

## Unit 8: Biodiversity

### Content Outline: Animal Kingdom – Invertebrates (8.14) – Part 1

- I. **Invertebrates** – animals without a backbone. (These are lower grade animals.)
  - A. Most of these are aquatic life forms.
  - B. They account for *95% of all known animal life forms* existing today.
- II. **Parazoa** (like-animals) (“para” means “like”; “zoa” means “animal”... like a zoo is where we see animals.)
  - A. Phylum: Porifera - These are pore bearers. (The common name is Sponges.)
    1. Porous –**porocytes** (Where water enters in to the organism.); **Osculum** (Where water exits the organism.)
    2. *No true tissues are present*; no muscle or no nerves either.
    3. They are all sessile (means “non-moving”) **filter feeders**.
    4. **Hermaphrodites** – Organism contains both sexes.
- III. **Radial** Eumetazoa (“true” animals) (“eu” means “true”)
  - A. Phylum: Cnidaria - These are Jellyfish and Sea anemones.
    1. **Diploblastic** (Means “two germ layers”) – **endoderm** (for digestion) and **ectoderm** (outer protective layer)
    2. **Mesoglea** (middle jelly) - This provides buoyancy and shape to the organism.
    3. Mostly marine (means “salt water”) animals.
    4. Two Life Stages
      - a. **Polyp Stage** (sessile) This stage is similar to the sponges in appearance.
      - b. **Medusa Stage** (motile)
        - i. Moves using a **nerve net** to *shock* the mesoglea.
        - ii. **Bell** (top portion) has **statocysts** (cells that detect gravity) and **oscilli** (cells that detect light)
        - iii. Tentacles contain **Cnidocytes** (stinging cells)
    5. **Gastrovascular cavity** - Functions in digestion and food distribution. (Possesses *one mouth/anus opening*.)
    6. Sexual (medusa stage) and asexual (Polyp stage) reproduction can occur by these organisms.
- IV. **Bilateral** Eumetazoa
  - A. Phylum: Platyhelminthes (Flatworms)
    1. **Triploblastic** – having three germ layers – **ectoderm**, **mesoderm** (makes muscles), **endoderm**.
    2. **Acoelomates** – (means “without a cavity”) These are small animals that *move materials by osmosis/diffusion*.
      - a. They can only be a *couple of cells thick*; just like the bryophytes of plants.
    3. **Nervous System** (Has a ganglia/brain and nerve chords.) Responds to the environment and helps in movement.
      - a. **Eyespots** - These are structures for detecting light. (They are *recessed* oscilli.)
      - b. This is the beginnings of **cephalization** - The accumulation of sensory tissue in a “head” region.
    4. **Gastrovascular cavity** extends the length of the body (Still a single mouth/anus opening.)
    5. **Flame cells** – These are for excreting nitrogenous waste associated with protein breakdown.
      - a. They are similar to your kidneys.
    6. Four classes exist
      - a. Turbellaria (planarians)
        - i. These are free-living, marine, carnivorous flatworms.
      - b. Trematodes (flukes) and Monogeneans
        - i. These are internal or external parasites associated with feces water.
        - ii. Most common is Schistosomiasis. (Blood/liver fluke) Kills 200 Million people/year – third world.
      - c. Cestoidea (Tapeworms)
        - i. These are parasites of the intestines. (They cause *extreme* weight loss quickly upon infection.)
        - ii. **Scolex** (the head) It has sucker cups with hooks to hold on in the intestine as food moves paste.
        - iii. **Proglottids** - These are the reproductive segments. (hermaphroditic)(Larger sections – older.)
        - iv. Can be acquired by contaminated feces water or feces eating, such as with dogs and cats.

