Invertebrate Chordates and the Origin of Vertebrates
- Introduction to the Vertebrates
- Superclass Agnatha
 - Jawless Fishes
- Superclass Gnathostomata I
 - The Fishes
- Superclass Gnathostomata II
 - The Tetrapods
- Primates

Invertebrate Chordates and the Origin of Vertebrates

- Three subphyla:
 - Urochordata
 - Cephalochordata
 - Vertebrata
- common characteristics:
 - notochord
 - dorsal, hollow nerve cord
 - pharyngeal slits
 - muscular postanal tail

Tunicates

Lancelets



Invertebrate Chordates

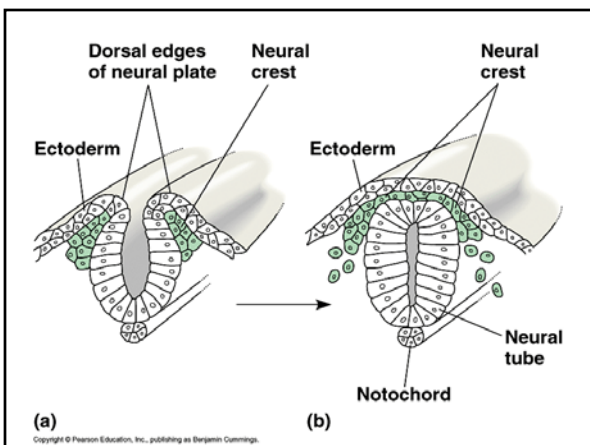
- **Urochordata**
- filter feeders
- sessile, marine animal
- larval forms contain chordate characteristics
- adults lack notochord, nerve cord, and tail
- **Cephalochordata**
- Lancelets
- marine filter feeders
- burrow into sediment
- Feeble swimmers

Relationship of Invertebrate Chordates to the Vertebrates

- Vertebrates first appeared 500,000,000 years ago
- first vertebrates probably possessed all four chordate characteristics
- probably resembled lancelet
- Probably evolved by *paedogenesis*
- (*precocious attainment of sexual maturity in larva*)

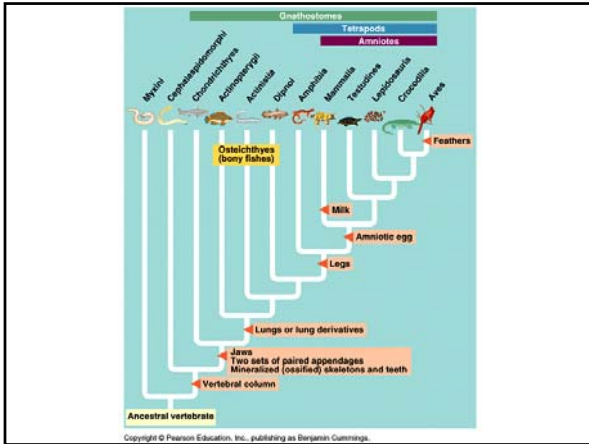
Introduction to the Vertebrates

- Special characteristics:
- neural crest-helps form cranium
- **cephalization**-brain with associated sensory apparatus
- skeleton with a cranium and vertebral column



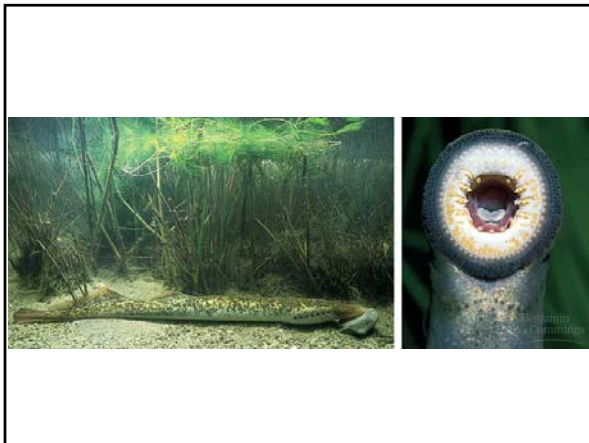
Overview of Vertebrate Diversity

- **Agnatha**
- superclass
- lack jaws
- **Gnathostomes**
- jawed fishes and
- **tetrapods**-two pairs of limbs, terrestrial, **amniote egg**



