Cytoplasm

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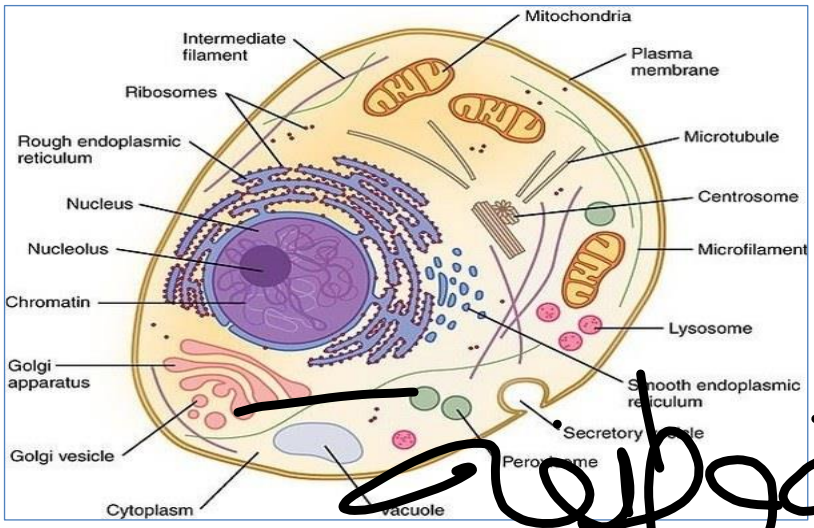
Cytoplasm

Learning Objectives:

- **Identify the components of the cytoplasm.**
- **Enumerate the types of cell organelles.**
- **Identify the structure of cell organelles & recognize their functions.**
- **Define the cell inclusions & list their types.**

Cytoplasm

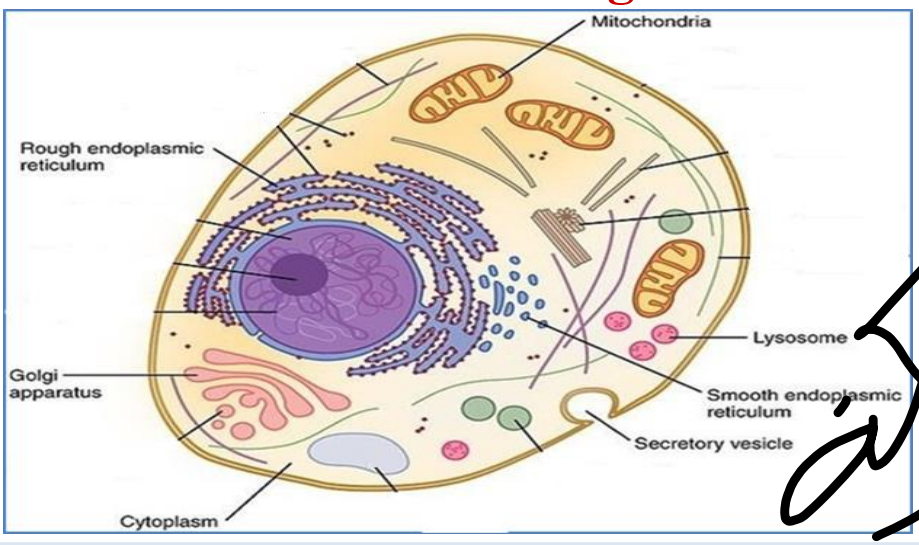


The cytoplasm contains:

1- Cell organelles (membranous & non-membranous organelles).

2 - Cell inclusions.

Membranous Cell Organelles



1- Rough & smooth endoplasmic reticulum
2- Golgi apparatus
3- Secretory vesicles
4- Lysosomes
5- Mitochondria

Endoplasmic Reticulum

*Endoplasmic reticulum is a network of membrane-bound spaces.

