

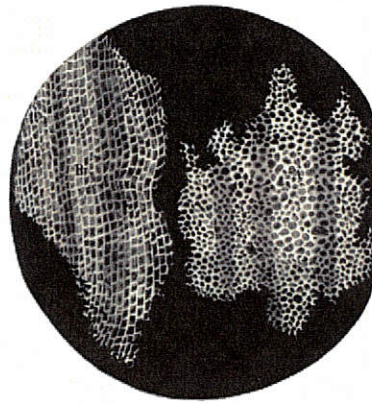
BIOLOGY NOTES

Cells #1: Cell Theory, Cell Organelles and Cell Membrane

For additional support and information: Complete Chapter 3 Sections 1-3 in your Interactive Reader

Read and reference Chapter 8 in your Biology book.

- Section 1 = Cell Theory
 - Cells: Basic unit of life.
 - Microscopes: Enable scientist to view and study cells
- Early studies led to the development of the cell the cell theory:
 - Robert Hooke:
 - Actually gave cells their name in 1665.
 - Looking at a piece of a cork (tree bark).



- Used a compound light microscope
 - Though its crude lenses severely limited the amount of detail that he could see.
 - Saw the spaces that cells once occupied = Dead cells.
- **Anton van Leeuwenhoek:** (A Dutch tradesman that was born the son of a basket-maker. He was trained as a fabric merchant. He was accustomed to using magnifying lenses to examine threads. To make his job easier he worked on making his lenses stronger. Eventually he succeeded and one of his single lenses was actually stronger than Hooke's compound light microscope.
 - In 1674 Leeuwenhoek became the 1st to describe living cells.
 - Saw numerous single celled organisms swimming in pond water.

***** Due to these two discoveries, scientists began to ask: Are all living things made of cells? And where do cells come from?

○ Cell Theory:

- Mostly developed by three German scientists

- Matthias Schleiden (plants)
- Theodor Schwann (animals)
- Rudolf Virchow

○ Has 3 major parts.

Must be able to list these from memory.

- All organisms are made of cells.
- The cell is the most basic unit of life.
- All existing cells are produced by other living cells.

- Your body contains trillions of cells of many different shapes and sizes.

- In general, cells.....

- Tend to be microscopic in size and have similar building blocks.

- Enclosed by a membrane that controls what enters & exits the cell.

- Contain cytoplasm: A jellylike substance that contains dissolved proteins, nucleic acids, minerals & ions.

- In SOME cells the cytoplasm contains

organelles.

- Organ like structures that are specialized to do certain jobs.

- We can put cells in two different groups: Prokaryotic and Eukaryotic

- Prokaryotic Cells:

- No Nucleus

- No membrane bound organelles.

- DNA is suspended in the cytoplasm.

- All prokaryotes are single-celled.

- 3 main types of fibers:
 - Microtubules
 - Intermediate Filaments
 - Microfilaments
 - Cytoplasm also helps when it comes to cell structure.
 - In eukaryotes, it fills the space between the nucleus and the cell membrane. The fluid portion is called cytosol and consists mostly of water.
 - This is why water is necessary for maintaining cell structure.
 - The water also acts as a solvent for the many chemical reactions that occur in cytoplasm.
 - Plant cells vs. Animal Cells
 - Both use many of the same type of organelles that carry out basic functions.
 - But both cell types also have organelles that are unique to their needs.
- Several organelles are involved in making and processing proteins:
 - **Main job of the cell:** Make proteins
 - Proteins are made from 20 types of amino acids
 - Proteins carry out many critical functions and it is important to make them correctly.
 - Organelles of the Cell
 - Nucleus: The Brain of the cell
 - Stores genetic information called DNA.
 - DNA contains the instructions for making proteins
 - The DNA in the nucleus is enclosed in a double membrane called the nuclear membrane.
 - The nucleus also contains the Nucleolus:
 - This is where the ribosome are assembled.
 - Endoplasmic Reticulum (The ER)
 - Fills a large part of the cytoplasm
 - Site of cellular chemical reactions
 - An interconnected network of thin folded membranes.
 - Interior portion of this maze = Lumen