Agnatha: Jawless Fish

- Lack paired fins
- 60 extant species
- lampreys and hagfish
- parasitic forms and scavengers



The Fishes

- Extinct group called *placoderms*, armored fish
- Jaws evolved from gill accessories
- Chondrichthyes and osteichthyes are extant classes

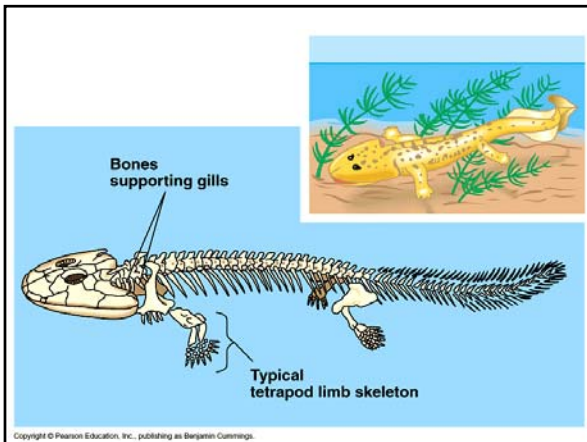
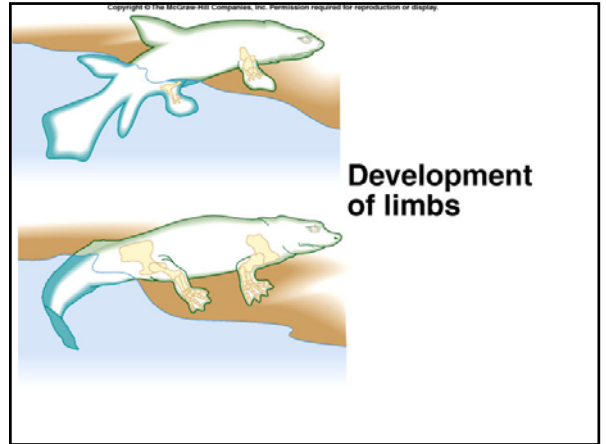
Extant Fishes

- | | |
|---|--|
| <ul style="list-style-type: none"> • Chondrichthyes • sharks and rays • cartilaginous endoskeleton • well-developed jaws, continuous swimmers • oviparous, ovoviviparous and viviparous forms | <ul style="list-style-type: none"> • Osteichthyes • 30,000 extant species • flattened, bony scales • swim bladder and operculum are key advancements • lobe-finned forms key to terrestrial evolution? |
|---|--|



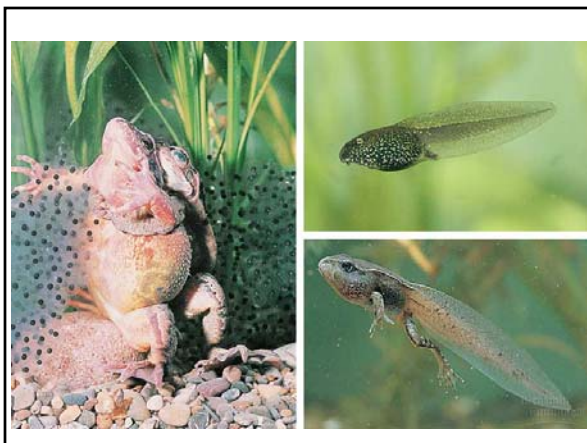
The Tetrapods

- Amphibians
- Reptiles
- Birds
- Mammals
- Terrestrial
- two pairs of limbs
- lungs



Amphibians

- 3 extant orders: salamanders, frogs and toads, caecilians (apoda) or legless burrowers
- most undergo complete metamorphosis
- sexual, usually external fertilization in water
- no marine forms



