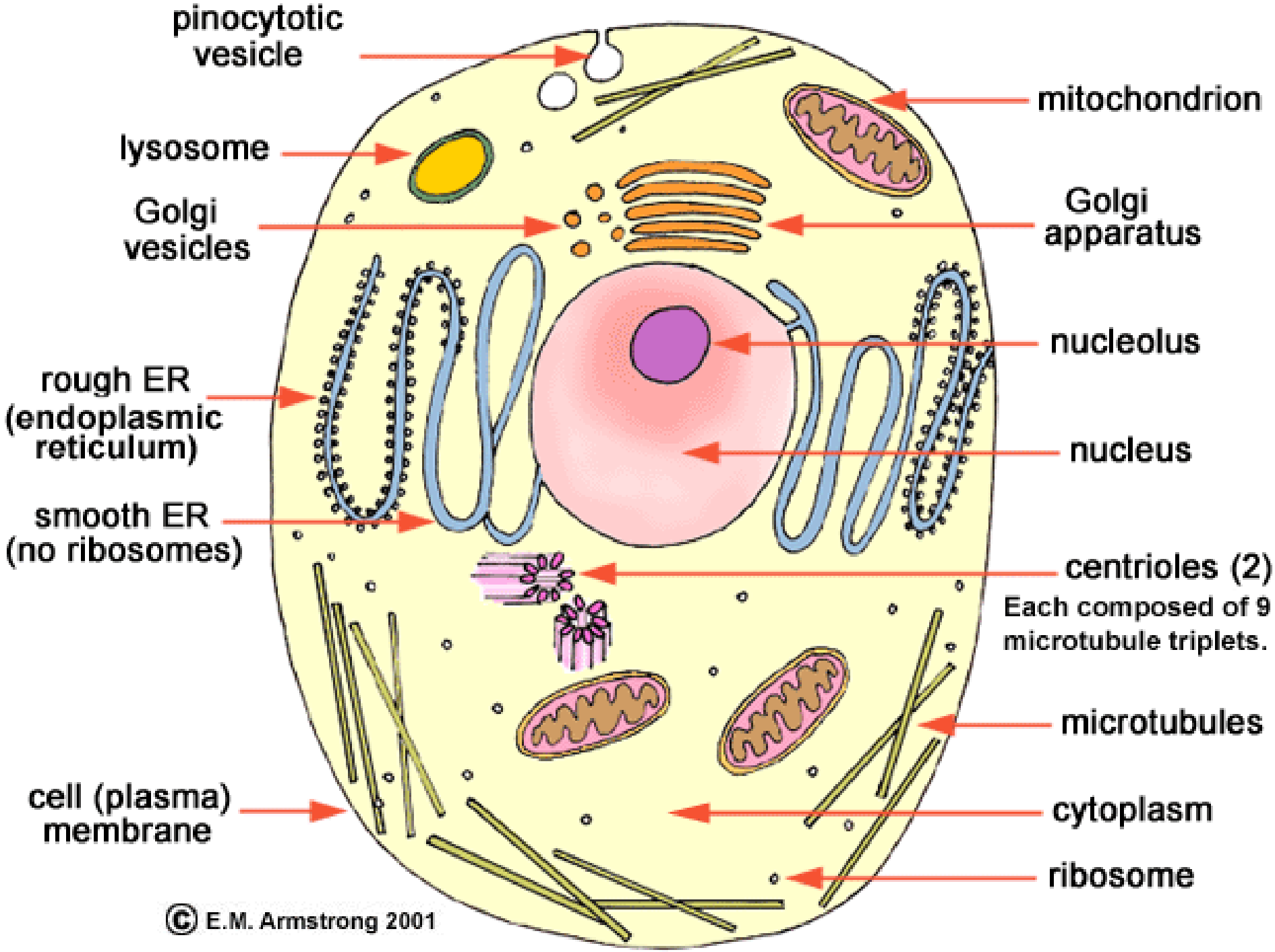
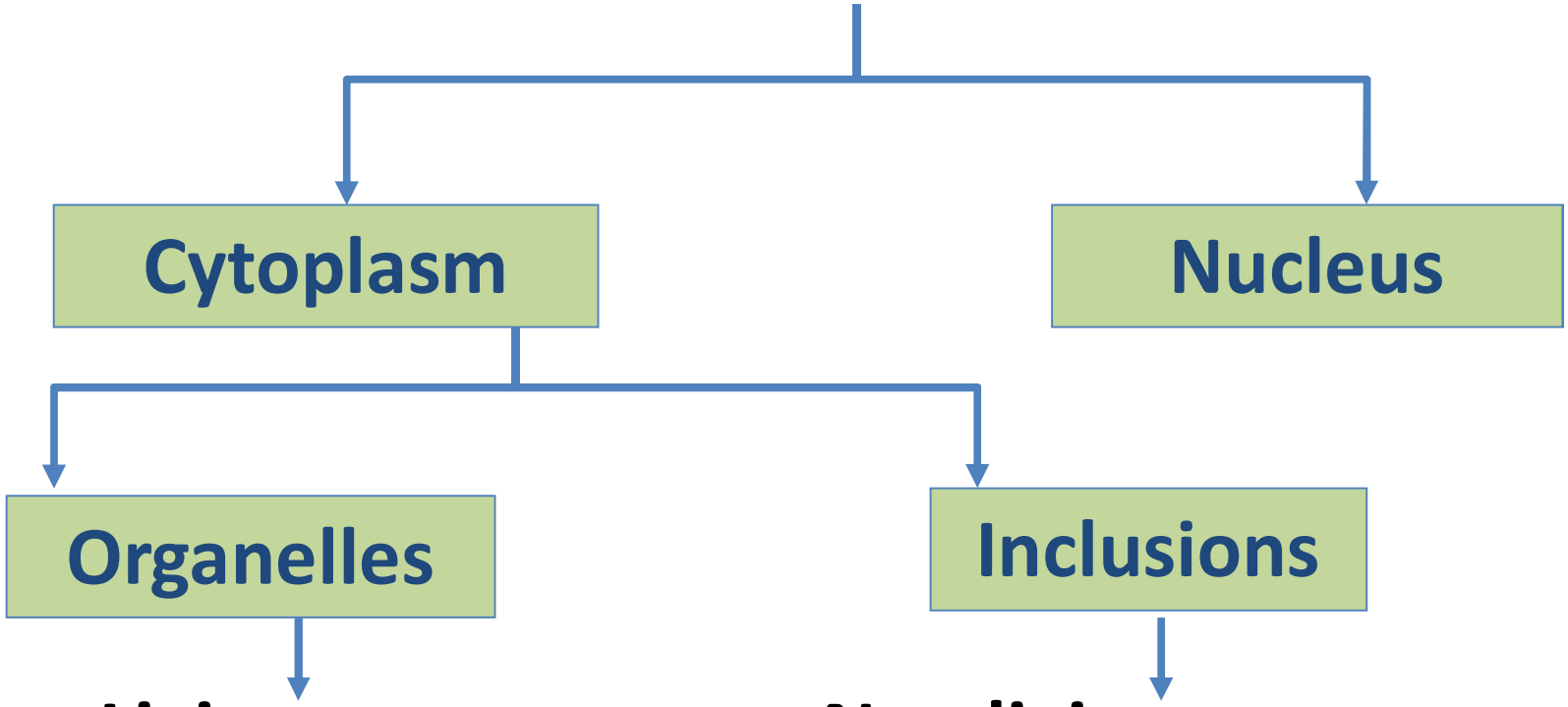

pinocytotic vesicle
lysosome
Golgi vesicles
rough ER (endoplasmic reticulum)
smooth ER (no ribosomes)
cell (plasma) membrane
mitochondrion
Golgi apparatus
nucleolus
nucleus
centrioles (2)
Each composed of 9 microtubule triplets.
microtubules
cytoplasm
ribosome
© E.M. Armstrong 2001

Structure of cell



- Living
- Permanent
- Essential
- Active

- Non living
- Temporary
- Not essential
- Inert as glycogen & lipids

Organelles

Membranous

1. Cell membrane
2. Mitochondria
3. Endoplasmic reticulum
4. Golgi apparatus
5. Lysosomes
6. Peroxisomes

Non-membranous

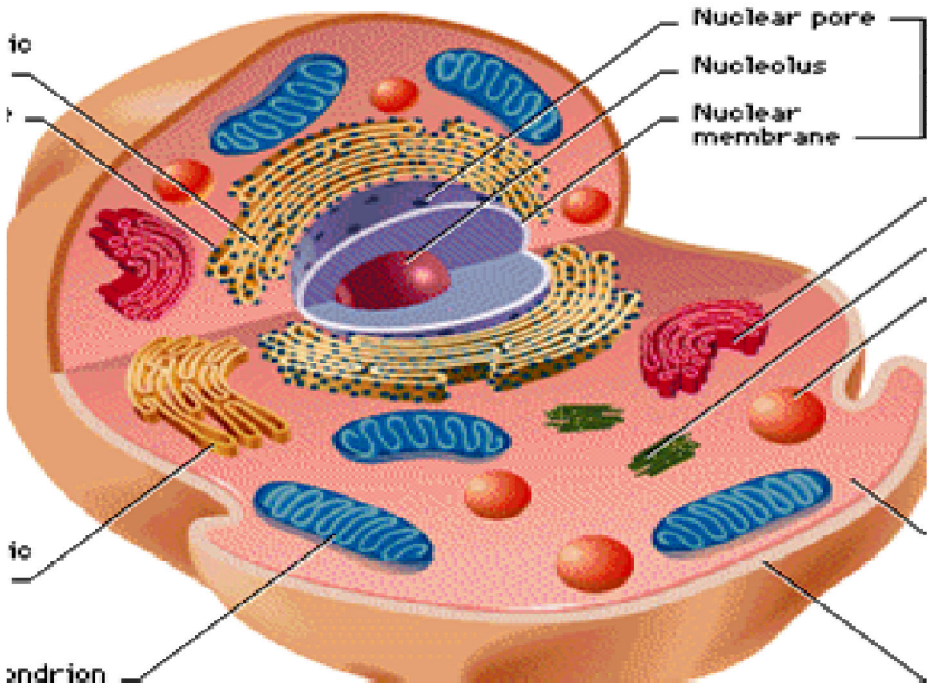
1. Ribosomes
2. Cytoskeleton:
   - a- Microtubules:
     - Centrioles
     - Cilia & flagella
   - b- Filaments:
     - Thin
     - Thick
     - Intermediate

