Cell Structure and Types
Lec . 1

Second year

Histology

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Cell Structure and types

Learning Objectives :

At the end of this lecture , the student must be able to know

1- the characteristics of all cells.

2- types of cells and difference between them .

3- the cells overall structures .

4- define shape , position , and functions of each structure .

Histology :

- is the study of the anatomy of cells and tissues using microscopy.
- Histological studies may be conducted using tissue culture, where live animal cells are isolated and maintained in an artificial environment for various research projects.

Cytology

- The science that study the cellular organization structurally, functionally and the relation of this organization with metabolic activities ,growth ,differentiation ,evolution ,heredity.
- **What Is a Cell?**

  The cell is the smallest and basic units of life,
- **How Cells Are Organized ?**

  Human cells have a plasma membrane, cytoplasm, and a nucleus.

  The cytoplasm contains several types of organelles.

Cell theory

- Scientists first observed living cells under the microscope in 1674 by Robert Hooke,
- Then scientists concluded that all plant and animal tissues consisted of cells. (1839) Theodor Schwann & Matthias
- Rudolf Virchow in 1858 combined the ideas and added that all cells come from preexisting cells,
- **formulating the cell theory**:-
- 1-all living things are composed of one or more cells, and cell products.
- 2-a single cell is the smallest unite that exhibits all the characteristic of life.
- 3-all cells come only from preexisting cells

The cell

- The cell is the structural unite also the cells are the functional unite because the functions of living organism are the result of cellular activities.
- If we examine any part of the human body under microscope, we find living cells or cell products. cell products include materials composed of dead cells and substances resulting from cellular activity.
- all of our cells divided from earlier cell, going to our first cell, the fertilized egg, even that original cell come pre- existing cells ,the sperm and egg from our parents.

Cell Size

- Most cells are small and can be seen only under a microscope .
- The small size of cells means that they are measured using the smaller units of the metric system.
- Cells are about 100 micrometers (μ m) in diameter, about the width of a human hair . Some large cells (e.g. an egg) can be seen with the naked eye.

General features of the cells

1- the use of energy .

2- maintain the genetic information about the synthesis of cellular molecules through the reproduction and division.

3- regulation of intracellular reaction.

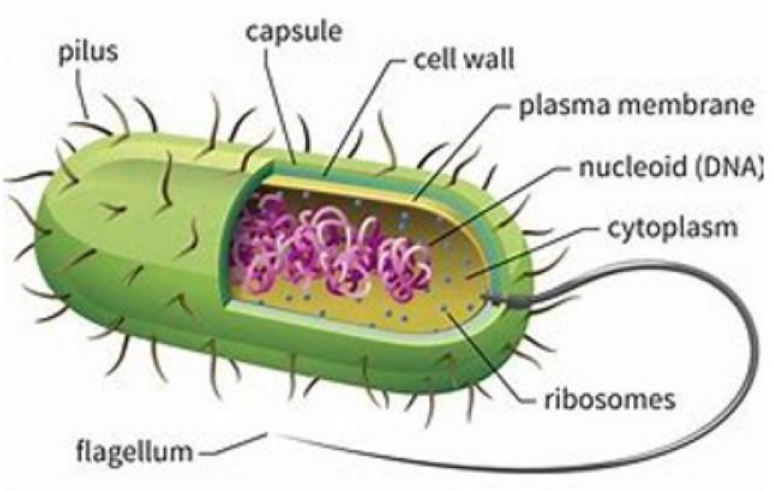
Characteristics of All Cells :

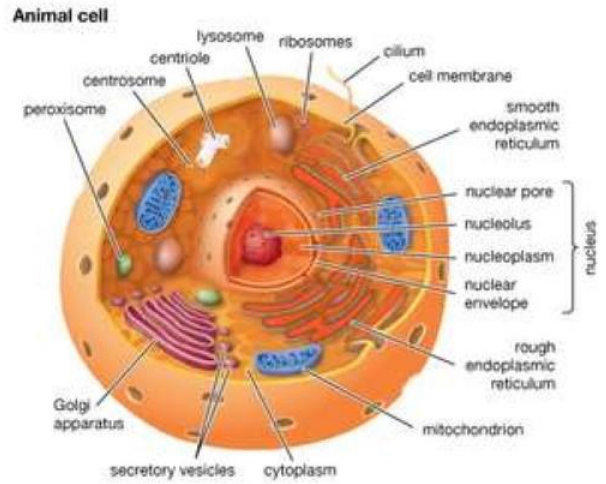
- A surrounding membrane.
- Protoplasm or cytoplasm – cell contents in thick fluid
- Organelles – structures for cell function
- Nucleus - Control center with DNA

