Genetic Code- Table

The properties of the genetic code

Learning objective

- Explain the properties of the genetic code
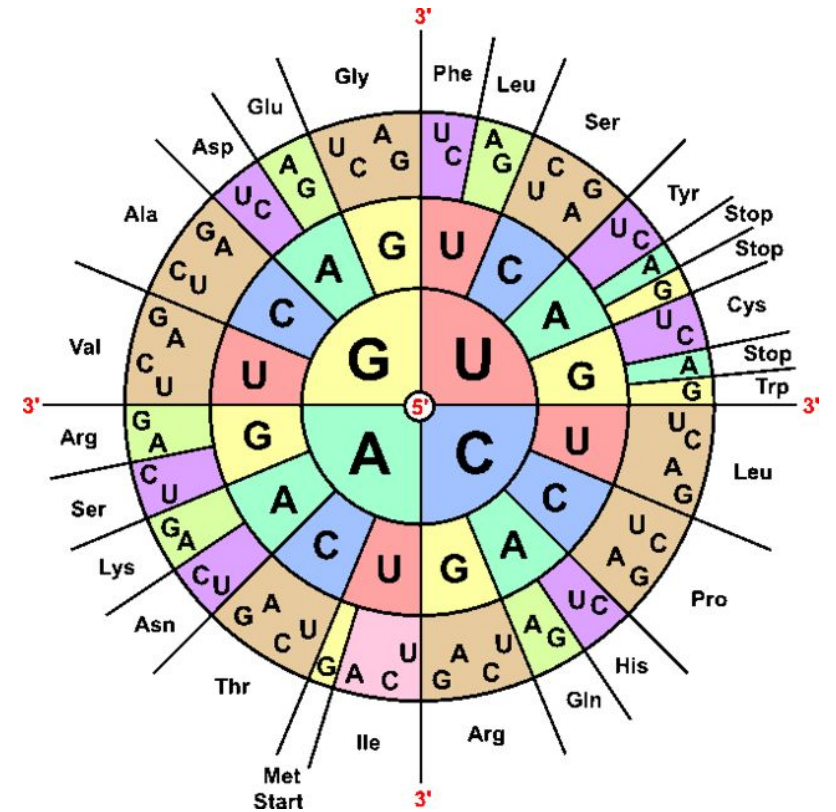
Success Criteria

- Describe correctly how triplet code can be transferred to protein mode using at least four given terms.
- Explain properties of genetic code.

terminology

- Genetic code
- codon/triplet/anticodon/base
- Code is a Triplet
- The Code is Degenerate
- The Code is Non-overlapping
- The Code is Comma Less
- The Code is Unambiguous
- The Code is Universal
- Co-linearity
- Gene-polypeptide Parity

- Генетический код
- кодон / триплет / антикодон/ основание
- Код - триплетен
- Код - вырожденный
- Код не перекрывается
- Код – нет знаков препинания
- Код - однозначен
- Код - универсальным
- Линейность
- Паритетность гена-полипептида

The scientist investigating nucleic acids

Marshall Nirenberg, the scientist that **deciphered the genetic code** in 1961.

The scientist investigating nucleic acids

Har Gobind Khorana, creator of new methods to **produce synthetic nucleic acids.**

The scientist investigating nucleic acids

Robert Holley, the discoverer of **the transfer RNA - tRNA**.

Properties of Genetic Code

1. ### Code is a Triplet:

As pointed out earlier, the coding units or **codons for amino acids** comprise **three letter words**, 4 x 4 x 4 or 43 = **64**. 64 codons are quite adequate to specify **20 proteinous amino acids.**

	Second base			
First base	**A**	**C**	**G**	**U**
A	AA	AC	AG	AU
C	CA	CC	CG	CU
G	GA	GC	GG	GU
U	UA	UC	UG	UU

Singlet Code: 4¹= 4 x 1=4 codons

Doublet Code: 4²= 4 x 4=16 codons

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

Triplet Code: 4³= 4 x 4 x 4=64 codons

www.biologyexams4u.com

Properties of Genetic Code

2. The Code is Degenerate:

The occurrence of more than **one codon** for a **single amino acid** is referred to as degenerate. A review of genetic code dictionary will reveal that most of the amino acids have more than one codon. Out of 61 functional codons, AUG and UGG code to one amino acid each. But remaining 18 amino acids are coded by 59 codons.

