Cell Structure and Function

Cells are the basic functional units of all living things

Outline of Today's Lecture

1. Cell Theory
2. Prokaryotic and Eukaryotic Cells
3. Animal Cells and Plant Cells
4. Functions of cell components
5. Hammerling's experiments: Acetabularia

Cell Theory

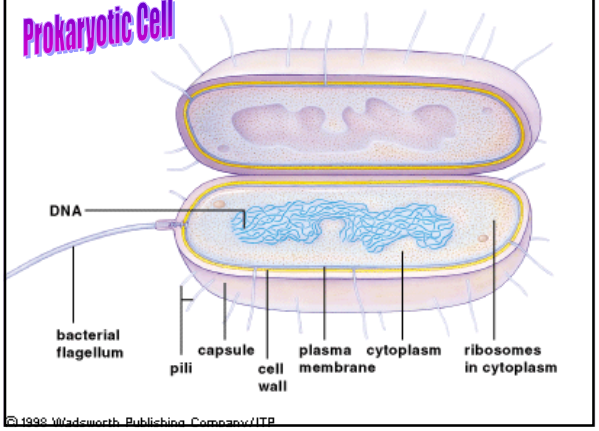
Cell Theory

a. All organisms are cellular.

b. Cells are the basic functional units of all living things.

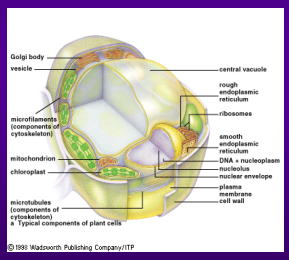
c. Cells come from pre-existing cells.

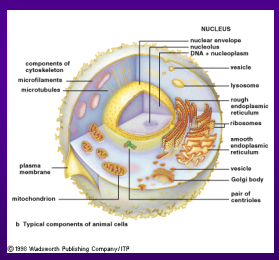
Prokaryotic Cell



Eukaryotic Cells

A Plant Cell **An Animal Cell**





Animal Cells and Plant Cells

Size:10-30 µm (1 micrometer =1/1,000,000 m)

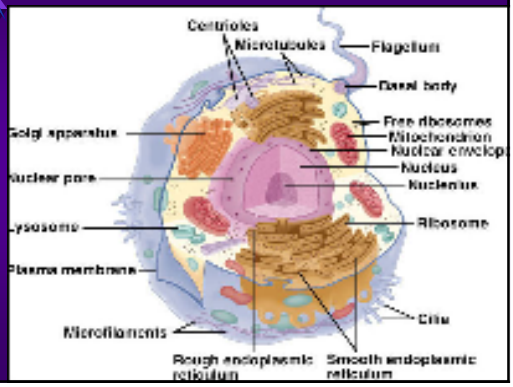
a. Plasma membrane (cell membrane)

b. Nucleus (chromosomes, nucleolus and nuclear envelope)

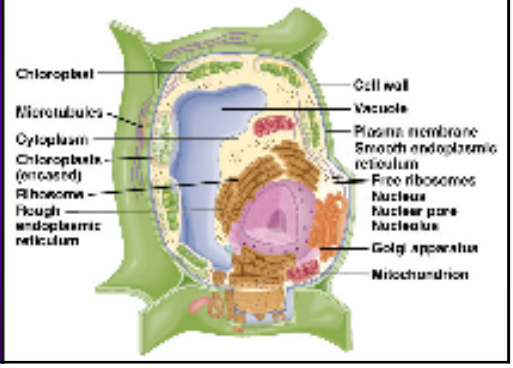
c. Cytoplasm (every thing inside the cell membrane, exclusive of the nucleus) Organelles: mitochondria, Golgi complex, rough and smooth endoplasmic reticulum, ribosomes, lysosomes, vesicles, etc.

Plant cells have: I. Chloroplast II. Cell wall III. Central vacuole.

