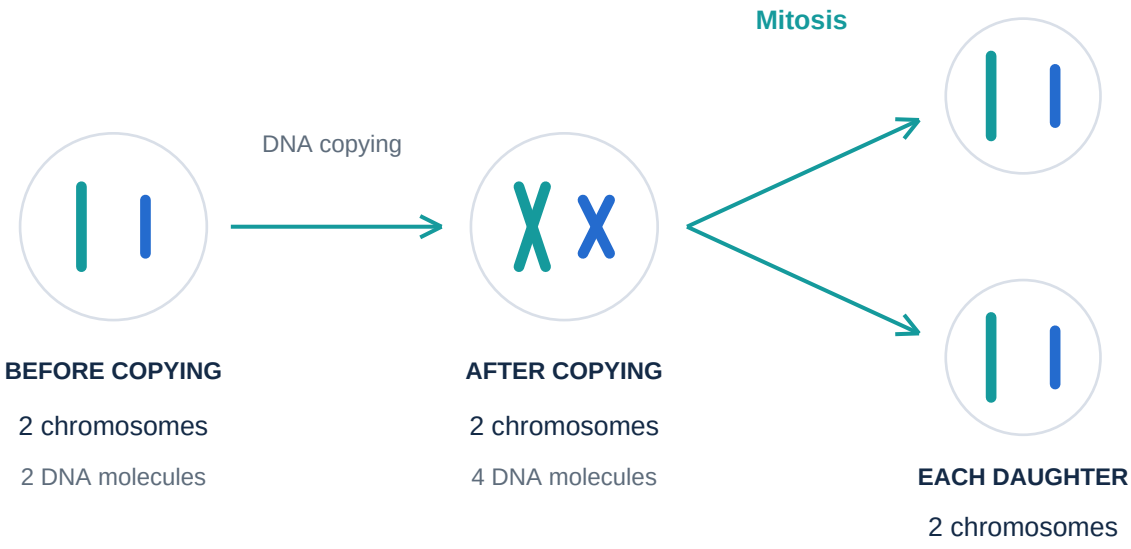
More cells, the same genetic instructions

Mitosis divides a nucleus into two daughter nuclei with the same chromosome number and genetic information, provided DNA copying and chromosome separation are accurate.

1. PRESERVE A COMPLETE CHROMOSOME SET



Simplified model: each outline represents a nucleus; only two chromosomes shown.

2. COPYING COMES BEFORE MITOSIS

DNA replication produces sister chromatids before nuclear division. Mitosis distributes one copy of each chromosome to each daughter nucleus. It does not halve the chromosome number.

3. NUCLEAR DIVISION IS NOT CYTOPLASM DIVISION

Mitosis is nuclear division; cytokinesis divides the cytoplasm to form separate cells. Together they usually turn one parent cell into two daughter cells. Later growth supplies material for further divisions.

Genetically identical means the same DNA information, not necessarily the same size, shape or activity. Different patterns of gene expression can later give cells different specialised functions.

Genetic continuity and daughter cells: NHGRI, Mitosis.
Chromosome number and division: MedlinePlus Genetics, How do cells divide?

Scope: Cambridge Biology 9700 syllabus, section 5.1, outcome 2, p. 23.

Build, maintain and restore tissues

Growth, replacement and repair all need new cells. Mitosis preserves the genetic information those cells need while they become part of the existing organism.

1. GROWTH: INCREASE CELL NUMBER

Repeated mitosis and cytokinesis add cells during the growth of a multicellular organism. For example, dividing cells in root and shoot meristems supply new plant cells. Cell enlargement also contributes to growth; division alone does not create extra biomass.

2. REPLACEMENT: MAINTAIN A WORKING TISSUE

New cells replace cells lost through normal wear, death or damage. For example, dividing precursor cells continually replenish the gut lining. Mitosis maintains a supply of cells carrying the same genetic instructions.

3. REPAIR: REPLACE CELLS LOST AFTER INJURY

Division of suitable surviving cells or precursor cells helps restore damaged tissue. Mitosis contributes new cells; it does not mend a dead cell. Wound repair also involves other processes, such as cell migration and formation of supporting material.

4. ILLUSTRATIVE TISSUE-REPLACEMENT MODEL



A cell has been lost

New cell replaces the loss

Division supplies cells; the diagram is not a timeline of all wound-healing events.

Required roles: Cambridge Biology 9700 syllabus, section 5.1, outcome 2.
New body cells and controlled division: MedlinePlus Genetics.

Scope: Cambridge Biology 9700 syllabus, section 5.1, outcome 2, p. 23.

Asexual reproduction preserves a genotype

In many eukaryotes, mitosis supplies the cells for a new individual without fusion of gametes. The offspring is a genetic clone of the parent, apart from mutations.

1. EXAMPLE: A STRAWBERRY RUNNER



One parent; no gamete fusion; genetic information retained in the new plant.

2. WHY GENETIC CONTINUITY MATTERS

Asexual reproduction can preserve a successful combination of alleles and produce offspring without finding a mate. However, genetically similar offspring may share susceptibility to a disease or environmental change. A clone is not guaranteed to look identical in every environment.

3. MATCH THE NEED TO THE RESULT

Growth	More cells in one organism
Replacement	New cells take the place of lost cells
Tissue repair	New cells help restore damaged tissue
Asexual reproduction	A new individual without gamete fusion

Do not confuse mitosis with meiosis, which reduces chromosome number in sexual life cycles. Bacterial binary fission is not mitosis: bacteria have no nucleus. Detailed mitotic stages belong to later lessons.

Strawberry runners and clonal reproduction: OpenStax Biology 2e, section 32.3.
Mitosis contrasted with meiosis: MedlinePlus Genetics.

Scope: Cambridge Biology 9700 syllabus, section 5.1, outcome 2, p. 23.