SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIOPULMONARY PERFUSION CARE TECHNOLOGY

COURSE NAME: Physiology

UNIT I – Cell

TOPIC: Cell Organelles

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Define - What is Physiology?

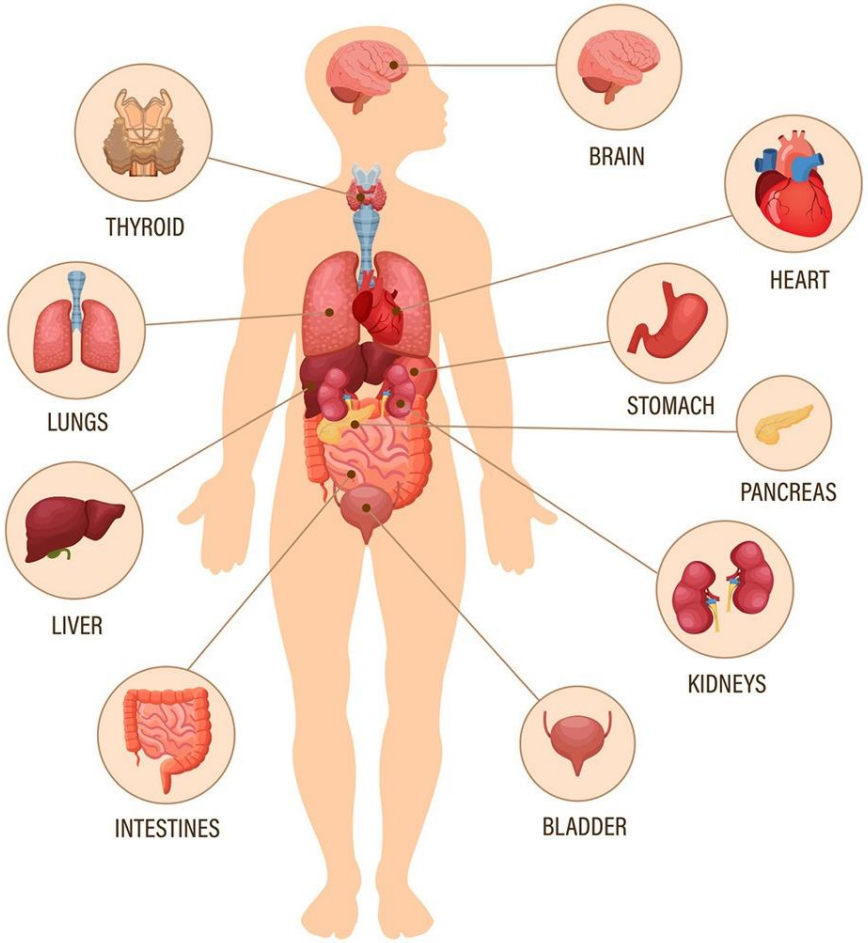
- Physiology is the study of how living organisms, organs, and cells function and interact to maintain life.

Definition

- Human cells are the fundamental, microscopic units of life in the body, capable of independent function while contributing to tissues/organs.

- ~37 trillion cells in an adult human.

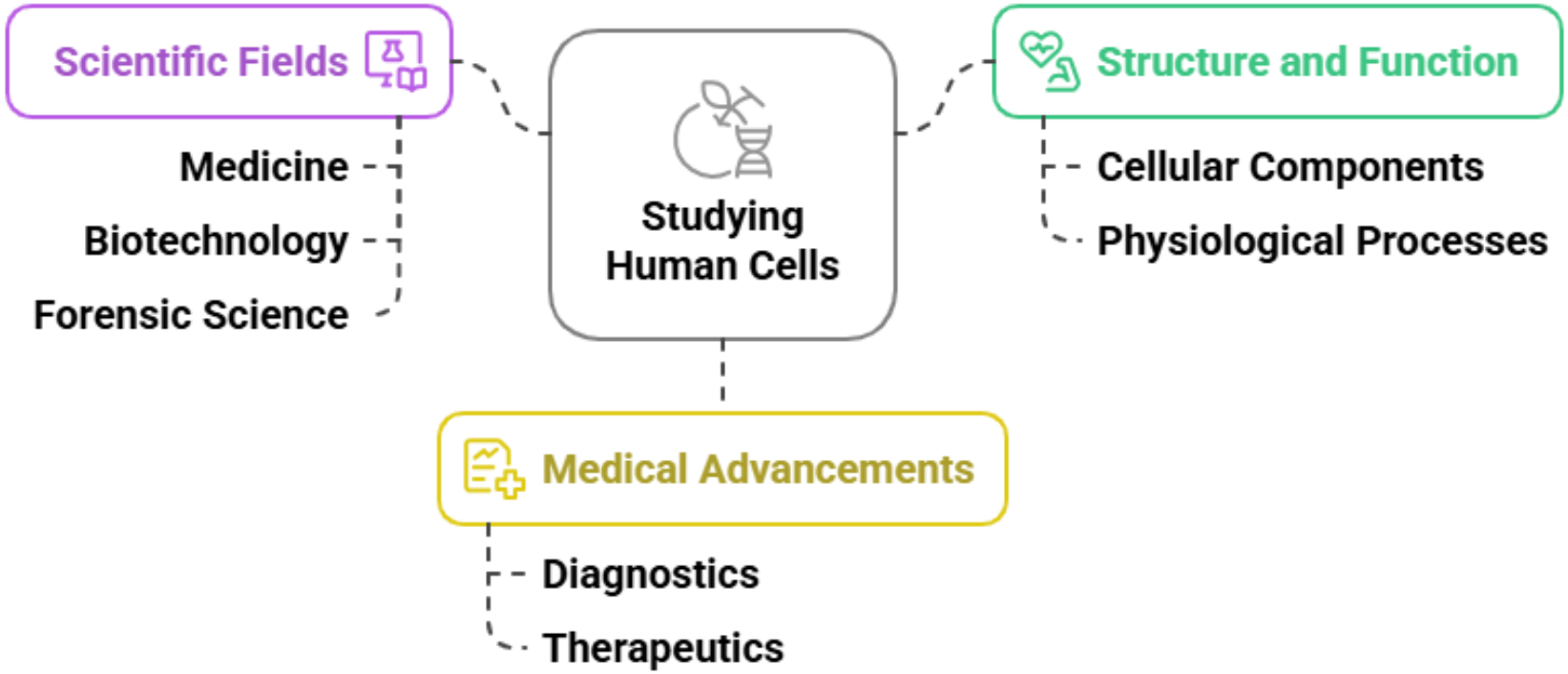
- Responsible for metabolism, growth, reproduction, and response to stimuli.



