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B.Sc HONS Part-III Paper -VI
Topic: Structure and Function of Ribosome.
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Q. Give an account of structure and function of Ribosome.

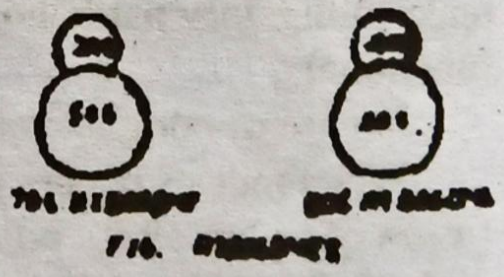
Introduction : Ribosomes are ribonucleo protein particles found in almost all cells. They are found in the cytoplasm or attached to the assembly shops for protein synthesis. They are also described as protein factories.

Discovery : Ribosomes were first observed by CLAUDE 1941 and named them as microsomes. PALADE in 1955 named them as ribosomes.

Occurrence : Ribosomes are found in the living cells which synthesize protein. They are usually located on the membrane of the endoplasmic reticulum. Some ribosomes remain scattered in the cytoplasm. They are also present inside the cell organelles like mitochondria and choloroplast.

Number : The number and the concentration of ribosomes are directly related to the RNA content of the cell. In Rabbit's reticulocytes, their number is found to be 1×10^5 per cell. One mm of liver contains about 1×10^{13} ribosomes. In E. Coli, there are about 20,000 to 30,000 ribosomes per cell.

Shape and Size : Ribosome are spherical in shape. Their size remains constant. The ribosomes of prokaryotes are smaller in size and those of Eukaryotes are larger in size. In prokaryotes they are 150Å and in eukaryotes they are 250Å in diameter.



Types of Ribosomes : According to the size and sedimentation coefficient two types of ribosomes have been reported. They are 70'S ribosomes and 80'S ribosomes.

70'S Ribosomes : These are comparatively small in size and have the sedimentation co-efficient 70'S. Their molecular weight is $1{\cdot}7 \times 10^6$ daltons. They occur in the prokaryotic cells blue green algae and mitochondria and chloroplast of eukaryotic cells.

80'S Ribosomes : Their sedimentation co-efficient is 80'S and their molecular weight is 40×10^6 daltons. They occur in eukaryotic cells.

Structure : Ribosomes are spherical in shape. Their diameter is 250 Å. Each ribosome is porous, hydrated having two sub units, a larger sub- unit and smaller sub-unit. The larger sub-unit is dome-like and the smaller sub-unit is lying above the larger and forming a cup-like structure.

The sub-units of 80 S ribosome are 60 S and 40 S. The sub-unit of 70S ribosomes are 50 S and 30 S.

$$80\,S \longrightarrow 60\,S + 40\,S.$$

$$70\,S \longrightarrow 50\,S + 30\,S.$$

The larger sub-unit of each ribosome contains two slots called P-site or donar site and A-site or acceptor site. During protein synthesis *t*-RNA carrying peptide chain is attached to the *P*-site. The *t*-RNA carrying activated amino acid is attached to the *A*-site.

Association and Dissociation of Ribosomes : The sub-units remain freely in the cytoplasm. In the beginning of the process of protein synthesis the two sub-units unite together and at the end of protein synthesis they dissociate. Similarly two ribosomes unite together to from a dimer. Many ribosomes link together to form a polyribosome. The association of sub- units as well as ribosomes occur at a high concentration of *Mg*. The dissociation is brought about by low concentration of *Mg*.

Chemical composition : The ribosomes contain RNA, protein, enzymes, lipid and metallic ions.

Ribosomal RNA : The RNA present in the ribosomes are called RNA are found in three forms namely 28 S *r*-RNA, 18 S *r*-RNA and SS *r*-RNA. In eukaryotic cells *r*-RNA and 5 S *r*-RNA. In prokaryotic cells they are in the form of 23 S *r*-RNA, 16 S *r*-RNA.

Ribosomes enzymes : Ribosomes contain a variety of enzymes required for protein synthesis. They are the following—

1. F_3 Factor	
2. $1F_1$ Factor	They help in the binding of *m*-RNA to
3. 1 F_2 Factor	ribosomes and in the dissociation of
4. $1F_3$ Factor	ribosomal sub-units.
5. *Tu* Factor	They help in the binding of AA *t*-RNA
6. T_3 Factor	complex to ribosomes.
7. Peptidyl transeferase	Transfer of peptidyl.
8. R_1 Factor	Release of protein.
9. R_2 Factor	

Metallic ions : The metallic ions present in ribosomes are *Mg*, *Ca*, *Mn* *Fe* etc.

Origin : In eukaryotic cells ribosomes originate from the nucleolar organiser. Nucleolar organiser is present in one of the chromosome. This region contains ribosomal DNA (*r*-DNA). It produces *r*-RNA.

Functions : Ribosomes do the following functions.

1. Protein synthesis : Ribosomes play an important role in protein synthesis. It is the assemble shop or engine where amino acids are linked to produce proteins. During protein synthesis the two sub-units link together on the *m*-RNA.

Like this many ribosomes are attached to the *m*-RNA to form polyribosome. The ribosomes contain slots for the attachment of *r*-RNA containing activated amino acids and *t*-RNA containing peptide chain. The ribosomes move on the *m*-RNA. As they move the triplet code on the *m*-RNA is translated and the peptide chain is elongated by the addition of amino acids.

2. Protection : The *m*-RNA passing through the ribosomes is protected from nucleases. Similarly newly synthesized polypeptide chains are protected