Your notes

GCSE Biology: revision notes

Genetic inheritance

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Start here: how features are passed on

- You get one copy of each gene from each parent, so you have two copies, called **alleles**, of every gene.
- An **allele** can be **dominant** (it shows even if there is only one copy; written as a capital letter, B) or **recessive** (it only shows if both copies are recessive; written in lower case, b).
- A **Punnett square** shows every way the parents' **alleles** can combine, so you can work out the chance of each feature in their children.

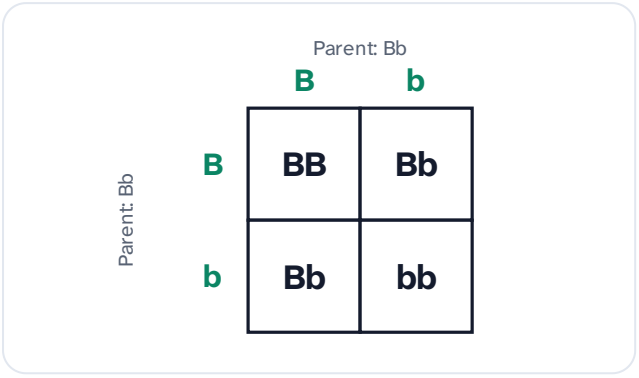
Key words

- **Alleles** are different forms of the same gene. You inherit one **allele** of each gene from each parent.
- A **dominant allele** is always expressed, even if only one copy is present. A **recessive** allele is only expressed if two copies are present.
- **Homozygous** means both **alleles** are the same (AA or aa); **heterozygous** means the alleles are different (Aa).
- The **genotype** is the **alleles** present (for example Bb); the **phenotype** is the characteristic shown (for example brown eyes).
- Some characteristics are controlled by a single gene, but most result from multiple genes interacting.

Genetic crosses

- A **Punnett square** shows the possible combinations of **alleles** in the offspring of two parents.

- Example: two **heterozygous** parents (Aa × Aa) give offspring AA, Aa, Aa and aa, a 3 : 1 ratio of **dominant** to **recessive** phenotype.
- Ratios are probabilities: each child has the same chance, whatever happened to its brothers and sisters.



Sex determination

- Human body cells have 23 pairs of chromosomes. 22 pairs control characteristics only; one pair determines sex.
- Females have two X chromosomes (XX); males have one X and one Y (XY).
- A **Punnett square** shows a 50% chance that a baby will be a boy or a girl.

Inherited disorders

- **Polydactyly** (having extra fingers or toes) is caused by a **dominant allele**, so only one parent needs to pass it on.
- **Cystic fibrosis** is a disorder of cell membranes caused by a **recessive allele**, so a child must inherit it from both parents. Parents who are heterozygous are carriers.
- Embryo screening can identify embryos with a disorder, and gene therapy may one day correct faulty **alleles**.
- These raise economic, social and ethical issues: screening is expensive, embryos may be destroyed, and some worry it could lead to choosing embryos for other characteristics.

Exam tip

- For a **Punnett square**, set out the key, gametes and offspring, then answer the exact question: a ratio, a percentage or a probability.
- Use the words: **dominant**, **recessive**, **homozygous** and heterozygous.

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Common mistakes

- Reading a 3:1 ratio as 3 in 1. It means 3 out of 4, or 75%.
- Assuming a **dominant allele** must be the most common.
- Thinking that earlier children change the chance for the next one. Each child's chance is separate.

Worked examples

Two parents are carriers of cystic fibrosis (Ff). Find the probability their child has cystic fibrosis.

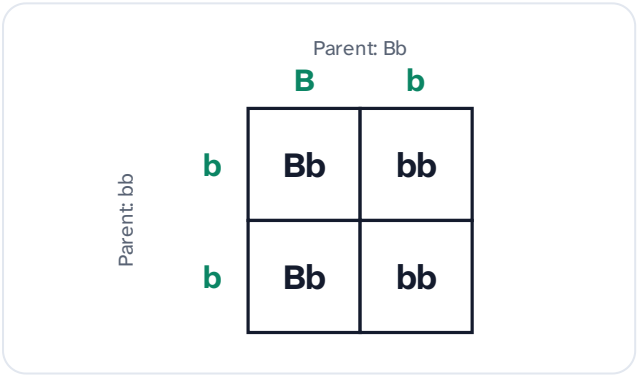
Write each parent's alleles along the top and side of a Punnett square. **F f × F f**

Fill in each box with one allele from the top and one from the side. **FF, Ff, Ff, ff**

Cystic fibrosis is recessive, so only ff has it. Count those boxes. **1 out of 4**

Answer: 25% (a probability of ¼)

One parent is Bb and the other is bb. What is the chance their child shows the recessive feature?



Write each parent's alleles along one side of a Punnett square. **Bb along the top, bb down the side**

Fill in each box with one allele from each parent. **Bb, Bb, bb, bb**

Count the boxes with two recessive alleles. **2 out of 4**

Answer: 2 in 4, which is 50% (a probability of 0.5)

Key terms

Allele	A different form of the same gene.
Dominant	An allele that is expressed even if only one copy is present.
Recessive	An allele that is expressed only when two copies are present.
Homozygous	Having two identical alleles of a gene.
Heterozygous	Having two different alleles of a gene.
Genotype	The combination of alleles an organism has.

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Phenotype	The characteristic that is shown, resulting from the genotype.
Punnett square	A diagram used to predict the outcomes of a genetic cross.
Carrier	A person with one recessive allele for a disorder who does not have the disorder.
Polydactyly	An inherited disorder causing extra fingers or toes, caused by a dominant allele.
Cystic fibrosis	An inherited disorder of cell membranes caused by a recessive allele.

Your notes

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is an allele?
2. What does heterozygous mean?
3. What is a phenotype?
4. What are the sex chromosomes of a human male?
5. What is the chance that a baby will be a girl?
6. Two heterozygous parents (Aa × Aa) have a child. What is the chance it shows the recessive characteristic?
7. What causes polydactyly?
8. Why can two healthy parents have a child with cystic fibrosis?

Answers

1. A different form of the same gene
2. The two alleles of a gene are different
3. The characteristic that is shown
4. XY
5. 50%
6. 25%
7. A dominant allele
8. Both can be carriers of the recessive allele

What to do next

Practise 12 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.