8.5

Mitosis produces new somatic cells

Anki Vocab

- **Cell division** — The process by which a cell divides to form new cells
- **Mitosis** — A type of cell division that produces two identical daughter cells
- **Somatic cell** — Any body cell that is not a sex cell.
- **Daughter cells** — The new cells produced after cell division.
- **Chromosome** — Coiled up DNA that carries genetic information.
- **Nucleus** — The part of the cell that contains chromosomes/DNA.

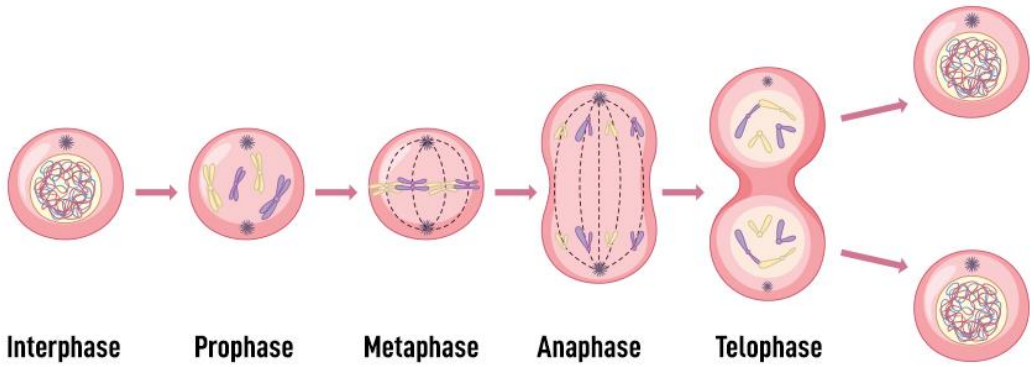
What is the purpose of mitosis?

To allow multicellular organisms to grow and maintain tissues.

What do these multicellular organisms use mitosis for?

- To grow (e.g. increasing body size)
- To repair (e.g. healing cuts)
- To replace damaged or dead cells

Example 1. Stages of mitosis



Query

1. As mentioned in *Anki Vocab* and demonstrated in **Example I**, mitosis produces two identical daughter cells. Why do you think this helps an organism to grow?

What's a 'somatic cell?'

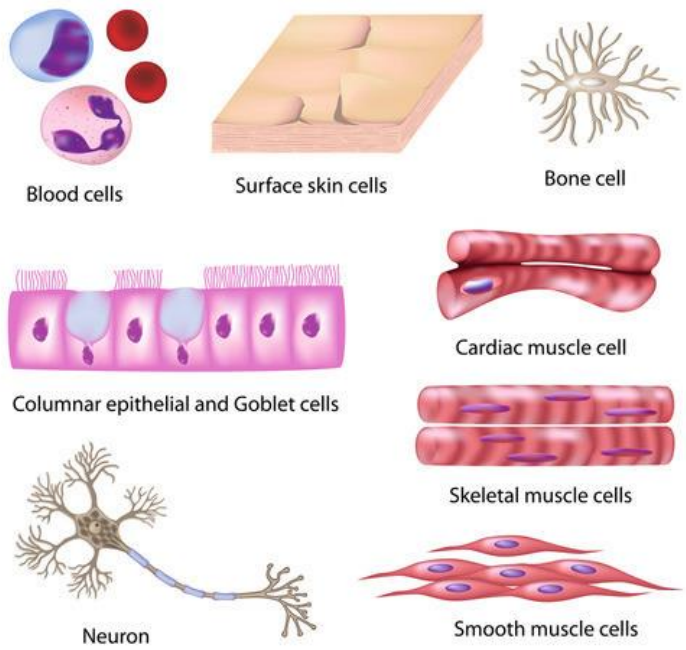
Somatic cells are 'body cells' (which includes a range of cells as shown in **Example 2**.

Any cell in the body that isn't a sex cell is a somatic cell.

Somatic cells are classified as 'diploid' cells, meaning that they have a full set of chromosomes (think 'di' as in *two*, and a full set of chromosomes is 23 *pairs,* or *46 chromosomes*).

Importantly, the only way to get a new somatic cell is via mitosis.

Example 2. Examples of body cells



Queries

1. What's the difference between a chromosome and a pair of chromosomes?
2. Somatic cells are 'diploid' cells with 46 (a full set of) chromosomes in total. However, sex cells are 'haploid' cells. Based on the information given, how many chromosomes do you think a sex cell would have?

