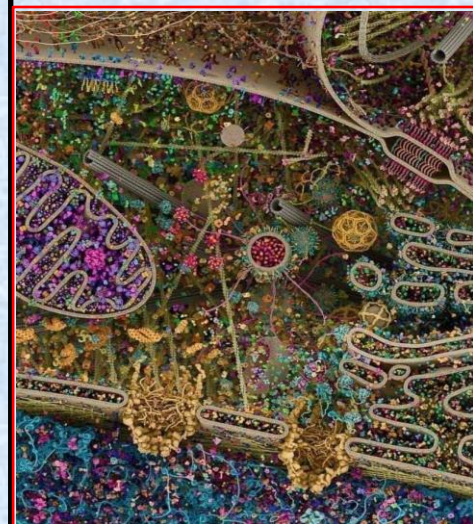


General Animal Biology

Zoo-109

علم الأحياء

109- حين



For Pre-Medical Students



Common First Year

السنة الأولى المشتركة - المسار الصحي

1444-H - 2023

Reference: Campbell, N. A. and Reece, J. B. (2014). *Biology (10th edition)*. Pearson Education. Inc. USA.

عمادة التعليم الإلكتروني والتعلم عن بعد
E-learning Deanship



King Saud University

جامعة الملك سعود

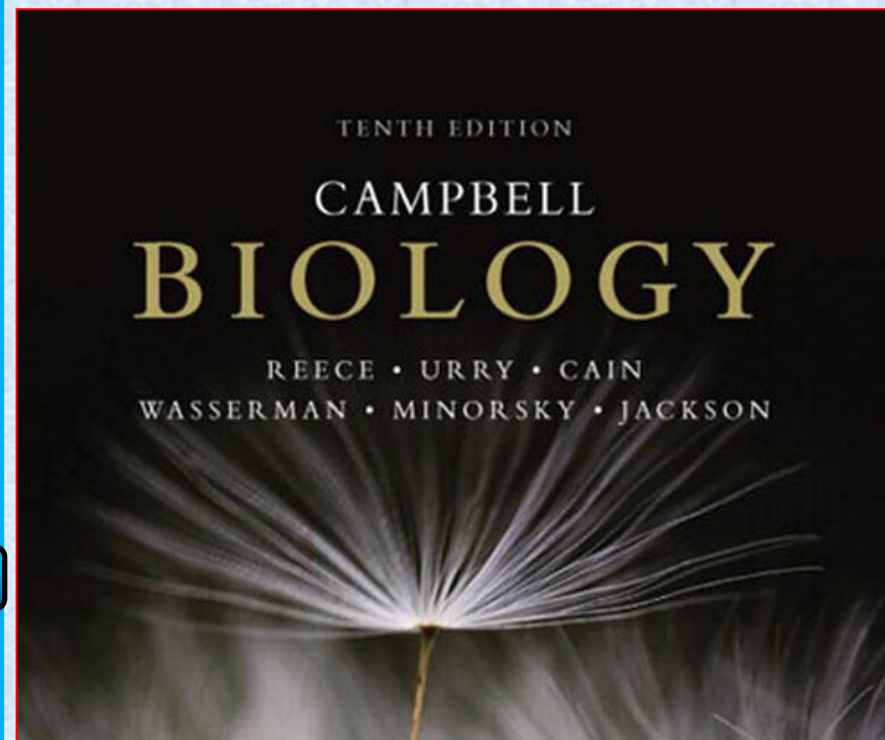
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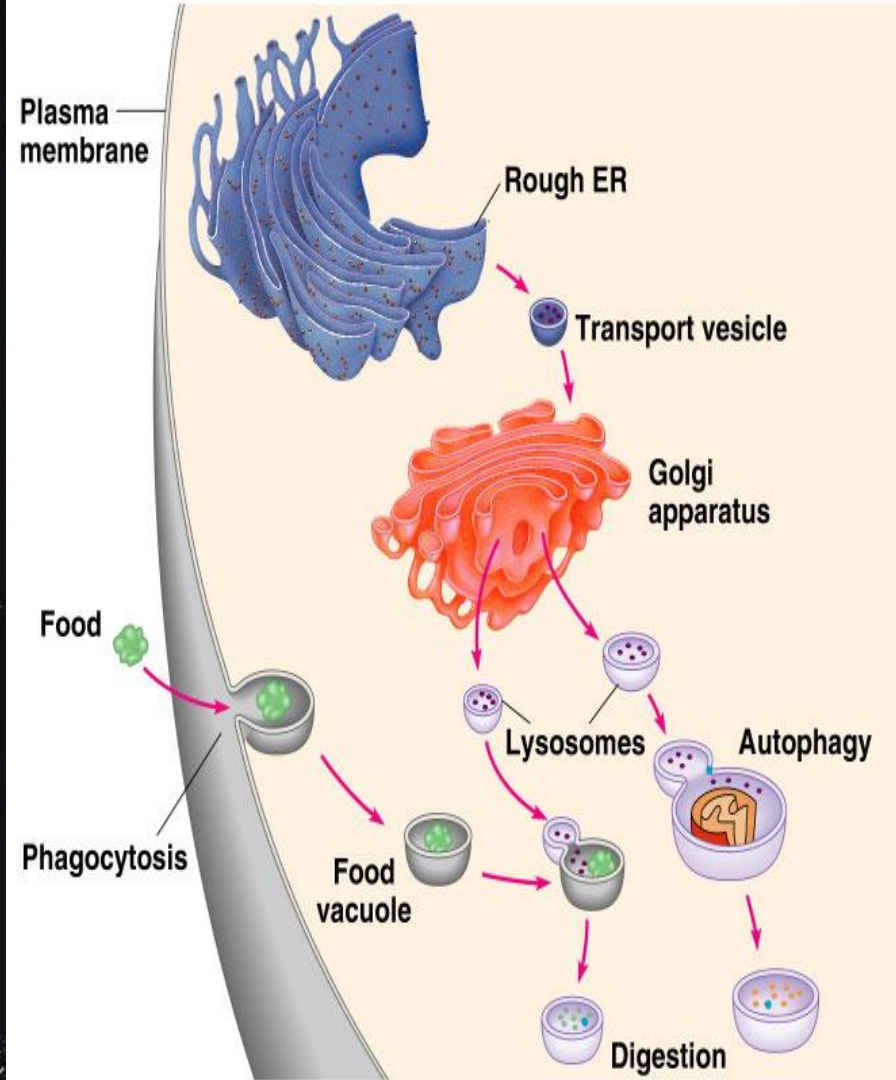
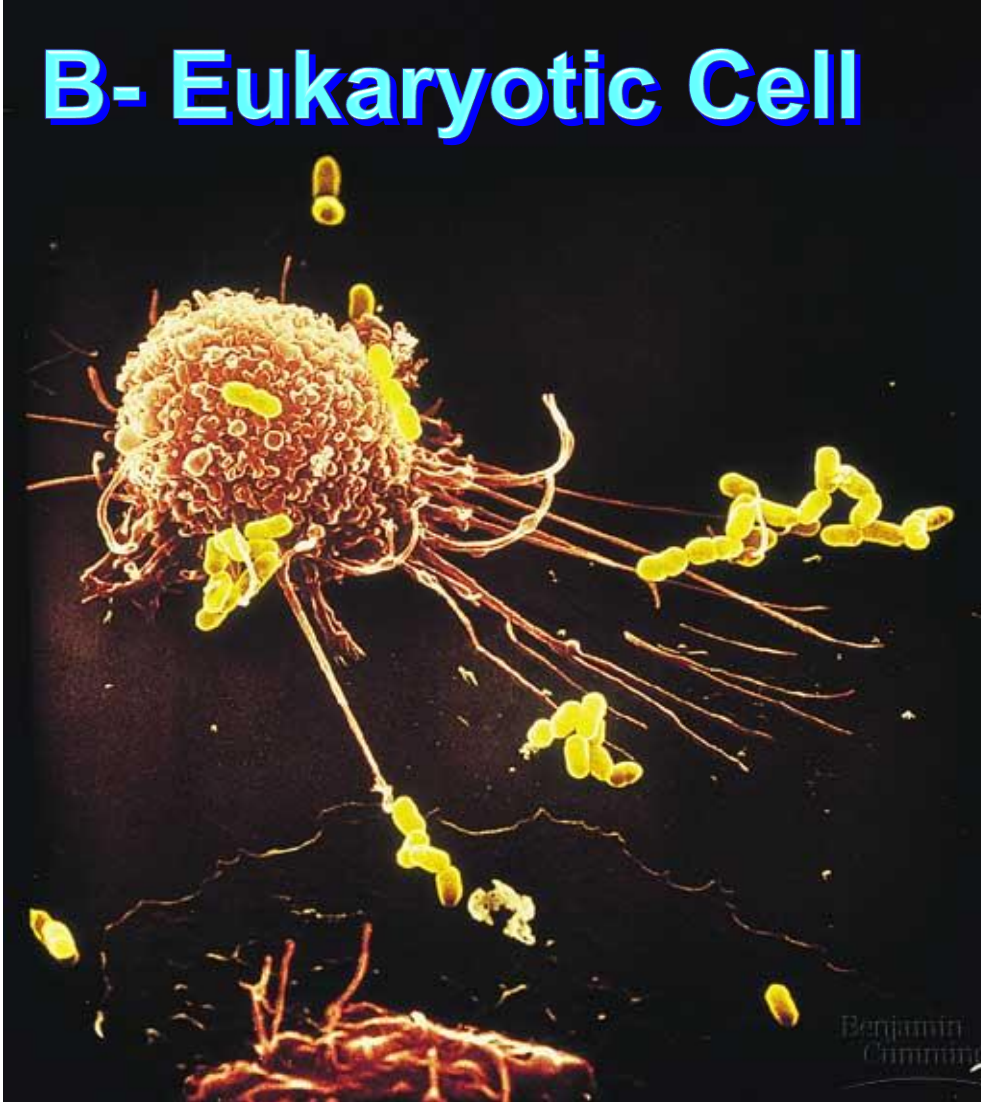
College of Science,
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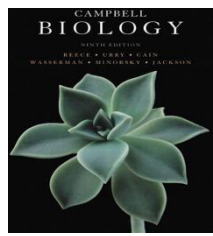
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B- Eukaryotic Cell





