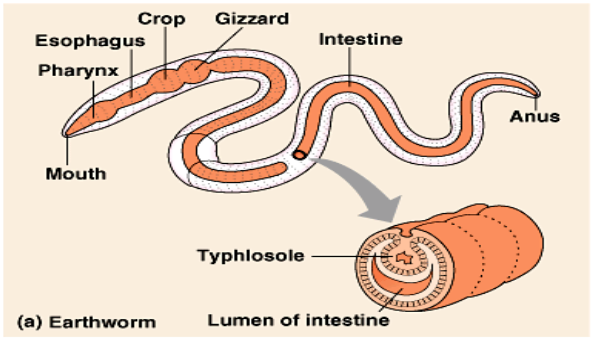
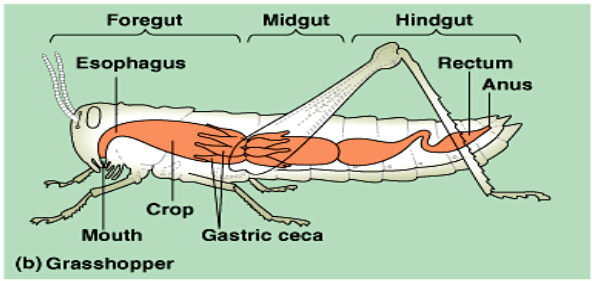
Ch41 – Animal Nutrition

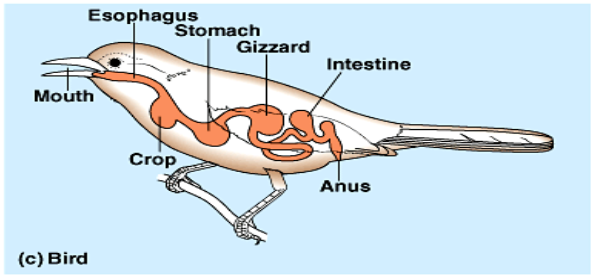
- Digestive system
  - Purpose = break down food into smaller nutrients to be used in the body for energy and raw materials for biosynthesis

Overview of food processing

- Ingestion: act of eating
- Digestion: process of food break down chemically or mechanically
  - *enzymatic hydrolysis*
  - *intracellular*: breakdown within cells (sponges)
  - *extracellular*: breakdown outside cells (most animals)
- Absorption: cells take up small molecules
- Elimination: removal of undigested material

