

Welcome all, for module number 36, from the paper: Diversity of non Chordates and Cell Biology and the title of the unit 12 is Cell Organelles and the module name is Introduction and Types of Ribosomes.

Myself, Dr. K.K. Therisa, assistant professor from Dhempe College of Arts and Science.

The outline of this presentation includes Introduction to ribosomes, Occurrence and Distribution of Ribosomes, Composition of Ribosomes, Types of Ribosomes.

The learning outcomes expected at the end of this module, the student should be able to explain the occurrence, distribution, and composition of ribosomes, and also understand and differentiate the types of ribosomes.

Let us begin with the introduction.

Ribosomes are the non membrane's cell organelle. Required for the protein synthesis and found in almost all types of cells except RBCs. Ribosomes are dense granules like structures inside the cell of approximately 150 to 200 angstrom in diameter. They are made up of two subunits. The ribosomes are either 70 S subunit, or 80 S. S stands for the Svedberg unit, which is the sedimentation coefficient. Which is done at the time of ultracentrifugation, based on the size of the molecules that get separated out. So accordingly the ribosome is a cell organelle which is composed of two subunits and the subunit, which is smaller and lighter, has got the lower Svedberg unit compared to the ribosomes with heavier ones.

Ribosomes were first observed in 1950s by biologist George Emil Palade, using an electron microscope, and he found that some dense granules were found in the cytoplasm and also attached to the cell. Other cell organelle, and later Richard B. Roberts named it as ribosomes. The occurrence and distribution of ribosomes is something like this. They are found in almost all type of cells, including the prokaryotes as well as the eukaryotes. It maybe 10,000 in bacterial cell to 10,000,000 in eukaryotic cell in number and They are absent in RBC and this is because the ribosomes are found in those cells which are active in protein synthesis. In cytoplasm they are, either in the free form and then they are known as monosomes,

or they may be associated with the mRNA to form polysomes. In eukaryotes, ribosomes are found in Free State in cytoplasm and also they are found attached to the membrane of the endoplasmic reticulum, which gives a rough appearance and the Endo-plasmic reticulum is known as a rough endoplasmic reticulum. And even these are found in mitochondrial matrix and chloroplast.

This is a structure of a prokaryotic cell that is a bacteria E.coli. In the cytoplasm, there are dense granules of ribosomes, which are found in the Free State. You can see the label which is colored yellow, is the ribosome found distributed inside the cytoplasm of a bacterial cell? Coming to the eukaryotic cell, a cell that has got all the membrane bound cell organelles, even the nucleus which is being found in a double membrane structure. But in the case of eukaryotic cells the ribosomes are not only found in the Free State in the cytoplasm. But also they are found attached on the surface of the endoplasmic reticulum.

This is an ultra structural picture of an endoplasmic reticulum with ribosomes embedded on it and you can make out, this looks like a beads over the membrane. And this gives a rough appearance and the very fact that the rough endoplasmic reticulum is involved in carrying the proteins, transporting the proteins and also the synthesis of proteins which takes place across is because of the presence of ribosomes on its membrane.

Coming to the composition of ribosomes, they are made up of RNA and proteins which are intertwined in the two subunits of the ribosomes. The two subunits are caught hold by means of a magnesium ion. If there is a lack of magnesium, these subunits get disassembled easily and the purpose of protein synthesis doesn't take place. Because it is made up of RNA and protein. It is also known as ribonucleoprotein. And the RNA protein ratio in most of the prokaryotic cell is around 2 is to 1 ratio rather in eukaryotes it is approximately one is to one.

The two subunits are caught hold by means of magnesium ions and this magnesium ions are very important for the structure of the ribosome, which has been maintained either in the 70 S in case of prokaryotes or 80 S in case of eukaryotes.

Coming to these types of ribosomes, basically there are two types, based on the sedimentation coefficient. One is the 70 S stands for the svedberg unit and in eukaryotes it is the 80 S stands for again, this variable unit and also make a note here that these are found in the mitochondria and chloroplast within the eukaryotic cell, but the size here is 55 S with Or 30 S and 40 S subunit.

And this variable unit, which has been given, is based on the size of this subunit at the time of ultracentrifugation. The way that it gets separated.

At the same time, we have to remember one important point here. The subunits are in prokaryotic ribosome that is in 70 S ribosome is made up of 30S, which is a smaller subunit and in 50 S, which is a larger subunit and these are not additive because the total size is 70 years and not 80 S. In case of prokaryotic ribosomes, the 70s ribosomes are found. In bacteria and blue green algae etc. And as I already mentioned they are formed of a small subunit and the large subunit, the small subunit composed of 21 proteins and 16 Sr RNA. RNA in the ribosomes are specifically known as ribosomal RNA.

And that larger subunit which is 50 S is made up of 34 proteins and 23 S RNA plus 5S RRNA. And when you Add all this together, it should be around 80S. But because it is not additive it is 70 S.

And this is a structure of a 70sribosome found in the bacterial cell and in both the subunit. You can see the size is been shown in this picture. The blue color is the smaller subunit and the red color is the largest subunit. Eukaryotic ribosomes are 80 S and small subunits are made of 40 S. Where the large subunit is 60 S. As I already mentioned, these are not additive and that's why the total size of the ribosome is eukaryotic 80 s.

The 40 is the smaller subunit are curved and flat and ellipsoid in shape consisting of 1/3 head and two third body and the components are as follows. The smaller subunit that is 40 S is made up of 18 Sr RNA with 33 proteins and 60 S is made up of 5 S, 5.8 S and 28 SrRNA with 49 proteins and this is a structure

of a prokaryotic ribosome and eukaryotic ribosome, differentiating in the size and the type of RNA as far as its size is concerned. Present in the smaller and the larger subunit.

To conclude, ribosomes are the non membrane. Cell organelles present in prokaryotic as well as eukaryotic cells. They are present in all the types of cells except RBC. Ribosomes are of two types. 70 S and 80S and they are made up of two subunits and these two subunits are being held together with the help of a magnesium ion.

These are the references which were used for this module.

Thank you.