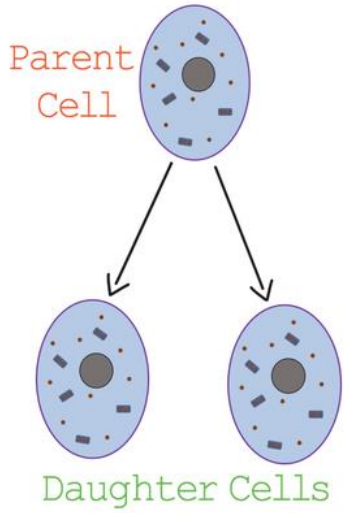
Chromosome numbers and DNA preservation

As mentioned above, mitosis produces only somatic cells, and somatic cells are diploid, meaning that they contain 46 chromosomes.

As mentioned in *Anki vocab,* the result of mitosis is two identical daughter cells (See **Example 3**). From one 'parent' somatic cell, we get *two* exact replica 'daughter' cells.

The reason why mitosis allows a somatic cell to make two identical copies of itself, is so that the organism can *preserve* all of its DNA, as it grows, repairs, and replaces.

Example 3. Mitosis produces two daughter cells identical to the parent cell



Query

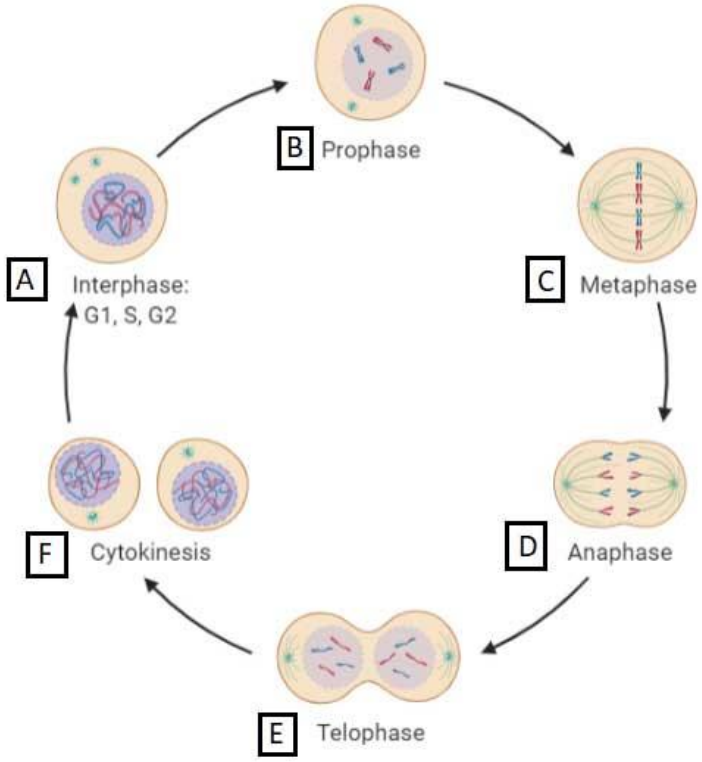
1. Mitosis allows the 46 chromosomes/23 pairs in the somatic cell to be replicated in the 2 new daughter cells, allowing all of the organism's DNA to be preserved. Why do we say that 46 chromosomes are "all" of an organism's DNA?

The Cell Cycle (briefly)

If a cell wants to divide, it has to enter the 'cell cycle', wherein the cell makes various changes that prepare it to divide. We're only concerned with mitosis for now, but the three main stages include:

1. Interphase – the cell copies its DNA (so now it has two copies), grows a bit, and prepares to divide.
2. Mitosis – two genetically identical daughter cells are created
3. Cytokinesis – the physical splitting of these two cells from each other

Example 4. The cell cycle



The stages of Mitosis

We mentioned in *The Cell Cycle (Briefly)* section that the three main phases are Interphase, Mitosis, and Cytokinesis. However, if we examine **Example 4,** we find Interphase and Cytokinesis, but the term 'Mitosis' is absent and instead we find 4 apparent 'phases'.

These are the 4 phases or stages of mitosis (remember them using the mnemonic 'PMAT') and a few key things happen to the cell at each stage (also see **Example 5**):

Prophase

- Chromosomes condense and become visible.
- The cell's nuclear membrane (a layer that separates the cell's nucleus from the cytoplasm, see **Example 6**) breaks down.

Metaphase

- Chromosomes line up along the middle of the cell (think 'M' as in 'middle')

Anaphase

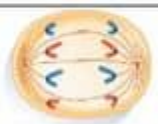
- Sister chromatids (see **Example 7** with explanation) separate
- (think 'A' as in 'away')

- Chromatids move to opposite ends of the cell.