An animal cell



A plant cell



Functions of cell components

The Nucleus – Regulates the cell activities

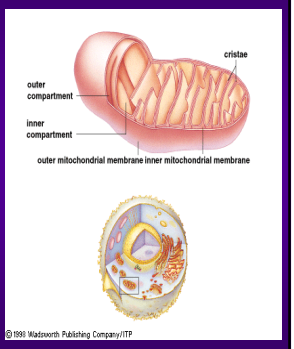
1. Eukaryotic DNA resides in the nucleus
2. Chromosomes
3. Nuclear envelope (2 membranes) controls exchange of substances between nucleus and cytoplasm

Plasma membrane – Isolates cell contents from environment; regulates movement of materials into and out of cell; communicates with other cells

1. Lipid bilayer
2. Proteins: Channels, transport, pumps, receptors

Mitochondria

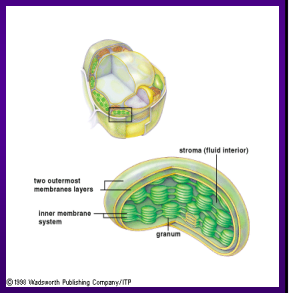
- Production of ATP
- Double-membrane system
- Have their own DNA
- Divide on their own
- Have ribosomes



Chloroplast

- Photosynthetic
- Two outer membrane layers

Chlorophyll

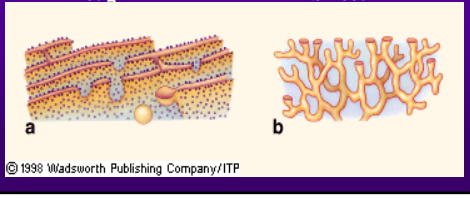


The Endoplasmic Reticulum

Rough and Smooth

- Presence or absence of ribosomes
- Rough: Proteins
- Smooth: Lipids

Rough ER Smooth ER

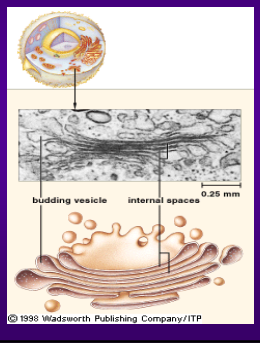


Golgi Bodies

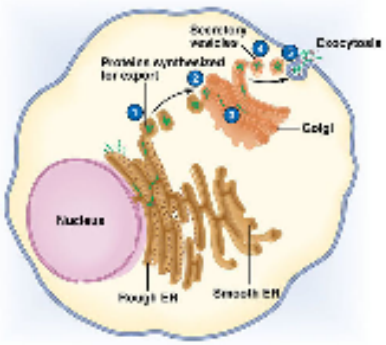
Enzymatic finishes on proteins and lipids, and packaging in vesicles

Vesicles : one membrane-bound sac, tansport, storage, or digestion

Lysosomes : intracellular digestion

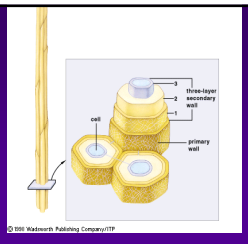


movement



Cell Walls

- Structure:
  - cellulose
- Function:
  - support and rigidity
  - protection from drying environment



Deposition of layers inside primary wall

Stiffen wall

Maintain shape

Central Vacuole

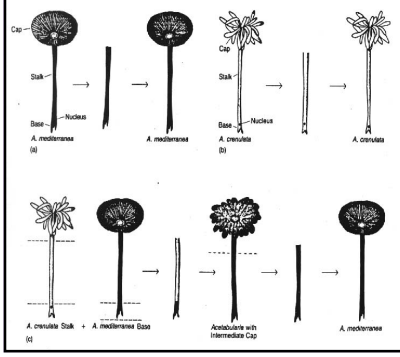
Large , fluid-filled organelle of living, mature plant cell.

Stores amino acids, sugars, ions, and toxic wastes.

As it enlarges during the growth, it forces the primary cell wall to expand and cell surface area to increase – maintaining turgor pressure.

BIO 301 L – ZHAO

Hammerling's experiments on the role of the nucleus and the cytoplasm in determining cell structure in Acetabularia species.



Hammerling's experiments with *Acetabularia* revealed the essential role of the nucleus in heredity.

Acetabularia is a single-celled alga with a rootlike base containing the nucleus, a stalk, and a cap. (a) If the upper stalk and cap are cut from *Acetabularia mediterranea*, the cell regenerates the characteristic umbrellalike cap. (b) If the upper stalk and cap are cut from *Acetabularia crenulata*, the cell regenerates the characteristic petal-like cap. (c) If an *A. crenulata* stalk without its cap is transplanted onto the base cut from an *A. mediterranea* cell, the alga regenerates a cap that is intermediate in appearance between the petal-like and umbrellalike caps. If this intermediate cap is then cut off, the algal cell regenerates an umbrellalike cap of the *A. mediterranea* type, and any further amputations of the cap result in the regeneration of only this type. Since the base, which contains the cell nucleus, came from an *A. mediterranea* cell, the experiment shows that the nucleus must contain information governing the cell's architecture.