Objectives

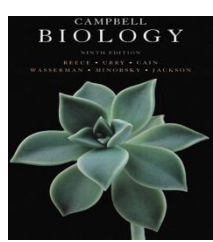


3)- The Endomembrane System

- a. The endoplasmic reticulum (ER)
 - Smooth ER.
 - Rough ER .
- b. Golgi apparatus.
- c. Lysosomes.
- d. Vacuoles.

4)- Other membranous organelles

- a. Peroxisome.
- b. Mitochondria.



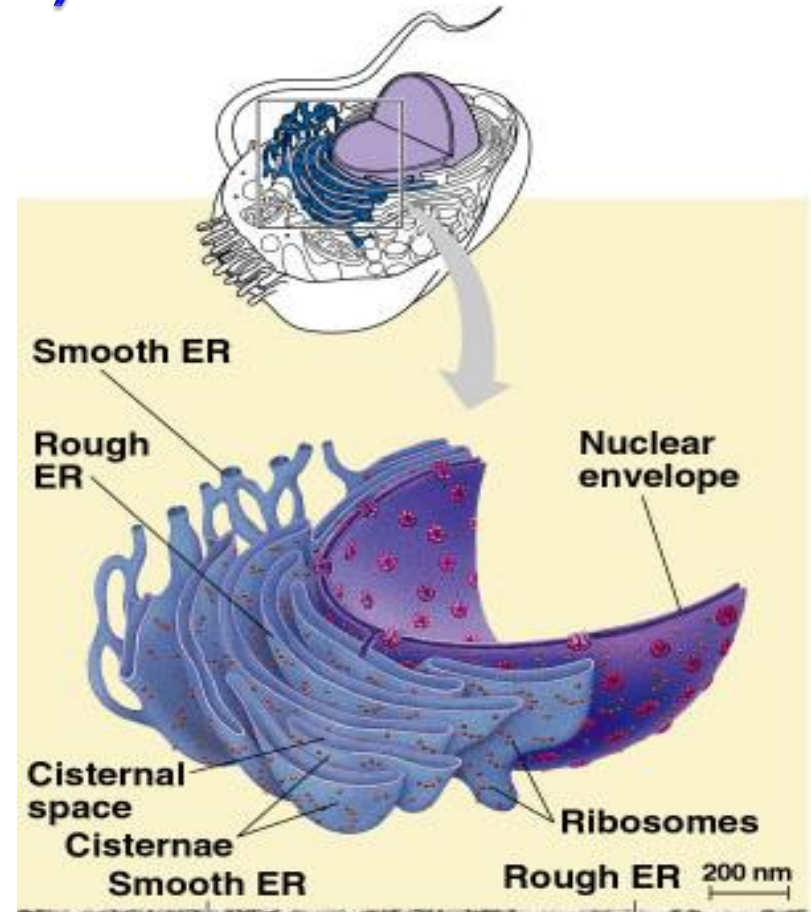
3- The Endomembrane System

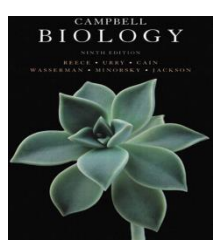


A)- The endoplasmic reticulum (ER)

(The intracellular highway)

- It is the largest internal membrane, composed of lipid bilayer
- It serves as a system of channels from the nucleus.
- It functions in **storage** and **secretion** of cell products

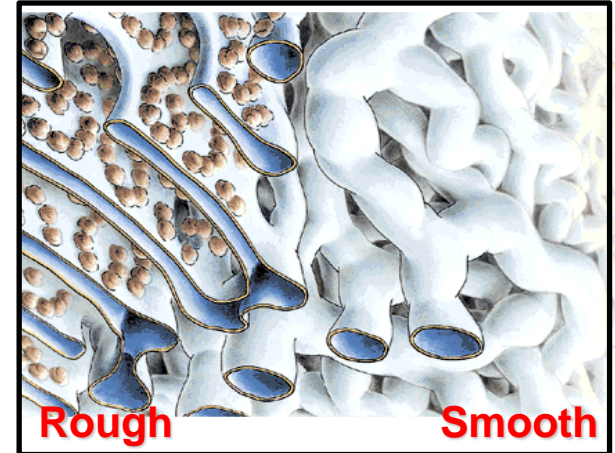




3- The Endomembrane System



Types of endoplasmic reticula

