

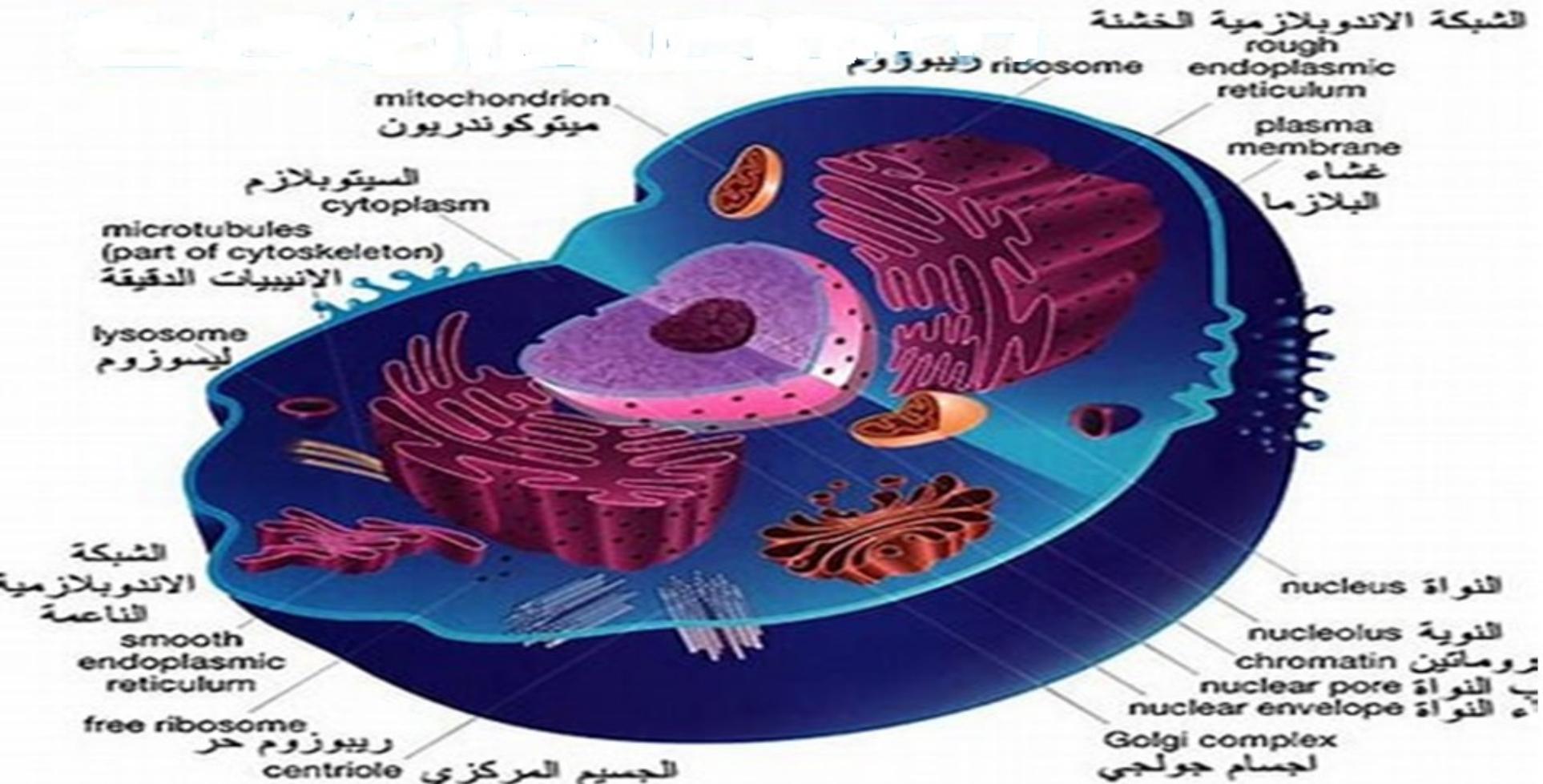


Practical Biology Lecture -3

Kidney Dialysis Techniques Department

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Cellular Organelles: Structure and Function



Illustrative image of an animal cell with major organelles.

