Cells: The Basic Units of Life

Types of Cells

Prokaryotic Cells
- Earliest Cells
- Do not have a nucleus
- Have very few organelles
- Examples: bacteria and archaea

Eukaryotic Cells
- Evolved from prokaryotic cells
- Do have a nucleus
- Have many organelles
- Examples: plants, animals, fungi and protists

Organelles*(Eukaryotes)
- An organelle is a small structure inside the cell that is specialized to perform a particular job.
- Animal cells and plant cells have many organelles in common, but also have some differences.
- The following are important organelles:

Cell or Plasma Membrane
- All cells have a cell or plasma membrane; it is the outermost portion of a cell, or it lies just inside the cell wall (plant, fungi, bacteria).
- It forms a dynamic barrier around the cytosol to maintain the internal environment of the cell.
- It is semi-permeable, and controls the movement of material in and out of the cell

**more on this later**

Cytosol
- The jelly-like fluid inside the cell; suspends the organelles.
- **Cytoplasm is a term that refers to all of the internal components of the cell, excluding the nucleus

Nucleus
- The control center of the cell.
- It is keep separate from the rest of the cell by the nuclear membrane (double membrane; outer part of E.R.).
- The nuclear membrane has holes in it called nuclear pores which allow items in and out.
- Inside the nucleus there is DNA and usually a nucleolus.
- DNA when uncoiled is called chromatin.

Nucleolus
- Dense, irregular shape
- It makes the subunits of ribosomes out of proteins and RNA

Ribosomes
- Can be free-floating or attached to an endoplasmic reticulum.
- The site of protein synthesis.

**more on structure and function in Molecular Genetics unit**
Endoplasmic Reticulum (ER)
- A series of canals that connect the nucleus to the cell membrane; flattened & folded tubes.
- It is like a subway system in which molecules made by the cell can travel all over.
- Rough ER have ribosomes on them; make proteins.
- Smooth ER do not have ribosomes; make lipids and break down carbs, fatty acids, drugs and poisons.
- Molecules made in the ER are packaged into vesicles.

Vesicles
- Membrane bound, saclike organelles
- Transports, stores or digests substances within a cell
- Several types include: peroxiosomes, vacuoles and lysosomes.

Peroxisomes
- Mainly found in liver and kidney cells.
- Contain enzymes; they are used to break down toxins like hydrogen peroxide, alcohol and heavy metals.
- Similar in appearance to lysosomes.

Vacuoles
- Large, fluid-filled, storage organelles that isolates water, metabolic wastes, and can store nutrients.
- Usually very large in plant cells – its fluid pressure keeps the plant cell firm (turgid).

Lysosomes
- Small, membrane-bound sacs that contain digestive enzymes.
- They fuse with vacuoles and the enzymes breakdown broken cell parts or are used to digest nutrients.
- Found in animal cells.

Golgi Bodies
- Stacked, folded membranes
- It processes the lipids and proteins made in the ER and then ships them to the cell membrane or to lysosomes.
- Vesicles are the bubbles of protein/lipid that it receives from the ER and ships out towards the cell membrane.

Mitochondria (pl.)
- Cellular respiration occurs in the mitochondrion, making energy (ATP) for the cell. (# vary depending on cell type)
- It has two membranes: an outer membrane and the inner called the cristae; the space between the membranes is the intermembrane space (IMS); the mitochondrial matrix lies inside the cristae.

Plastids
- Found only in plants and algae.
- Used for photosynthesis or storage.
Chromoplasts – make and store pigments other than chlorophyll
Amyloplasts – store starch

Chloroplasts
- Site of photosynthesis (make sugars); green due to chlorophyll pigment (reflects green light).
- Oval or disc shape with two outer membranes.
- Has an inner membrane that surrounds a compartment called a thylakoid.
- The thylakoids stack up on one another to make grana.
- The fluid inside the chloroplast is the stroma.

Cytoskeleton
- Made up of microfilaments (with actin protein) and microtubules (hollow tubes) which strengthen the cell, help maintain the shape, and move organelles and other structures through the cytoplasm.

Centrosome
- Located near the nucleus, this organelle organizes the cytoskeleton and contains centrioles which help separate chromosomes during mitosis.

Flagella (sing. Flagellum)
- Whip-like tails found in some animal cells, bacteria and protists.
- Usually quite long compared to the cell.
- Used for propulsion

Cilia
- Tiny hair-like projections found in some animal and protist cells.
- Move water and mucus in eukaryotes; used for movement/propulsion of prokaryotes

Pseudopods
- Extensions (lobes) that stretch out from the cell to engulf a target, or to move the cell

Cell Wall
- The outermost portion of a plant, fungal or protist cell.
- It protects, supports and keeps the cell’s shape.
- It is not as selective as the cell membrane; porous.
- Plant cell walls are made of cellulose, a sugar filled with lots of energy, however humans cannot digest it. *Primary wall – cellulose *Secondary wall – thicker coating; internal

Extra-cellular matrix
- Found in multi-cellular organisms; non-living mixture of proteins and polysaccharides secreted by cells; varies depending on cell type.
- Functions: support and anchors cells, separates tissues, function in cell signaling
- Examples: Plant cell wall (cellulose), Fungi cell wall (chitin), animals bone, insect exoskeleton, shells.
- Cell junctions are structures that allow cells to interact with each other and the surrounding environment