GENE EXPRESSION
(PROTEIN SYNTHESIS)
Translation: (Reading the code):

Protein synthesis occurs on ribosomes

(In Eukaryotes ribosomes $60S$ and $40S = 80S$ in union).
(In prokaryotes ribosomes $50S$ and $30S = 70S$ in union).

Start by attachment of small ribosome subunit (30 S) carrying a methionine tRNA with the mRNA at the starting codon (AUG).
Once the initiation complex has formed, synthesis of polypeptide chain is driven by elongation factor that join the large subunit (50 S) of the complex and move the ribosome relative to the mRNA.
Each tRNA carries an amino acid and triplet of bases (anticodon) which recognize a codon on mRNA, for example: tRNA that carries methionine has anticodon UAC that recognize the codon AUG.
Triplet code:-

The universal genetic code means the nucleotide sequence in mRNA that is translated to amino-acids in ribosomes. How many nucleotides translated to one aa?

There is 4 nucleotide (A, C, G, U):

- Impossible for one nucleotide = 4 aa.
- Impossible for two nucleotides = $4^2$ (16) aa.
- Because there is 20 aa so the accepted is 3 nucleotide = 1 amino acid $4^3 = 64$ probabilities.
three none coding or stopping amino acid synthesis (UAA, UAG, and UGA) also called termination codon.

61 codes → for 20 amino acids.

Some amino acids have more than one codon up to six codons like tryptophan.

The triplet nucleotide translated to amino acids this is what we call codon.

When a ribosome reaches a termination codon, the completed polypeptide is released from the last tRNA and the ribosomal units fall off the mRNA.
Steps of translation

- Amino acids are enzymatically activated and transferred to specific adapter molecules of RNA, called "transfer RNA" (tRNA).

- Each amino acid has its own specific tRNA.
• Each tRNA has at one end a triplet of bases (anticodon) complementary to a triplet of bases on mRNA, and at the other end, it carries its specific amino acid.

The triplet of bases on mRNA is called the codon for that amino acid.
- mRNA and tRNA come together on the surface of the ribosome.

- The process is started by attachment of a methionine tRNA with the mRNA at the starting codon (AUG).

- Once the initiation complex has formed, synthesis of polypeptide chain is driven by elongation factor that joins the large subunit of the ribosome and move the ribosome relative to the mRNA.
As each tRNA finds its complementary nucleotide triplet on mRNA, the amino acid that it carries is put into peptide linkage with the amino acid of the preceding tRNA molecule.

The enzyme peptidyltransferase catalyzes the formation of the peptide bond.
The ribosome moves along the mRNA, the polypeptide growing sequentially until the entire mRNA molecule has been translated into a corresponding sequence of amino acids.
When a ribosome reaches a termination codon on mRNA (UAA, UAG, UGA), the completed polypeptide is released from the ribosome and the ribosomal units fall off the mRNA.
Post–translation processing of proteins:

- After formation of the linear polypeptide chain, some modifications occur to form the complex structure of proteins by:
  - folding
  - hydroxylation
  - phosphorylation
  - addition of sugars

- Protein changes from the primary structure to secondary, tertiary, or quaternary structure.
THANK YOU