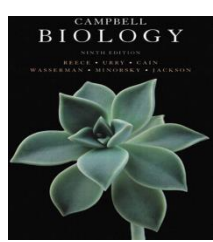


The rough ER:

- It is “rough” because of the associated ribosomes (bound ribosomes)
- It is abundant in those cells that secrete proteins such as **digestive glands** and **antibody-producing cells**.

The smooth ER:

- It is smooth as it lacks the associated ribosomes.
- It is rich in enzymes and plays a role in metabolism.
- Its enzymes synthesize **lipids** (oils, phospholipids and steroids), including the (sex hormones).
- It helps in **detoxifying drugs and poisons**, thus, it exists extensively in the **liver cells**.

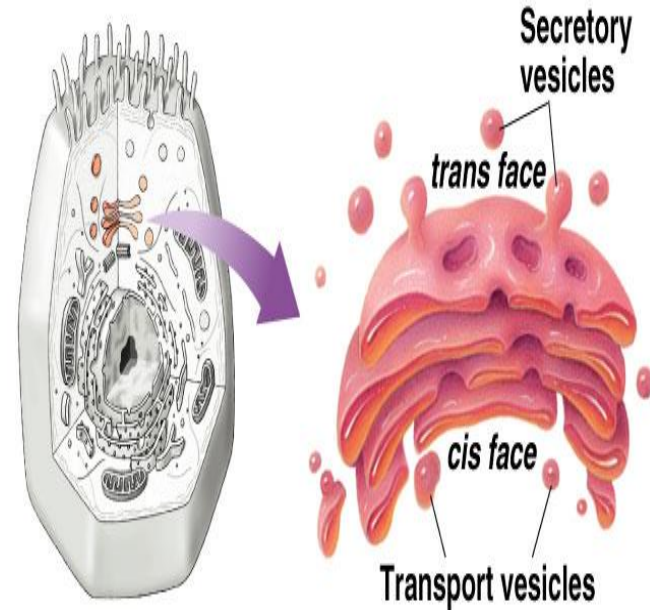


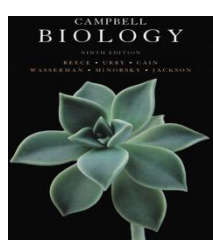
3- The Endomembrane System



B)- Golgi apparatus: (finishes, sorts, packages and ships cell products)