Learning Objectives

By the end of this lecture, the student will be able to:

Define a cellular organelle.

Name the major organelles in an animal cell.

Explain the function of each organelle.

Relate organelle dysfunction to relevant kidney diseases.

What are Cellular Organelles?

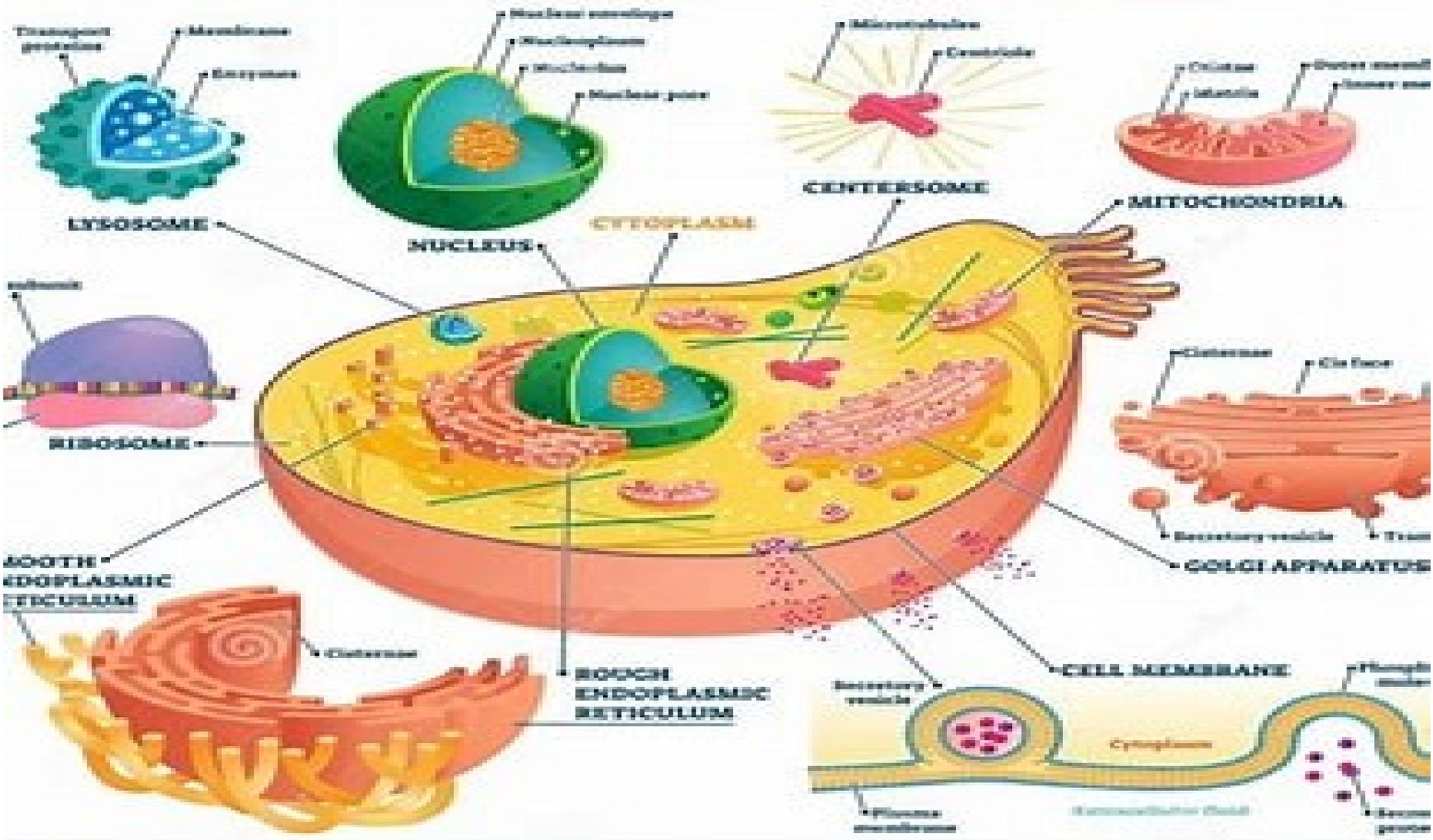
Specialized structures within the cell (like "organs" of the cell)

Each has a specific function.

