

These notes explain the **why** behind every concept, not just the what. They include **analogies**, **real-life examples**, and explanations of **common mistakes**. Use these alongside your revision notes for full understanding.

### Topic 3 Genetics — Reading the Blueprint of Life

DNA is the most remarkable molecule in biology. It stores information using just four "letters" (bases: A, T, C, G) in a language that all life on Earth shares. A gene is a sequence of these bases that contains the instructions for making one specific protein.

#### From DNA to Protein — The Central Dogma

Step 1	Transcription	In the nucleus, the relevant section of DNA unzips. An enzyme reads one strand and builds a complementary mRNA molecule. mRNA has the same sequence as the coding strand, but with uracil (U) instead of thymine (T).
Step 2	mRNA leaves the nucleus	The mRNA molecule passes through nuclear pores into the cytoplasm, carrying the genetic code to the ribosomes.
Step 3	Translation	Ribosomes read the mRNA three bases at a time (each triplet is called a codon). Each codon codes for one amino acid. Transfer RNA (tRNA) molecules bring the correct amino acids.
Step 4	Protein assembly	Amino acids are joined by peptide bonds in the sequence specified by the mRNA. The chain folds into its final 3D shape, becoming a functional protein.

#### Mutations — The Source of All Variation

A mutation is any change in the DNA base sequence. Some mutations have no effect (silent mutations), some are harmful (causing genetic disorders or cancer), and some are beneficial (potentially giving an evolutionary advantage). Mutations are the ultimate source of all genetic variation — without them, evolution would be impossible.

*"Mutations always cause disease."*

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<b>DNA</b>	Deoxyribonucleic acid — the molecule carrying genetic information, made of four bases: A, T, C, G
<b>Gene</b>	A sequence of DNA bases coding for a specific protein
<b>mRNA</b>	Messenger RNA — carries genetic code from nucleus to ribosomes
<b>Codon</b>	A sequence of three mRNA bases coding for one amino acid
<b>Translation</b>	The ribosome reads mRNA codons and assembles amino acids into a protein
<b>Mutation</b>	Any change in DNA base sequence — can be beneficial, harmful or neutral