A) Membranous Organelles

1- The Cell membrane

Definition

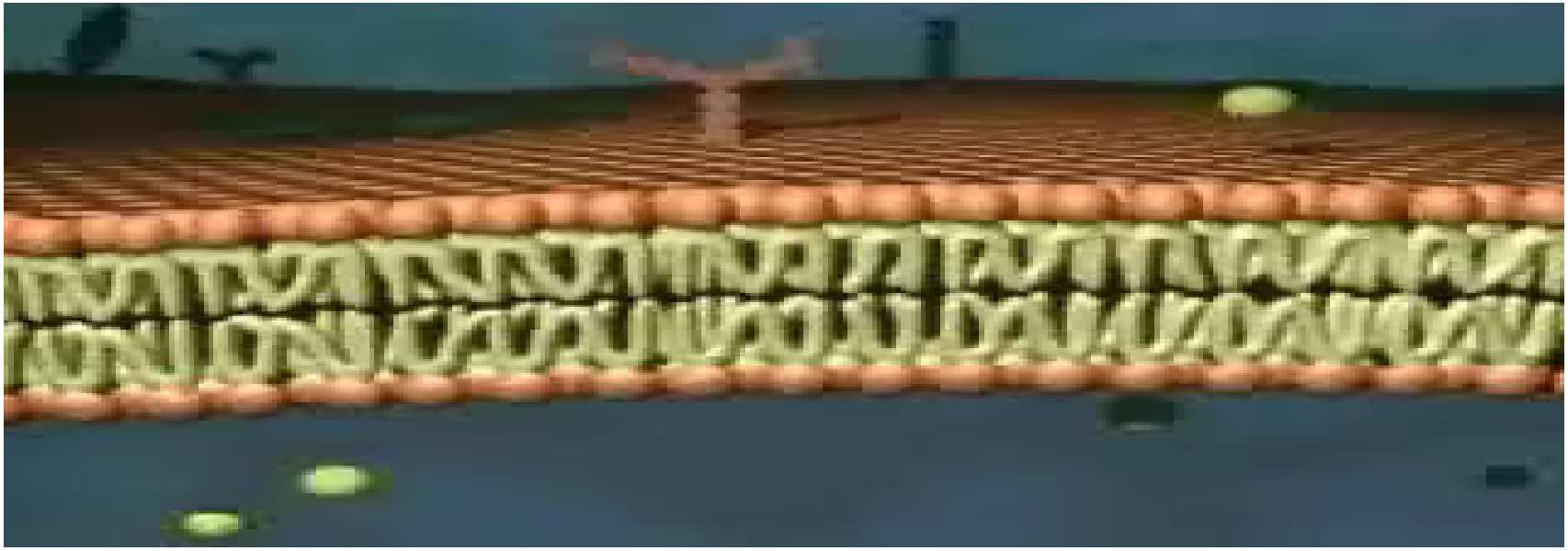
A living membrane forming the outermost cover of the cytoplasm

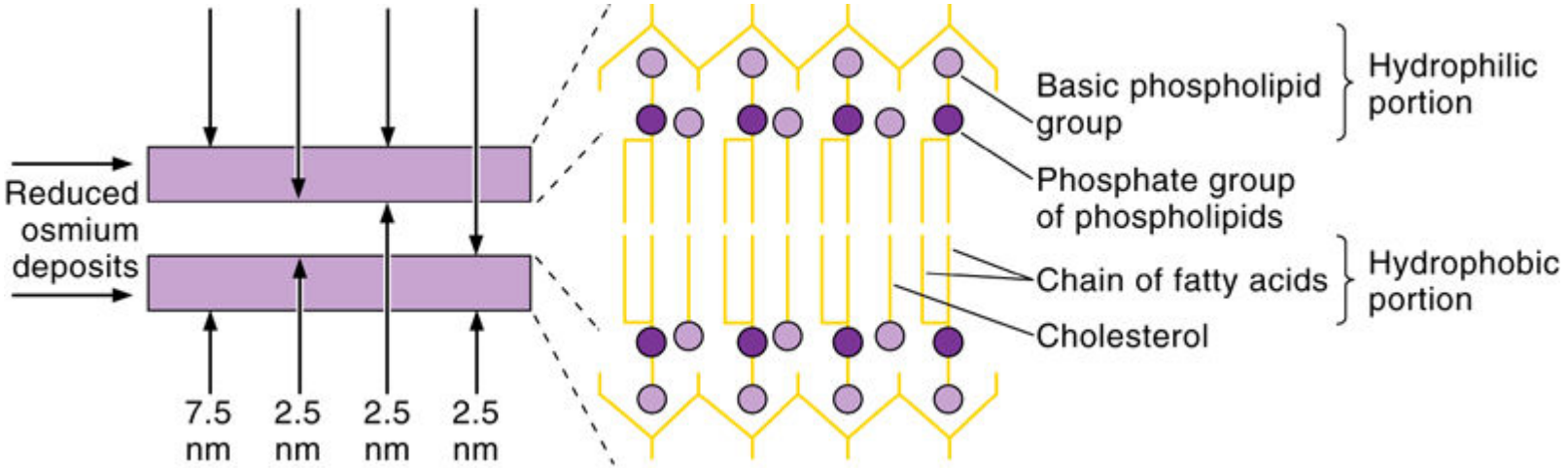


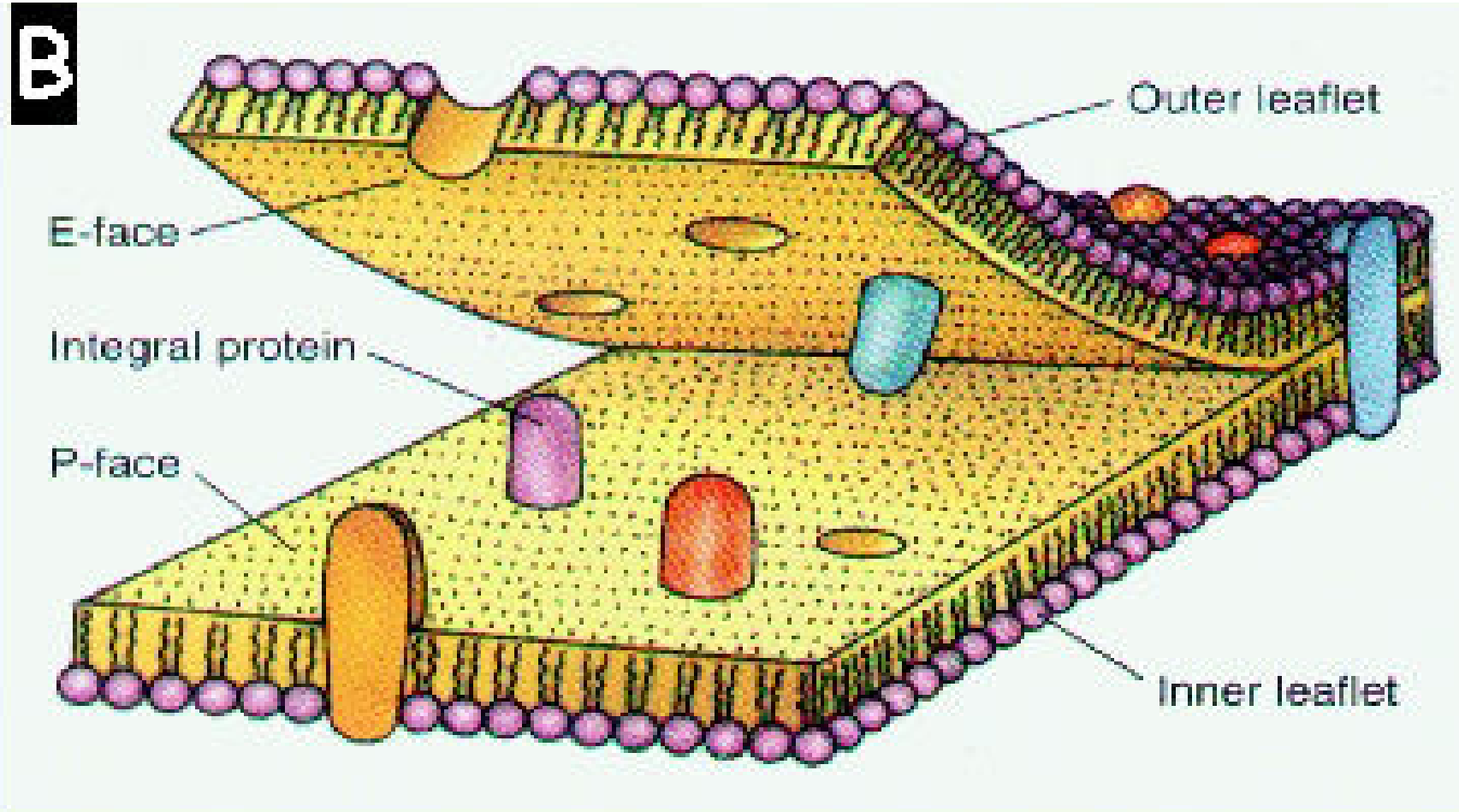
Electron Microscopic Structure of Cell Membrane

Trilamellar membrane

Why is the cell membrane trilamillar?





