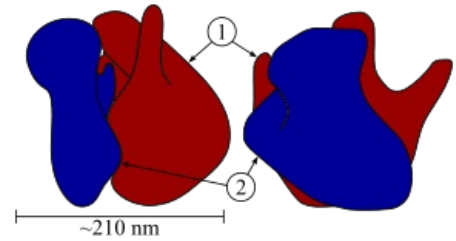


# Ribosome

**Ribosomes** are nucleoprotein particles, composed of 1 small and 1 large **subunit**, found in prokaryotic and eukaryotic cells. The subunits are a complex of ribosomal RNA (rRNA) and ribosomal proteins. It is rRNA, which makes up roughly two-thirds of the mass of the ribosome, that is primarily responsible for functions related to proteosynthesis, including the catalytic function in the formation of covalent peptide bonds between amino acids - ribosomes are thus *ribozymes* (RNA molecules with a catalytic function).

- **Prokaryotic ribosomes:** large subunit – 2 different rRNAs + 34 proteins, small subunit – 1 rRNA + 21 proteins
- **Eukaryotic ribosomes:** large subunit – 3 rRNA + 49 proteins, small subunit – 1 rRNA + 33 proteins

The size of the ribosome, its subunits and individual rRNAs is expressed in Svedberg sedimentation units = S. The eukaryotic ribosome has 80 S (it has a 60 S large subunit + a 40 S small subunit, the resulting size is determined by the structure). The prokaryotic ribosome has 70 S (50 S large, 30 S small). The large subunit has a spherical shape and a channel through which the newly synthesized peptide chain is released during translation. A small subunit mounts on top of a large subunit.



Structure of the large(1) and small(2) ribosome subunits.

## Synthesis of ribosomes

The rRNA of ribosomes is synthesized in the nucleolus. The genes for rRNA synthesis are on satellites of acrocentric chromosomes, which are the so-called nucleolar **organizers** (NOR). In the nucleolus, the short arms of the acrocentric chromosomes join together. In the nucleolus, polymerase 1 produces a primary pre-rRNA transcript, which is cut using snoRNA (small nuclear RNA) into 3 rRNA molecules: 18S rRNA (for the small subunit), 5.8S rRNA and 28S rRNA (for the large subunit). These travel to the nucleus, where they are combined with proteins and the 4th rRNA molecule (5S rRNA). Individual ribosome subunits leave the nucleus through nuclear pores. Complete ribosomes are then formed in the cytoplasm, which take part in the process of proteosynthesis.

Ribosomes can be dissociated in vitro into individual components – proteins and rRNA. By assembling these components under appropriate conditions, a poorly functional ribosome can be reconstructed. This principle, which also applies to the assembly of complex proteins, is called **self-assembly**.

## Cytology

In the electron microscope, ribosomes appear as small, **electron-dense particles** with a size of 20x30 nm. They are not visible under a light microscope, but in some cells we can see basophilic areas of the cytoplasm (for example, Nissl's substance in neurons), which determine the localization of the cluster of ribosomes in the cytoplasm. Ribosomes are basophilic due to the high proportion of rRNA. It is found in all cells, but their number and localization is different. They occur either **freely in the cytoplasm or attach to the membranes of the endoplasmic reticulum** as a large subunit. Sites where large ribosome subunits attach to the endoplasmic reticulum membrane they represent 2 integral membrane proteins on the ER: **ribophorin I and II**. Ribosomes can occur individually in the cytoplasm or form small ring-shaped or spiral-shaped groups - **polyribosomes** (polysomes), where they are connected to each other by the mRNA molecule.

## Links

### Related articles

- RNA
- Translation

### References

- GOETZ, Pavel, et al. *Selected Chapters in Medical Biology II.* 1st ed. Prague 1, Ovocný trh 3: Nakladatelství Karolinum, 2002. 140 pp. ISBN 80-246-0320-9.
- VAJNER, Luděk, Jiří UHLÍK and Václava KONRÁDOVÁ. *Medical histology. 1, Cytology and General Histology.* 1st edition. Prague: Karolinum, 2010. 112 pp. pp. 16. ISBN 978-80-246-1860-9.

### Literature

- GOETZ, Pavel, et al. *Selected Chapters in Medical Biology II.* 1st ed. Prague 1, Ovocný trh 3: Nakladatelství Karolinum, 2002. 140 pp. ISBN 80-246-0320-9.
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