Cell Structure and Function

Cell Types:

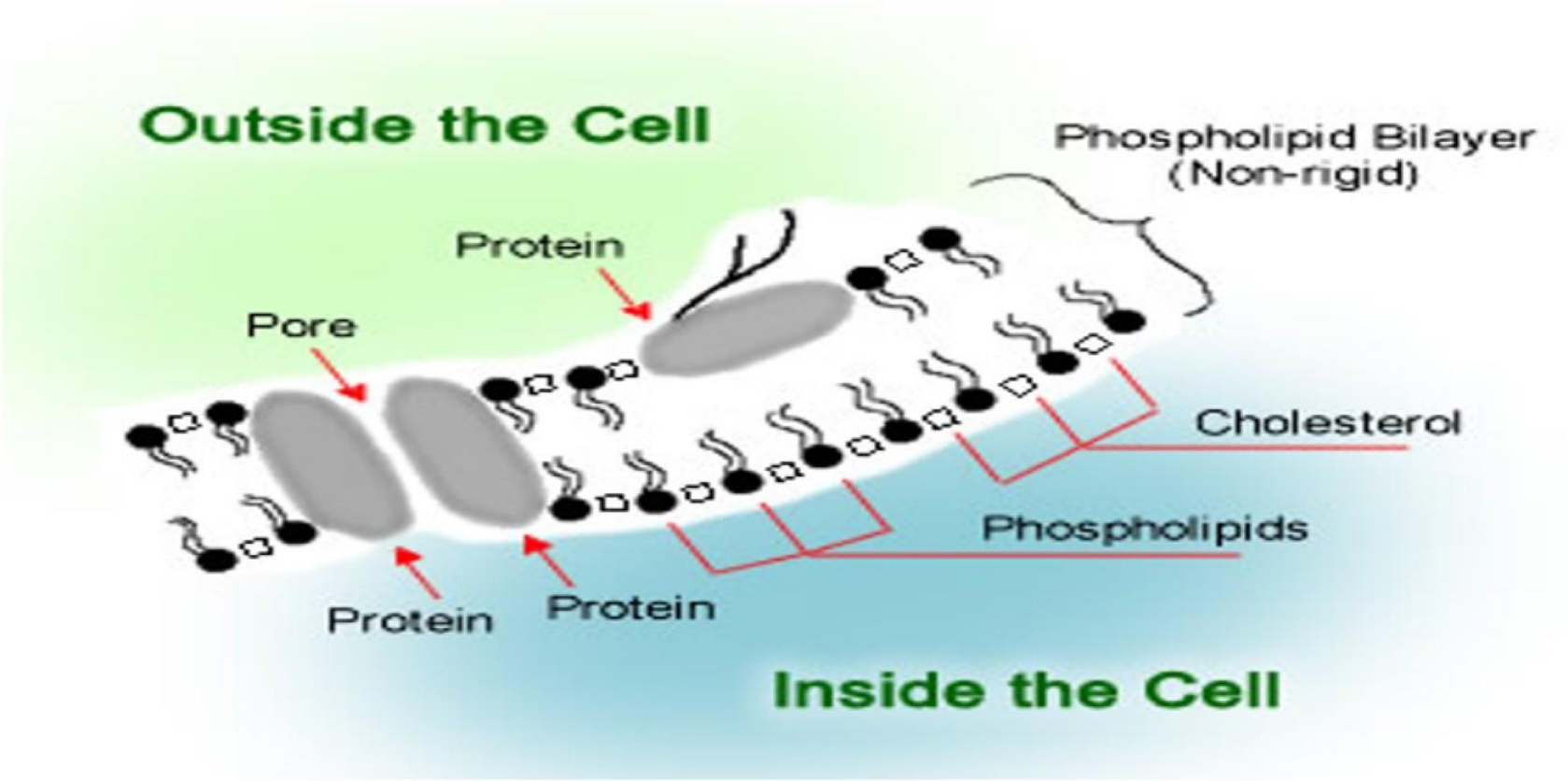
- **PROKARYOTES**
- **EUKARYOTES.**





Cell Structure and Function

1- **Cell Membrane**(plasma membrane).