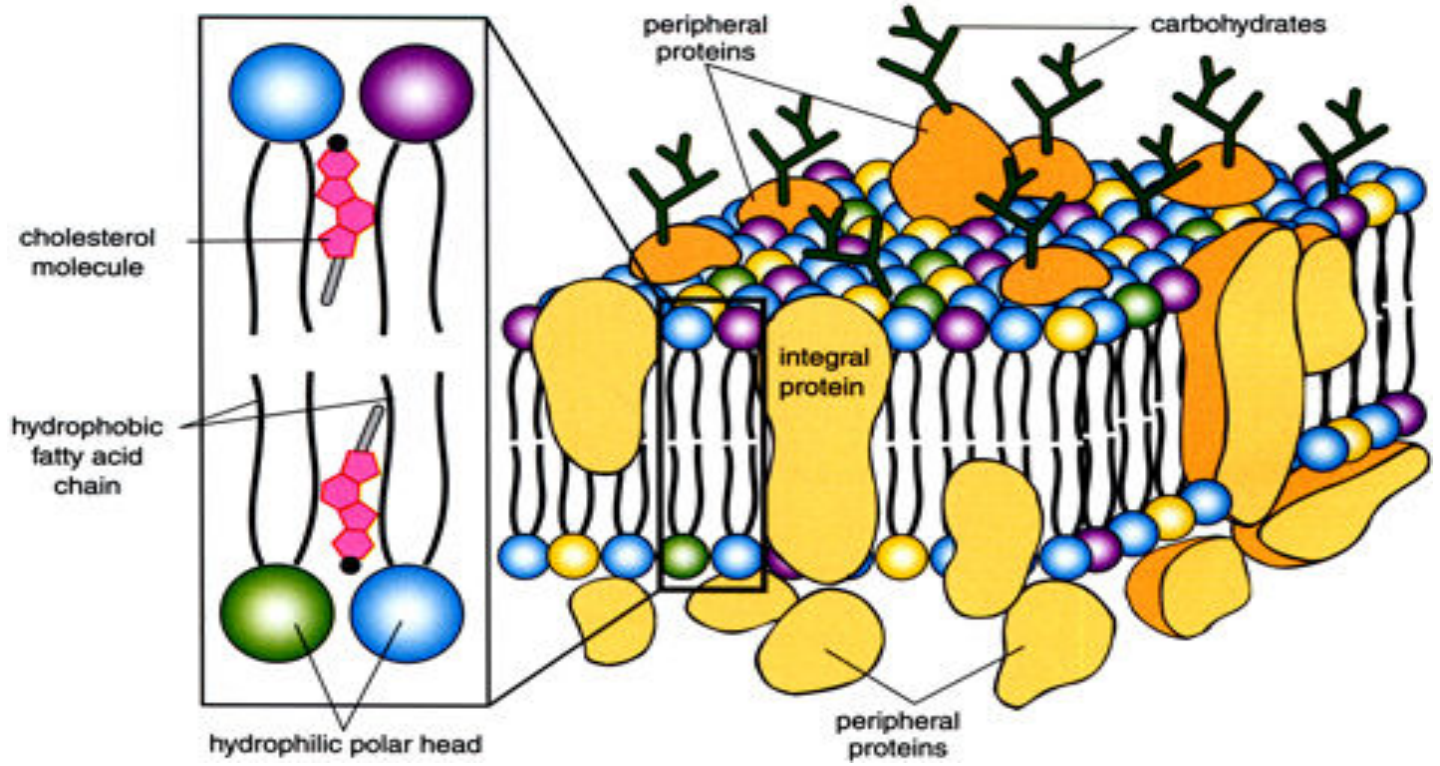

B
Outer leaflet
E-face
Integral protein
P-face
Inner leaflet

Molecular Structure

Lipids
30%
Phospholipids
Cholesterol

Proteins
60%
Intrinsic
Extrinsic

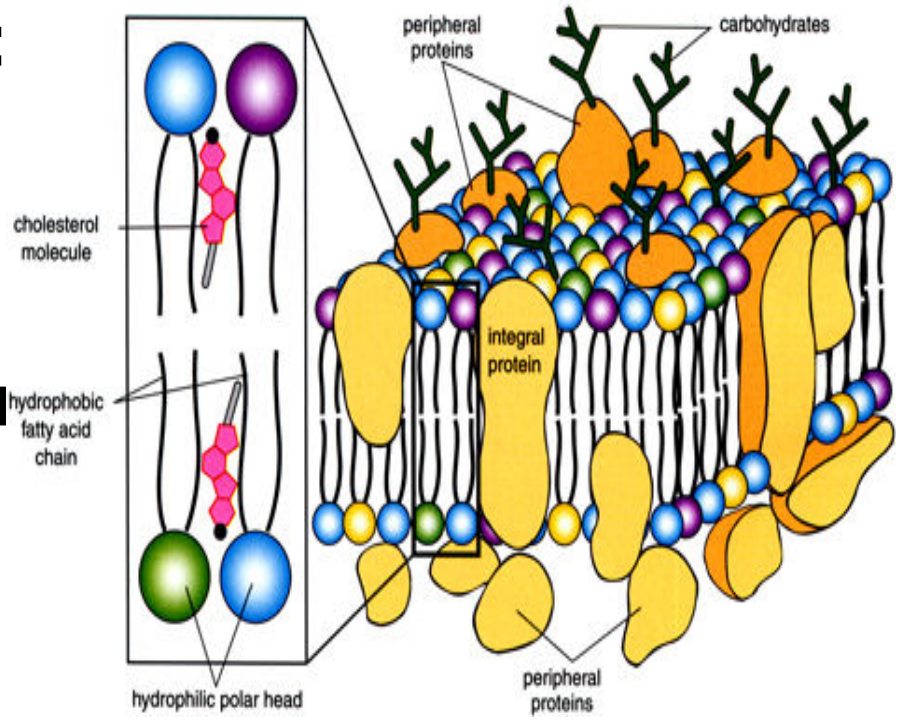
Carbohydrate
10%
Glycoprotein
Glycolipid



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:

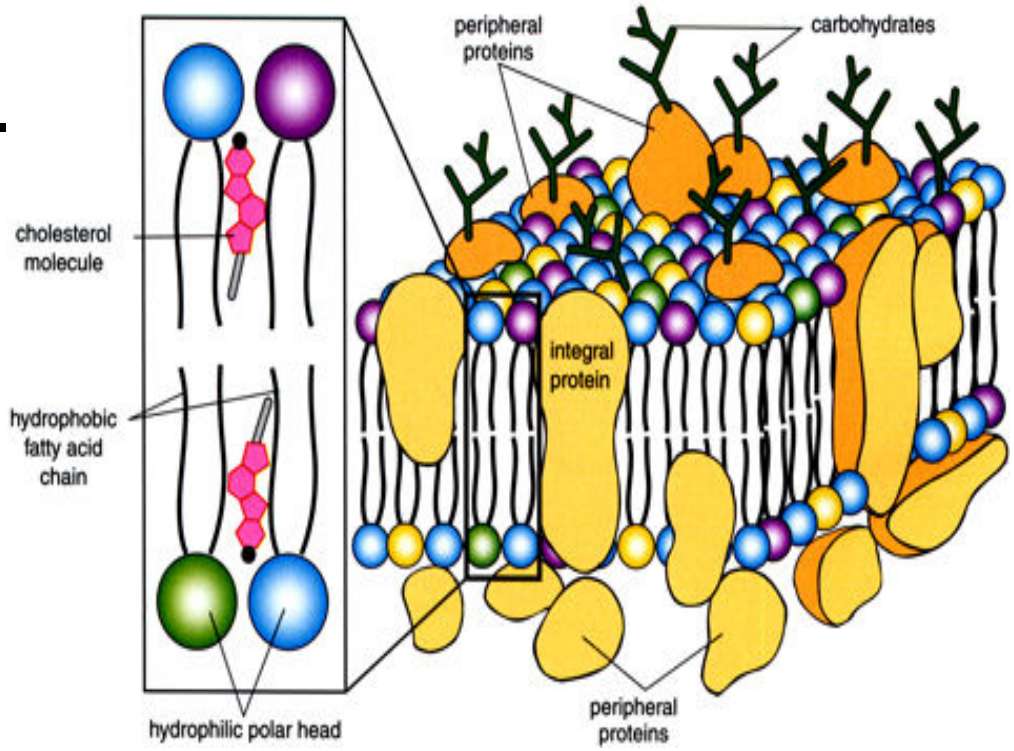
Incorporated with hydrophobic region of phospholipids