- Many transport products from the ER travel to the Golgi apparatus for **modification of their contents**.
- Thus, Golgi body's function is **manufacturing, warehousing, sorting (Packaging), and shipping materials to outside the cell**.
- The Golgi also **manufactures polysaccharides**.
- It correctly **send proteins** to their respective addresses
- If the Golgi makes a mistake in shipping the proteins to the right address, certain functions in the cell may stop.
- **The Golgi apparatus is more abundant in secretory cells.**



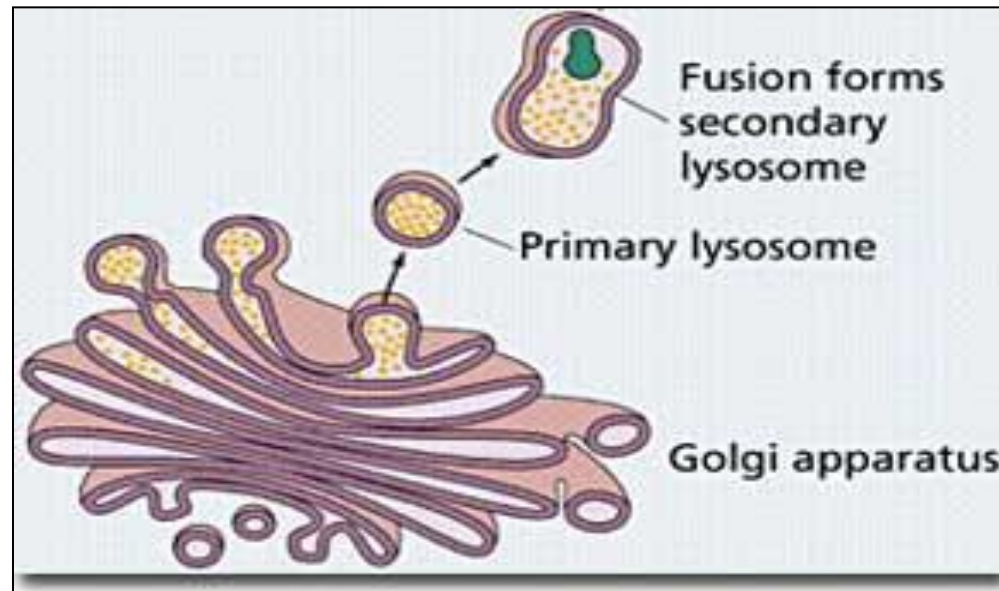


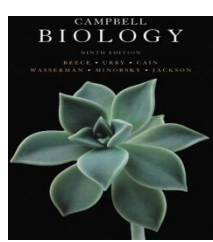
3- The Endomembrane System



C)- Lysosomes: They are digestive components

- Lysosome is a membrane-bounded sac contains enzymes that digest macromolecules.
- **Lysosomal enzymes** work best at pH = 5 (acidic).
- **Lysosomal enzymes** are synthesized by rough ER and then transferred to the Golgi then to lysosomes.



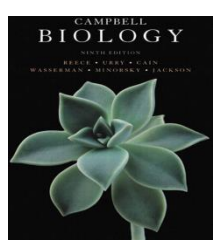


3- The Endomembrane System



Functions of Lysosomes

- 1) They have enzymes that **hydrolyze** the macromolecules (proteins, fats, polysaccharides, and nucleic acids).
- 2) Can destroy the cell by auto-digestion (**autophagy**).
- 3) Can also fuse with and digest another organelle or part of the cytosol. This process is called **recycling** which **renews the organelle** and/or the cell.
- 4) Can fuse with food vacuoles to **digest food**, (*when a food item is brought into the cell by Phagocytosis*).
5. They **digest** unwanted particles.
6. They help white blood cells to **destroy bacteria**.

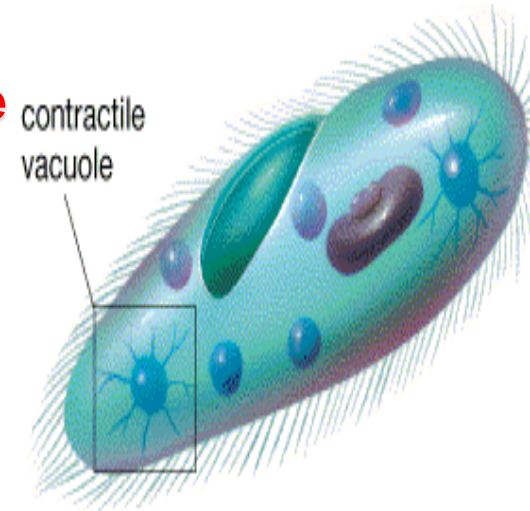


3- The Endomembrane System



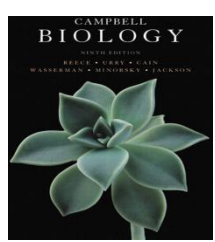
D)- Vacuoles: They have diverse functions in cell maintenance

- They are membrane-bound sacs with varied functions such as **storage, digestion, and waste removal**.
- Contain water solution and help plants maintain shape.



