

BioMedical Admissions Test (BMAT)

Section 2: Biology

Topic B3 - Cell Division and Sex Determination

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Topic B3 - Cell Division and Sex Determination

Cell Division

There are 2 key ways in which cells are produced in our bodies:

	Mitosis	Meiosis
Function	<ul style="list-style-type: none"> • Growth, repair and replacement of damaged or worn out cells • Asexual reproduction 	<ul style="list-style-type: none"> • To create genetically diverse offspring
Where it occurs	<ul style="list-style-type: none"> • In damaged or worn out cells • In organisms that reproduce asexually. 	<ul style="list-style-type: none"> • In human reproductive organs - ovaries and testes. • Produces genetic variation
Stages	<ul style="list-style-type: none"> • Interphase - chromosome number doubles • DNA from nucleus split in a singular division 	<ul style="list-style-type: none"> • Fertilisation - male and female gametes fuse to form a zygote with diploid number • 2 rounds of cell division to reduce to haploid number
Daughter cells	<ul style="list-style-type: none"> • 2 identical daughter cells which are clones of parent cell • Diploid (46n, i.e. 23 pairs) - identical to the parent cell 	<ul style="list-style-type: none"> • 4 genetically diverse daughter cells • Gametes • Haploid (23n) - either mother's or father's

In summary:

- In **mitosis**, the parent cell divides **once** to form **2 identical diploid** daughter cells.
- In **meiosis**, the parent cell divides **twice** to form **4 genetically unique** daughter cells, which all contain **different combinations of DNA**. The daughter cells are known as **gametes**, and are **haploid**: they contain **half the number of chromosomes**.

Exam Tip - The processes of meiosis and mitosis are one of the **most commonly tested subjects in BMAT Biology**, so make sure you understand them well!

The key comparisons are outlined in the table above. To revise them, you may find it useful to cover the “meiosis” and “mitosis” columns with one hand, and try to recall the answers to the headings on the left.



Asexual Reproduction

- Requires only **one parent**, so there is **no fusion of gametes**
- Offspring will be genetically identical to the parent
- E.g. strawberry plants produce runners from which new plants grow from
- E.g. bacterial cells undergoing **binary fission**
 - However, due to **mutations** when DNA is copied the bacteria produced are not always genetically identical.

Sexual Reproduction

- Two parents - fusion of gametes produced by meiosis occurs
- Offspring are genetically different to parents due to receiving only half from each
- Offspring are genetically different from each other due to random fusion of gametes
- Creates **genetic variation** - important for survival through natural selection

Sex Determination

The 23rd pair of chromosomes are the X and Y chromosomes; the **sex chromosomes**. All **women** have two X chromosomes (**XX**), while all **men** have one X and one Y (**XY**). It is therefore the sperm that determines the sex of the zygote.

In a male, a single gene on the Y chromosome is transcribed and translated into a protein, which results in the development of **testes** (the male reproductive organ). The **testes then go on to produce male sex hormones**, which cause male characteristics.

A female, however, lacks the gene so develops **ovaries, female reproductive hormones**, and female characteristics instead.

Using a Punnett square we are able to show that there is a 50% chance of male and 50% chance female.

	X	X
X	XX	XX
Y	XY	XY

Red circle = Female
 2/4 are female = 50%

Green circle = Male
 2/4 are male = 50%