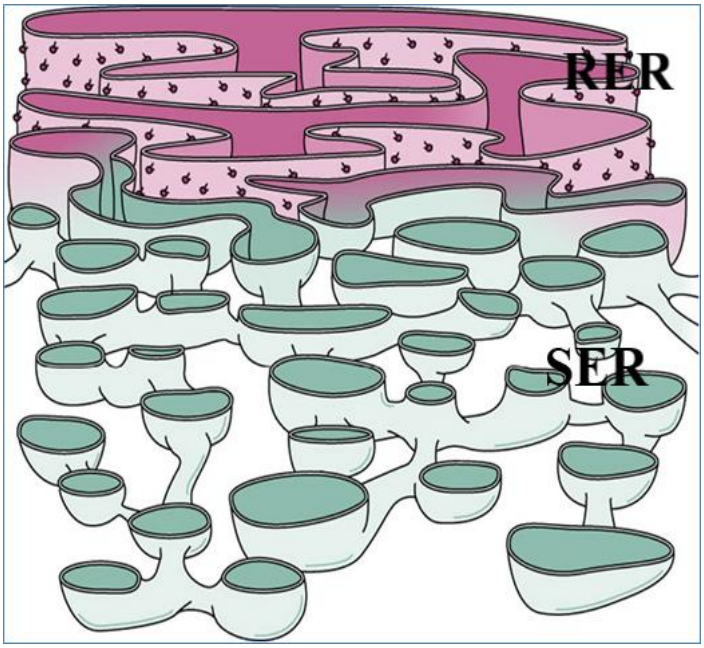


Diagram of SER and RER

Types of Endoplasmic Reticulum:

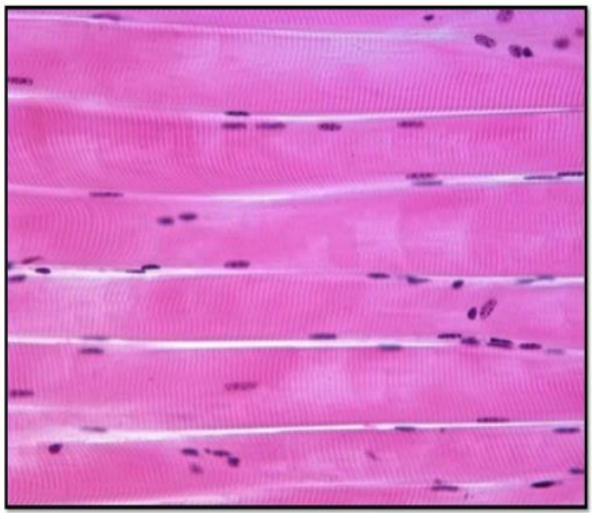
1- Smooth endoplasmic reticulum (SER)

2- Rough endoplasmic reticulum (RER)

Smooth Endoplasmic Reticulum (SER)

- **With L.M:**

Cells rich in SER are highly acidophilic with H&E stain.


L.M. of muscle cells rich in SER by H&E stain

- **With E.M:**

SER Has NO ribosomes on its membranes.

- **Functions:**

1- Lipid synthesis.

2- Detoxification of drugs.

3- Helps muscular contraction.

Rough Endoplasmic Reticulum (RER)

- **With L.M:**

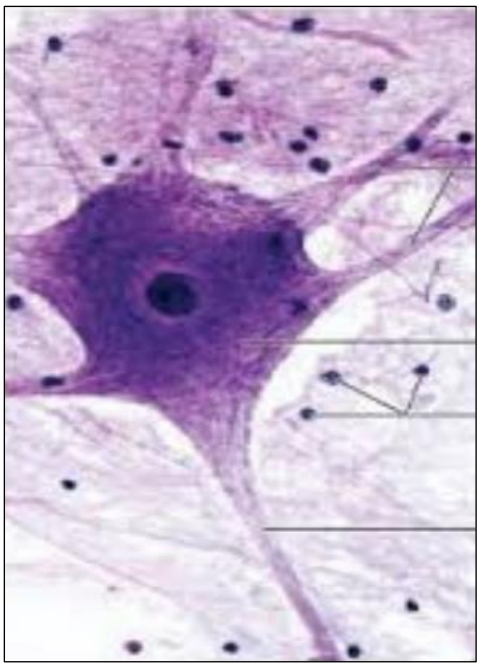
Cells rich in RER are highly basophilic with H&E stain.

