

## GENETIC CODE AND ITS PROPERTIES

Genetic code are the sequence of nucleotides or nitrogenous bases present on messenger RNA (*m* RNA). As they are originating from DNA their bases are complementary to the segment of DNA, from where they are originated.

Genetic code plays the key role in arranging the amino acid sequences in a polypeptide chain during protein synthesis. In our body there are 20 different types of amino acids but the number of nitrogenous bases on mRNA is just four (A,U,G and C). So, there was confusion earlier that- how these four base code for 20 amino acids during protein synthesis? This confusion was overcome by the research contribution of different geneticist. Gamow (1951) first raised a concept that genetic code may be triplet i.e. three bases combinely code for one amino acid. This was established by Marshall Nirenberg through artificial synthesis of genetic code in the laboratory. He synthesize a **polyuridylic molecule** (composed of three uracil bases-UUU), which was found to code for amino acid phenylalanine when introduced to a cell-free medium containing all the enzymes required for protein synthesis (extracted from bacteria *E. Coli*) and all the 20 amino acids. This artificial synthesis of genetic code is described as the **cracking of genetic code**. Har Govind Khorana also synthesize artificial gene. Both the workers shared Nobel Prize in 1968.

		Second Letter					
		U	C	A	G		
1st letter	U	UUU   Phe UUC   UUA   Leu UUG	UCU   Ser UCC   UCA   UCG	UAU   Tyr UAC   UAA   Stop UAG   Stop	UGU   Cys UGC   UGA   Stop UGG   Trp	U C A G	
	C	CUU   Leu CUC   CUA   CUG	CCU   CCC   Pro CCA   CCG	CAU   His CAC   CAA   Gln CAG	CGU   Arg CGC   CGA   CGG	U C A G	
	A	AUU   AUC   Ile AUA   AUG   Met	ACU   ACC   Thr ACA   ACG	AAU   Asn AAC   AAA   Lys AAG	AGU   Ser AGC   AGA   Arg AGG	U C A G	
	G	GUU   Val GUC   GUA   GUG	GCU   GCC   Ala GCA   GCG	GAU   Asp GAC   GAA   Glu GAG	GGU   GGC   Gly GGA   GGG	U C A G	
						3rd letter	

Tab- Showing the triplet codons of *m* RNA and the amino acids coded by them (in blue colour), three Termination codons (in red colour) and initiation codon, code for methionon (green colour)

Among the 64 triplet codons 61 is sense codon, i.e. they code for amino acids. There are three codons –UAA, UAG and UGA they do not code for any amino acid, known as **termination codon**. These codons perform a very important function to terminate the polypeptide chain synthesis, at the time of protein synthesis in the cytosol. They are also

known as **stop codon**. Genetic code AUG is considered as the **initiation codon** being it is always present at the initiation point. AUG code for amino acid methionine.

### Properties of genetic code-

- **Triplet-** Three nitrogenous bases comprises one genetic code arranged in a specific sequence. (About this property we have discussed already in the above paragraph).
- **Commaless-** there is no comma or any punctuation mark between the adjacent genetic codes.
- **Non-overlapping-** On the *mRNA*, one codon do not overlap with the next codon. Eg- AUG GCA ACG GGA etc.
- **Universality-** Same genetic code is present in all organism including virus, bacteria and all living organism.
- **Degeneracy of genetic code-** as the number of genetic code is more than the number of amino acids, it is implide that one amino acid may be coded by more than one codon. This is known as degeneracy.

To understand see the table above .

- **Ambiguity-** A genetic code is always nonambiguous, ie. One codon never code for two different amino acids.
- **Collinearity-** The codons on *mRNA* and the corresponding amino acid residues in the polypeptide chain have a linear arrangement.

**NB:-** These are few lines only to guide you. You please go through the chapter and try to solve the following-

1. Where from the genetic codes are originated? Write about their functional role?
2. The initiation codon present on the 3' end or 5' end?
3. AUG is initiation codon. but, can it be present on the other parts of *mRNA*?
4. Is there any genetic code which can also be an initiation codon apart from AUG ?
5. Is there any genetic code, which does not show degeneracy?
6. Why termination codons do not code for any amino acid?
7. What is Wobble hypothesis?