- a given amino acid may be coded for by more than one codon

64 codons and only 20 amino acids:

so some amino acids are coded for by several codons – exceptions [next slide]:
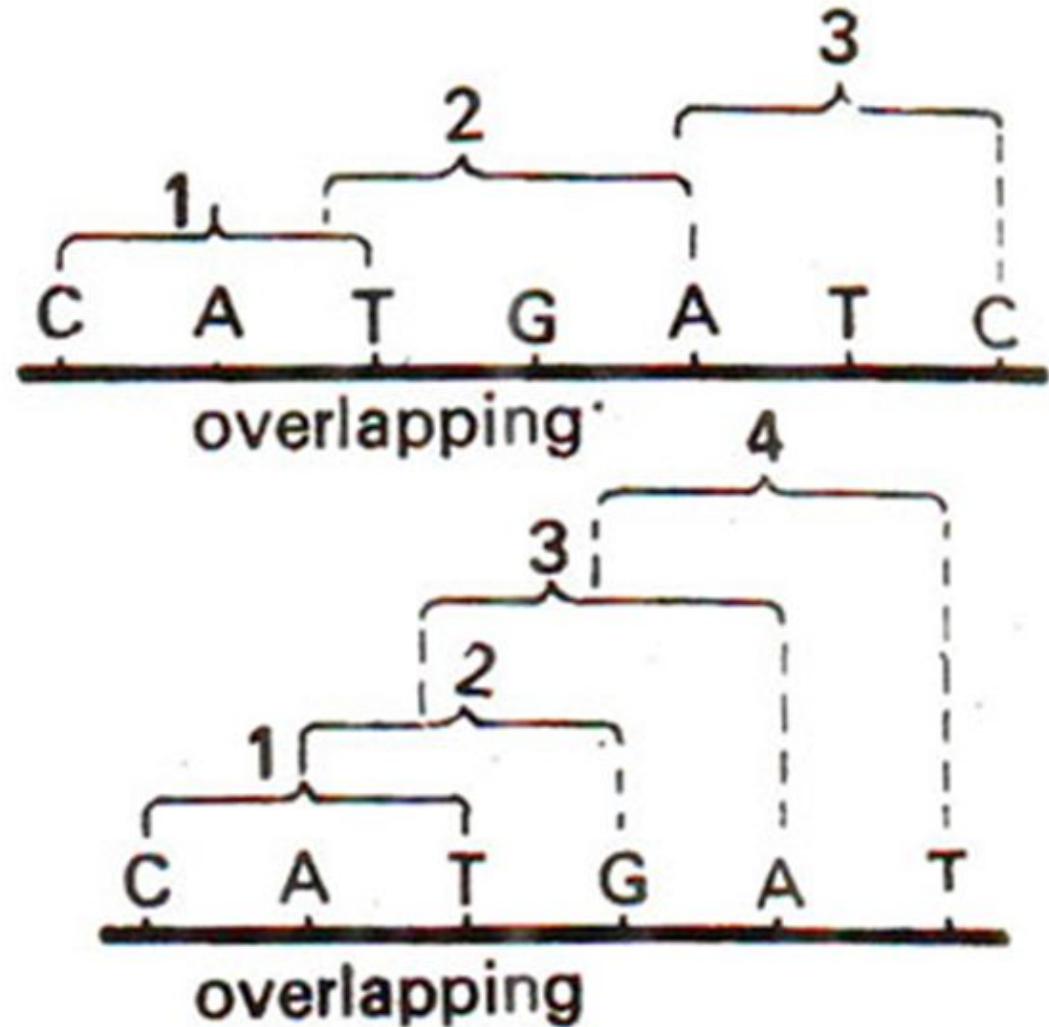
Valine
GUU
GUC
GUA
GUG

Lysine
AAA
AAG

Tyrosine
UAU
UAC

Properties of Genetic Code

3. The Code is Non-overlapping:

In a non-overlapping code, the same letter (i.e., base) is **not used in the formation of more than one codon**.

Properties of Genetic Code

4. The Code is Comma Less:

A comma less code means that no **nucleotide** or comma (or punctuation) **is present in between two codons**. Therefore, code is continuous and comma less and no letter is wasted between two words or codons.
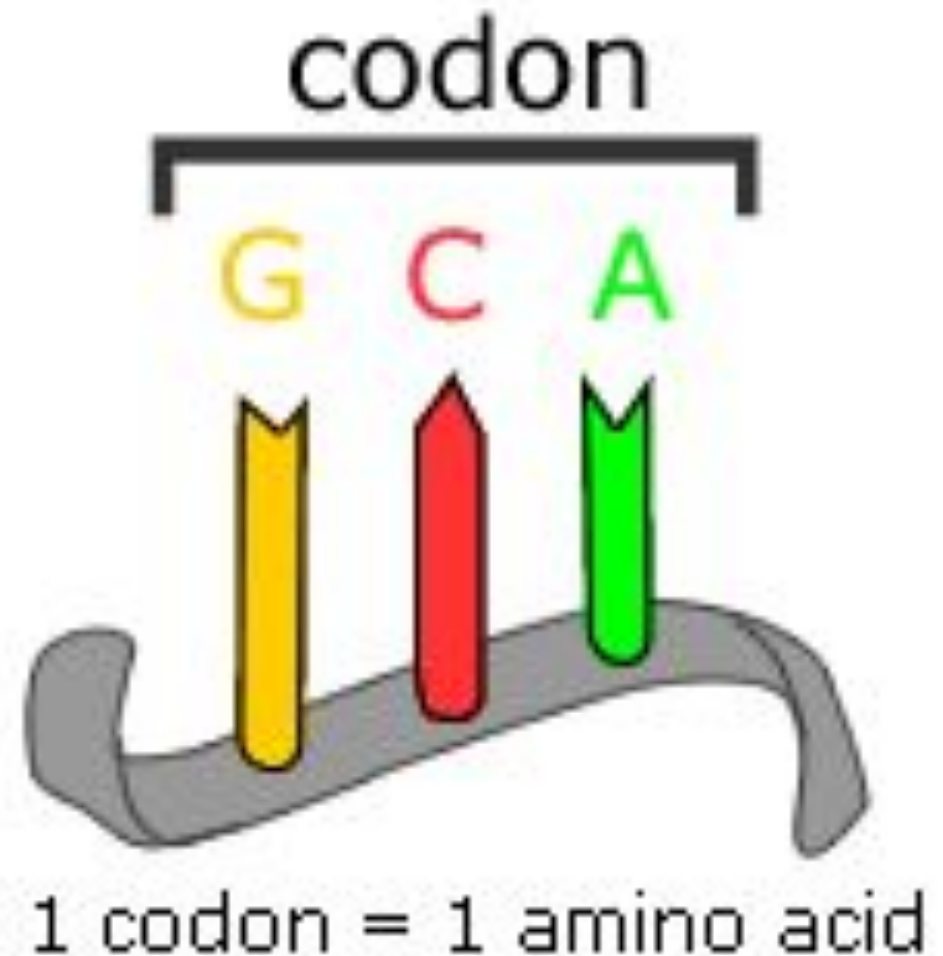
A—U—G,
aa1

—C—A—G
aa2

Properties of Genetic Code

5. The Code is Unambiguous:

There is no ambiguity in the genetic code. A given **codon always codes** for a **particular amino acid**, wherever it is present.

codon

G C A

1 codon = 1 amino acid

Properties of Genetic Code

6. The Code is Universal:

The genetic code has been found to be **universal** in **all kinds of living organisms** — prokaryotes and eukaryotes.

What does the DNA of all these organisms have in common?

They all share a universal genetic code.

Properties of Genetic Code

7. Co-linearity:

DNA is a linear polynucleotide chain and **a protein is a linear polypeptide chain.** The sequence of amino acids in a polypeptide chain corresponds to the sequence of nucleotide bases in the gene (DNA) that codes for it. Change in **a specific codon in DNA produces** a **change of amino acid in the corresponding position in the polypeptide.** The gene and the polypeptide it codes for are said to be co-linear.
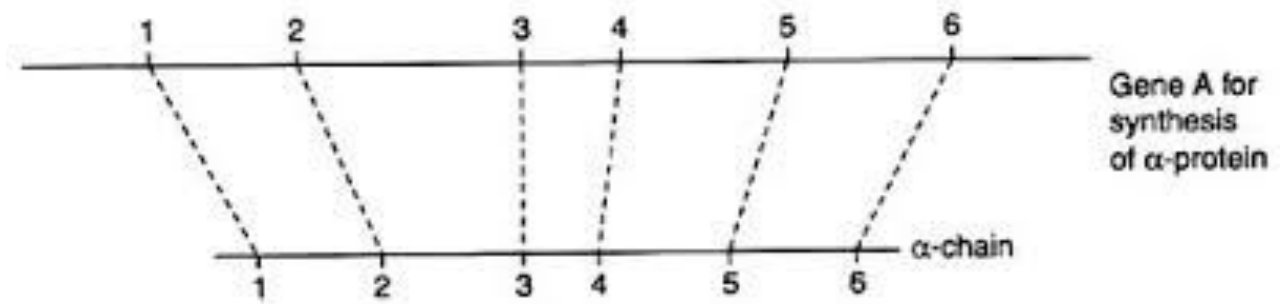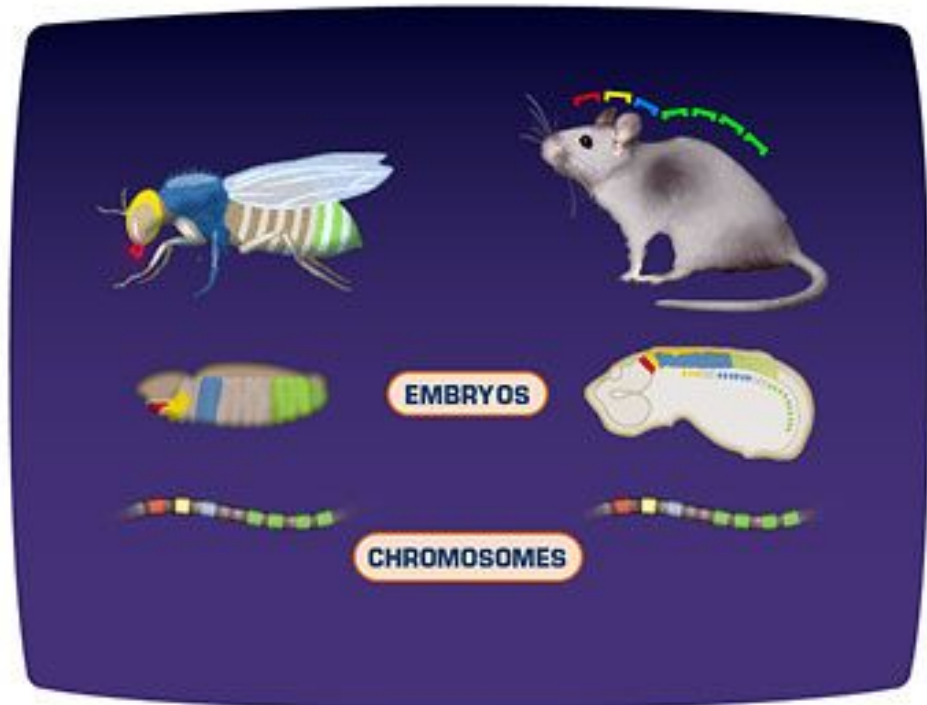

