

CELL STRUCTURE AND FUNCTION

CELL THEORY

- All organisms are composed of cells.
- Cells are the structural and functional unit of organisms.
- Cells come only from pre-existing cells.

CELL SIZE

- Cells need a surface area of plasma membrane large enough to adequately exchange materials.
- **SA/V ratio** requires that cells be small.
 - a. As cells get larger in V, SA relative to V ↓.
 - b. Size limits how large the actively metabolizing cells can become.
 - c. Cells needing greater surface area utilize membrane modifications such as folding, microvilli, etc.

PROKARYOTIC CELLS

- Lack a nucleus.
- Extremely small.
- 2 taxonomic domains: Bacteria + Archaea – organisms are structurally similar but biochemically different.

STRUCTURE

- Lack a nucleus.
- Occur in 3 basic shapes: spherical **coccus**, rod-shaped **bacillus** & spiral:
 - ✓ **spirillum** (if rigid)
 - ✓ **spirochete** (if flexible)

CELL ENVELOPE

- Includes **plasma membrane**, **cell wall** + **glycocalyx**.
- **Plasma membrane**: lipid bilayer with imbedded & peripheral proteins.
 - ✓ Regulates movement of substances into + out of the cell.
 - ✓ Can form internal pouches – **mesosomes** – which increase internal SA of membrane for enzyme attachment.
- **Cell wall**: maintains cell shape; strengthened by **peptidoglycan**.
- **Glycocalyx**: layer of polysaccharides on outside of cell wall:
 - ✓ Called **capsule** if organized & not easily removed,
 - ✓ **Slime layer** if not well-organized & is easily removed.

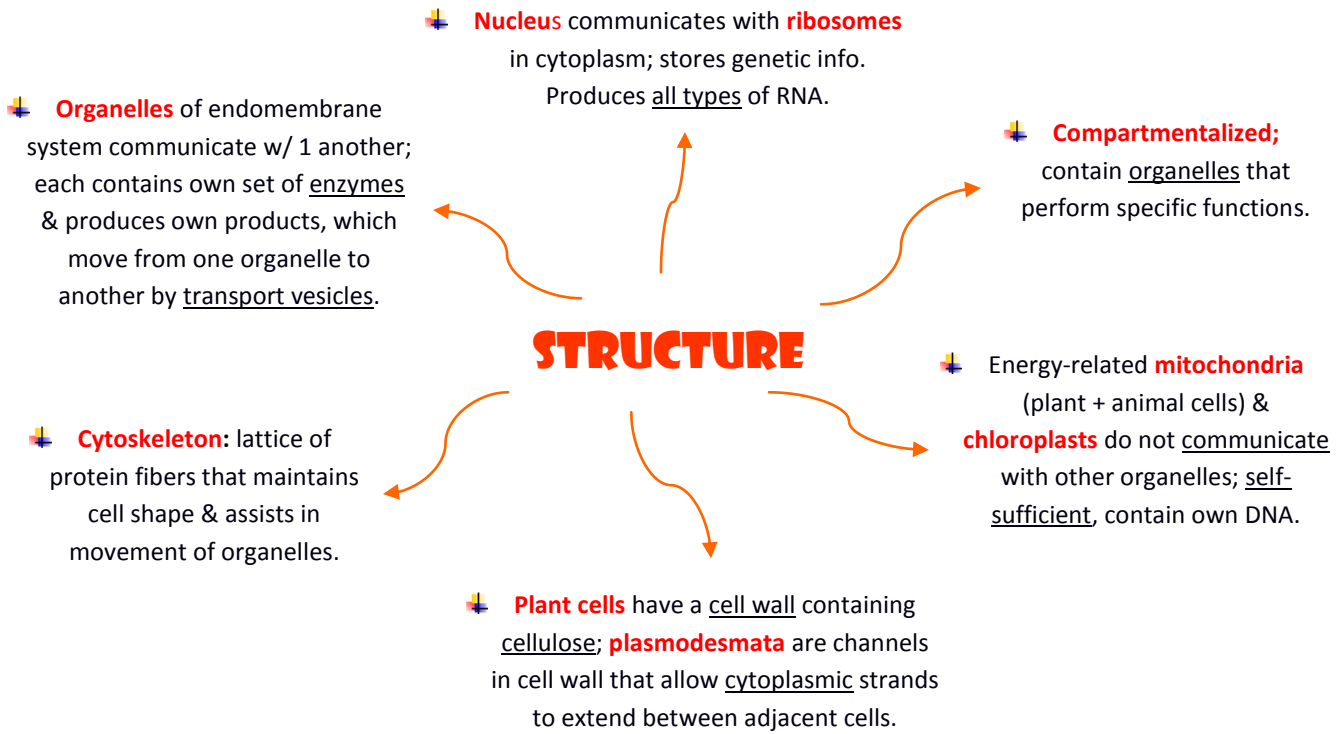
CYTOPLASM

- Semi-fluid **solution** containing H₂O, inorganic + organic molecules & enzymes.
- **Nucleoid**: region that contains single, circular DNA molecule.
- **Plasmids**: small accessory (extra-chromosomal) rings of DNA; not part of bacterial genetic material.
- **Ribosomes**: particles with 2 RNA- and protein-containing subunits that synthesize proteins.
- **Inclusion bodies** in the cytoplasm are granules of stored substances.
- **Cyanobacteria**: photosynthesize.
 - ✓ Lack chloroplasts but have **thylakoids** containing chlorophyll + other pigments.

APPENDAGES

- **Motile bacteria** have flagella; filament, hook + basal body work to rotate the flagellum to move through fluid medium.
- **Fimbriae**: mall, bristle like fibers that attach to an appropriate surface.
- **Conjugation pili**: tubes used by bacteria to pass DNA from cell to cell.

4.3 EUKARYOTIC CELLS



NUCLEUS

- ✚ **Chromatin**: threadlike material that condenses & coils into chromosomes just before cell division.
- ✚ **Chromosomes**
 - ✓ rodlike structures formed during cell division
 - ✓ composed of coiled or folded chromatin
 - ✓ contains DNA, protein & some RNA
- ✚ **Genes**: composed of DNA & present on chromosomes.
- ✚ **Nucleolus**: dark region of chromatin inside nucleus where rRNA joins with proteins to form ribosomes.
- ✚ **Nucleoplasm**: semifluid medium of nucleus.
- ✚ **Nuclear envelope**
 - ✓ double membrane that separates nucleus from cytoplasm
 - ✓ contains **nuclear pores** to permit passage of substances (e.g., ribosomal subunits, mRNA, proteins, etc.) in & out of nucleus