Chapter 12
Soft Bodied Critters: Porifera, Cnidarians

I. The Animal Kingdom: Terms etc.

A. Symmetry:

1. **Spherical Symmetry**: Example- Volvox; animal can be bisected thru any plane that passes thru the **center point** of the critter. Most primitive of symmetrical types
2. **Radial Symmetry**: Example – sea anemone, starfish, sea urchins jellyfish; animal can be bisected w/ equal halves when plane cuts thru a **central line**. 2nd most primitive symmetry
3. **Bilateral Symmetry**: Examples- Planarians, vertebrates; only one plane will bisect the critter into two relatively equal halves. Plane must go thru a **central plane** for symmetry to occur. Most advanced

B. Anatomical positions

1. Dorsal / Ventral
2. Anterior / posterior
3. Lateral / Medial
4. Proximal / Distal
5. Right / Left
6. Cranial / Caudal

C. Cell → Tissue →organ → organ system → organism

D. **Invertebrate**: animal w/out a backbone: all animals except those w/ backbones!!

E. **Vertebrate**: animals with backbone: Fish, Amphibians, reptiles, birds and mammals only!

F. **Terms to understand**: Autotroph, heterotroph, sexual & asexual reproduction, fertilization, zygote, embryo, larvae, predator, prey, parasite, host, herbivore, carnivore, filter feeders, exoskeleton, endoskeleton, ganglia, artery, vein, open and closed circulation, regeneration, internal and external fertilization

G. There are seven essential life functions that need to be performed by an animal. These include:

1. **Feeding** – a way used to gather food
2. **Respiration** – a way need to obtain oxygen from environment and remove carbon dioxide from the organism
3. **Internal transport** – (circulation) need to move nutrients and wastes to all cells of the organism
4. **Excretion** – need a way to remove the nitrogenous cellular wastes products
5. **Respond to the environment** – **Nervous System** - a way to sense & gather information from the environment
6. **Reproduction** – a way to generate off spring
7. **Movement** – most are able to move from place to place or at least move their surrounding to or through them.

H. Body Cavity types: Coelum: "body cavity"

1. **Acoelomate:** " no coelum" Flatworms, Cnidarians – most primitive
2. **Pseudocoelomate**: "false coelum" – Roundworms – 2nd most primitive
3. **Coelomate**: "true coelum" present – annelids, vertebrates etc.

II. Phylum Porifera - Sponges

A. **Invertebrate,** Most have Radial Symmetry some w/ no symmetry,

B. Most primitive of invertebrates

C. All are aquatic, most are marine

D. No specialized tissue or organs, essential life functions performed at the cell level

E. Filter feeders that sift microscopic particles from the water

F. Structure and Function

1. **Central Cavity**: Area enclosed by the body wall of the sponge
2. **Osculum**: Large dorsal hole where water leaves the sponge 's central cavity
3. **Pore cells**: Specialized cells in the body wall through which water enters
4. **Pores:** one of thousands of openingsin the body wall allowing water to enter the central cavity
5. **Epidermal cells:** outer cell layer on the surface of the sponge
6. **Spicule**: Structural "skeletal" support usually made of silica or calcium
7. **Amebocyte**: specialized cells that manufacture the spicules
8. **Collar cells:** cells facing the inside w/ flagella that create water current and traps food

G. **Form and Function**

1. **Feeding:** filter feeders that sift particles of food from the water that passes into the central cavity. The food is trapped by the collar cells.
2. **Internal Transport (the system that carries nutrients & wastes through the body) –** The water being pulled through the sponge acts as the transport system.
3. **Excretion –** Cellular wastes are also carried away by the water movementand leaves through the osculum
4. **Respiration –** Again, the water passing past the sponge cells allow for O_2 and CO_2 to be absorbed and discharged respectively.
5. **Reproduction**:
   a. Sexual w/ egg and sperm:
      i. **Hermaphroditic**
      ii. Eggs produced and held in central cavity.
      iii. Sperm produced by different sponge and pass thru the pores to fertilize.
      iv. Larvae passed into water current and become plankton
   b. Asexual forming
      i. **Gemmules**: clumps of amebocytes covered by spicules endure poor environmental conditions
      ii. **Budding**: small new growth breaking off creating genetically identical offspring

III. Phylum Cnidaria: AKA Coelenterata: Jellyfish, hydra, sea anemone & corals

A. Aquatic, Invertebrate, Soft bodied critters w/ sting cells (nematocysts) on tentacles surrounding a mouth
B. Radial symmetry
C. First example of specialized cells and tissue
D. All are aquatic
E. 2 types of **body shapes**:
   1. **Polyp**: Hydra, sea anemones and corals – sessile "flower-like"(sedentary, doesn't move around much)
   2. **Medusa**: jellyfish, Man-of-War, free swimming, planktonic, motile bell-shaped

F. Structure and Function

1. **Nematocyst**: specialized stinging structures located on the tentacles. Dart-like structures that are triggered by touch and inject poison to kill prey items.
2. **Tentacle**: finger-like projections that contain the nematocysts and bring prey item to the mouth
3. **Mouth**: opening into which prey items enter gastrovascular cavity and since there is no anus, waste products leave through this opening also.
4. **Gastrovascular Cavity**: "stomach": prey items digested here
5. Body wall w/ three layers:

a. **Ectoderm**: Epidermis
b. **Mesoglea**: mesoderm - middle jelly-like layer
c. **Endoderm**: Gastroderm: secretes digestive enzymes into the gastrovascular cavity

6. **Basal disk**: Sticky base that attaches to the substrate and holds the polyp in place

G. Reproduction

1. Asexual: reproduces by budding, producing a genetically identical individual
2. Sexual:
   a. Hermaphroditic
   b. Eggs produced in ovaries
   c. Sperm produced in testis
   d. Fertilized eggs are **zygotes** and are released into the water becoming planktonic

H. **Digestion**: incomplete digestive system- only one in and out orifice

I. **Internal Transport**: no specialized tissue, organism thin enough for diffusion to move substances between the GVC and the rest of the organism

J. **Excretion:** no specialized tissue, organism thin enough for diffusion to be enough

K. **Respiration:** no specialized tissue organism thin enough for diffusion to be enough

L. **Nervous system:** Primitive network of nerves, no true "Brain" or central nervous system

IV. Phylum: Platyhelminthes – Flatworms, Planaria, tapeworms and blood flukes

A. Invertebrate, Simplest critter w/ bilateral symmetry

B. Simplest critter w/ distinct head (**anterior)** and tail (**posterior)** regions

C. Most are aquatic

D. Free living and parasitic life styles

1. **Free-living**: Planarians, freshwater worms, live on bottom
   a. **Mouth** – pharynx – gastrovascular cavity: incomplete digestive system w/ many branches that increase surface area of digestive tract
   b. Nervous system w/ **dorsal ganglia "brain**" and lateral nerve cords
   c. **Eyespots**: sensitive to light but can't "see"
   d. Regeneration is asexual but also has hermaphroditic sexual reproduction
   e. During food shortage times they absorb their own internal organs
2. **Parasitic Flukes**: complex life cycle includes two or more hosts and cause several diseases. Blood flukes: host is snail lay eggs in digestive system, barefoot human pick up eggs/larvae on skin, bore into bloodstream and grow. Adult grow and migrate into digestive tract, release eggs out digestive tract of host. Snails pick up eggs and grow larvae
3. **Parasitic tapeworms**:
   a. **Scolex**: head region,
   b. **Proglottids**: body "segments" parts have reproductive organs
   c. Complex multi-host sexual live cycle: cattle eat contaminated food, larvae enter bloodstream then bore into muscle tissue and encapsulate, humans eat undercooked meat and larva grows in our digestive system into adults. Can be 4 to 9 meters in length!!

E. **Excretory system:** uses **flame cells** to excrete waste products thru pores

F. Reproduction both sexual and asexual reproduction can occur

G. Digestion –

1. Sometimes present (incomplete) w/ mouth and GVC
2. Absent in most parasitic tapeworms – simply absorb nutrients directly through the epidermis.

H. **Nervous system –** includes the first **brain** – dorsal ganglia and then two lateral nerve cords

V. Phylum Nematoda: Roundworms – Ascaris, hookworms, pinworms

A. Simplest invertebrate with complete digestive system: mouth and anus present
B. Free living and parasitic: Aquatic- marine and freshwater and terrestrial
C. May be the most abundant animals on earth.
D. A bucket of soil can contain > 1 million roundworms!!
E. **Reproduce** sexually – not asexually. Sexes separate w/ internal fertilization
F. **Digestive system**: First complete system, has a mouth and an anus a **"tube within a tube"**
G. Still no **circulatory** system no **respiratory** system – uses diffusion

VI. Phylum Annelida: Segmented worms- earthworms

A. Invertebrate, Aquatic marine and freshwater life style
B. Terrestrial life style
C. Segments called **metameres**
D. External Structures and function
1. **Mouth** – ingest food and materials into digestive system
2. **Anus** – Undigested food and wastes leave the body
3. **Metamere** – Segments of the earthworm
4. **Setae** – bristles found on ventral surface
5. **Clitellum** – secretes mucus and egg sacs

E. Internal Structures and Function

1. Mouth (entrance)
2. Pharynx (grabs food & pushes in)
3. Esophagus (passage way)
4. Crop (stores)
5. Gizzard (grinds)
6. Stomach (digests)
7. Intestine (digests)
8. Anus (eliminates)
9. 5 pairs)Aortic Arches (hearts)
10. Cerebral Ganglia (brain)
11. Dorsal blood vessel (vein)
12. Ventral Blood vessel (artery)
13. Septa
14. Seminal Vesicles
15. Ventral Nerve Cord

F. Respiration: Aquatic annelids typically breath through gills, whereas terrestrial annelids diffusion O2 and CO2 thru the skin
G. **Internal Transport – The Circulation:** First critter w/ true circulatory system. Closed circulation w/ dorsal & ventral blood vessels connected at each segment w/ smaller vessels called "ring vessels". Has 5 pairs of enlarged ring vessels called "Aortic Arches" which act as hearts to pump the blood.
H. **Excretory system:** Two types of wastes are produced, solid wastes pass through the digestive system whereas Nitrogenous wastes from cellular activities excreted thru use of nephridia, (small tubular structures located in each metamere.
I. Nervous system is well developed w/ organized brain extending ventrally to a ventral nerve cord which connects small nerves from each segment (metamere)
J. Movement – muscles in the annelid are of two types longitudinal and circular
K. Reproduction – most reproduce sexually, some w/ separate sexes and some species have individuals w/ both male and female organs in the same animal – hermaphroditic.