- **With E.M:**

RER Has ribosomes on its membranes.

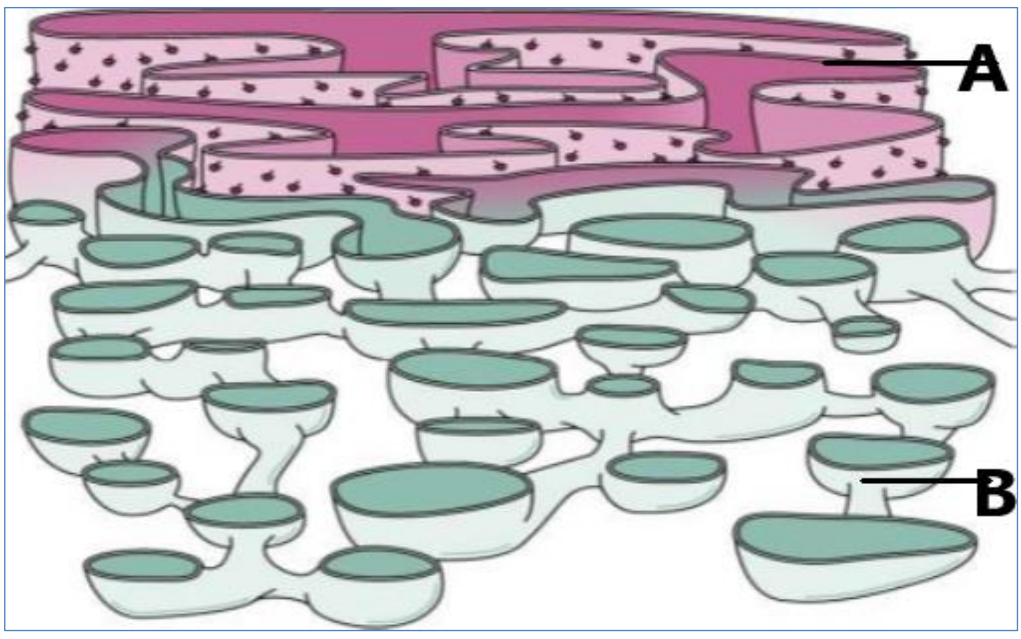
- **Function:**

Synthesis of proteins.



L.M. of nerve cells rich in RER by H&E stain

Let's Think



a) Write the name of (A) & (B).

b) Compare between A & B?

Golgi Apparatus (=Golgi Complex)

- **With L.M:**

Golgi apparatus is stained with silver stain.

