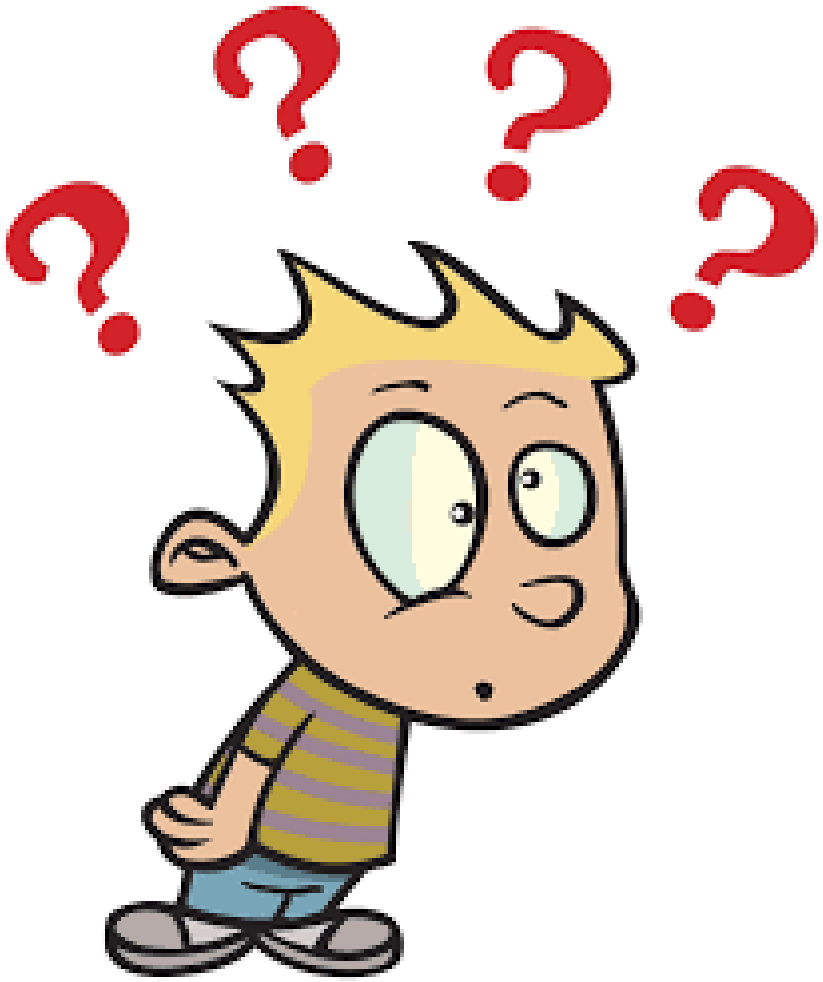
Introductory Module

The cell


Good Morning


Welcome


بسم الله الرحمن الرحيم
قالوا سبحانك لا علم لنا إلا ما
علمتنا إنك أنت العليم الحكيم
صدق الله العظيم
البقرة (٣٢)



If you don’t understand…TELL ME!

Cytology

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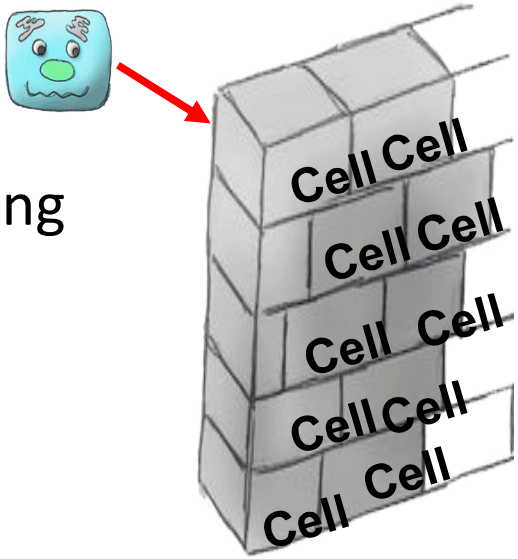
The cell



Definition:

Smallest ***S***tructural and functional unit living tissues that can live independently (perform vital functions)..

Functions:

Secretion, Respiration, Absorption, reproduction , Excretion, Sensation, contraction.

Size:

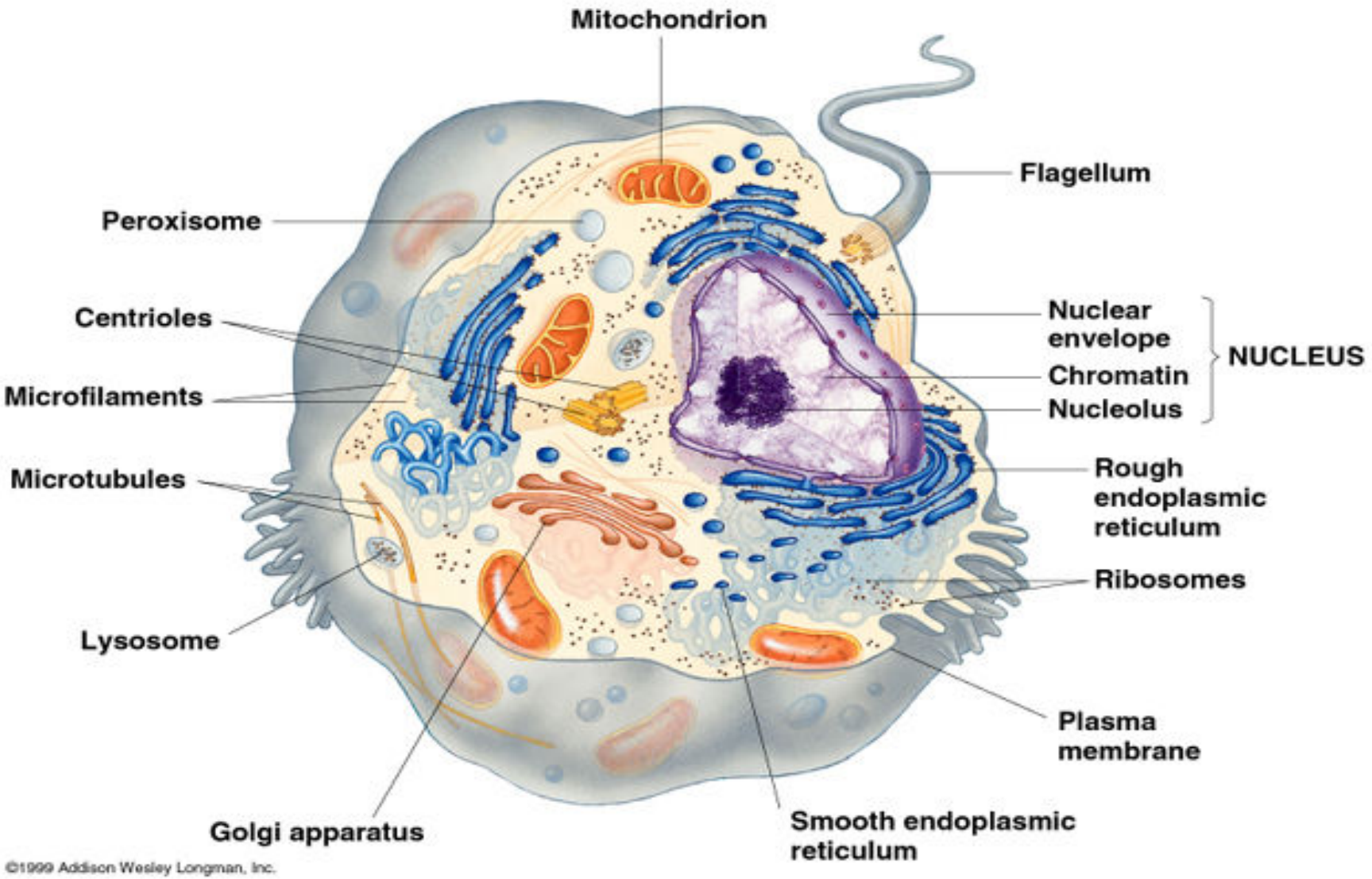
- varies from 4-150 □m
- Small cells as lymphocyte 6 □m
- Large cells as ovum 150 □m

Shape: Different shapes (Rounded, oval, flat , Stellate, polygonal , Cubical, columnar