- Production of proteins and lipids occur both on the surface of the ER and in the Lumen
- Highly folded = *These folds allow it to take up less space while keeping the same amount of surface area.*
- Some parts contain ribosomes:
 - Actually made of proteins and RNA. After they are made in the nucleolus, they pass through the nuclear pores into the cytoplasm where more of the protein synthesis occurs.
- Rough ER = *Covered in Ribosomes*
 - Function = Makes *proteins* and sends them to the lumen
- Smooth ER = *No Ribosomes*
 - Function = *Make Lipids*
 - Responsible for breaking down drugs and alcohol
- **Golgi Apparatus: The Post Office**
 - Consists of Layered stacks of membrane-enclosed spaces that:
 - *Process, sort + package proteins.*
 - Proteins move from ER to the Golgi.
 - **It's the Postal Service of the Cell:**
 - Where does it send the proteins???
 - Some.....
 - *Stay for later use.*
 - *Are transported to other organelles.*
 - *Are carried to the membranes and secreted outside the cell.*
- **Vesicles:**
 - The *Shipping Containers of the cell.*
 - Small membrane-bound sacs that *divide some material* from the rest of the cytoplasm.
 - After a protein has been made, part of the ER pinches off to form a vesicle surrounding the protein.
 - This allows for the protein to be safely *transported* to the Golgi apparatus.
 - Once a protein reaches the Golgi apparatus, it is then.....*processed, sorted + placed in a new vesicle for storage, transportation or secretion.*

- **Mitochondria:**

- Power-Plant of the cell.
- It supplies cellular energy to the cell.
- Bean-shaped organelle.
- Contains its own ribosomes and DNA.
 - These are thought to have once been free-living prokaryotes that were taken in by larger cells.
 - If so.... This must have been a relationship that helped both organisms survive.

- **Vacuole:**

- Fluid filled sac used for storage.
 - Stores water, food molecules, inorganic ions and enzymes
- In Animal Cells...
 - Small vacuoles (if any).
- Plant Cells
 - Very large vacuoles

- **Lysosomes:**

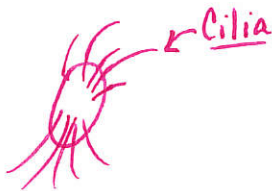
- The Garbage Disposal
 - Membrane bound organelle that contains digestive enzymes.
 - What is an enzyme???
 - A special protein that causes chemical reactions to start, stop, speed up, or slow down.
 - Hmmmmmm.....
 - If enzymes are proteins, where do you think they are made?
 - They are made by ribosomes that are attached to the ER.
 - They.....
 - Defend a cell from invading bacteria + viruses.
 - Break down damaged or worn out cell parts.
 - Think about this....

- If lysosomes can destroy worn out cells parts, what prevents them from destroying functioning cell parts?
 - Lysosomes are surrounded by a membrane that prevents the digestive enzymes from leaking out.

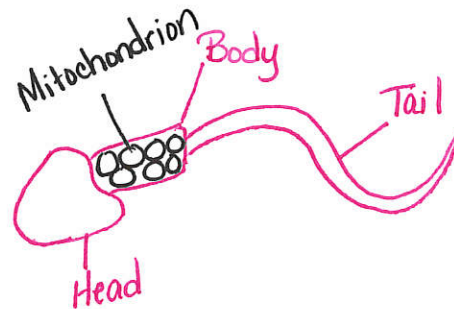
- Centrioles:

- Cylinder shaped organelles that are made from microtubules that are arranged in a circle.
 - Microtubules..... what other cell part contains these?
 - Cytoskeleton
- The Centrioles help form cilia and flagella.
 - Both of these structures aid in movement.

Cilia: Hair-like Projections



Flagella: Whip-like Extension



- Cell Wall:

- Found only in plants, fungi, & some bacteria cells.
 - It is a tough / rigid, outer layer that gives support, protection, and shape to the cell.
 - In plants, the cell wall is made up of Cellulose, a polysaccharide.
 - What is a polysaccharide?
 - Complex Sugar

- **Chloroplasts:**

- **Organelles that run photosynthesis.**

- Chlorophyll is a green pigment that is found on the inside of the chloroplasts.

- Chlorophyll is responsible for absorbing energy from the sun.

3.2 Questions:

1. What problems might a cell experience if it had no cytoskeleton?

The cell would be disorganized. It would be weak & might fall apart.
The cell would be unable to move, divide & transport organelles.

2. How are the nucleus and a vesicle similar and different in structure and function?

Both are membrane-bound compartments that store & separate certain materials. The nucleus is a permanent structure protected by a double membrane. Vesicles are temporary organelles.