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)

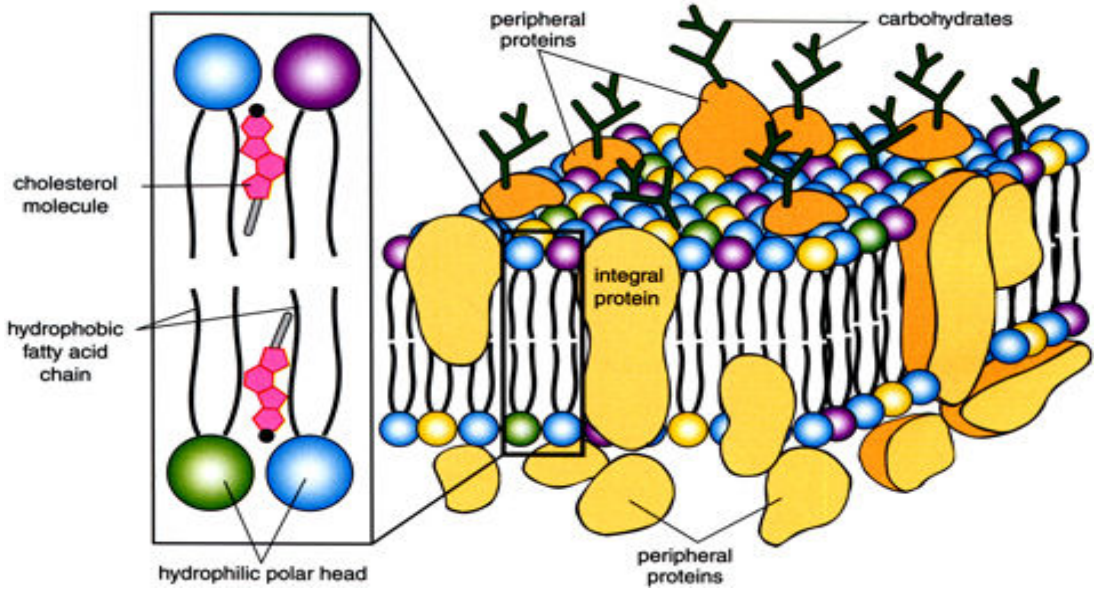
C. Carbohydrate

1. Glycoproteins:

Polysaccharide chains attached to protein molecules

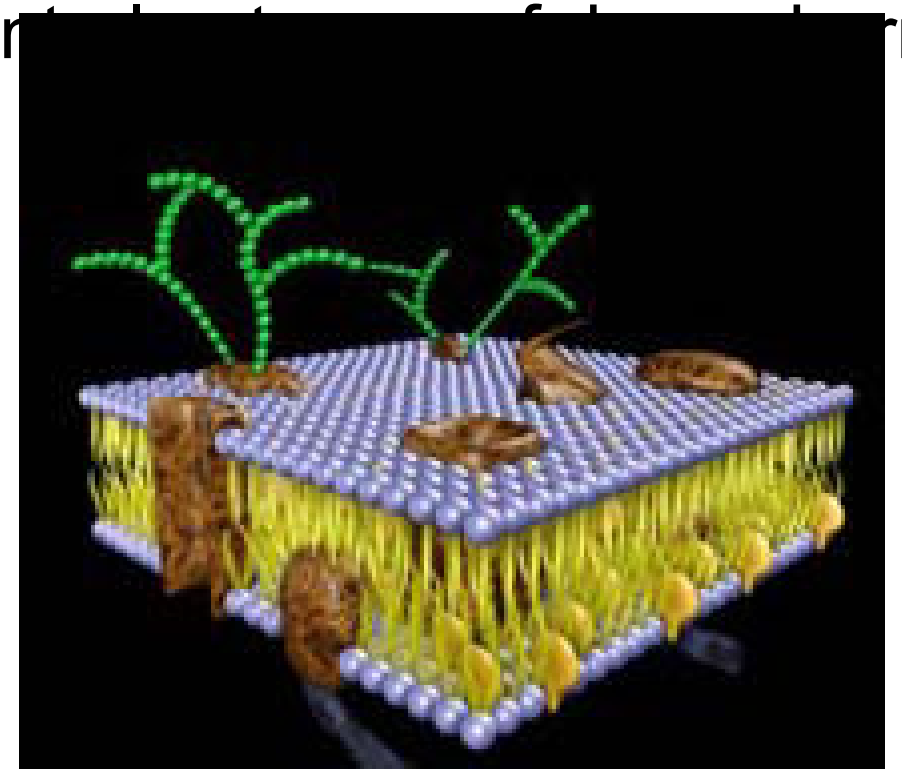
2. Glycolipids:

Polysaccharides linked to lipid molecules.

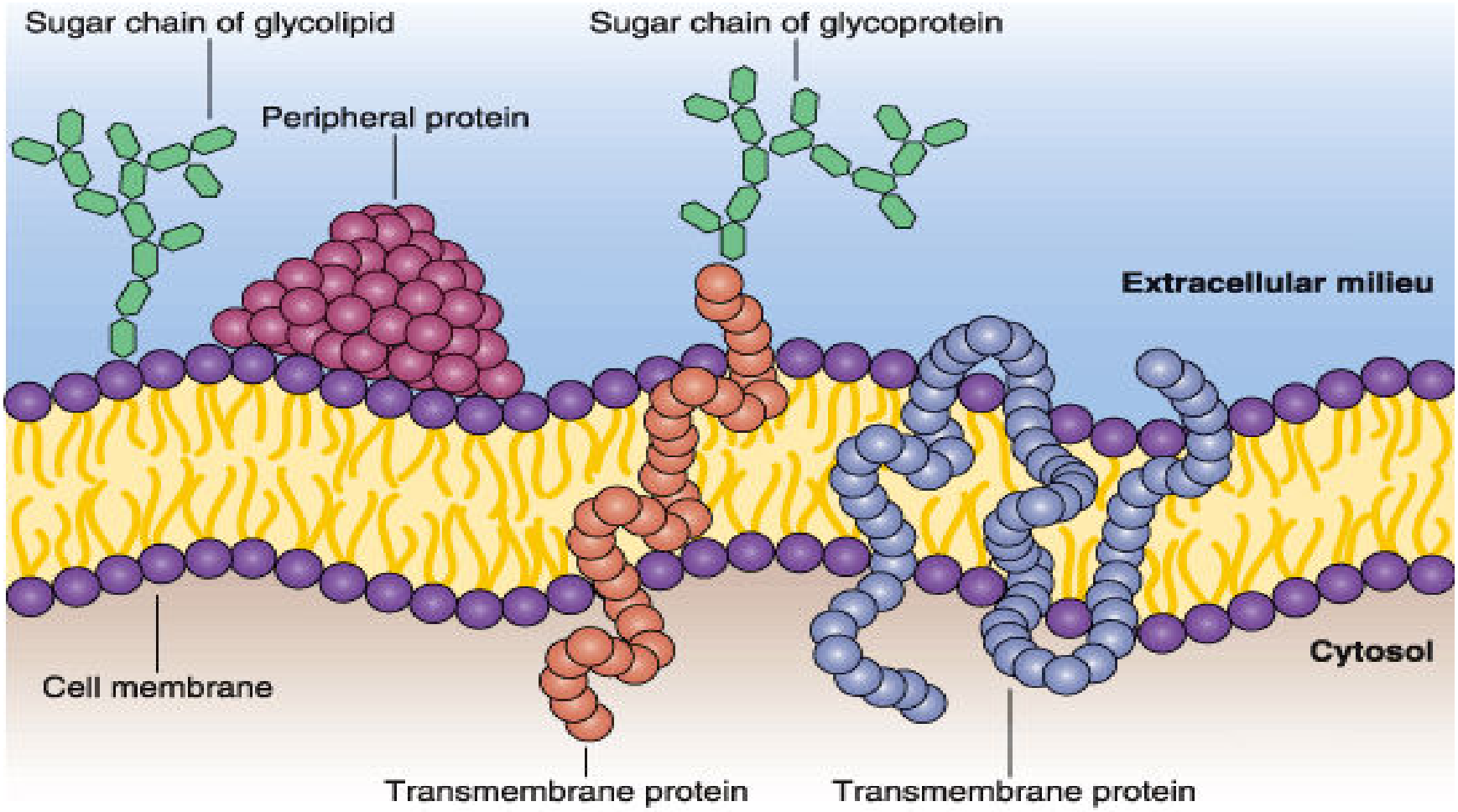


Cell coat (Glycocalyx)