- **With E.M:**

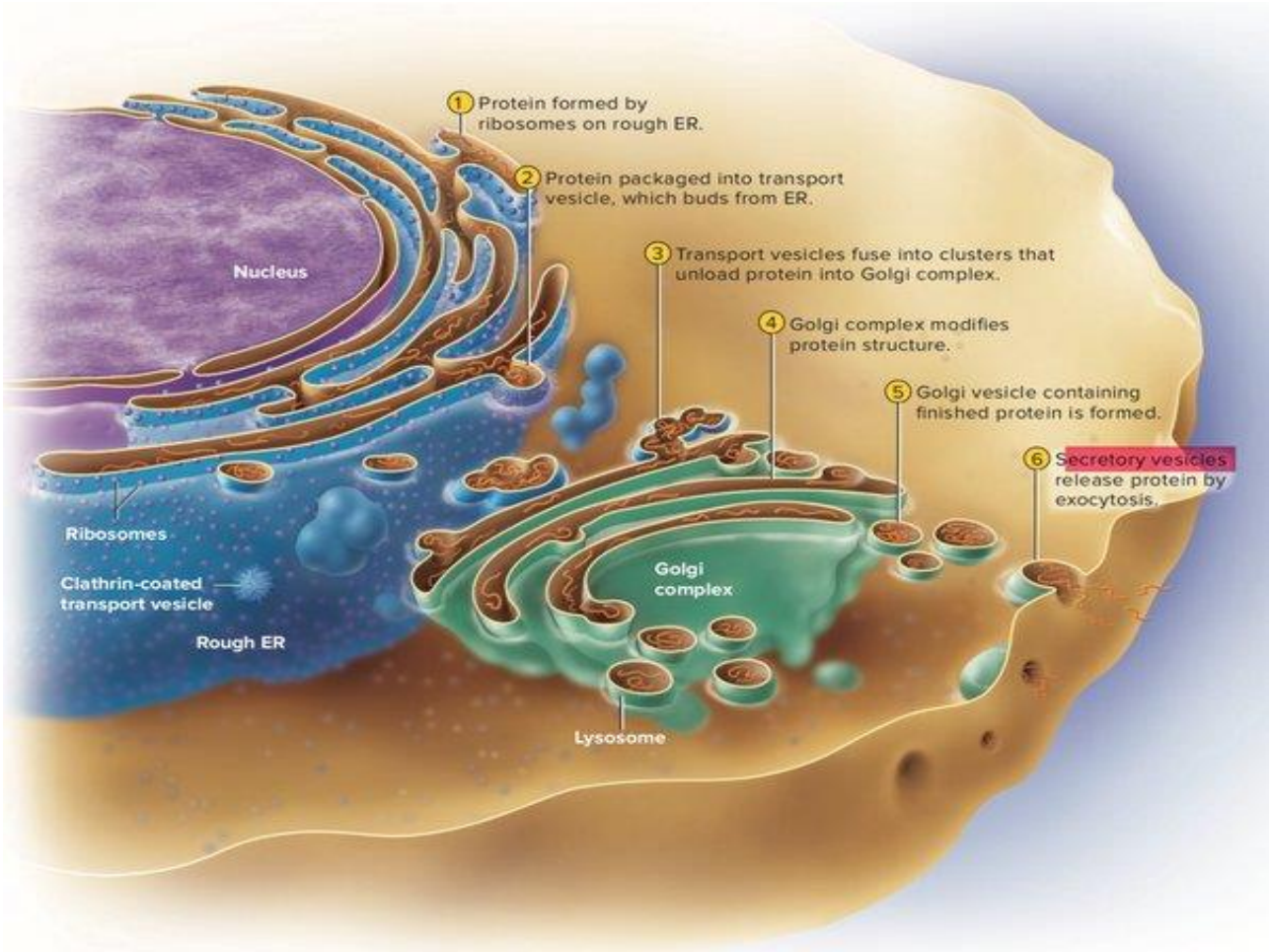
Golgi apparatus is formed of *cisternae* and *vesicles*.

- Function:

1. Modifications of proteins.

2. Packing of proteins to form lysosomes and secretory vesicles.

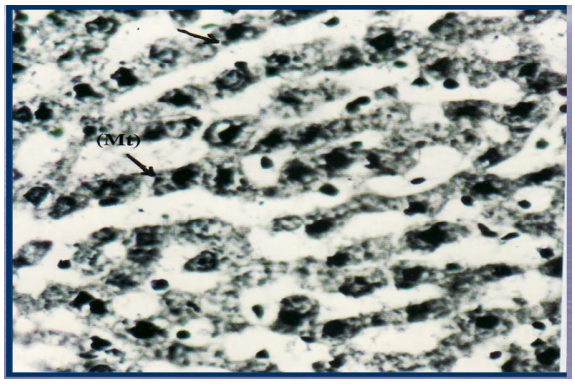
L.M. of Golgi apparatus by Silver stain



Mitochondria (Power House of the cell)

- **With L.M:**

Mitochondria are stained with iron hematoxylin stain.



LM of mitochondria by Iron Hematoxylin stain

- **With E.M:**

Mitochondria are surrounded by two membranes. The outer membrane is smooth and the inner membrane has folds called cristae.

-The space inside the inner membrane contains the matrix which has a high concentration of enzymes in addition to small circular DNA, ribosomes, and Ca^{++} particles.