May or may not be surrounded by a membrane.

Essential for cell survival and function.

CELL ORGANELLES



Structure: Largest organelle, surrounded by a nuclear envelope with pores.

Function:

Control center of the cell.

Stores genetic material (DNA.)

Coordinates cell activities (growth, metabolism, reproduction)

Ribosome

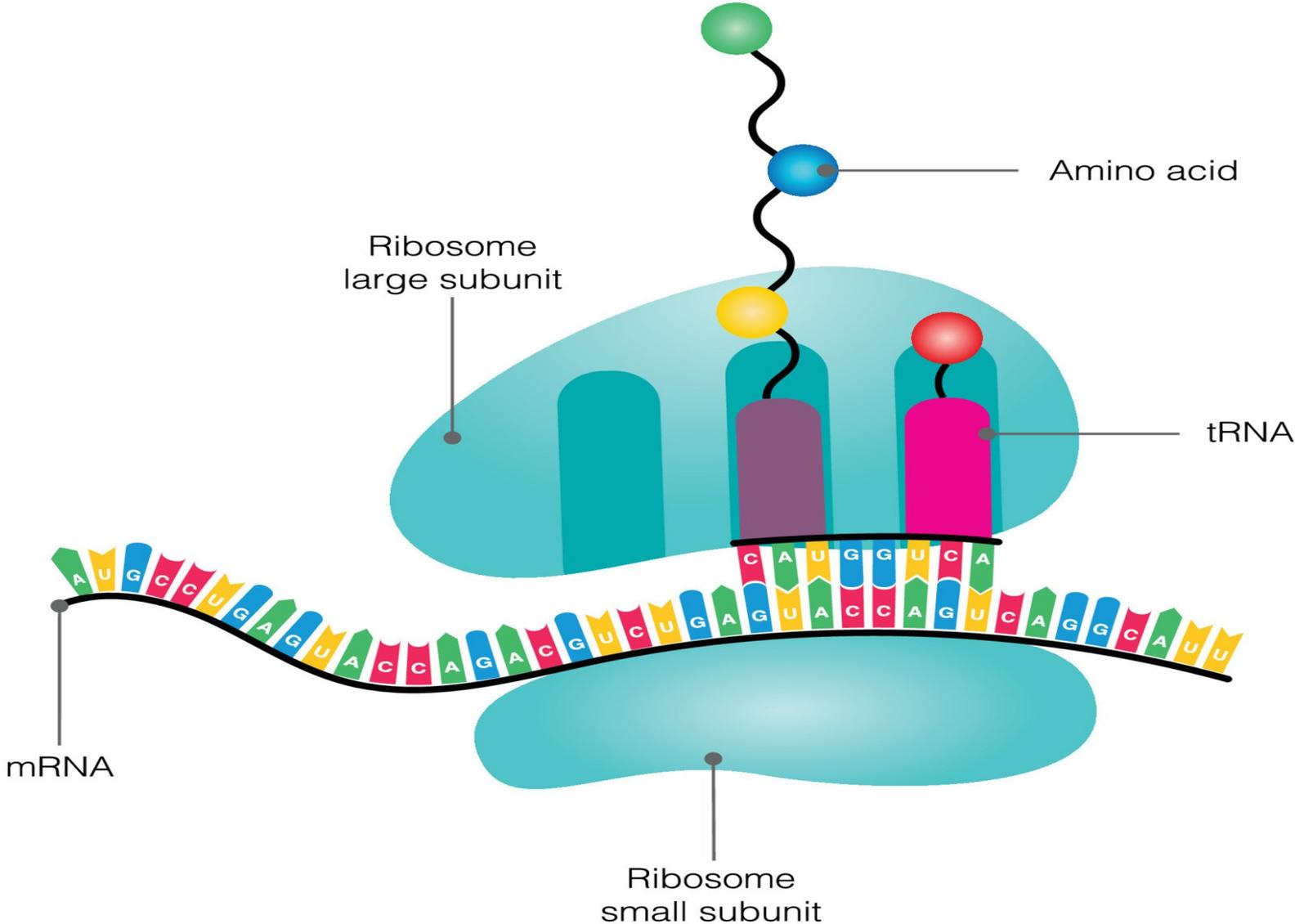
Structure: Small particles (no membrane), made of RNA and protein.

