Prokaryotes - The first Cells

- Cells that lack a nucleus or membrane-bound organelles
- Includes bacteria
- Simplest type of cell
- Single, circular chromosome
Prokaryotes

- Nucleoid region (center) contains the DNA
- Surrounded by cell membrane & cell wall (peptidoglycan)
- Contain ribosomes (no membrane) in their cytoplasm to make proteins
Eukaryotes

• **Cells that HAVE a nucleus and membrane-bound organelles**
• **Includes protists, fungi, plants, and animals**
• **More complex type of cells**
Eukaryotic Cell

Contain 3 basic cell structures:

- **Nucleus**
- **Cell Membrane**
- **Cytoplasm with organelles**
Two Main Types of Eukaryotic Cells

Plant Cell

Animal Cell
Organelles
Organelles

• Very **small** (Microscopic)
• Perform **various functions** for a cell
• Found in the **cytoplasm**
• Most are **membrane-bound**
Plant Cell Organelles

- Chloroplast
- Mitochondria
- Plasma Membrane
- Peroxisome
- Golgi Apparatus
- Vacuole
- Cytoplasm
- Rough Endoplasmic Reticulum
- Nucleus
- Nucleolus
- Nuclear Envelope
- Cell Wall
- Smooth Endoplasmic Reticulum
- Ribosomes

Copyright cmassengale
Cell (Plasma) Membrane

- **2 layers of phospholipids (lipid bilayer)**
- **FUNCTION:** Controls what enters or leaves the cell
- **Analogy:** Mrs. Melissa (or a security guard) = controls who comes in or out of the school
- **Surrounds outside of ALL cells**
Cell Wall

• Thick, tough layer made of cellulose in plants
• FUNCTION = Supports & protects the cell
• Found outside of the cell membrane
• Found in plants, fungi, & bacteria
• NOT in ANIMAL CELLS
• Analogy = Walls of the school (support & protect)

copyright cmassengale
Cytoplasm (Cytosol) of a Cell

- Jelly-like substance inside cell membrane
- **FUNCTION**: Provides a place for chemical reactions to happen
- **Contains organelles** to carry out specific jobs
- Found in **ALL** cells
- Analogy = **air** in the school (fills up the rest of the space and allows learning to happen)
Mitochondria
(singular = mitochondrion)

• “Powerhouse” of the cell
• FUNCTION: Generate cellular energy (ATP)
• Site of CELLULAR RESPIRATION (burning glucose)
• More active cells like muscle cells have MORE mitochondria
• All eukaryotes have mitochondria (plant, animal, fungi & protists)
• Analogy = generator or electrical wiring (provides electrical power to the school)
Chloroplasts

- Contains enzymes & pigments for Photosynthesis
- FUNCTION: Site of Photosynthesis - using light to make food from \( CO_2 \) & \( H_2O \)
- Only in Algae (protists) & Plants
- Never in animal, fungi, or bacterial cells
- Analogy = cafeteria (makes food)
Lysosomes

- Contain digestive enzymes
- FUNCTION: Break down food, bacteria, & worn out cell parts so that the materials can be used by the cell
- Programmed for cell death
- Found in ALL Eukaryotes (plants, animals, fungi & protists)
- Analogy = janitors or recycling center (break down things; help keep school clean & functioning)
Lysosome Digestion

• Cells take in food by phagocytosis
• Lysosomes digest the food & get rid of wastes
**Vacuoles**

- **FUNCTION:** Fluid filled sacks for storage (mostly water but also wastes, food, etc…)
- **Large Central Vacuole in Plants**
- **Small or absent in animal**
- **No vacuoles in bacteria**
- **Analogy = Storage closets & filing cabinets in a school** (store materials to be used later)

- In plants, they store **Cell Sap**
- Includes storage of sugars, proteins, minerals, lipids, wastes, salts, water, and enzymes
Endomembrane System

Includes nuclear membrane connected to ER connected to cell membrane (transport)

copyright cmassengale
Endoplasmic Reticulum - ER

- Network of hollow membrane tubules
- Connects to nuclear envelope & cell membrane
- Functions in Synthesis of cell products & Transport

Two kinds of ER --- ROUGH & SMOOTH

Copyright cmassengale
Rough Endoplasmic Reticulum (ER)

- Has **ribosomes** on its surface & is attached to nuclear membrane
- **FUNCTION:** Makes membrane proteins and modifies **proteins** for **transport** out of cell
- **ALL** eukaryotes
- Analogy = Technology and Textbooks in a school (used by teachers to modify students)

Figure 1
Smooth Endoplasmic Reticulum (ER)

- **Smooth ER** does NOT have ribosomes on its surface & is attached to the ends of rough ER.
- **FUNCTION:** Makes **Lipids** for cell membrane & cell products that are USED INSIDE the cell.
- **Detox** (destroys harmful substances)
- **ALL** eukaryotes
- Analogy = School Nurse (maintains/monitors student health while in the school)
Golgi Bodies

Look like a stack of pancakes

FUNCTION: Modify, sort, & package molecules from ER for storage OR transport out of cell
Golgi Bodies

- Stacks of flattened membranes (disks)
- **FUNCTION:** Modify & Package proteins made on the rough ER
- **Transport vesicles with modified proteins** pinch off the ends
- **ALL Eukaryotes**

- Analogy = Guidance Counselors (deal with student schedules and scholarships for after high school)
Nucleus - The Control Organelle

- **FUNCTION:** Controls the normal activities of the cell
- **Contains the DNA (chromosomes)**
- **Surrounded by a nuclear envelope (membrane) with pores**
- **Usually the largest organelle**
- **ALL Eukaryotes**
- **Analogy = School Principal (controls what happens in the school)**

*copyright cmassengale*
Nuclear Membrane (Envelope)

- Double membrane surrounding nucleus
- FUNCTION: Contains **nuclear pores** for materials to enter & leave nucleus
- Connected to the rough ER
- ALL Eukaryotes
- Analogy = **Main Office & Secretaries** (protect student records & send messages from the principal)
Inside the Nucleus -

The genetic material (DNA) is found

**FUNCTION:**

These are the instructions for making proteins

DNA is spread out and appears as **CHROMATIN** in non-dividing cells

DNA is condensed & wrapped around proteins forming as **CHROMOSOMES** in dividing cells

Analogy = Student Records

copyright cmassengale
What Does DNA do?

DNA is the **hereditary material** of the cell.

**Genes** that make up the DNA molecule code for different proteins.
Nucleolus

• **Inside** nucleus
• **Dense** region that does **NOT** contain **DNA**
• **Disappears** when cell divides
• **FUNCTION**: Makes ribosomes that make proteins
• ALL Eukaryotes
• Analogy = Board of Education (hires teachers)
Ribosomes

Can be Attached to Rough ER

OR

Free (unattached) in the Cytoplasm
Ribosomes

- FUNCTION: Makes Proteins!
- “Protein factories” for cell
- Process called protein synthesis
- Join amino acids together to make proteins
- ALL CELLS (prokaryotes & eukaryotes)
- Analogy = Teachers in the School (teachers build student learning; students would be the proteins)
Centrioles

- Paired structures near nucleus
- Made of bundle of microtubules
- Appear during cell division forming mitotic spindle
- FUNCTION: Help to pull chromosome pairs apart to opposite ends of the cell
- Found only in animal cells
- None for a school (School analogy is for a plant cell)

BUT you could say it is like 2 tug of war teams
Centrioles & the Mitotic Spindle

Made of MICROTBULES (Tubulin)