

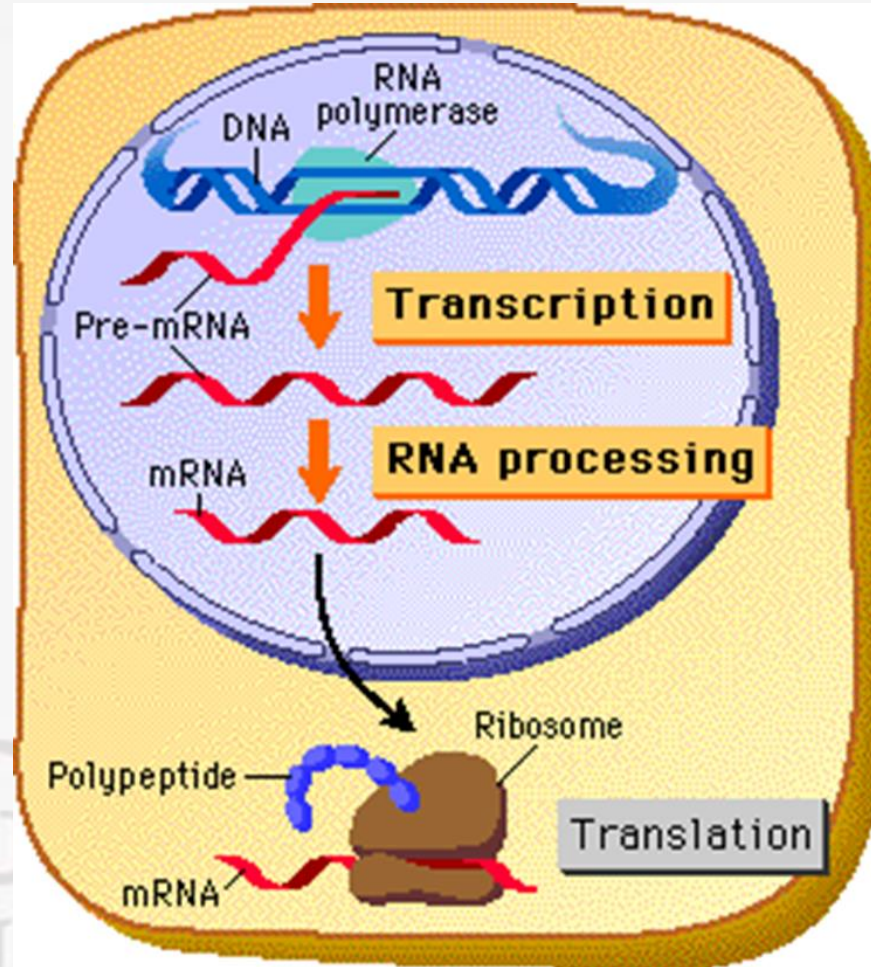
The logo of Galgotias University is a circular emblem with a stylized 'G' shape in the center. The 'G' is composed of several curved, overlapping bands in shades of yellow, orange, and blue. The background of the emblem is a light, textured grey.

**TRANSLATION IN PROKARYOTES AND
EUKARYOTES**

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- A well-conserved process among prokaryotes and eukaryotes.
- Protein synthesis is the final stage of gene expression .
- The genetic message transcribed to mRNA is translated into protein by a complex cellular machinery. Additional processing and assembly often required to modify the proteins.
- Occurs in 3 stages: initiation, elongation & termination

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Source: <https://ibiologia.com/dna-translation/>

