

Genetic code-1

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The genetic code is the set of rules by which a linear sequence of nucleotides specifies the linear sequence of a polypeptide. That is, they specify how the nucleotide sequence of an mRNA is translated into the **amino acid** sequence of a polypeptide. Thus, the relationship between the nucleotide sequence of the mRNA and the amino acid sequence of the polypeptide is the genetic code. The nucleotide sequence is read as triplets called codons.

PRINCIPLES OF THE GENETIC CODE

- The genetic code consists of 64 different codons, each of which codes for 1 of the 20 amino acids.
- 1. A codon consists of a triplet of nucleotide bases. **Triplet nature:**
 - Singlet and doublet codes are not adequate to code for 20 amino acids; therefore, it was pointed out that triplet code is the minimum required.
- 2. **Degeneracy**
 - The code is degenerate which means that the same amino acid is coded by more than one base triplet.
 - Degeneracy does not imply lack of specificity in protein synthesis.
 - It merely means that a particular amino acid can be directed to its place in the peptide chain by more than one base triplets.
 - For example, the three amino acids arginine, alanine and leucine each have six synonymous codons.
 - The code degeneracy is basically of 2 types: partial and complete.
 - In partial degeneracy, the first two nucleotides are identical but the third (i.e., 3' base) nucleotide of the degenerate codon differs; for example, CUU and CUC code for leucine.
 - Complete degeneracy occurs when any of the 4 bases can take third position and still code for the same amino acid; for example, UCU, UCC, UCA and UCG all code for serine.

3. **Non-overlapping**

- The genetic code is nonoverlapping, i.e., the adjacent codons do not overlap.
- A nonoverlapping code means that the same letter is not used for two different codons. In other words, no single base can take part in the formation of more than one codon.

4. **Commaless**

- The genetic code is commaless (or comma-free). There is no signal to indicate the end of one codon and the beginning of the next.
- There are no intermediary nucleotides (or commas) between the codons.

5. **Non-ambiguity**

- Non-ambiguous code means that there is no ambiguity about a particular codon.
- A particular codon will always code for the same amino acid.
- While the same amino acid can be coded by more than one codon (the code is degenerate), the same codon shall not code for two or more different amino acids (non-ambiguous).

6. **Universality**

- Universality of the code means that the same sequences of 3 bases encode the same amino acids in all life forms from simple microorganisms to complex, multicelled organisms such as human beings.
- Although the code is based on work conducted on the bacterium *Escherichia coli* but it is valid for other organisms.
- The genetic code applies to all modern organisms with only minor exceptions, such as the yeast, mitochondria, and the *Mycoplasma*.

7. **Polarity**

- The genetic code has polarity, that is, the code is always read in a fixed direction, i.e., in the 5' → 3' direction.
- It is apparent that if the code is read in opposite direction (i.e., 3' → 5'), it would specify 2 different proteins, since the codon would have reversed base sequence.