

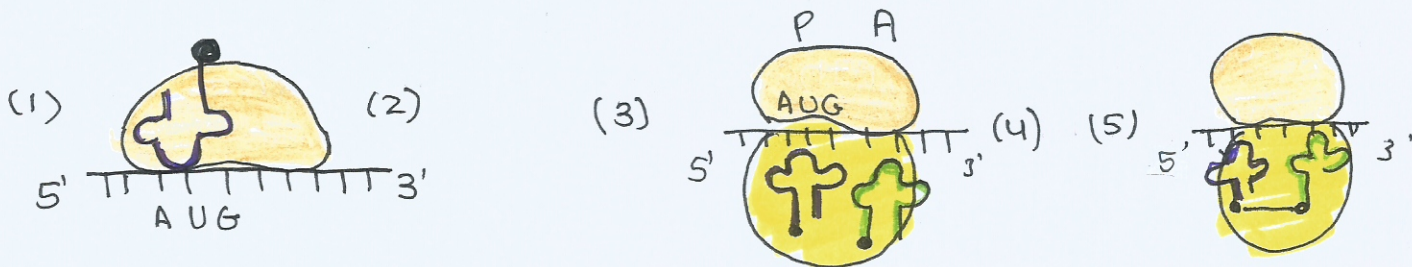
7.3. TRANSLATION

Initiation of Translation → Elongation → Termination.

INITIATION:

It involves assembly of the components that carry out the process.

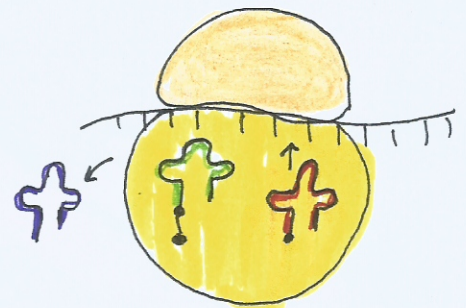
- An mRNA molecule binds to the small ribosomal subunit at the mRNA binding site. (1)
- Initiator tRNA binds at the start codon AUG. (2)
- The large ribosomal sub-unit binds to the small one (3)
- The initiator tRNA is in the P site. The next codon signals another tRNA to bind on the A site. (4)
- Peptide bond is formed between the amino acids and the P & A sites. (5)



ELONGATION:

It involves a repeated cycle of events.

- The ribosome translocates the 3 bases along the mRNA.
- The tRNA moves from the P site to the E site. It freezes there and allows the next tRNA to bind to the next codon.
- The next tRNA occupies the A site.



TERMINATION

Disassembly of the components.

- The process of elongation continues until a stop codon is reached.
- The polypeptide chain is then released.



FREE RIBOSOMES

They synthesize proteins for use primarily in the cell.

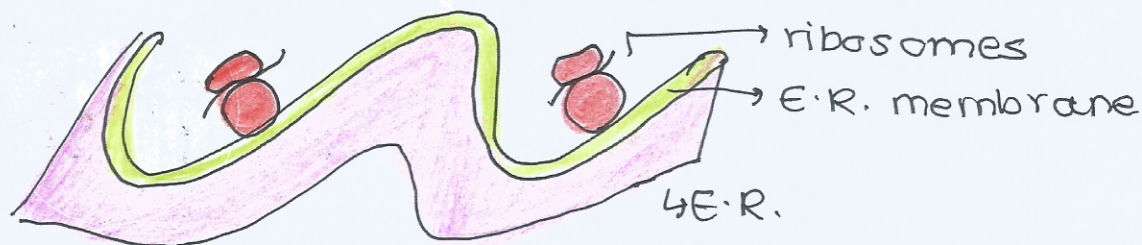
- Proteins are synthesized either in the cytoplasm or at the endoplasmic reticulum. It depends on the final destination of the protein.
- Translation occurs in the cytosol.
- Proteins that are used in the cytoplasm, mitochondria & chloroplasts are synthesized by free ribosomes in the cytoplasm.

BOUND RIBOSOMES

They synthesize proteins for secretion or for use in lysosomes.

Proteins must be sorted so that they end up in their correct location.

Proteins that are used in the ER, Golgi apparatus, lysosomes, plasma membrane or outside the cell are synthesized by ribosomes that are bound to the ER.



How we figure out whether a ribosome is free in the cytosol or bound to an ER?

Depends on the presence of a signal sequence on the polypeptide being translated.

It is the first part of the polypeptide translated.