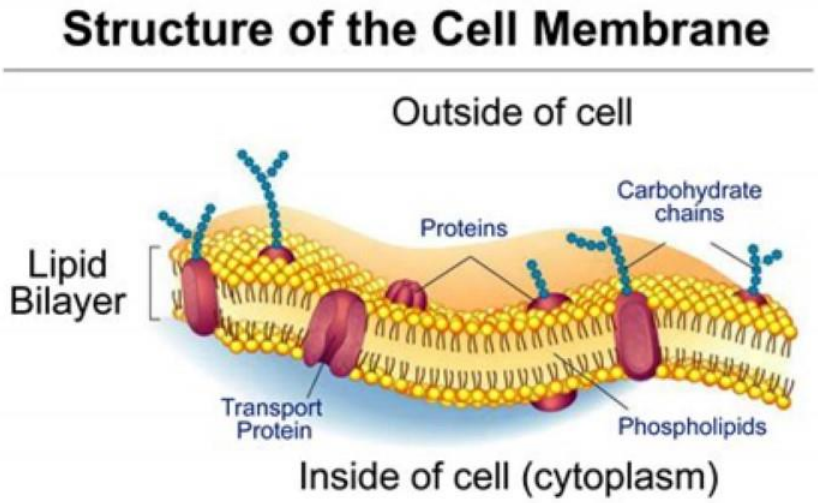
The cell membrane functions :

1-transport of materials in and out of cell,

2-recognition,

3-communication,

4-homeostasis.



Receptors and communication

- cells communicate with each other through surface protein (markers) .

- Cell membranes often include receptor sites for interaction with specific biochemicals.

Homestasis

- is the property of a system in which variables are regulated so that internal conditions remain stable and relatively constant , examples:

regulation of temperature , PH , and various solutes across the cell membrane .

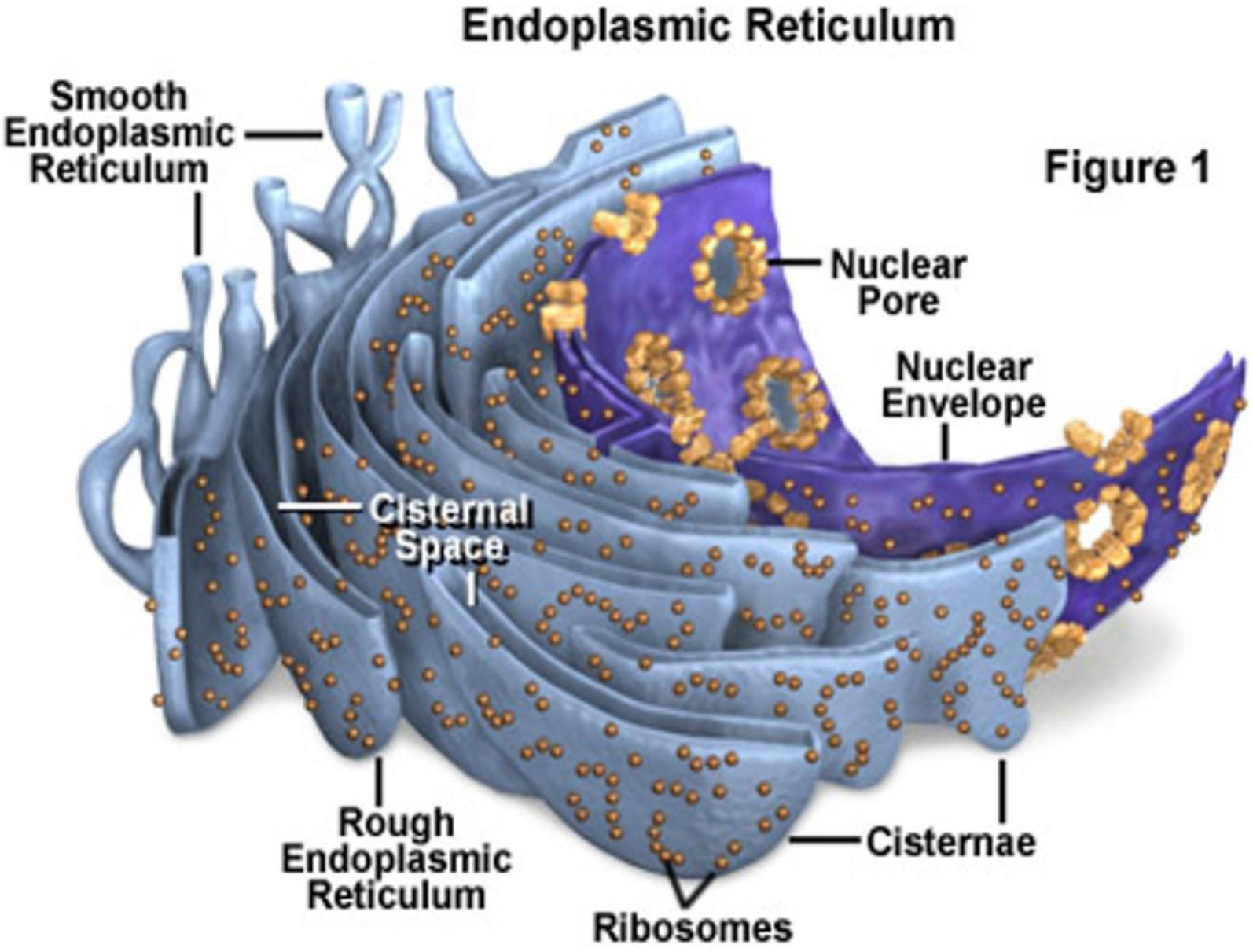
2- Nucleus :

