Introduction

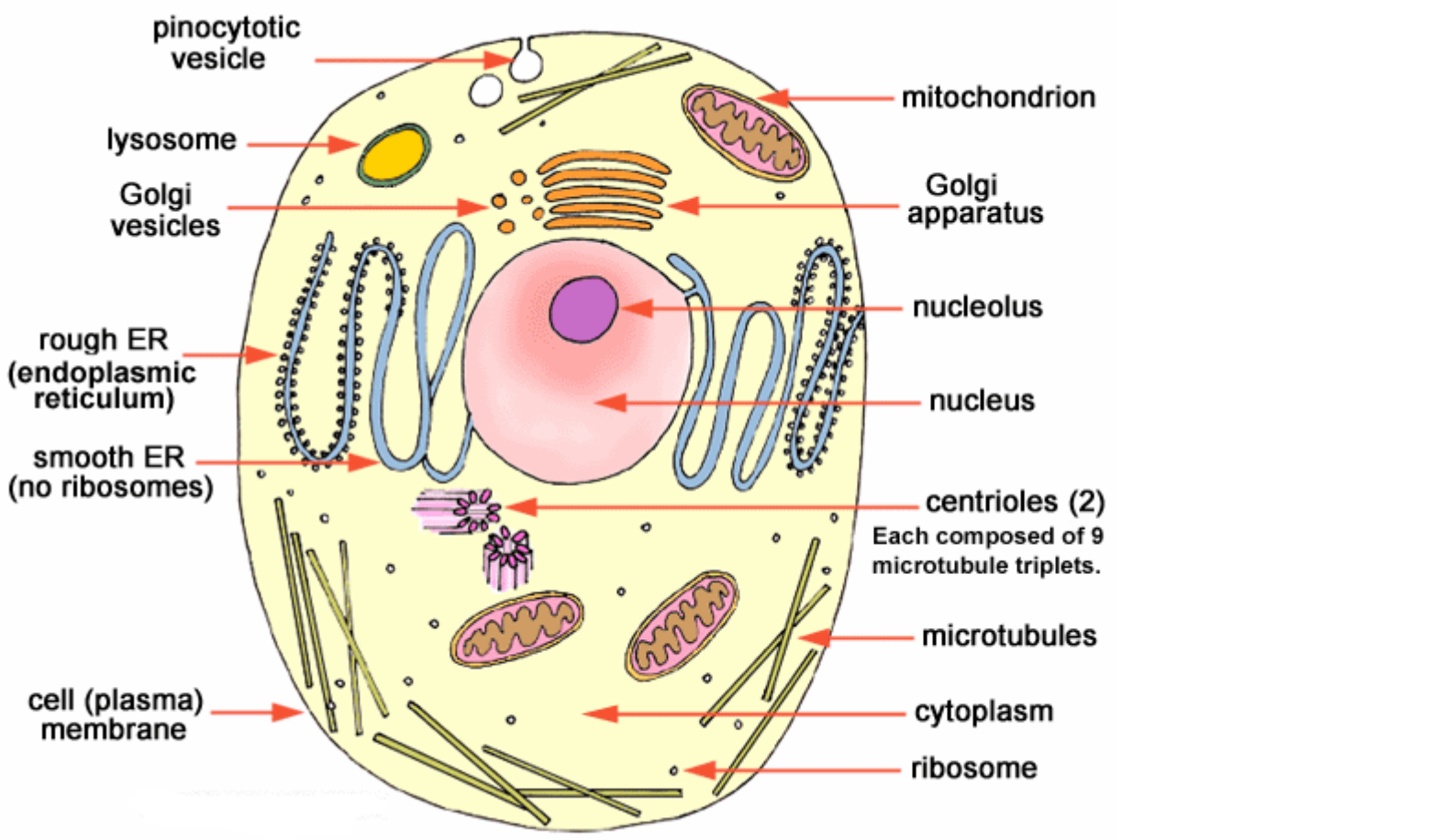
Learning Objectives

By the end of the lecture, the student should be able to describe :

- Define cell.
- Recognize various types of cells.
- Differentiate between eukaryotic and prokaryotic cell.
- Identify different components of a cell.
- Recognize different organelles of a cell.

Cell

- **Basic unit** of structure and function in living things.
- **Smallest independently** functioning unit.



VARIOUS TYPES OF CELLS

- There are about 210 distinct **HUMAN CELL TYPES**. There are between 50 and 75 trillion cells in the human body .
- Myocytes(muscles)
- Neurones(nervous system)
- Germ cells(ova and sperms)
- Osteocytes
- Chondrocytes
- Epithelial cells

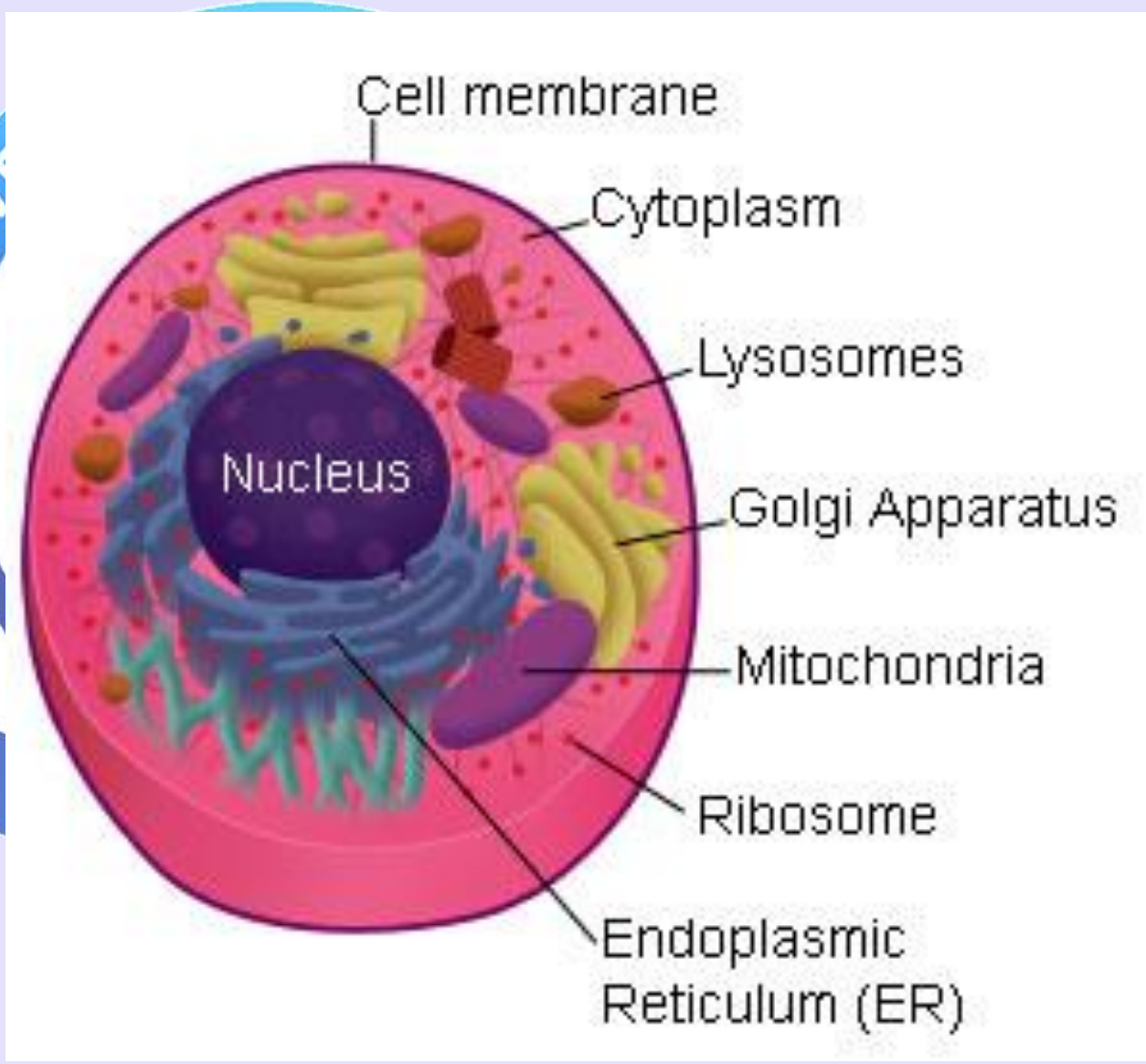
DIFFERENTIATE BETWEEN EUKARYOTIC AND PROKARYOTIC CELL

- Prokaryotes are singled cell organisms.
- They are very simple organisms that lack a cell nuculeus and membrane bound organelles.
- They are heterotrophic organisms (i.e. they rely on others as a source of food). Some however can produce their own food.