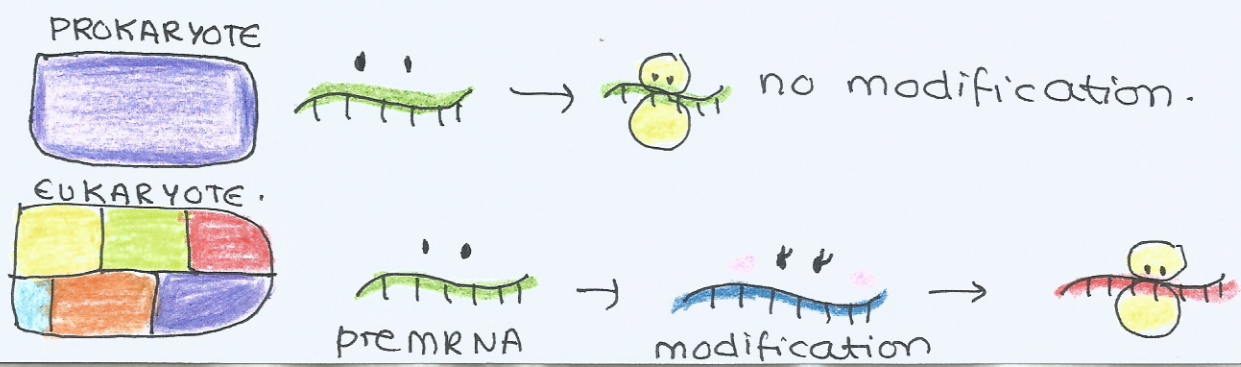
It becomes bound to a signal recognition protein that stops the translation until it can bind to a receptor. (on the surface of the ER)

THE COUPLING OF TRANSCRIPTION AND TRANSLATION IN PROKARYOTES.

Translation can occur immediately after transcription in prokaryotes due to the absence of a nuclear membrane.

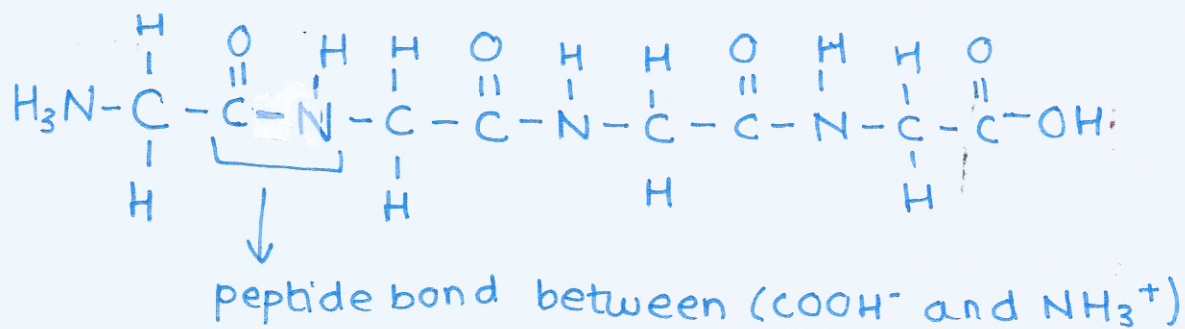
In eukaryotes, the pre mRNA is modified before it reaches the ribosome for translation. This is because cellular functions are compartmentalized. ∴ There is a delay between transcription & translation in eukaryotes.

As there are no compartments in prokaryotes, as soon as the mRNA is transcribed, the translation begins.