Reptiles

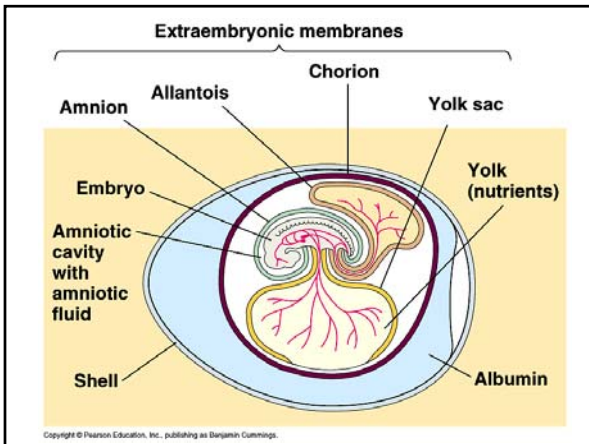
- Turtles, lizards, snakes, and crocodilians
- Internal fertilization
- Dry, scaly skin
 - serves as a barrier to moisture and prevents water from leaving the body
- most oviparous
- *Ectotherms*
 - Cold blooded
 - Moderate body temperatures by environment selection

Reptile Reproduction

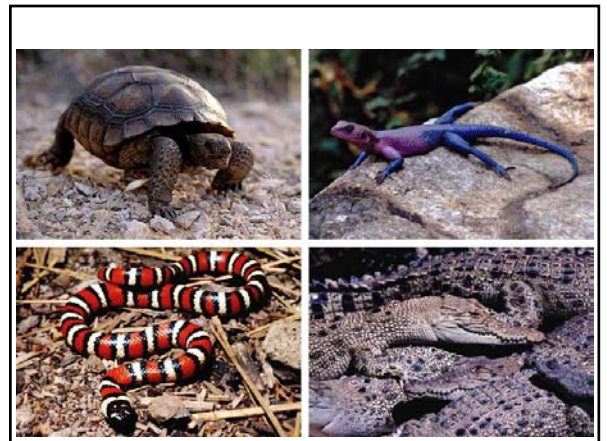
- Most reptiles reproduce by laying eggs, although some give birth to live young that have hatched from eggs inside the mother's body.
- Most reptiles produce amniote eggs, which are able to survive outside of water.
- These eggs have complex membrane systems and protective shells that are permeable to oxygen and other gases.

Amniote Egg

- Internally fertilized
- shell prevents desiccation
- contains extraembryonic membranes for nutrients, gas exchange, waste repository, protection
- hard shell in birds and most reptiles, only a few mammals

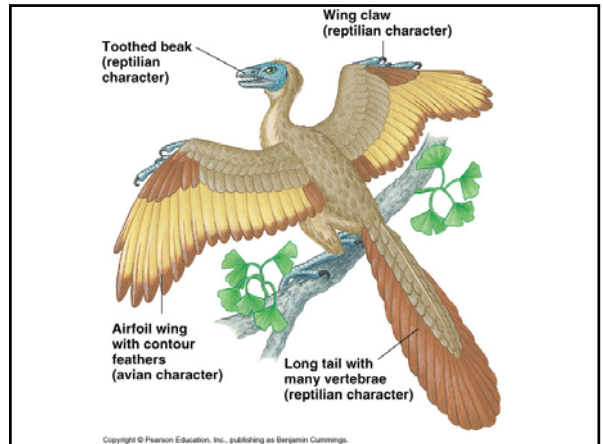


Dragon Hatchling



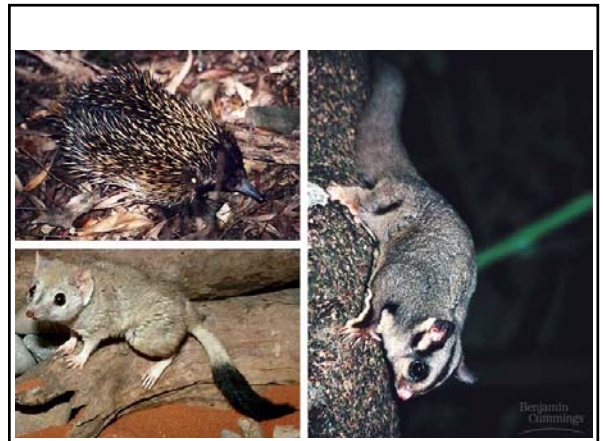
Birds

- Flying, endothermic reptiles
- Feathers, hollow bones, four-chambered heart, internal fertilization, well-developed cerebrum
- 8600 extant species
- most fly, a few flightless forms



