Life Lecture Notes Chapter 13

I. Phylum **Mollusca**
   a. General Characteristics
      i. Soft **unsegmented bodied critters** often covered by a shell called a **Valve** which is produced by the **mantle**.
      ii. **Bilateral symmetry**
      iii. **Gills** usually present
      iv. Thick muscular **foot** often present,
      v. **Radula** (rough scraping tongue used to gather food)
      vi. **Visceral mass** containing most systems,
      vii. Open circulatory system except for closed system in cephalopods
      viii. Most are aquatic (both marine and freshwater), some are terrestrial
      ix. **Complete digestive** system, **dioecious**, external fertilization
   b. Terminology
      i. Valve, adductor mussels, foot, radula, mantle, gills, siphons, visceral mass, arms, tentacles, pen, ink sack
   c. Classification by the presence or absence of a shell, the number of shells and by the type of foot present
      i. One valve: Class **Gastropods** "*stomach foot*"– snails, slugs, abalone, nudibranchs. Radula is usually present, single shell may be present. Movement by creeping on a single foot. A tight fitting plate (operculum) attached to the foot that can be closed tight to protect the animal, a "trap door".
      ii. *Two shells*: Class **Bivalve** – clams, scallops, mussels, oysters, bivalves are filter feeders no radula is present
      iii. *Head-foot*: Class **Cephalopod** – squid (flexible pen: internal shell present), octopus (no shell present: internal or external), cuttlefish (hard internal shell is present)nautilus (only cephalopod w/ external shell). Foot is modified into Tentacles: octopus have eight arms, squid have eight arms plus two tentacles and nautilus have many tentacles. **Most intelligent of all invertebrates**. All are Predators. All are marine.

II. Phylum **Arthropoda:** "*Jointed feet*"
   a. General Characteristics:
      i. Exoskeleton made of chitin present and must be molted when out grown, segmented body, Jointed appendages and attachments.
      ii. Aquatic, marine and freshwater, and terrestrial
      iii. Respiration: by gills or tracheal tubes
      iv. Circulation: by hearts pumping thru an open system
      v. Excretion: elimination of nitrogenous wastes by **malpighian** tubules on most terrestrial arthropods, simple diffusion or by green glands in aquatic arthropods.
      vi. Nervous system: well developed, sensory appendages include, antenna, antennules, ocelli, compound eyes, tympanum along w/ cerebral ganglia now called a brain.
      vii. Reproduction: sexes are separate, **dieocous**.
      viii. Development:
         1. **incomplete metamorphosis**: grasshoppers – egg → nymph → adult
         2. **complete metamorphosis**: butterflies – egg → larvae → pupa → adult
   b. Terminology
      i. Head, thorax, abdomen, cephlathorax, compound eyes, ocelli, spiracles, tracheal tubes, malpighian tubules, swimmerets, walking legs, mandible, femur, tibia, tarsus, crop, gizzard, stomach, intestines, tympanum, ovipositor, gastric ceaca, green glands, chelipeds, uropods, telson, etc.