- Nucleus is the control center or "brain" of cell (controls cell functioning and reproduction). Contains the DNA and is site of manufacture of RNA. The DNA is contained by a number of chromosomes, which consist of long strands of DNA tightly arranged into coils with proteins called histones. The combination of DNA and histone proteins is known as CHROMATIN.
- The nucleus, therefore, determines the metabolism, growth, differentiation, structure, and reproduction of cell.

3. **Organelles**:

- Endoplasmic Reticulum (ER)

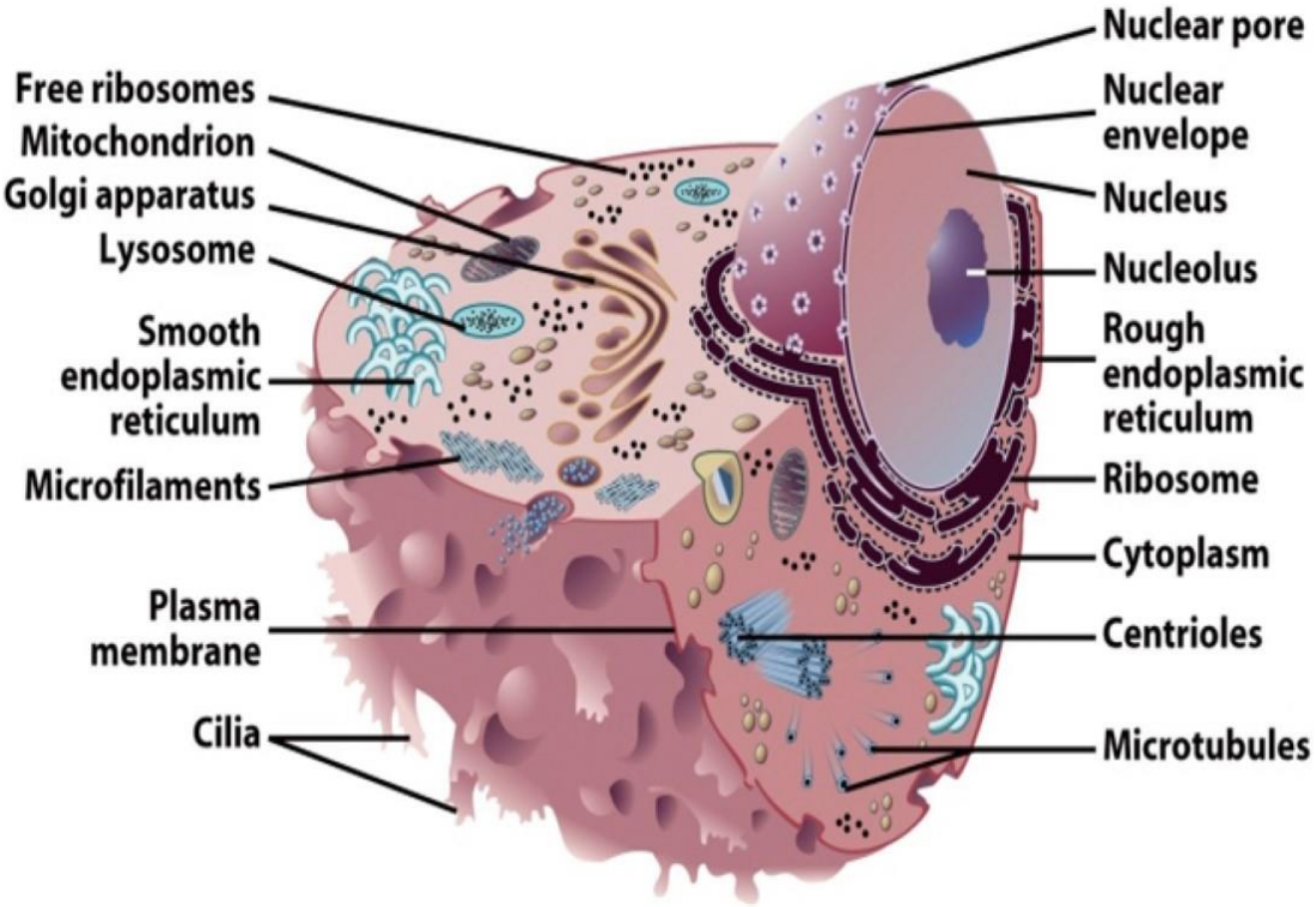
- the **ER** is a system of MEMBRANOUS TUBULAR CANALS that begins just outside the nucleus and branches throughout the cytoplasm. • if ribosomes are attached to the ER, it is called ROUGH Endoplasmic Reticulum. The function of rough ER is protein synthesis. if no ribosomes are attached to the ER, it is called SMOOTH Endoplasmic Reticulum. The function of smooth ER is synthesis of lipids (Lipids are required for the growth of the cell membrane and for the membranes of the organelles within the cell and are often used to make hormones).


