GENETIC CODE

The process of translation requires transfer of genetic information from a polymer of nucleotides to a polymer of amino acids. There is no complementarity between nucleotides and amino acids. But, there exist ample evidences to support the notion that change in nucleic acids (genetic material) were responsible for change in amino acids in proteins. This led to the proposition of a genetic code that could direct the sequence of amino acids during proteins synthesis.

The proposition and deciphering of genetic code were most challenging. In a very true sense, it required involvement of scientists from several disciplines – physicists, organic chemists, biochemists and geneticists.

George Gamow, a physicist, argued that since there are only 4 bases and if they have to code for 20 amino acids, the code should constitute a combination of bases. He suggested that in order to code for all the 20 amino acids, the code should be made up of three nucleotides. This was a very bold proposition, because a permutation combination of 4^3 (4 × 4 × 4) would generate 64 codons; generating many more codons than required.

Providing proof that the codon was a triplet, was a more daunting task.

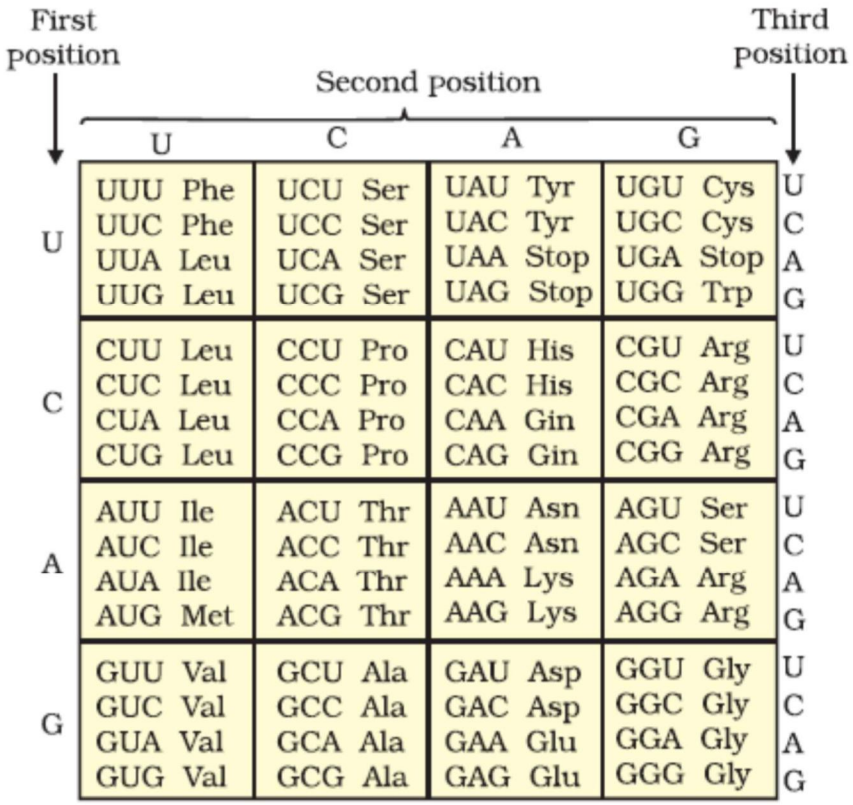
Har Gobind Khorana synthesised RNA molecules with defined combinations of bases (homopolymers and copolymers).

Marshall Nirenberg's cell-free system for protein synthesis finally helped the code to be deciphered.

Severo Ochoa enzyme (polynucleotide phosphorylase) was also helpful in polymerising RNA with defined sequences in a template independent manner (enzymatic synthesis of RNA).

Finally a checker-board for genetic code was prepared.

The Codons for the Various Amino Acids



The salient features of genetic code are as follows:

(i) **Tripletness:** The codon is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids, hence they function as stop codons.

(ii) **Unambiguity:** One codon codes for only one amino acid, hence, it is unambiguous and specific.

(iii) **Degeneracy:** Some amino acids are coded by more than one codon, hence the code is degenerate.

(iv) **Punctuationless:** The codon is read in mRNA in a contiguous fashion. There are no punctuations.

(v) **universality**: The code is nearly **universal**: for example, from bacteria to human UUU would code for Phenylalanine (phe). Some exceptions to this rule have been found in mitochondrial codons, and in some protozoans.

(vi) AUG has dual functions. It codes for Methionine (met), and it also act as **initiator** codon.