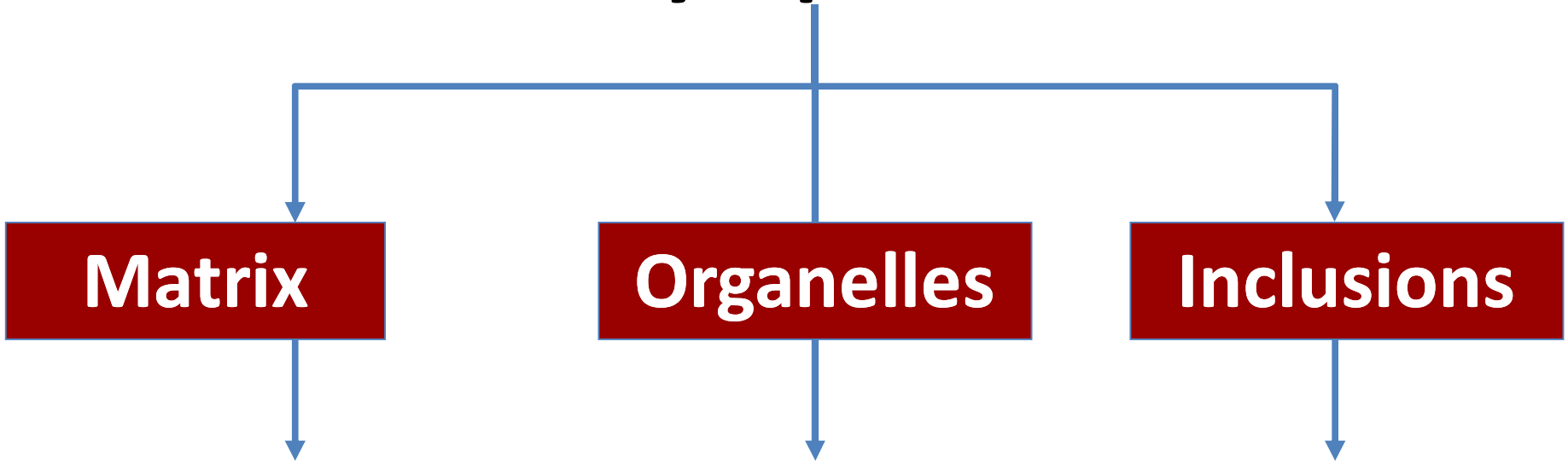
Structure of the cell

Cytoplasm

Nucleus



1- Cytoplasm



Colloidal solution
- Proteins
- Carbohydrates
- Lipids
- Enzymes
- minerals

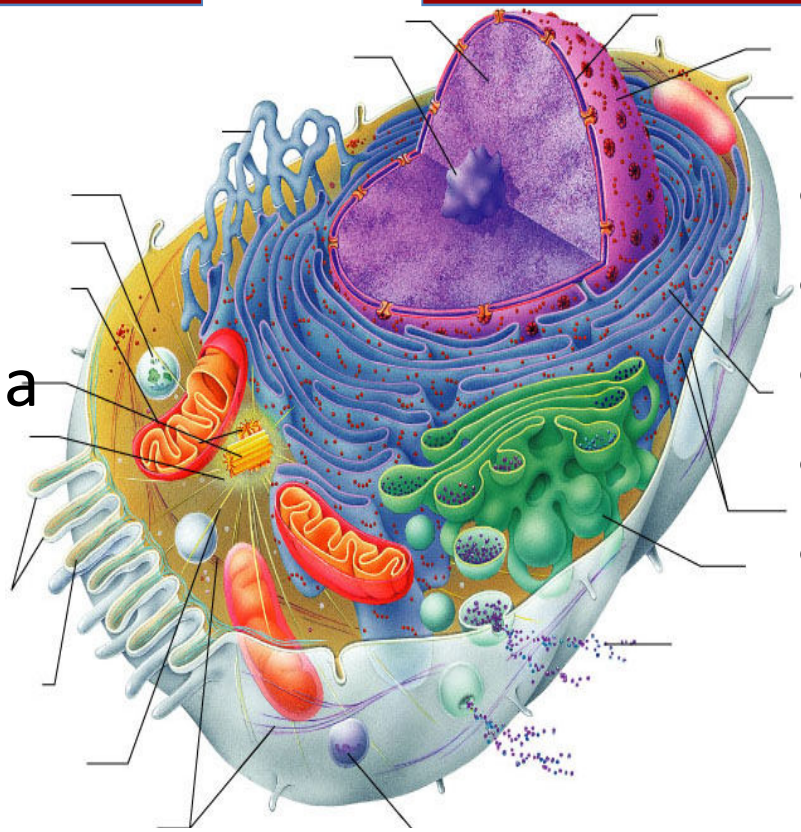
- Living structures
- Permanent
- Essential in all nucleated cells
- Have vital functions

- Non living
- Temporary
- Not essential
- Not in all cells
- Result of cell activity

