Genetic Code :→

DNA → DNA
→ RNA

* During replication & transcription a nucleic acid was copied to form another nucleic acid. Hence, these processes are easy to understand on the basis of complementarity.

* But during translation transfer of genetic information occurs from of polymer of aminoacid from polymer of nucleotides. Neither does any complementarity exist b/w nucleotides and amino acids, nor could any be drawn theoretically.

* There are many evidences shows that change in nucleic acids were responsible for change in amino-acids in proteins. This led to the proposition of genetic code that could direct the sequence of amino acids during synthesis of protein.

The relationship b/w the sequence of nucleotides in a polypeptide and a nucleotide sequence of DNA or m-RNA is called Genetic code"

There is one problem

DNA contain 4 Bases, while no. of aa. is 20

Therefore "George Gamow", physicist suggested that, the code should constitute a combination of Bases.

$4^1 \longrightarrow$ 4 aa. (4 codon)

$4^2 \longrightarrow$ 16 a.a. (16 codon)

$4^3 \longrightarrow$ 64 a.a. → but code for 20 aa only. (64 codon)

Providing Proof that codon was a triplet, was a mor difficult task.

(1) Har Gobind Khorana (1964) :→ The chemical method developed by him was instrumental in synthesizing RNA molecules with defined combinations of bases (homopolymer or copolymers)

UGUG

UGUGUGUGUGUG.....

GUG UGU GUG UGU
Val – Cys – Val – Cys

This is possible only if three adjacent nucleotides specify one amino acid.

(2) Nirenberg (1961) :- He prepared polymer of four nucleotides

UUUU.., CCCC..., AAAA...., GGGG....

He observed that poly U stimulated the formation of poly phenylalanine, poly A – polylysine poly- polyproline poly G- did not function. Marshall Nirenberg's cell free system for protein synthesis finally helped the code to be deciphered.

UUU → phenyl alanine

(3) Severo Ochoa :- Severo ochoa enzyme (Polynucleotide phosphorylase) was also helpful in polymerising RNA with defined sequence in a template independent manner (enzymatic synthesis of RNA)

Slowly all the codons were worked out

AUG → Initiation codon
GGU → Glycine

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

Arg → Tryptophan

Met → Initiator codon

Exception to Degeneracy

Leu, Ser, Arg, Val, Ala, Pro, Thr, Gly

Met, Trp → Single codon

Met → Initiator

Trp → Tryptophan

Stop

T → Tyr
G → stop
H → His
G → Gln
A → Asn
L → Lys
A → Asp
G → Glu

→ Thyrosine

DNA

Met → Initiator

Met → AUG

Met → Methionine

Met → Methionine

Met → Methionine