

SEGMENTED WORMS (Chapter 23, section 6, pages 506-507)

- **How do you classify segmented worms?**
 - Invertebrate (without a backbone)
 - Kingdom Animalia
 - **NOTE: All members of the animal kingdom share some universal characteristics. All animals:**
 - Are eukaryotic
 - Lack a cell wall
 - Are multicellular
 - Are heterotrophs that **INGEST** food (in other words, all animals digest food inside their bodies, unlike a fungus that digests food outside its body and then absorbs the digested material).
 - *See page 494 for comparison of protists, fungi, plants, and animals!!*
 - Earthworms and all other segmented worms belong to the phylum Annelida (“annelid” means “little rings”).

- **Characteristics of segmented worms/Annelids:**
 - Body divided into sections by internal walls coming down from each segment
 - Each segment contains nerve cells and waste-secreting organs
 - The digestive tract is **NOT** segmented – it is instead a continuous, through-and-through tube that runs through all segment walls.
 - Just like the digestive tract, the nerve cord and the two main blood vessels are also continuous.
 - Each body segment has some small blood vessels that connect to the two main blood vessels.
 - Closed circulatory system – blood **ALWAYS** stays within blood vessels (compared to an open circulatory system, where blood vessels open into chambers within organs and the organs are then directly bathed in blood; in other words, in an open circ. system, the blood leaves the blood vessels to get to the organs).
 - Bilaterally symmetrical (if you cut an earthworm along its vertical plane, the two resulting halves are identical to each other).
 - Three tissue layers:
 - Ectoderm: body’s outer covering
 - **Mesoderm:** “middle” layer
 - Endoderm: inner layer (digestive tube)
 - Have a body cavity called a **coelom** – a fluid-filled cavity lined by mesodermal tissue.

- **15,000 species of annelids, divided into three classes:**
 - **POLYCHAETA:** sandworms; eat off the ocean floor (“P” for polychaeta close to “S” for sandworm in the alphabet)
 - **OLIGOCHAETA:** earthworms; help air move through the soil as they tunnel in the ground. This air circulation in the soil helps plants grow. (Note: the word “oligochaeta” starts with a vowel and the word “earthworm” also starts with a vowel.)
 - **HIRUDINEA:** leeches (“H” for hirudinea close to “L” for leeches in the alphabet)

OVERVIEW OF VERTEBRATES (Chapter 25.1)

- All vertebrates are **chordates**, meaning they all have a **notochord** (a flexible tube that runs the length of the body).
 - o Note: There are two kinds of invertebrates that also belong to the chordate phylum; these are the tunicates and lancelets.
 - o Vertebrate chordates are different from invertebrate chordates because they have a segmented backbone (separate from the notochord).
 - o In adult vertebrates, the notochord partially disintegrates and forms the cartilage discs in your backbone. (The notochord is only present as a full structure in the embryo stage of vertebrates.)

- All chordate *embryos* (both vertebrate and invertebrate) have four characteristics in common:
 - o Notochord
 - o Hollow nerve cord on the dorsal (back) side: the nerve cord develops into the brain and spinal cord.
 - o Slits in the pharynx (throat region):
 - Some vertebrates have these slits all through their lifetime.
 - In other vertebrates, these slits develop into gills, jaw structures, ears, etc.
 - Tail that extends beyond the anus
 - The tail allow aquatic vertebrates to swim
 - In humans, the “tail” is reduced to a small piece of bone on the vertebral column (backbone); this is the “tailbone” or coccyx.

- Specific features unique to vertebrate chordates:
 - o Skull and backbone to protect the nervous system.
 - The backbone is composed of many individual bones called vertebrae
 - The vertebrate skeleton is also called an endoskeleton because it all lies inside the body (versus an arthropod’s exoskeleton).
 - The vertebrate skeleton is partly cellular; as those cells divide, growth can occur.
 - The vertebrate skeleton can be all cartilage or a mix of bone and cartilage.
 - o Hinged jaw – allows a vertebrate to capture and eat prey of many different sizes.
 - o Paired limbs

- Overview of vertebrate diversity:
 - o See page 544 for review
 - o Vertebrate ancestors: hagfishes and lampreys (both are considered vertebrates but do NOT have hinged jaw or paired limbs)
 - o Fish
 - o Tetrapods – two sets of paired limbs (tetra = 4, pod = foot; tetrapod = four footed)
 - Amphibians, Reptiles, Birds, and Mammals = all tetrapods
 - Note: snakes are considered tetrapods because they most likely evolved from a four-footed ancestor.

AMPHIBIANS (Chapter 25.4)

- **Amphibians live part of life on water, part on land.**
- Most of an amphibian's adult life occurs on land but adults do return to the water to reproduce.
- Amphibians were the first vertebrates to live on land
- Acanthostega: ancestor to modern amphibians; early tetrapod

- **Characteristics of amphibians:**
 - The larval (tadpole) stage lives in water.
 - The adult lives on land
 - The adult has lungs, smooth and moist skin, and NO scales.
 - Eggs laid by amphibians do NOT have shells; these eggs therefore can dry out quickly. This is why adult amphibians lay their eggs in water.

- **Characteristics of tadpoles (amphibian larvae):**
 - Legless
 - Aquatic
 - Eat plants
 - Have gills
 - Have a lateral line system: a row of sensory organs that run along each side of the body; this system is sensitive to vibrations in the water
 - Long, finned tail

- **Characteristics of adult amphibians:**
 - Four legs
 - Lungs
 - Eardrums
 - No lateral line system
 - Note: some amphibian species never live on land and some never live in water, but this is the exception to the rule.
 - Smooth skin – helps lungs with gas exchange
 - Poisonous glands used for defense
 - 3 chambered heart:
 - The ventricle pumps blood away from the heart; the blood then divides into two blood vessel pathways. One pathway takes blood to the lungs for gas exchange while the other pathway takes blood to the rest of the body.
 - The two atria collect blood (one atrium collects blood from the lungs while the other atrium collects blood from the rest of the body).
 - See page 553 for diagram of the 3-chambered heart.

- **Diversity of Amphibians:**
 - 4800 species
 - Divided into three groups:
 - **Order Anura (Frogs)**
 - Lack tail
 - Have a pair of external eardrums
 - Strong hind legs for jumping
 - Webbed feet
 - Smooth, moist skin
 - Toad: a frog with rougher skin; typically always lives on land
 - Defense mechanisms: camouflage, poisonous glands on skin
 - **Order Urodela (Salamanders)**
 - Note: “U” for “Urodela” is close to “S” (for Salamander) in the alphabet
 - Have tails
 - Most keep tails all through life
 - Have four equally sized legs – do not jump but instead scurry
 - Some use only their skin for gas exchange (in other words, some salamanders do not have lungs)
 - Meat eaters (insects, small invertebrates)
 - **Order Apoda (Caecillians)**
 - Note: “pod” refers to feet. (A **podiatrist** is a foot doctor, for example). Any time you put an “a” in front of a word, it usually means “without”. “Apoda” means “without feet”.
 - No legs
 - Blind
 - Burrow into moist soil