Translation

The protein synthesis is called translation because the “language” of the nucleotide sequence on the mRNA is translated into the language of an amino acid sequence.

The process of translation requires a genetic code, through which the information contained in the nucleic acid sequence is expressed to produce a specific sequence of amino acids.

Any alteration in the nucleic acid sequence may result in an improper amino acid being inserted into the protein chain, causing disease or even death of the organism.

A. Amino acids

All the amino acids that appear in the finished protein must be present at the time of protein synthesis. If one amino acid is missing [e.g., if the diet does not contain an essential amino acid], translation stops at the codon specifying that amino acid.

This shows the importance of having all the essential amino acids in sufficient quantities in the diet to ensure continued protein synthesis

B. Transfer RNA

tRNAs are able to carry a specific amino acid and to recognize the codon for that amino acid.

At least one specific type of tRNA is required per amino acid.

In humans, there are at least 50 species of tRNA, whereas bacteria contain 30 to 40 species.

Some amino acids have more than one specific tRNA molecule.

This is particularly true of those amino acids that are coded for by several codons.

Two Important sites present in tRNA

1. Amino acid attachment site: Each tRNA molecule has an attachment site for a specific amino acid at its 3’ end.

When a tRNA has attached amino acid, it is said to be charged; when tRNA is not bound to an amino acid, it is described as being uncharged. The amino acid that is attached to the tRNA molecule is said to be activated.

2-Anticodon: Each tRNA molecule also contains a three-base nucleotide sequence—the anticodon—that recognizes a specific codon on the mRNA

C. Aminoacyl-tRNA synthetases

This family of enzymes is required for the attachment of amino acids to their corresponding tRNA.

Each member of this family recognizes a specific amino acid and the tRNA that corresponds to that amino acid.

Each aminoacyl-tRNA synthetase catalyzes a reaction that results in the attachment of an amino acid to the 3′ end of tRNA. The overall reaction requires adenosine triphosphate (ATP).

The synthetases have a “proofreading” activity that can remove mischarged amino acids from the enzyme or the tRNA molecule.