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



Molecular structure of cell membrane



2- Mitochondria

(Mito = thread, chondria = granules)

Definition: Membranous organelles containing enzymes

Number:

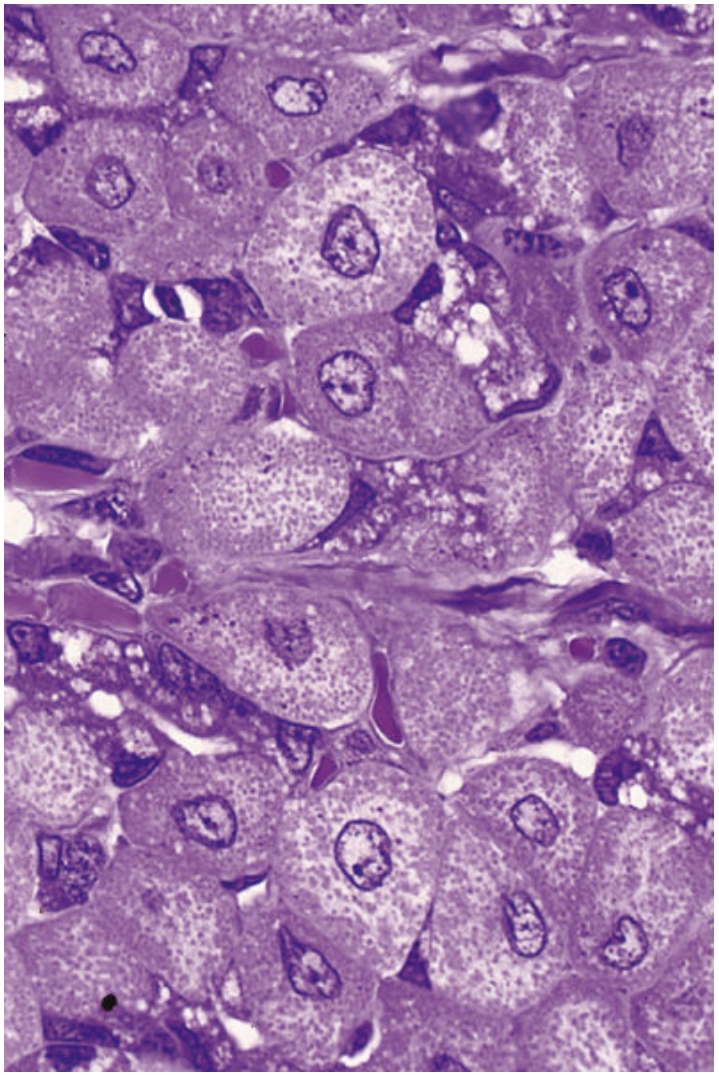
More numerous in highly active cells

WOW: Mitochondria can divide

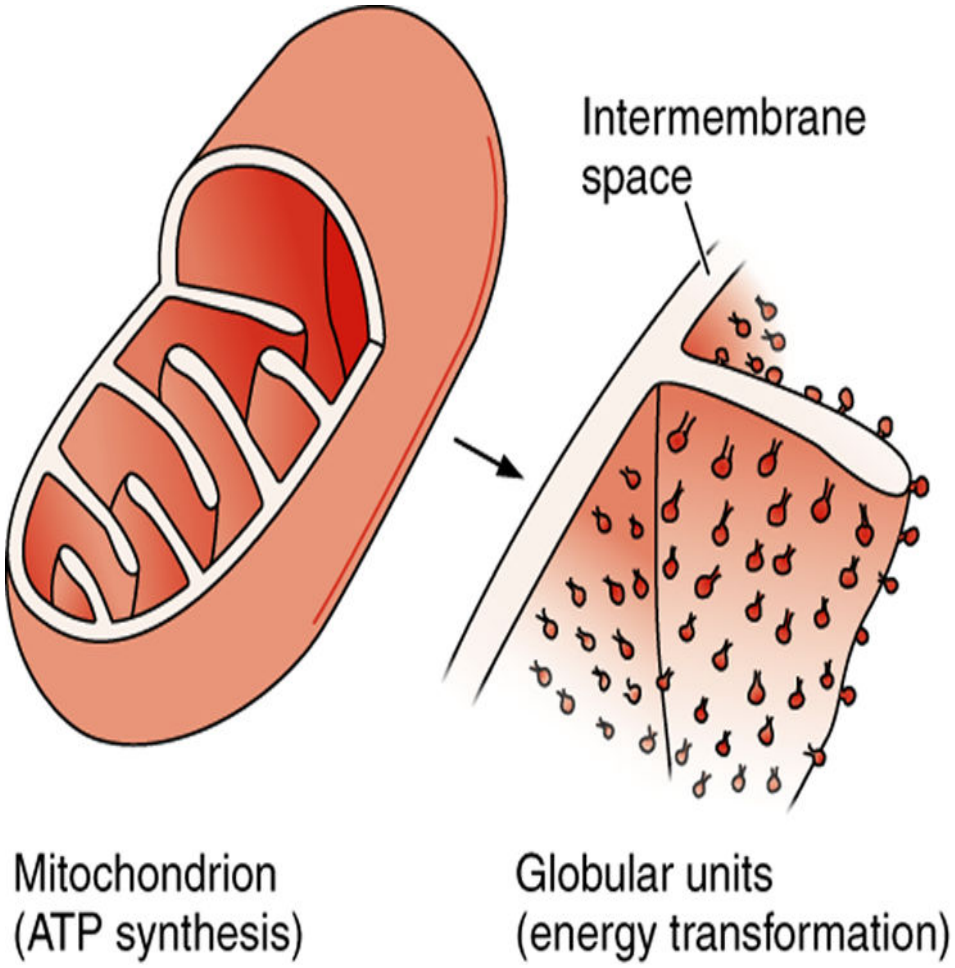
Mitochondria

LM

- **Iron hematoxylin**
- **Janus green (supravital stain) : stains living components in vitro**



- **Outer membrame (smooth)**
- **Inner membrane (Elementary particles) (globular units)**