Empathize - Importance of Studying Human Cells

- Foundation for Disease Understanding: Mutations in cells lead to cancer, diabetes, etc.

- Advances in Medicine: Stem cell therapy, gene editing.



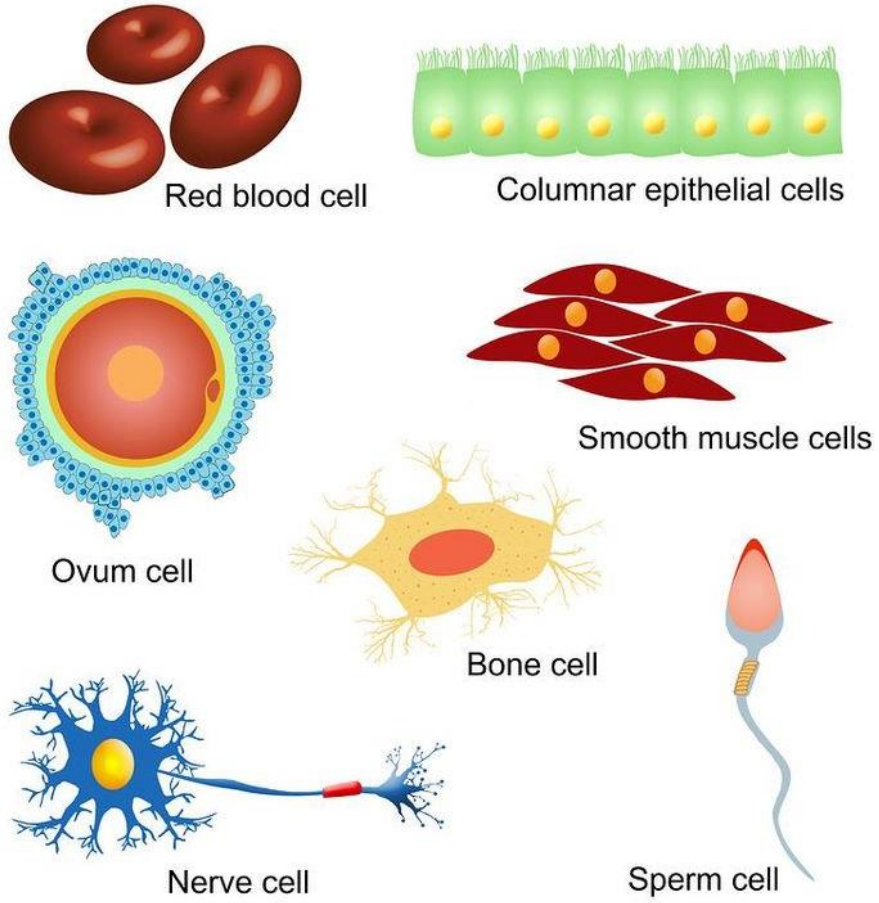
Ideate - Types of Cells

- **Prokaryotic Cells**: Simple, no nucleus (e.g., bacteria); DNA in nucleoid.
- **Eukaryotic Cells**: Complex, nucleus-bound DNA; includes human cells.
- **Human Cell Types**:

Somatic (body cells, e.g., muscle, nerve).

Gametes (reproductive, e.g., sperm/egg).

