Tuesday, 14 September 2021 11:27 AM

Translation :-

* Process of polymerization of amino acids to form a polypeptide refers to translation.

* The order and sequence of aminoacids are defined by the sequence of bases in the m-RNA.

* The amino acids are joined by a bond which is k/a peptide bond. formation of peptide bond requires energy. ** Therefore,

In the first phase itself aminoacids are activated in the presence of ATP and linked to their cognate t-RNA - a process commonly called as charging of t-RNA or aminoacylation of t-RNA to be more specific. If two such charged t-RNAs are bought close enough, the formation of peptide bond between them would be favoured energetically. The presence of a catalyst would enhance the rate of peptide bond formation.

* The cellular factory responsible for synthesising proteins is the ribosomes. The ribosome consists of structural RNAs and about 80 different proteins.

* In its inactive state, it exists as two sub units; a larger and a smaller sub unit.

* When the small sub-unit encounters an m-RNA, the process of translation of the m-RNA to protein begins.

* There are two sites in the larger subunit, for subsequent amino acids to bind to and thus, be close enough to each other for the formation of a peptide bond.

* The ribosome also act as a catalyst (23S rRNA in bacteria is the enzyme - ribozyme) for the formation of peptide bond.

* A translational unit in m-RNA is the sequence of RNA that is flanked by the start codon (AUG) and stop codon and code for polypeptide.

* An m-RNA also has some additional sequences that are not translated and referred as untranslated regions (UTR). The UTRs are +nt at both 5'-end (before start codon) and at 3'-end (after stop codon). They are required for efficient translation process.

* For initiation, the ribosomes binds to mRNA at the start codon (AUG) that is recognised by the initiator t-RNA.

* The ribosomes proceed to the elongation phase of protein synthesis, during this stage, complexes composed of amino acid linked to tRNA, sequentially bind to the appropriate codon in mRNA by forming complementary base pairs with the t-RNA anticodon.

* The ribosome moves from codon to codon along the m-RNA.

* Aminoacids are added one by one, translated into polypeptide sequences dictated by DNA and represented by mRNA.

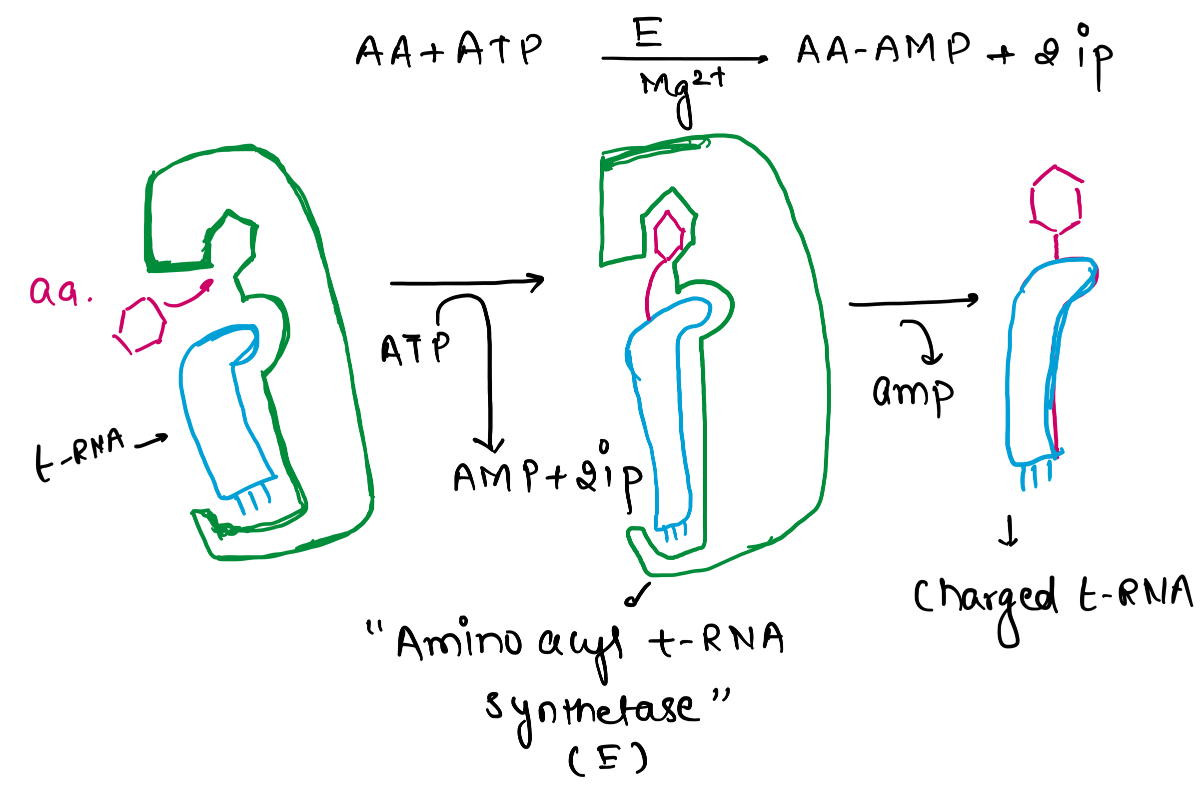
* At the end, a release factor binds to the stop codon, terminating translation and releasing the complete polypeptide from the ribosomes.