Cytoplasmic organelles

Membranous

- Cell membrane
- Mitochondria
- RER & SER
- Golgi
- Lysosomes



Non-membranous

- Ribosomes
- Microtubules
- Microfilaments
- Cilia
- Flagella

A) Membranous Organelles

1- The Cell membrane

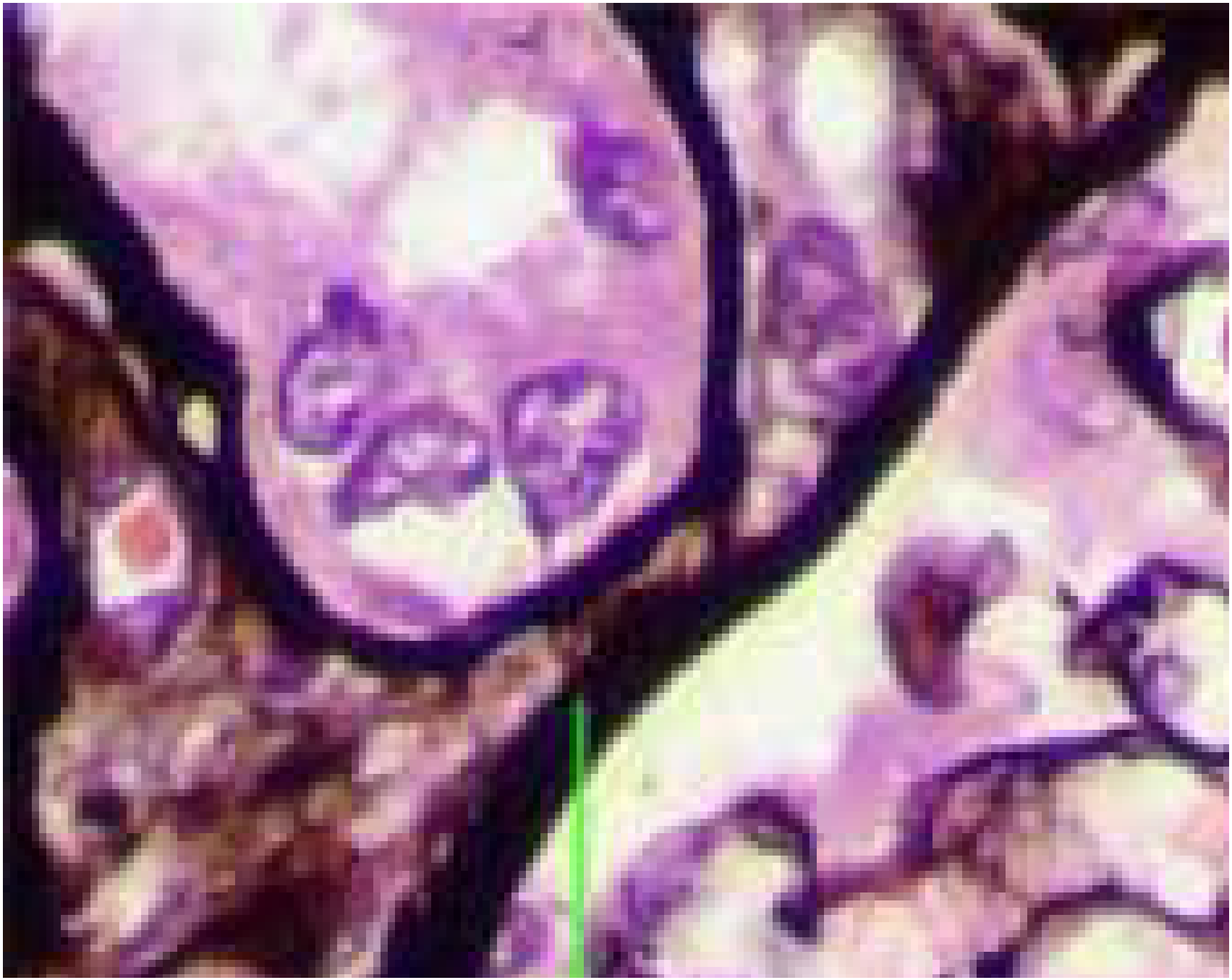
Definition

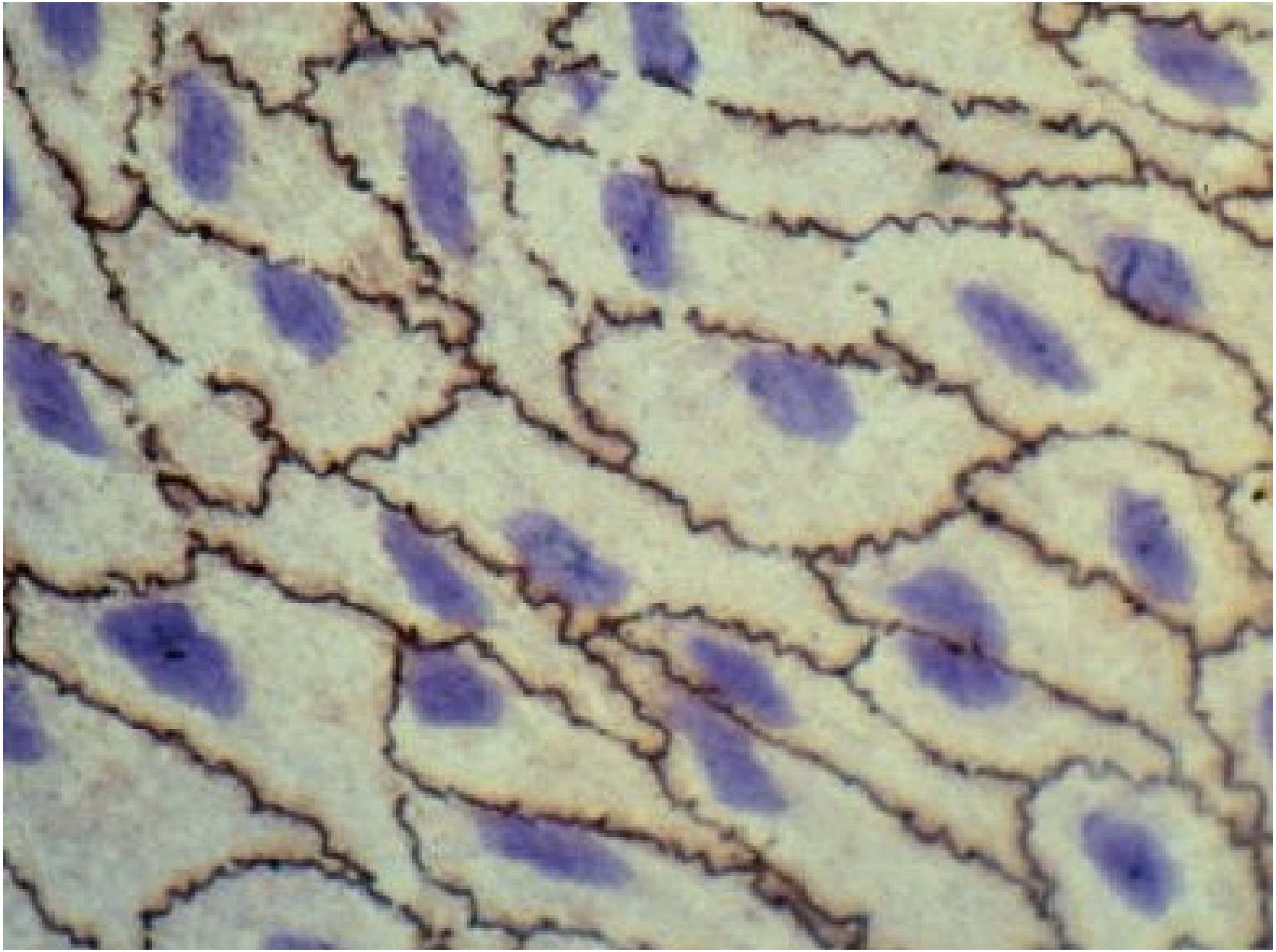
A living membrane forming the outermost cover of the cytoplasm

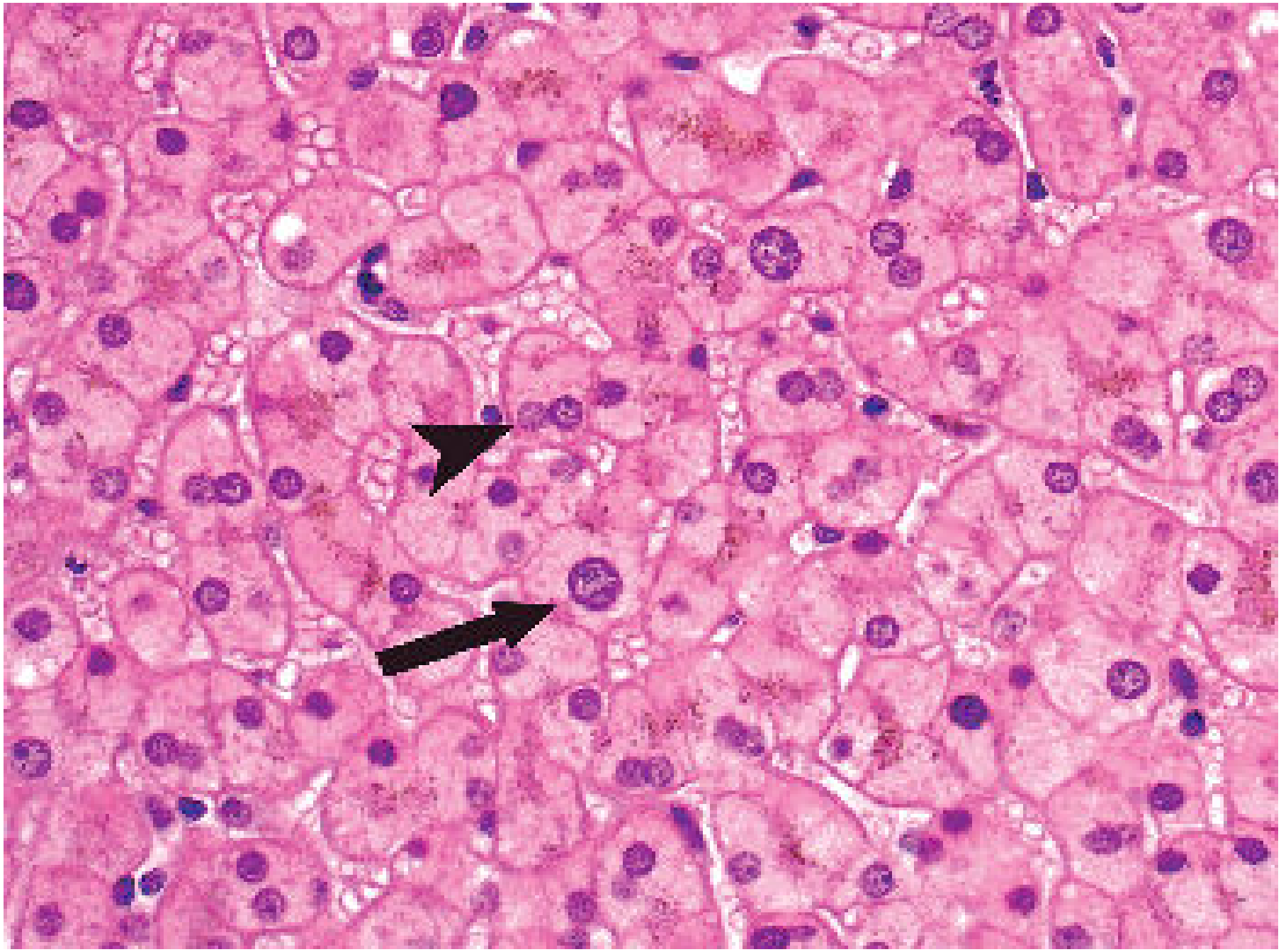
LM:

H & E: Can not be seen because very thin (8-10 nm)