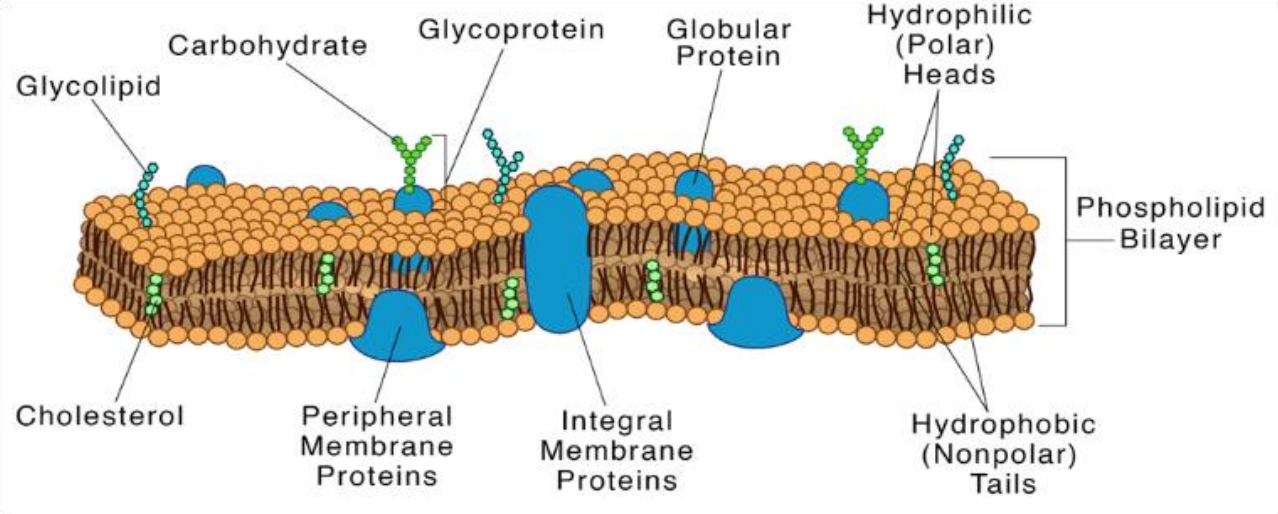
Specialized: Red blood cells (no nucleus), Neurons (long axons).

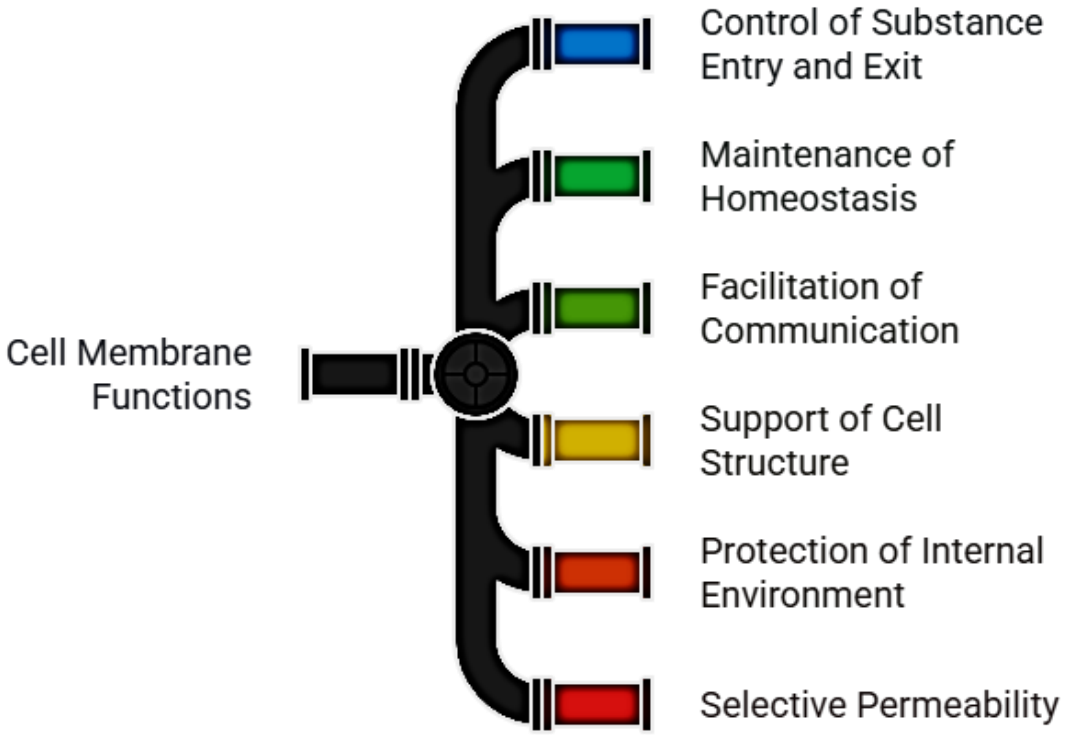


Cell Membrane

The cell membrane, primarily composed of phospholipids, cholesterol, and proteins, forms a semi-permeable barrier.

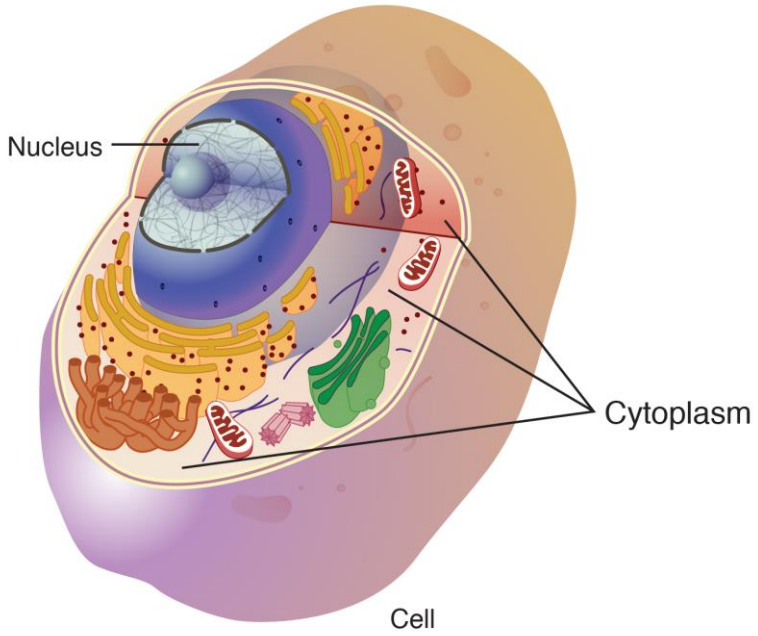
Phospholipids arrange in a bilayer, while cholesterol stabilizes fluidity.