TOOLS OF TRANSLATION

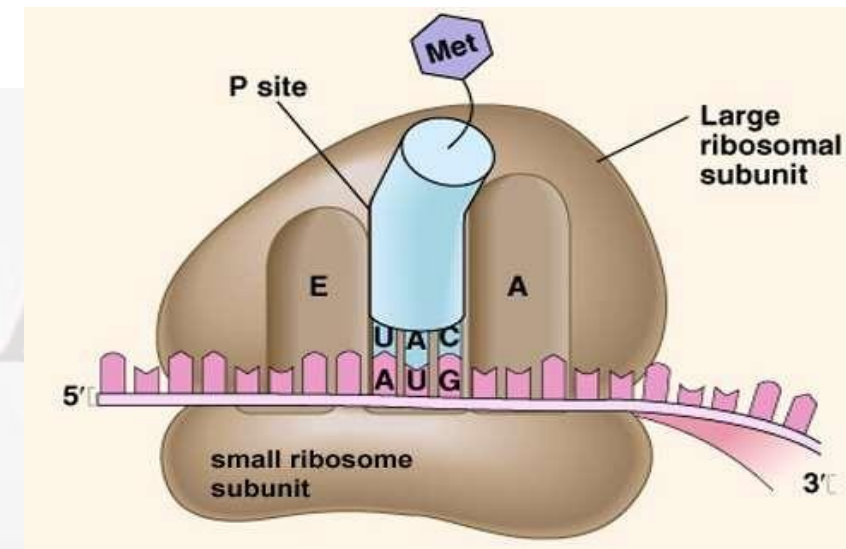
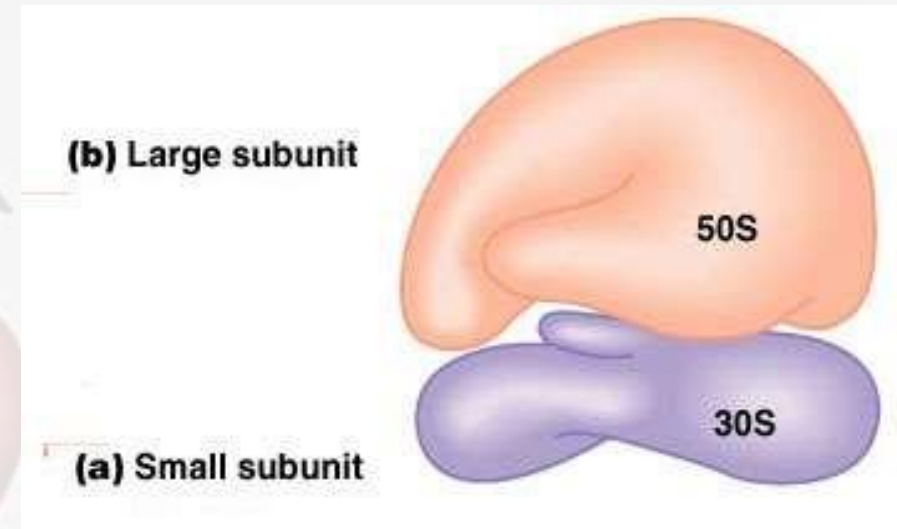
- Mainly :Ribosomes, tRNA, mRNA, Initiation factors, elongation factors, termination factors, amino acids etc.

