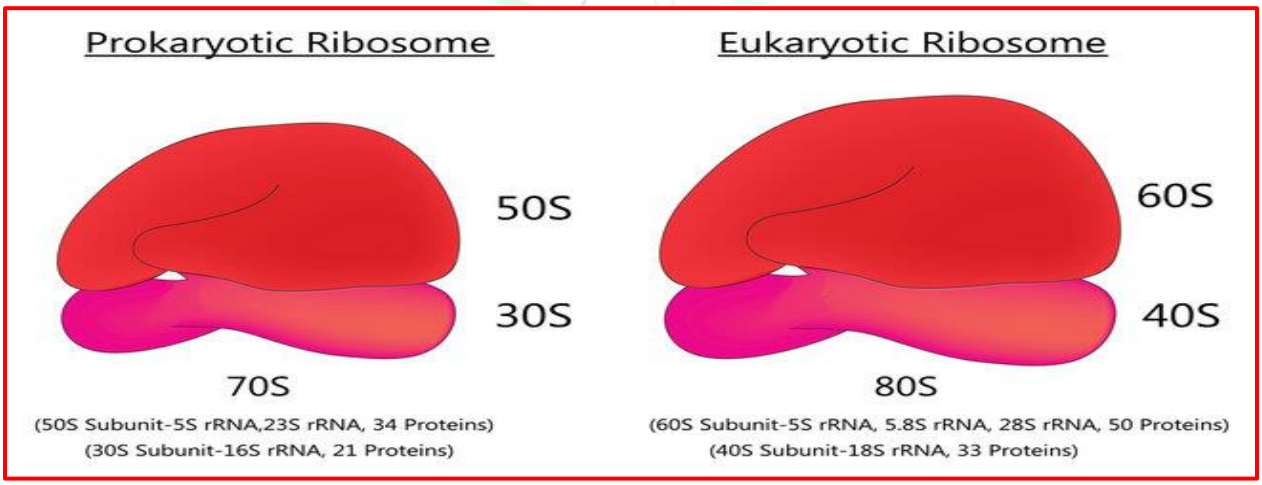
Ribosomes

The ribosomes are sub-microscopic particles that appear as round or spherical body in the cytoplasmic region of the cell.

Ribosomes are the protein synthesis units of a cell described by G.E. Palade in 1952.

In eukaryotes, the ribosomes are (20 – 30) nm, and in prokaryotes they are slightly smaller. In both types of cells, ribosomes are composed of two subunits, one large and one small. The two subunits come together by binding an mRNA strand, and typically numerous ribosomes are present on an mRNA as **polyribosomes (polysomes).**

The number of ribosomes in a cell varies depending on its functions, for example, pancreatic cells and those of other glands have many ribosomes because they produce secretions that contain proteins.



Locations

In eukaryotic cells, some ribosomes occur freely within the cytoplasm like in (lymphocytes, embryonic nerve cells and cancerous cells) or in groups called **polyribosomes,** and others are attached to the endoplasmic reticulum (ER) like in (pancreatic cells, plasma cells, hepatic parenchymal cells, adult nerve cell (Nissls bodies) and osteoblasts. In prokaryotic cells the ribosomes often occur freely in the cytoplasm or sometimes as polyribosome.

Functions of Ribosomes

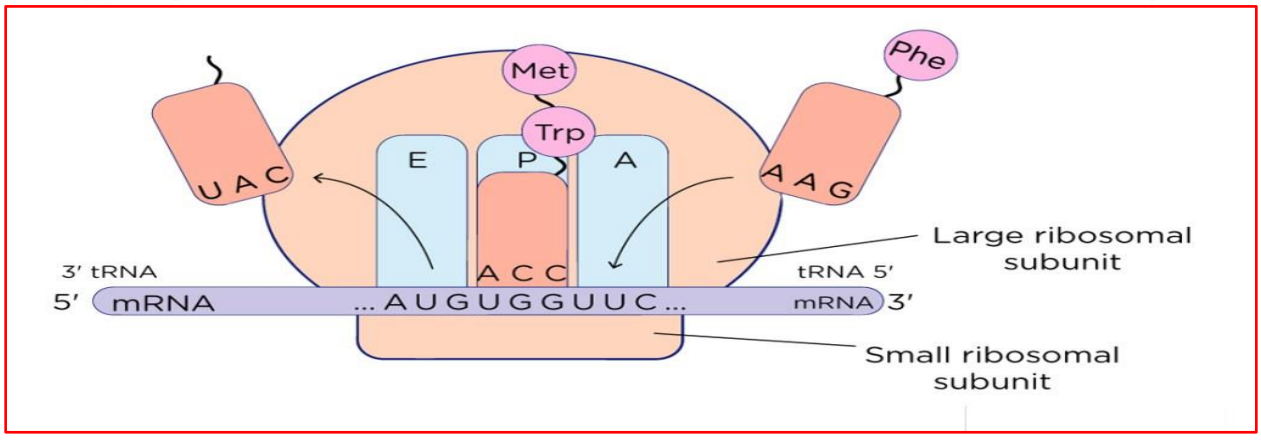
The ribosome is a complex molecular machine, found within all living cells, that serves as the site of biological protein synthesis (translation).

