



DNA translation and protein

- Translation is the first stage of protein biosynthesis.
- In translation, (mRNA) produced by transcription is decoded by the ribosome to produce a specific amino acid chain, or polypeptide, that will later fold into an active protein.
- Translation occurs in the cell's cytoplasm, where the large and small subunits of the ribosome are located, and bind to the mRNA.

Translation process

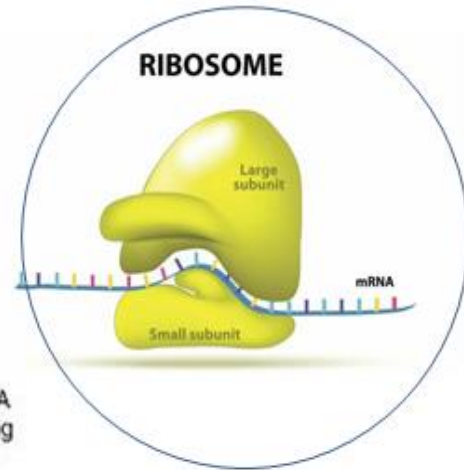
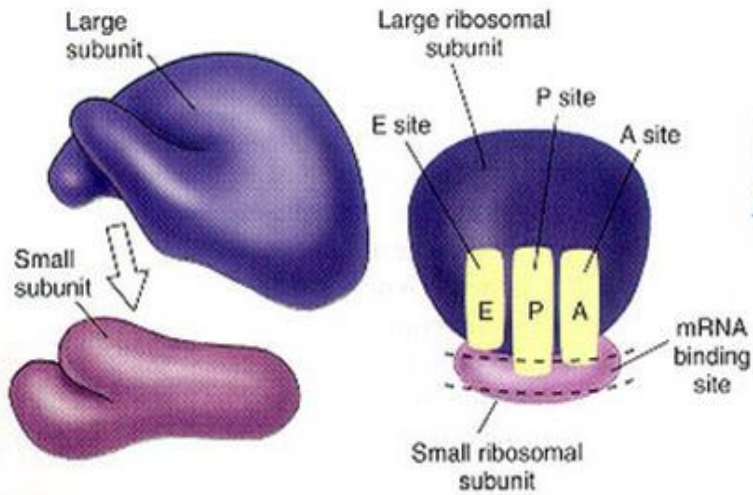
The ribosome facilitates decoding by inducing the binding of tRNAs with complementary anticodon sequences to mRNA.

- The tRNAs carry specific amino acids that are chained together into a polypeptide as the mRNA passes through and is "read" by the ribosome.
- the entire ribosome/mRNA complex will bind to the outer membrane of the rough endoplasmic reticulum and release the nascent protein polypeptide inside for later vesicle transport and secretion outside of the cell.

Ribosomes

Ribosomes are small particles consisting of RNA and associated with proteins that function to synthesize proteins. **Ribosomes** can be found floating within the cytoplasm or attached to the endoplasmic reticulum . There are two types of ribosome:

- 1- Prokaryotic ribosomes (**70S**) is smaller than eukaryotic Ribosomes . It is composed of two subunit (large subunit **50S** and small subunit **30S**).
- 2- Eukaryotic ribosomes (**80 S**)is larger than prokaryotic Ribosomes . It is composed of two subunit (large subunit **60S** and small subunit **40S**).



Ribosome Subunits

The smaller subunit fits into a depression on the surface of the larger one. The A, P, and E sites on the ribosome play key roles in protein synthesis.



Stages of translation

1-The initiation stage

The initiation stage of translation brings together mRNA, tRNA bearing the first amino acid of the polypeptide, and two subunits of a ribosome.

The start codon in all mRNA molecules has the sequence AUG and codes for methionine.

the initiating tRNA in the P site, and the A site free for binding to the next tRNA.

- The ribosome moves along the mRNA in a 5' to 3' direction, in a step-wise process, recognizing each subsequent codon.

2.The elongation stage

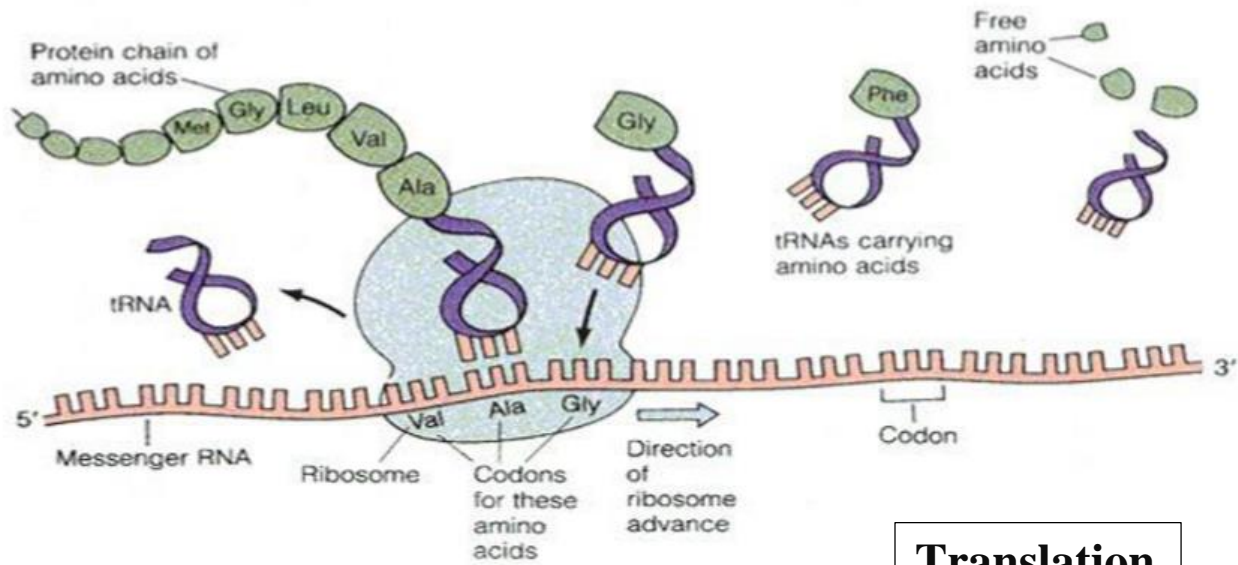
In the elongation stage the mRNA is bound to the complete two subunit ribosome,

The peptidyltransferase enzyme then catalyzes the formation of a peptide bond between the free N terminal of the amino acid at the A site, and the Carboxyl end of the amino acid at the P site, which is actually connected to the tRNA.

3.The termination

*The final stage is termination when the ribosome reaches a stop codon in the mRNA.. One of the three stop codons (UAA, UGA, UAG) enters the A site. No tRNA molecules bind to these codons so the peptide and tRNA in the P site become hydrolysed releasing the polypeptide into the cytoplasm.

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Translation

RNA codon table

| 1st position | 2nd position | | | | 3rd position |
|--------------|--------------------------|--------------------------|----------------------------|---------------------------|------------------|
| | U | C | A | G | |
| U | Phe Phe Leu Leu | Ser Ser Ser Ser | Tyr Tyr stop stop | Cys Cys stop Trp | U C A G |
| C | Leu Leu Leu Leu | Pro Pro Pro Pro | His His Gln Gln | Arg Arg Arg Arg | U C A G |
| A | Ile Ile Ile Met | Thr Thr Thr Thr | Asn Asn Lys Lys | Ser Ser Arg Arg | U C A G |
| G | Val Val Val Val | Ala Ala Ala Ala | Asp Asp Glu Glu | Gly Gly Gly Gly | U C A G |

Amino Acids

- Ala: Alanine Gln: Glutamine Leu: Leucine Ser: Serine
- Arg: Arginine Glu: Glutamic acid Lys: Lysine Thr: Threonine
- Asn: Asparagine His: Histidine Met: Methionine Trp: Tryptophane
- Asp: Aspartic acid Ile: Isoleucine Phe: Phenylalanine Tyr: Tyrosine
- Cys: Cysteine Pro: Proline Val: Valine



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