Lec. 2
CELLULAR ORGANELLES
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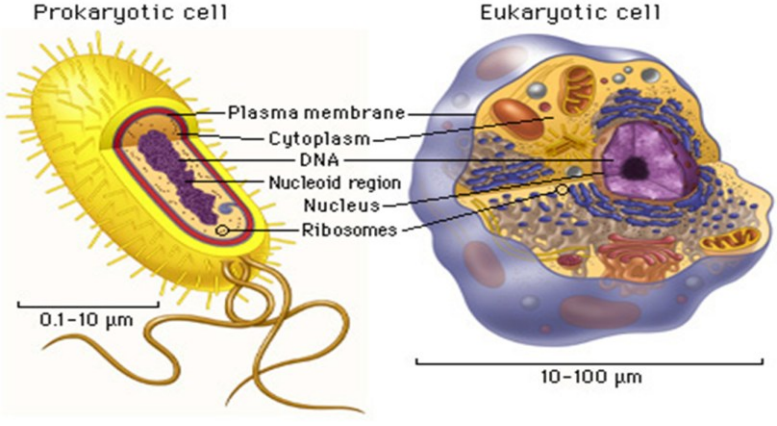
Cell Theory

- All living things are made up of cells.
- Cells are the smallest working units of all living things.
- All cells come from preexisting cells through cell division.
- **Cell definition** : A cell is the smallest unit that is capable of performing life functions.



What's the difference between prokaryotes and eukaryotes?

- **Prokaryotic cells** were here first and for billions of years were the only form of life on Earth. All **prokaryotic** organisms are **unicellular**
- **Eukaryotic cells** appeared on earth long after **prokaryotic cells** but they are much more advanced. **Eukaryotic** organisms unlike **prokaryotic** can be **unicellular** or **multicellular**.

	Prokaryotes	Eukaryotes
DNA	DNA is naked	DNA bound to protein
	DNA is circular	DNA is linear
	Usually no introns	Usually has introns
Organelles	No nucleus	Has a nucleus
	No membrane-bound	Membrane-bound
	70S ribosomes	80S ribosomes
Reproduction	Binary fission	Mitosis and meiosis
	Single chromosome (haploid)	Chromosomes paired (diploid or more)
Average Size	Smaller (~1–5 µm)	Larger (~10–100 µm)

•Cytoplasm

- **is viscous,semifluid and jelly-like material which is found between cell membrane and nucleus.All metabolism** (many vital biochemical reactions**) occurs in it.**

Structure of Cytoplasm

It has two main parts

∗Cytosol (Nonliving components of the cytoplasm)

***Organelles (living components of the cytoplasm)**

• Cytosol

- **-Most of the cytosol is composed of water.The amount however varies according to the type of cell.for example human cell which is composed of only 65 %water.**
- **-Cytosol also contains both organic and inorganic molecules. Organic molecules constitute 90 % of the structural components of the cytosol (protein, carbohydrate, lipid, enzymes where as inorganic molecules constitute only 10% of it.**

ORGANELLES

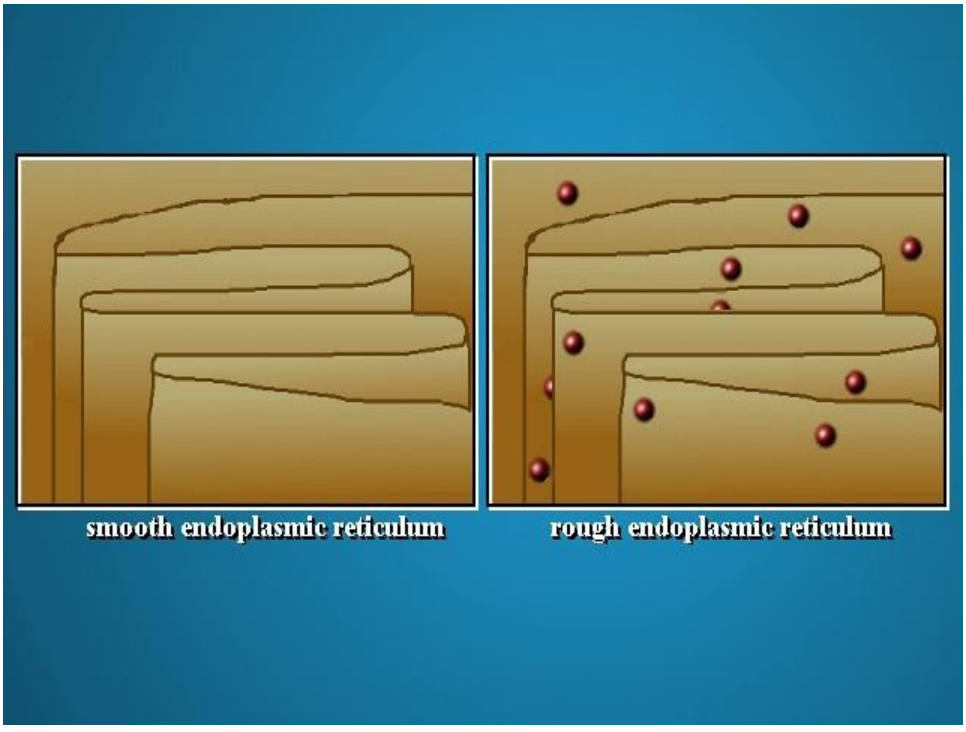
- **They comprise the essential machinery that perform all cell activities.**
- **They are specialised to perform a variety of specific functions**

ORGANELLES

•Ribosome	Golgi Body
•Endoplasmic reticulum	Lysosome
•Mitochondria	Centriole
•Vacuole	Plastids

Endoplasmic reticulum

- The ER is system of membranous tubules and canals or channels.
- The membranes of the ER are similar in structure to the cell membrane and nuclear membrane.
- These canals generally form a continuous network throughout the cytoplasm.
- The canals of the ER serve as transport of materials within cells .
- It is located between plasma membrane and nuclear membrane.
- ER is categorized into two groups according to its structure: Rough ER and Smooth ER.



Rough ER

- In Rough ER, the outer surfaces of the membranes are lined with tiny particles called ribosomes. The ribosomes give the membrane a granular appearance.
- It provides distribution of synthesized substances such as protein.
- Proteins synthesized at the ribosome pass via the channels of the ER to the Golgi apparatus where they are capsulated and secreted.

•Smooth ER

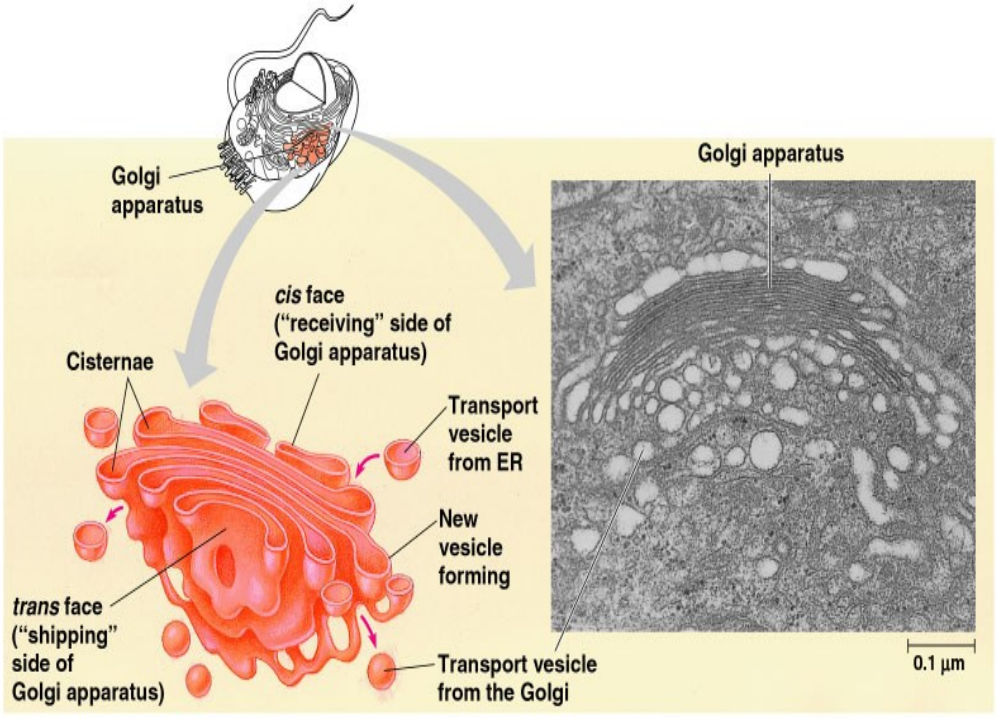
- On smooth ER there are no ribosomes.
- Smooth ER is plays a role in the synthesis and metabolism of lipids.
- It is generally found in the liver, testis, ovaries and stomach

Functions of Endoplasmic Reticulum

- Support of cellular structures and maintenance of their shape.
- Intercellular transport of ions and small molecules.
- Transport of protein molecules synthesized by the ribosomes to the Golgi apparatus.
- Synthesis of lipid molecules.

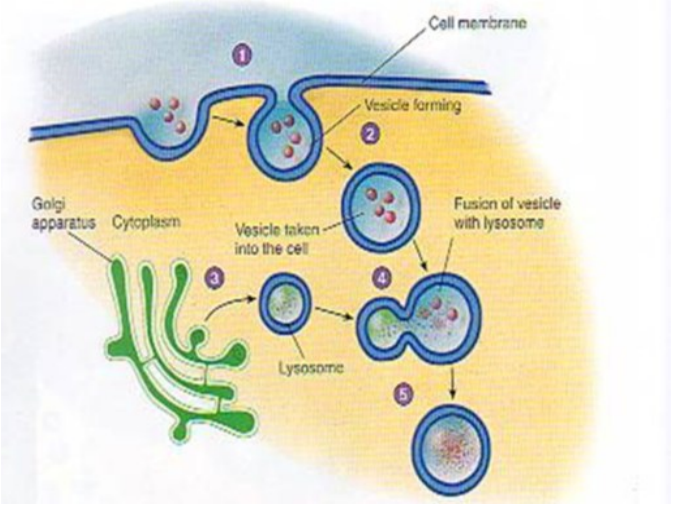
The Golgi Apparatus

- It consist of a stack of membranes forming flattened sacs and small vesicles.
- Golgi bodies serve as processing, packaging and storage centers for secretory products of the cell.
- May also chemically modify the proteins by attaching carbohydrates or lipids to them
- Found in great number in cells that make a great deal of protein e.g. pancreas



Lysosomes

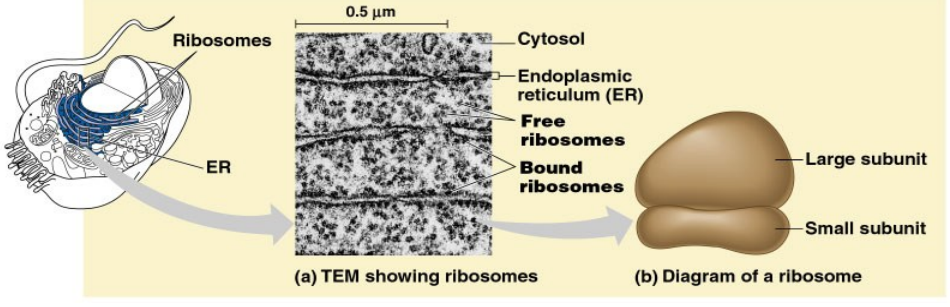
- Lysosomes are small, saclike structures surrounded by a single membrane.
- Lysosomes are membrane bound vesicles formed from the golgi apparatus . They contain a strong digestive or hydrolytic enzymes that functions as intracellular digestive systems
- They are found in most animal cells



•Ribosomes

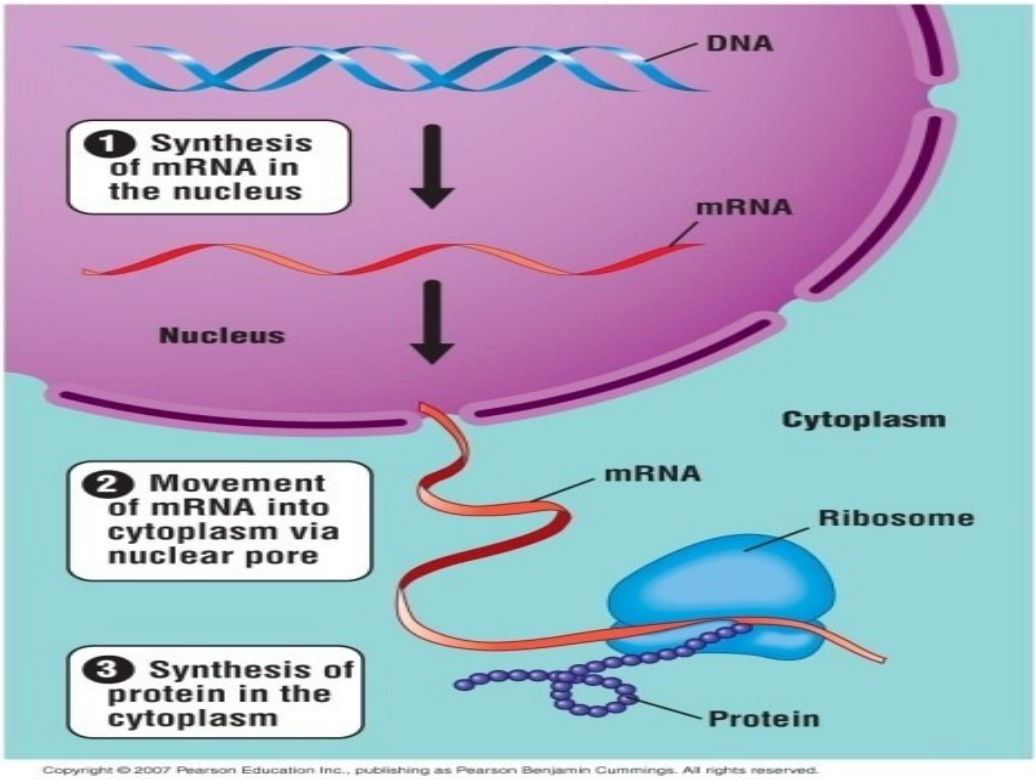
- They are the sites of protein synthesis in the cell.
- They are found both free in cytoplasm and lining the membranes of the ER.
- with no Membranes

- Ribosomes contain rRNA and protein.
- A ribosome is composed of two subunits that combine to carry out protein synthesis



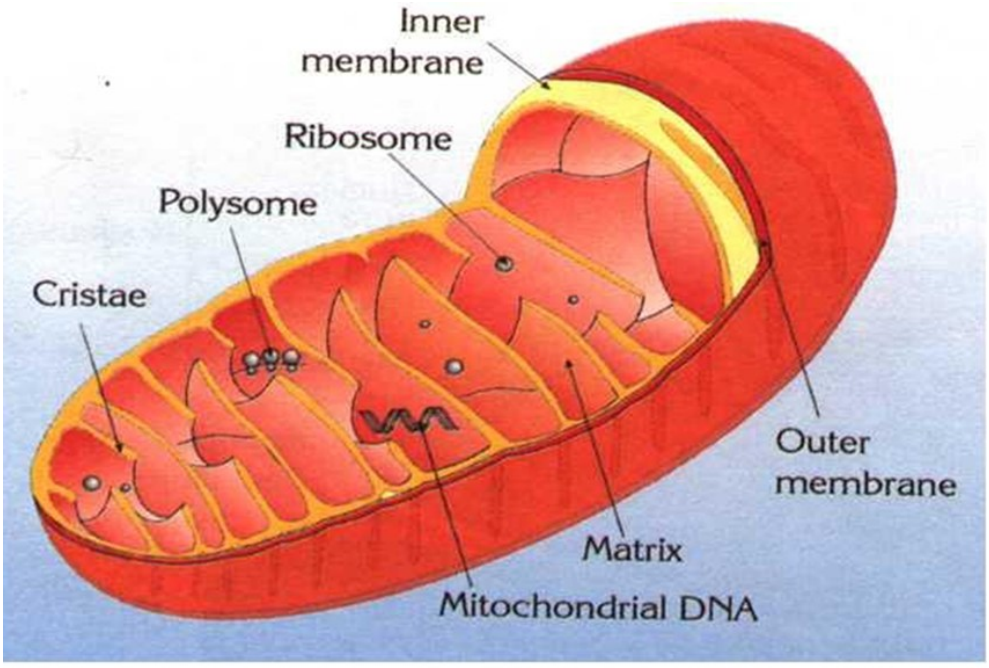
Location of ribosome

- free in the cytoplasm (of all cells, prokaryotic and eukaryotic alike)
- attach to the endoplasmic reticulum
- attach to nuclear envelope
- are in the nucleoli
- are in mitochondria
- are in chloroplasts



Mitochondria

- Double unit membrane
- The outer membrane is smooth but inner membrane is folded into the matrix to form cristae.
- The cristae of the mitochondria provide a large surface area on which many biochemical reactions occur.
- ATP synthesized by enzymes on cristae from energy extracted from organic compounds



- Space between cristae called the matrix

- contains ribosomes minerals, water, proteins and small, circular DNA (mitochondrial DNA)

- Mitochondrial DNA is circular and can replicate itself, thus a mitochondria can regulate and perform its own metabolic activities.(Reproduce independently of cell and live for 10 days)

- Active cells, such as muscle cells, which use much energy, contain large number of mitachondria.Therefore this organelle is often called powerhouse of the cell.

Cilia and Flagella

- Cilia and flagella are hairlike organelles whith capacity for movement.

- They extend out from the surface of many different types of cell.

- There are usually only a few flagella on a cell, but cilia often cover the entire cell surface.

- In unicellular organisms, cilia and flagella are involved in the cell movement.