

# Synthesis of proteins: Translation

- The site of translation: the cytoplasm. In eukaryotes: the ribosomes on the Rough endoplasmic reticulum (RER) and free ribosomes.

Figure: General schematic of translation.

- The mRNA is providing the information to build up polypeptides. The information is showing the amino acid sequence, coded by the **genetic code**. The direction of reading the code is  $5' \rightarrow 3'$  on the mRNA, the new polypeptide. N terminus  $\rightarrow$  C terminus

- The ribosome is composed of rRNA and proteins. It has two subunits: a small and a large.

The large subunit has two binding sites for tRNAs carrying amino acids.

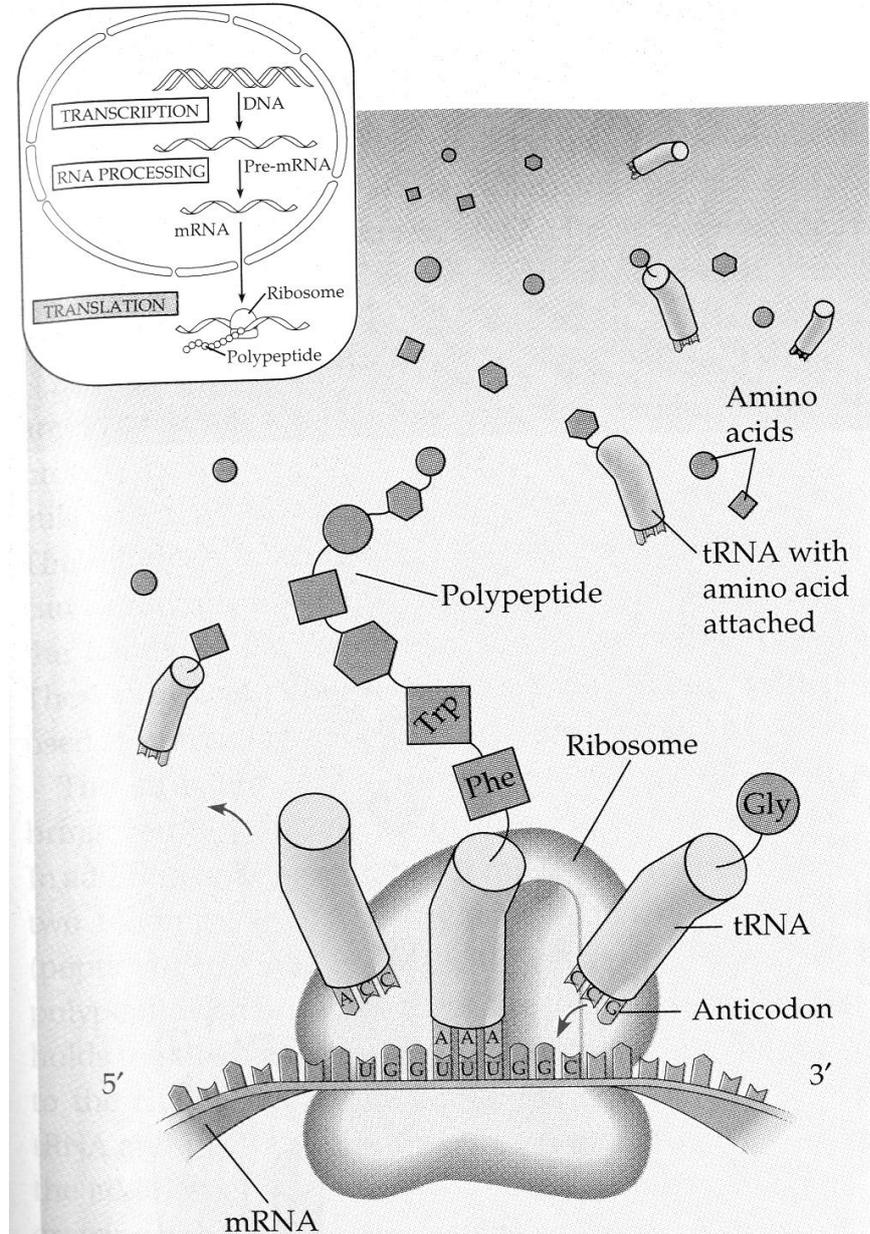
The ribosome creates the peptide bonds between the amino acids.