Endoplasmic Reticulum
Smooth Endoplasmic Reticulum
Figure 1
Nuclear Pore
Nuclear Envelope
Cisternal Space
Rough Endoplasmic Reticulum
Cisternae
Ribosomes

Golgi apparatus

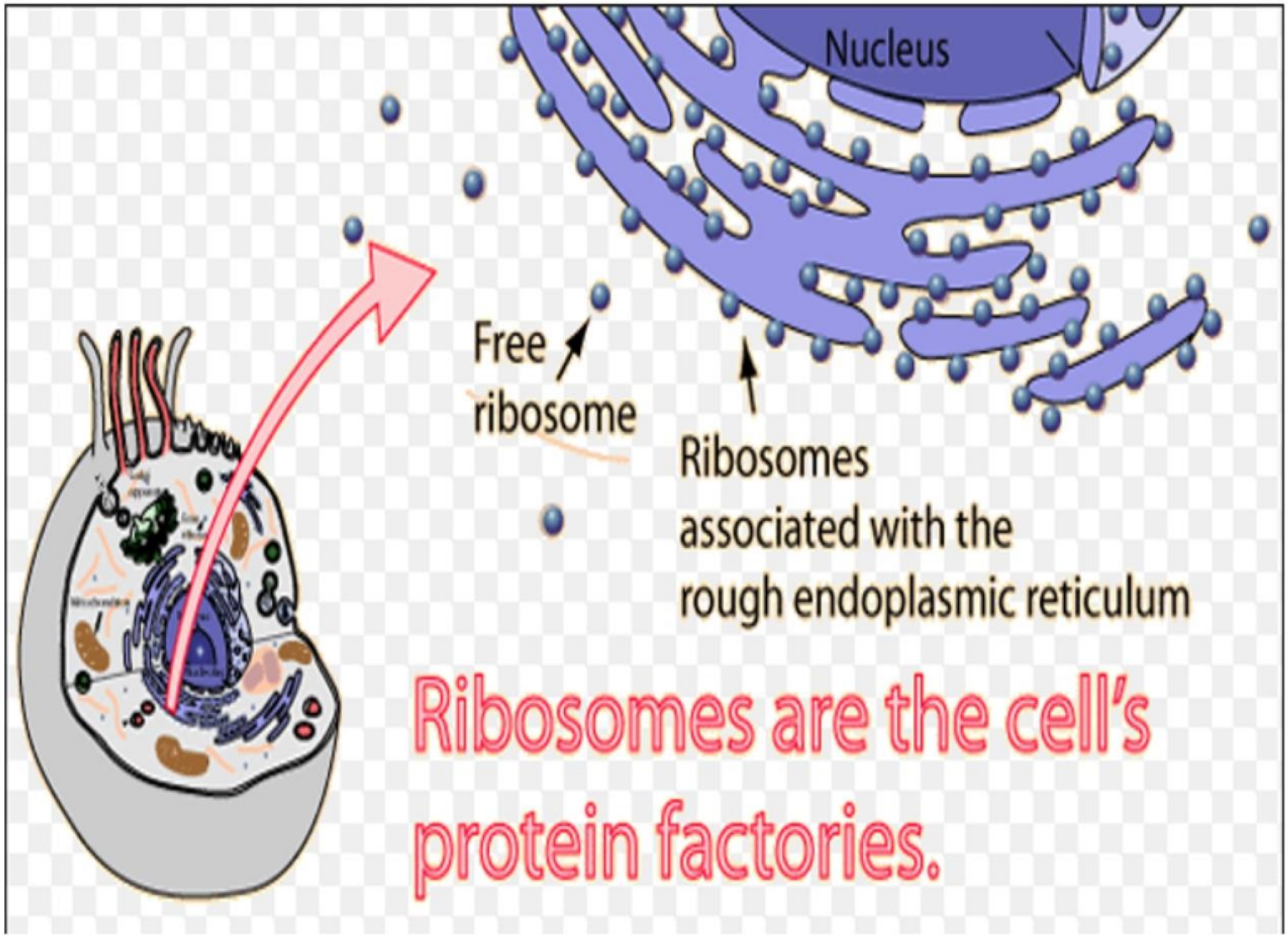
- The Golgi apparatus found universally in both plant and animal cells, it is typically composed of a series of five to eight cup-shaped, membrane-covered sacs called cisternae that look something like a stack of deflated balloons.