Location: Free in cytosol or attached to the Endoplasmic Reticulum.

Function: Protein synthesis (translation).

Illustration: Ribosome reading mRNA and synthesizing a polypeptide chain.

Ribosome



Endoplasmic Reticulum (ER)

Structure: Network of membranous tubules and sacs.

Types:

Rough ER (RER): Studded with ribosomes.

Function: Synthesis of proteins for secretion or membranes.

Smooth ER (SER): No ribosomes.

Function: Lipid synthesis, carbohydrate metabolism, detoxification

Difference Between Smooth and Rough Endoplasmic Reticulum

The main difference between Rough Endoplasmic Reticulum and Smooth Endoplasmic Reticulum is that the RER is primarily involved in the synthesis and modification of proteins, while the SER is involved in the synthesis and modification of lipids and plays a role in a variety of other cellular processes. SER and RER are two different types of ER which are organelles found in eukaryotic cells.

Golgi Apparatus

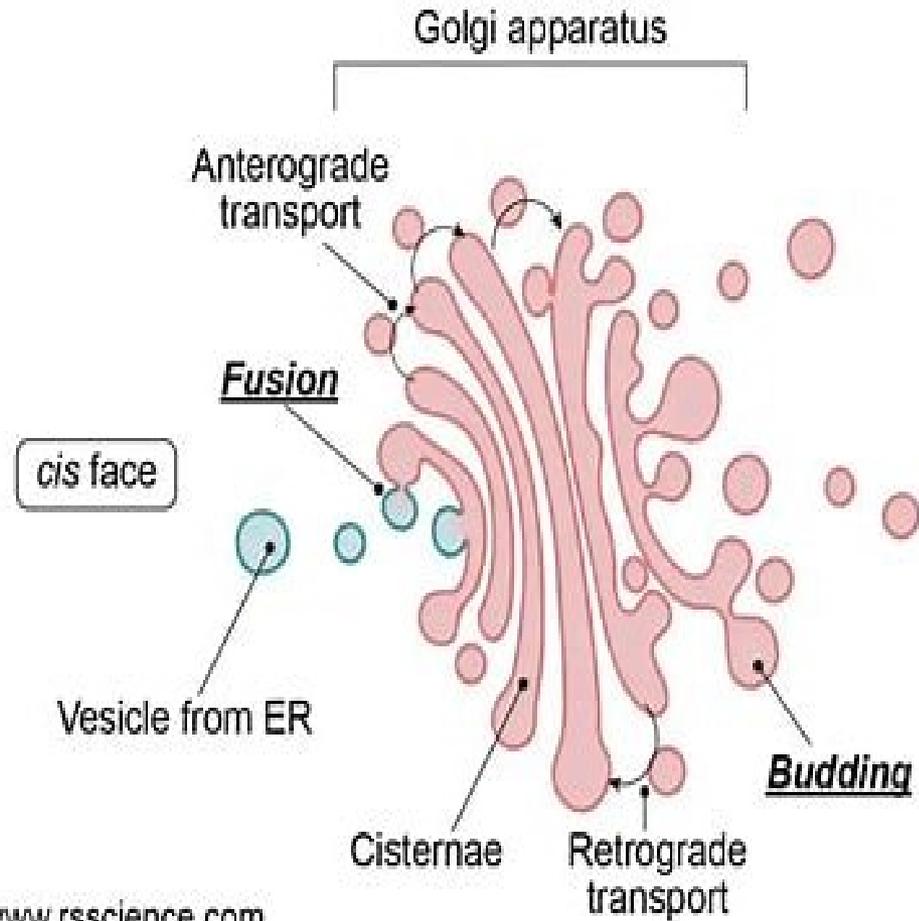
Structure: Stack of flattened membranous sacs (cisternae.)