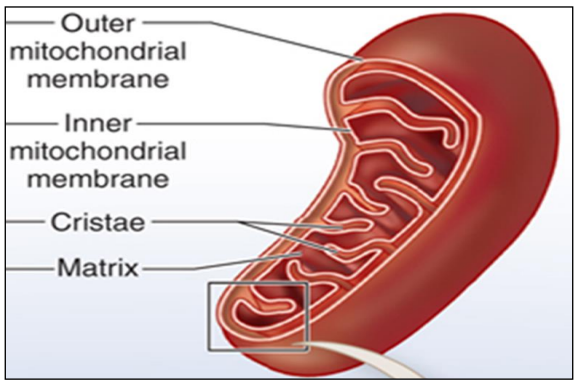
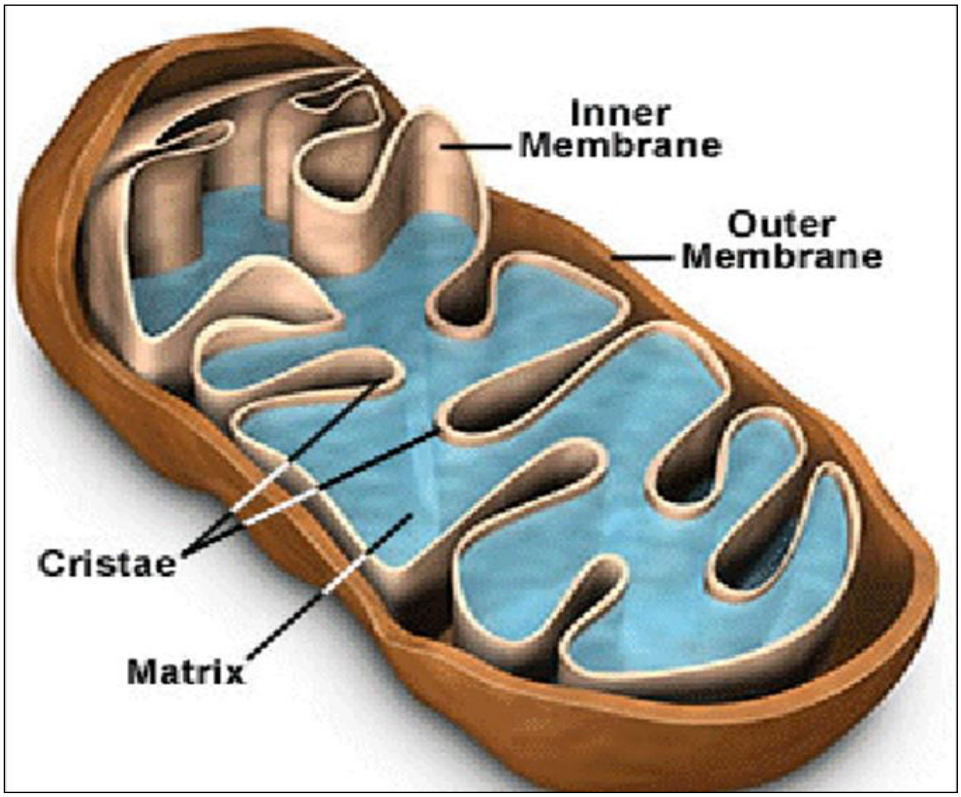


Diagram of EM of mitochondria

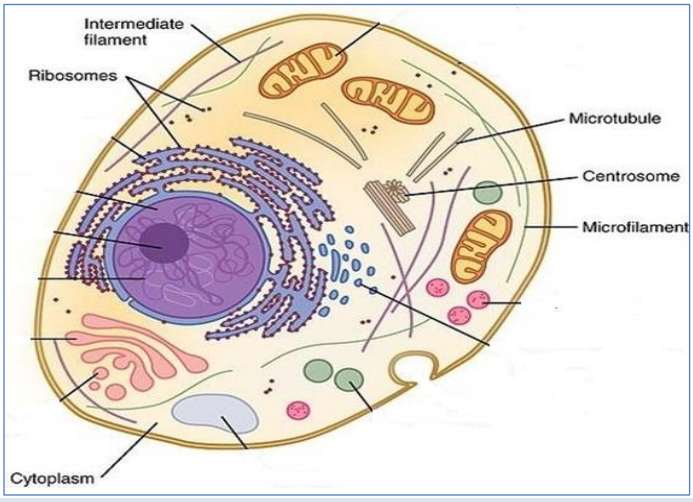
- **Function:**

Production of energy for the cell.