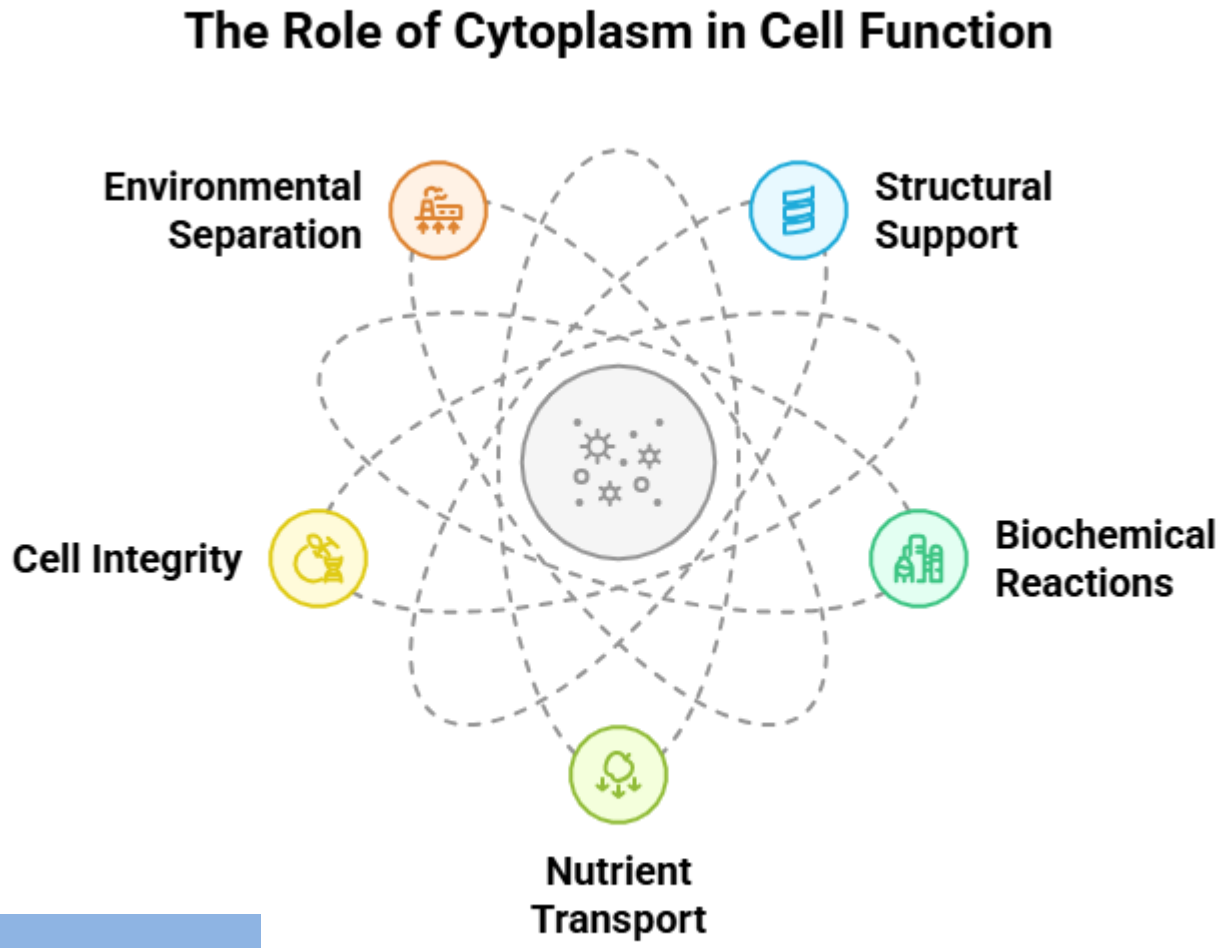




Cytoplasm

Cytoplasm is the gel-like substance within a cell, encompassing various organelles

