

Cell division

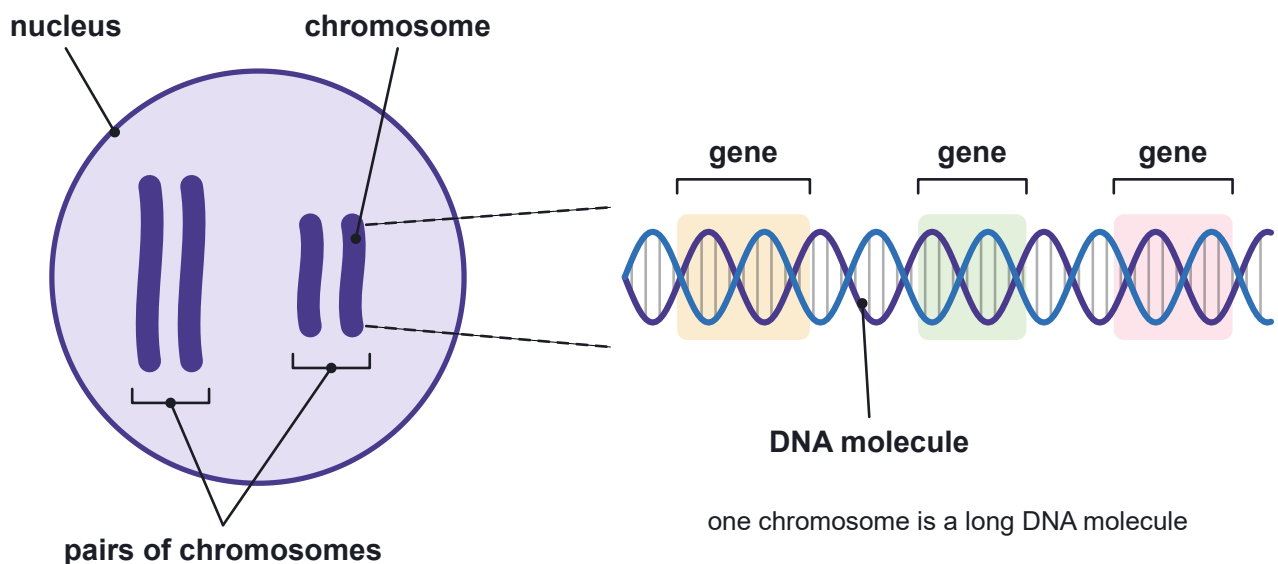
Revision notes • Chromosomes, the cell cycle and mitosis, and stem cells in embryos, adult animals and plant meristems.

For AQA GCSE Biology 8461 and Combined Science: Trilogy 8464. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Cell division Spec 4.1.2

Chromosomes Spec 4.1.2.1

The nucleus of a cell contains **chromosomes** made of **DNA** molecules. Each chromosome carries a large number of **genes**. In body cells the chromosomes are normally found in **pairs**.



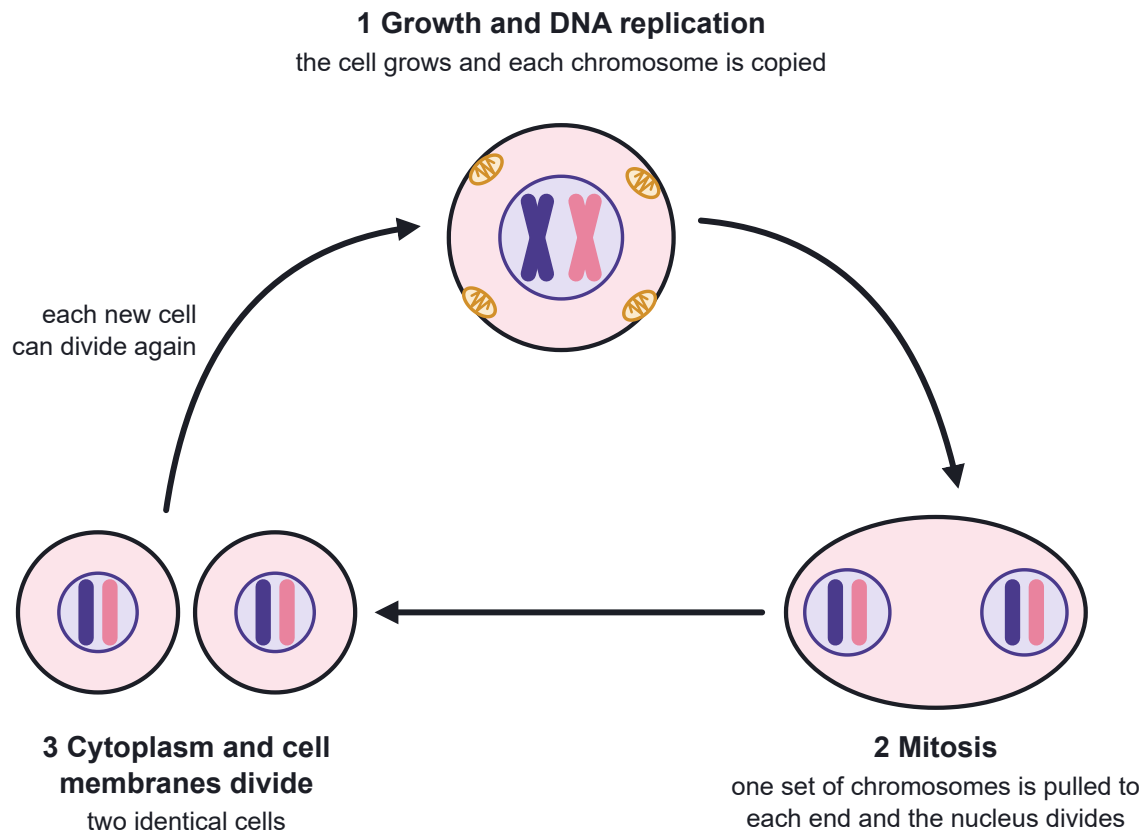
A nucleus contains **chromosomes** in pairs. Each chromosome is a long DNA molecule carrying many **genes**.