- They are very complex organisms .
- They have a cell nucleus and membrane bound organelles.
- They have many different functions that make eukaryotes specialised organisms.
- Some can be autrotrophic while others are heterotrophic.

COMPONENTS Of The Cell.

- **C**ell membrane
- **C**ytoplasm.
- **N**ucleus.



SUBSTANCES THAT MAKE UP CELL.

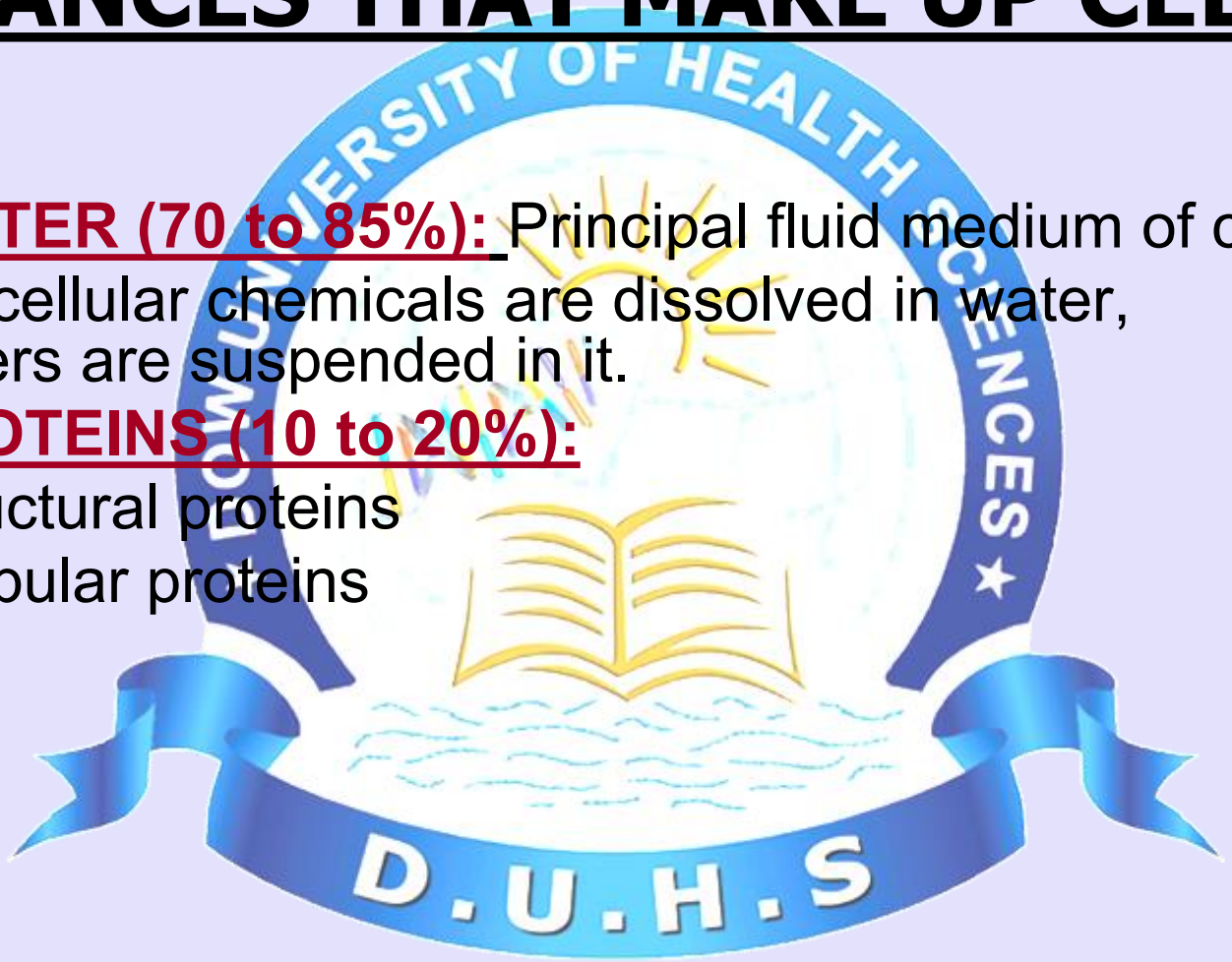
- WATER (70 to 85%)
- PROTEINS (10 to 20%)
- LIPIDS (Normally up to 2%, in fat cells up to 85%)
- CARBOHYDRATES (1 to 6%)
- MINERALS / IONS (traces)

SUBSTANCES THAT MAKE UP CELL.

- **WATER (70 to 85%):** Principal fluid medium of cell

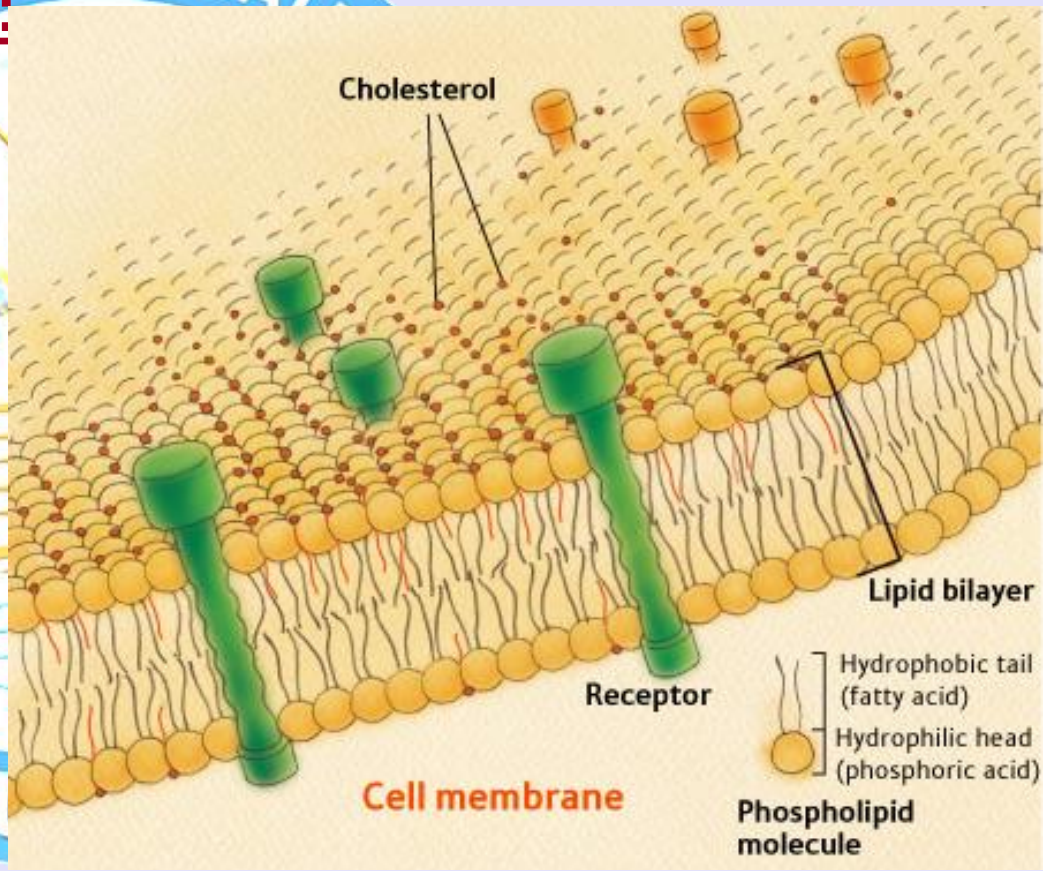
Many cellular chemicals are dissolved in water, others are suspended in it.

- **PROTEINS (10 to 20%):**
  - Structural proteins
  - Globular proteins



SUBSTANCES THAT MAKE UP CELL.