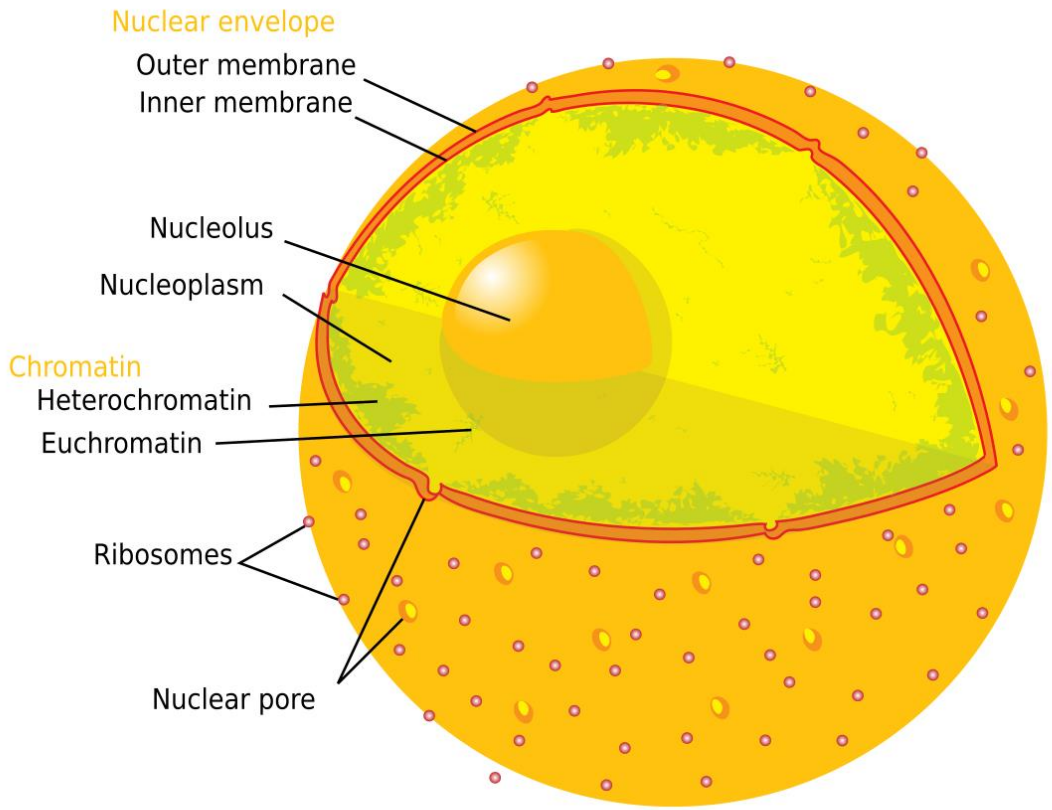




Nucleus

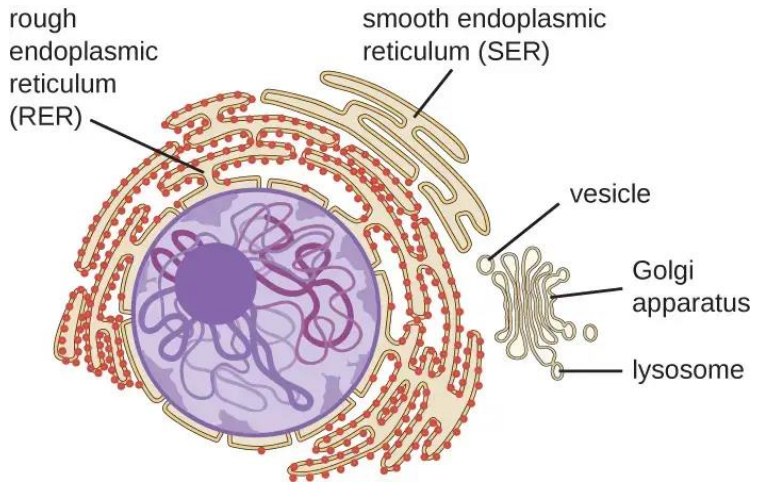
- The nuclear envelope is a double lipid bilayer that encloses the nucleus, separating it from the cytoplasm.

- It features nuclear pores that regulate the exchange of materials, such as RNA and proteins, thereby playing a crucial role in cellular function and communication.



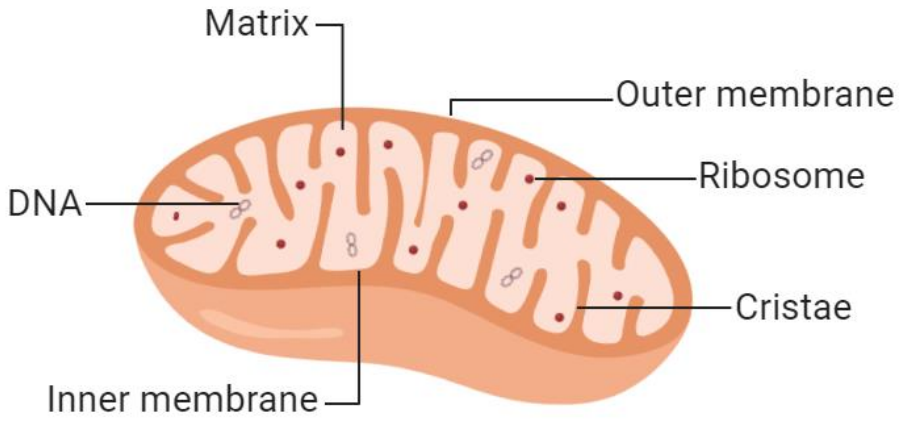
Functions of Nucleus

Function	Description
Storage of Genetic Material	Houses DNA/chromosomes, preserving hereditary information
Regulation of Cellular Activities	Controls gene expression, cell growth, metabolism, and differentiation
DNA Replication	Ensures accurate copying of DNA before cell division
Transcription & RNA Processing	Site for RNA synthesis and processing
Ribosome Production	Nucleolus assembles ribosomal subunits
Regulation of Cell Division	Directs cell cycle and multiplication
Compartmentalization	Segregates genetic processes for precise control



Mitochondria and its function

Mitochondria possess a double membrane structure comprising an outer membrane and a highly folded inner membrane, known as cristae.



