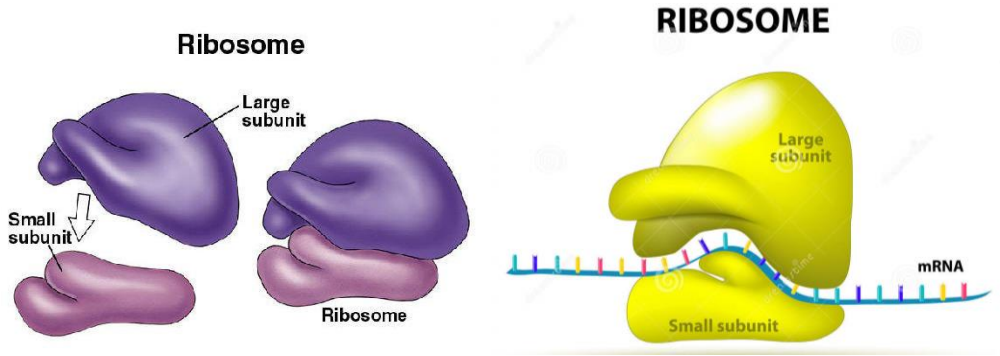
What are Ribosomes?

The ribosome is a complex molecular machine found inside the living cells that make proteins from amino acids in the process called protein synthesis or translation. Protein synthesis is a major task performed by living cells.

Ribosomes are special organelles as they are found in both prokaryotic and eukaryotic cells. Every cell needs ribosomes to manufacture proteins.

It binds to a messenger ribonucleic acid (mRNA) and decodes the information carried by the nucleotide sequence of the mRNA. The transfer RNAs (tRNAs) containing amino acids enter the ribosome at the acceptor site. When it binds correctly, it adds amino acid to the growing protein chain on tRNA.

- Ribosomes can be found floating within the cytoplasm or attached to the endoplasmic reticulum.
- The location of the ribosomes in a cell determines what kind of protein it makes. If the ribosomes are floating freely throughout the cell, it will make proteins that will be utilized within the cell itself.



Ribosomes Structure

A ribosome is a complex of RNA and protein and is, therefore, known as a ribonucleoprotein. It is made up of two subunits. The **smaller subunit** is where the mRNA binds and is decoded.

While the **larger subunit** is where the amino acids get added. Both of the subunits are made up of both protein and ribonucleic acid components.

The two subunits are joined to each other by interactions between the rRNAs in one subunit and proteins in the other subunit.

In an animal or human cell, there could be up to 10 million ribosomes and numerous ribosomes can be connected to the equivalent mRNA strand, this structure is known as a **POLYSOME.**

Ribosomes are located inside the cytosol found in the plant cell and animal cell.

The **ribosome structure** includes the following:

- It is located in two areas of cytoplasm.
- Scattered in the cytoplasm.
- Prokaryotes have 70S ribosomes while eukaryotes have 80S ribosomes.
- Eukaryotes have 80S ribosomes respectively comprising of little (40S) and substantial (60S) subunits.
- The smaller 40S ribosomal subunit is prolate ellipsoid in shape and consists of one molecule of 18S ribosomal RNA (or rRNA) and 30 proteins (named as S1, S2, S3, and so on).
- The larger 60S ribosomal subunit is round in shape and contains a channel through which growing polypeptide chain makes its exit.
- It consists of three types of rRNA molecules, i.e., 28S rRNA, 5.8 rRNA and 5S rRNA, and 40 proteins (named as L1, L2, L3 and so on).
- Around 62% of ribosomes are comprised of RNA, while the rest is proteins.
- The structure of free and bound ribosomes is similar and is associated with protein synthesis.

