

Mitosis and cancer

Revision notes · The cell cycle, the stages of mitosis, why it matters for growth, repair and asexual reproduction, and how uncontrolled division causes cancer.

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Mitosis and cancer Spec 2.1-2.4

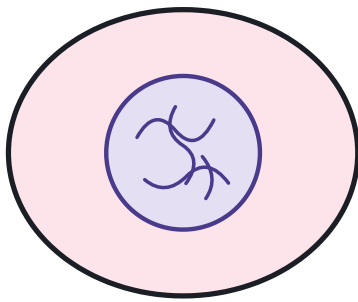
The cell cycle and mitosis Spec 2.1

Cells grow and divide in a repeating sequence called the **cell cycle**. Most of the cycle is **interphase**, when the cell is not dividing. **Mitosis** is the part of the cycle in which the nucleus divides. It is followed by **cytokinesis**, when the cytoplasm and cell membrane divide.

The stages of the cell cycle

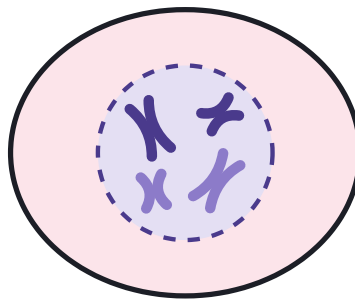
Stage	What happens
Interphase	The cell grows and makes more of its sub-cellular structures. The DNA is copied, so each chromosome is made of two identical copies (chromatids).
Prophase	The chromosomes become shorter and thicker, so they can be seen. The membrane around the nucleus breaks down.
Metaphase	The chromosomes line up along the middle (the equator) of the cell. They are attached to spindle fibres.
Anaphase	The spindle fibres pull the two copies of each chromosome apart, to opposite ends of the cell.
Telophase	A new nuclear membrane forms around each set of chromosomes, so there are two nuclei.
Cytokinesis	The cytoplasm and cell membrane divide to make two separate cells.

The order is interphase, prophase, metaphase, anaphase, telophase, then cytokinesis.



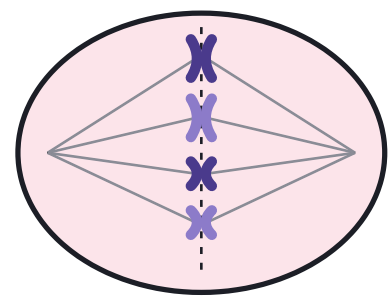
1 Interphase

cell grows; DNA is copied



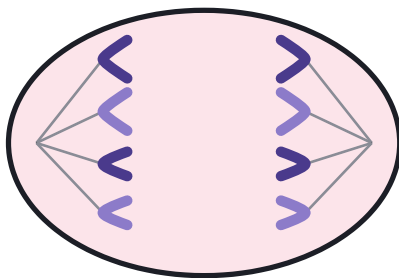
2 Prophase

chromosomes visible;
nuclear membrane breaks down



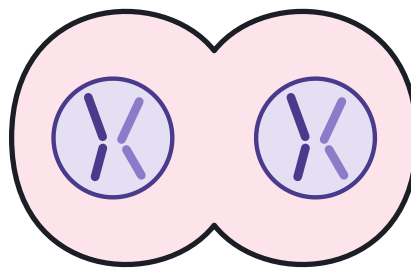
3 Metaphase

chromosomes line up on the
equator, on spindle fibres



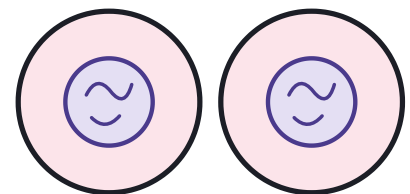
4 Anaphase

copies pulled to opposite
ends of the cell



5 Telophase

new nuclear membranes form:
two nuclei



6 Cytokinesis

cytoplasm and cell membrane
divide: two identical cells

The stages in order: interphase, prophase, metaphase, anaphase, telophase, cytokinesis.

Common mistake: Interphase is not a resting stage. The cell is very busy: it grows and copies its DNA ready for mitosis.

What mitosis produces Spec 2.3

Mitosis produces **two daughter cells**. Each daughter cell has an **identical set of chromosomes** in its nucleus to the parent cell, so the two cells are **genetically identical** to the parent and to each other.

Body cells are **diploid**. This means the nucleus contains two sets of chromosomes, which form pairs. For example, human body cells have 46 chromosomes, arranged as 23 pairs. The DNA is copied in interphase and the copies are shared equally in mitosis, so each daughter cell also has 46 chromosomes.

Daughter cell	One of the two new cells produced when a parent cell divides.
Diploid	A cell with two sets of chromosomes in its nucleus.
Genetically identical	Having exactly the same genetic information (the same DNA).

Exam tip: To describe the result of mitosis, give the key points: **two daughter cells, identical sets of chromosomes to the parent, genetically identical and diploid.**

Why mitosis is important Spec 2.2

Mitosis is important in three ways.

- **Growth**: a multicellular organism grows by making more cells by mitosis. All the new cells are genetically identical, so they have the same instructions.
- **Repair**: damaged or worn-out cells are replaced with new cells made by mitosis, for example when skin is cut.
- **Asexual reproduction**: one parent produces offspring that are genetically identical to it. The offspring are made by mitosis, so there is no mixing of genetic information.

Exam tip: Asexual reproduction needs only one parent and gives genetically identical offspring. Say both if the question asks you to describe it.

Cancer Spec 2.4

Cell division is normally controlled, so a tissue makes only the cells it needs. **Cancer** is the result of changes in cells that lead to **uncontrolled cell division**.

The cells keep dividing by mitosis when they should not. This can form a mass of cells called a **tumour**.

Common mistake: Do not just say cancer is 'cells dividing'. Healthy cells divide too. The key idea is that the division is uncontrolled.

Quick check

1. Put the stages of the cell cycle in order, starting with interphase.
2. What happens to the chromosomes in metaphase?
3. Name three uses of mitosis.
4. What does diploid mean?
5. What causes cancer?

Quick check answers

Mitosis and cancer

1. Interphase, prophase, metaphase, anaphase, telophase, cytokinesis.
2. They line up along the equator of the cell.
3. Growth, repair and asexual reproduction.
4. The nucleus contains two sets of chromosomes, which form pairs.
5. Changes in cells that lead to uncontrolled cell division.