Mitochondrial Functions

ATP Synthesis

The process of generating energy currency for cellular activities.

Metabolic Regulation

Controlling and balancing metabolic pathways within the cell.

Apoptosis

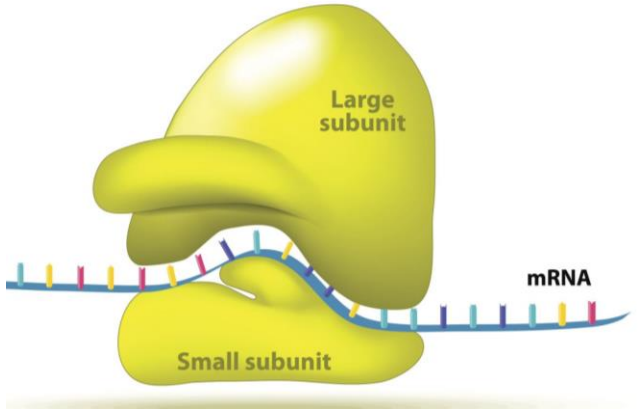
Involvement in programmed cell death, crucial for cellular health.

Cellular Homeostasis

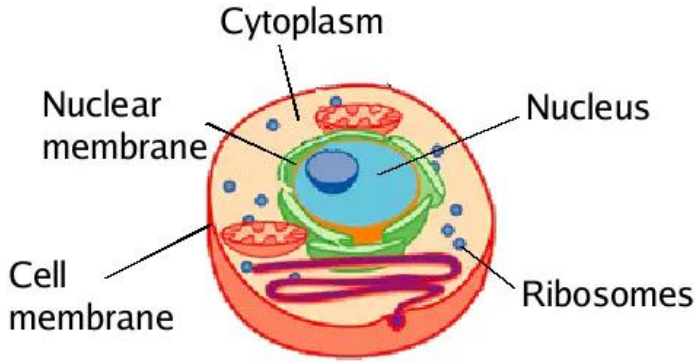
Maintaining a stable internal environment for optimal cell function.

Ribosomes

- Ribosomes are non-membrane-bound organelles, consisting of ribosomal RNA (rRNA) and proteins organized into two subunits (small and large) that assemble during use.



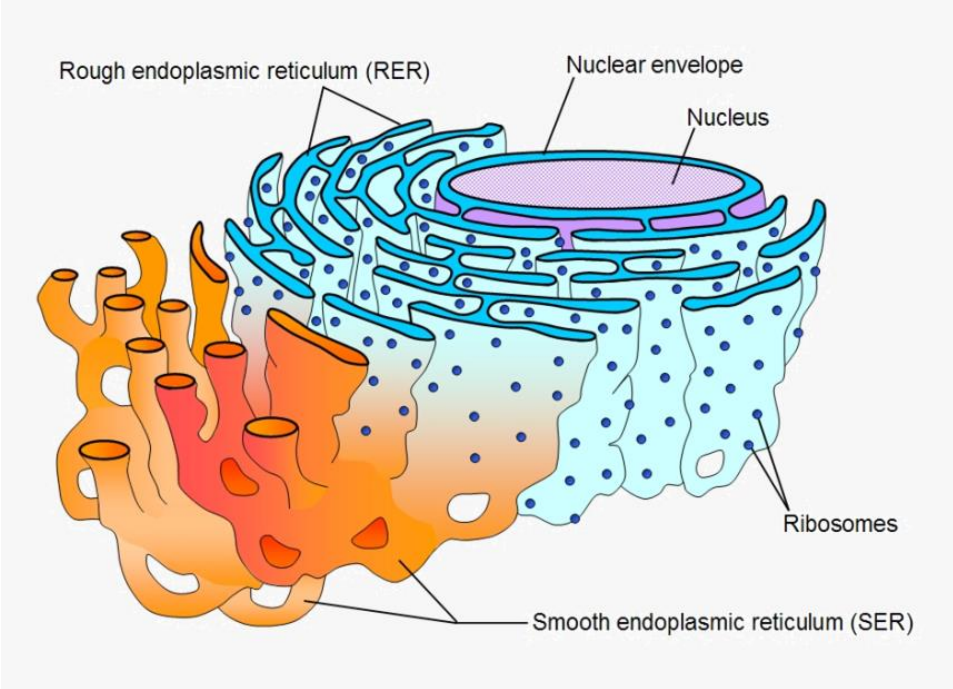
- They measure about 20-30 nm in diameter and can be free-floating in the cytosol or bound to the rough ER.



- **Function:** Protein Synthesis

Rough Endoplasmic Reticulum (Rough ER)