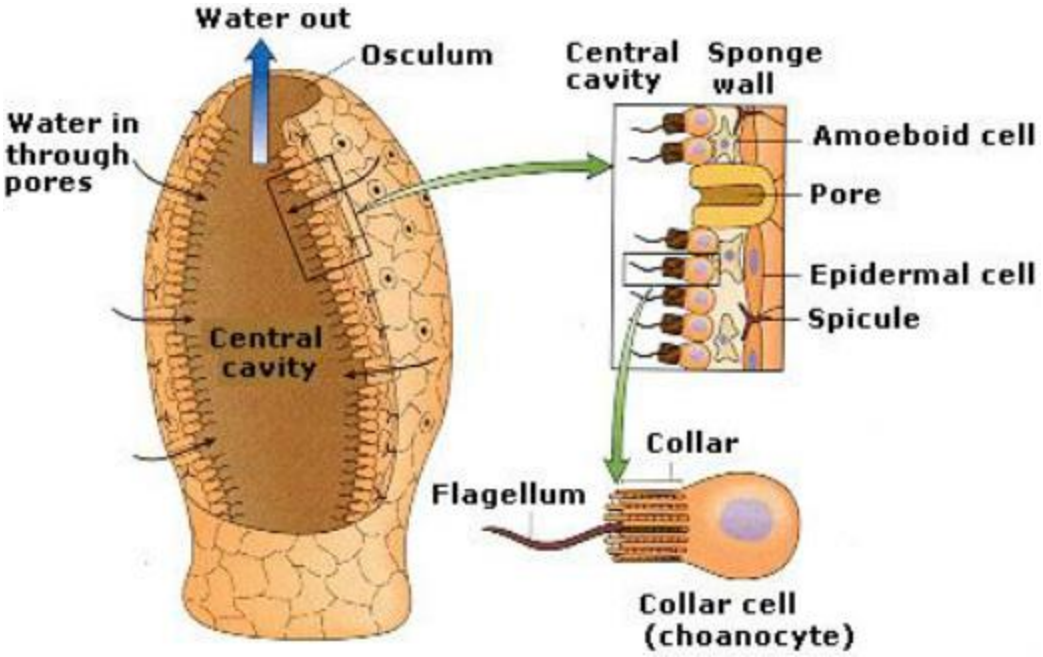






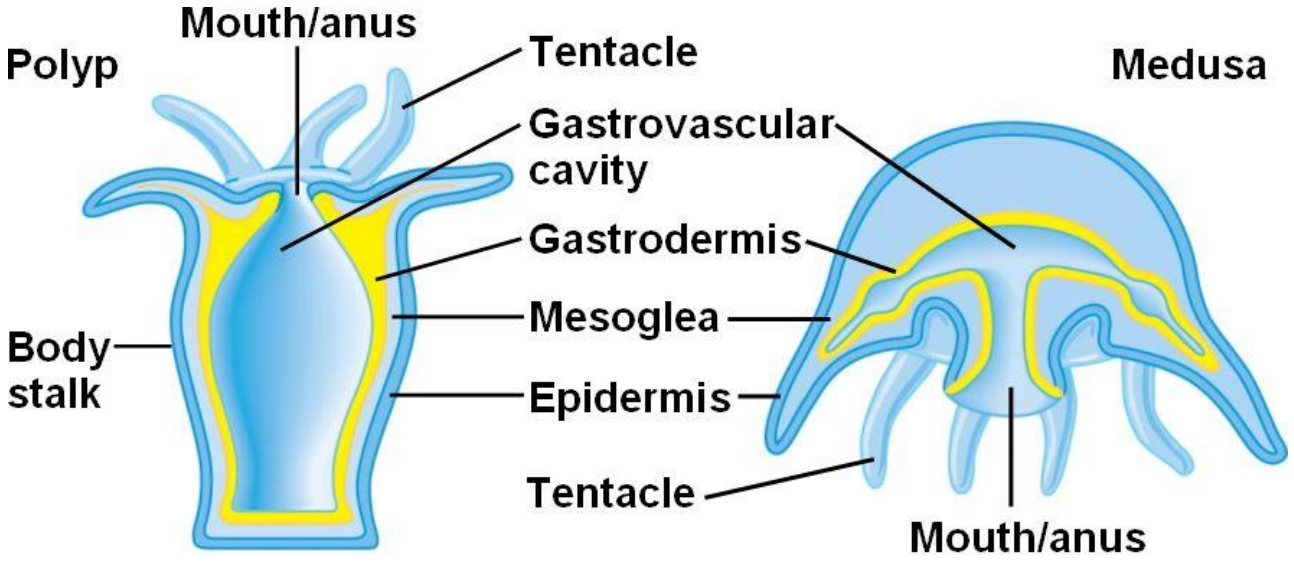
Digestion in Different Animals

- Sponges = suspension feeders
  - Water enters pores and into the spongocoel
  - Food particles get trapped in mucous layer of collar cells and taken in by phagocytosis (intracellular digestion)



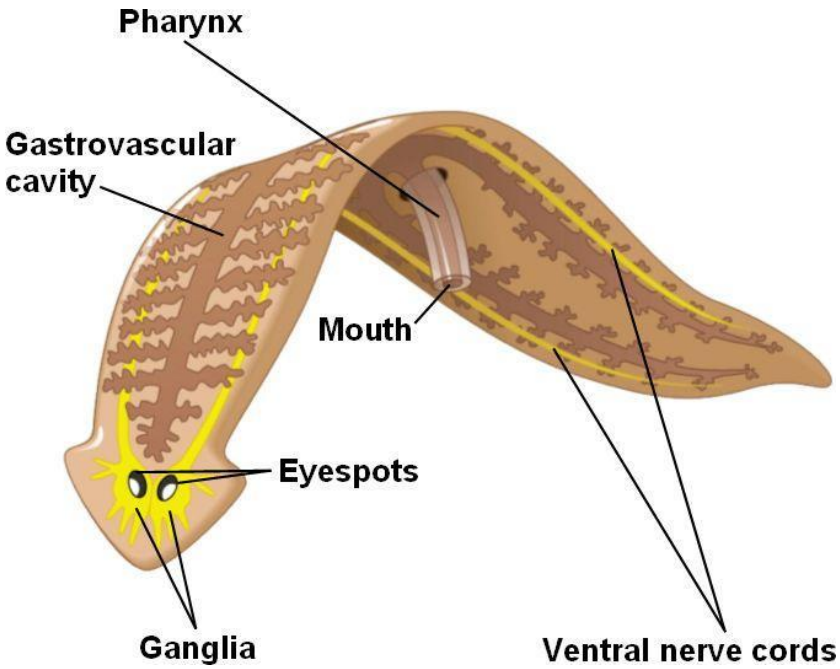
Digestion in Different Animals

- Cnidarians = within gastrovascular cavity
  - Tentacles bring food to the opening of the cavity
  - Gastrodermis – cells that line cavity and release digestive enzymes
  - Digestive enzymes mix with food and pseudopods engulf food particles