- **LIPIDS (Normally up to 2%, in fat cells up to 85%):**
  - Form cellular and intra cellular membranes.
  - Energy
- **CARBOHYDRATES (1 to 6%):**
  - Source of nutrition
  - Structural function
- **MINERALS / IONS:**
  - Provide inorganic chemicals for cellular reactions

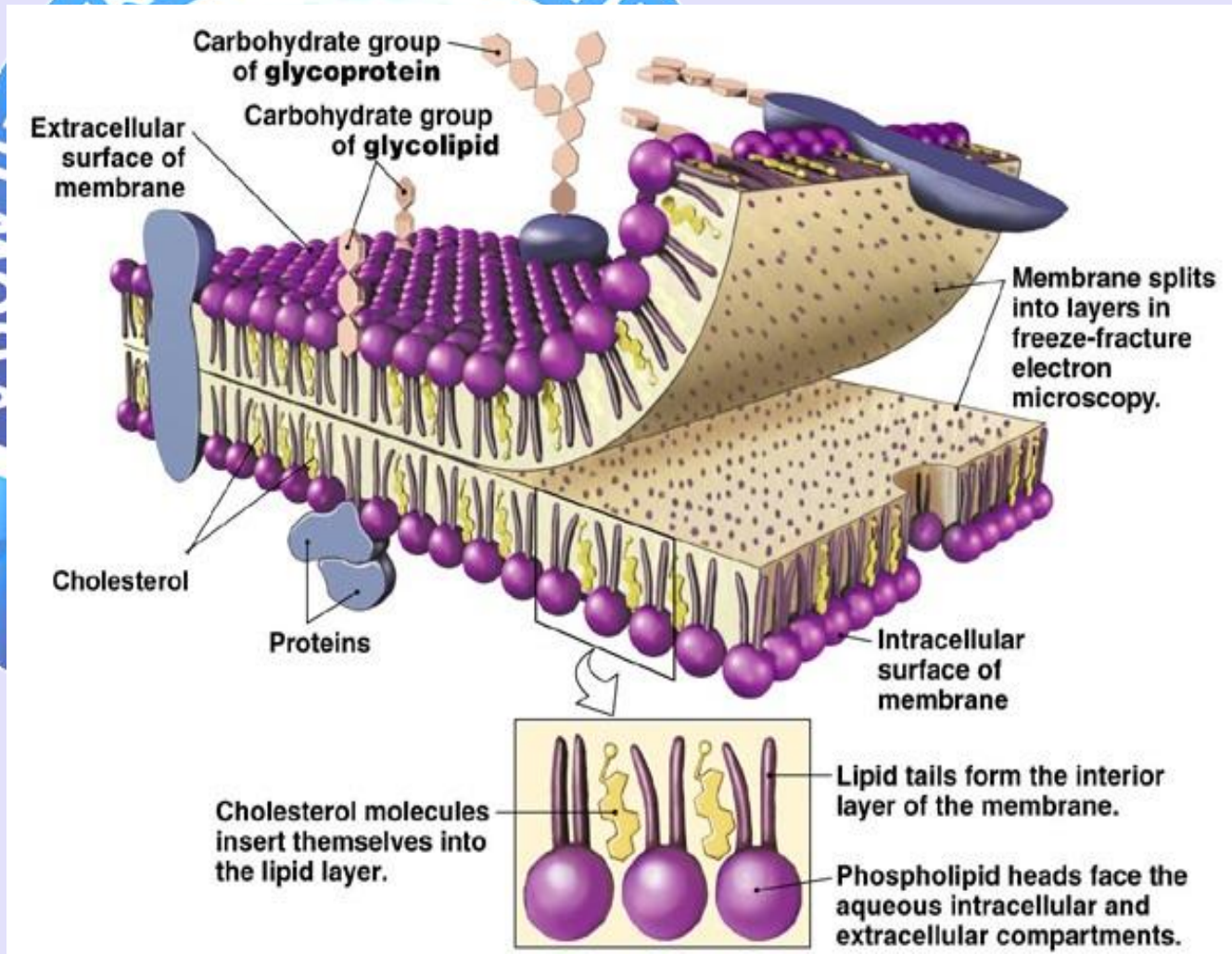


CELL MEMBRANE

Cell membrane envelopes the cell, it is a thin, pliable elastic structure 7.5 to 10 nanometers thick.

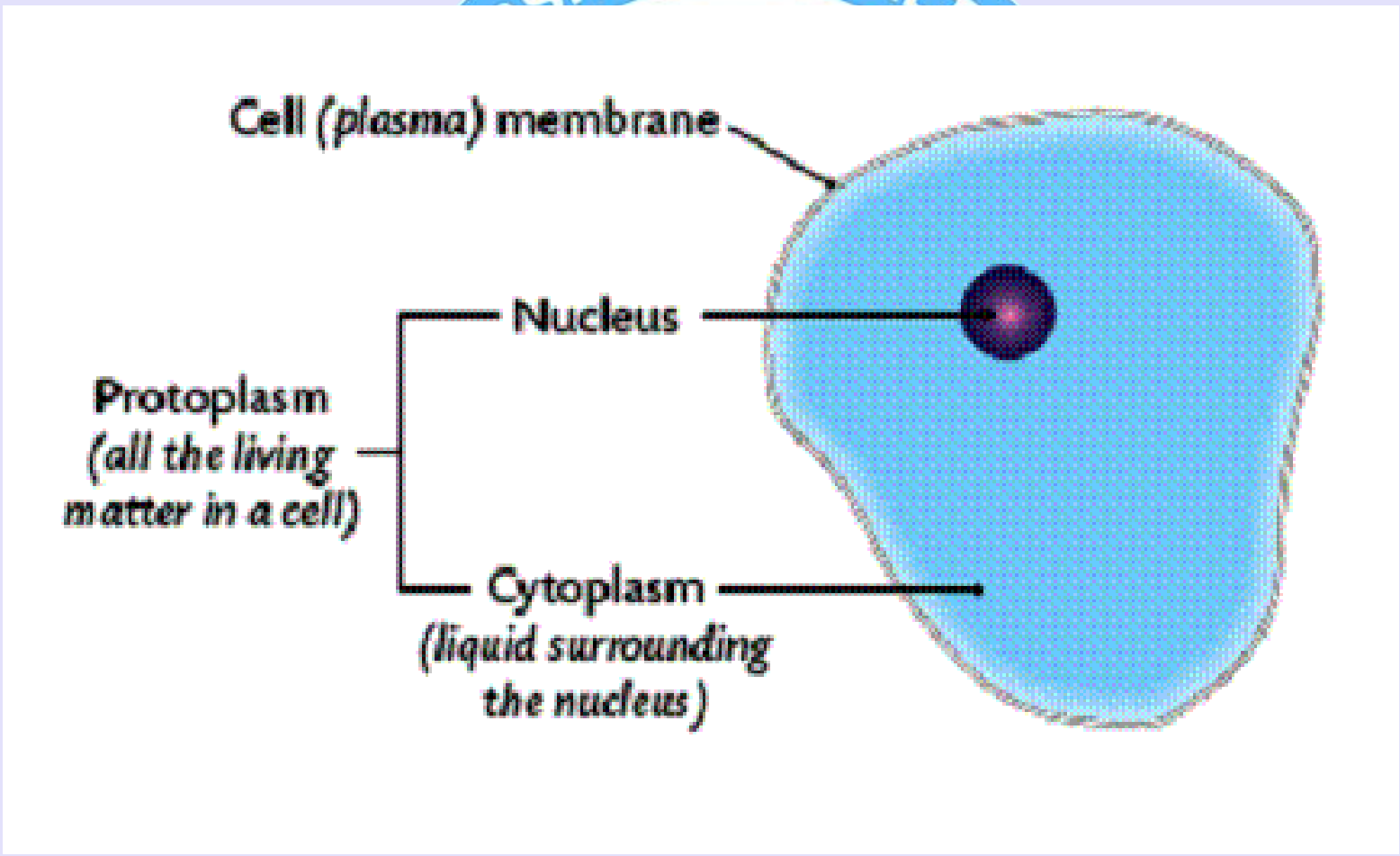
COMPOSITION:

- Proteins 55%
- Phospholipids 25%,
- Cholesterol 13%
- Carbohydrates 3%



Cytoplasm

- Portion of **protoplasm** that surrounds the nucleus and is peripherally bound by cell membrane.



Composition of Cytoplasm

Cytosol:

- **Clear fluid portion of cytoplasm** in which **inclusions, particles** and organelles are dispersed.