Translation

" m-RNA to polypeptide "

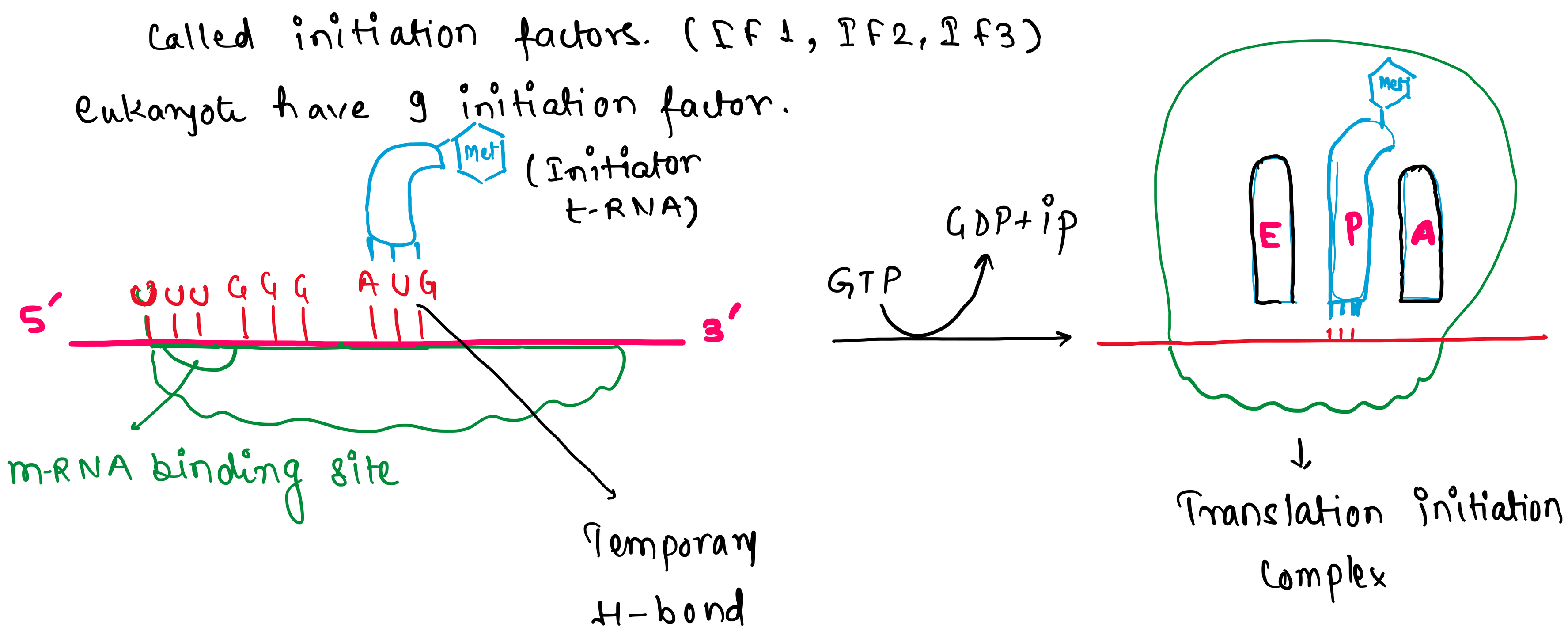
1. Activation of amino acids :-

$$AA + ATP \xrightarrow[Mg^{2+}]{E} AA\text{-}AMP + 2ip$$



* This process is k/a charging of