Digestion

Digestion is the process of converting large organic molecules (Polymers) into smaller ones (Monomers) so they can pass through a cell's membrane.

Polymers

- Polymers are molecules made up of repeating subunits. They are usually large and complex molecules (Protein, DNA, Carbohydrates)
- Monomers are the small molecular building blocks that are used to make polymers (Amino Acids, Nucleotides, simple sugars)

There are two ways to acquire nutrients:

make them or **take them**

Producers vs. Consumers

- Autotrophs: Make their own food
  - Chemosynthesis (Archae)
  - Photosynthesis (Protists, plants)
- Heterotrophs: Cannot make their own food
  - Intracellular digestion (within cell, *Amoeba*, *Paramecium*)
  - Extracellular digestion (outside cell, molds, *Hydra*)

Major Types of Food Molecules

All food is composed of at least one of the 3 major food molecules

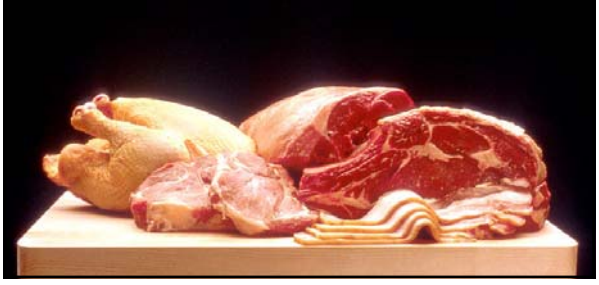
-Carbohydrates
-Proteins
-Lipids

Carbohydrates

- Carbohydrates are used as an energy source in cellular respiration.
- Polysaccharides (Starch) are digested into monosaccharides.

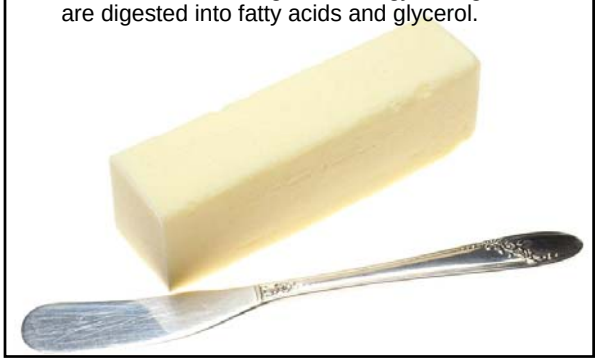
Proteins

- Proteins are digested into Amino Acids.



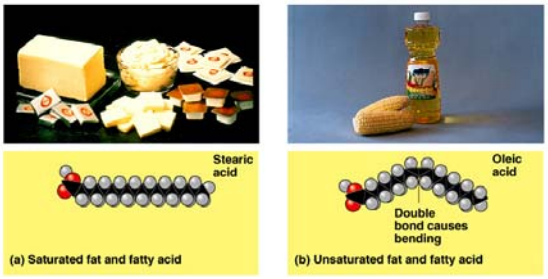
Lipids (Fats)

- Fats are used as long term energy storage and are digested into fatty acids and glycerol.



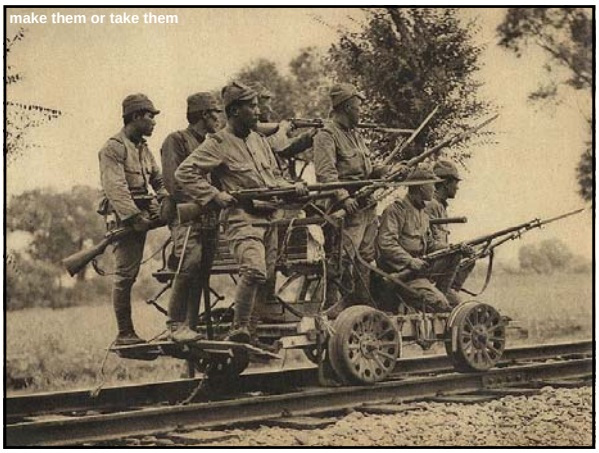
Lipids come in two varieties

- Saturated fats are solid at room temperature
- Unsaturated fats are liquids at room temperature



Basic food molecules

Molecule	Building Blocks	Function	Sources
Protein	Amino acids	muscle, enzymes	Eggs, fish, chicken, meat, nuts, legumes
Carbohydrates	Monosaccharides (glucose)	Energy	Fruit, veggies, bread, potatos, pasta, grains
Fats (lipids)	Fatty acids and glycerol	Energy, structure, hormones	Vegetable oils (olive, safflower), animal fats (butter)
Nucleic acids	Nucleotides	DNA, RNA	Cells