There are different types of vacuoles including:

1. **Food vacuoles:** from phagocytosis, fuse with lysosomes for digestion.
2. **Contractile vacuoles**, فجوة متقبضة: found in freshwater protists (e.g. *Paramecium*) to maintain **osmoregulation** (water balance) by pumping excess water out of the cell.
3. **Central vacuoles:** in mature plants; store wastes, maintain the cell shape.

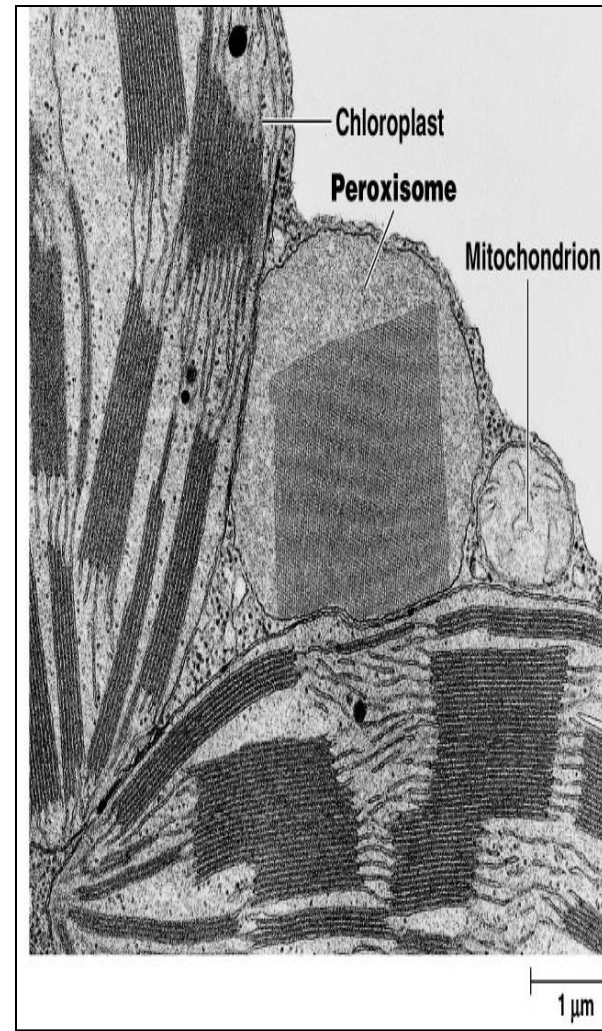


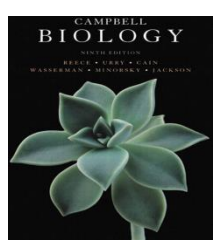
4- Other Membranous Organelles



1)- Peroxisomes

- Are similar in appearance to lysosomes, but the two have different origins:
 - *Lysosomes are generally formed in the Golgi complex,*
 - *Whereas peroxisomes are self-replicating themselves.*
- Contain enzymes for **degrading amino acids and fatty acids**, resulting in production of the **toxic hydrogen peroxide (H_2O_2)**; as a byproduct of cellular metabolism.



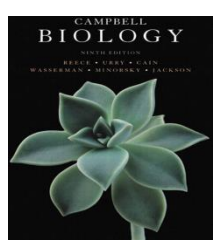


Other Membranous Organelles



Functions of peroxisomes:

- 1- They have enzymes that converts the toxic H_2O_2 to water (H_2O).
- 2- They **break fatty acids** down to smaller molecules that are transported to mitochondria as fuel (for cellular respiration).
- 3- They detoxify alcohols and other **harmful compounds**. Thus, it exists extensively in the **liver cells.**
- 4- They initiate the production of **phospholipids**, which are the major component of cellular membranes.