Animal Cell Structure and Function

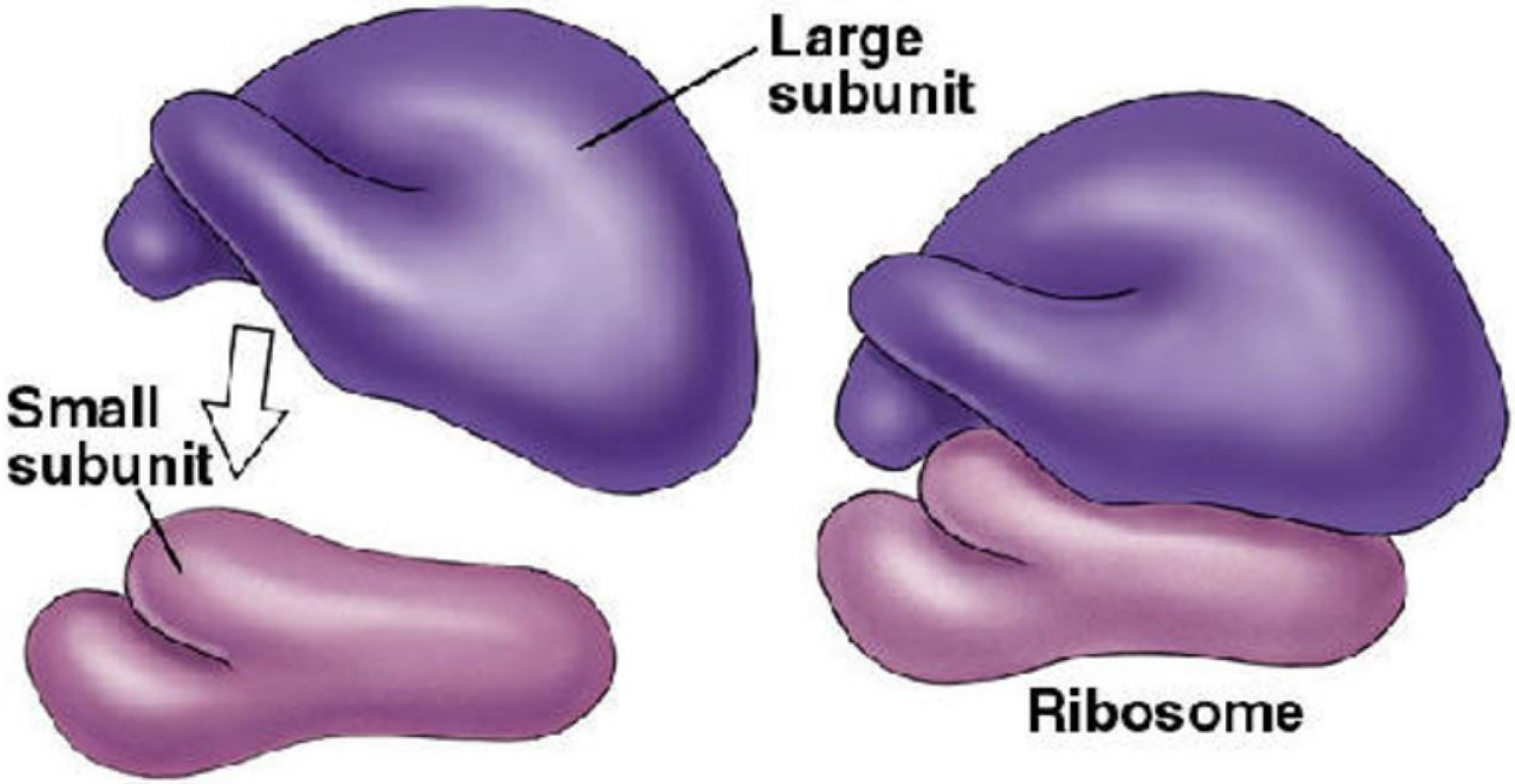


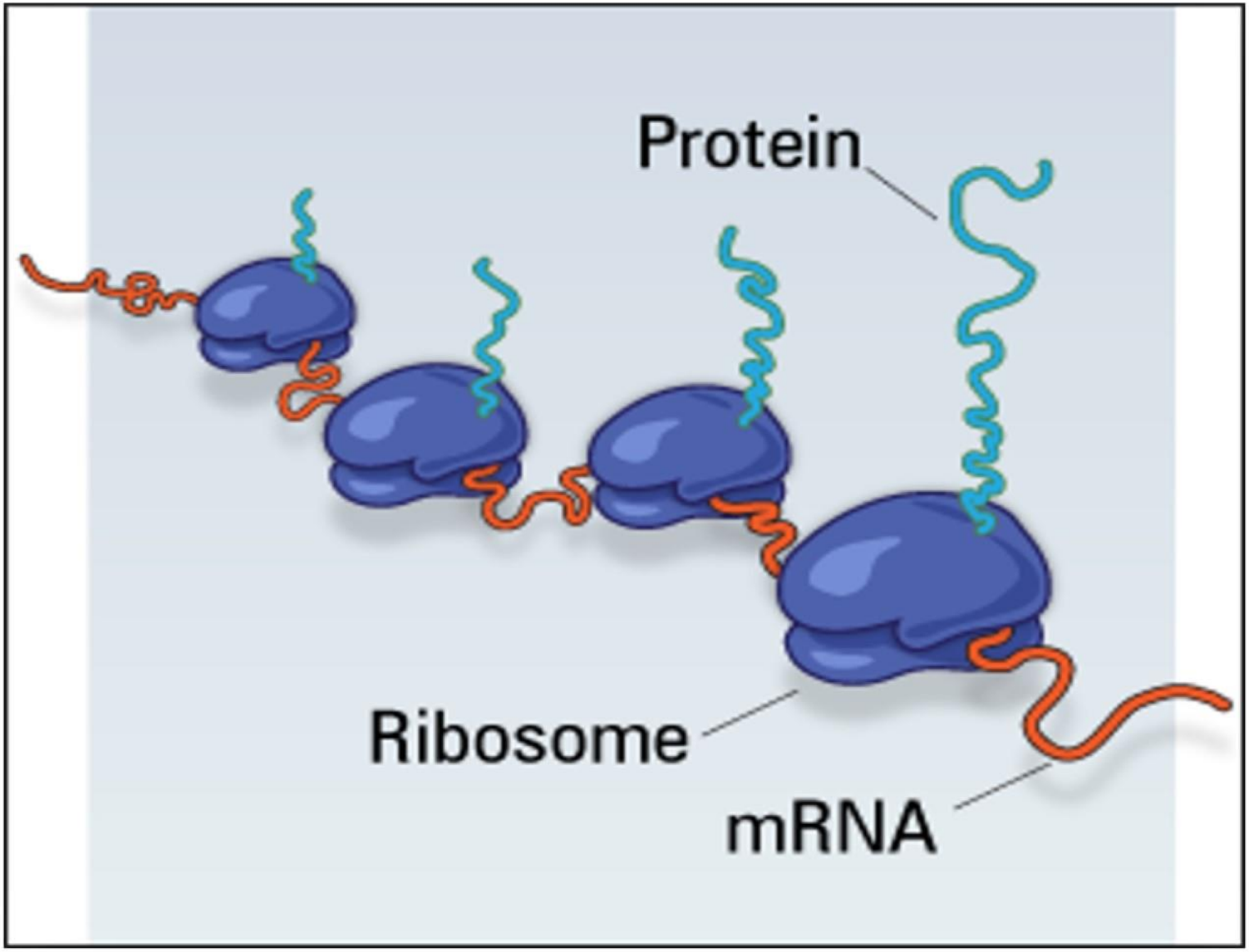
Ribosomes:

- A ribosome is a cell organelle. It functions as a micro-machine for making proteins. Ribosomes are composed of special proteins and nucleic acids. The TRANSLATION of information and the Linking of AMINO ACIDS are at the heart of the protein production process ,


Nucleus
Free ribosome
Ribosomes associated with the rough endoplasmic reticulum
Ribosomes are the cell's protein factories.

Ribosome




Protein
Ribosome
mRNA

Vacuoles and Vesicles: Storage Depots

- A **VESICLE** is a small **vacuole**
- vacuoles and vesicles are formed by:

1) pinching off from the Golgi apparatus.
2) endocytosis of the cell membrane.

they are used for **transport** and **storage** of materials.

Lysosomes: Cellular "Stomach"

• special vesicles which are formed by the Golgi apparatus. • contain powerful hydrolytic enzymes •

functions in

1) cellular digestion.

2) Auto digestion or disposal of damaged cell components like mitochondria.