- The tRNA has an **adapter** function.

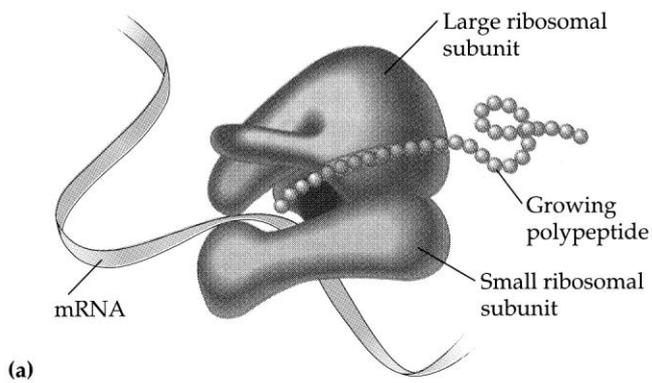
- It carries the amino acids
- It binds to the mRNA with its **anticodon** on the **anticodon loop**

It also binds to the ribosome (P-site and A-site)

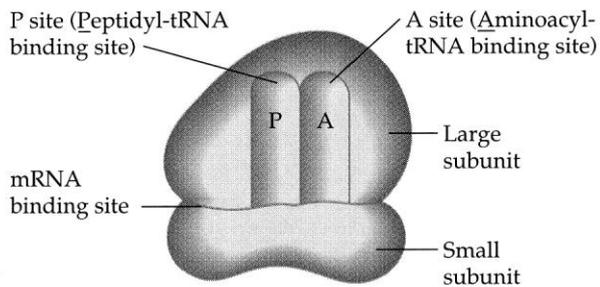
- Aminoacyl-tRNA: tRNA binds an amino acid
- Peptidyl-tRNA: tRNA binds a peptide or polypeptide



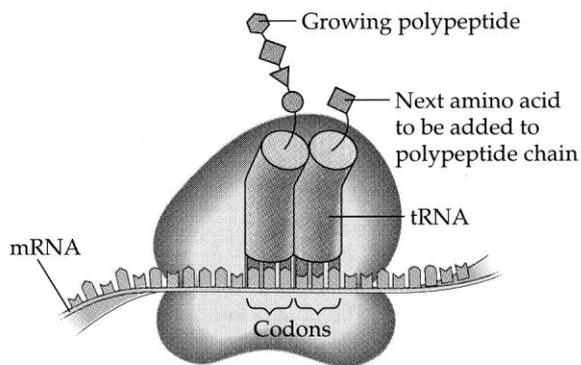
- The translation has 3 stages: 1., **initiation** 2., **elongation** 3., **termination**



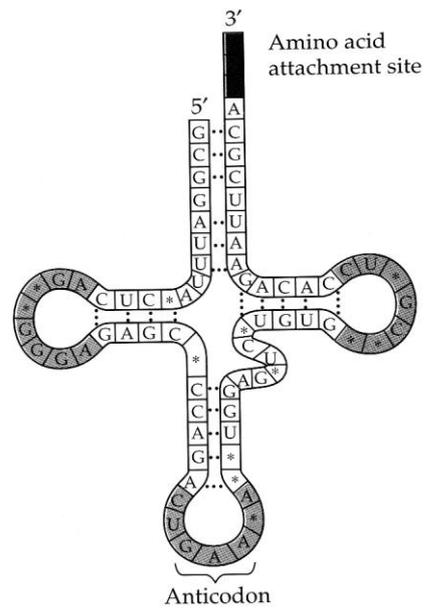
(a)



