Biology 101: Cell Structure & Function

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1. Cellular Organization

- The **nucleus** is the control center of the cell that contains DNA.
- **DNA** is the molecule that carries genetic information and provides the blueprint for protein synthesis.

Although our focus today is on energy and protein production, remember that other systems like the Golgi apparatus and endoplasmic reticulum handle packaging and transport later on.

2. Energy Conversion

- **Mitochondria** is an organelle that produces energy for the cell by converting nutrients into usable power.
- **ATP** is a molecule that stores and transfers energy in cells, fueling processes like muscle contraction and active transport.

Inside the mitochondria, a series of enzyme-driven reactions break down glucose. The next section shows how those enzymes actually work.

3. Enzymatic Activity & Protein Synthesis

- An **enzyme** is a protein that speeds up chemical reactions in a cell.
- **Ribosome** is a structure that synthesizes proteins by reading mRNA codons and linking amino acids.

After ribosomes build a polypeptide chain, the Golgi apparatus modifies and packages it for export. Meanwhile, cytoskeletal filaments maintain cell shape and help move vesicles.

4. Photosynthesis (Plant Cells Only)

- **Chloroplast** is an organelle in plant cells where photosynthesis occurs.
- **Photosynthesis** is the process by which green plants convert sunlight into energy, producing glucose and oxygen.

Chlorophyll within the chloroplast absorbs light, splitting water molecules and generating high-energy electrons. Those electrons power the synthesis of ATP and NADPH, which then drive carbon fixation in the Calvin cycle.

5. Membrane Dynamics

- The **cell membrane** is a barrier that surrounds the cell and controls what enters and leaves.

It's composed of a phospholipid bilayer with embedded proteins, cholesterol, and carbohydrate chains. Diffusion, osmosis, and active transport all occur across this dynamic boundary.

Quick Recap

1. **Nucleus**: control center (contains **DNA**)
2. **Mitochondria** → **ATP** production
3. **Enzyme**-catalyzed reactions
4. **Ribosome**-based protein synthesis
5. **Chloroplast** & **photosynthesis** (plants)
6. **Cell membrane**: selective barrier

(Extra notes: next lecture we'll cover cell division—mitosis vs. meiosis—and how errors in DNA replication can lead to mutations.)