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RIBOSOME

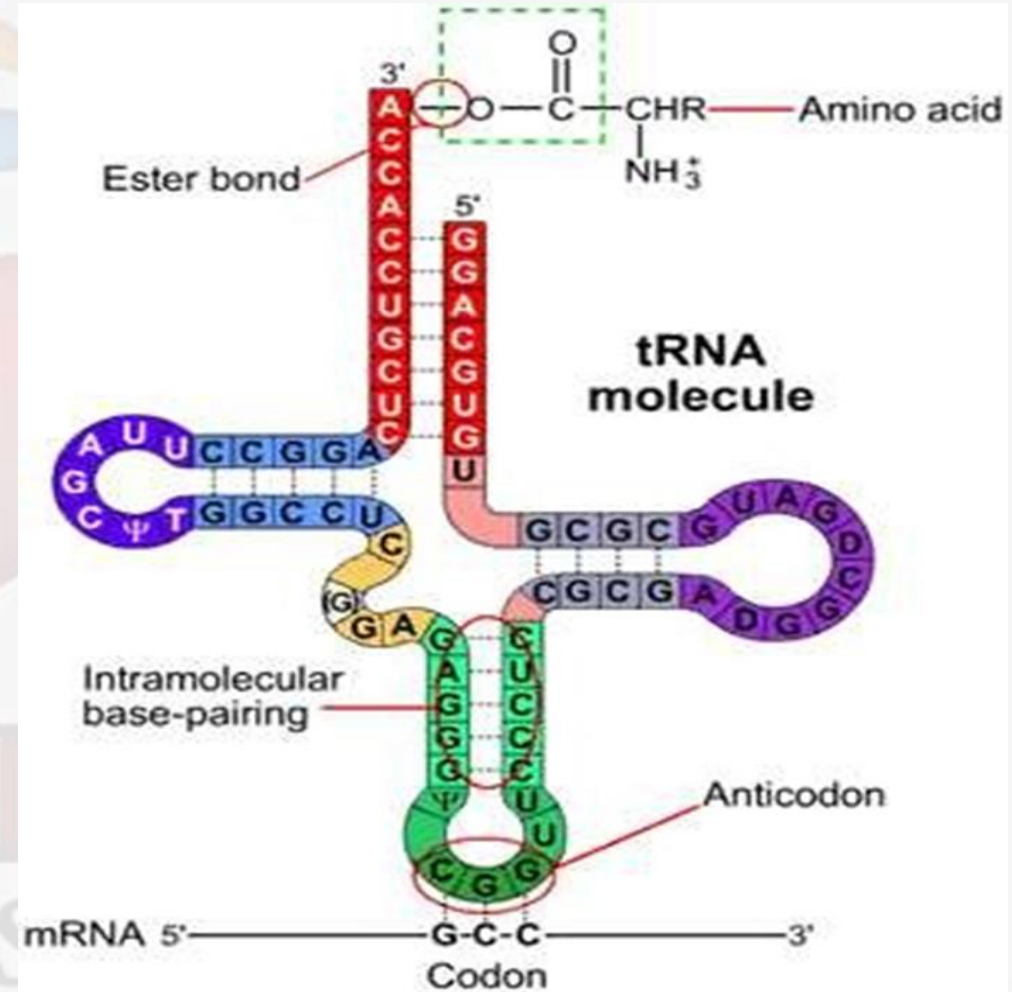
- Protein synthesising factories of the cell.
- 70S & 80S
- Structure: A site, P site & E site. And also an mRNA binding site. The mRNA-binding site binds a sequence near the 5' prime end of the mRNA, placing the mRNA in the proper position for the translation of its first codon.

The binding sites are all located at or near the interface between the large and small subunits.



Transfer-RNA

- tRNA molecules contain
 - 1) three major loops, a 3 prime terminal sequence of CCA (where the appropriate amino acid can be attached by an ester bond) etc.
- Clover Leaf Model



<https://www.slideshare.net/soniarjohn/translation-in-prokaryotes-52998498>

PROCESS OF TRANSLATION

- A.A is activated by Rn with RNA(ATP) to form activated A.A.
- The activated A.A joined to the 3 prime terminus of tRNA to form amino acyl tRNA (catalyzed by aminoacyl synthetase)
- Messenger RNA brings polypeptide-coding information to the ribosome.