2 spaces

A. Inter-membranous space

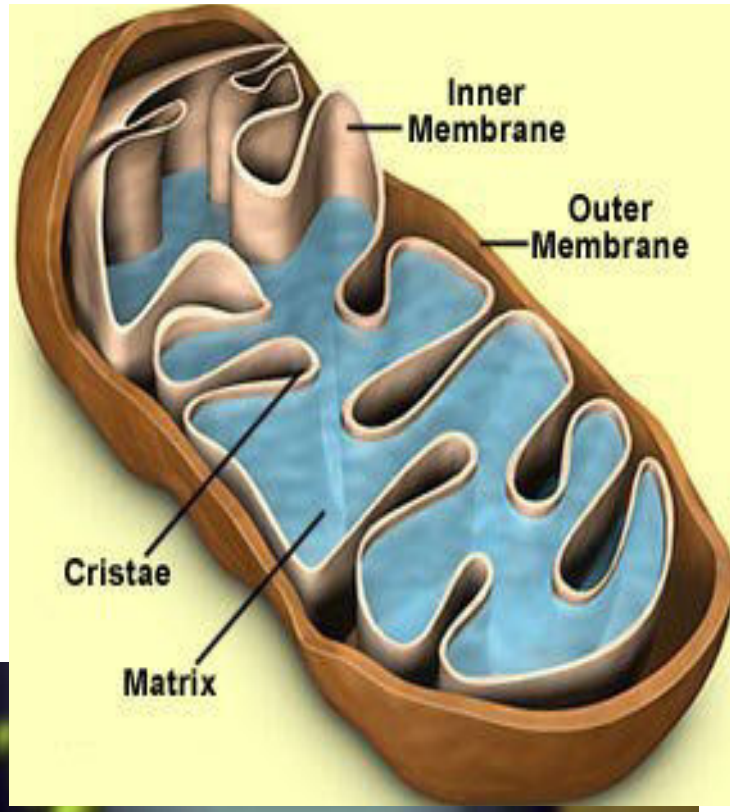
Between the two membranes

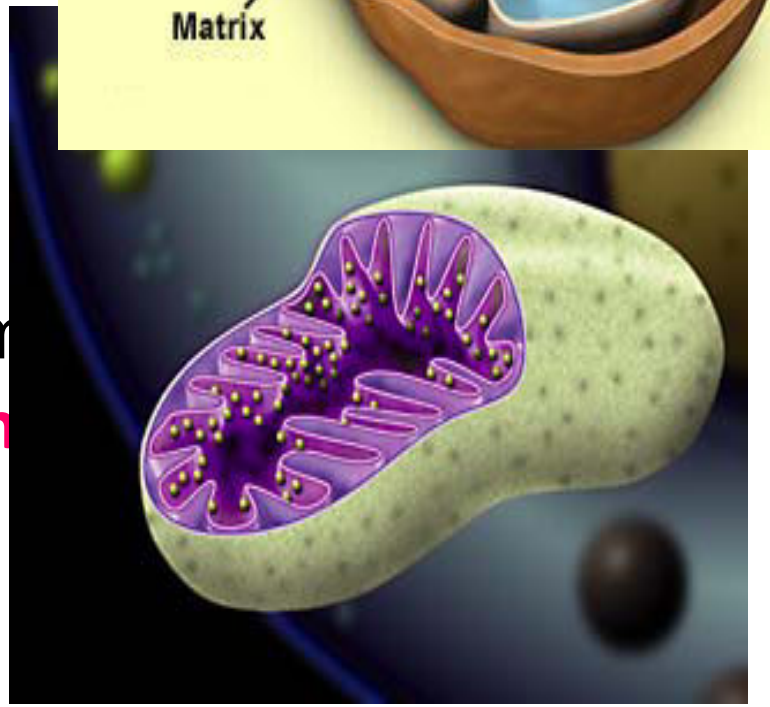
B. Interior space

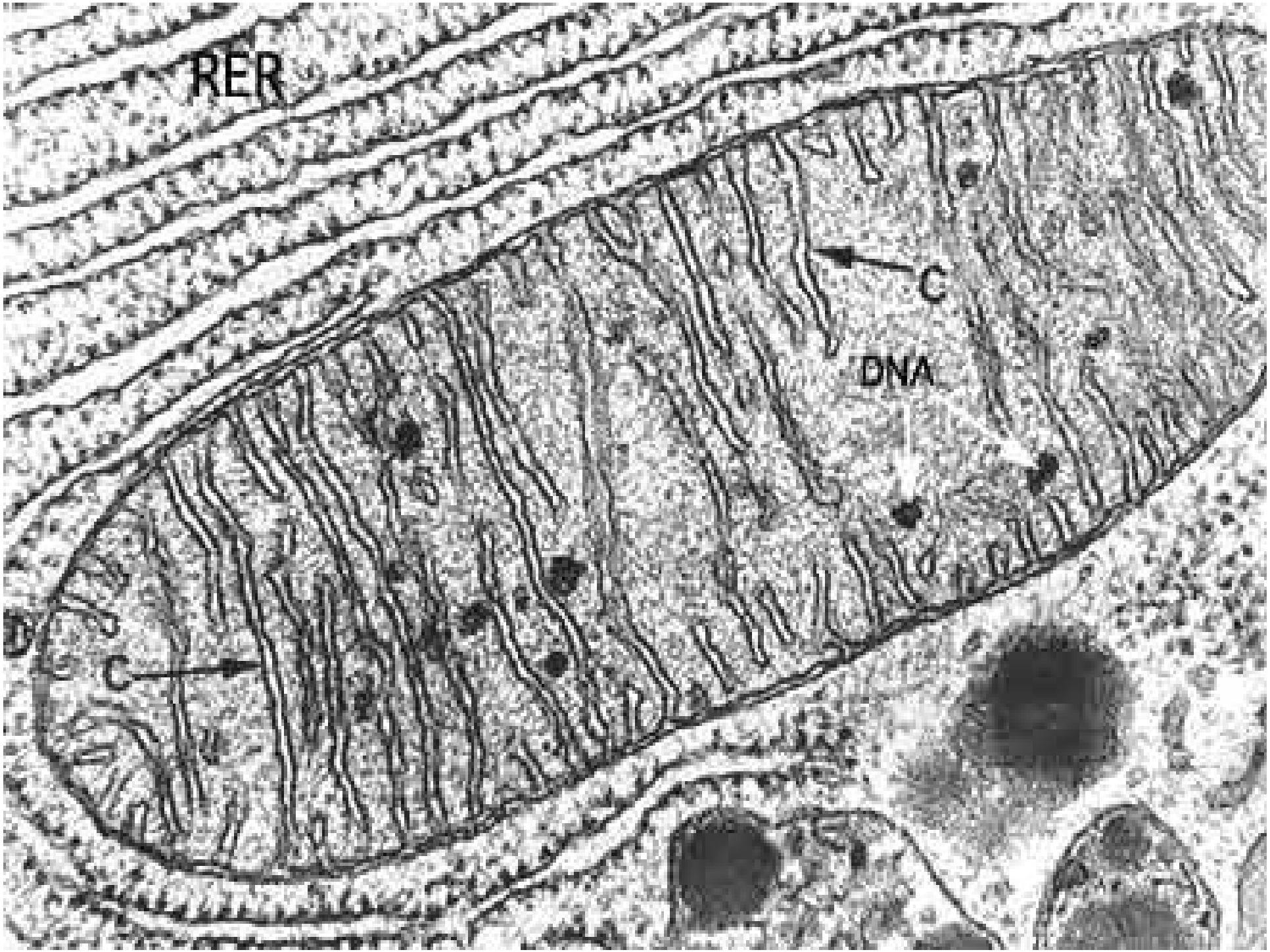
Filled with matrix

Full of granular materials:

1. **Elementary particles:**
   They contain respiratory enzym
2. **Matrix granules** (lipids, protein
   Ca++, Mg++),
3. **DNA & RNA**





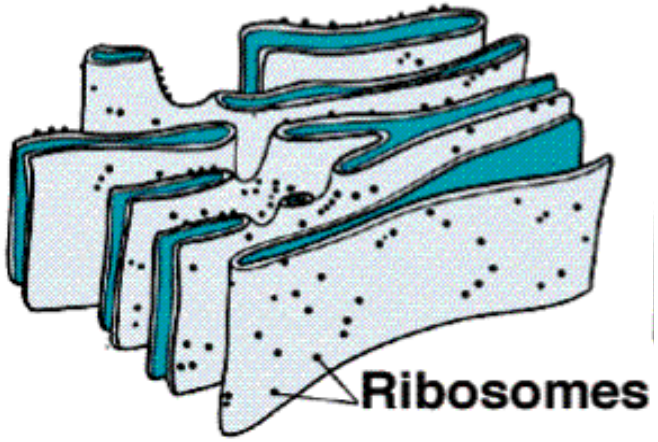

RER
C
DNA
C

3- Endoplasmic Reticulum

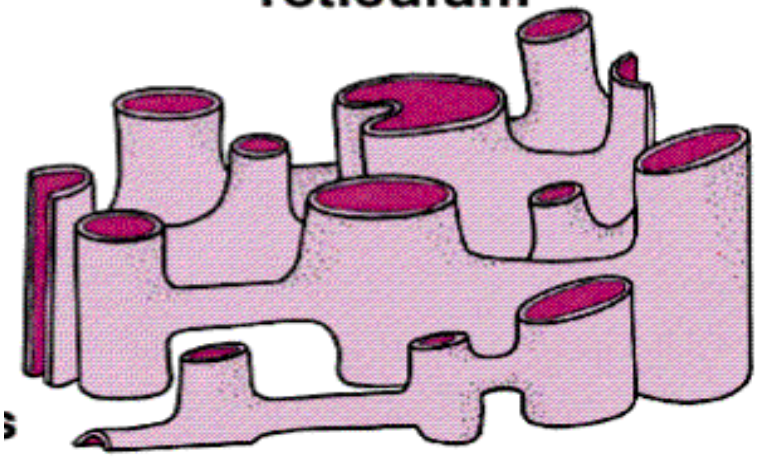
Network of tubules **(cisternae)**

Types:

Granular endoplasmic reticulum



Agranular endoplasmic reticulum



A. Rough Endoplasmic Reticulum (rER)

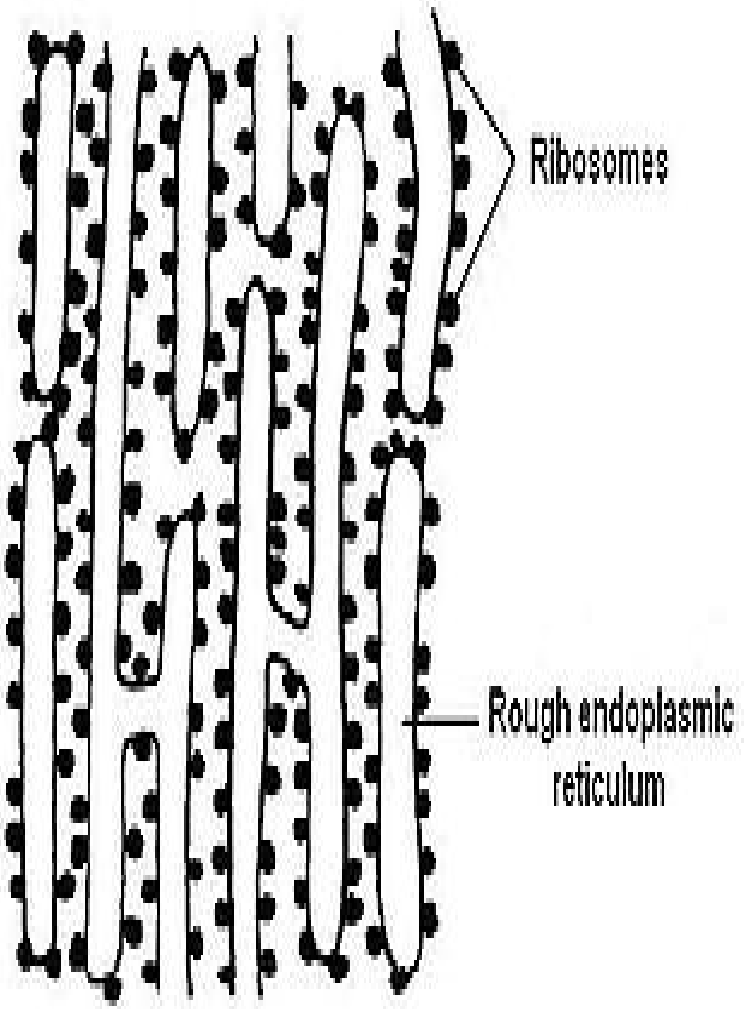
Name ??

