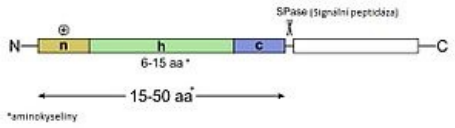
Polypeptide signal sequences, free and bound ribosomes

Cytosolic proteins are synthesized on **free** cytosolic **ribosomes**, while membrane proteins, organelle proteins, and proteins released outside the cell are synthesized on ribosomes bound to the rough endoplasmic reticulum (ER). Free and bound ribosomes are structurally and functionally exactly the same, their binding to the ER is determined by the sequence of the synthesized chain. Most proteins determined outside the cytosol have a so-called 13 –16 amino acid **signal sequence** at the N-terminus. Although these sequences vary from protein to protein, the presence of several hydrophobic amino acid residues is characteristic. The sequence is recognized by an **SRP particle** (signal recognition particle), consisting of six protein subunits and 7SL RNA. It binds to the signal sequence of the synthesized protein and stops translation at an early stage. The ER membrane contains receptors for SRP. Once the ribosome-SRP complex binds to them, proteosynthesis continues with the participation of two other membrane proteins, **riboforin I and II**, and at the same time, the peptide chain passes through the membrane into the ER tank. The SRP is again released from the receptor into the cytosol.

The signal sequence is crucial for translocation. If it is attached to a cytosolic protein, such as hemoglobin, by gene manipulation, then this protein is released outside the cell. Peptide translocation is an active energy-requiring membrane process (ATP). Permeation is not driven by translation, the ribosome. Theoretically, it could take place even after the synthesis of the free ribosome chain has been completed. However, early binding of the synthesized protein and ribosome to the ER is advantageous and mostly necessary because, after synthesis on the free ribosome, the protein could assume a conformation that would prevent translocation across the membrane.



Signal peptidase

The tight space between the translation site and the translocation will not allow the chain to conform before or on the other side of the membrane. Some proteins remain anchored in the membrane, which is also due to their primary sequence.

In fact, in addition to the signal sequence, membrane proteins also have an **anchoring, stop-transferase sequence**, which terminates translocation across the membrane and the protein remains an anchored part of the membrane. The signal sequence of these proteins may also be somewhat distant from the N-terminus. Some even have several such sequences, alternating with stop-transfer sections, so that they are anchored in the membrane in several ways, sometimes several times (see figure). The signal sequence of the secreted proteins is still cleaved by the membrane **signalase** during translocation. The protein penetrates the ER tank. Here and especially in the Golgi apparatus, it is covalently modified (see Post-translational glycosylation of proteins) and then transported to the site of its function.

References

Related Articles

- Translation of membrane and secretory proteins (protein sorting, targeting)
- Translation, post-translational processing of proteins in eukaryotes
- Post-translational modifications and protein targeting

Source

- ŠTÍPEK, Stanislav. *Stručná biochemie : Uchování a exprese genetické informace.* 1. edition. Medprint, 1998. ISBN 80-902036-2-0.

References

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