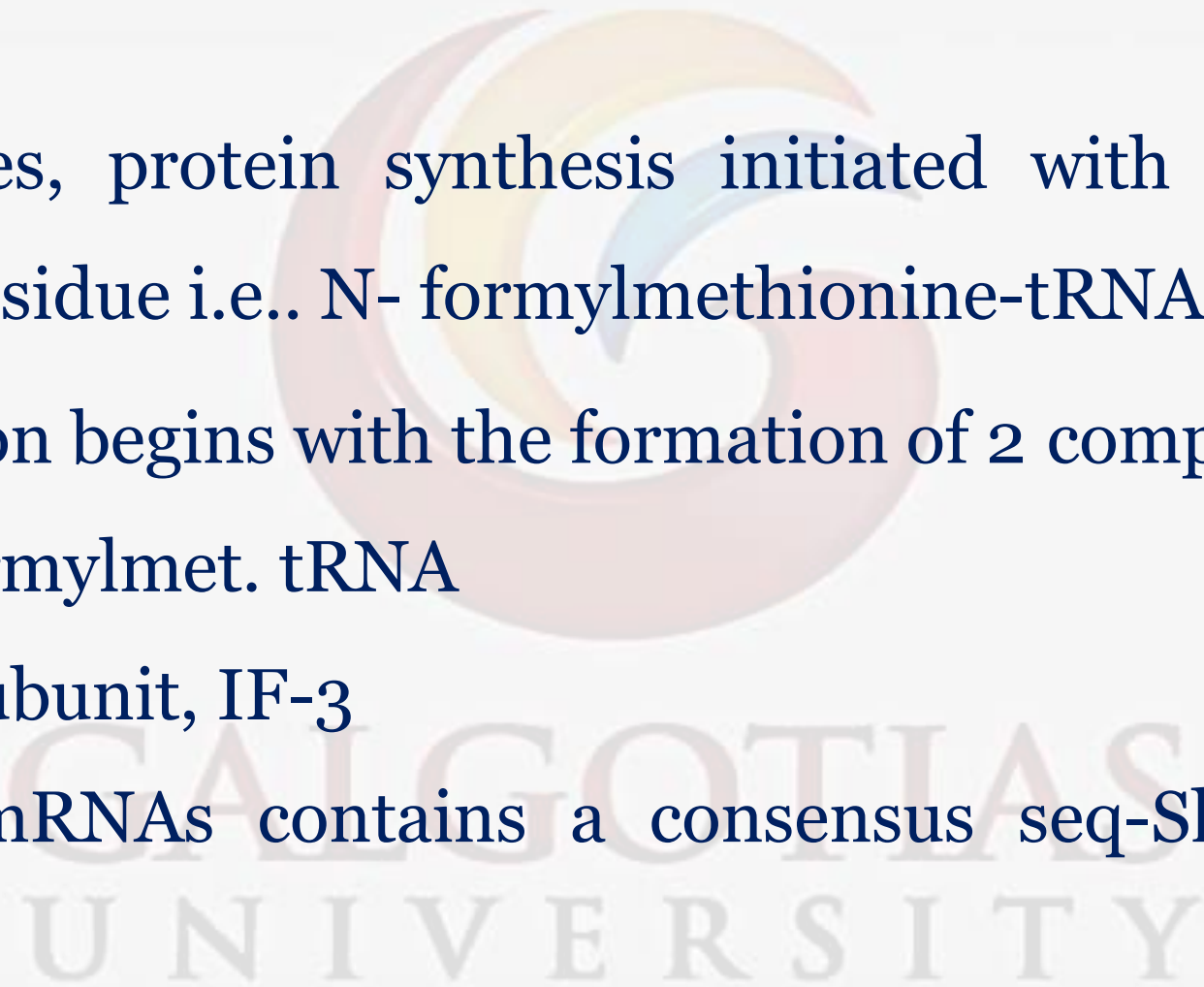


INITIATION

- In prokaryotes, 70S ribosome
- Initiation starts with interaction of 30S subunit with an mRNA mol & 3 Ifs.