Ribosomes link amino acids together in the order specified by messenger RNA (mRNA) molecules.

Ribosomes act as catalysts in two extremely important biological processes called peptidyl transfer and peptidyl hydrolysis.

Two populations of ribosomes in cells: free ribosomes (in the cytosol) and bound ribosomes (attached to the ER). Free ribosomes mostly synthesize proteins that function in the cytosol.

Bound ribosomes make proteins of the endomembrane system and proteins that are secreted from the cell. Ribosomes are identical and can switch from free to bound.



The Endomembrane system

The Endomembrane system (endo =within) is a group of membranes and organelles in eukaryotic cells that works together to modify ,package and transport Lipids and proteins. It includes the, nuclear envelope, endoplasmic reticulum, , Golgi apparatus, lysosome ,vacuoles, vesicles, endosomes, plasma membrane , the endomembrane system doesn't include the membrane of either mitochondria and chloroplast .

Endoplasmic reticulum (ER)

Endoplasmic reticulum (ER) and Golgi body are single membrane bound structures. The membrane has the same structure (lipid-protein) as the plasma membrane but ribosomes do not have membranes Ribosomes are involved in synthesis of substances in the cell, Golgi bodies in secreting and the ER in transporting and storing the products. These three organelles operate together.

the ER are different from cells to cell, a cell´s function determine the size and structure of the ER. for example, some cells, such as sperm cells and red blood cells, do not have an ER of any kind. Cells that synthesis and release a lot of protein would need a large amount of ER. The pancreas or liver for good examples of cells with large ER structure.

Endoplasmic reticulum has two types:

-Rough endoplasmic reticulum (RER) studded with membrane - bound ribosomes.

-Smooth endoplasmic reticulum (SER) (Lacks ribosomes).

all these structure (tubules and sacs) are held in their place by the cytoskeleton.

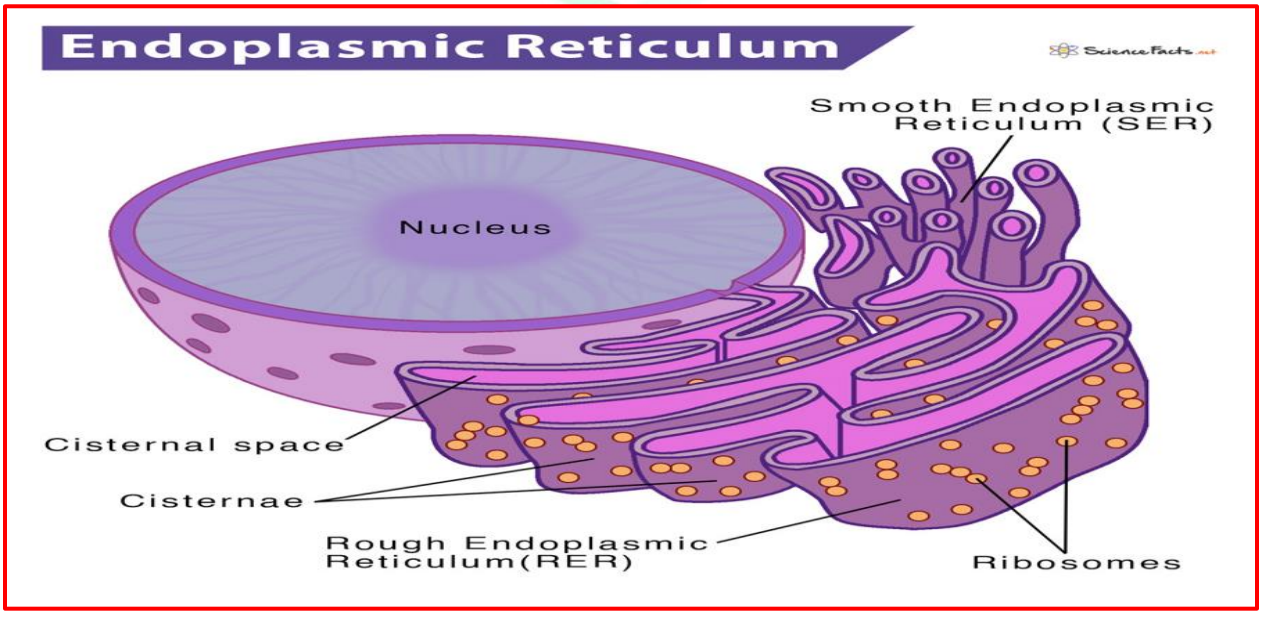
The endoplasmic reticulum acts as an Intracellular circulatory or transporting system .the ER function as a manufacturing and packaging system .it works closely with the Golgi apparatus ,ribosomes ,mRNA and tRNA.