Other Membranous Organelles



2)- Mitochondria:

They are rod-shaped organelles that convert oxygen and nutrients into **ATP** (adenosine triphosphate) during **aerobic respiration**.

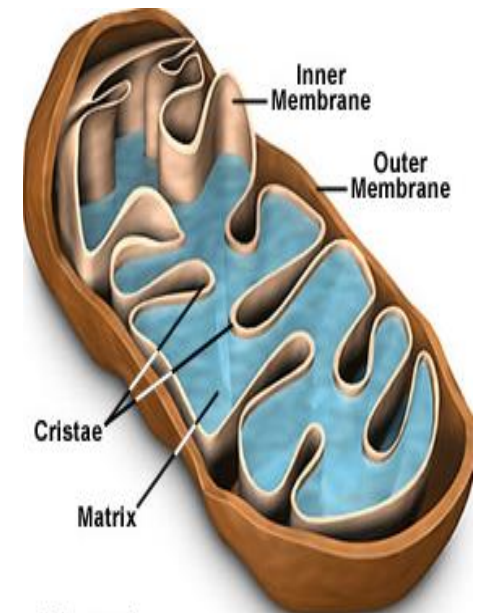
- **Mitochondria are the sites of cellular respiration,**

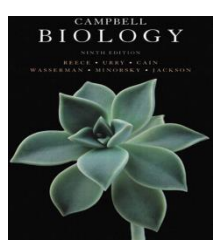
- Generating **ATP** from the catabolism (هدم/احرق) of sugars, fats, and other fuels in the presence of oxygen.

- Almost all eukaryotic cells have mitochondria except red blood cells.

- Mitochondria **are mobile** and moving around inside the cell along tracks in the cytoskeleton.

- The **number of mitochondria** present in a cell depends upon the metabolic requirements of that cell, and may range from **a single large mitochondrion to thousands**.





Other Membranous Organelles

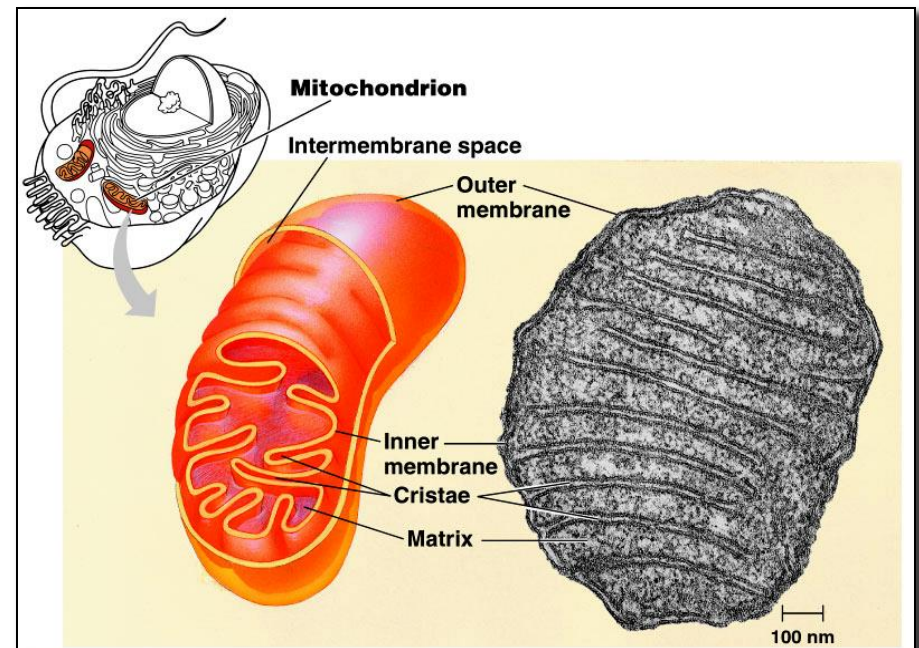


Structure of mitochondrion:

- Mitochondria have a smooth outer membrane and a highly folded inner membrane forming the **cristae**.
- The inner membrane encloses the **mitochondrial matrix**, a fluid-filled space with the mitochondrial **DNA, ribosomes, and enzymes**.

The mitochondrion is different from the most other organelles because:

1. It has its own **DNA, ribosomes, and enzymes**.
2. It reproduces independently of the cell.



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Thank you very much

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