

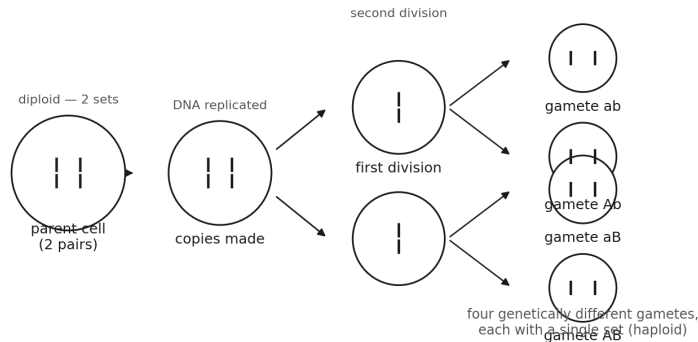
Exercise walk-through

6.2

Genetic inheritance, disorders and sex determination (4.6.1.6–4.6.1.8)

AQA · GCSE · Biology

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.

Punnett squares and family trees

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

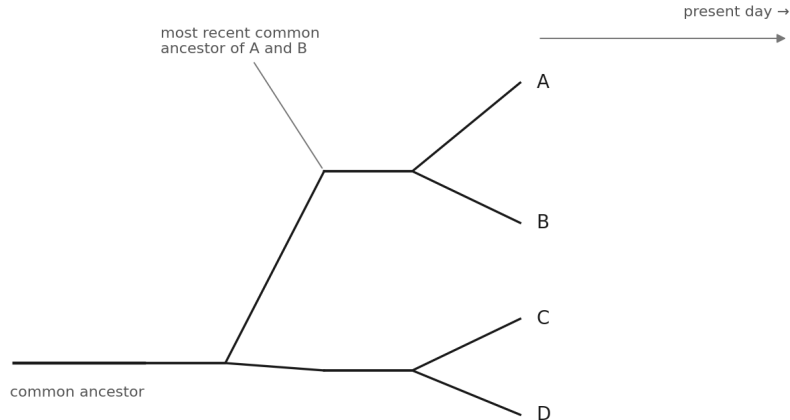
XX female : XY male = 1 : 1 (50 % each)

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.

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.

Exercises 2.1·2.3

2.1 Define allele and genotype.

[2]

2.2 A heterozygous brown-eyed parent (Bb) crosses with a blue-eyed parent (bb). Give the expected phenotype ratio.

[2]

2.3 Name one dominant and one recessive inherited disorder of humans.

[2]

Exercises 2.1·2.3

2.1 Define allele and genotype. [2]

2.1 Allele – a version/form of a gene. Genotype – the alleles an organism has for a characteristic.

2.2 A heterozygous brown-eyed parent (Bb) crosses with a blue-eyed parent (bb). Give the expected phenotype ratio. [2]

2.2 Gametes B, b and b, b $\rightarrow$ Bb, Bb, bb, bb; 1 tall : 1 dwarf (50 % each).

2.3 Name one dominant and one recessive inherited disorder of humans. [2]

2.3 Polydactyly (dominant); cystic fibrosis (recessive).

Exercises 3.1·3.2

3.1 Explain the difference between genotype and phenotype, using a plant stem-height gene with alleles T (tall, dominant) and t (dwarf) as your example. [4]

3.2 (*HT*) Two parents are both heterozygous for polydactyly (Dd). Construct a genetic cross and predict the probability that a child has polydactyly. [4]

Exercises 3.1·3.2

3.1 Explain the difference between genotype and phenotype, using a plant stem-height gene with alleles T (tall, dominant) and t (dwarf) as your example. [4]

3.1 Genotype is the alleles present, e.g. TT, Tt or tt; phenotype is the characteristic expressed – tall or dwarf; TT and Tt are different genotypes but both give the tall phenotype because T is dominant; only the homozygous tt gives the dwarf phenotype.

3.2 (*HT*) Two parents are both heterozygous for polydactyly (Dd). Construct a genetic cross and predict the probability that a child has polydactyly. [4]

3.2 Parents $Dd \times Dd \rightarrow$ gametes D and d from each; Punnett square: DD, Dd, Dd, dd; D is dominant, so DD and Dd have polydactyly – 3 of 4, probability 75 %; only dd (25 %) is unaffected.

Exercise 3.3

3.3 A couple are both carriers of cystic fibrosis. Explain why they might choose embryo screening, and give one economic and one ethical issue it raises. [5]

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3.3 Both are carriers (Ff), so each child has a 1 in 4 chance of cystic fibrosis; screening can identify embryos without the disorder before implantation, letting them avoid having an affected child / prepare treatment. Economic issue – screening and IVF are expensive for the family/health service. Ethical issue – embryos with the disorder may be destroyed, raising the right-to-life question; or false results could misinform the family's decision. Accept any justified informed judgement.