

Topic 6: Inheritance, variation and evolution

AQA GCSE Biology 8461 · spec 4.6 · sheets 6.1–6.5

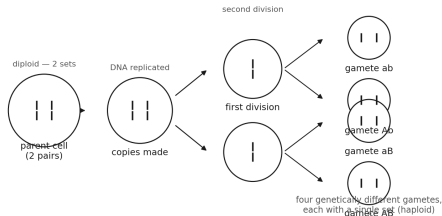
The story of Topic 6

- Meiosis makes gametes; fertilisation restores the full set.
- Genes and alleles set the odds; Punnett squares count them.
- Variation plus selection changes species over time.

Sexual vs asexual

- Sexual — two gametes fuse; offspring vary.
- Asexual — one parent, mitosis only; identical clones.
- Named double-lifers — malarial parasite, fungi, strawberry runners, daffodil bulbs.

Meiosis in two divisions



- Copies of the genetic information are made first.
- Two divisions give four genetically different gametes.
- Fertilisation restores the number; mitosis builds the embryo.

DNA, genes, genome

- DNA — a two-strand polymer, double helix, in chromosomes.
- Gene — a section coding one protein; genome — all the DNA.
- Human genome — disease genes, inherited disorders, migration.

Nucleotides and protein synthesis

- Nucleotide — sugar + phosphate + one base of A, C, G, T.
- Three bases code one amino acid (HT: ribosomes, carrier molecules, folding).
- (HT) mutations — most silent, some slight, a few reshape the protein.

Ten words of genetics

- gamete, chromosome, gene, allele, dominant, recessive.
- homozygous, heterozygous, genotype, phenotype.
- Say each definition out loud once — it is free marks.

Punnett squares and family trees

Mother's gametes			
Father's mates	X	X	
X	XX	XX	
Y	XY	XY	

XX female : XY male = 1 : 1 (50 % each)

Carrier mother ($X^N X^n$)			
Father ($X^N Y$)	X^N	X^n	
X^N	$X^N X^N$	$X^N X^n$	
Y	$X^N Y$	$X^n Y$	

e.g. red-green colour blindness cross — ratios read straight off

- Write the parents' gametes on the edges first.
- Read ratios straight off — 3 to 1, 1 to 1, probabilities as fractions.
- Family trees — track carriers through the generations.

Inherited disorders and screening

- Polydactyly — dominant allele.
- Cystic fibrosis — recessive; carriers are heterozygous.
- Embryo screening — weigh economic, social and ethical issues.

Variation and natural selection

- Variation — genes, environment, or both; all variants arise by mutation.
- Best-suited phenotypes survive and breed; alleles pass on.
- No fertile interbreeding — two new species.

Selective breeding

- Choose, breed, choose again — many generations.
- Uses — disease-resistant crops, more meat or milk, gentle dogs, showy flowers.
- Risk — inbreeding; disease-prone breeds.

Genetic engineering and GM

- (HT) gene cut out, into a plasmid or virus vector, into the cells.
- GM crops resist insects or herbicides; bacteria make human insulin.
- Weigh yields against wild-life effects and objections.

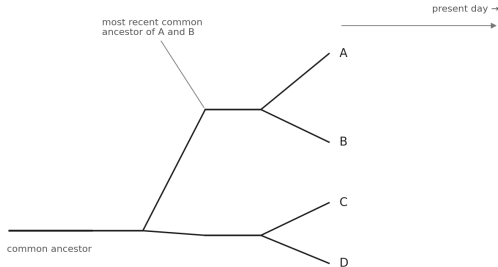
Four ways to clone

- Tissue culture and cuttings — plants, identical and cheap.
- Embryo transplants — split before specialisation.
- Adult cell cloning — new nucleus, electric shock, womb.

Darwin, Wallace, Mendel

- Darwin 1859 — variation, survival, inheritance; slow acceptance.
- Wallace — independent theory, 1858 joint papers, speciation.
- Mendel's 'units' became genes half a century later.

Fossils and extinction



- Fossils — no decay, mineral replacement, preserved traces.
- Soft-bodied early life — a record we cannot trust fully.
- Extinction — disease, predators, competition, catastrophe.

Resistant bacteria

- Fast reproduction plus mutation — new strains.
- Resistant bacteria survive, reproduce, spread — MRSA.
- Fewer prescriptions, complete the course, restrict farm use.

Linnaeus and the three domains

- Classification of living organisms.
- Kingdom, phylum, class, order, family, genus, species — then binomial.
- Woese — archaea, bacteria, eukaryota — from chemical evidence.
- Better microscopes and biochemistry drove the change.

Check yourself

- Checklist before you call this topic done.
- Meiosis numbers, ten genetics words, Punnett ratios, XX-XY.
- Selection sequence, four cloning methods, MRSA, three domains.