Organelles:

Endoplasmic reticulum,

Golgi apparatus,

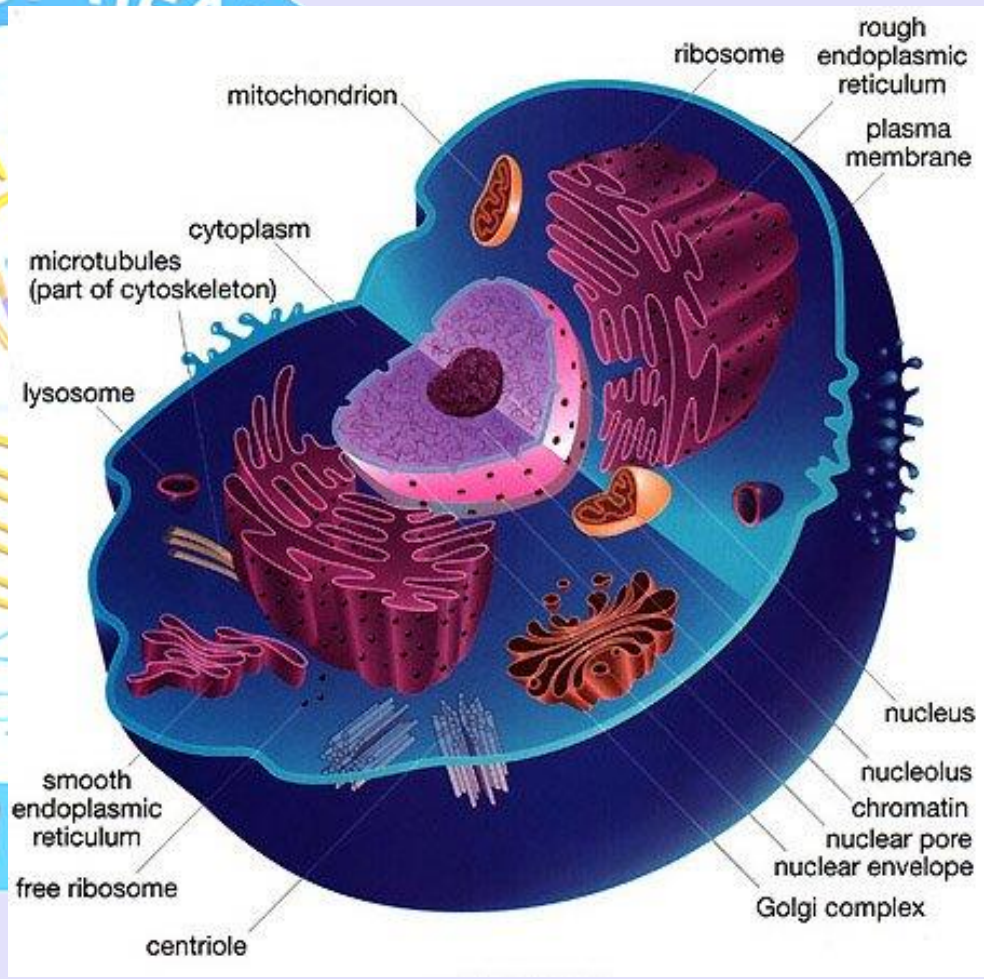
Lysosomes,

Mitochondria,

Peroxisomes,

Ribosomes,

Microtubules , **M**icrofilaments.



ORGANELLES OF A CELL

- **E**ndoplasmic reticulum,
- **G**olgi apparatus,
- **L**ysosomes,
- **M**itochondria,
- **P**eroxisomes,
- **R**ibosomes,
- **M**icrotubules , **M**icrofilaments.

Endoplasmic Reticulum (ER)

- Network of **interconnected** tubular and flat vesicular structures.
- Bounded by **lipid bilayer membrane** that contain large number of proteins.
- Filled with **endoplasmic matrix.**
- **Vast surface area** and multiple enzymes provide machinery for major metabolic functions.

TYPES:

- **Rough ER**

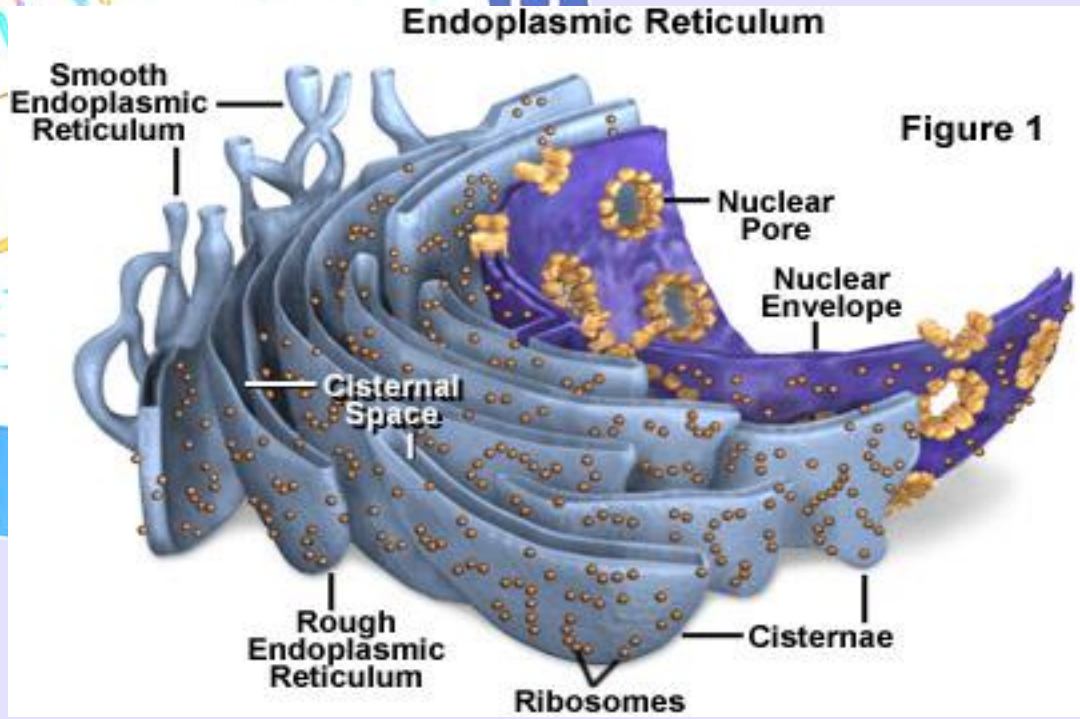
  (has ribosomes attached)

Concerned with protein synthesis

- **Smooth ER**

  (has No ribosomes attached)