Definition:

Formed of narrow flat tubules, form a reticulum

Site: Well developed in

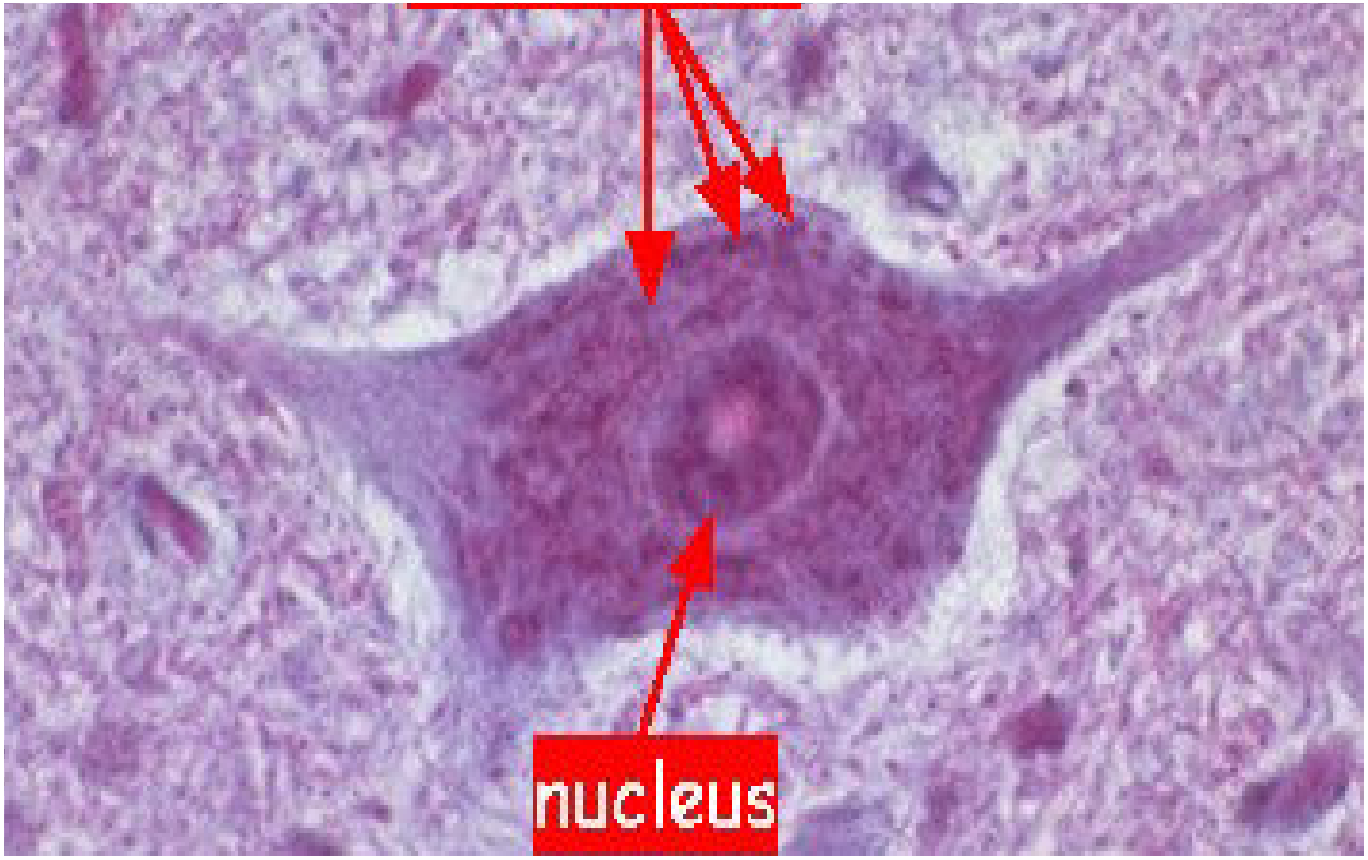
protein synthesizing cells



LM:

H & E: Can not b seen

If increased give cytoplasmic **basophilia**

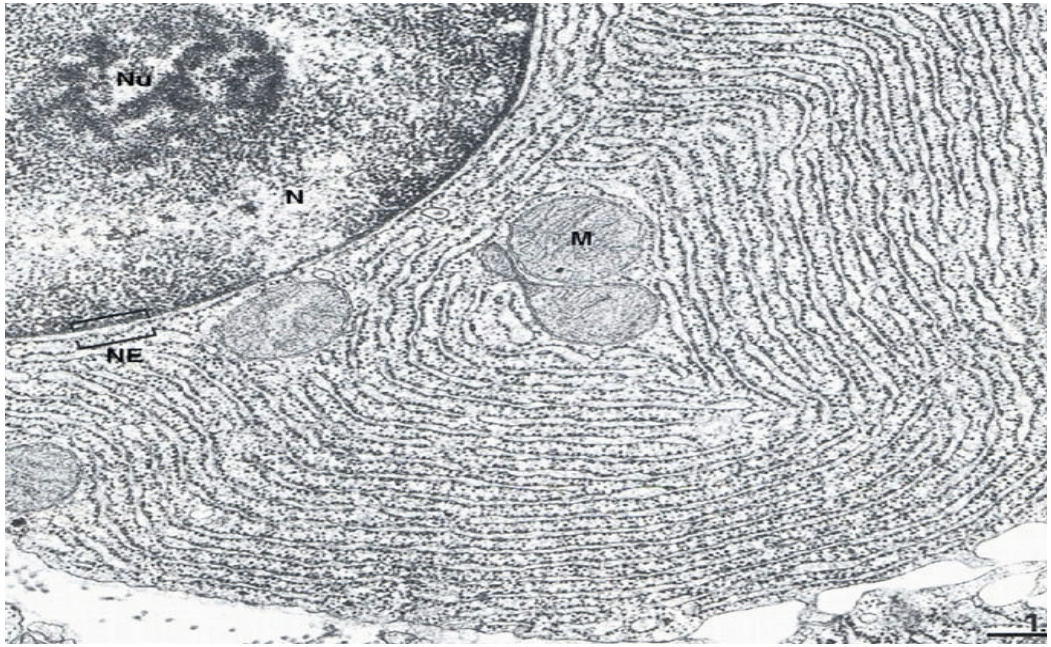


EM

Network of tubule **(cisternae)**

Attached to **ribosomes**

Ribosomes bounded to specific receptors
(ribophorins)
Under the receptor is a **pore**



Functions of rough endoplasmic reticulum:

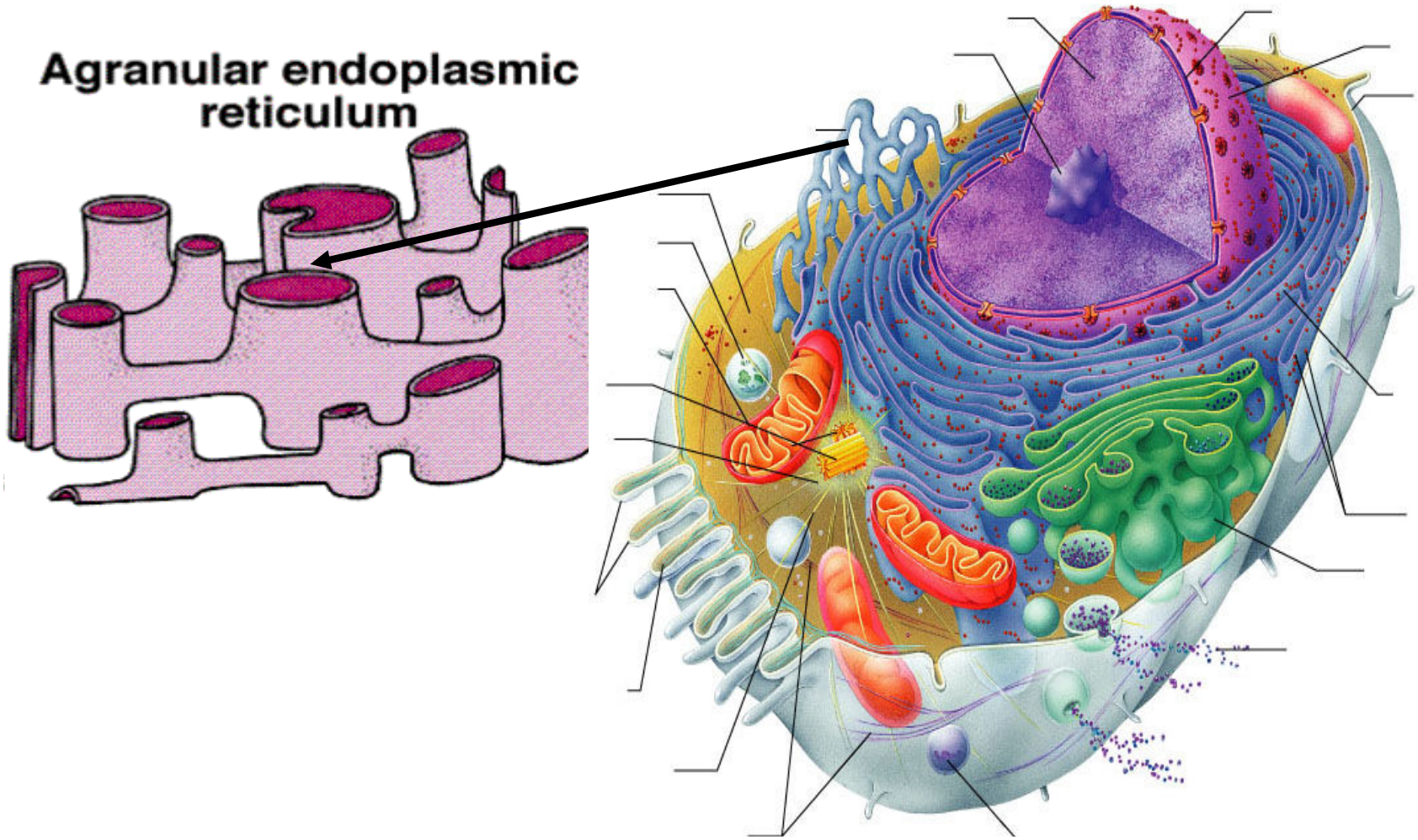
Dealing with protein synthesis

- Protein accumulation
- Protein segregation
- Protein initial glycozylation
- Protein packing in transfer vesicle

- Protection of cytoplasm by packing hydrolytic
- enzymes
- Intracellular pathway for the formed substances

B) Smooth Endoplasmic Reticulum (sER):

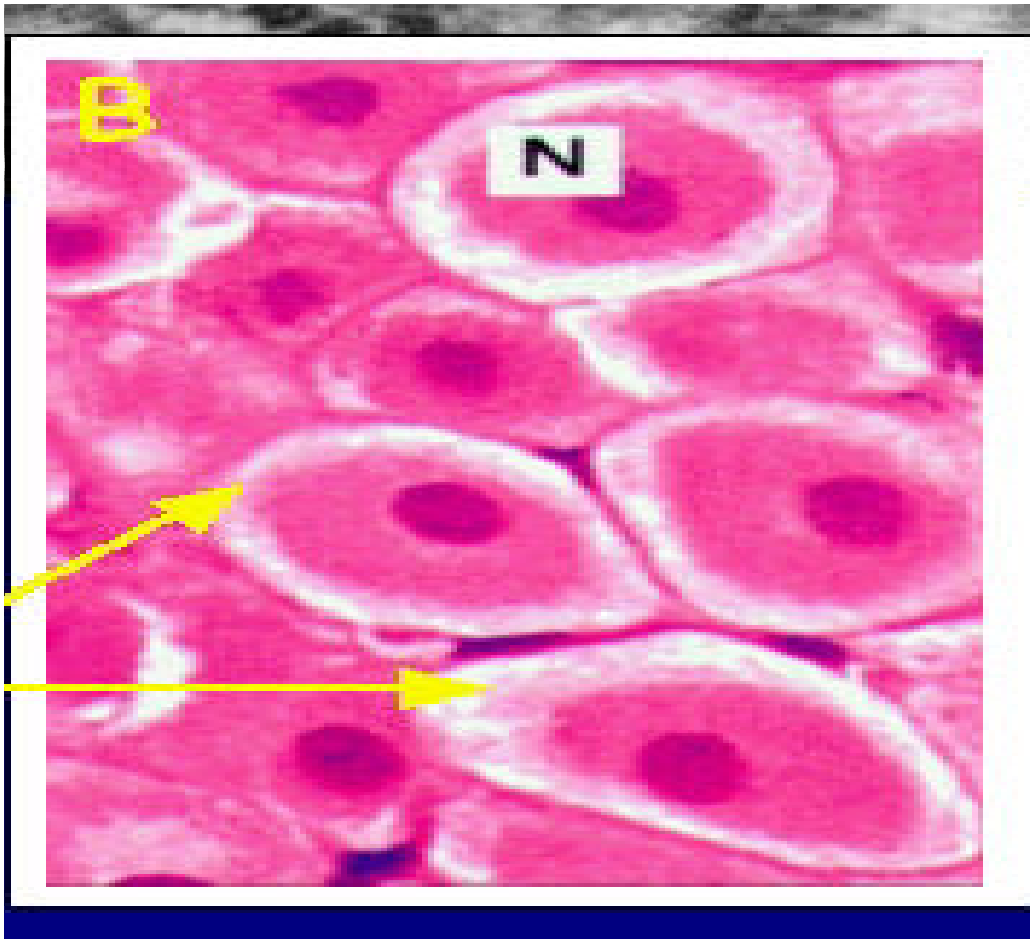
Sites: well developed in fat cells.



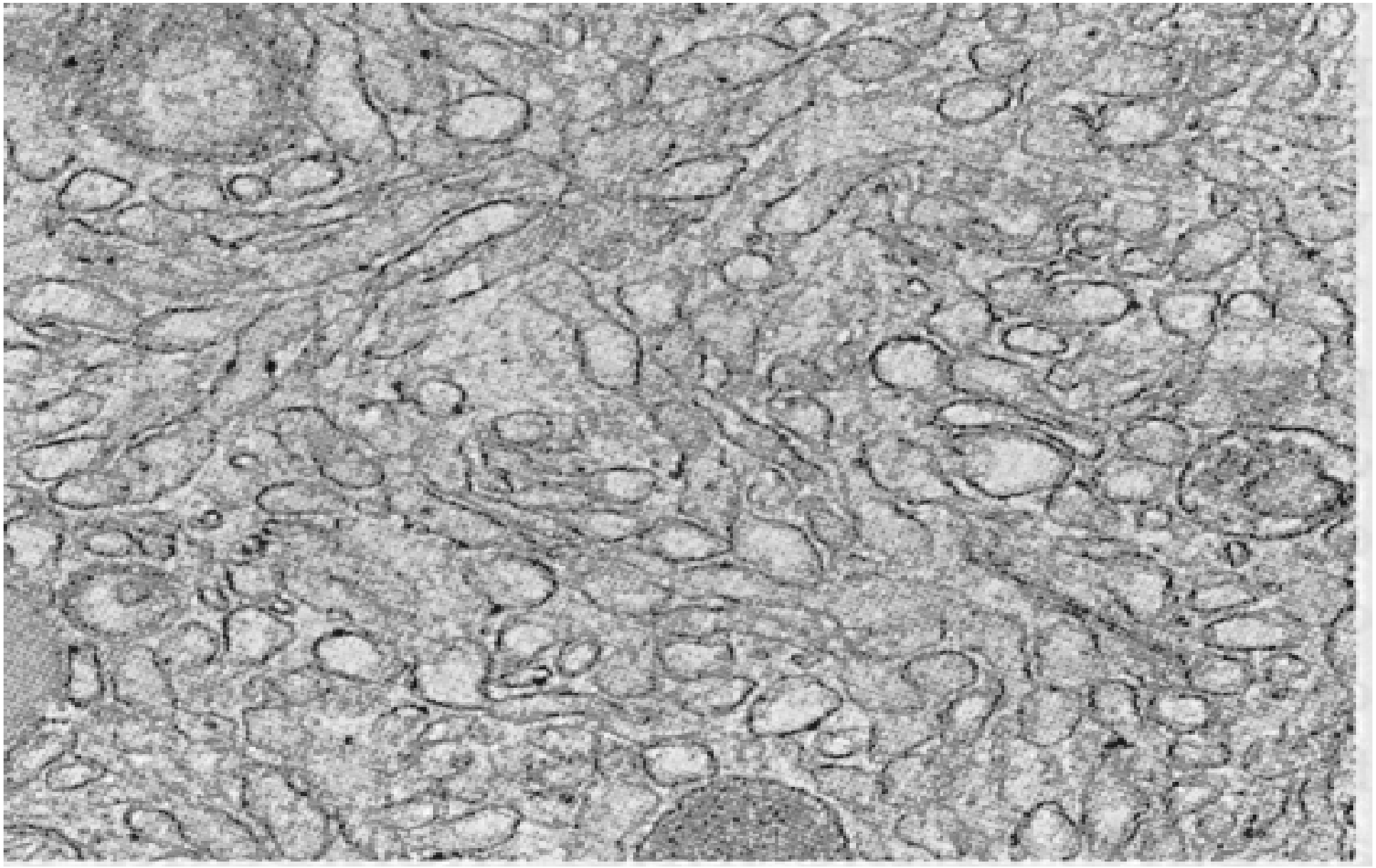
LM:

H&E: can not be demonstrated,

But if abundant: cytoplasmic **acidophilia**



EM: Network of tubules



Function of smooth endoplasmic reticulum

- **Lipid metabolism**
- **Cholesterol** metabolism
- **Steroid hormones** metabolism
- **Glycogen** metabolism
- **Mineral** metabolism
- **Drug** detoxification
- **HCL** formation in stomach
- Acts as an intracellular pathway