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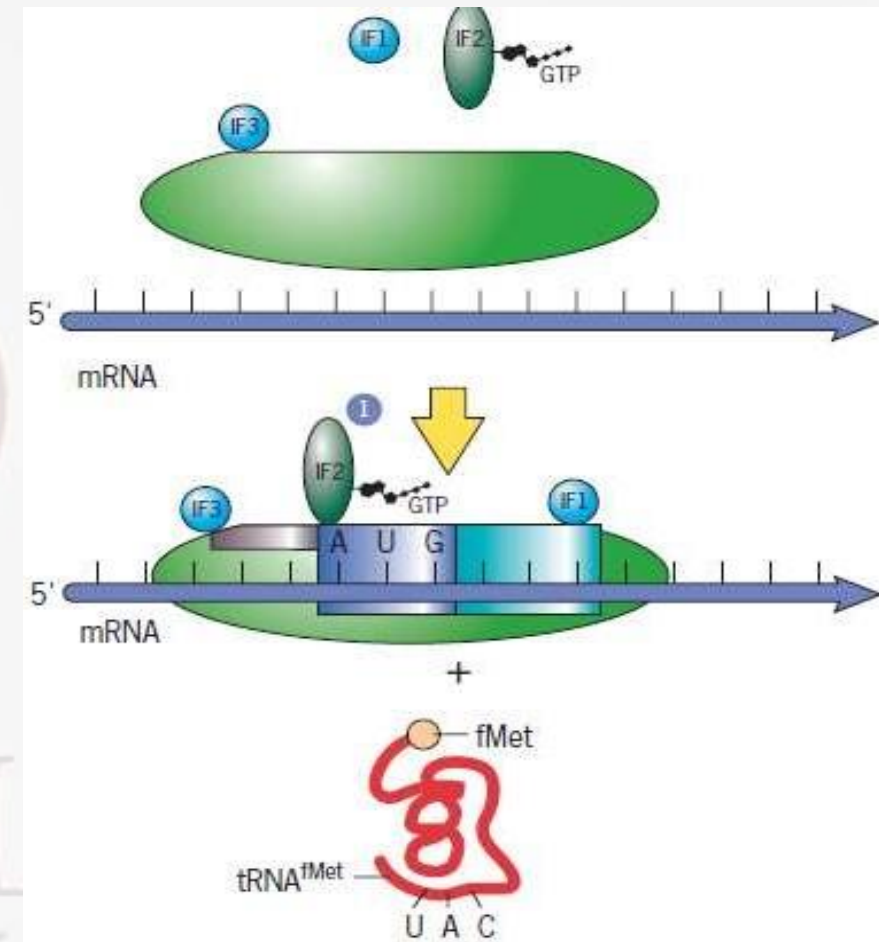
- In prokaryotes, protein synthesis initiated with a modified methionine residue i.e.. N- formylmethionine-tRNA
- Chain initiation begins with the formation of 2 complexes:
- 1.IF-2 & N-formylmet. tRNA
- mRNA, 30s subunit, IF-3
- Prokaryotic mRNAs contains a consensus seq-Shine Dalgarno Sequence.



- Shine-dalgarno sequence is complementary to a sequence of nucleotides at 3prime end of ribosomal RNA of the 30 S subunit.
- Interaction between these complementary sequence enhances the attachment of the 30S subunit to the AUG initiator codon.

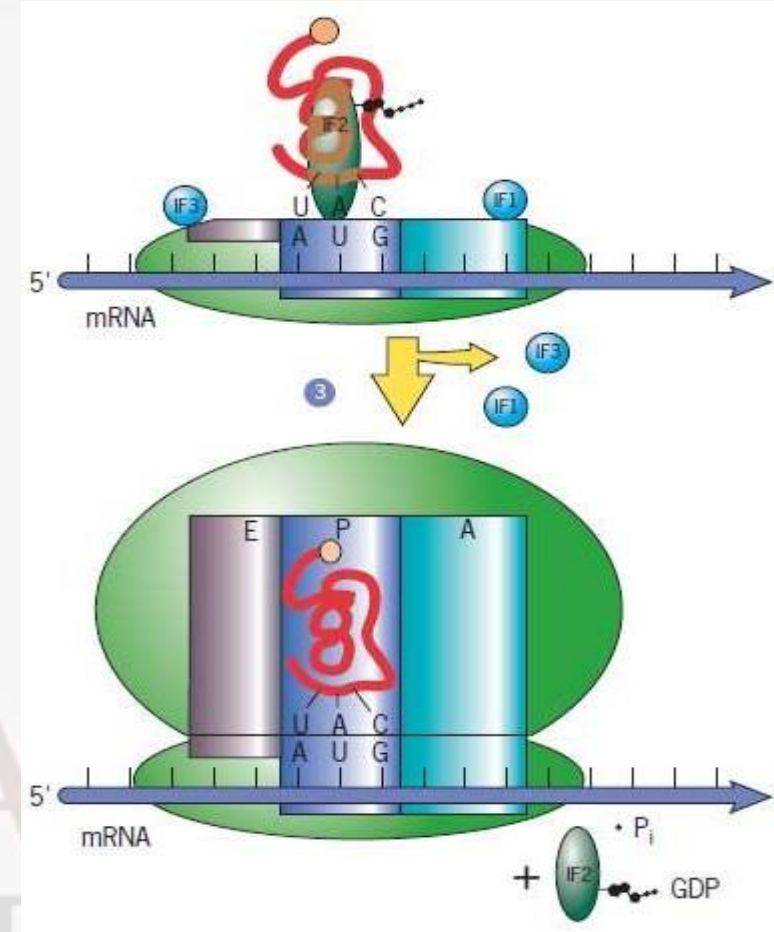
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- Both the complexes combine with each other with IF-1 and 1 mol of GTP
- 50 S subunit gets added to the complex structure. IF-3 is released.
- The addition of 50S subunit utilizes GTP which in turn triggers the release of IF-1 and IF-2.