Special stain: Silver or PAS



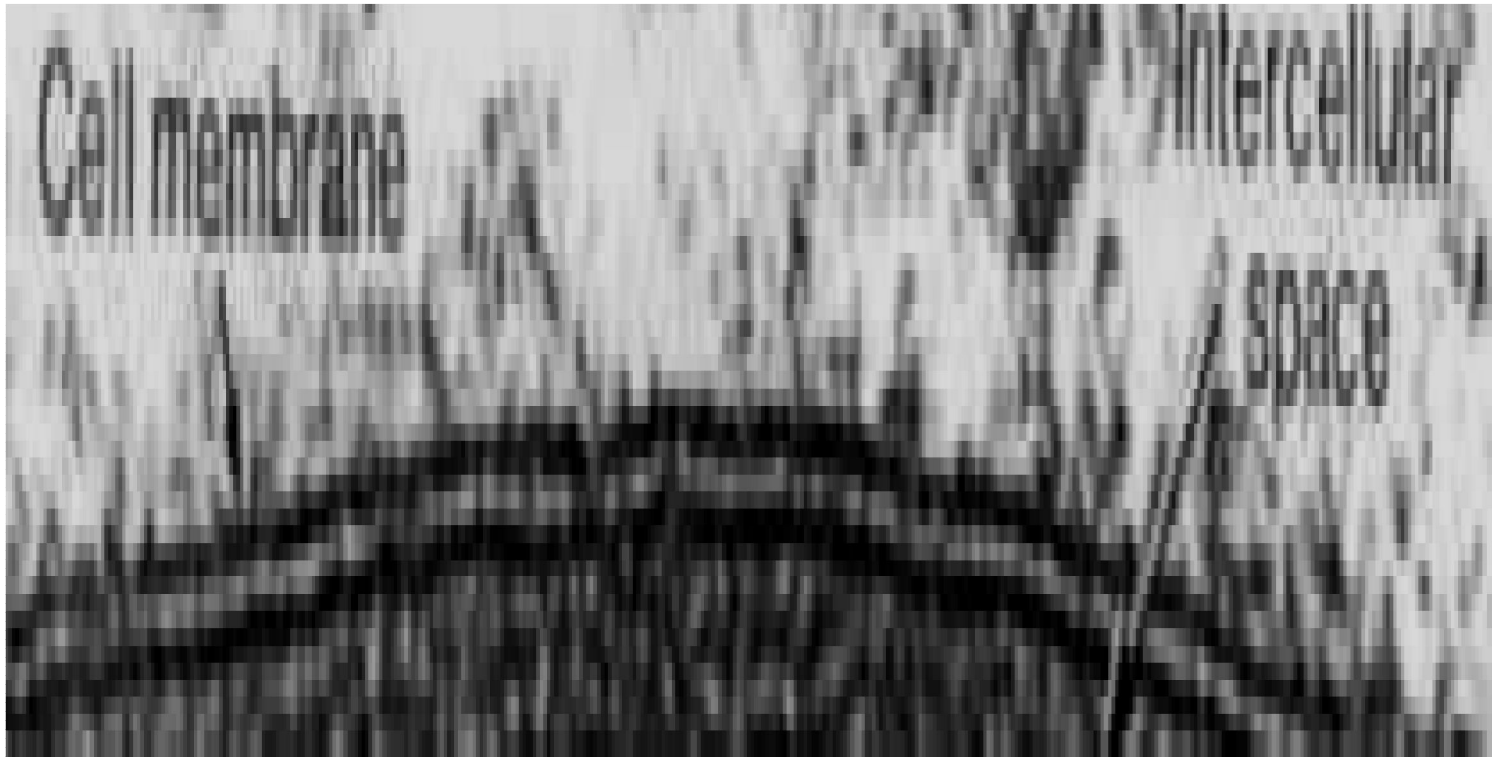




EM:

Two dark lines separated by a light one

= Trilamellar membrane = Unit membrane



EM picture of cell membrane of 2 adjacent cells

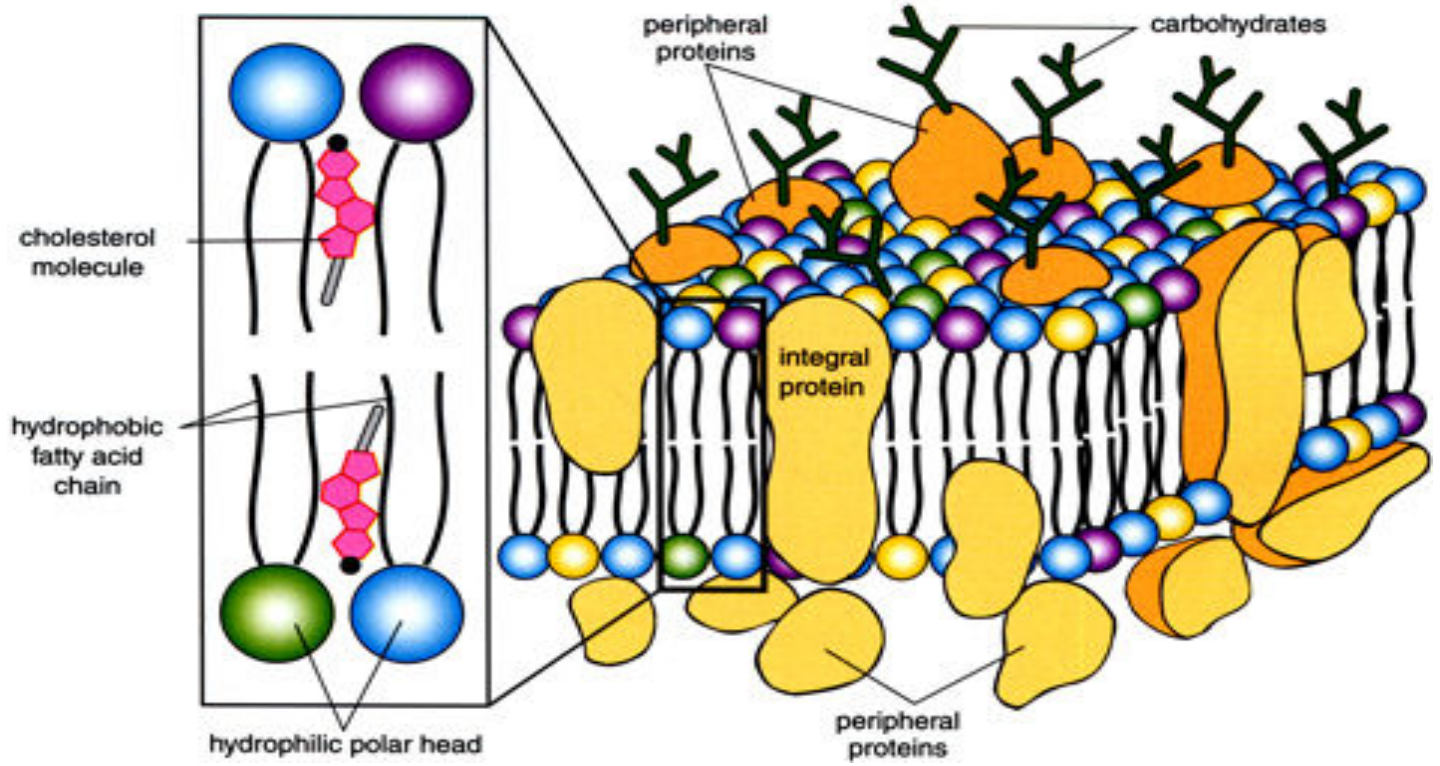
Why is the cell membrane trilamillar?

Molecular Structure

Lipids
30%
Phospholipids
Cholesterol

Proteins
60%
Intrinsic
Extrinsic

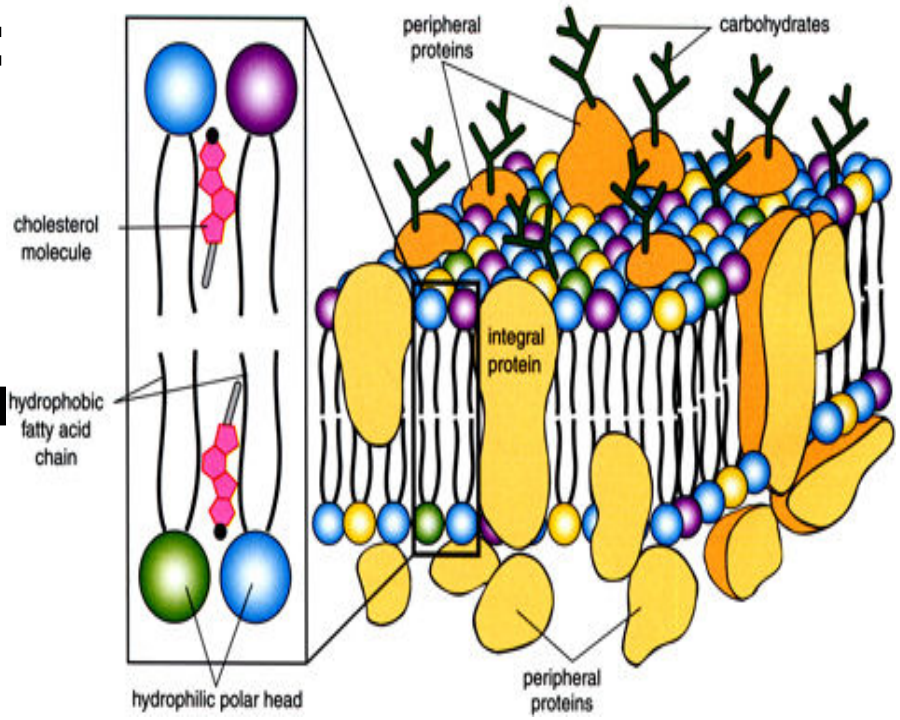
Carbohydrate
10%
Glycoprotein
Glycolipid



A. Lipids

1. Phospholipid molecules: each molecule has:

- **Hydydrophilic polar end:**
  Phospholipid head
  Hydrophilic
- **Hydrophobic nonpolar en**
  Hydrocarbon fatty acid tail
  Hydrophobic



2. Cholesterol molecules:

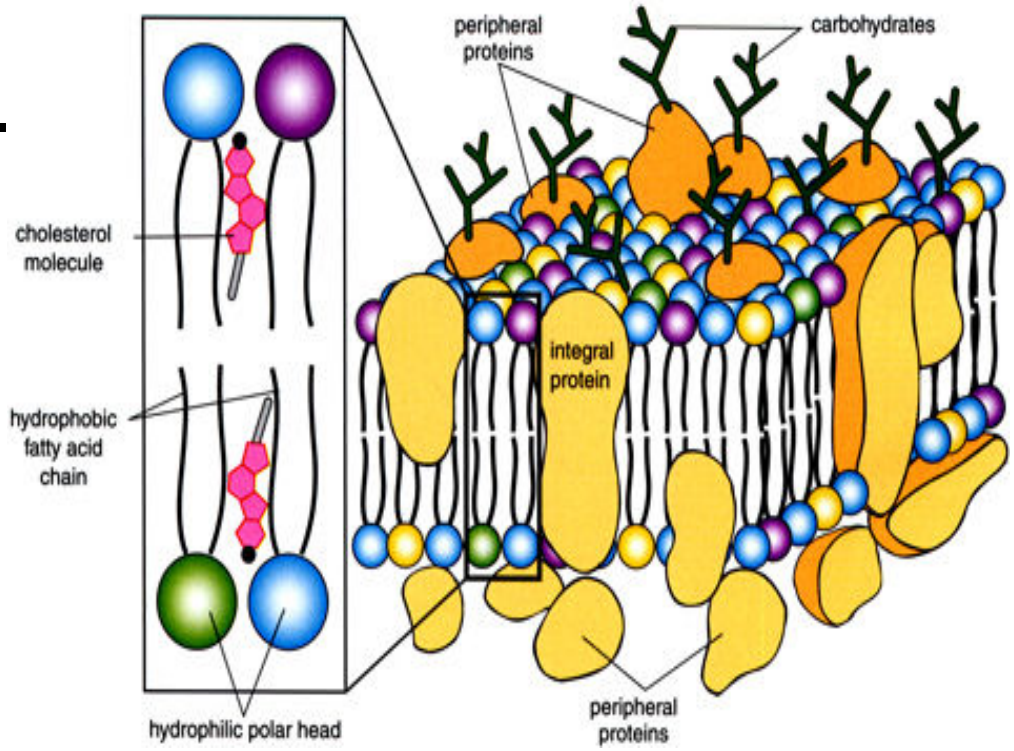
Incorporated with hydrophobic region of phospholipids

B. Proteins

a) Extrinsic proteins:

Small molecules

Outside the lipid bilayer



b) Intrinsic proteins:

1. Small molecules:

2. Large globules:

Extend through the full thickness (Transmembrane)

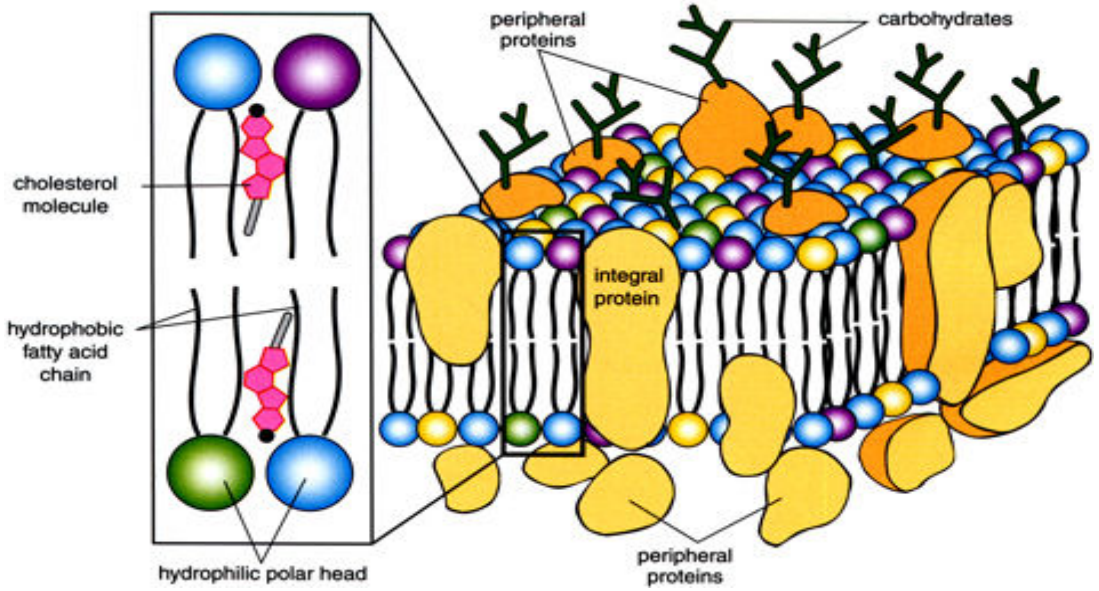
C. Carbohydrate

1. Glycoproteins:

Polysaccharide chains attached to protein molecules

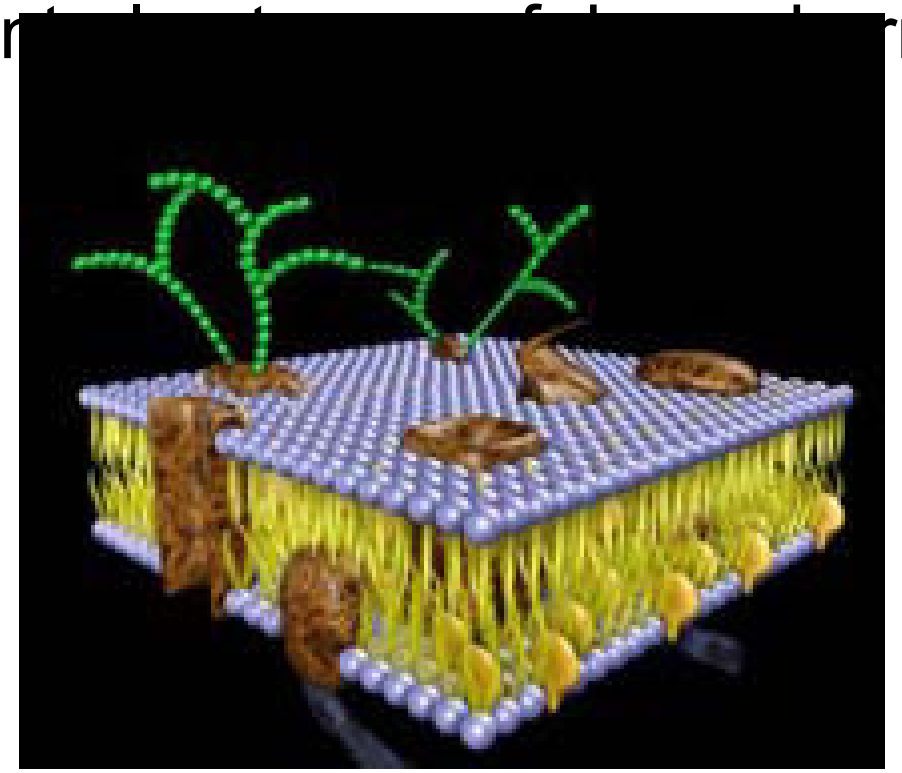
2. Glycolipids:

Polysaccharides linked to lipid molecules.



Cell coat (Glycocalyx)

- Glycoproteins and glycolipids
- Present on the external surface of cell membrane
- It includes special molecules (receptors)
- Receptors con[illegible]rmones ..etc into cells



Functions of Cell Membrane:

1- Encloses the cell, maintains its shape and Keep its internal composition

2- Controls transport of materials between cell and surroundings

a- Simple (passive)transport:

- ***Passive diffusion:*** molecules cross according to concentration gradient e.g. water and gasses

- ***Facilitated diffusion:*** fat insoluble substances need a carrier

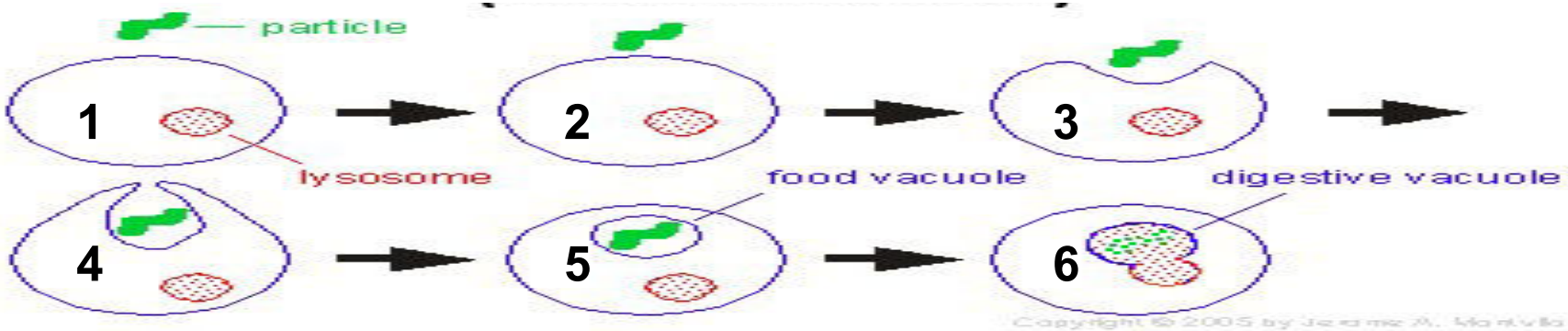
b- Active transport: Molecules pass against concentration gradient so needs energy e.g. Na+/K pump