Smooth E.R. function

1. Synthesis of steroid hormones (e.g. cells of the gonads and endocrine glands)
2. Detoxification of a variety of organic compounds in the liver (e.g. barbiturates and ethanol)
3. Release of glucose from glycogen by Glucose 6- phosphate
4. Sequestration and regulated release of calcium ions (e.g. skeletal muscle cells—sarcoplasmic reticulum) .

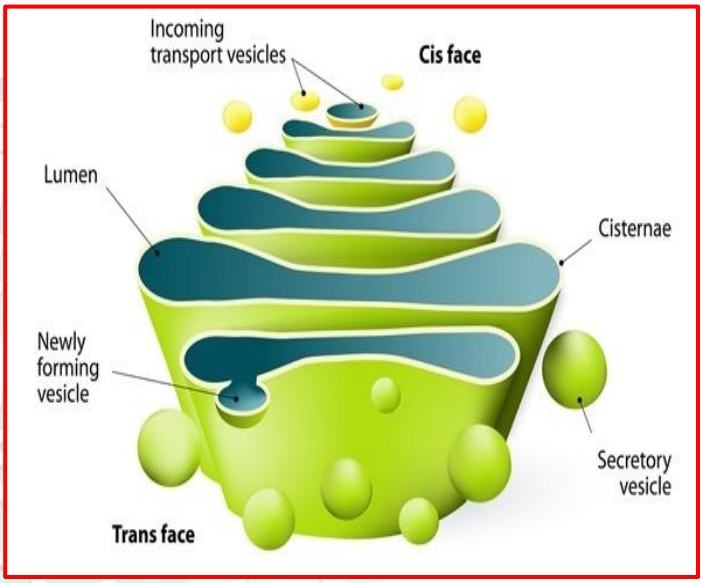
Rough E.R. Function

1. Synthesis of secreted and membrane bound proteins.
2. 2. post-translational modification of membrane proteins (e.g. glycosylation and lipid modification)
3. Membrane biosynthesis



Golgi apparatus

The Golgi consists of a stacked series of flattened, membranous saccules that are interconnected by a complex network of anastomosing tubules. It is polarized into a convex forming face (cis face) and a concave maturing face (trans face). Transfer vesicles from the RER fuse with the saccule of the forming face, and after suitable processing within the Golgi, the membrane-bound product emerges from the maturing face.



The Golgi apparatus is the only cell organelle to be named after a scientist. The visible characteristics of the organelle were first reported by Camillo Golgi (1843-1926) at a meeting of the Medical Society of Pavia on 19 April 1898 when he named it the ‘internal reticular apparatus.

Golgi apparatus, also called Golgi complex or Golgi body, membrane-bound organelle of eukaryotic cells (cells with clearly defined nuclei) that is made up of a series of flattened, stacked pouches called cisternae. The Golgi apparatus is responsible for transporting, modifying, and packaging proteins and lipids into vesicles for delivery to targeted destinations. It is located in the cytoplasm next to the endoplasmic reticulum and near the cell nucleus. While many types of cells contain only one or several Golgi apparatus, plant cells can contain hundreds.

Function of Golgi apparatus

1. Post-translational modification of proteins

- ☒ Glycosylation; Membrane-bound enzymes add terminal sugars to glycoproteins (core sugars were added in the RER).
- ☒ Sulfation: Membrane-bound enzymes add sulfate groups to proteins.
- ☒ Phosphorylation: Membrane-bound enzymes add phosphate groups to proteins.
- ☒ Proteolysis: Cleavage of some precursor proteins, e.g., prohormones

2. Sorting and packaging of modified proteins

Most proteins processed by the Golgi are either secretory proteins for export or hydrolytic enzymes for cell use. These two kinds of proteins are segregated and packaged separately by the Golgi.

3. Constitutive secretion

Secretory products are produced and released continuously.

4. Regulated secretion

Secretory products are released in response to specific stimuli.

Hydrolytic enzymes are similarly packaged in membrane-bound vesicles called lysosomes.