<https://themedicalbiochemistrypage.org/protein-synthesis-translation-processes-and-regulation/>

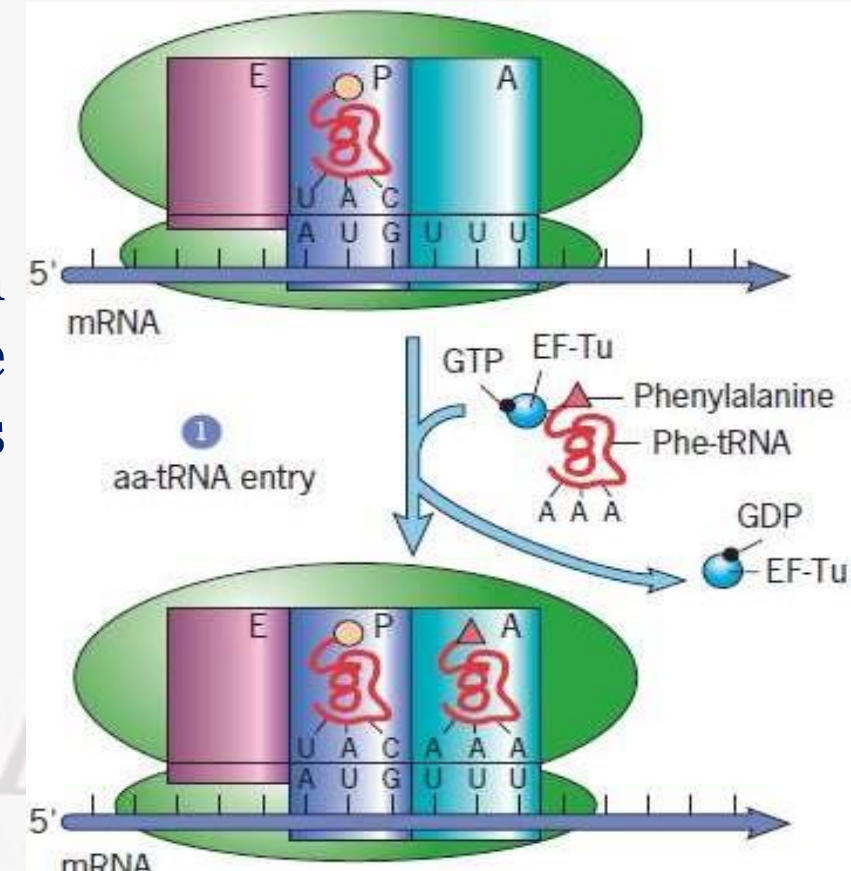
- Addition of 50S to the complex, positions N-formyl met tRNA in the P site directly with the anticodon of the tRNA aligned with AUG codon of mRNA.
- With the AUG initiator codon positioned in the P site, 2d codon in the mRNA positions in such a way that it corresponds to the incoming aminoacyl-tRNA in the A –site.