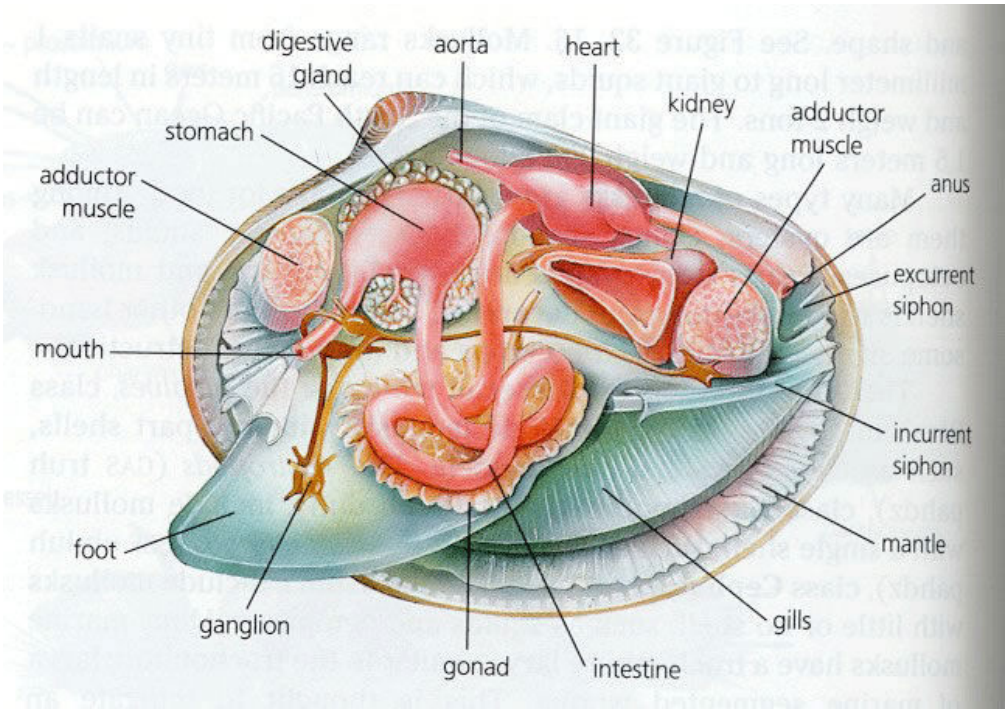
c. Classification
    i. Five main groups:
        1. Class **Arachnida** – spiders, ticks, mites, chiggers and scorpions
            a. 2 body sections: **cephlathorax and abdomen**
            b. 4 pair of walking legs
            c. no antenna
            d. usually terrestrial
            e. respiration via "book lungs"
        2. Class **Crustacea** – crabs, lobsters, barnacles, crayfish, pill bugs, "rollie pollie", sow bugs
            a. Usually two or three body segments, sometimes more
            b. Two pair of antenna
            c. 5 or more paired appendages
            d. mouth parts formed by appendages called mandibles
            e. usually aquatic
            f. eggs usually carried beneath the abdomen and held in place by the swimmerets
        3. Centipedes & Millipeds
            a. Long worm-like body
            b. Body made of many segments
            c. Chilopoda - Centipedes
                i. One pair of legs per segment
                ii. Carnivorus life style
            d. Diplopoda - Millipeds
                i. Two pair of legs per segment
                ii. Herbivore life style
        4. Class **Insecta** – all six legged, arthropods with three body sections: head, thorax and abdomen: 14 "Need to Know" orders
            a. Three body parts
            b. One pair of antenna
            c. Three pair of legs attached to the thorax

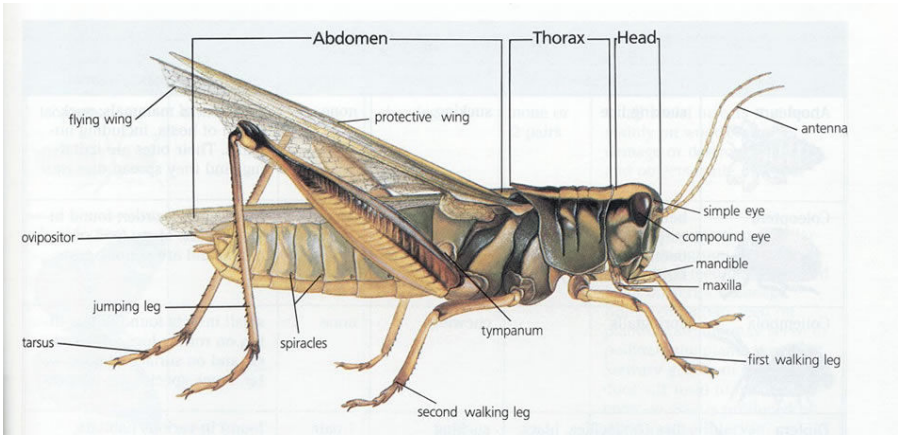
III. Insect orders that you need to know:

1. **Diptera** – Flies, mosquitoes and gnats: single pair of wings
2. **Dermaptera** – earwigs: pincher-like structures on abdomen
3. **Coleoptera** – beetles: two pair of wings, 1st pair forms hard protective shell & forms a straight line down the back medial surface of the abdomen
4. **Hemiptera** –true bugs: two pair of wings, 1st pair forms a leathery protection shield, while second pair are membranous and form an "X" on the back of the abdomen
5. **Orthoptera** – crickets, grasshoppers, praying mantis, cockroach: two pairs of wings, hind legs usually enlarged used for hoppingor front pair desined for grasping prey
6. **Lepidoptera** – butterflies and Moths: two pair of wings made of the same material. Wings are covered w/ scales that rub off easily
7. **Homoptera** – Leafhoppers and aphids: small insects w/ soft plump body w/ small head. Wings slope down from the body when at rest.
8. **Hymenoptera** – ants, bees and wasps: Social insects found in large numbers within hives or colonies. Narrow pinched in "waist" between thorax and abdomen. Ability to sting used for protection.

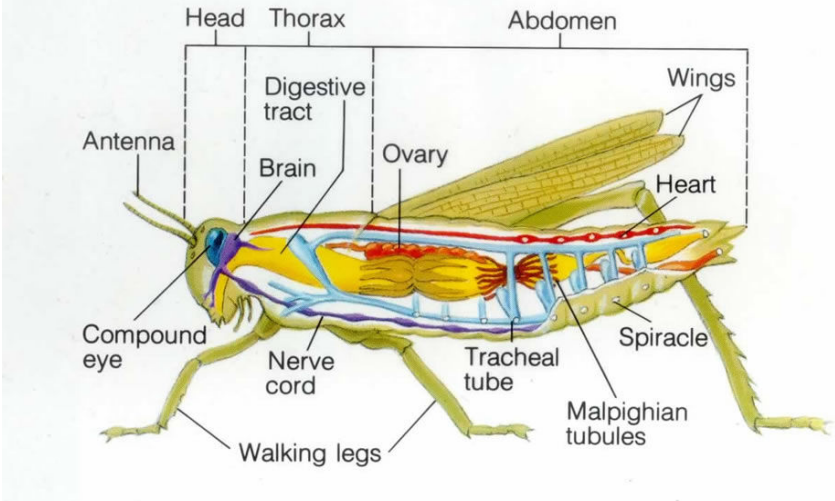
9. **Ephemeroptera** – mayflies: two or three long thread-like tails extending from the posterior end of the abdomen
10. **Odonata** – dragonflies: two pair of wings about the same size and shape acting independently. Antenna are short and not obvious
11. **Neuroptera** – ant lions, lacewings: head w/ long antenna and large pincher like jaws used to capture prey items.
12. . **Isoptera** – termites and white ants: soft bodied insects, usually social, abdomen usually has two short tails protruding from the posterior end of the abdomen
13. **Siphonaptera** – Fleas: tiny parasitic insect w/ body laterally flattened. Ability to hop w/ its hind legs
14. **Thysanura** – Silverfish: delicate, soft bodies w/ powdery scales. The abdomen have long jointed threadlike tails and antenna.

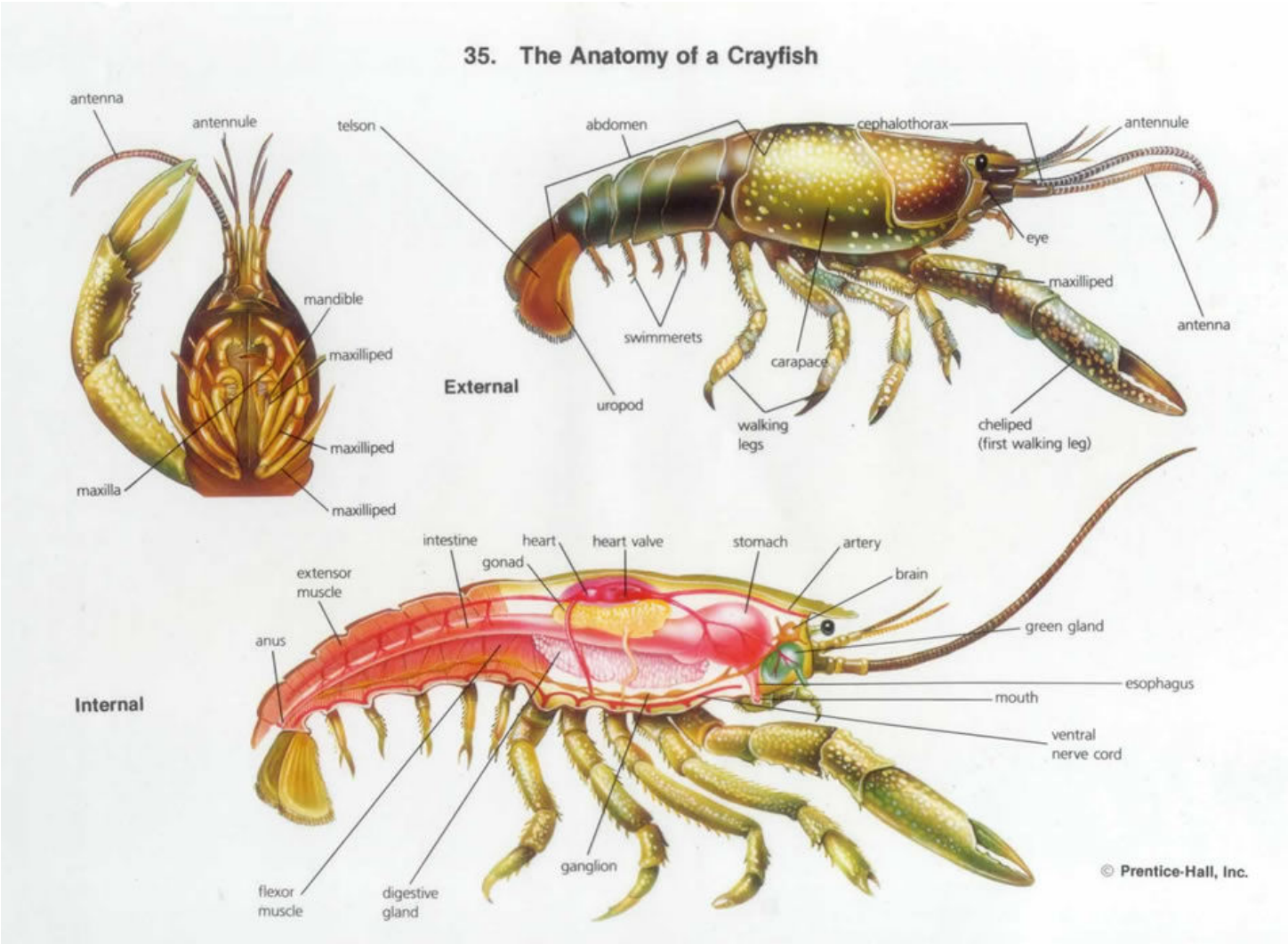
IV. Phylum: Echinodernata – "Spiny Skinned" Animals – Sea Stars, Sea Urchins, Sea Cucumbers & Sand Dollars
   a. Classification
      i. Class Asteroidea – Starfish
      ii. Class Echinoidea – Sea Urchins & Sand Dollars
      iii. Class Holothuroidea – Sea Cucumbers
   b. Characteristics
      i. Invertebrate- Aquatic – most are marine
      ii. Penta-Radial Symmetrical – usually in multiples of 5
      iii. Most with spiny hard endoskeleton
      iv. Internal Water Vascular System – control the tube feet
      v. Sessile – they crawl on the bottom
      vi. Ability to regenerate
   c. Anatomy
      i. External
         1. Madreporite – water inlet for WVS
         2. Anus – Complete digestive system exit – located on the dorsal surface
         3. Central disc – main body, arms radiate out from here
         4. Dorsal spines – long spines or hard bumps that protect
         5. Rays (arms)
         6. Spines
         7. Dermal brachia
         8. Pedicellaria – hundreds of 3 jawed "pincher-like" objects on the surface of the starfish used to clean and rid itself of unwanted debris and "guests"
         9. Mouth – located on the ventral surface
         10. Tubefeet – hundreds of pairs found ventrally along the radial canals
      ii. Internal
         1. Cardiac Stomach
         2. Pyloric Stomach
         3. Hepatic cecum
         4. gonads
         5. Water Vascular System
            a. Madreporite
            b. Stone Canal
            c. Ring Canal
            d. Radial Canal
            e. Ampullae
            f. Tube Feet