## Part 2

- I. Phylum: Molluska (mollusks)(means “soft body”)
  - A. Most have a protective shell (either external or internal) made of chitin or Calcium Carbonate.
  - B. All mollusks have three soft body parts:
    1. **Foot** – A muscle for movement, swimming, or grabbing prey.
    2. **Mantle** – This is a tissue flap that can produce the protective shell.
    3. **Visceral Mass** – Area that contains the vital organs (heart, gills/lungs, stomach, gonads, and nephridia)
  - C. **Mantle Cavity** – This cavity (space) contains the gills (if aquatic) or lungs (if terrestrial).
  - D. **Radula** – This is a barbed, shredding tongue that goes back and forth.
  - E. **Beaks** – Eagle-shaped structure found in the cephalopods for killing and eating prey. (These are razor sharp.)
  - F. Separate sexes exist (Except in snails, which are *still* hermaphroditic.)
  - G. Four classes of Mollusks exist:
    1. Polyplacophora (Chitons)
      - a. These are flat worm- like organisms; but with 8 hard protective plates of Calcium Carbonate.
    2. Gastropoda (means “Stomach-foot”; “poda” means “foot”) These are Snails and slugs.
      - a. These are mostly marine; but some are terrestrial.
      - b. The head has eye stalks that possess retractable eye spots.
      - c. Some have a twisted shell of Calcium Carbonate. (Except the slugs.)
    3. Bivalvia (means “**possessing two shells**”) These are oysters, scallops, and clams.
      - a. These organisms possess a protective shell, having two halves, of Calcium Carbonate.
      - b. The shell is *controlled* by large adductor muscles.
      - c. These are *filter feeders* and possess gills for gas exchange.
    4. Cephalopoda (means “Head-foot”) These are squid, octopus, and nautilus.
      - a. Most are aerodynamic; all are *carnivorous predators* with beaks.
      - b. They all have tentacles with strong suction cups to hold prey.
      - c. They move by *jet propulsion using siphons*. (Move by swimming backwards.)
      - a. **Shell** – external – nautilus (These are living fossil); internal – squid(pen); non-existent in octopus
      - b. *Closed circulatory system and digestive tract* - this affords a larger size organism.
      - c. *Very well developed nervous system and senses* (They have eyes and brain as they’re predators.)

### Part 3

- I. Phylum: Annelida - These are the segmented worms. ("annelid" means "fused rings")
- A. They have a septated (segmented) coelom. (This allows for specialization of each segment to occur.)
  - B. They possess a true digestive tract with different organs:
    1. **Pharynx** - This structure sucks up food.
    2. **Esophagus** - This structure lubricates the food so it can slide by **peristalsis**... rhythmic contraction.
    3. **Crop** - This structure is for food storage.
    4. **Gizzard** - This structure is for food breakdown. (Crop and gizzard will evolve in a stomach later in time.)
    5. **Intestines** - This structure is for food absorption. (Food molecules are passed into the circulatory system.)
  - C. They have a **closed circulatory system**. The system runs dorsally and ventrally for the whole length of the organism. The system has 5 muscular tube hearts for pumping hemoglobin. (**Hemoglobin** is iron rich blood.)
  - D. **Nervous system** has *anterior ganglion brain* with ventral nerve cord possessing segmental ganglia.
  - E. **Excretory system** (removes nitrogenous waste) is composed of segmental **Metanephridia** (2 per segment.)
  - F. Reproduction - They perform *cross fertilization* even though they are hermaphrodites. (Structure = Function, Take and stick out your thumb and index finger on both hands. Then rotate one hand so that you have one palm side and one top side facing you. Point each hand toward the other hand. Now move them together. Each thumb (male organ) is touching a index (female organ). So they can cross fertilize each other.
    1. They are **hermaphrodites**. (This is due to life style – living in dirt.)
    2. **Clitellum**- it is the one enlarge segment.

This segment makes a *protective case to collect the eggs* in. The eggs are laid in front of the clitellum and then "scooped up" as the worm moves forward.
  - G. Three classes of annelids exist
    1. Oligochaeta (Earthworms)
    2. Polychaeta (sea worms)
    3. Hirudinea (leaches)- These are fresh water worms. (They are also parasites.)
      - a. They have a blade like jaw and anesthetic saliva. (So you can't feel them until you see them.)
      - b. **Hirudin** - This protein in the saliva is an anti-coagulant; so it keeps blood from clotting while it feeds.
- II. Phylum: Nematoda - These are the round, unsegmented worms.
- A. They are free-living decomposers or parasites.
  - B. Have a thick **chitinous skin** (called the **cuticle**) that has to undergo **ecdysis** (means "shed") periodically to grow larger.
    1. This skin protects against **desiccation** (means "water loss").
  - C. These are **pseudocoelomates**.
  - D. There are **separate sexes**.
  - E. For example, *Tricinella spiralis* "trichinosis" (Can be caught by eating undercooked pork.)