Function:

Modifies, sorts, and packages proteins and lipids from the ER.

Forms secretory vesicles.

Helps form lysosomes.



Mitochondria

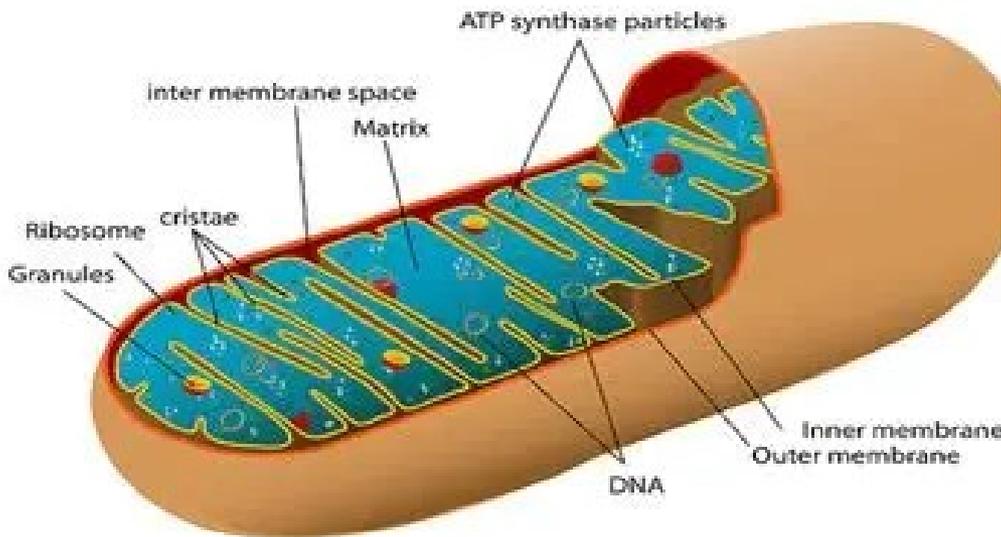
Structure: Double-membrane organelle, inner membrane folded (cristae).

Function:

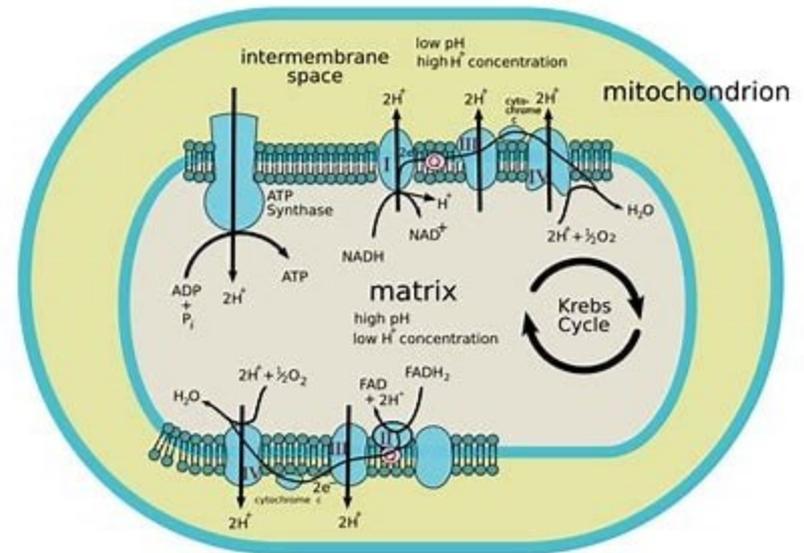
"Powerhouse" of the cell.

