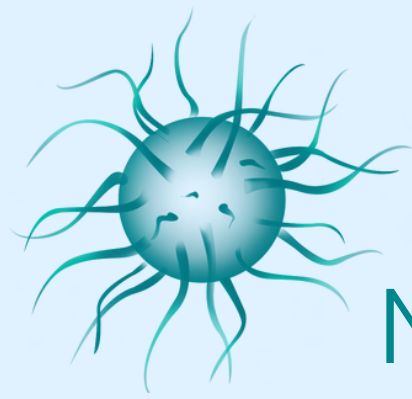





# UNIT 2

# CELL STRUCTURE & FUNCTION



Nucleus Notes

The background features a light blue gradient with several stylized illustrations of biological entities. In the top left, a large green cell with multiple protrusions is partially visible. To its right is a small, purple, rod-shaped microorganism with flagella. In the top right, a large, light blue, irregularly shaped structure resembling a cell or tissue is shown. In the bottom left, a large, light blue cell with internal organelles is partially visible. In the bottom center, a small green spherical organism with many radiating cilia or flagella is shown. In the bottom right, a large purple spherical cell with several protrusions is partially visible. A small purple rod-shaped microorganism is also located near the bottom center.

# THE CELL ORGANELLES



# Nucleus

- **Structure:** Double membrane nuclear envelope with pores which allow materials like mRNA to leave the nucleus
- **Functions:**
  - Stores genetic information
  - Synthesizes RNA
  - Assembles ribosomes

# Ribosomes

- **Structure:** Composed of mRNA and protein; consists small and large subunits
- **Types:**
  - Bound to ER (endoplasmic reticulum)
  - Cytoplasmic (free in cytoplasm)
- **Function:** Site of protein synthesis



# Rough Endoplasmic Reticulum

- **Structure:** Membrane studded with ribosomes; attached to nuclear envelope
- **Functions:**
  - Synthesis of membrane bound proteins and secreted proteins
  - Cell compartmentalization
  - Mechanical support and intracellular transport

# Smooth Endoplasmic Reticulum

- **Structure:** Folded, tubelike structure (cisternae)
- **Functions:**
  - Detoxification
  - Calcium storage
  - Lipid synthesis



# Golgi Complex

- **Structure:** Flattened membrane bound sacs (cisternae)
- **Functions:**
  - Folding and chemical modification of proteins
  - Packaging proteins into vesicles ready for transport

# Mitochondria

- **Structure:** Double membrane (inner membrane folded into cristae for more surface area, making it more efficient in the exchanging of materials)
- **Functions:**
  - Site of oxidative phosphorylation
  - Site of the Krebs's cycle



# Chloroplast

- **Structure:** Double outer membrane, contains stacked thylakoid (stacks are called grana) and fluid (called stroma)
- **Functions:**
  - Site of photosynthesis
  - Light reactions occur in the thylakoid
  - Calvin-Benson cycle occurs in the stroma

# Lysosome



- **Structure:** Membrane enclosed sacs containing hydrolytic enzymes (to break down the bacteria that they engulf)
- Functions:
  - Intracellular digestion
  - Recycling of cell materials
  - Programmed cell death (apoptosis)



# Vacuole

The background features a collage of biological illustrations. In the top left, a large, spiky, spherical cell is partially visible. To its right is a smaller, oval-shaped cell with internal structures. In the top right, a large, irregularly shaped cell with internal organelles is shown. In the bottom left, a cell with several large, clear, circular vacuoles is depicted. In the bottom center, there is a small, spherical cell with many fine, radiating spines. In the bottom right, a large, spiky cell is partially visible, and a small, elongated, multi-segmented organism is shown nearby.

- **Structure:** Membrane-bound sacs
- Functions:
  - Storage and release of macromolecules and cell waste
  - **Central vacuole:** water retention and turgor pressure
  - **Contractile vacuole:** osmoregulation in protists
  - **Food vacuole:** formed by phagocytosis, fuses with lysosome

# Plasma Membrane

- **Structure:**

- Phospholipid bilayer
- Cholesterol (acts as a buffer to keep bilayer fluid during temperature changes)
- Channel proteins
- Glycolipids and glycoproteins



# MEMBRANE TRANSPORT

## Simple Diffusion

- Passive transport
- No energy required
- Moves down concentration gradient
- Small, nonpolar molecules can pass through

# MEMBRANE TRANSPORT

## Facilitated Diffusion

- Passive transport
- No energy required
- Carrier/channel protein required
- Moves down concentration gradient
- Small, polar molecules can pass through



# MEMBRANE TRANSPORT

## Active Transport

- Energy required
- Moves against concentration gradient
- Requires transport protein (usually carrier)

# BULK TRANSPORT

## Endocytosis

- Phagocytosis: Cellular eating
  - ingestion of large particles
- Pinocytosis: Cellular drinking
  - internalization of extracellular fluids
- Receptor-mediated endocytosis
  - Ligands bind to receptor to allow materials in
  - Uses cell communication



# BULK TRANSPORT

## Exocytosis

- Export of materials
- Pathway:
  - Rough ER
  - ↓
  - Golgi complex
  - ↓
  - Plasma membrane

# OSMOSIS & TONICITY

## Hypertonic Solution

- High solute concentration
- Low free water concentration
- Cell loses water to the hypertonic solutions

## Hypotonic Solution

- Low solute concentration
- High free water concentration
- Cell gains water from hypotonic solutions

## Isotonic Solution

- Equal solute concentration (as compared to other solution)
- Equal free water concentration