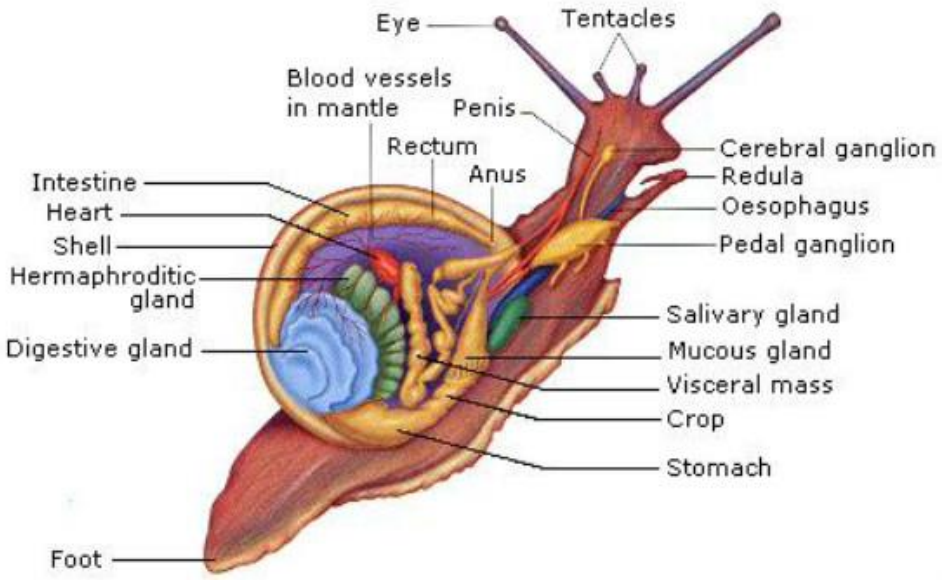
Digestion in Different Animals

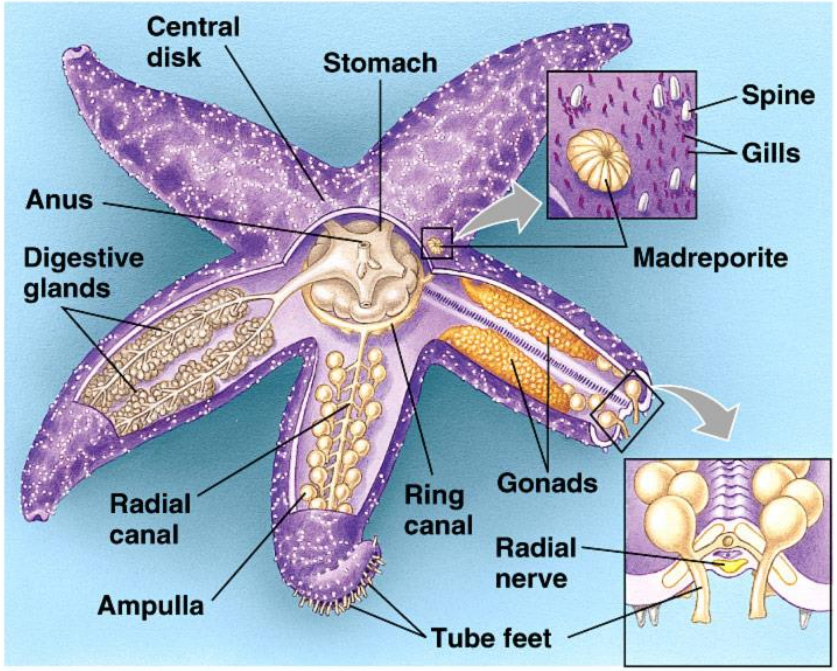
- Platyhelminthes = within gastrovascular cavity
  - One opening (mouth/anus together)
  - Branches of gastrovascular cavity delivers food directly to animal's cells



Digestion in Different Animals

- Mollusca, Annelids, Arthropods, and Echinoderms
  - 2 openings for digestion (one-way tube)
  - Start to get specialized mouth parts and digestive tract is capable of removing nitrogenous wastes in the arthropods