Mammals

- 4500 species
- hair, endothermic, well-developed cerebrum, four-chambered heart, internal fertilization, mammary glands, most viviparous, differentiated teeth
- monotremes, marsupials, and placentals



Primates

- First were arboreal
- 65,000,000 years ago
- premonkeys and anthropods
- first humans: *Australopithecus africanus* ("Lucy"), numerous other australopithecines, 3.2 million years ago
- **Homo habilis**
 - 2.5 million years ago, tool user
- **Homo erectus**
 - 1.8 million years ago, fires, clothing, refined tools (Neanderthals)
- **Homo sapiens**
 - 100,000 years ago?

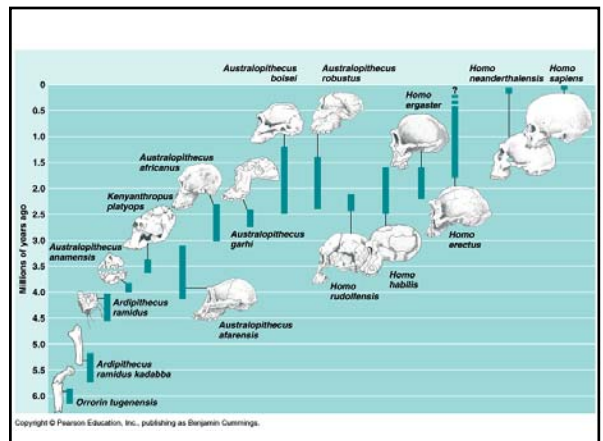










Table 34.1 Major Orders of Mammals (Monotremata – Sirenia)

Order Examples	Main Characteristics	
Monotremata Platypuses, echidnas	Lay eggs; have no nipples; suck milk from fur of mother	 Echidna
Marsupialia Kangaroos, opossums, koalas	Embryonic development completed in marsupial pouch	 Koala
Proboscidea Elephants	Have a long, muscular trunk; thick, loose skin; upper incisors elongated as tusks	 African elephant
Sirenia Sea cows (manatees)	Aquatic herbivores; possess finlike forelimbs and no hindlimbs	 Manatee




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Table 34.1 Major Orders of Mammals (Edentata – Primates)

Order Examples	Main Characteristics	
Edentata Sloth, anteaters, armadillos	Have reduced or no teeth	 Tamandua
Rodentia Squirrels, beavers, rats, porcupines, mice	Possess chisel-like, continuously growing incisor teeth	 Red squirrel
Lagomorpha Rabbits, hares, pikas	Possess chisel-like incisors; hind legs longer than forelegs and adapted for running and jumping	 Jackrabbit
Primates Lemurs, monkeys, apes, humans	Opposable thumb; forward-facing eyes; well-developed cerebral cortex; omnivorous	 Golden lion tamarin




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Table 34.1 Major Orders of Mammals (Carnivora – Cetaceans)

Order Examples	Main Characteristics	
Carnivora Dogs, wolves, bears, cats, weasels, otters, seals, walruses	Carnivorous; possess sharp, pointed canine teeth and molars for shearing	 Coyote
Cetartiodactyla		
Artiodactyls Sheep, pigs, cattle, deer, giraffes	Possess hooves with an even number of toes on each foot; herbivorous	 Bighorn sheep
Cetaceans Whales, dolphins, porpoises	Marine forms with fish-shaped bodies, paddlelike forelimbs and no hind limbs; thick layer of insulating blubber	 Pacific white-sided porpoise

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Table 34.1 Major Orders of Mammals (Perissodactyla – Insectivora)

Order Examples	Main Characteristics	
Perissodactyla Horses, zebras, tapirs, rhinoceroses	Possess hooves with an odd number of toes on each foot; herbivorous	 Indian rhinoceros
Chiroptera Bats	Adapted for flying; possess a broad skinfold that extends from elongated fingers to body and legs	 Frog-eating bat
Insectivora "Core insectivores": some moles, some shrews	Insect-eating mammals	 Star-nosed mole

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