Make them or Take them

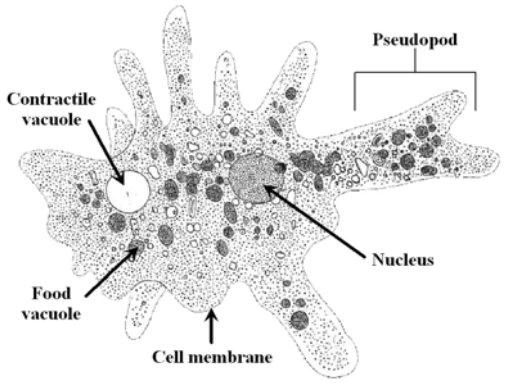
- **Autotrophs can produce organic molecules via photosynthesis and therefore do not need to eat to get nutrients.**
- **Heterotrophs must obtain their nutrients from the environment. Usually this means eating other organisms that have them.**

Is it a producer? Or consumer?

Producer!!!

Venus Flytrap uses the sunlight to make sugar but because it grows in poor swampy soil it must obtain nitrogen and phosphorus from the bodies of insects

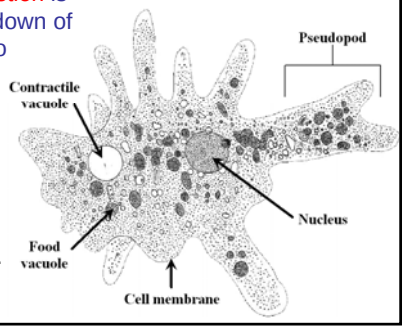
Amoeba



Amoeba use intracellular digestion

Intracellular digestion is where the breakdown of food particles into simpler units occurs entirely within the cell.

Amoebas use pseudopods to engulf their food via phagocytosis.

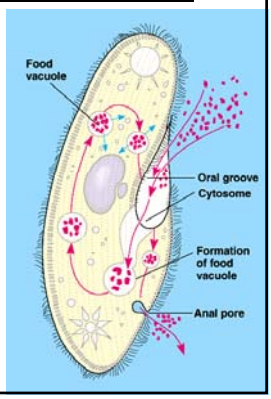


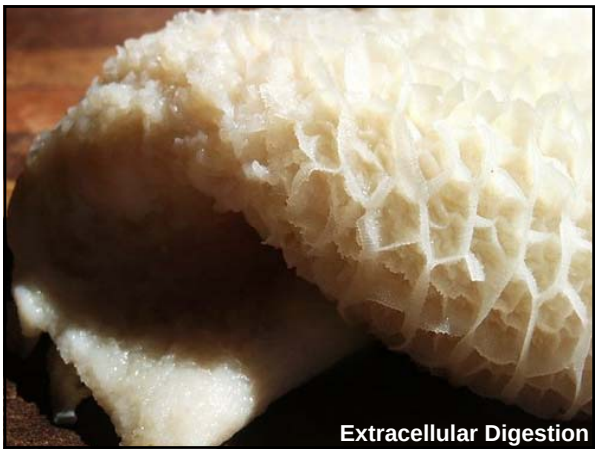
DIGESTION IN PARAMECIUM

Paramecium use their cilia to draw food particles into their oral groove where it can be phagocytized into their cell.

Once the food is inside a vacuole it is broken down using the digestive enzymes inside lysosomes.

After the nutrients have diffused from the food vacuole the waste materials exit the cell via exocytosis.





Extracellular Digestion

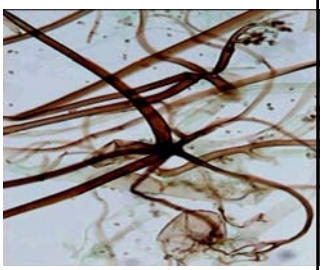
Digestion that takes place outside of individual cells.