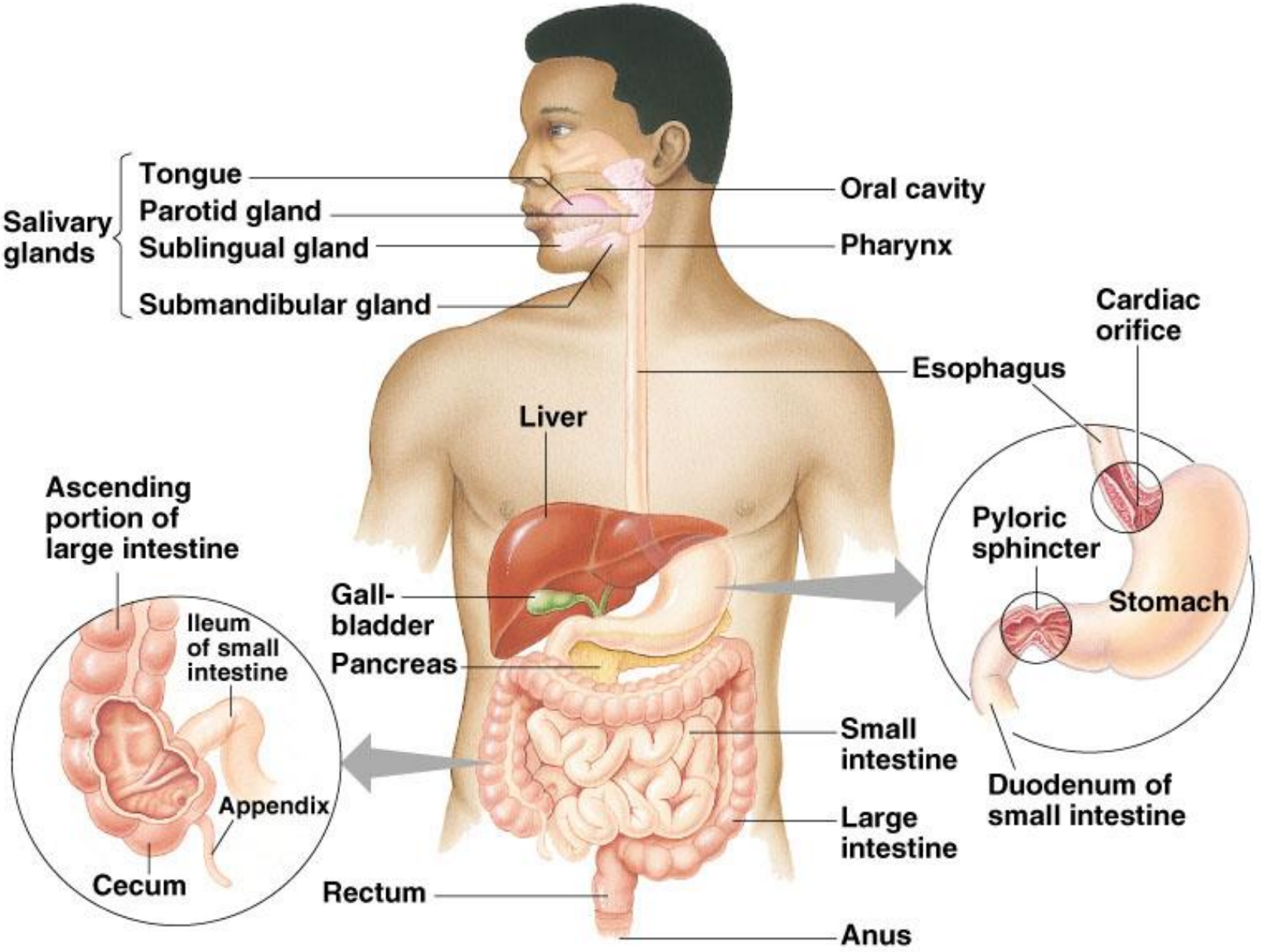
Digestion in Different Animals

- Early Chordates and Vertebrates = one-way tube
  - Contains mouth, esophagus, stomach, intestines, and anus
  - Cows: separate compartments to stomach: rumen, reticulum, omasum, and abomasum

Mammalian Digestion

- Alimentary canal (digestive tract) – muscular tube that extends from the mouth to the anus in most animals

- Peristalsis: rhythmic waves of contraction by smooth muscle
- Sphincters: ring-like valves that regulate passage of material
- Accessory glands: salivary glands, pancreas, liver, gallbladder



Mammalian Digestion

- Oral cavity (mouth) = site of ingestion of food
  - **Salivary amylase** – enzymes that breaks down carbohydrates
  - Bolus – mixture of food and saliva
  - Contains teeth and tongue to aid in digestion of food
- Pharynx = shared passageway for food and air
  - Epiglottis – flap attached to the larynx that closes the respiratory passageway during swallowing
- Esophagus = transports bolus by peristalsis to the stomach
  - Slow, rhythmic muscle contractions move food