Concerned with lipid synthesis

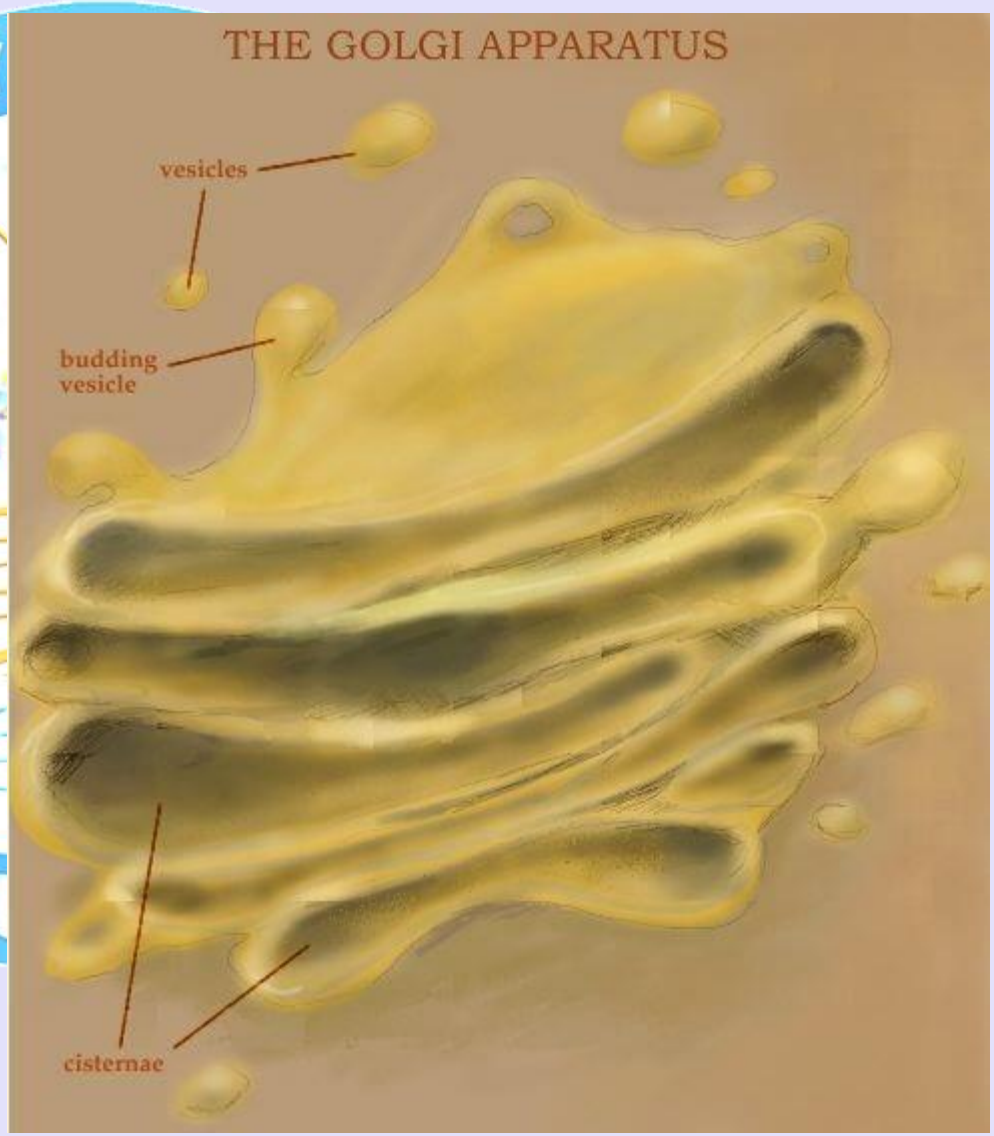


GOLGI APPARATUS (GA)

STRUCTURE:

- Consists of **4 to 5 layers of flat vesicles** closely related to the ER.

- Prominent in **secretory cells**.(those that secrete enzymes and hormones)



Functions:
GOLGI APPARATUS

- **It processes substances** synthesized by the ER to form
  - **L**ysosomes,
  - **S**ecretory vesicles

It packages these products

- **F**ormation of carbohydrates esp. large saccharide polymers bound with small amounts of proteins e.g. Hyaluronic acid and chondroitin sulphate.

LYSOSOMES (CELL GARBAGE DISPOSAL SYSTEM)

STRUCTURE:

- **250 to 750 nanometers** in diameter
- **Lipid bilayer** outer membrane
- Filled with a mixture of **hydrolytic enzymes** (40 different types) all manufactured in the ER and modified in the GA.
- **Organelles** formed by breaking off from Golgi apparatus

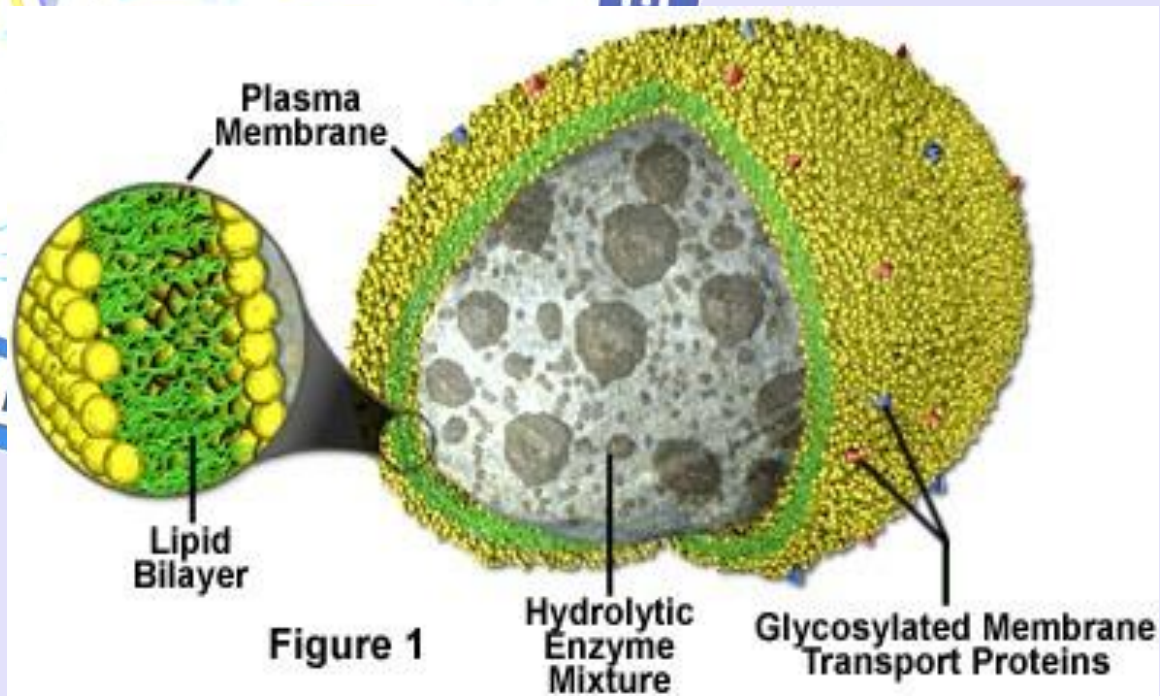
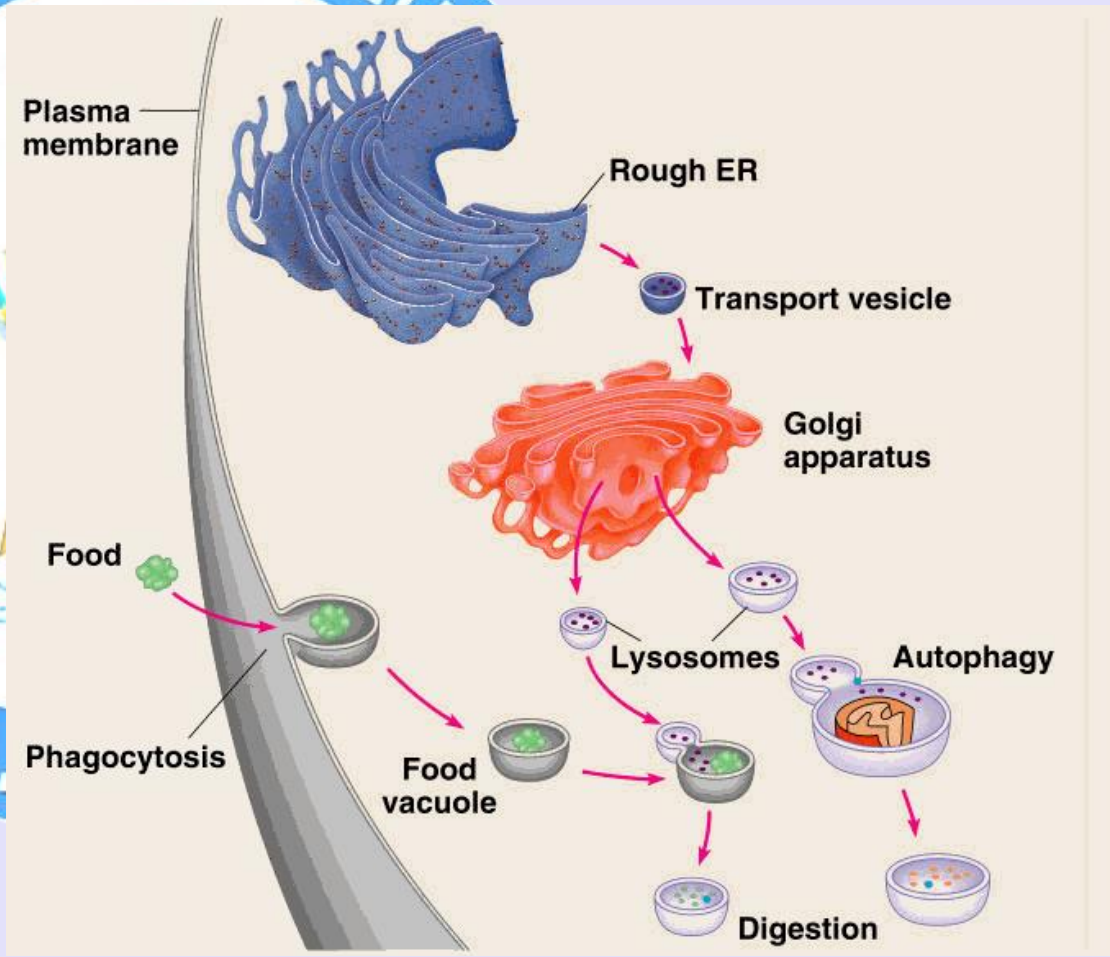


Figure 1

LYSOSOMES FUNCTIONS

- **Digestion** of food stuff.
- **Bactericidal agents** e.g.
  - lysozyme and
  - lysoferrin.
- **Regression** of various tissues



PEROXISOMES:

STRUCTURE:

- **250 to 750** nanometers.
- Bound by **lipid bilayer.**
- Contain **oxidase .**
- Formed by budding off from smooth ER.