c- Bulk transport: of large substances

Endocytosis: by which substances enter the cell

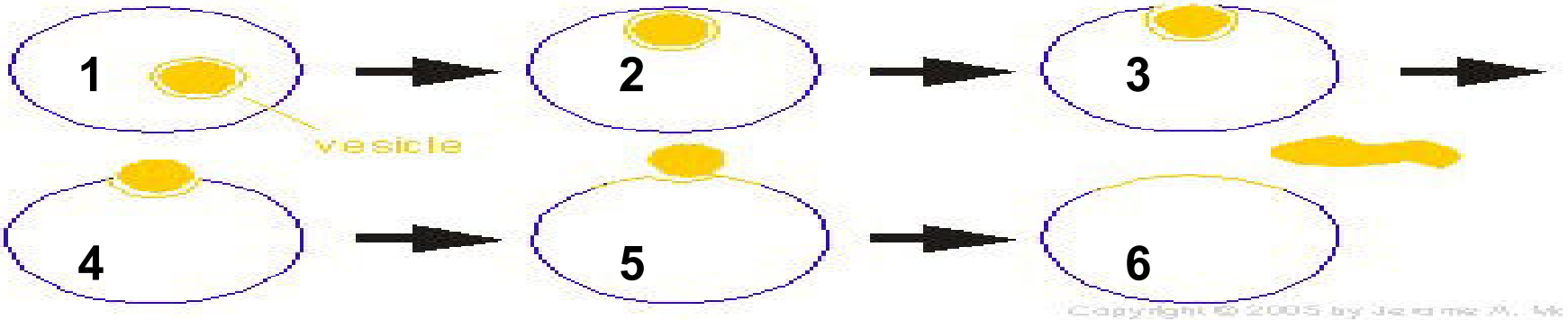
i- Phagocytosis = if the substance is solid

ii- Pinocytosis= if the substance is fluid



b) Exocytosis:

in which substances leave the cell to outside. e.g. Extrusion of residual bodies



D- Selective transport: by presence of receptors in the cell membrane which allow certain substances only to enter the cell so called (Receptor mediated endocytosis)

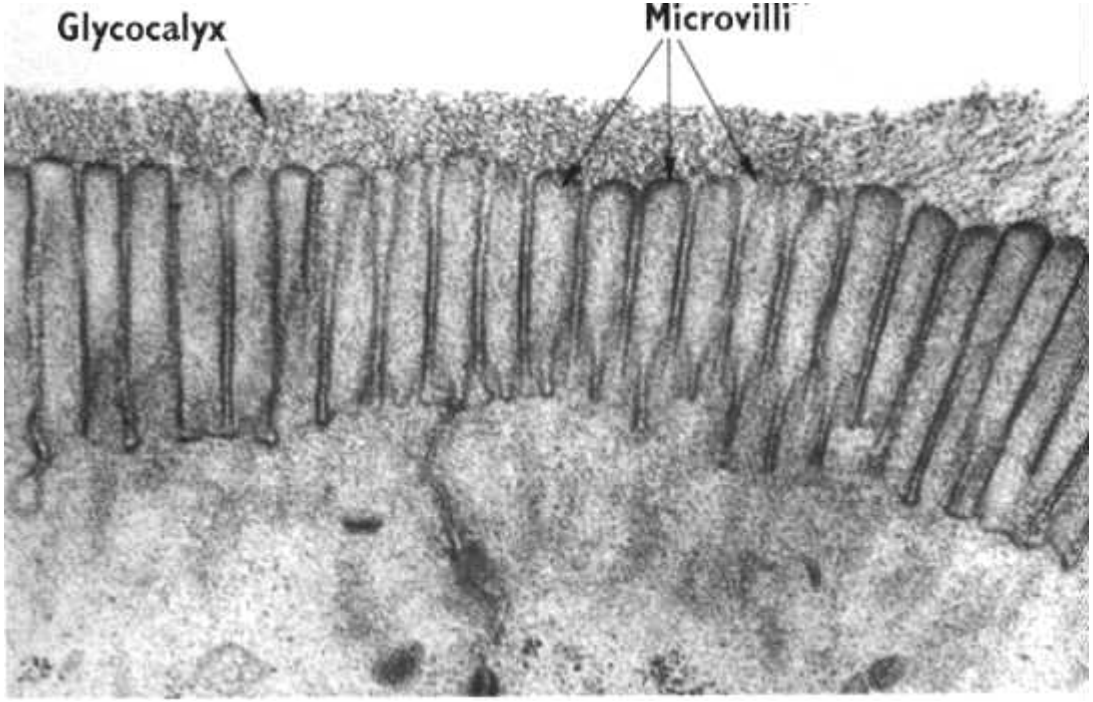
4- Functions of Receptors

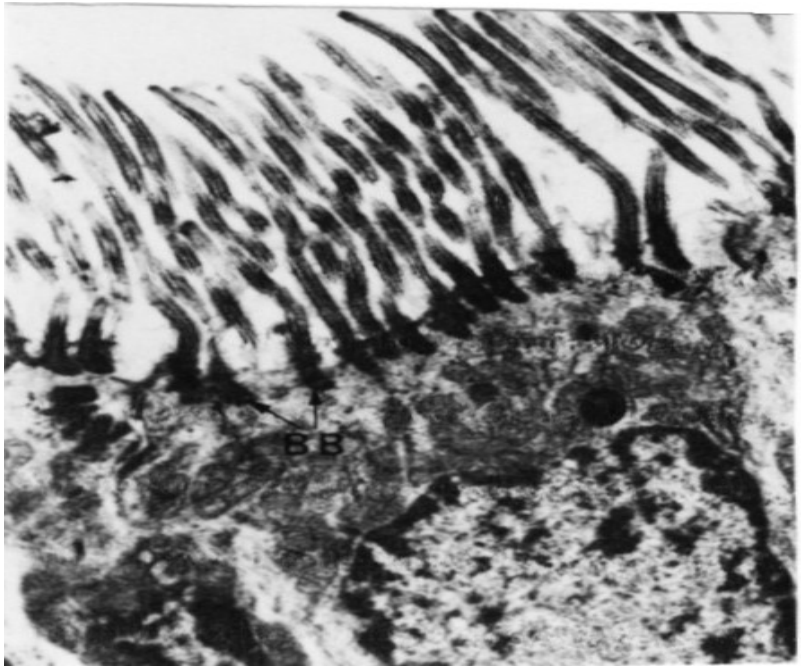
- Cell recognition (cell identity) , protection and immunity

5- Cell membrane modifications :

- ***Microvilli:*** Increase surface area for absorption or secretion
- ***Cilia:*** move particles above the cell membrane in one direction
- ***Flagella:*** form the tails of spermatozoamuscles.

6- Conduction of excitation waves in nerve cells and


Glycocalyx
Microvilli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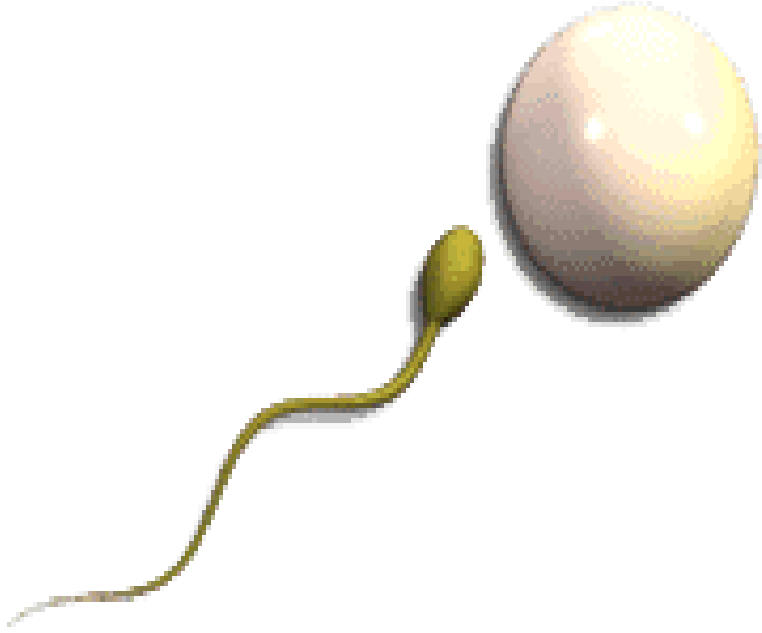


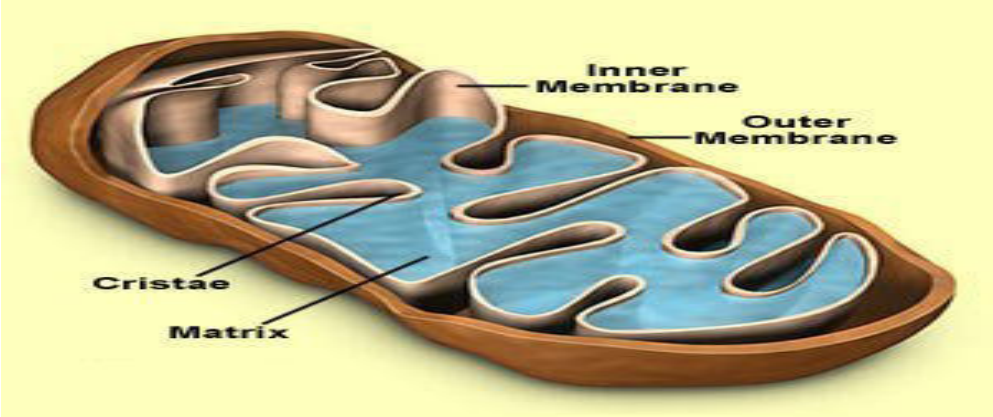
2- Mitochondria

(Mito = thread, chondria = granules)

Definition: membranous organelles, containing enzymes responsible for cell respiration and energy production. They are considered the **power-house** or **the battery** of the cell.