Ribosomes Function

The important ribosome function includes:

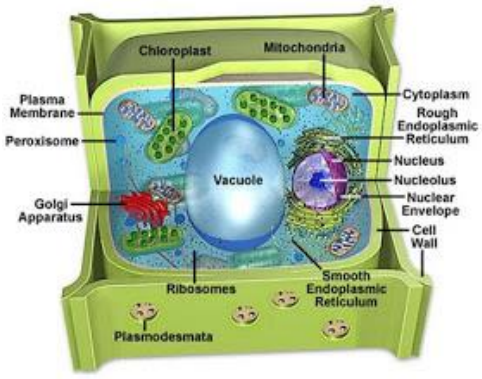
1. It assembles amino acid to form proteins that are essential to carry out cellular functions.
2. The DNA produces mRNA by the process of DNA transcription.
3. The mRNA is synthesised in the nucleus and transported to the cytoplasm for the process of protein synthesis.
4. The ribosomal subunits in the cytoplasm are bound around mRNA polymers. The tRNA then synthesises proteins.
5. The proteins synthesised in the cytoplasm are utilised in the cytoplasm itself, the proteins synthesised by bound ribosomes are transported outside the cell.

How are prokaryotic ribosomes different from eukaryotic ribosomes?

Prokaryotic ribosomes include three separate rRNA molecules whereas eukaryotic ribosomes comprise four separate rRNA molecules. Prokaryotic ribosomes contain the small ribosomal subunit (70S), whereas, eukaryotic ribosomes contain the large ribosomal subunit (80S).

Vacuoles

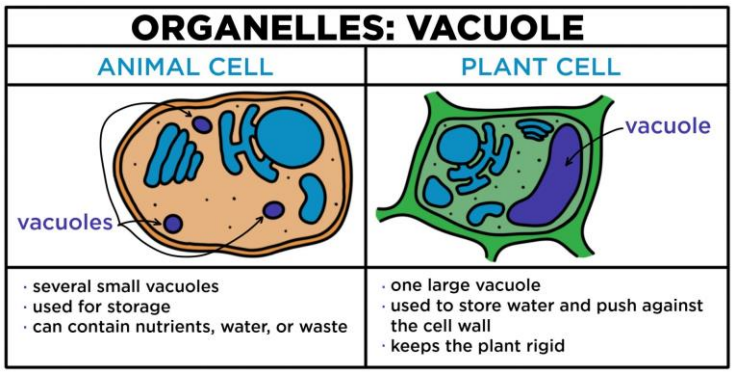
"Vacuoles are membrane-bound cell organelles present in the cytoplasm and filled with a watery fluid containing various substances."



What are Vacuoles?

The term "vacuole" means "empty space". They help in the storage and disposal of various substances. They can store food or other nutrients required by a cell to survive. They also store waste products and prevent the entire cell from contamination.

The vacuoles in plant cells are larger than those in the animal cells. The plant vacuoles occupy more than 80% of the volume of the cell. The vacuoles may be one or more in number.



Function

The functions of the vacuole include:

- Isolating materials that might be harmful or a threat to the cell
- Containing waste products
- Containing water in plant cells
- Maintaining internal hydrostatic pressure or turgor within the cell
- Maintaining an acidic internal pH
- Containing small molecules

- Exporting unwanted substances from the cell
- Allows plants to support structures such as leaves and flowers due to the pressure of the central vacuole
- By increasing in size, allows the germinating plant or its organs (such as leaves) to grow very quickly and using up mostly just water.
- In seeds, stored proteins needed for germination are kept in 'protein bodies', which are modified vacuoles.

The important functions of vacuole include:

Storage

A vacuole stores salts, minerals, pigments and proteins within the cell. The solution that fills a vacuole is known as the cell sap. The vacuole is also filled with protons from the cytosol that helps in maintaining an acidic environment within the cell. A large number of lipids are also stored within the vacuoles.

Turgor Pressure

The vacuoles are completely filled with water and exert force on the cell wall. This is known as turgor pressure. It provides shape to the cell and helps it to withstand extreme conditions.

Endocytosis and Exocytosis

The substances are taken in by a vacuole through endocytosis and excreted through exocytosis. These substances are stored in the cells, separated from the cytosol. Lysosomes are vesicles that intake food and digest it. This is endocytosis and it varies in different cells.

Why do plant cells have larger vacuoles?

The plant cells have larger vacuoles because they require more water, organic and inorganic components for the proper functioning of the cell.