Basic Medical Science

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Study of Human Cell and Functions of Organelles

- Human Cell Overview

Cells = Basic structural & functional units of life.

Human body = trillions of cells.

Cells → tissues → organs → systems.

Types of cells

- **Nerve Cells (Neurons):** Transmit info by signals.
- Example: Brain neurons → thinking, learning, memory.
- **Muscle Cells:** Movement, contraction, relaxation.
- Example: Skeletal muscle → walk, run, lift.
- **Connective Cells:** Support, structure, connectivity.
- Example: Osteocytes (bone cells) → body support.
- **Immune Cells:** Defense against pathogens.
- Example: Leukocytes (WBCs) → fight infections.
- **Blood Cells:** Transport O_2, nutrients, waste.
- Example: RBCs → carry oxygen to tissues.

Components of a Cell

- **Plasma Membrane:** Semi-permeable, controls entry/exit.
- Example: Allows O_2 & nutrients, blocks toxins.
- **Cytoplasm:** Jelly-like, site of metabolism.
- Example: Glycolysis in cytoplasm.
- **Nucleus:** Control center, stores DNA.
- Example: DNA decides traits & cell functions.
- **Mitochondria:** Powerhouse, produces ATP.
- Example: ATP for muscle contraction.

Functions of Organelles

1-Nucleus:

Stores DNA.

Controls growth, metabolism, cell cycle.

Example: Ensures proper cell division.

2- **Mitochondria:**

Energy production via respiration.

Produces ATP.

Example: ATP in muscles → contraction.

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3-Golgi Apparatus:

Modifies, processes proteins & lipids.

Packages for transport/secretion.

Example: Prepares insulin in pancreas.

4- Lysosomes:

Digest waste & foreign material.

Recycle cell components.

Example: WBC lysosomes digest pathogens.

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5-Endoplasmic Reticulum (ER):

1-Rough ER: Protein synthesis.

Example: Makes digestive enzymes in pancreas.

2-Smooth ER: Lipid synthesis, detoxification.

Example: Liver smooth ER detoxifies drugs.

Nucleus

Nucleus

1-Structure

1-Nuclear Envelope: Double membrane with perinuclear space; regulates movement between nucleus and cytoplasm.

2-Nuclear Pores: Protein complexes that control transport of RNA, proteins, and signals.

3-Nucleoplasm: Gel-like substance containing chromatin, nucleolus, and proteins.

4-Chromatin: DNA + RNA + proteins.

5-Euchromatin: Less condensed, transcriptionally active.

6-Heterochromatin: Highly condensed, transcriptionally inactive.

7-Nucleolus: Synthesizes rRNA and assembles ribosomal subunits (for protein synthesis).

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1. **2-Functions**

1-Storage of Genetic Material: Contains DNA with cell's instructions.

2-Gene Expression: Site where DNA is transcribed into mRNA, then exported for protein synthesis.

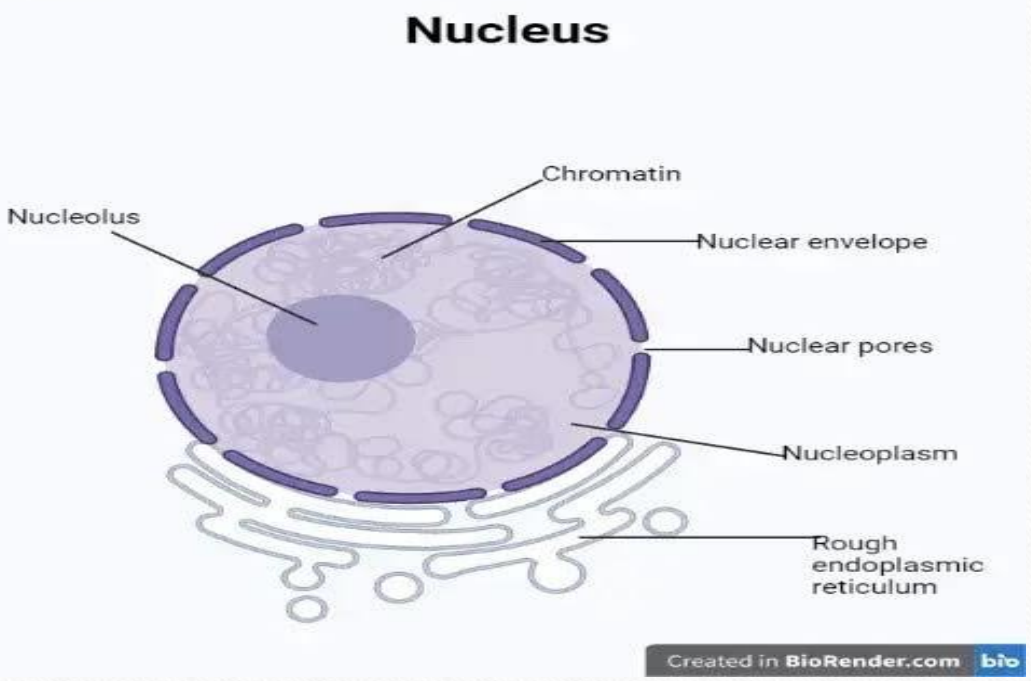
3-Regulation of Gene Expression: Controlled through mechanisms like:

4-Chromatin remodeling

5-Histone modification

6-Transcription factor binding

Nucleus in Human Cell



Ribosome Synthesis

Anatomy:

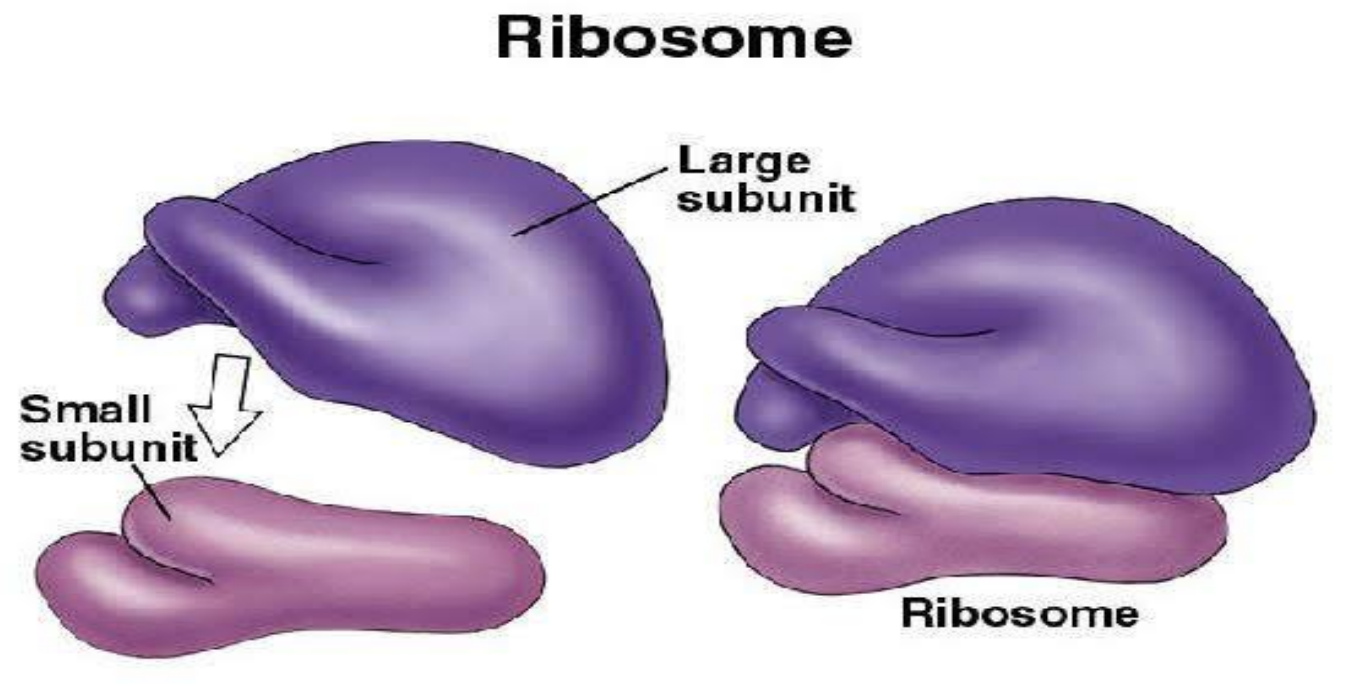
1-Nucleolus → synthesizes and assembles ribosomal RNA (rRNA) and ribosomal subunits

2-Ribosomes → cellular machinery for protein synthesis

Cellular Reproduction

1. Nucleus undergoes events during cell division
2. DNA replication occurs
3. Chromatin condenses into chromosomes
4. Chromosomes segregate properly
5. Ensures accurate transmission of genetic material to daughter cells

Structure of Ribosome



Cellular Signalling

1. Nucleus acts as a signaling hub
2. Contains transcription factors and regulatory proteins
3. Modulates gene expression in response to internal and external signals
4. Pathways involved in:
5. Cell growth
6. Cell differentiation
7. Responses to environmental cues

Any question


thank you