t-RNA or aminoacylation of t-RNA

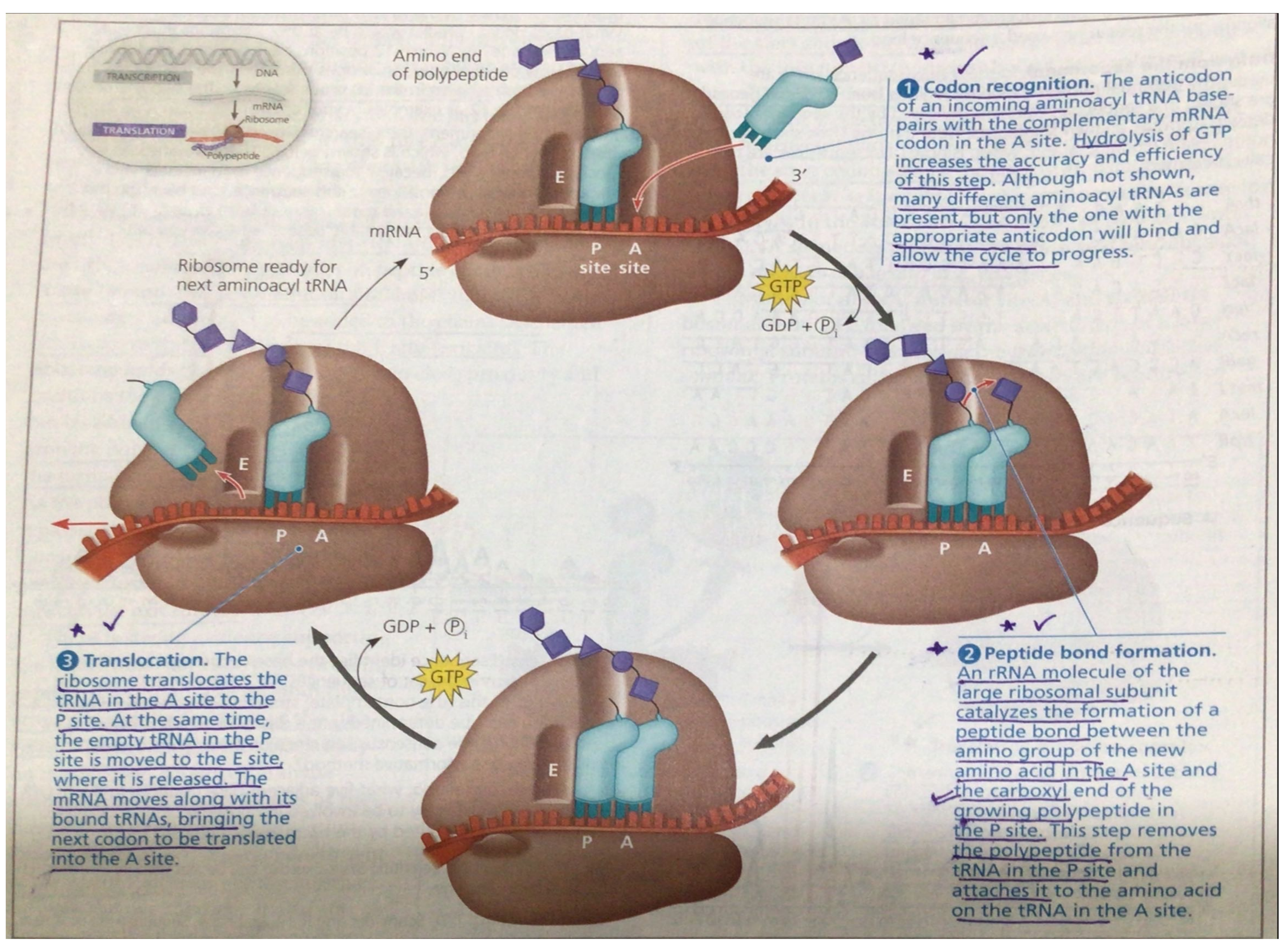
(2.) Initiation of translation :- It require factor called initiation factors. (IF1, IF2, IF3) Eukaryote have 9 initiation factor.