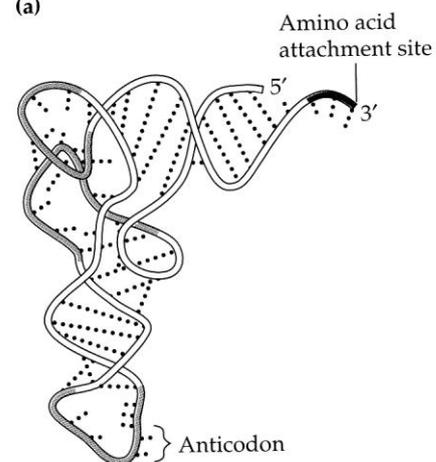
(b)



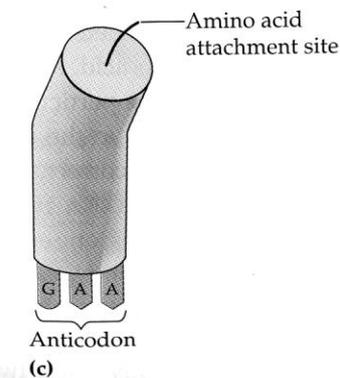
(c)



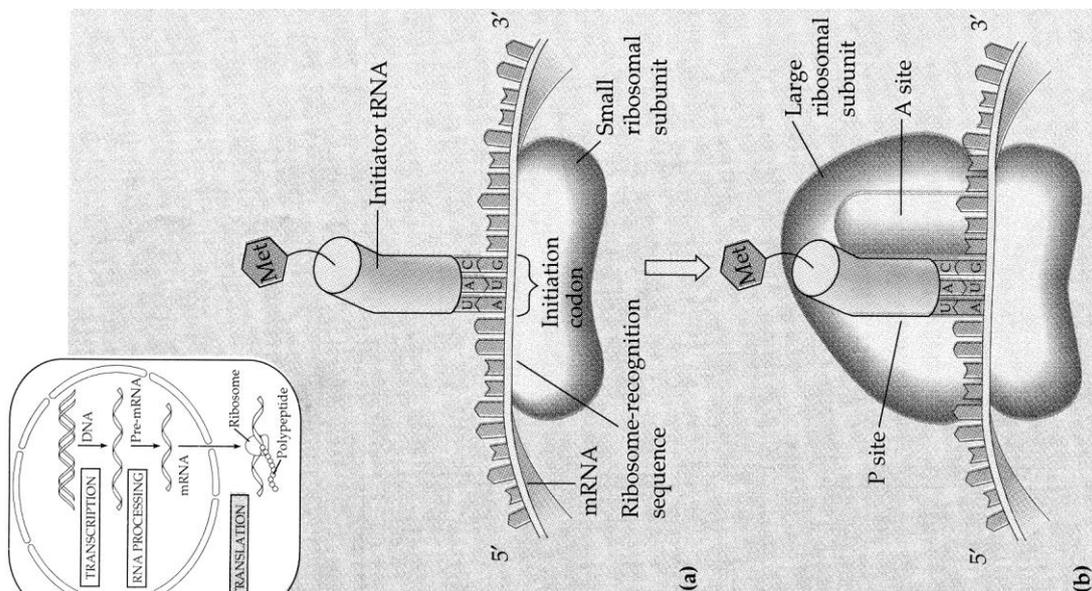
(a)



(b)



(c)