3. In what ways are lysosomes, vesicles and the central vacuole similar?

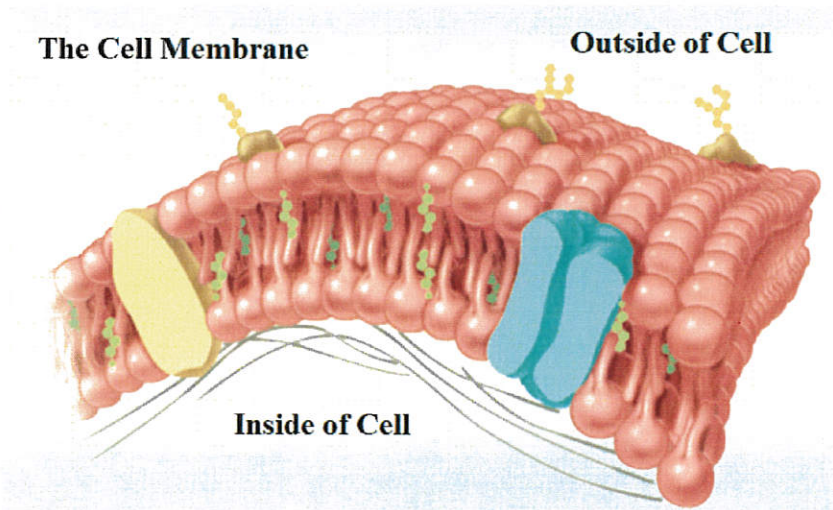
All are membrane-bound organelles that store or separate certain substances.

4. Would it be accurate to say that a chloroplast makes energy for a plant cell? Explain your answer.

No, energy cannot be created or destroyed. The chloroplast converts energy to a form that a cell can use.

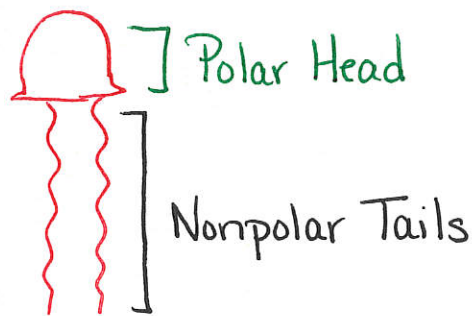
Section 3 - Cell Membrane

- Cell Membrane = AKA Plasma membrane
 - Boundary between the cell and its outside environment.
 - Controls what comes in and goes out of the cell.



- It has a double layer of phospholipids, this is why they call it a : Phospholipid Bilayer

- Phospholipid:



- Polar Vs Non-Polar:

- Heads =

- Can interact with water.
- Phosphate group + Glycerol

- Tails =

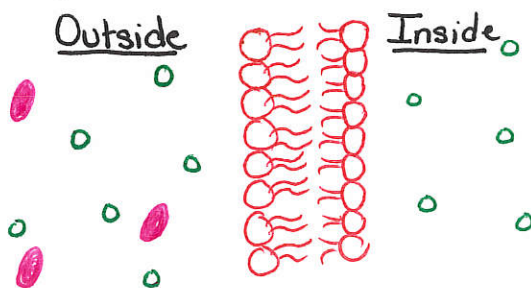
- Non-polar = Repelled by water
- Two fatty-acid tails.

- Fluid Mosaic Model:
 - Describes the arrangement of the molecules that make up a cell membrane.
 - It is = Flexible
 - Phospholipids can slide past each other in a "fluid" motion.
- Other Molecules of the Cell Membrane:
 - Cholesterol = Strengthens the cell membrane.
 - Proteins = Helps some materials cross the membrane.
 - Carbohydrates = Serves as identification tags (allow cells to distinguish one type of cell from another.)

- The Cell membrane is.....

- Semi-permeable or Selectively Permeable
 - Some things can cross but not all.

- Diagram of Cell Membrane:



- Selective Permeability = Semi- Permeable

- Allows the cell to maintain Homeostasis
- Allows some but not all molecules to pass
 - Molecules cross in several ways
 - Some use energy = Active Transport

- Others do not = Passive Transport (Requires No Energy).

- Being Semi-permeable

- Allows the cell to..... Maintain Homeostasis

- Must be maintained because many vital chemical reactions can occur within a limited range of conditions.

- Chemical signals are transmitted across the cell membrane.

- Receptor

- Receptors bind with _____.

- There are two types of receptors.

- Intracellular =

- Membrane =

- Read page 84 for more information about receptors.

Chapter 3.3 Questions:

1. Compare and describe a semipermeable membrane with something that you are already familiar with: