Genetic Code

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GENETIC CODE

The relationship between the sequence of amino acids in polypeptide chain and nucleotide sequence of mRNA or DNA is called genetic code.

Or

The genetic representation of codon by which the information in RNA is decoded in a polypeptide is called genetic code.

Or

The order in which bases (nucleotides) are arranged in RNA deciding the order in which amino acids are arranged in proteins. (i.e. it is the relationship between nucleotide bases and the amino acids).

Genetic Code- Table

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

"Genetic code is triplet"

- The genetic code is triplet. There are 64 codons.

First letter	Second letter: U	Second letter: C	Second letter: A	Second letter: G	Third letter
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

Properties of Genetic Code

"Universality"

- The genetic code is universal.
- AUG is the codon for methionine in mitochondria. The same codon (AUG) codes for isoleucine in cytoplasm. With some exceptions noted the genetic code is universal.

" Non-Ambiguous"

- The genetic code is non-ambiguous.
- Thus one codon can not specify more than one amino acid.

"Non-overlapping"

- One base cannot participate in the formation of more than one codon.
- This means that the code is non-overlapping.

"Continuous Translation"

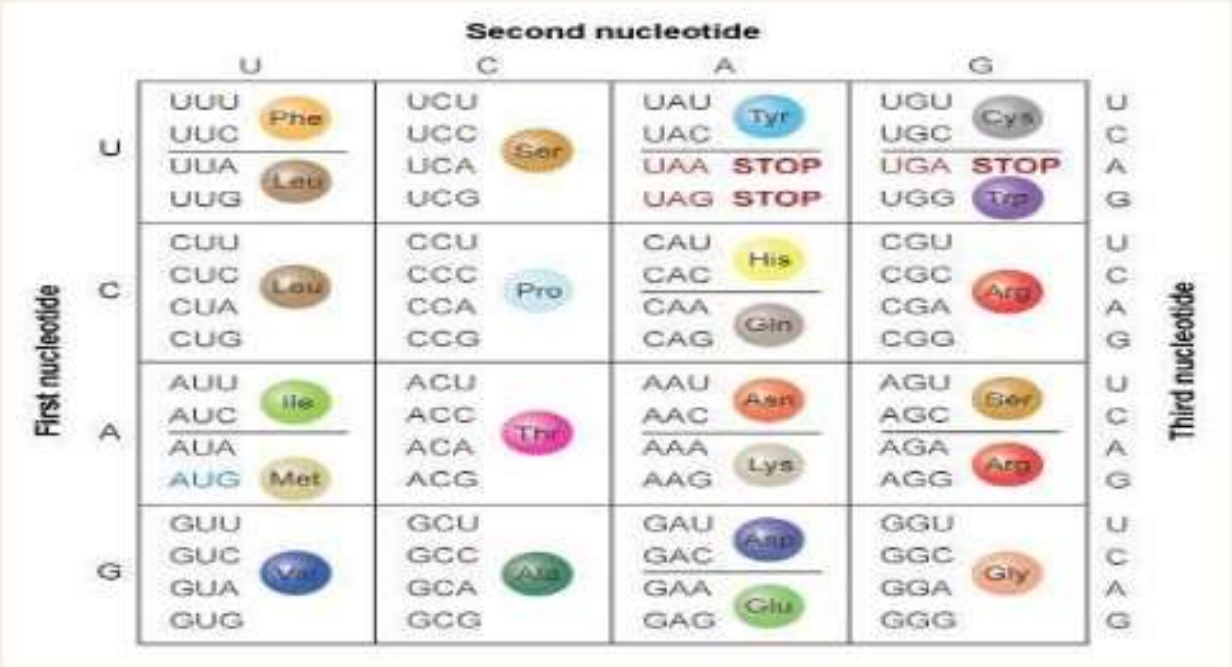
- The gene is transcribed & translated continuously from a fixed starting point to a fixed stop point.
- Punctuations are not present between the codons.

"The code has polarity"

- The code has a definite direction for reading of message which is referred to as polarity.
- Reading of message from left to right & right to left will specify for different amino acids.
- For Example UUG stands for leucine, & from right to left it is GUU which stands for valine.

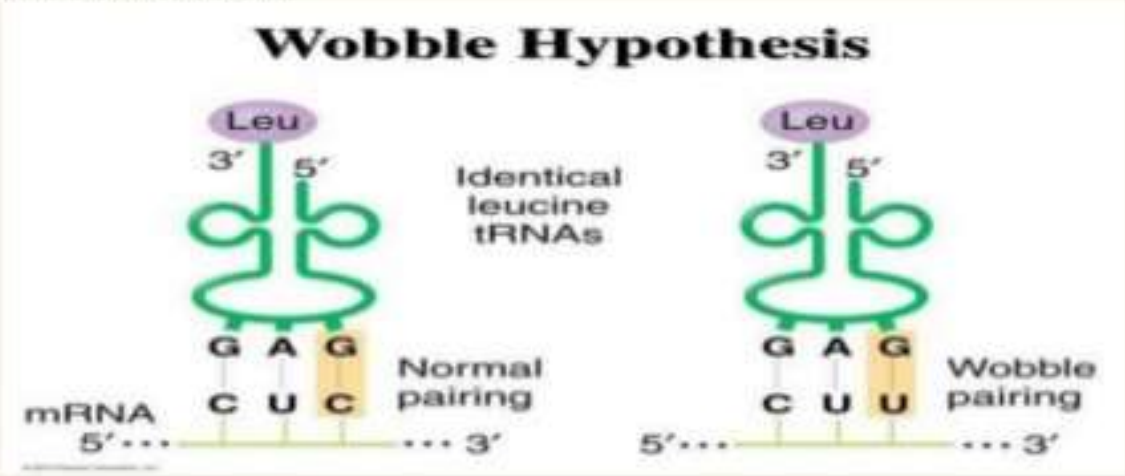
Degeneracy of genetic code

- An amino acid can be coded for by more than one codon. This is called degeneracy of genetic code.



Wobble hypothesis

- Crick postulated the 'wobble hypothesis' to account for the degeneracy of genetic code. According this hypothesis, the first two bases of a codon pair according to the normal base pairing rules with the last two bases of the anticodon. Base-pairing at the third position of a codon is wobble



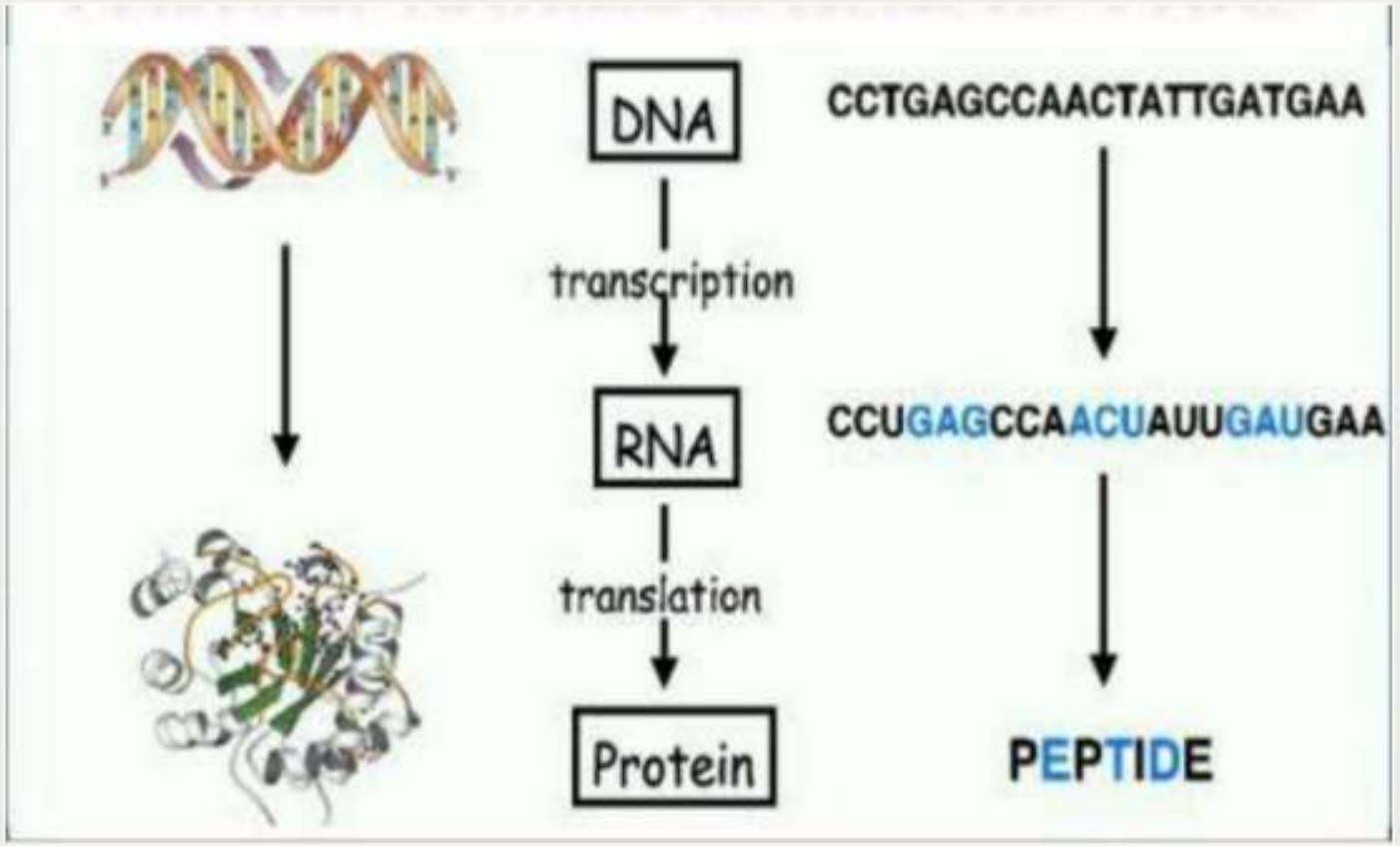
Wobble hypothesis explains degeneracy

- Wobble hypothesis explains the degeneracy of the genetic code, i.e, existence of multiple codons for a single amino acid. Although there are 61 codons for amino acids, the number of tRNA is far less (around 40)which is due to wobbling.

Biological significance of degeneracy of the genetic code

- If the code were not degenerate, 20 codons would designated amino acids and 44 would lead to chain termination.
- The probability of mutating to chain termination would therefore be much higher with a non degenerate code.

FLOW OF GENETIC INFORMATION



CLINIC SIGNIFICANCE

- Mutation can be well explained using the genetic code.
- A) Point Mutations
  1) Silent
  2) Misense
  3) Nonsense
- B) Frame shift mutations

Thank You!