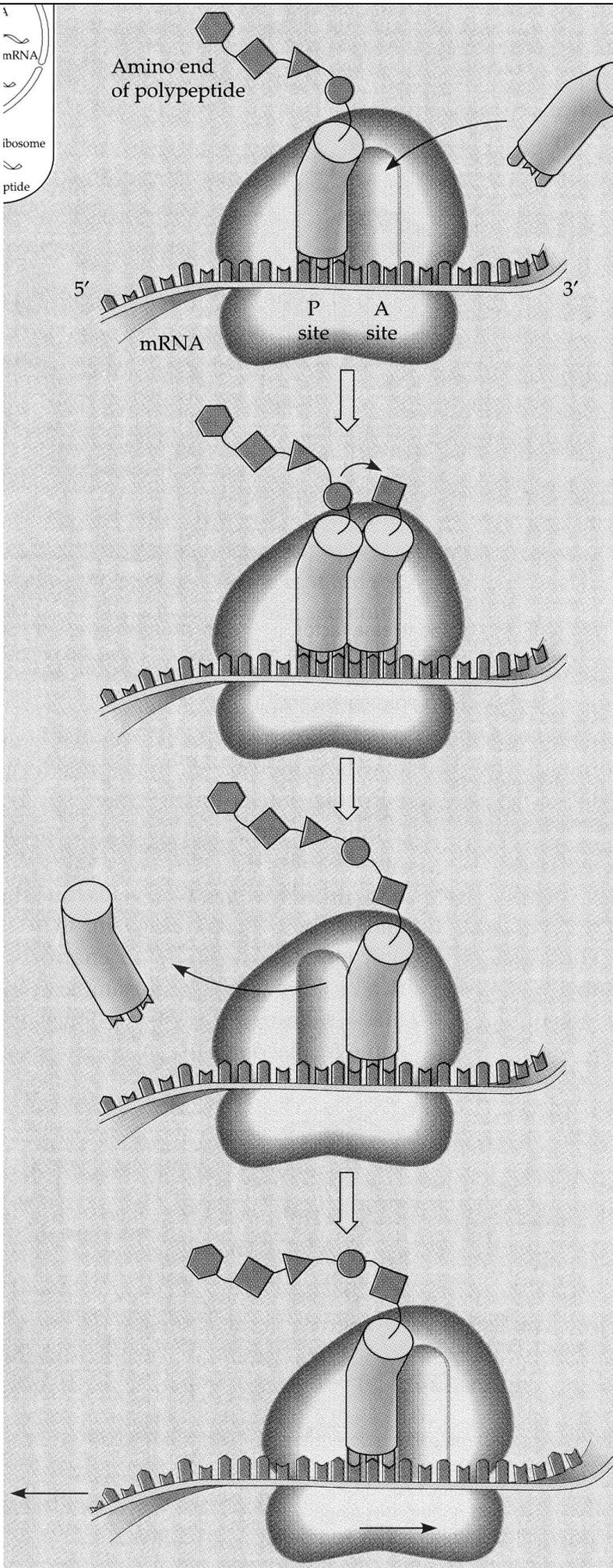
(a)

(b)

Figure: Up, left: the ribosome, its important components, and connections with mRNA and polypeptides. Up, right: The tRNA molecule.

Figure left: Initiation. A tRNA binding a Methionin binds to the initiation codon, in the P site.

Figure: The 3 steps of elongation.