33. The Anatomy of a Grasshopper




35. The Anatomy of a Crayfish
antenna
antennule
telson
abdomen
cephalothorax
antennule
eye
maxilliped
antenna
mandible
maxilliped
swimmerets
carapace
External
uropod
walking legs
cheliped (first walking leg)
maxilliped
maxilla
maxilliped
intestine
heart
heart valve
stomach
artery
gonad
brain
extensor muscle
green gland
anus
esophagus
Internal
mouth
ventral nerve cord
ganglion
flexor muscle
digestive gland
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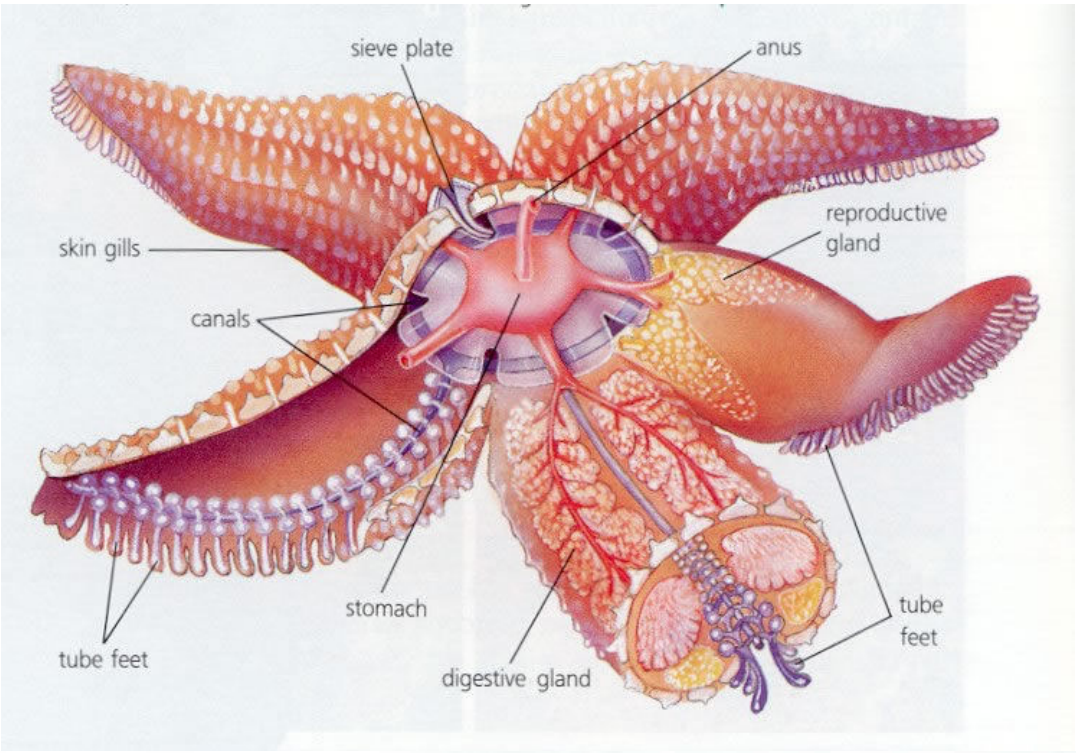

Water Vascular System

Water enters the system through holes in a flat plate on top of the sea star. This plate is called the **sieve plate.**

The water flows through a tube to the **ring canal** around the mouth.

From the ring canal, the water flows into **radial canals** in the arms.

Each tube foot is connected to a bulb called an **ampulla.** The ampulla regulates fluid pressure so that each tube foot may extend or retract, hang on or let go. The movement of the tube feet and of the arm together move a sea star slowly along the bottom of the sea.

The radial canals connect to dozens of tiny suckers called **tube feet.** These tube feet are used to move and to capture food. Oxygen enters and wastes leave through the thin walls of the tube feet.