CELL BIOLOGY : STRUCTURE AND FUNCTIONS OF RIBOSOMES

Dr Poonam kumari
Professor

Dept Of Zoology
Maharaja college, Ara
(B.Sc Part III PAPER VI Zoology Hons)

Ribosomes are the granular structures first observed under the electron microscope as dense particles by George Palade (1953). They are composed of ribonucleic acid (RNA) and proteins and are not surrounded by any membrane. The eukaryotic ribosomes are 80S while the prokaryotic ribosomes are 70S. Here 'S' (Svedberg's Unit) stands for the sedimentation coefficient; it indirectly is a measure of density and size. Both 70S and 80S ribosomes are composed of two subunits.

1. Unlike most other organelles, ribosomes are not surrounded by a membrane.

2. Ribosomes are the site of protein synthesis in a cell.

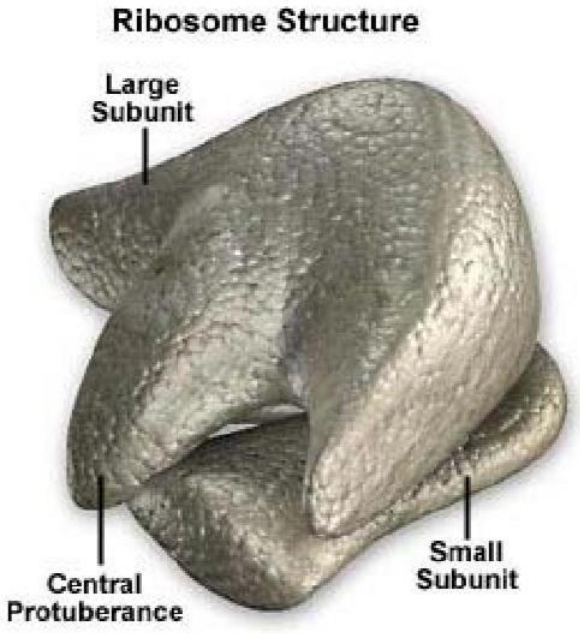
3. They are the most common organelles in almost all cells.

4. Some are free in the cytoplasm (Prokaryotes); others line the membranes of rough endoplasmic reticulum (rough ER).

5. They exist in two sizes: 70s are found in all Prokaryotes, chloroplasts and mitochondria, suggesting that they have evolved from ancestral Prokaryotic organisms. They are free-

floating. 80s found in all eukaryotic cells – attached to the rough ER (they are rather larger).

6. Groups of 80s ribosomes, working together, are known as a polysome.



STRUCTURE

Ribosomes are made of proteins and ribonucleic acid (abbreviated as RNA), in almost equal amounts. It comprises of two sections, known as subunits. The tinier subunit is the place the mRNA binds and it decodes, whereas the bigger subunit is the place the amino acids are included.

Both subunits comprise of both ribonucleic acid and protein components and are linked to each other by interactions between the proteins in one subunit and the rRNAs in the

other subunit. The ribonucleic acid is obtained from the nucleolus, at the point where ribosomes are arranged in a cell.

The structures of ribosomes include:

- Situated in two areas of the cytoplasm.
- They are seen scattered in the cytoplasm and a few are connected to the endoplasmic reticulum.
- Whenever joined to the ER they are called the rough endoplasmic reticulum.
- The free and the bound ribosomes are very much alike in structure and are associated with protein synthesis.
- Around 37 to 62% of RNA is comprised of RNA and the rest is proteins.
- Prokaryotes have 70S ribosomes respectively subunits comprising the little subunit of 30S and the bigger subunit of 50S. Eukaryotes have 80S ribosomes respectively comprising of little (40S) and substantial (60S) subunits.
- The ribosomes seen in the chloroplasts of mitochondria of eukaryotes are comprised of big and little subunits composed of proteins inside a 70S particle.
- Share a center structure which is very much alike to all ribosomes in spite of changes in its size.
- The RNA is arranged in different tertiary structures. The RNA in the bigger ribosomes is into numerous continuous infusions as they create loops out of the center of the structure without disturbing or altering it.
- The contrast between those of eukaryotic and bacteria are utilized to make antibiotics that can crush bacterial disease without damaging human cells.

FUNCTION

When it comes to the main functions of ribosomes, they assume the role of bringing together amino acids to form particular proteins, which are important for completing the cell's activities.

Protein is required for numerous cell functions, for example, directing chemical processes or fixing the damage. Ribosomes can yet be discovered floating inside the cytoplasm or joined to the endoplasmic reticulum.

The other functions include:

- The procedure of creation of proteins, the deoxyribonucleic acid makes mRNA by the step of DNA transcription.
- The hereditary information from the mRNA is converted into proteins amid DNA translation.
- The arrangements of protein assembly amid protein synthesis are indicated in the mRNA.
- The mRNA is arranged in the nucleus and is moved to the cytoplasm for an additional operation of protein synthesis.
- The proteins which are arranged by the ribosomes currently in the cytoplasm are utilized inside the cytoplasm by itself. The proteins created by the bound ribosomes are moved outside the cell.

Taking into consideration their main function in developing proteins, it's clear that a cell can’t function in the absence of ribosomes.

DIFFERENCE BETWEEN DIFFERENT TYPES OF RIBOSOMES

- Prokaryotes have 70S ribosomes, singly made of a 30S and a 50S subunit. While the Eukaryotes have 80S ribosomes, singly made of a 40S and 60S subunit.
- 70S Ribosomes are relatively smaller than 80S while the 80S Ribosomes are relatively bigger than 70S ribosomes.
- Prokaryotes have 30S subunit with a 16S RNA subunit and comprise of 1540 nucleotides bound to 21 proteins. The 50S subunit gets produced from a 5S RNA subunit that involves 120 nucleotides, a 23S RNA subunit that contains 2900 nucleotides and 31 proteins.
- Eukaryotes have 40S subunit with 18S RNA and also 33 proteins and 1900 nucleotides. The big subunit contains 5S RNA and also 120 nucleotides, 4700 nucleotides and also 28S RNA, 5.8S RNA as well as 160 nucleotides subunits and 46 proteins.
- Eukaryotic cells have mitochondria and chloroplasts as organelles and those organelles additionally have ribosomes 70S. Hence, eukaryotic cells have different kinds of ribosomes (70S and 80S), while prokaryotic cells just have 70S ribosomes.