Diagram of E.M. of Mitochondria



Non-membranous Cell Organelles

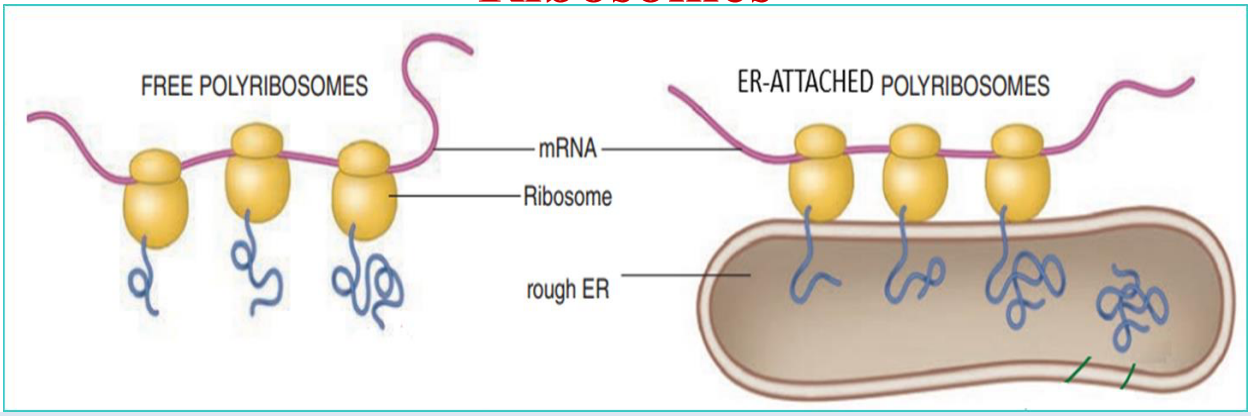


1- Ribosomes.

2- Centrosomes.

3- Microtubules
4- Microfilaments — (3, 4 & 5 form the Cytoskeleton)
5- Intermediate filaments

Ribosomes



- **Structure**:

Ribosomes are composed of ribosomal RNA (rRNA) and protein.

- **With L.M**:

Cells rich in ribosomes are highly basophilic.

- **Types of ribosomes**:

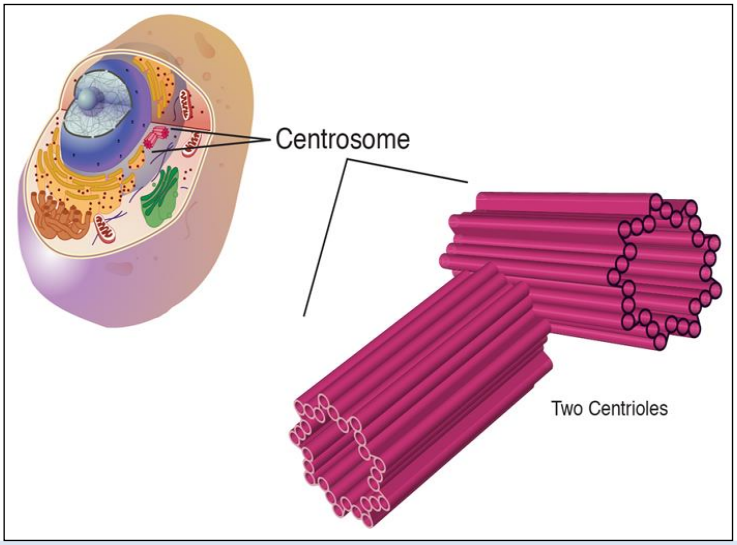
1- Attached to rough endoplasmic reticulum (RER).

2- Free in the cytoplasm.

- **Function**:

Synthesis of proteins.