Sites: accumulate in the cytoplasm at sites of most activity.

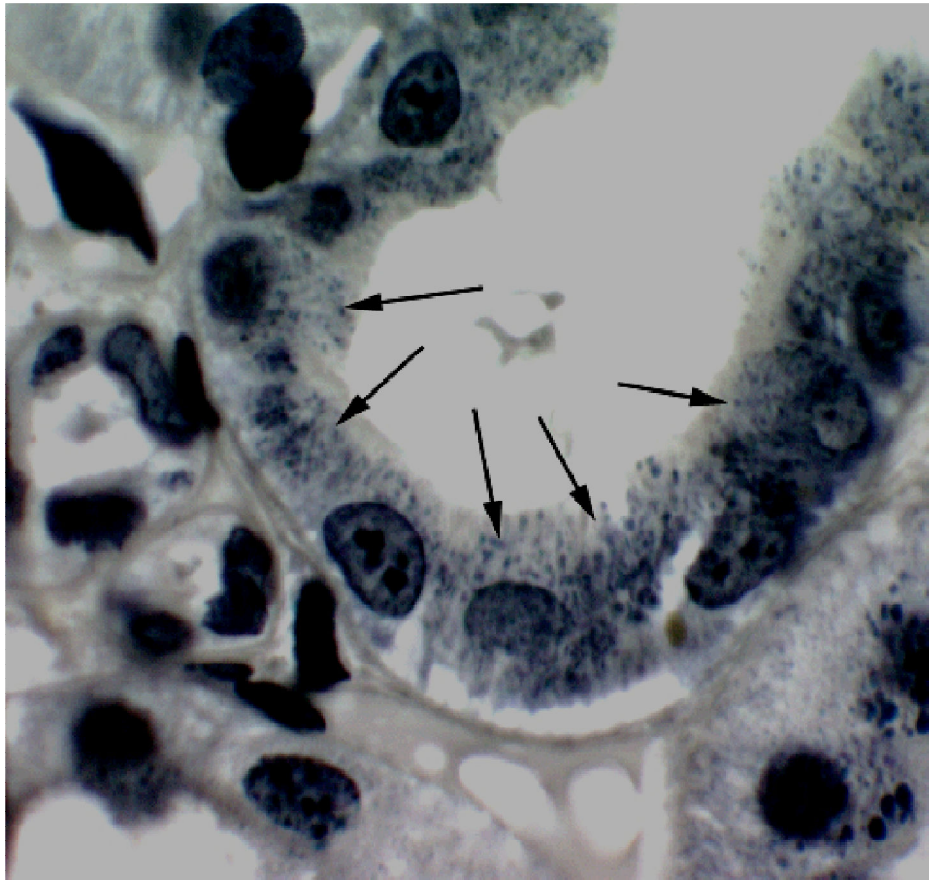
- **Number:**
- More numerous in highly active cells. .
- Mitochondria can divide as they have their own DNA and RNA.

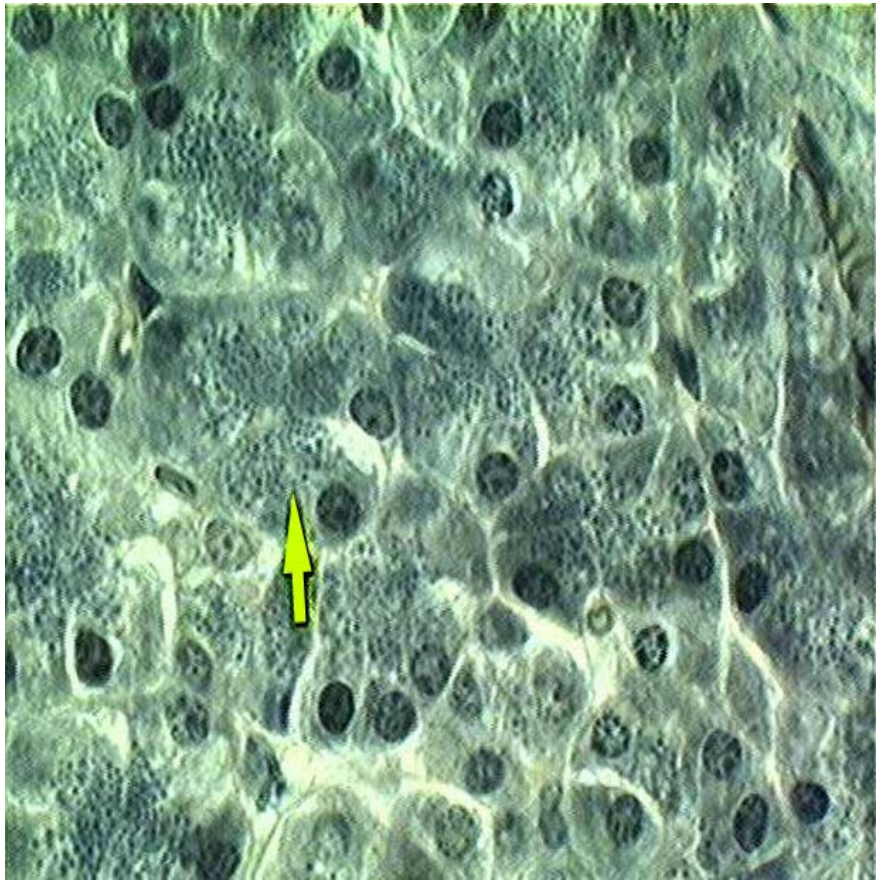


LM:

Not seen by H & E

Special stains: ***Iron hematoxylin &*** **Janus green stain**





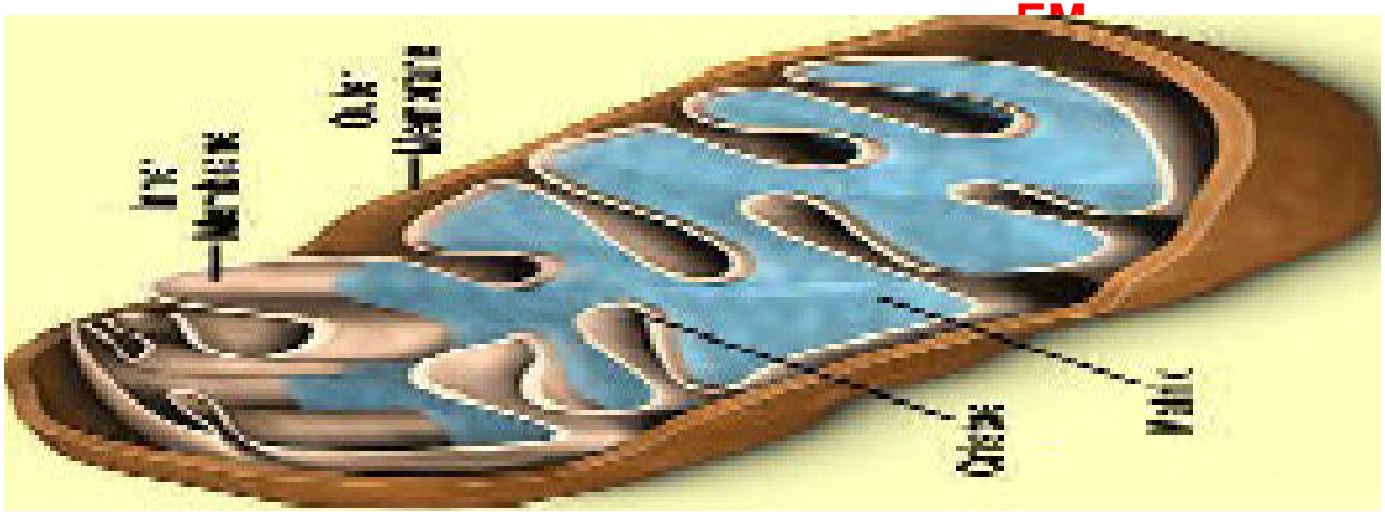
EM: 2 membranes + 2 Spaces

outer membrane

- Thicker, Smooth

inner membrane

- Thinner, and projects into the cavity forming **cristae**



2 spaces

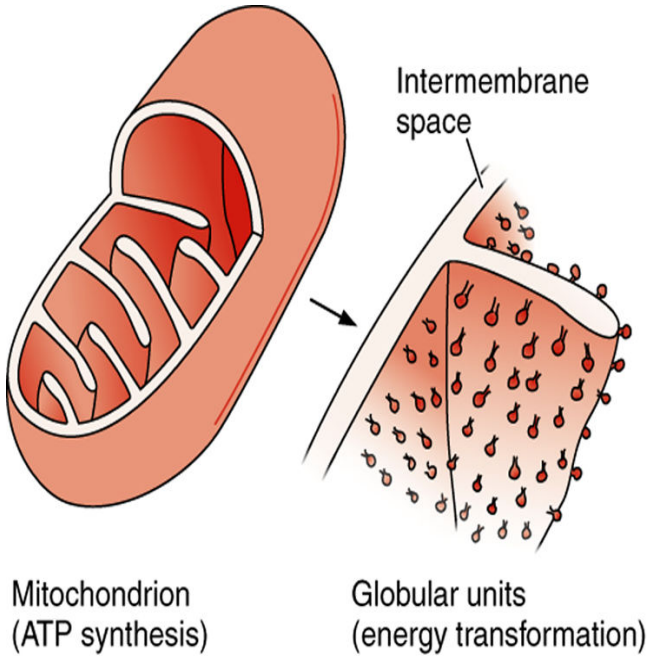
A. Inter-membranous space

Between the two membranes

B. Interior space

Filled with matrix

Full of granular materials:



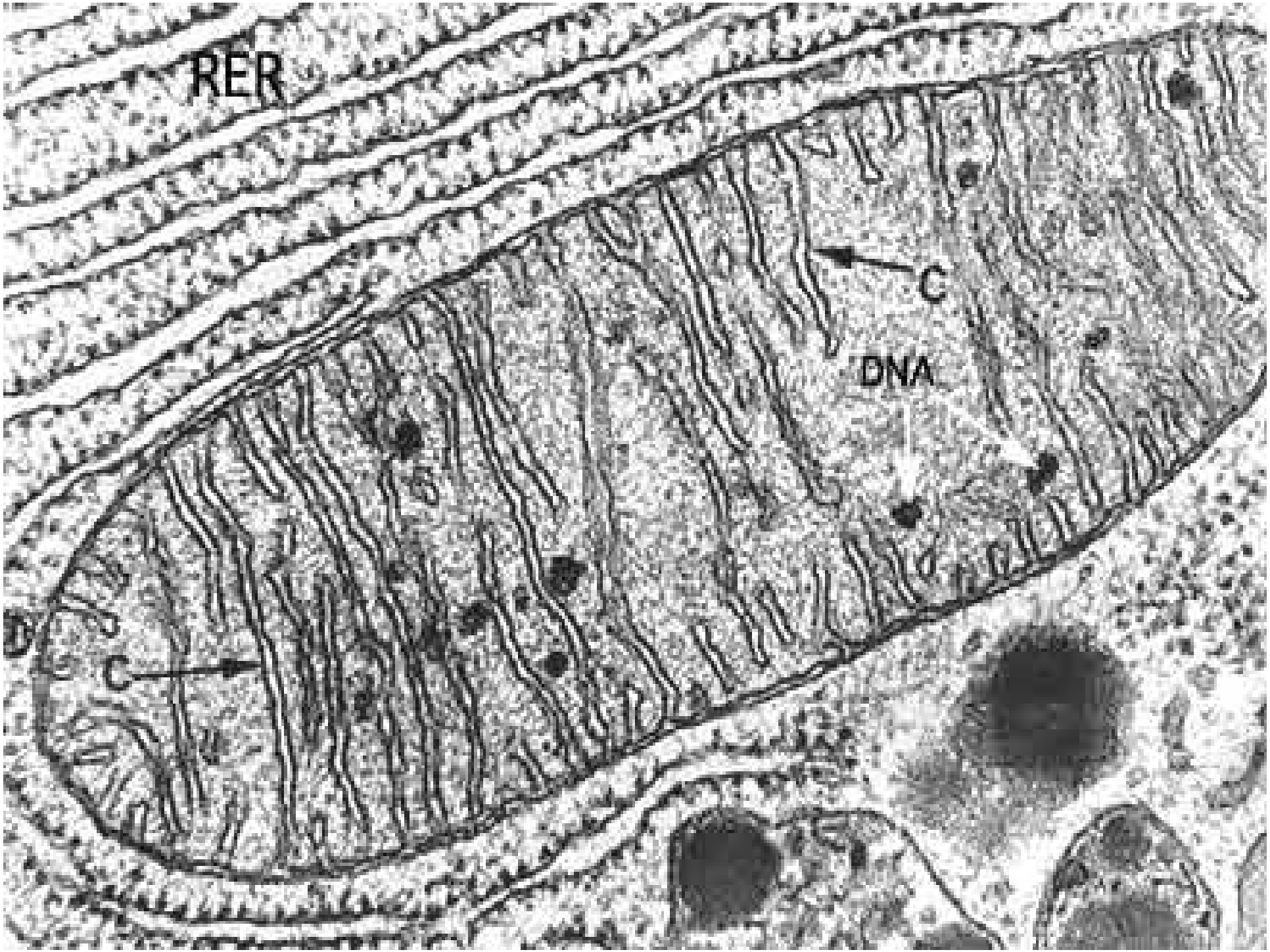
1. Elementary particles:

They contain respiratory enzymes

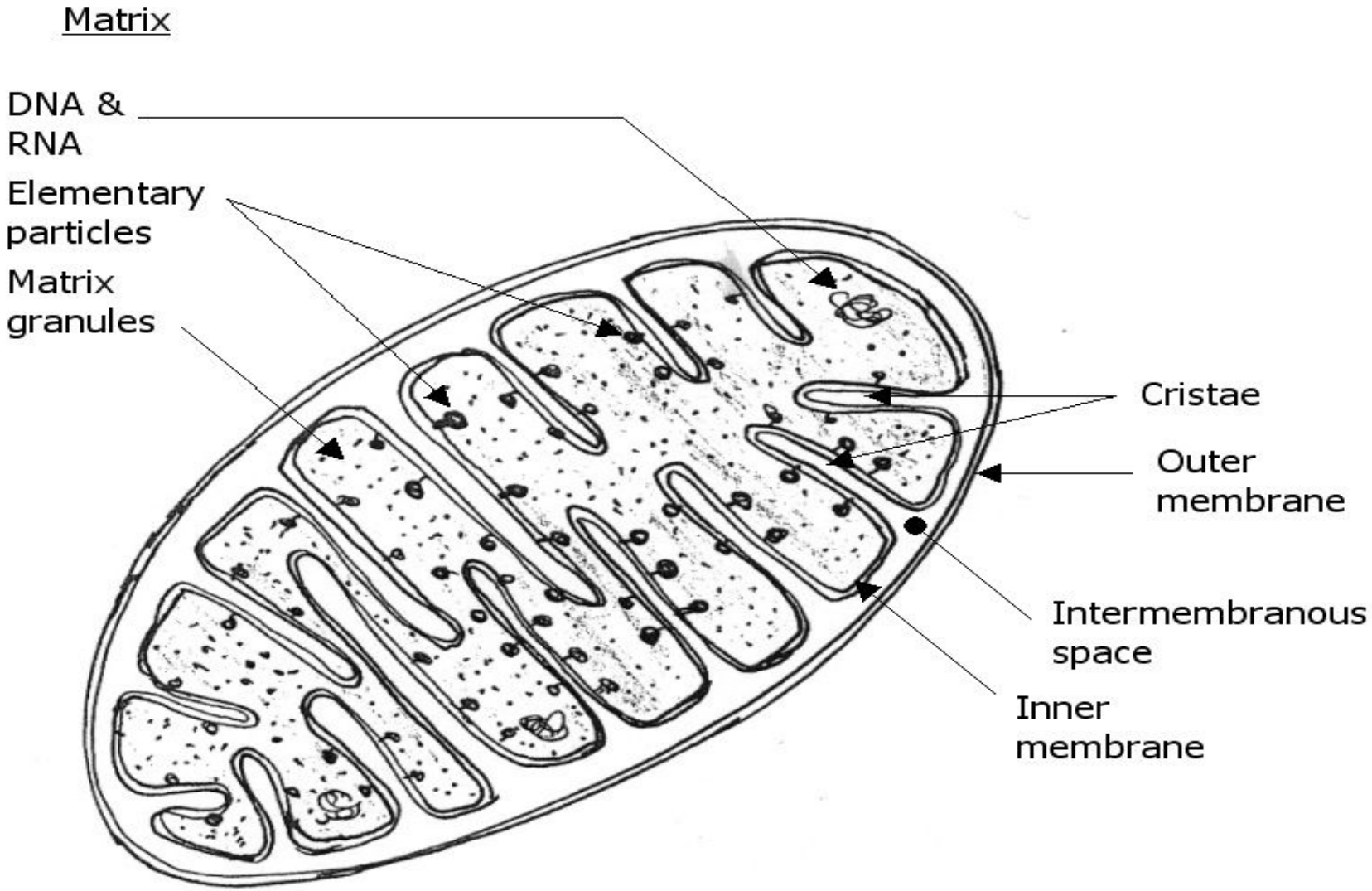
2. Matrix granules **(lipids, proteins, Ca++, Mg++),**

3. DNA & RNA

It was recently discovered that all mitochondria are derived from those in the fertilized ovum and are entirely of maternal origin.


RER
C
DNA
C

Mitochondria




Thank you