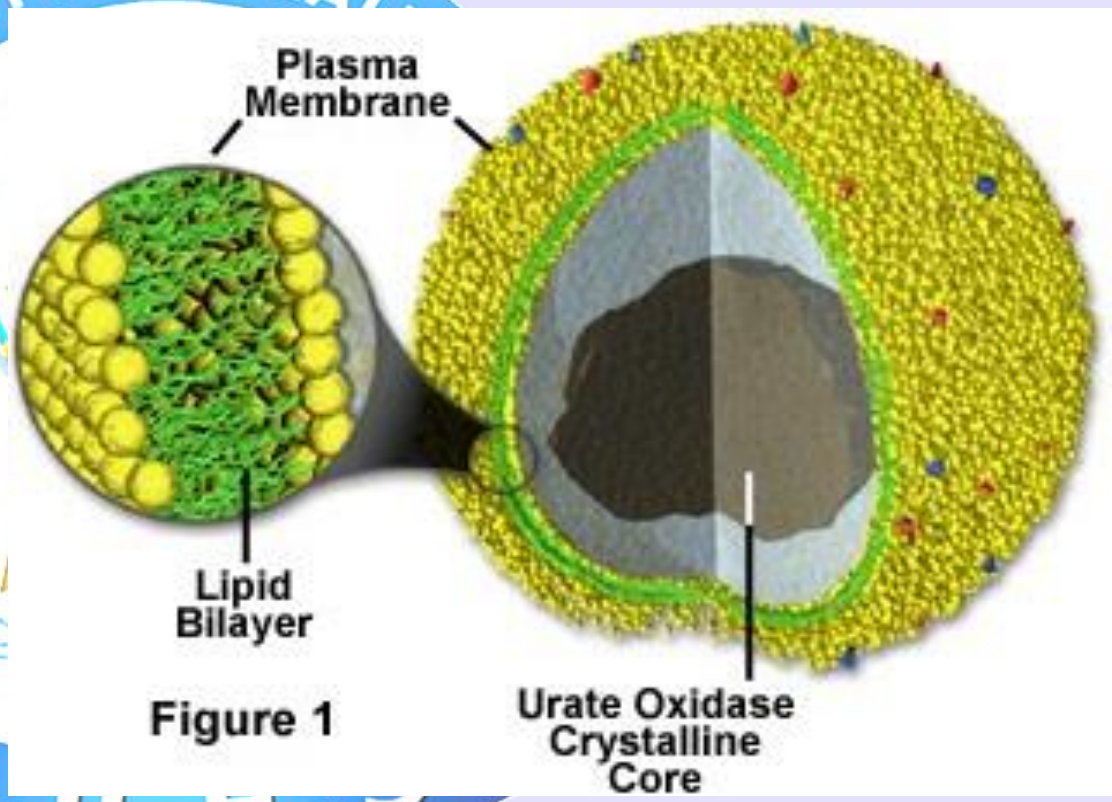
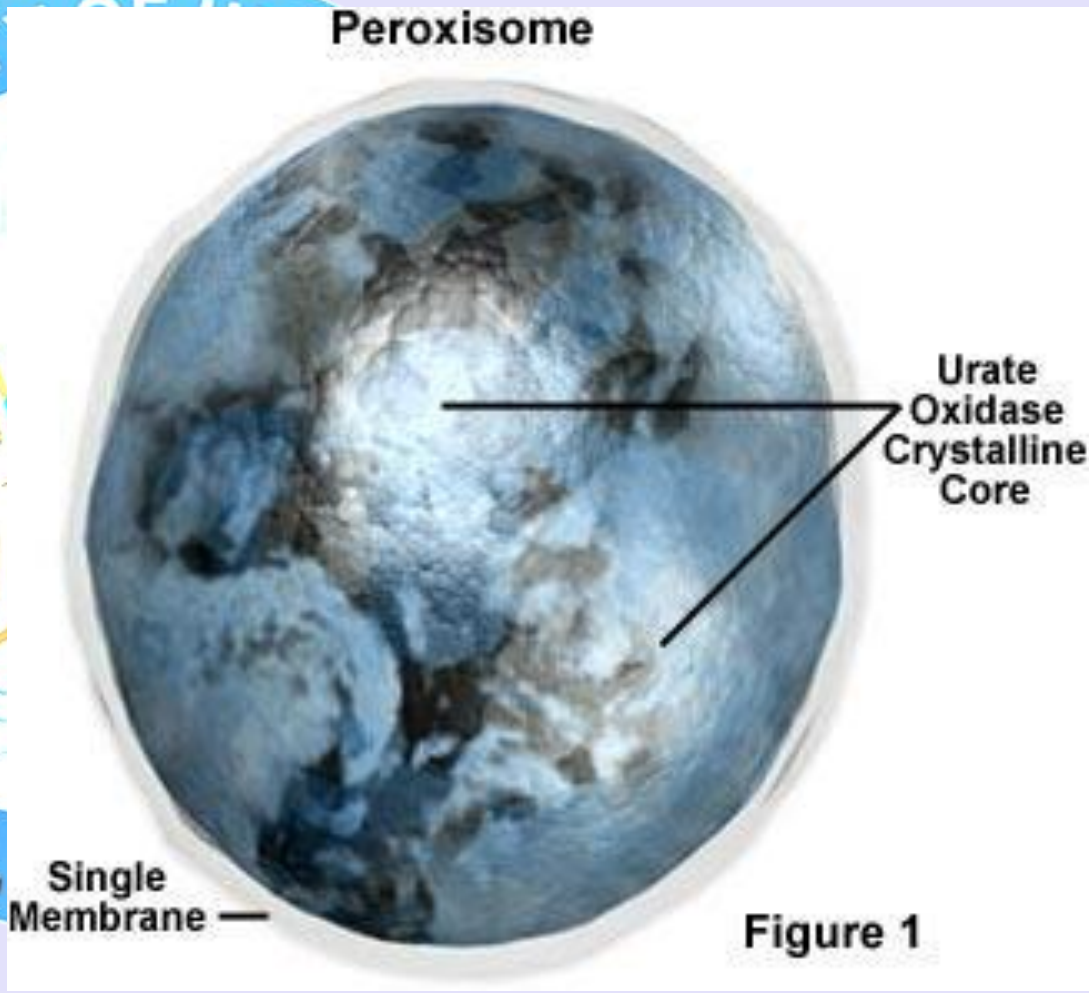


Figure 1

FUNCTION OF PEROXISOMES

- Causes the **oxidation (detoxification)** of poisons and toxins in the cell.