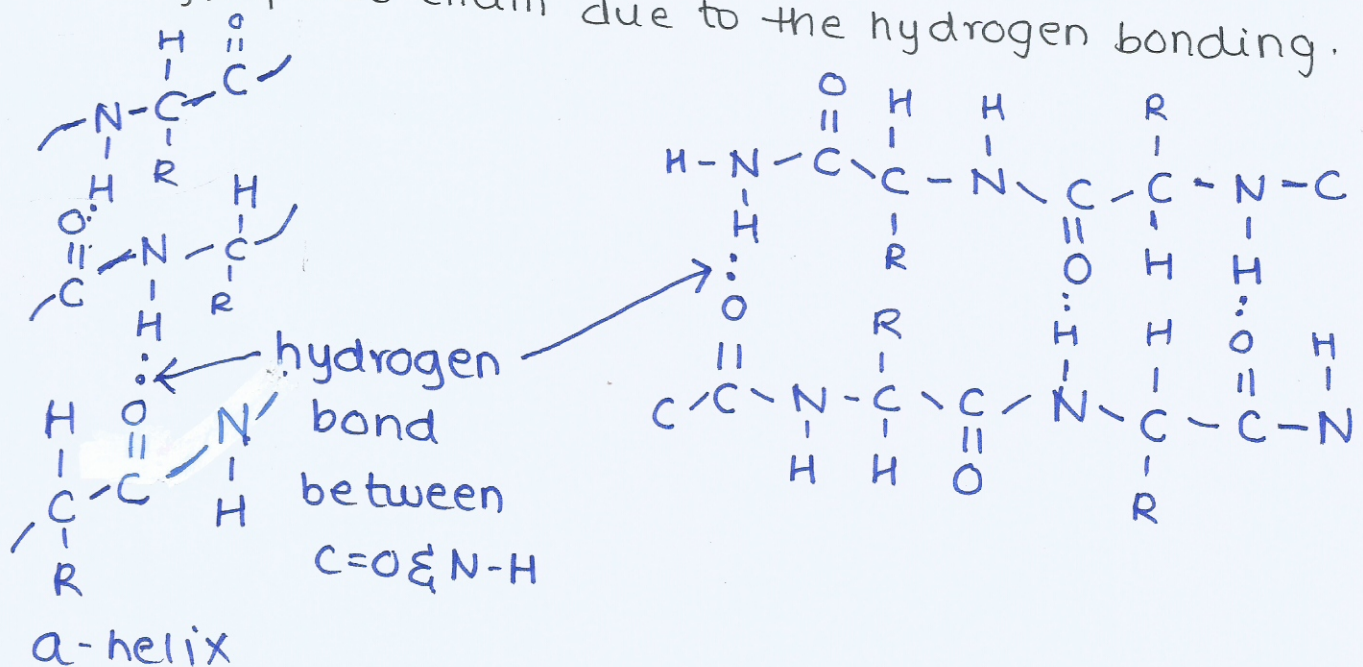
PRIMARY STRUCTURE

- The sequence and the number of amino acids in the polypeptide is the primary structure.
- The bond is formed between the amine (NH_2) and carboxyl groups of adjacent amino acids.



SECONDARY STRUCTURE

- The polypeptide folds in a repeated arrangement to form α -helices & β -pleated sheets (secondary structure).
- The folding is a result of hydrogen bonding between the $\text{C}=\text{O}$ and $\text{N}-\text{H}$ group of an amino acid.
- Secondary structure provides mechanical stability to the polypeptide chain due to the hydrogen bonding.

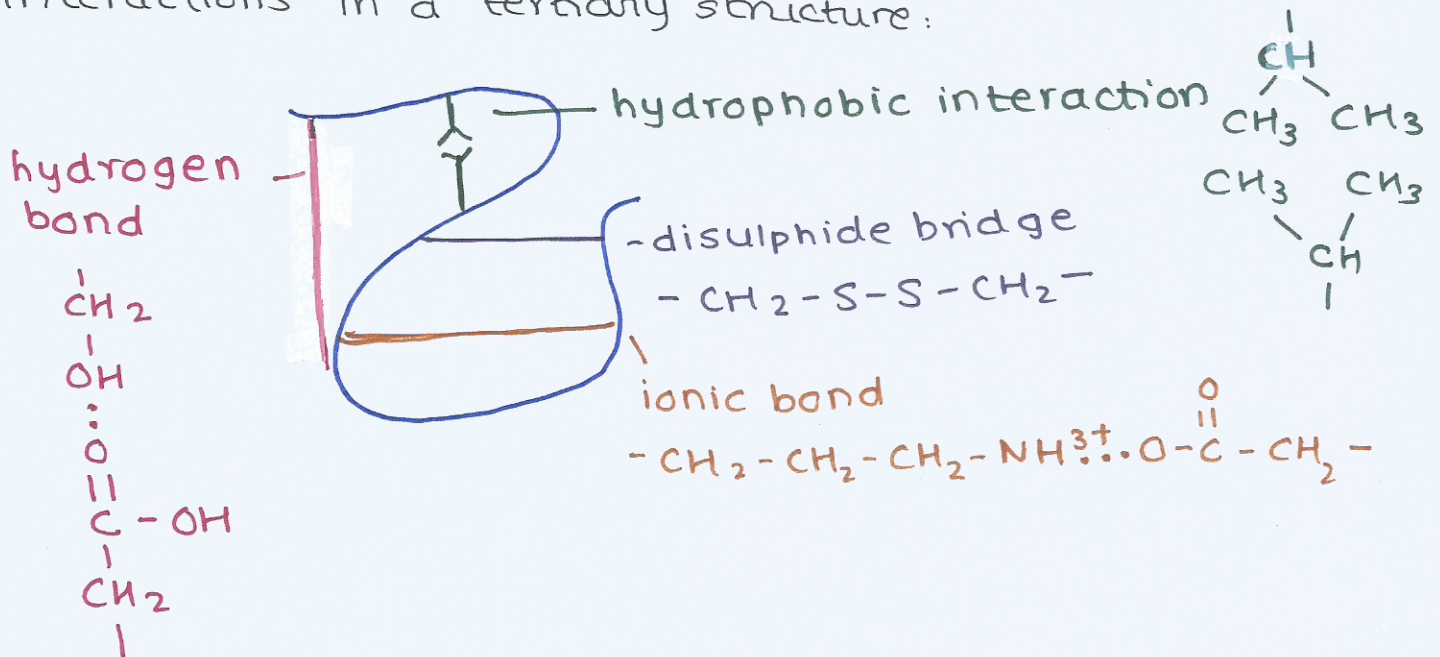


TERTIARY STRUCTURE

→ The tertiary structure is further folding of the polypeptide stabilized by interaction between R groups.

→ It forms a 3-D structure

Interactions in a tertiary structure:



- ▶ positively charged R-groups interact with negatively charged R groups
- ▶ hydrophobic amino acids arrange towards the centre of the polypeptide to avoid contact with water. hydrophilic amino acids will arrange themselves outwards.
- ▶ polar R-groups form hydrogen bonds with other polar R-groups.
- ▶ The R-group of cysteine can form a disulphide bridge with the R-group of another cysteine.



QUATERNARY STRUCTURE

- multiple polypeptides or prosthetic groups interact to form a quaternary structure.
- A prosthetic group is an inorganic compound involved in protein structure or function.
- Protein with a prosthetic group (like heme) is known as a conjugated protein. (eg. haemoglobin)

