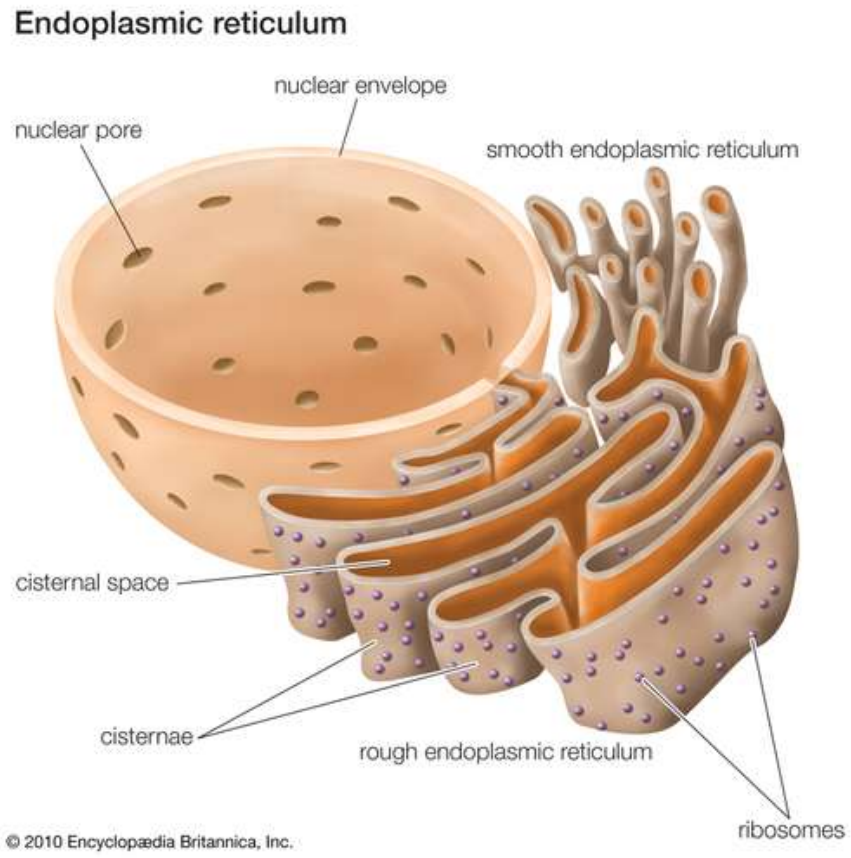
Homework #3

Lupașcu Marian
Syntactic Modeling of Biological Systems
University of Bucharest

March 16, 2020

Overview

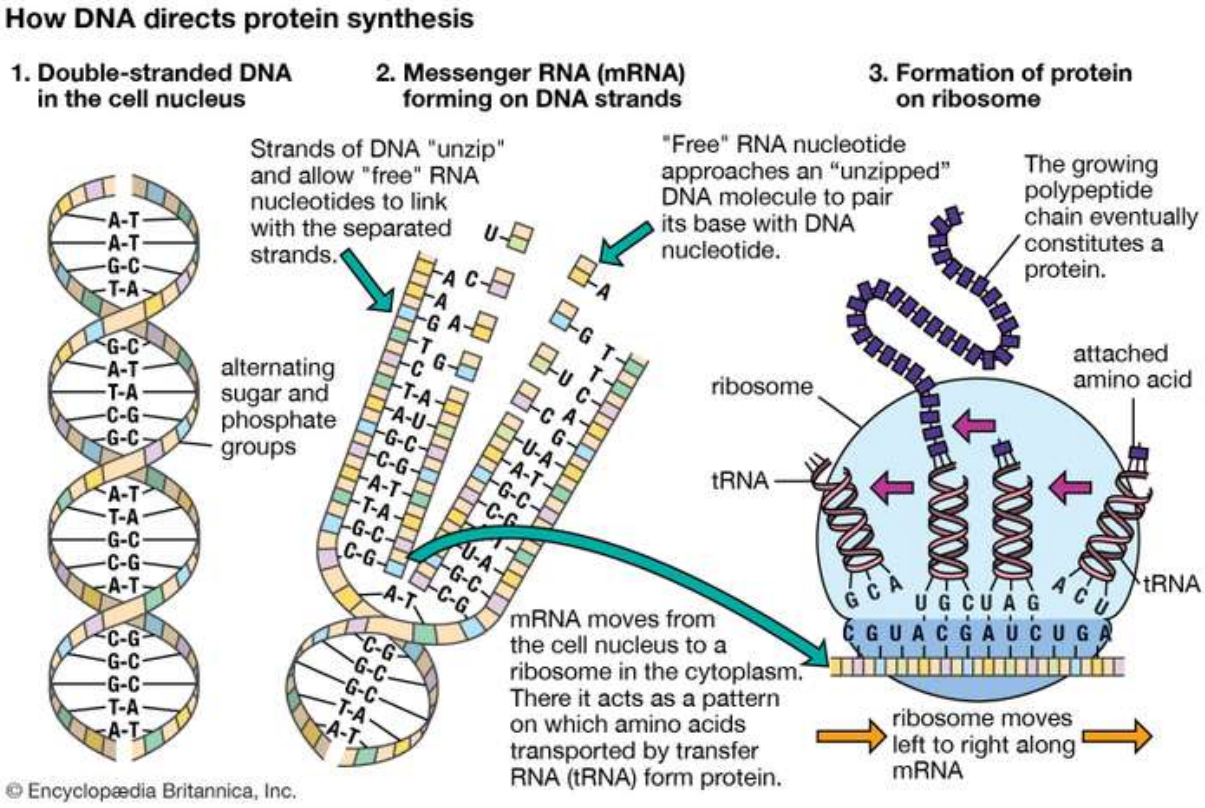
The ribosome (or Palade's corpuscles) is one of the main components of a cell (alongside the nucleus, mitochondria, lysozyme, cytoplasm, etc.). In addition, robosomes can appear as free components of the cell both in eukaryotes and in prokaryotes but also as components attached to the membrane of the edoplasmic reticulum in eukaryotes cells. Most of the ribosomes are located on the membrane of the endoplasmic reticulum in eukaryotic cells, and a small part of the ribosomes may be free in the cytosol. The main function of the ribosome is to synthesize proteins.



