Genetic code:

The pathway of protein synthesis is called translation because the lang. of nucleotide seq. on mRNA is translated into the lang. of an amino acid seq. The protein amino acid which codes for one amino acid is known as codon and codes one a determine one specific protein called as genetic code. The collection of codons known as genetic code. The proposed by F.H.C Crick.

& evidence

Properties of Genetic Code:

Following properties of the genetic code proved by definite experimental evidence:

i) The code of is triplet:

A codon of the genetic code comprises three nitrogenous bases of mRNA in a specific sequence. The codes earlier outlined, singlet and doublet codes are not enough to code for 20 amino a, it was pointed out that triplet code is min. req.

ii) The code is degenerate & Ambiguity:

The genetic code inside the cell medium (in vivo) is said to be non-ambigous because a particular codon always codes for the amino acid. No doubt the same amino acid may be coded by more than one codon (degeneracy), but one codon never codes for two different amino acid

But in certain cases genetic code is found to be ambiguous (some codons coding for different amino acids under different conditions) In an ambiguous code, the same codon could code for one or more than two different amino acid. In AUG and GUG; both may code for methionine as initiating codons, although GUG is meant for valine

iii) Commaless: A commaless code means no comma (punctuation) are needed between any two words i.e, codons is immediately followed by the next codon with no intervening

iv) Universality: The same genetic code is said to be present in all kinds of living organism including viruses, bacteria, unicellular and multicellular organisms. Although the code has been worked out by using from microorganism, Rare variants of the genetic code operate both in the nuclear and mitochondrial genome

v) Non-overlapping: Initially it was disturbing for some geneticists to think of degeneracy in connection with genetic code. Therefore, a triplet code with overlapping sequence was suggested. Under the overlapping triplet code the no. of codons could be reduced to twenty. But evidence have been

gathered in support of the existence of non overlapping code.

vi) Collinearity: The codons in DNA and mRNA and corresponding amino acid residues in the polypeptide chain have a linear arrangement which demonstrated in the studies of T4 mutants. These produce incompleted head protein molecules. In map, the mutant has shown as linear seq. by recombination technique. This suggests that the code is collinear.

DNA replication:

Watson and Crick give double helical structure of DNA replication. In the process of replication weak H bonds b/w the nitrogenous base of nucleotide separate so that two polynucleotide strand of DNA also separate and uncoil. The strand thus separated are complementary to one another. Each nucleotide of separated chain attracts its complementary nucleotide from the cell cytoplasm. The sugar radicals unite through phosphate and form of polynucleotide chain.

Thus, each strand of the double helix DNA serve as template. This method of DNA replication is described as semi-conservative method.

Mechanism of DNA replication in Prokaryotes:

In: E. coli replication involves following steps:

1. Activation of amino acid:

The deoxyribonucleoside monophosphate

13.08.17

First N-Base	Second Base				Third Base
	U	C	A	G	
U	UUU Phenyl alanine UUC UUA Leucine UUG	UCU UCC UCA UCG Serine	UAU Tyrosine UAC UAA Non sense codon UAG	UGU Cysteine UGC UGA Non sense codon UGG Tryptophan	U C A G
C	CUU CUC CUA CUG Leucine	CCU CCC CCA CCG Proline	CAU Histidine CAC CAA CAG Glutamine	CGU CGC CGA CGG Arginine	U C A G
A	AUU AUC AUA Isoleucine AUG Methionine	ACU ACC ACA ACG Threonine	AAU AAC AAA AAG Lysine	AGU AGC AGA AGG Serine / Arg	U C A G
G	GUU GUC GUA GUG Valine	GCU GCC GCA GCG Alanine	GAU GAC Aspargine GAA GAG Glutamine	GGU GGC GGA GGG Glycine	U C A G

Codon assignment :

Introns and exons :— From different biochemical analysis and studies it was observed that all the nucleotide sequences non coded protein synthesis or they can't be called genetic code. In this way, in a nucleotide there are two types of sequences

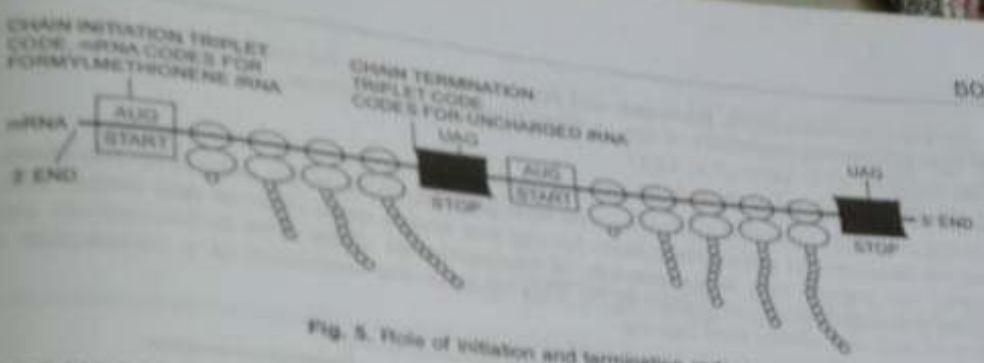

Fig. 5. Role of initiation and termination codons

DISCOVERY OF GENETIC CODE OR CRACKING OF GENETIC CODE

The existence of a triplet code was simply an assumption till **Nirenberg** (Nobel Prize winner) and **Mathaei** in 1961 proved its existence by experiments. They were able to synthesise artificial mRNA which contained molecules of only one base uracil. It was named **polyuridylic** (poly U) molecule. The synthetic poly-U was placed in a cell-free system containing protein-synthesising enzymes extracted from *Escherichia coli* and the twenty amino acids together with necessary ATP. After some time a small protein-like molecule was produced which was formed by the linking of phenylalanine. It means UUU is the codon for phenylalanine.

Subsequently, it was found that poly-A mRNA gave polylysine peptide chain and poly-C gave polyproline. Therefore, codon-AAA was assigned for lysine and CCC to proline. Such a polynucleotide chain of mRNA formed of a single type of nucleotide is known **homopolymer** chain. After establishing the codons of different homopolymers, **Nirenberg** and his associates tried to establish the nature of codons formed by two or more bases. These were named as **copolymers**-ACA, CAA, CCA, etc.

MARSHALL NIRENBERG
(10th April, 1927)

Nirenberg successfully prepared cell free protein synthesising system from E. coli. By adding new mRNA (poly U), Nirenberg was able to synthesise polyphenyl polypeptide chain. This was described as **cracking of genetic code**, for which he shared 1968 **Nobel Prize** with H. G. Khorana.

HAR GOBIND KHORANA

Har Gobind Khorana was born in 1919 in Raipur (now in Pakistan). He made remarkable contribution in artificial synthesis of nucleic acids. He discovered how to synthesise triplet RNA molecules of known sequence thereby assigning the genetic code.

Contribution of Khorana

Indian born biochemist, **Dr. H.G. Khorana**, devised an ingenious technique for artificially synthesising mRNA with repeated sequences of known nucleotides. For this valuable contribution he was awarded Nobel Prize in 1968.