Fig. 15.3 Diagram illustrating colinearity between gene and protein.

Gene A for synthesis of α-protein

α-chain

EMBRYOS

CHROMOSOMES

Properties of Genetic Code

8. Gene-polypeptide Parity:

A **specific gene transcribes a specific mRNA that produces a specific polypeptide**. On this basis, a cell can have only as many types of polypeptides as it has types of genes. However, this does not apply to certain viruses which have overlapping genes.
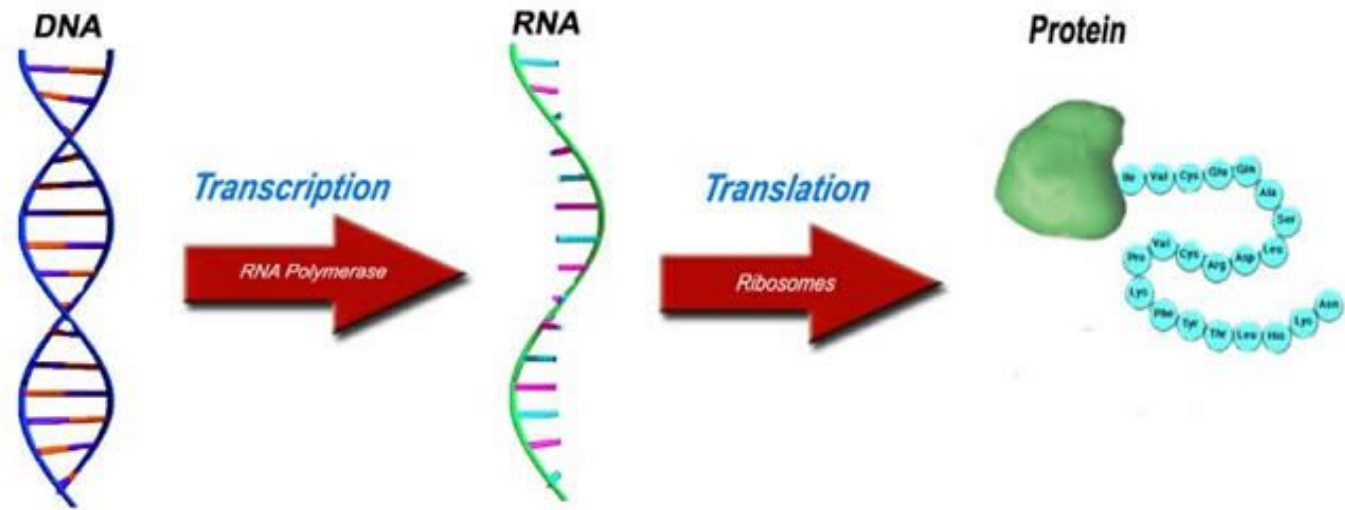
PROPERTIES OF GENETIC CODE

1. Unambiguous. In any organism each codon corresponds to only one amino acid.

2. Code is degenerate. There are multiple codons for most amino acids.

3. Universal. Codons are the same for all organism.

4. Without punctuation. There are no punctuations between trinucleotides.

5. Nonoverlapping. Codons do not overlap each other.

First position	Second position				Third position
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	STOP	STOP	A
	Leu	Ser	STOP	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G