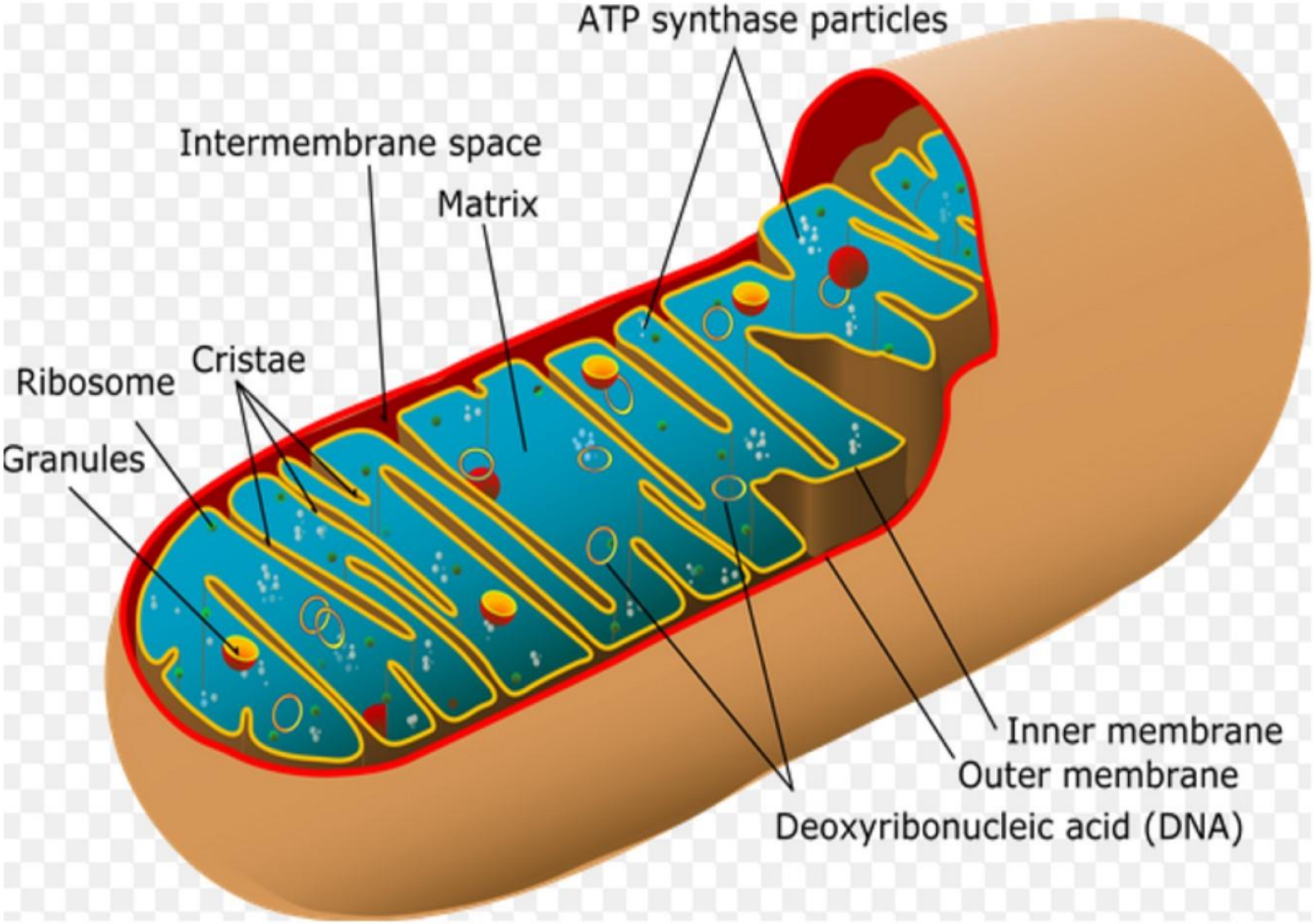
3) breakdown of a whole cell (by releasing their contents into the cell cytoplasm). For this reason, they are sometimes called "*suicide sacs*."

4) destroy invading bacteria.

Mitochondria: the Cell's Powerhouse

- Function is AEROBIC ENERGY METABOLISM (also called CELLULAR RESPIRATION). Converts glucose and fatty acids to ATP, the cell's primary energy molecule, as well as lesser amounts of other energy rich molecules. The overall formula for cellular respiration is:

- Carbohydrate + O2 " CO2 + H2O + ENERGY (i.e. ATP)


ATP synthase particles
Intermembrane space
Matrix
Cristae
Ribosome
Granules
Inner membrane
Outer membrane
Deoxyribonucleic acid (DNA)

Cytoplasm:

- Viscous fluid between nucleus and cell membrane Function as protected environment for various structures of cells and suitable environment for various process of cells to take place.
- components of cytoplasm
  - Interconnected filaments & fibers
  - Fluid = cytosol
  - Organelles (not nucleus)
  - storage substances