

★ **HIGHER TIER ONLY** content is highlighted in blue. Foundation students — focus on the un-highlighted sections.

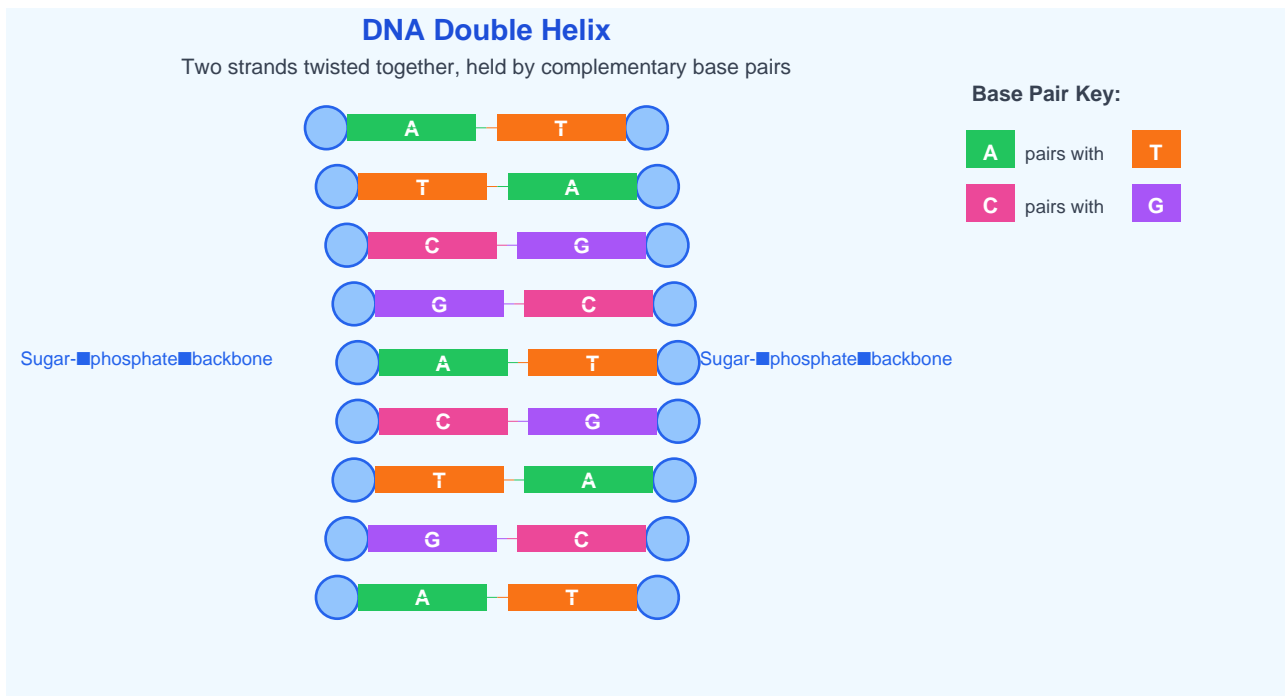


Fig: Simplified DNA structure — A pairs with T, C pairs with G (complementary base pairing)

★ **HIGHER TIER ONLY:** Protein synthesis: DNA → mRNA (transcription in nucleus) → ribosome reads codons → amino acid chain built (translation). A codon is 3 bases and codes for 1 amino acid.

Punnett Square: Cystic Fibrosis Cross (Ff x Ff)

F = normal (dominant) f = cystic fibrosis allele (recessive)

| | | F Parent 1 (Ff) f | |
|----------|-------------------------------------|----------------------------------|--|
| F | FF Normal (homozygous) | Ff Normal (carrier) | |
| P2 Ff | Ff Normal (carrier) | ff Cystic Fibrosis | |
| f | | | |

Results:

- 1 FF (normal, homozygous)
- 2 Ff (normal, carrier)
- 1 ff (cystic fibrosis)

75% unaffected

25% affected

Fig: Punnett square for two carrier parents (Ff x Ff) — shows inheritance of cystic fibrosis

Allele Terminology

| Term | Definition | Example |
|-----------|--------------------------------|--|
| Allele | A version of a gene | B (brown eyes) or b (blue eyes) |
| Dominant | Expressed with just ONE copy | B — brown eyes always show if B is present |
| Recessive | Only expressed with TWO copies | bb — blue eyes need two b alleles |

| | | |
|--------------|----------------------------|--------------|
| Homozygous | Both alleles the SAME | BB or bb |
| Heterozygous | Alleles are DIFFERENT | Bb (carrier) |
| Genotype | The ALLELES present | Bb |
| Phenotype | The VISIBLE characteristic | Brown eyes |

Natural Selection — Step by Step

| | |
|---|---|
| 1. Variation | Individuals differ due to mutations and sexual reproduction |
| 2. Competition | Limited resources — food, mates, space |
| 3. Survival of the fittest | Best-adapted individuals survive and REPRODUCE MORE |
| 4. Inheritance | Advantageous alleles passed to offspring |
| 5. Change over time | Beneficial alleles become MORE COMMON in the population |
| ■ Exam Tip: "Survival of the FITTEST" does NOT mean strongest — it means BEST ADAPTED to that environment! | |