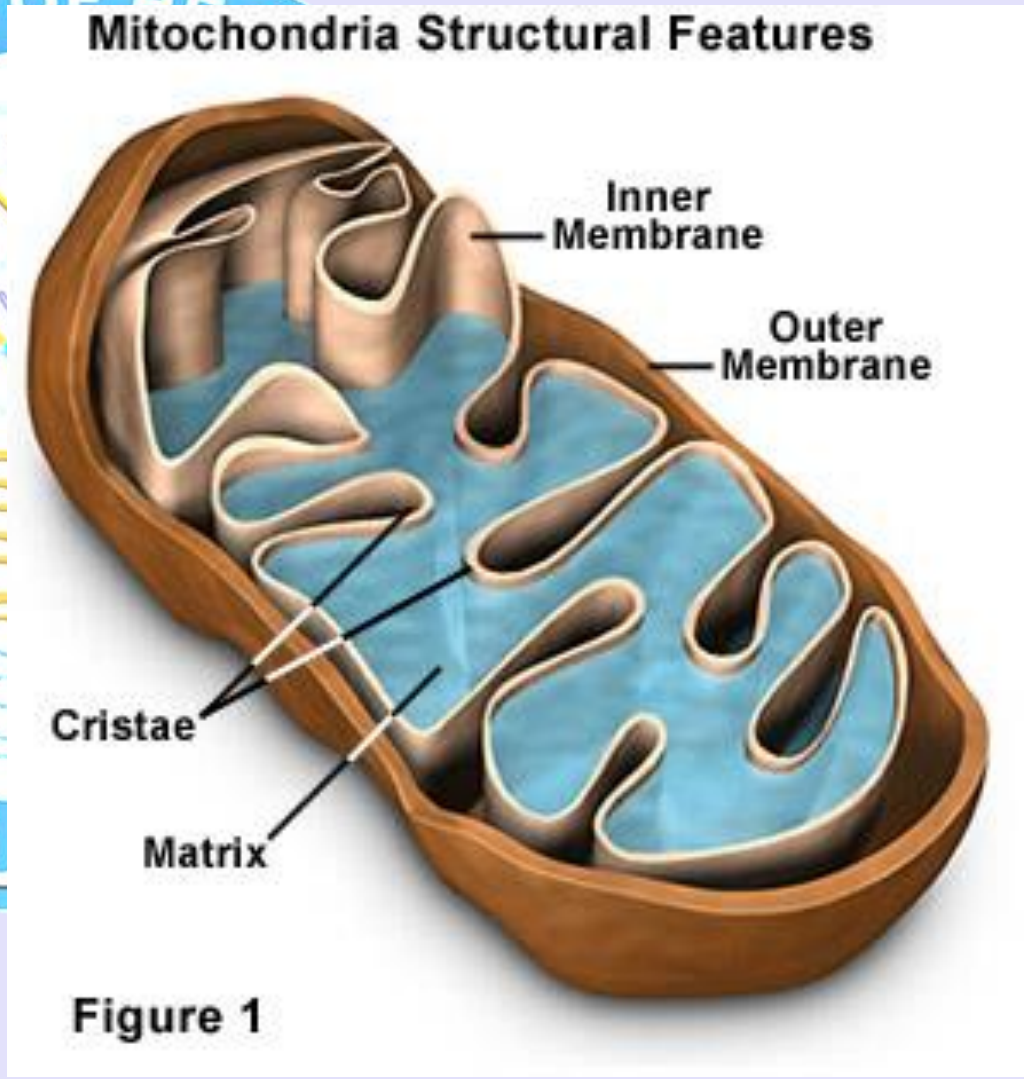


MITOCHONDRIA

(POWER HOUSE OF THE CELL)

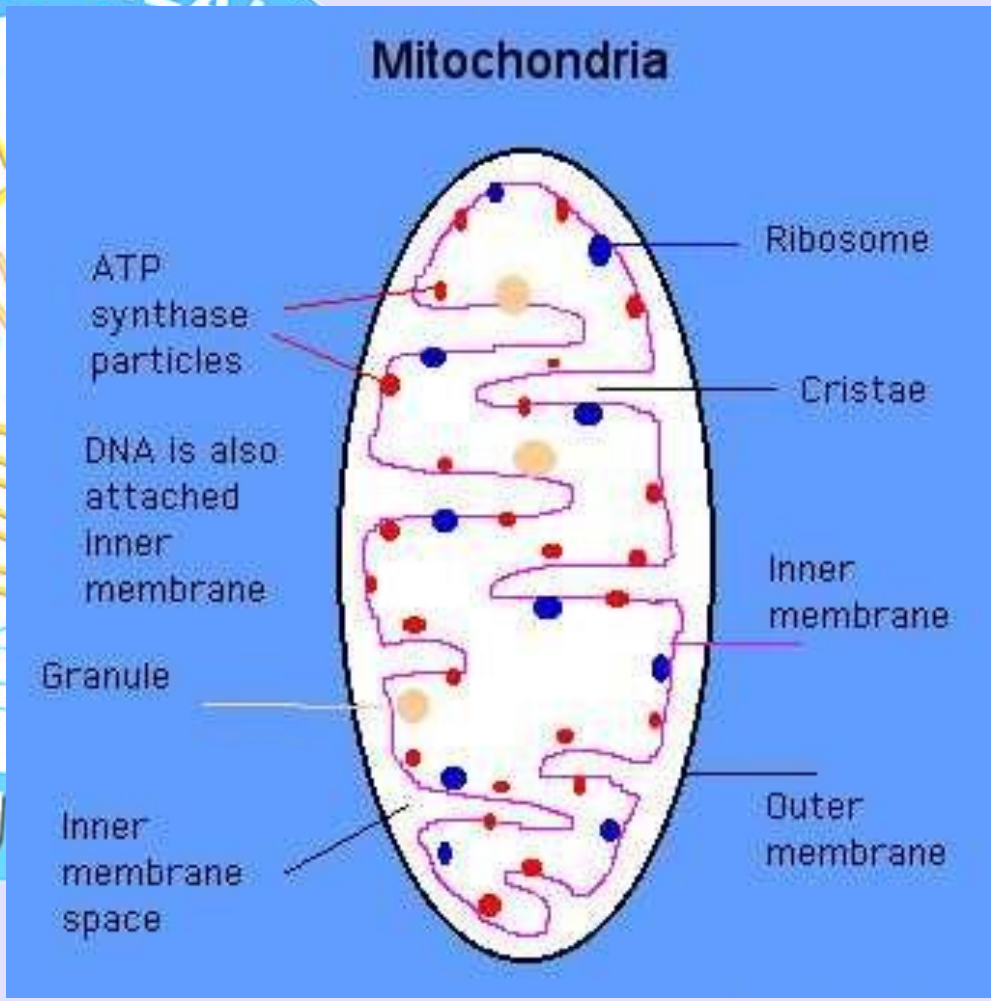
STRUCTURE:

- **Two lipid bilayer.**
- Shelves formed by in folding of inner bilayer onto which **oxidative enzymes are attached.**
- Mitochondrial cavity filled with **gel matrix** containing enzymes.
- Variable sizes and shapes.
- Presence of **Deoxyribo Nucleic Acid (enables to self replicate)**



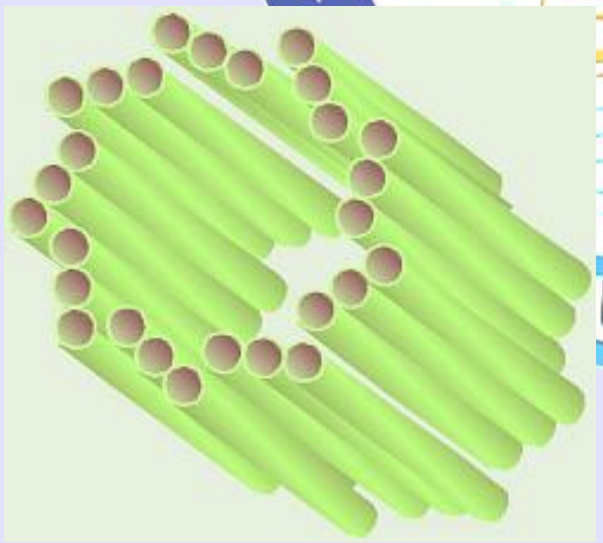
FUNCTIONS OF MITOCHONDRIA

- Formation of high energy compound Adenosine Tri phosphate **(ATP).**
- Mitochondria has its **own cellular DNA** and replicates independently of the cell in which it is found.

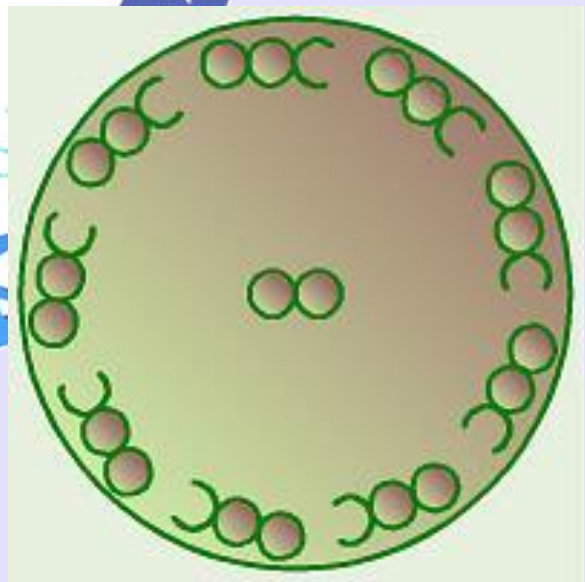


MICROFILAMENTS AND MICROTUBULES.

