Exercise walk-through

6.2

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

AQA · GCSE · Biology

Reproduction and meiosis

- **Sexual reproduction** involves the joining of male and female sex cells, each called a **gamete** : sperm and egg cells in animals, pollen and egg cells in flowering plants.
- It mixes genetic information from two parents, so the offspring vary. **Asexual reproduction** involves only one parent and no gametes.
- Its offspring are genetically identical to the parent, a **clone** (apart from any mutations).
- In plants and animals it uses cell division by **mitosis** .

DNA, genes and the genome

- DNA is a **polymer** made of two strands twisted into a **double helix** .
- It is found in the nucleus, in structures called chromosomes.
- A **gene** is a small section of DNA that codes for a particular sequence of amino acids, which makes a particular protein.
- The **genome** is all the genetic material of an organism.

Variation and evolution

- **Variation** is the difference between individuals of the same **species**.
- It can be caused by the genes they inherit (genetic), by the conditions in which they develop (environmental), or, most often, by both.
- All genetic variation comes from mutations.
- Most mutations have no effect on the **phenotype**, some change it slightly, and very few decide it completely.

Exercises 2.1·2.3

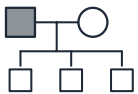
2.1 Define allele and genotype. [2]



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

Bb × bb

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



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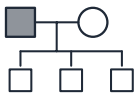
2.1 Allele – a version/form of a gene. Genotype – the alleles an organism has for a characteristic.

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

Bb × bb

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

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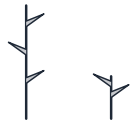


2.3 Polydactyly (dominant); cystic fibrosis (recessive).

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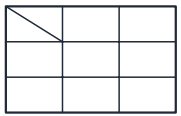
Exercises 3.1·3.2

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]



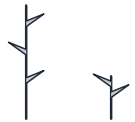
3.2 *(HT)* Two parents are both heterozygous for polydactyly (Dd). Construct a genetic cross and predict the probability that a child has polydactyly. [4]

Dd × Dd



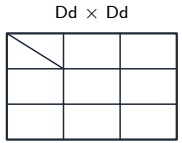
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3.1 Genotype is the alleles present, e.g. TT, Tt or tt; phenotype is the characteristic expressed – tall or dwarf; TT and Tt are different genotypes but both give the tall phenotype because T is dominant; only the homozygous tt gives the dwarf phenotype.

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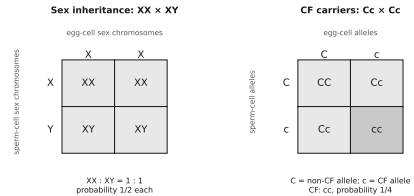
3.2 Parents Dd × Dd → gametes D and d from each; Punnett square: DD, Dd, Dd, dd; D is dominant, so DD and Dd have polydactyly – 3 of 4, probability 75 %; only dd (25 %) is unaffected.

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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]

3.4 The diagram shows two genetic crosses.



(a) A man with cystic fibrosis (cc) has children with a woman who is a carrier (Cc). Draw a Punnett square in the same way and give the probability that a child has cystic fibrosis. [3]

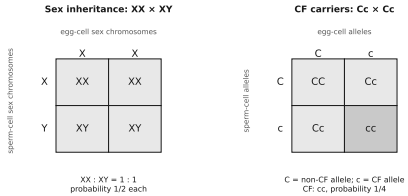
(b) A couple already have three daughters. Give the probability that their next child is a boy, and explain your answer. [2]

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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.

Full solution on next slide

Full solution 3.3

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3.4 (a) Gametes: c and c from the man, C and c from the woman; offspring Cc, Cc, cc, cc; probability of cystic fibrosis = 2 in 4 = 1/2 (50 %). (b) 1/2 (50 %); each child is a separate fertilisation, so an X or Y sperm is equally likely each time – earlier children do not change the chance.