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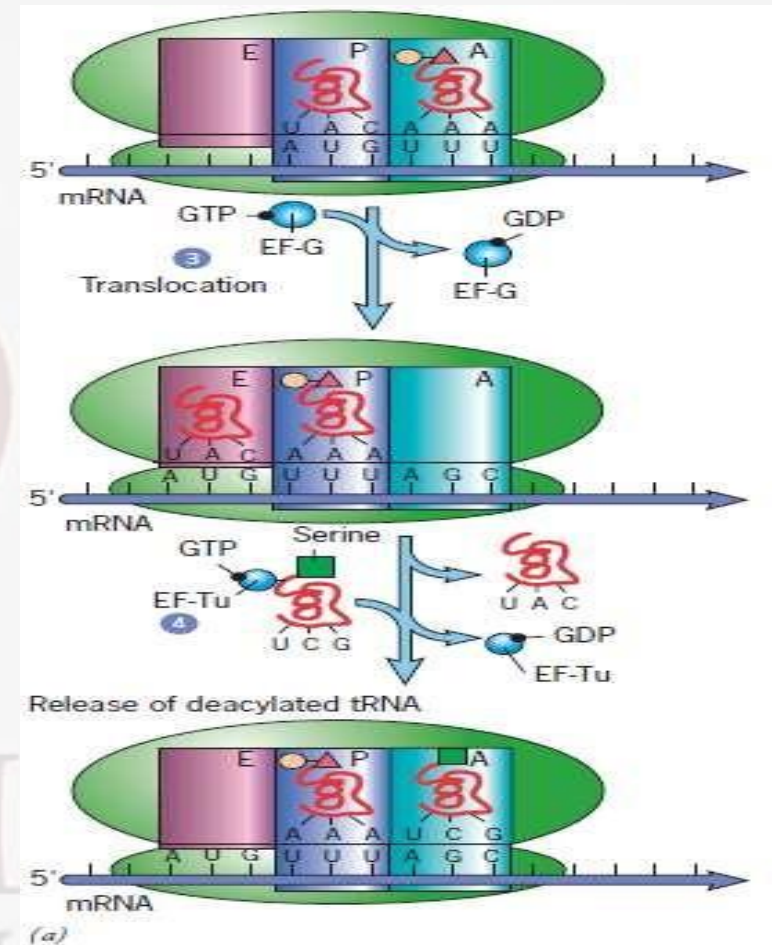
- Elongation begins with the binding of the second aminoacyl tRNA at the ribosomal aminoacyl (A) site.
- The tRNA is escorted to the A site by the elongation factor EF-Tu, which also carries bound GTPs. As the tRNA binds, the GTPs are hydrolyzed and EF-Tu is released.
- A peptide bond formed b/w the N-f-met-Trna at the P site & 2nd amino acyl tRNA at the A site; catalyzed by the peptidyl transferase.

CHAIN ELONGATION



<https://themedicalbiochemistrypage.org/protein-synthesis-translation-processes-and-regulation/>