Produces ATP molecules via cellular respiration.

Has its own DNA.



Mitochondrial Electron Transport Chain



Connection to Dialysis Techniques

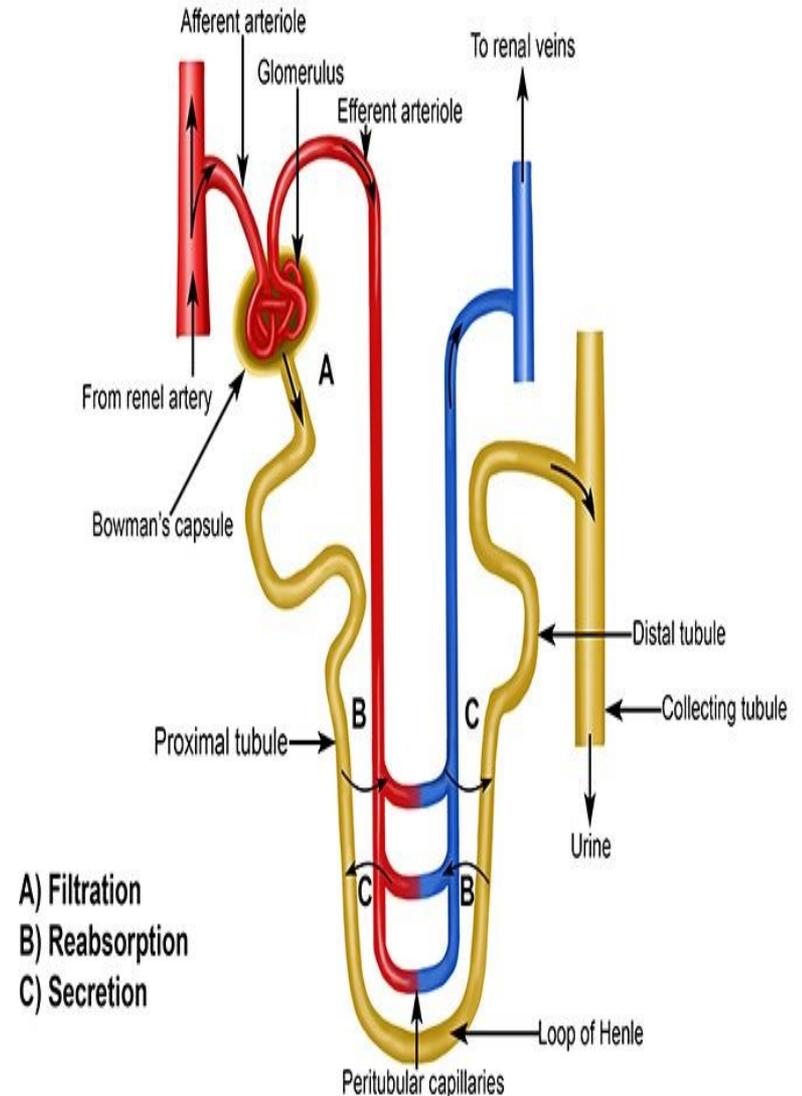
Kidney cells (e.g., in nephrons) are rich in mitochondria due to high energy demand.

-Organelle dysfunction

(e.g., mitochondrial)

may contribute to chronic kidney disease.

-Understanding cell health aids in understanding kidney function and causes of renal failure.



Summary

Organelle Main Function

Nucleus Control center, stores DNA

Ribosome Protein synthesis

Endoplasmic Reticulum Protein (RER) & lipid (SER) synthesis

Golgi Apparatus Modifies, sorts, packages molecules

Mitochondria Energy (ATP) production

References

1-Alberts, B. et al. Molecular Biology of the Cell. 7th ed .

2-Kumar, V. et al. Robbins Basic Pathology. 10th ed.

3-Trusted scientific sites: Nature Scitable, Khan Academy.

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