- **FORMATION:** Originate as precursor protein molecules synthesized by ribosomes which polymerize to form filaments.
- **Arrangement in Centriole**

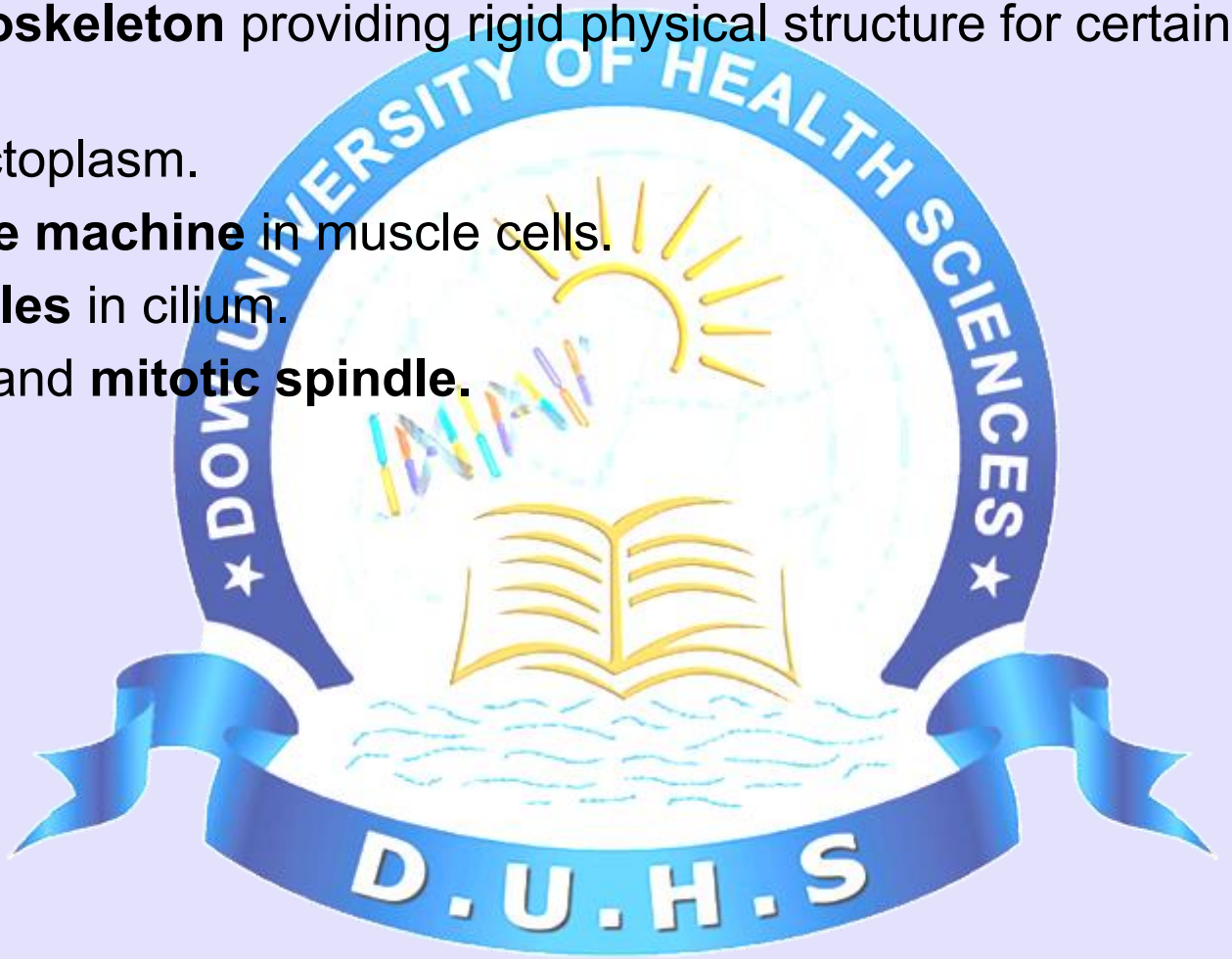


Arrangement in cilia / flagella.



FUNCTIONS:

- Act as **cytoskeleton** providing rigid physical structure for certain parts of cell e.g.
- **Actin** in ectoplasm.
- **Contractile machine** in muscle cells.
- **Microtubules** in cilium.
- **Centriole** and **mitotic spindle.**



NUCLEAR MEMBRANE

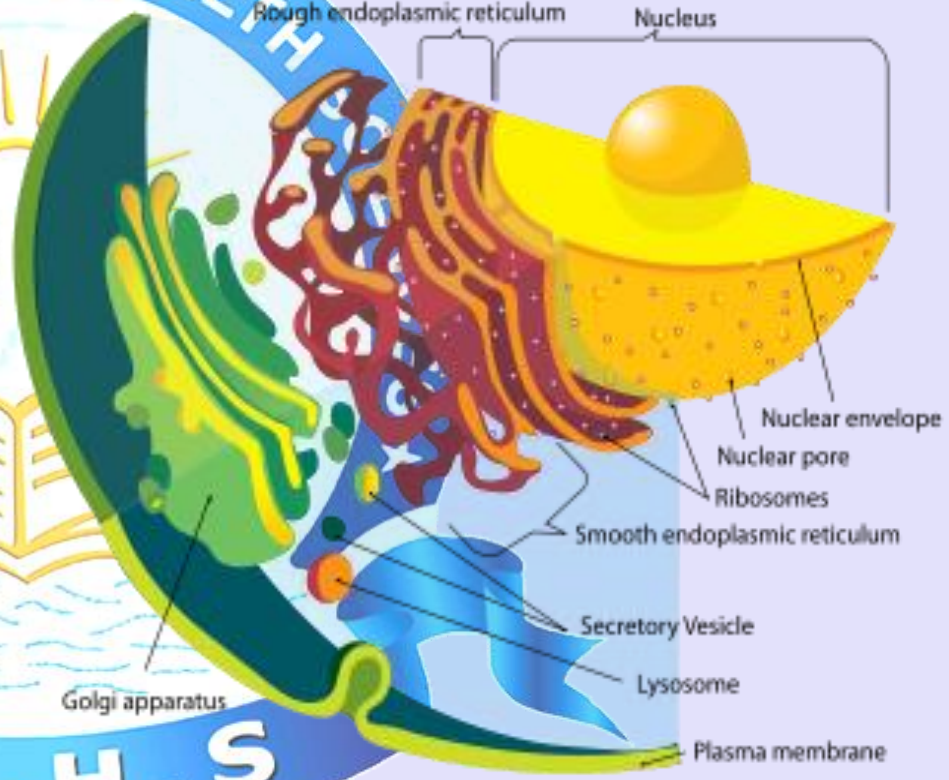
- It is the covering of the nucleus that separates it from the cytoplasm.

STRUCTURE:

- Two separate bilayer membrane (inner and outer)
- Outer membrane is continuous with the ER.
- It has many nuclear pores.

- **Prevents free mixing** of cytoplasm and the nucleoplasm.

- **Nuclear pores** allow proteins to pass.



NUCLEUS (CONTROL CENTER OF CELL)

COMPOSITION:

- **NUCLEOPLASM:** fluid in the nucleus.
- **CHROMOSOMES:** thread like coiled structures (genetic material)
- **NUCLEOLI:** one or more small masses present in the nucleus having no limiting membrane , contain mRNA

FUNCTION:

- Control center of cell.
- Controls protein synthesis.
- Controls cell division.

FUNCTIONS OF CELL.

INGESTION:

- Diffusion
- Facilitated Diffusion.
- Active transport.
- Endocytosis.

DIGESTION:

- Act of Lysosomes.

SYNTHESIS:

- Granular ER synthesizes proteins.
- Agranular ER synthesizes lipids.
- Golgi apparatus synthesizes Lysosomes and secretary vesicles, Hyaluronic acid and chondroitin sulphate.

EXTRACTION OF ENERGY:

- Mitochondria.

MOVEMENT:

- Amoeboid locomotion exhibited by WBC and macrophages.
- Cilliary movement exhibited by cilia of ciliated epithelium and flagellum of sperm.

References

BASIC HISTOLOGY BY **JUNQUEIRA**

page no 23-24