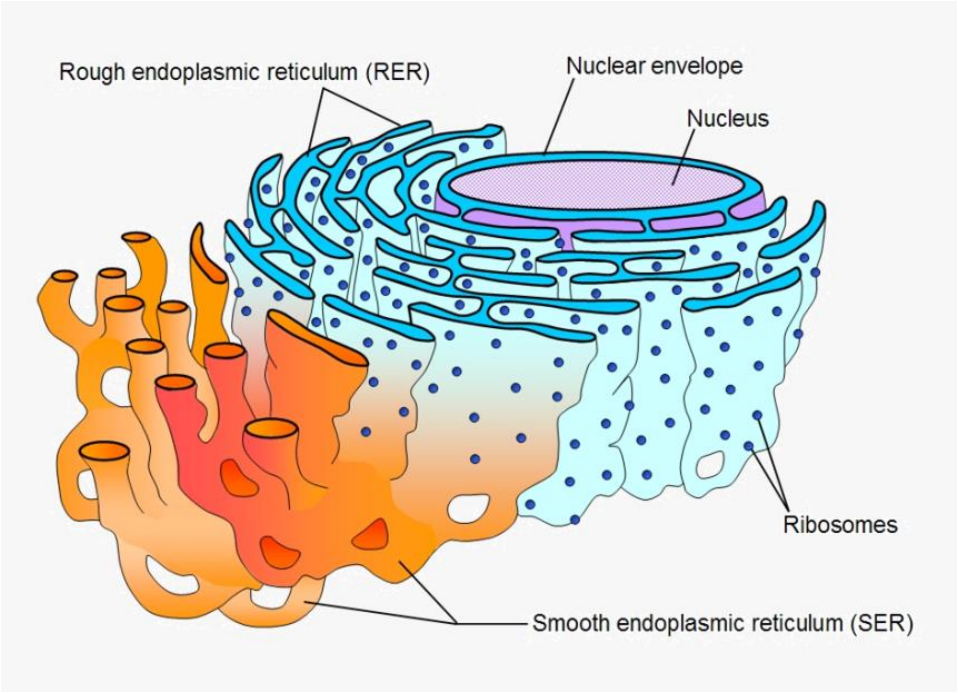
- A network of flattened sacs (cisternae) and tubules with ribosomes studded on the cytoplasmic side, giving a "rough" texture under electron microscopy.
- It's continuous with the nuclear envelope and forms a lumen for protein processing.
- **Function:** Protein Synthesis & Folding



Smooth Endoplasmic Reticulum

- Tubular network of membranes without ribosomes, appearing smooth; more convoluted than rough ER

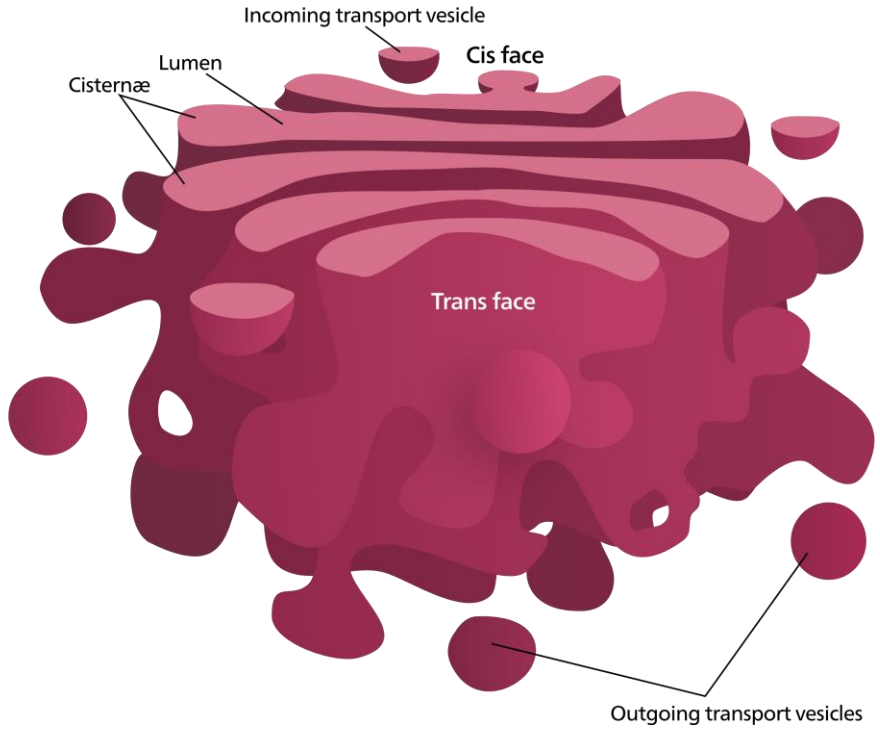
Function	Description
Lipid & Steroid Synthesis	Produces phospholipids, cholesterol, and hormones (e.g., from cholesterol).
Detoxification	Metabolizes drugs/toxins via cytochrome P450 enzymes.
Ion Storage	Sequesters Ca^{2+} for signalling (e.g., muscle contraction).



Golgi Apparatus

- Stacked, flattened cisternae (3-20 per stack).

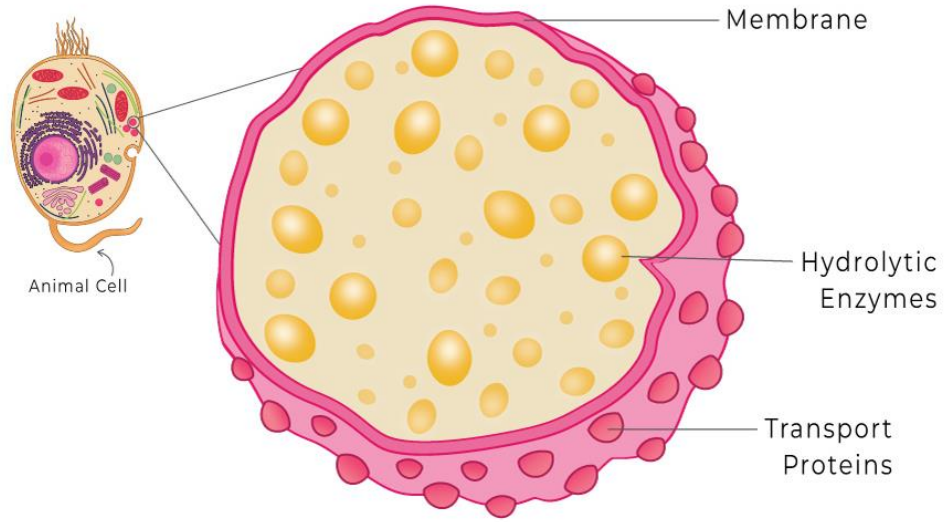
Function	Description
Protein/Lipid Modification	Adds sugars (glycosylation), cleaves peptides, or sulfates molecules.
Sorting & Packaging	Directs products into vesicles for lysosomes, secretion, or membrane insertion.