Mammalian Digestion

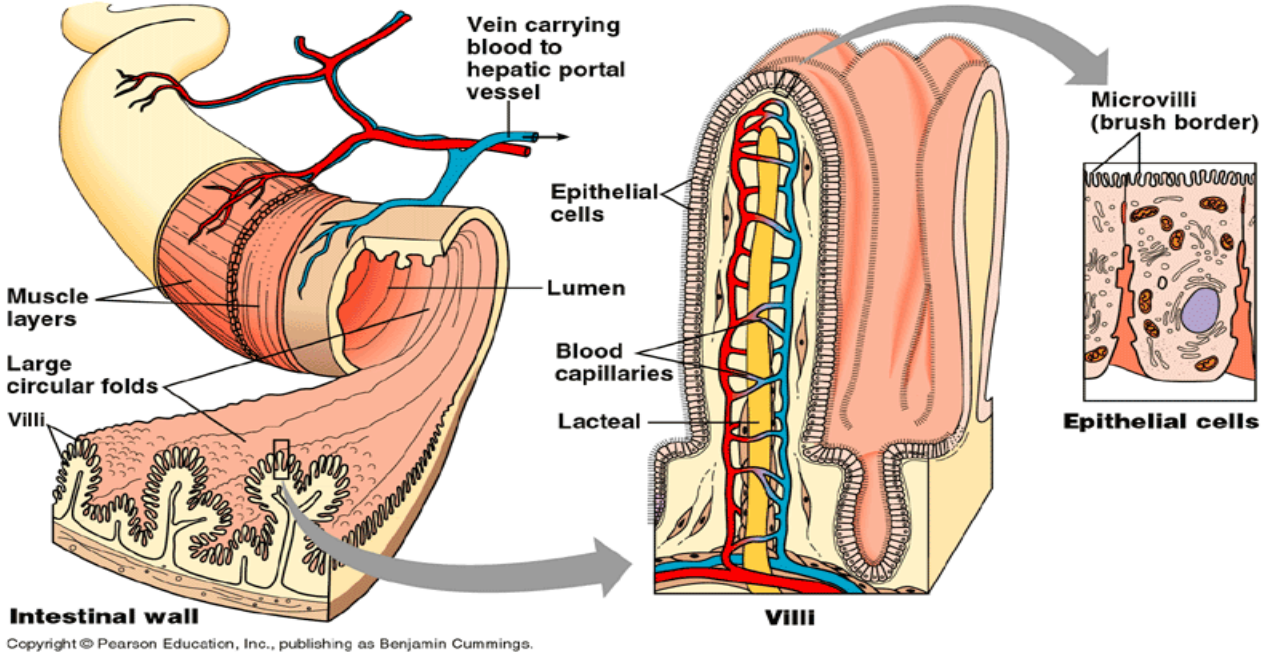
- Stomach = site of mechanical and chemical digestion of food; stores food
  - gastric juice released from gastric glands in lining
  - Food becomes acidic chyme
  - Cardiac and pyloric sphincter (muscular ring) controls food in and out of stomach

- Small intestine = nutrient absorption
  - Duodenum, jejunum, and ileum – 3 segments of the small intestines
  - Bile and pancreas have ducts that empty into the duodenum

Mammalian Digestion

Small Intestines:

- Duodenum – where digestion is completed
- Villi / microvilli – projections that aid in increased surface area to increase absorption of nutrients through diffusion into the blood
- Lacteal – immune system structures to protect pathogens coming in the body from food



Mammalian Digestion

- Large Intestines = removes excess water and stores waste
  - Cecum – herbivores have large pouch that helps in fermenting plant material
  - Appendix – reduced cecum in humans
  - Feces – undigested waste
  - Rectum/anus

- Molecules used in digestion
  - Intestinal enzymes, pancreatic enzymes, and bile (from gallbladder)
  - **Bile salts** = emulsifies fats and aids in absorption of lipids

Mammalian Digestion: Accessory Organs

- Liver = produces bile, breaks down toxins, destruction of red blood cells
- Gallbladder = stores bile
- Pancreas = produces digestive enzymes and hormones for blood sugar regulation

Hormones

1) Gastrin

- stimulates gastric juice release

2) Secretin

- stimulates pancreas to release bicarbonate to neutralize acid in duodenum

3) Cholecystokinin (CCK)

- stimulates pancreas to release enzymes and gall bladder to release bile

Evolutionary adaptations

- Dentition: an animal's assortment of teeth
  - Types of teeth can be analyzed to determine diet
- Digestive system length differs with species
- Symbiosis – microbes live in the digestive tract and aid in digestion