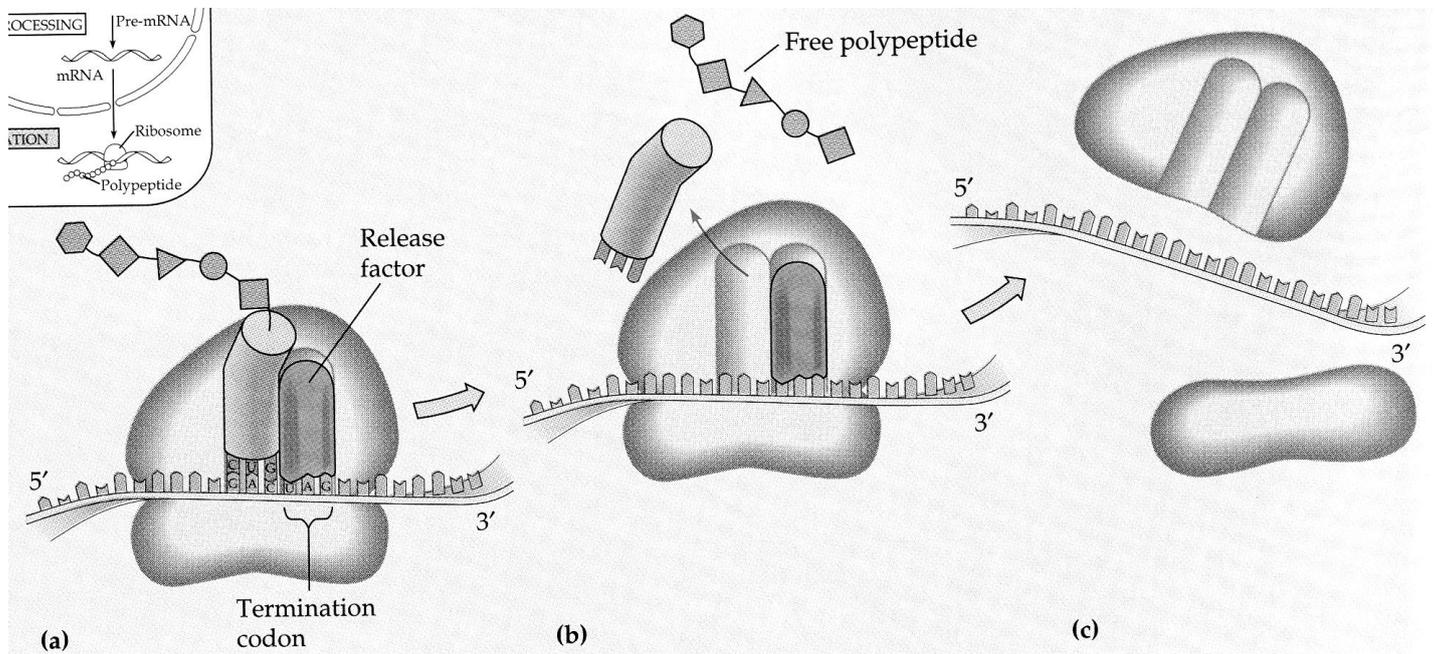


① **Codon recognition:** An incoming aminoacyl-tRNA binds to the codon in the A site.

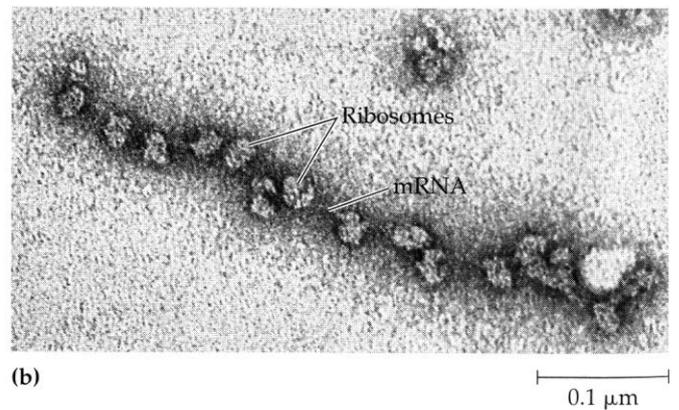
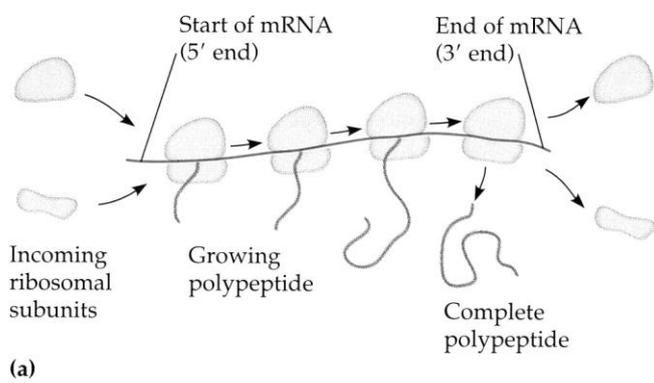
② **Peptide bond formation:** A peptide bond is formed between the new amino acid and the growing polypeptide chain.

③ **Translocation:** The tRNA that was in the P site is released. The tRNA in the A site is translocated to the P site; in the process, the ribosome advances by one codon.

FIGURE 16.14  
The elongation cycle of translation.



**Figure:** Termination. The STOP codons are recognized by releasing factors, and they set the polypeptide free.



**Figure:** Many ribosomes on an mRNA form a **polyribosome** or **polysome**. *b.*: An electronmicroscopic picture of a polysome.

All figures: Campbell: Biology 4<sup>th</sup> ed.