## Animal Kingdom - Invertebrates – Part 4

### I. Arthropods (means “jointed foot”)

- A. These are the *most abundant group of animals* on Earth. (Insects are the most abundant arthropods.)
- B. They are also segmented animals. (Remember, this allows for specialization of segments.)
- C. They all display a high degree of **cephalization**. (Brain, antenna, eyes, mouth parts all in the head.)
- D. **Exoskeleton of Chitin** - protects against desiccation and harm.  
**Please remind students that Chitin is a carbohydrate (energy source... why some insects eat it after molting)**
  - 1. It serves as an *attachment point* for muscle tissue. (Replaces the need for bones.)
  - 2. It too must undergo **ecdysis** to grow larger, unfortunately for the organism as they become exposed.
- E. All have an **open circulatory system** (There are no blood vessels to get pinched in the exoskeleton.)
  - 1. **Hemolymph** (similar to hemoglobin) travels through sinuses (spaces).
  - 2. Hemolymph *bathes* the organs instead.
  - 3. They possess a large *one chamber heart* with directing tubes.
- F. Use **gills, lungs, or tracheal tubes** (for insects) for gas exchange. (It depends on where they live...water or land.)
- G. Four subphylum exist in nature
  - 1. Cheliceriforms -These are the *fanged* arthropods. (“Chelicera” means “fang”)
    - a. These are Ticks, Spiders, Mites, Scorpions, Horseshoe Crabs. (
    - b. They have *no* antenna, have 8 legs, body has two parts: **Cephalothorax** and abdomen, have multiple eyes (simple and compound), book lungs, spinnerets (Cephalothorax is a *combined head and thorax*.)
  - 2. Myriapods (means “*multilegged*” animals)
    - a. Millipede belong to the class: Diplopoda - They have 2 pairs of walking legs per segment. (These are harmless decomposers.)
    - b. Centipedes belong to the class: Chilopoda - They have 1 pair of walking legs per segment. (These are poisonous carnivores and they have a pincher on the tail end like a scorpion.)
  - 3. Hexapoda (means “**six legged**” animals)- These are the Insects.
    - a. Most can fly using one or two pairs of *wings*. (Wings are an extension of the cuticle. They are basically air-filled tubes with a thin layer of Chitin covering the open spaces.)(*Analogous* to bird wing)  
**Please remind students of analogous structures versus homologous structures and the relationship of each to common ancestry and shared DNA nucleotide sequences.**
    - b. Possess *one pair of antenna*.
    - c. **Malpighian tubules** (like kidneys) - collect nitrogenous waste and empty it into the intestine for disposal.
    - d. **Tracheal tube system** with spiracles (openings in abdomen) for gas exchange.
    - e. **Incomplete Metamorphosis** – Insect grows from nymph to adult. (They look alike though.)
    - f. **Complete Metamorphosis** – Insect grows from Larva to pupa to adult. (Each looks different.)
    - g. Mate *once* in the life-time; then die. Males usually killed after mating. Females – after laying of eggs.
    - h. *Important pollinators* of angiosperm plants.
    - i. Some are disease carriers.
    - j. Some are considered by man to be pests. We use pesticides/insecticides to kill them.
  - 4. Crustaceans (These are *aquatic* arthropods.)
    - a. They possess *2 pair of antenna*. (long pair – for finding obstacles; short pair – for finding food)
    - b. *Walking legs on thorax and swimmerets on abdomen*
    - c. Possess a **Carapace** (this covers the visceral mass) It is a part of the exoskeleton.
    - d. Usually has two large *pincers* as first set of legs.
    - e. **Green gland** (like kidneys) collects nitrogenous waste. (They are under the eyes – the location acts as a defensive location. They urinate as they *retreat* backwards.)

## Animal Kingdom – Invertebrates – Part 5

- I. Phylum: Echinodermata (means “spiny skin”; “derm” means “skin”)
  - A. These are the Starfish, Sea urchins, Sea cucumbers, Sand dollars, and Sea biscuits.
  - B. They have an *internal calcium carbonate skeleton*. (It grows as the organism grows, so it is composed of living cells; just like yours.) It is **Homologous** to vertebrates. (Please remind students that it indicates common ancestry.)
  - C. They use a **water vascular system** for movement and transport.
    - 1. It has three parts to it:
      - a. **Madreporite** – This is the “mother pore” or opening to the inside.
      - b. **Tube feet** – These are for suction and walking.
      - c. **Ring canal** – This connects the five legs and madreporite.
  - D. *They start as bilateral larva → grows into radial adult.*
  - E. They are carnivores. (They eat bivalves.)
  - F. They can regenerate of lost limbs.
  - G. **Deuterostome** like the vertebrates in development (*Common ancestry* with the high grade animals.)