Centrosomes



- **Structure**: **The centrosome is found close to the nucleus. The centrosome consists of two centrioles. Each centriole is formed of microtubules.**

- **Function**: **form the mitotic spindle during cell division.**

Cell Inclusions

- **Types of cell inclusions:**

1. Glycogen granules:

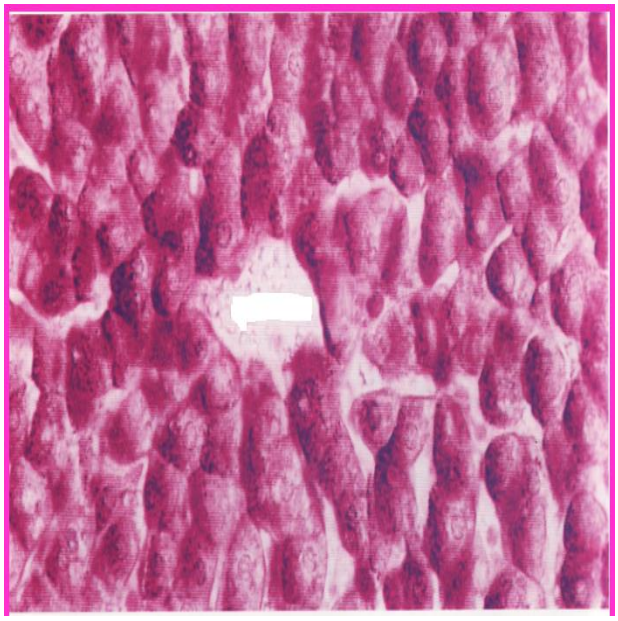
- Are aggregates of carbohydrate.
- Mainly stored in liver cells.
- Stained with PAS stain.

2. Lipid droplets:

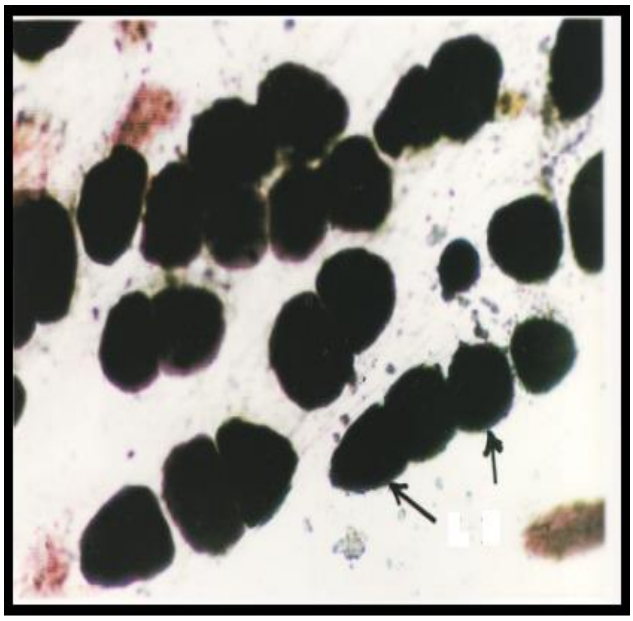
- Are aggregates of lipid.
- Mainly stored in fat cells.
- Stained with Sudan Black stain.