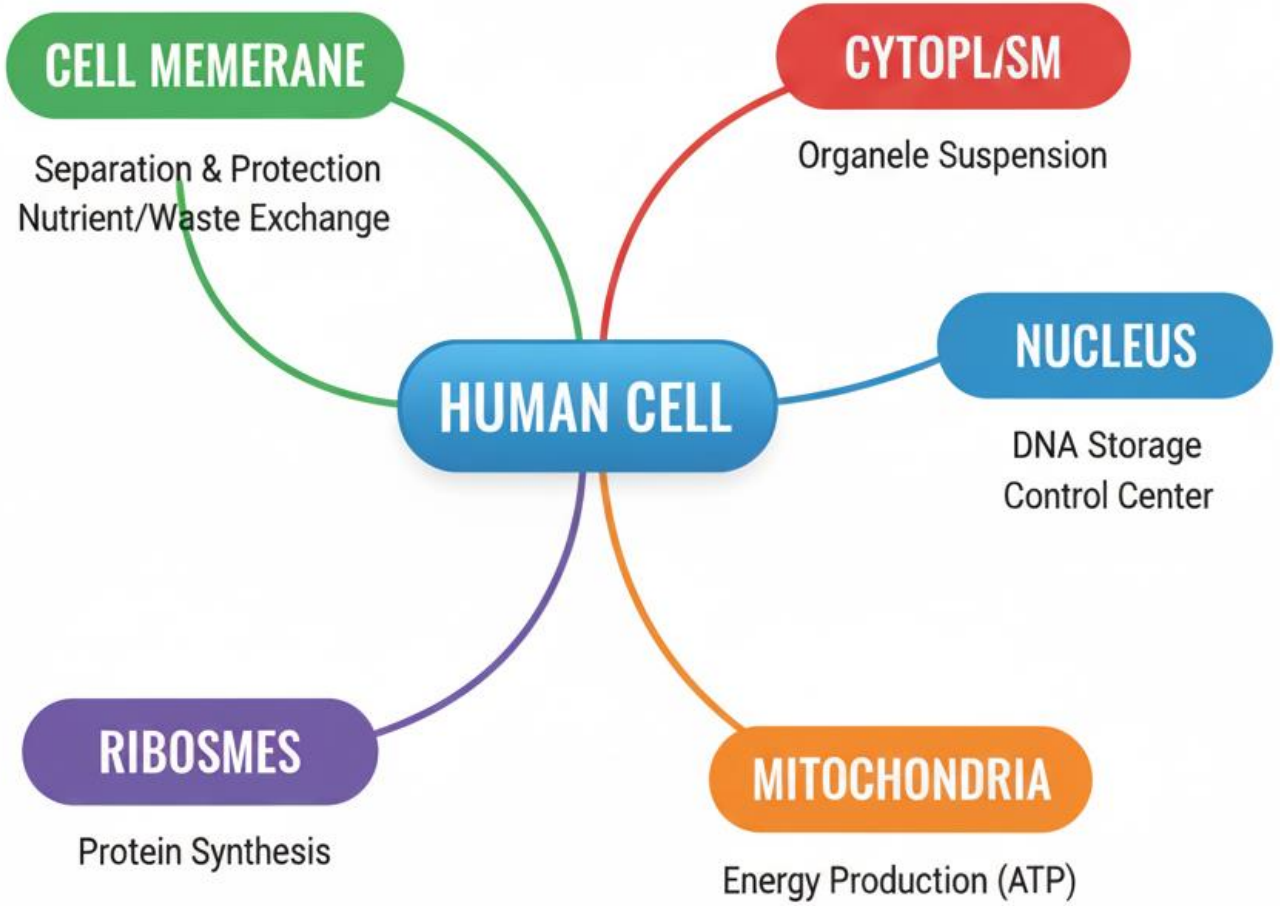
Lysosomes

- Spherical, membrane-bound vesicles (0.1-1.2 μm) containing 40+ hydrolytic enzymes

Function	Description
Intracellular Digestion	Breaks down proteins, lipids, carbs, and nucleic acids via hydrolysis.
Waste Recycling	Degrades damaged organelles (autophagy) or engulfed pathogens (phagocytosis).



Summary


CELL MEMERANE
Separation & Protection
Nutrient/Waste Exchange
CYTOPLASM
Organele Suspension
HUMAN CELL
NUCLEUS
DNA Storage
Control Center
RIBOSMES
Protein Synthesis
MITOCHONDRIA
Energy Production (ATP)

References

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THANK YOU