* The initiating methionine accepting t-RNA is charged with non-formylated methionine (t-RNA m^{met}) in the cytoplasm of eukaryotes & formylated methionine ($tRNA\, f^{met}$) in prokaryotes, plastids and mitochondria.

* t-RNA engaged in transfering formylated methionine is different than the one that transfer non-formylated methionine

(3) Elongation :- (Polypeptide chain formation)



3 Step Process

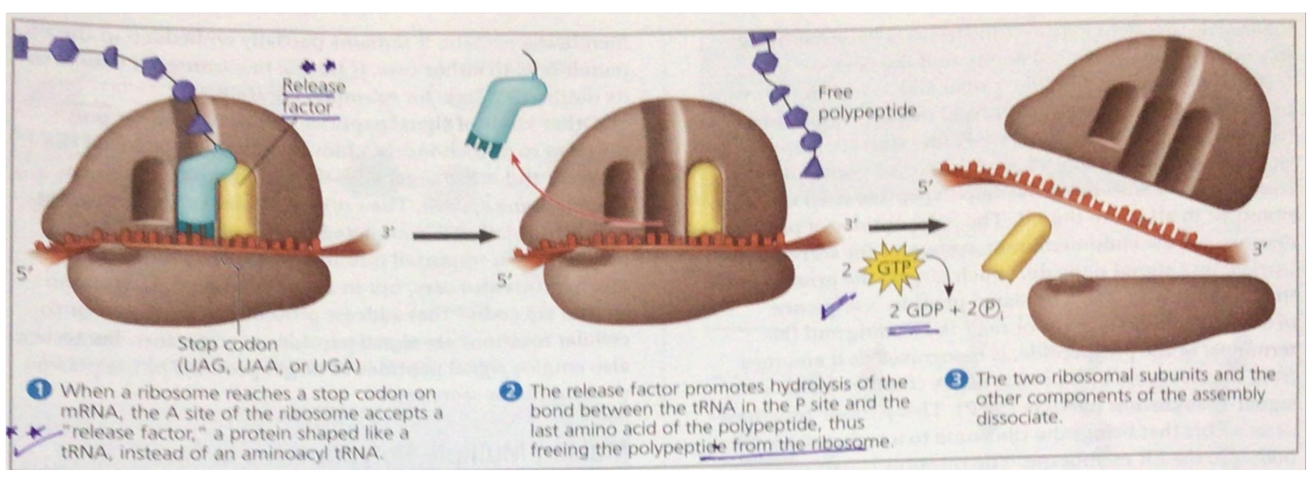
(1) Codon recognition ⟶ GTP ⟶ GDP+iP

(2) Peptide bond formation ⟶ (23S-rRNA = ribozyme)

(3) Translocation ⟶ GTP ⟶ GDP+iP (ribosomes moves over m-RNA)

elongation cycle takes less than a tenth of a second in bacteria and is repeated as each amino acid is added to until the polypeptide is completed.

(4) Termination of Translation :- This is final stage of Translation process



* Genetic code is read again on the principle of complementarity by t-RNA that act as an adapter molecule.

* Since transcription and translation are energetically very expensive processes, these have to be tightly regulated.