3. Pigments:

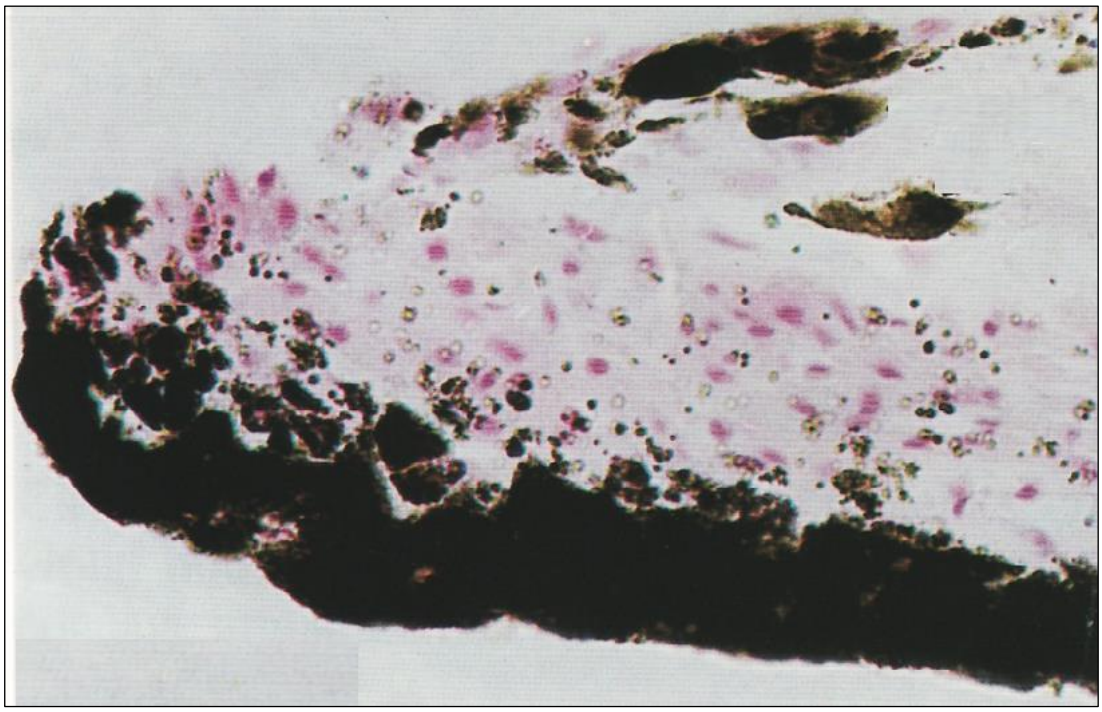
- Are aggregates of naturally colored material.
- Such as melanin pigment present in skin & eye.



Glycogen granules (stained by PAS stain)



Lipid droplets (stained by Sudan Black stain)



Melanin pigment in the eye (H&E stain)

Enumerate:

1. **Enumerate the membranous cell organelles.**
2. **Enumerate functions of smooth endoplasmic reticulum.**
3. **Enumerate the functions of Golgi apparatus.**
4. **Enumerate the functions of lysosomes.**
5. **Enumerate the types of lysosomes.**
6. **Enumerate the contents of the matrix of mitochondria.**
7. **Enumerate the non-membranous cell organelles.**
8. **Enumerate the types of cell inclusions.**
9. **Enumerate the types of ribosomes.**
10. **Enumerate the components of cytoskeleton.**

Complete:

1. Mitochondria is stained with ……. stain.

2. Cells rich in SER are highly ……with H&E stain.

3. Cells rich in RER are highly …… with H&E stain.

4. Golgi apparatus is stained with ……. stain.

5. The functions of lysosomes are…… and…….

6. The function of mitochondria is……

7. Types of cell inclusions are ……..… , ……... and ……

8. …….. pigment is present in the skin and eye.

9. Glycogen is stained by ……..... stain.

10. Lipid is stained by ……... stain.

Choose the correct answer:

1-Which of the following organelles is rich in hydrolytic enzymes?

a. Lysosomes. b. Smooth endoplasmic reticulum.
c. Mitochondria. d. Golgi complex.

2- Which of the following is <u>NOT</u> a membranous organelle?

a. Lysosomes. b. Golgi complex.
c. Mitochondria. d. Ribosomes.

3- Which of the following organelles is the power house of the cell?

a. Lysosomes. b. Golgi complex.
c. Mitochondria. d. Ribosomes.

4- Which of the following is a function of smooth endoplasmic reticulum?

a. Detoxification of drugs. b. Production of energy.
c. Removal of old mitochondria. d. Synthesis of proteins.

5-Which of the following organelles is important for cell division?

a. Lysosomes. b. Glycogen.
c. Melanin. d. Centrosomes.

6- Which of the following is true about ribosomes?

a. Basophilic. b. Synthesized in smooth endoplasmic reticulum.
c. Power house of the cell. d. Rich in hydrolytic enzymes.

7- Which of the following is true about glycogen?

a. A non-membranous organelle. b. Stained with PAS stain.
c. Synthesize proteins. d. A pigment.

Lecture References

- Junqueira's Basic Histology: Text and Atlas 15th Edition.

Thank you