Exam tip: Keep the order straight: a nucleus contains chromosomes, a chromosome is a long DNA molecule, and a chromosome carries many genes.

Mitosis and the cell cycle Spec 4.1.2.2

Cells divide in a series of stages called the **cell cycle**. During the cell cycle the genetic material is doubled and then divided into two identical cells. There are three overall stages.

1. Growth and DNA replication. Before a cell can divide it needs to grow and increase the number of sub-cellular structures such as ribosomes and mitochondria. The DNA replicates to form two copies of each chromosome.
2. Mitosis. One set of chromosomes is pulled to each end of the cell and the nucleus divides.
3. Cytoplasm and cell membranes divide. Finally the cytoplasm and cell membranes divide to form two identical cells.



The cell cycle: the DNA is copied, mitosis divides the nucleus, then the cell splits into **two identical cells**.

You need to understand the three overall stages but you do not need to know the different phases of the mitosis stage.

Cell division by mitosis is important in the **growth and development** of multicellular organisms. In mature animals, cell division is mainly restricted to repair and replacement.

Recognising mitosis in context

You should be able to recognise and describe situations in given contexts where mitosis is occurring. Look for the production of new, genetically identical cells.

- An embryo or seedling growing in size.
- The tip of a root or shoot lengthening.
- A cut healing, as new skin cells replace the damaged ones.
- Worn out cells being replaced.

Common mistake: Mitosis makes two cells that are genetically identical to each other and to the parent cell. Do not say 'different' or 'half the chromosomes'.

Stem cells Spec 4.1.2.3

Stem cell

An undifferentiated cell of an organism which is capable of giving rise to many more cells of the same type, and from which certain other cells can arise from differentiation.

You should be able to describe the function of stem cells in embryos, in adult animals and in the meristems in plants.

Where	What the stem cells can do
Human embryos	Can be cloned and made to differentiate into most different types of human cell
Adult bone marrow	Can form many types of cell, including blood cells
Plant meristems	Meristem tissue can differentiate into any type of plant cell, throughout the life of the plant

Knowledge and understanding of stem cell techniques are not required.

Medical uses

Treatment with stem cells may be able to help conditions such as **diabetes** and **paralysis**.

In **therapeutic cloning** an embryo is produced with the same genes as the patient. Stem cells from the embryo are not rejected by the patient's body, so they may be used for medical treatment.

Risks and objections

- There are potential risks, such as transfer of viral infection.
- Some people have ethical or religious objections to the use of stem cells from embryos.

Exam tip: In evaluation questions, give at least one benefit and one risk or objection, then reach a conclusion. Compare the medical benefit to patients with the ethical concerns of others.

Plant stem cells

Stem cells from meristems in plants can be used to produce clones of plants quickly and economically.

- Rare species can be cloned to protect them from extinction.
- Crop plants with special features such as disease resistance can be cloned to produce large numbers of identical plants for farmers.

Quick check

1. What are chromosomes made of, and where are they found?
2. Name the three overall stages of the cell cycle.
3. What does mitosis produce?
4. Why are stem cells from therapeutic cloning not rejected?
5. Where are stem cells found in plants?

Quick check answers

Cell division

1. DNA molecules, in the nucleus.
2. Growth and DNA replication; mitosis; division of the cytoplasm and cell membranes.
3. Two genetically identical cells.
4. The embryo has the same genes as the patient.
5. In meristems, throughout the life of the plant.