

Topic 3: Genetics

Edexcel GCSE Biology · Revision Notes
Specification reference: 3.1–3.9

Note: Sections marked ★ HIGHER TIER ONLY are for Higher tier students only. Foundation tier students should focus on the unmarked sections.

3.1–3.3 Meiosis and DNA

Meiosis produces 4 genetically different haploid cells (gametes). It involves two divisions.

- Meiosis introduces variation through crossing over and independent assortment of chromosomes.
- DNA structure: double helix; bases pair A-T and C-G. Genes are sections of DNA coding for proteins.

★ HIGHER TIER ONLY — Protein Synthesis

- Transcription: template strand of DNA copied into mRNA in the nucleus.
- Translation: ribosome reads mRNA codons (3 bases = 1 amino acid); tRNA brings amino acids.
- The sequence of amino acids determines the shape and function of the protein.

3.4–3.6 Genetic Crosses

Alleles control characteristics. Dominant alleles are always expressed; recessive alleles are only expressed when homozygous.

- Punnett squares predict the probability of offspring genotypes.
- Monohybrid cross: one gene considered. Ratio for two heterozygous parents: 3 dominant : 1 recessive.
- Sex determination: females XX, males XY.
- **Polydactyly** — dominant allele; extra digits.
- **Cystic fibrosis** — recessive allele; thick mucus in lungs and gut.
- **Sickle cell anaemia** — co-dominant; misshapen red blood cells.

Key Terms

Dominant: Allele expressed even with one copy

Recessive: Allele expressed only when two copies present

Co-dominant: Both alleles expressed in heterozygotes

3.7–3.9 Variation and Mutation

Genetic variation is caused by mutations and sexual reproduction. Environmental factors also affect phenotype.

- Mutations are changes in DNA base sequence — can be beneficial, harmful or neutral.
- Continuous variation (e.g. height) — many genes plus environment.
- Discontinuous variation (e.g. blood group) — controlled by one gene.

Exam Tip: Variation has two causes: genetic (inherited) and environmental. Most characteristics are affected by BOTH.