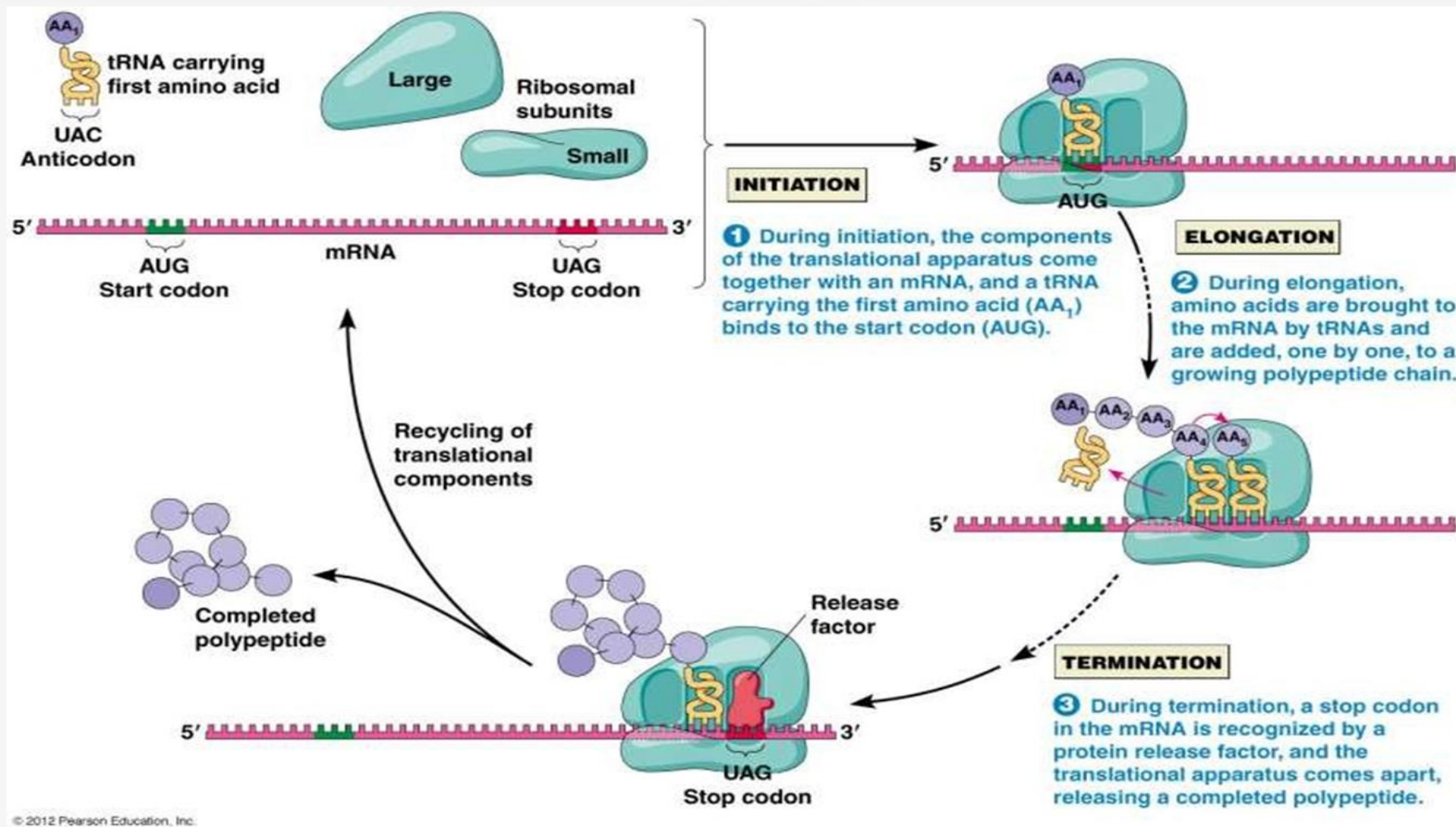
- Transfer of N-f-met. to aminoacyl-tRNA at A site forming a peptidyl tRNA at that position and leaving an uncharged tRNA at the P site.
- Peptidyl tRNA translocated to the P site & uncharged tRNA is translocated to E domain.
- A site unoccupied ; new aminoacyl-TRNA bind to A site & process continues



<https://themedicalbiochemistrypage.org/protein-synthesis-translation-processes-and-regulation/>

CHAIN TERMINATION

- When a stop codon (UAG, UAA, or UGA) arrives at the A site, it is recognized and bound by a protein release factor. (RFs). 2 classes of RFs: Class I & Class II. In *E. coli* 2 Class I RFs are seen- RF-1, RF-2.
- RFs bind to the termination codon at A site & stimulate hydrolysis of bond between tRNA & polypeptide chain at P site, resulting in release of complete polypeptide from ribosome.
- Termination is completed by release of mRNA from ribosome & dissociation of ribosomes into its subunits.



Source: <https://courses.lumenlearning.com/wm-biology1/chapter/prokaryotic-translation/>

- Genetic information carried in the mRNA sequence is translated into the sequence of amino acids in the polypeptide gene products by intricate macromolecular structures called ribosomes.
- Translation process is very complex, requiring the participation of many diff RNA and protein molecules.
- Transfer RNA molecules serve as adaptors, mediating the interaction between amino acids & codons in mRNA.
- Process of translation involves- Initiation, Elongation & Termination.

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Thank you

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