Usually extracellular digestion takes place in a digestive cavity surrounded by the body (stomach)

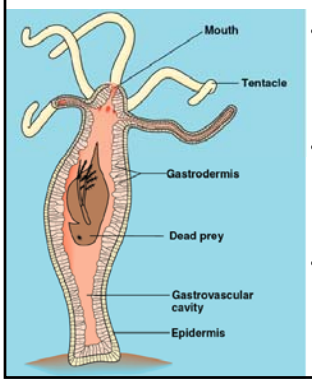
Digestion can also occur completely outside of body like in bread mold

Bread Mold - Rhizopus

- Saprophytes are organisms that only eat dead things
- Rhizoids grow through the food and secrete digestive enzymes into the food and absorb broken down nutrients

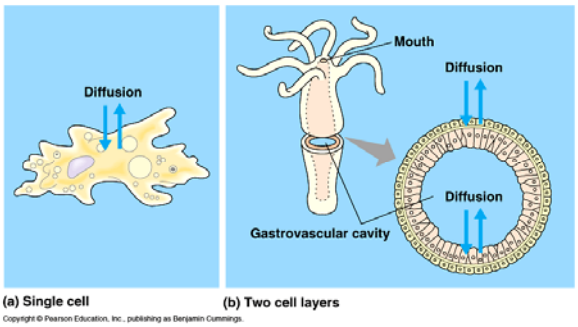


Extracellular Digestion in Hydra



- 2-Way traffic- Food and Waste both enter and exit using the same opening.
- Hydra are chunk feeders as they take in large bits of food which are then digested
- Digestion occurs inside a **gastrovascular cavity**.

Figure 40.7 Contact with the environment



- Chunk feeders
  - Take in food in large pieces
  - Require specialized structures for physical/mechanical digestion,
  - Require enzymes to provide chemical digestion

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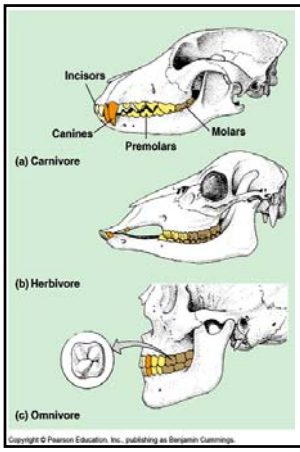


Dentition and Diet

Teeth are found in the jaws of many vertebrates. The primary function of teeth is to tear and chew food so as to allow for digestion.

Mammals have teeth of different sizes and shapes, a condition known as heterodonty, allowing different teeth to be specialized for different tasks.

These specialized teeth include:

Incisors- for cutting
Canines- for tearing
Premolars- for shredding
Molars- for grinding

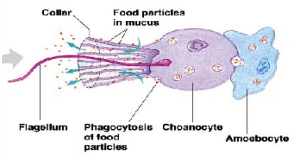
The type of teeth help determine the diet of an organism

Filter feeders don't need no stinkin' teeth

Filter feeders eat microorganisms and/or nutrients floating in water
Filter feeders tend to be sessile (sedentary)
They take water into their body and filter the out food as they expel water
Filter feeders include mollusks, baleen whales, flamingos

Sponges are filter feeders

- Sponges are sessile animals that filter the water.
- Sponges have flagella that draw the water into their bodies so they can digest the food
- Sponges use intracellular digestion



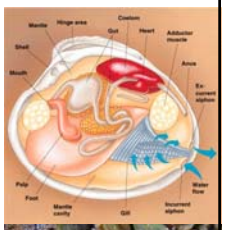
Bivalves

Filter Feeders

Have a true digestive tract

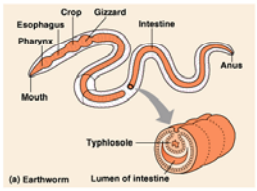
They strain food on mucus covered gills.

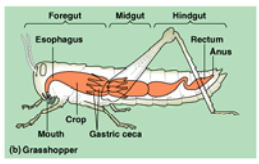
They use Incurrent & Excurrent siphons to suck water into and then push it out of their bodies

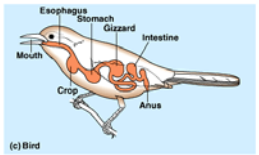


The shell of the Geoduck clam is large around 20 cm in length, but the extremely long siphons make the clam itself very much longer than this: the "neck" or siphons alone can be 1 meter (3.3 ft) in length.

1-Way Traffic A complete mouth to anus digestive tract is present in many animals. Much more efficient as digestion is divided into stages.







Earthworm digestion

- Mouth-opens to let food in
- Pharynx- muscular organ pulls food in moistens food
- Esophagus- muscular tube pushes food down using peristalsis
- Crop-stores
- Gizzard-grinds
- Intestine-chemical digestion & absorbs
- Anus