Discovery

The ribosome was discovered by the Romanian George Emil Palade (born November 19, 1912 Iași, Romania - died October 7, 2008 Del Mar, USA) in 1955. In 1974 Emil Palade with Albert Claude and Christian de Duve received the Nobel Prize in Physiology or Medicine for their discoveries concerning the structural and functional organization of the cell. [3, 4]

Sinteza proteinelor



In the figure above you can see how the proteins are synthesized in the cell. On the left (1) is the double helical DNA macromolecule, from the DNA information proteins will be synthesized. In the middle (2) the information is copied from DNA into RNA by Watson-Crick complementarity (that is, a base A whose DNA corresponds to a base T in RNA will have a base U, a base T whose DNA corresponds a base A in RNA will have base A, etc). In this way, an RNA macromolecule is obtained that has fixed DNA information only as otherwise stored. The RNA obtained is called messenger RNA (mRNA) and it will be like a pattern for amino acids. This mRNA molecule originates from the nucleus in the cytosol or on the endoplasmic reticulum, up to the ribosome. On the right side of the figure (3) the protein synthesis is performed on the ribosome: it is read mRNA of each ribosome from codon to codon (from 3 to 3 bases of RNA) and for each codon (to which it corresponds

a single amino acid) to the peptide is added to the current amino acid. Amino acids are brought to the tRNA (transport RNA) robosomes. When we have a stop codon in the mRNA (UAA or UAG or UGA) then the peptide / protein is ready. The protein is released into the cytosol from where it performs a number of functions in the cell or the rest of the body. As an observation, several ribosomes contribute simultaneously to the synthesis of a protein, working in parallel on several mRNA sequences. The binding rate of the ribosome is about 200 amino acids per minute.

Number and size

Robosomes are very abundant in number. On average, one eukaryotic cell has approximately 10 million ribosomes. In prokaryotes the number of ribosomes is smaller, for example in Escherichia bacteria there are about 15.000 ribosomes or in E.Coli bacteria there are about 20.000 ribosomes, making up a quarter of the cell mass. [1, 2]

The size of the ribosomes varies from prokaryotic cells to eukaryotic cells as follows: on average, the diameter of a ribosome in prokaryotic cells is 20 nm and the diameter of the ribosome in eukaryotic cells is 25-30 nm. The diameter of the ribosome also varies depending on the state of the cell, that is, whether it is resting or reproducing. [1, 2]

References

[1] Kara Rogers, ENCYCLOPÆDIA BRITANNICA, Ribosome
`https://www.britannica.com/science/ribosome`

[2] British Society for Cell Biology, Ribosome
`https://bscb.org/learning-resources/softcell-e-learning/ribosome/`

[3] The Nobel Prize in Physiology or Medicine 1974
`https://www.nobelprize.org/prizes/medicine/1974/summary/`

[4] Intracellular Aspects of the Process of Protein Secretion
`https://www.nobelprize.org/prizes/medicine/1974/palade/lecture/`