

Translation Facts

Proteins are synthesized from amino acids through the process of translation

tRNA carries amino acids to ribosome for protein synthesis. Amino acids not involved in decoding - fidelity of protein synthesis requires correct charging of tRNA

Properties of genetic code: triplet(codon), non-overlapping, unambiguous(clear), degenerate, universal

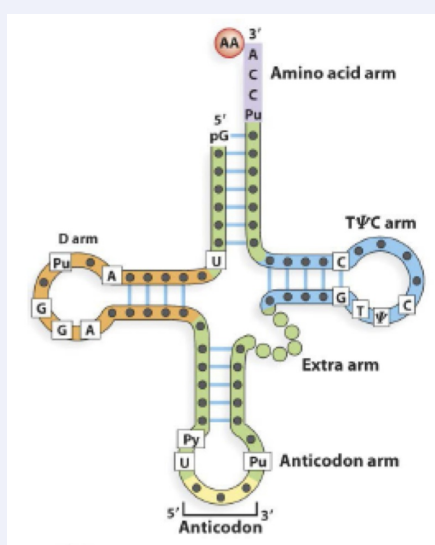
3 phases of translation: **initiation, elongation, termination**

- tRNA base-pairs with mRNA; wobble base pairing

- mRNA is read from 5' to 3', polypeptide extends from N- to C- terminus

Amino acid on tRNA is not involved in codon recognition

Structure of tRNA



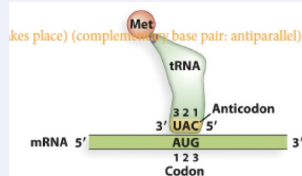
Structure of tRNA

The conformation (three-dimensional shape) of tRNA results from base pairing (hydrogen bonds) within the molecule.

The sequence on 3' end is always **CCA: the amino acid attachment site.**

Anticodon: site of base pairing with mRNA. Unique for each species of tRNA.

Anticodon



Charging a tRNA molecule

Aminoacyl-tRNA synthetases: for charging a transfer RNA with the correct amino acid

Each enzyme is specific for one amino acid

Properties of genetic code

3 bases made up a codon

Non-overlapping

Each codon specify one amino acid

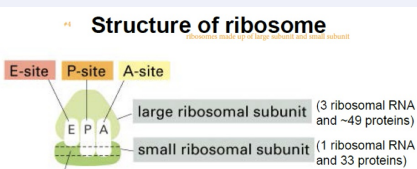
Degenerate: more than one codon for the same amino acid

Nearly universal

Codon table

		Second base				
		U	C	A	G	
U	U	UUU - Phenylalanine	UUC - Tyrosine	UAU - Tyrosine	UGU - Cysteine	U C A G
	U	UUA - Leucine	UUG - Stop codon	UAA - Stop codon	UGA - Stop codon	
	U	UUA - Leucine	UUG - Stop codon	UAA - Stop codon	UGA - Stop codon	
C	C	CUU - Leucine	CCU - Proline	CAU - Histidine	CGU - Arginine	U C A G
	C	CUC - Leucine	CCC - Proline	CAC - Histidine	CGC - Arginine	
	C	CUA - Leucine	CCG - Proline	CAA - Glutamine	CGA - Arginine	
A	A	AUU - Isoleucine	ACU - Threonine	AAU - Asparagine	AGU - Serine	U C A G
	A	AUA - Methionine start codon	ACC - Threonine	AAC - Asparagine	AGC - Serine	
	A	AUG - Methionine start codon	ACG - Threonine	AAA - Lysine	AGA - Arginine	
G	G	GUU - Valine	GCU - Alanine	GAU - Aspartic acid	GGU - Glycine	U C A G
	G	GUC - Valine	GCC - Alanine	GAC - Aspartic acid	GGA - Glycine	
	G	GUG - Valine	GCG - Alanine	GAA - Glutamic acid	GGG - Glycine	

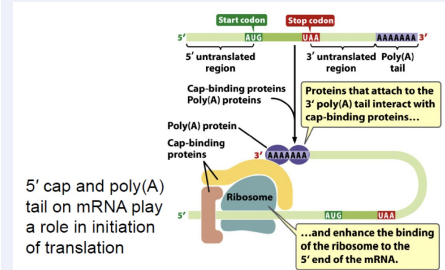
Structure of ribosome



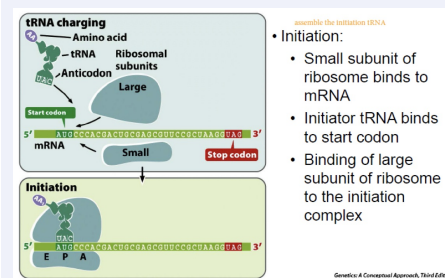
- Ribosomes hold mRNA and tRNA in the correct positions to allow assembly of polypeptide chain.
- A site binds tRNA charged with amino acid.
- P site binds tRNA carrying the growing polypeptide chain.
- E site is where tRNA sits before being released.

Three phases of translation

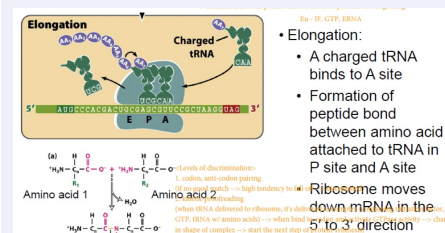
Ribosome



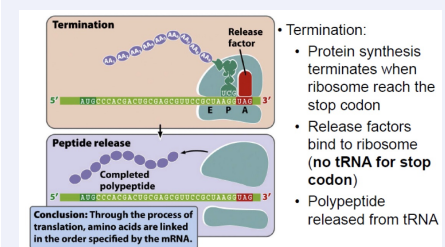
Initiation of translation



Elongation of translation



Termination of translation



Conclusion: Through the process of translation, amino acids are linked in the order specified by the mRNA.

Initiation

- Start codon: AUG

In eukaryotes, ribosome binds to 5' cap and moves along the mRNA to find the first start codon.

Elongation

- mRNA is read from 5' end to 3' end

- Proteins are synthesized from N-terminus to C-terminus

Termination

- Stop codons: UAA, UAG, UGA

C

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