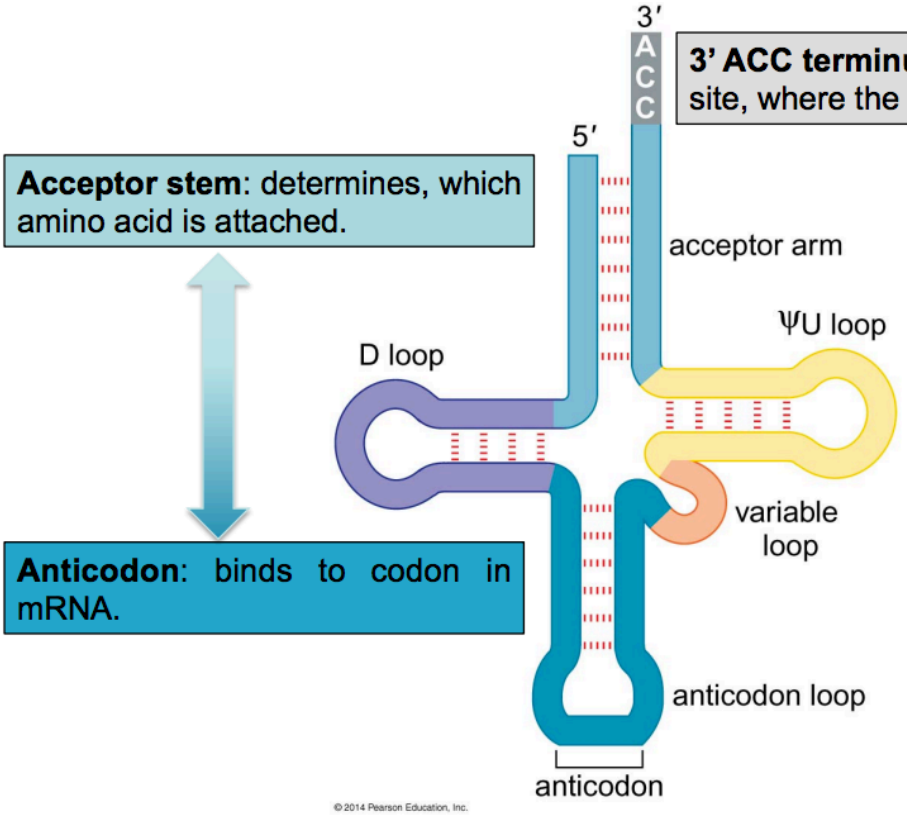
Lecture 10 – Eukaryotic Translation I

tRNAs are adaptors between mRNA and polypeptide that deliver the correct amino acid to the ribosome.



The acceptor stem sequence and anticodon sequence must not be mutated to

Fig 15-5

Isoacceptor tRNAs have different anticodons but can be 'charged' with the same amino acid due the degeneracy in the genetic code. Every amino acid has only one type of *Aminoacyl-tRNA synthetase*. This enzyme charges the tRNAs with amino acids while hydrolysing ATP into ADP and Pi in the process.

Initiation and termination of translation differ between prokaryotes and eukaryotes. *The process of translation below is very important, spend some time on it!*

Preparation of mRNA

1. The cap-binding protein elF4E binds to the 5' cap of the mRNA
2. Recruitment of additional initiation factors (elF4G, elF4A and elF4B) to the mRNA.
3. mRNA is unwinded by elF4A

Preparation of ribosomal small subunit

1. Recruitment of initiation factors to the small subunit of the ribosome. This prevents the binding of the large subunit and of tRNAs to the small subunit
2. Recruitment of the *ternary complex* to the P-site of the small subunit. The complex consists of tRNA-met and elongation factor 2-GTP

Assembly of the 80S Initiation Complex

1. Assembly of the 48S pre-initiation complex
2. The 48S pre-initiation complex scans the mRNA for the start codon (usually the first AUG/ surrounded by the Kozak sequence). During this step, ATP/GTP is hydrolysed
3. Release of initiation factors.
4. Recruitment of the large subunit to form the 80S translation complex.

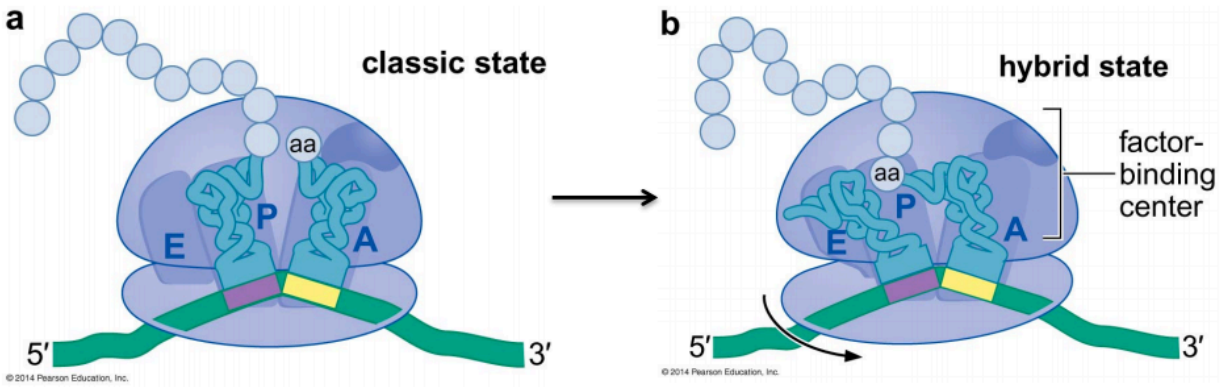
The poly-A tail and translation

The poly-A tail not only prevents the degradation of mRNA from exonucleases, it also plays a role in increasing translation efficiency.

1. Aids recruitment of initiation factors to mRNA
2. Stabilises the prepared mRNA through the formation of hydrogen bonds between the proteins binding to the poly-A tail and 5' end of the mRNA.

Translation Elongation I

1. The elongation factor EF-TU-GTP delivers the charged tRNA to the A-site. Once the right tRNA is delivered, GTP is hydrolysed allowing EF-TU to be released.
2. Transfer of the polypeptide chain from the P-site tRNA to the A-site tRNA which leads to the formation of peptide bond.



3. Recruitment of elongation factor G-GTP catalyses translocation (tRNA-peptide moves from A site to the P site, empty tRNA in the P-site moves to the E-site and is released). During this process, GTP is hydrolysed.

Termination

1. The eukaryotic release factor 1 (eRF1) recognises all three stop codons (i.e. no tRNA is involved)
2. Eukaryotic release factor 3 (eRF3) delivers eRF1 to the ribosome in a energy-dependent manner (hydrolysis of another GTP molecule)
3. eRF1 stimulates the release of the polypeptide chain.
4. eRF1 and the ATPase Rli1 release the components of the translational machinery and contribute to ribosome recycling.

Review questions

1. What is the role of the poly-A tail in mRNA for translation (name 3)
2. Contrast key properties of prokaryotic and eukaryotic mRNA
3. What is the eukaryotic release factor 1 (eRF1) and what its role in translation?