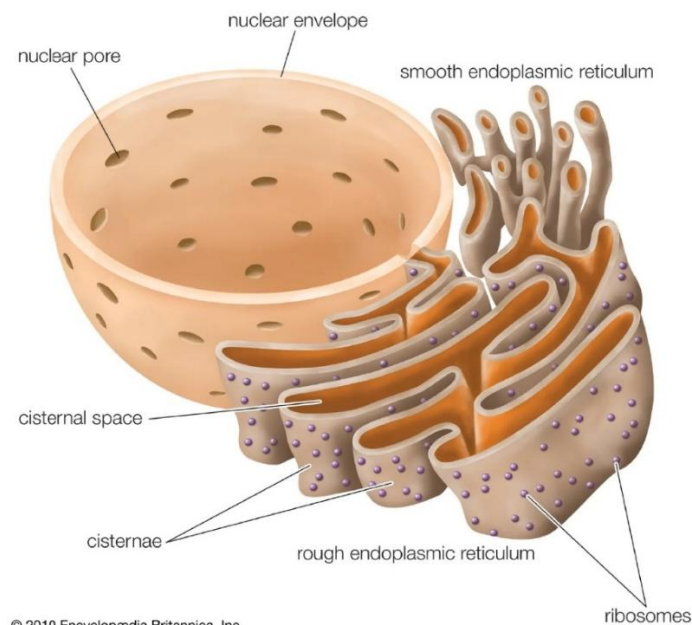


## **Endoplasmic Reticulum**

- Endoplasmic Reticulum is a complex network of tubular membranes exclusively present in the cytoplasm of the eukaryotic cell, **except sperm cells and red blood cells.**
- The endoplasmic reticulum(ER) is the transportation system of the eukaryotic cell and has many important functions such as protein folding, packaging, etc.
- The endoplasmic reticulum(ER) was discovered by **Keith R. Porter** and **Thomson** in 1945.

### **Structure of Endoplasmic Reticulum**



**Fig. Endoplasmic Reticulum**

The structure of the endoplasmic reticulum is shaped like a sac. Its tubular membranes form continuous folds, eventually joining the outer layer of the nuclear membrane. The endoplasmic reticulum presents in two forms: a type with a ribosome embedded surface and another with a smooth surface. The latter is called the **smooth endoplasmic reticulum**, and the former is called the **rough endoplasmic reticulum**.

Rough endoplasmic reticulum has ribosomes embedded within its structure, giving a “rough” appearance. The smooth endoplasmic reticulum does not have these ribosomes, hence appearing “smooth.”

Since ER is of two types, each has its own distinguishing features:

## **Rough Endoplasmic Reticulum Structure**

- The rough endoplasmic reticulum is named so because of its appearance.
- It is a series of connected flattened sacs having several ribosomes on its outer surface.
- It synthesizes and secretes proteins in the liver, hormones and other substances in the glands.
- Rough ER is prominent in cells where protein synthesis happens (such as hepatocytes)

## **Smooth Endoplasmic Reticulum Structure**

- The smooth endoplasmic reticulum, on the other hand, does not have ribosomes.
- The smooth endoplasmic reticulum has a tubular form.
- It participates in the production of phospholipids, the chief lipids in cell membranes and are essential in the process of metabolism.
- Smooth ER transports the products of the rough ER to other cellular organelles, especially the Golgi apparatus.

## **Functions of Endoplasmic Reticulum**

As stated above, the endoplasmic reticulum is categorised into two types, and both these types of ER perform specific functions:

### **Smooth Endoplasmic Reticulum Function:**

- Smooth ER is responsible for the **synthesis of essential lipids such as phospholipids and cholesterol.**
- Smooth ER is also responsible for the production and secretion of steroid hormones.
- It is also responsible for the metabolism of carbohydrates.
- The smooth ER store and releases calcium ions. These are quite important for the nervous system and muscular systems.

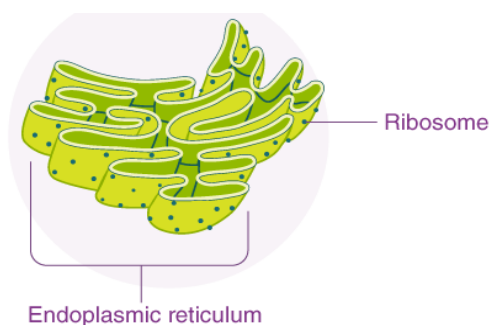
### **Rough Endoplasmic Reticulum Function:**

- The majority of the functions of rough ER is associated with protein synthesis.
- The rough endoplasmic reticulum also plays a vital role in protein folding.
- Also ensures quality control (regarding correct protein folding).
- The second most important function after protein synthesis and protein folding is protein sorting.

## Ribosome

- A ribosome is a complex molecular machine found inside the living cells that produce proteins from amino acids during a process called protein synthesis or translation. The process of protein synthesis is a primary function.
- Ribosome is present in large numbers in all living cells and serves as the site of protein synthesis.
- Ribosomes occur both as free particles in prokaryotic and eukaryotic cells and as particles attached to the membranes of the endoplasmic reticulum in eukaryotic cells.
- Ribosomes were discovered by **George E. Palade** in 1955, who found them to be frequently **associated with the rough endoplasmic reticulum** of eukaryotic cells.
- A ribosome is a complex of RNA and protein and is, therefore, known as a **ribonucleoprotein**.

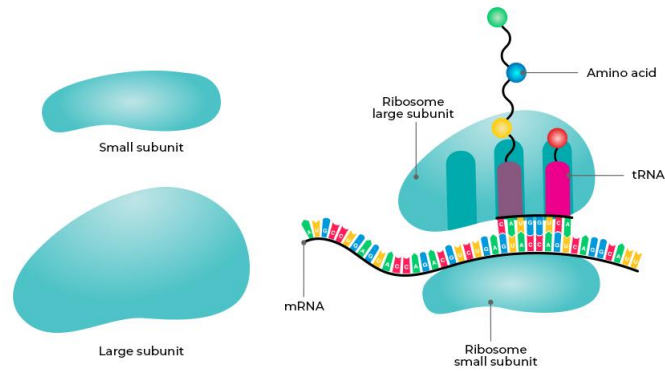
### Ribosomes Structure



It is composed of two subunits – smaller and larger.

The **smaller subunit** is where the **mRNA binds** and is decoded, and in the **larger subunit, the amino acids get added**. Both of the subunits contain both **protein and ribonucleic acid components**.

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



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 (**Some eukaryotic cells i.e. chloroplast and mitochondria contain 70S ribosomes**)
- 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 acids to form proteins that are essential to carry out cellular functions.
2. The DNA produces mRNA by the process of DNA transcription. The mRNA is synthesized in the nucleus and transported to the cytoplasm for the process of protein synthesis.
3. The ribosomal subunits in the cytoplasm are bound around mRNA polymers. The tRNA then synthesizes proteins.
4. Ribosomes are the site of protein synthesis.
5. The proteins synthesized in the cytoplasm are utilized in the cytoplasm itself, the proteins synthesized by bound ribosomes are transported outside the cell.