## Chapt. 34 – Vertebrates

The **Animal Kingdom** ~ 35 phyla **[Fig. 32.11; Table 33.7]**
>95% **invertebrates**; <5% **vertebrates**

**Deuterostomia, Phylum Chordata**
**Notochord** – attachment site for **muscles**
**Dorsal, hollow nerve cord** – one end forms the **brain** (if present)
**Pharyngeal gill slits**
**Postanal tail**

**Invertebrate subphyla [Fig. 34.2]**:
**Urochordata (Tunicates; a.k.a. sea squirts)**
The key shared derived characters of chordates are found in the **larval stage**
**Cephalochordata (Lancelets)**
The key shared derived characters of chordates are found in the **adult stage**

**Craniates [Fig. 34.2]**
A key shared derived character: **neural crest**, which gives rise developmentally to cartilage or bones of the **skull**

**Class "hagfishes"**
**Cartilaginous skull** and **notochord**
No **vertebrae**
No **jaws**
No **paired appendages**

**Vertebrates [Fig. 34.2]**
A key shared derived character: **vertebrae**

**Class "lampreys"**
**Cartilaginous skeleton**, including a structure surrounding the **notochord** with rudimentary **vertebrae**
No **jaws**
No **paired appendages**

**Gnathostomes [Fig. 34.2]**
Key shared derived characters: **hinged jaws** and **mineralization of skeleton**

**Class Chondrichthyes**
Over 750 species of **sharks, skates, rays**… and **ratfish**, or **chimaeras**
**Notochord** present only in **embryos**
Predominantly **cartilaginous skeleton**
Respire through **gills**
**Lateral line system** for detecting pressure changes

**2-chambered heart**

**Oviparous** – embryonic development fueled from nutrients supplied by **yolk**, and the unshelled eggs hatch outside the mother's body
**Ovoviviparous** – embryonic development fueled by **yolk**, but the eggs hatch inside the mother's body
**Viviparous** – embryonic development fueled by mother's blood through a **placenta**; live birth

**Osteichthyans [Fig. 34.2]**
Key shared derived character: **ossified skeleton (hard matrix of calcium phosphate)**

**Class "ray-finned fishes"**
Very diverse group; over 30,000 extant species
**Notochord** present only in **embryos**
**Ossified (bony) skeleton**
Respire through **gills**
**Lateral line system** for detecting pressure changes
**2-chambered heart**
**Swim bladder** – air-filled sac that helps control buoyancy

**Lobe-fins [Fig. 34.2]**
Key shared derived character: **rod-shaped bones in fins or limbs**

**Class "coelacanths"**

**Class "lungfishes"**
Respiration through **gills** supplemented by **lungs**

**Tetrapods [Fig. 34.2]**
Key shared derived character: **limbs** in place of **pectoral** and **pelvic fins**

**Class Amphibia**
"Two lives"
**Larvae** generally **aquatic**, **adults** generally **terrestrial**
**Bony skeleton**
**3-chambered heart**
Generally respire through **lungs** as adults, supplemented by gas exchange through the **skin**
**External fertilization** is common
**Eggs** lack a **shell** and are prone to desiccation
Over 4,800 extant species

**Order Anura ("tail-less ones") – frogs, toads**

**Order Urodela ("tailed ones") – salamanders, newts**

**Order Apoda ("legless ones") – caecilians**

**Amniotes [Fig. 34.2 & 34.23]**

Key shared derived character: **amniotic egg**, which contains specialized **extraembryonic membranes [Fig. 34.24]**

**Extraembryonic membranes** (and a **shell** in many species) are not part of the embryo's body, and aid gas exchange, waste storage, and nutrition

**Reptilia**

About 6,500 extant species (excluding birds)
Leathery **shell** around **egg**
**3-chambered heart (4** in **crocodilians)**
**Scales**
**Ectothermic**
**Internal fertilization**

*E.g.*, **turtles, tortoises**

*E.g.*, **squamates (snakes and lizards)**

*E.g.*, **crocodilians**

**Birds**

About 8,600 extant species, in about 28 orders
**Eggs** with hard **shells** (**calcium carbonate**)
**Feathers** – highly modified **scales**
**Endothermic**
**4-chambered heart**
Clear genetic, morphological, and fossil evidence for phylogenetic nesting within **Reptilia** (*e.g.*, *Archaeopteryx*)
Some groups lost the ability to fly (*e.g.*, cassowary, emu, kiwi, penguins)

For **Reptilia** to be **monophyletic**, it must contain the **birds**

**Mammalia [Fig. 34.23 & 34.36]**

About 4,500 extant species in about 16 orders
**Hair**
**Endothermic**
**4-chambered heart**
**Mammary glands**
**Differentiated, specialized teeth**

**Monotremes**

Egg-laying mammals
*E.g*., platypus, echidna

**Marsupials**

Embryonic development occurs outside the mother, often in a **marsupium**

**Eutherians (Placental Mammals)**

Embryonic development occurs inside the mother's **uterus**, joined by the **placenta**

**Carnivores**, **herbivores**, *etc*.
**Terrestrial**, **freshwater**, **marine**…
Some are even **volant**!

A special group (from our human perspective):

**Order Primates [Fig. 34.38]**

**Humans:**

**Opposable thumbs**
**Highly developed cerebral cortex**