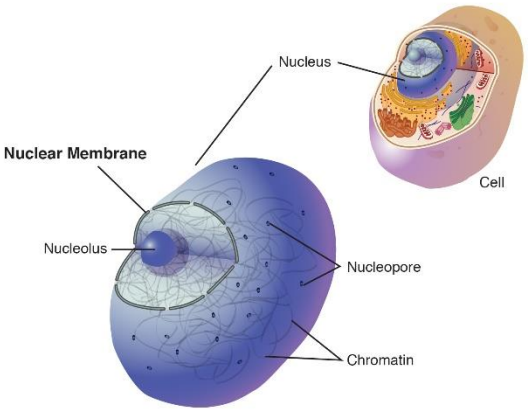
Telophase

- Nuclear membranes reform.
- Chromosomes unwind.

Example 5. The four phases of mitosis

Prophase		Chromosomes condense and become visible because nuclear membrane disappears & spindle fibres stretch across the cell.
Metaphase		Chromosomes line up in the middle of the cell and attach to the spindle fibres.
Anaphase		Spindle fibres pull chromosome pairs apart towards each end of the cell.
Telophase		Nuclear membrane reappears around chromosomes and the cell pinches apart in the middle.

Example 6. The nuclear membrane

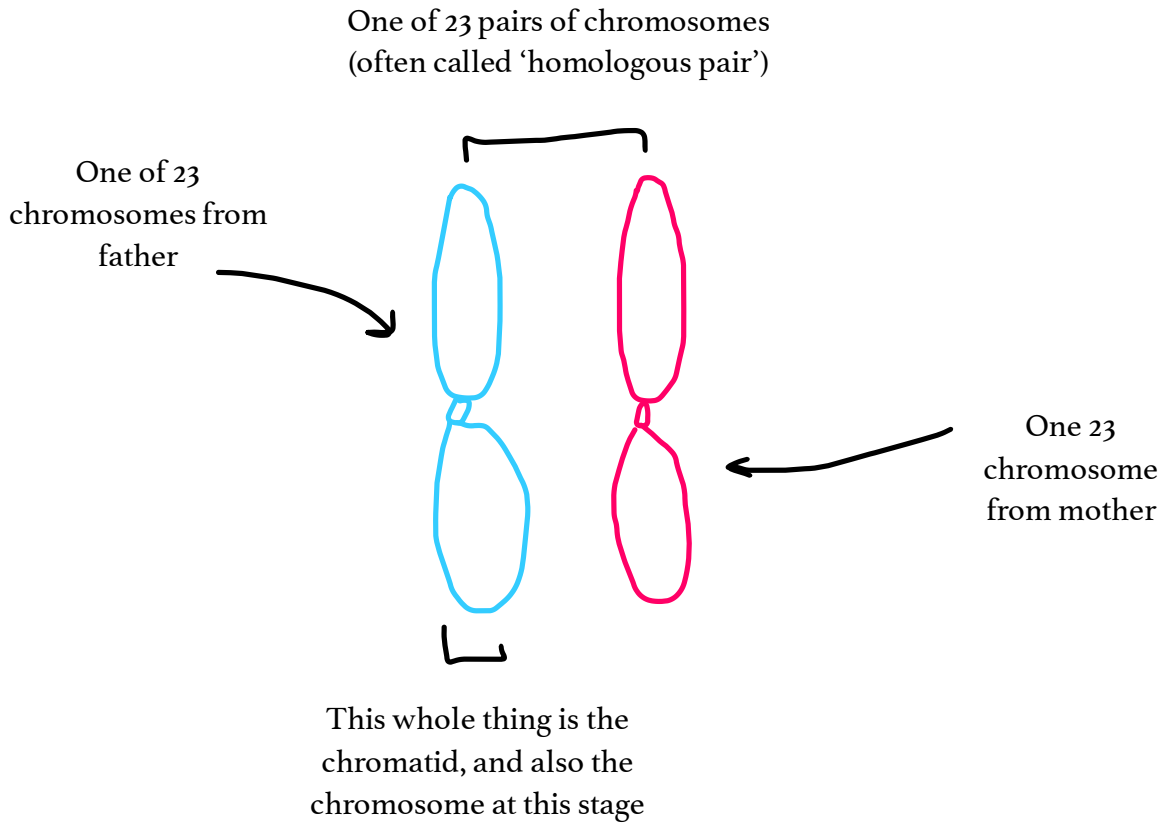


Example 7. Chromatid vs chromosome vs chromosome pair

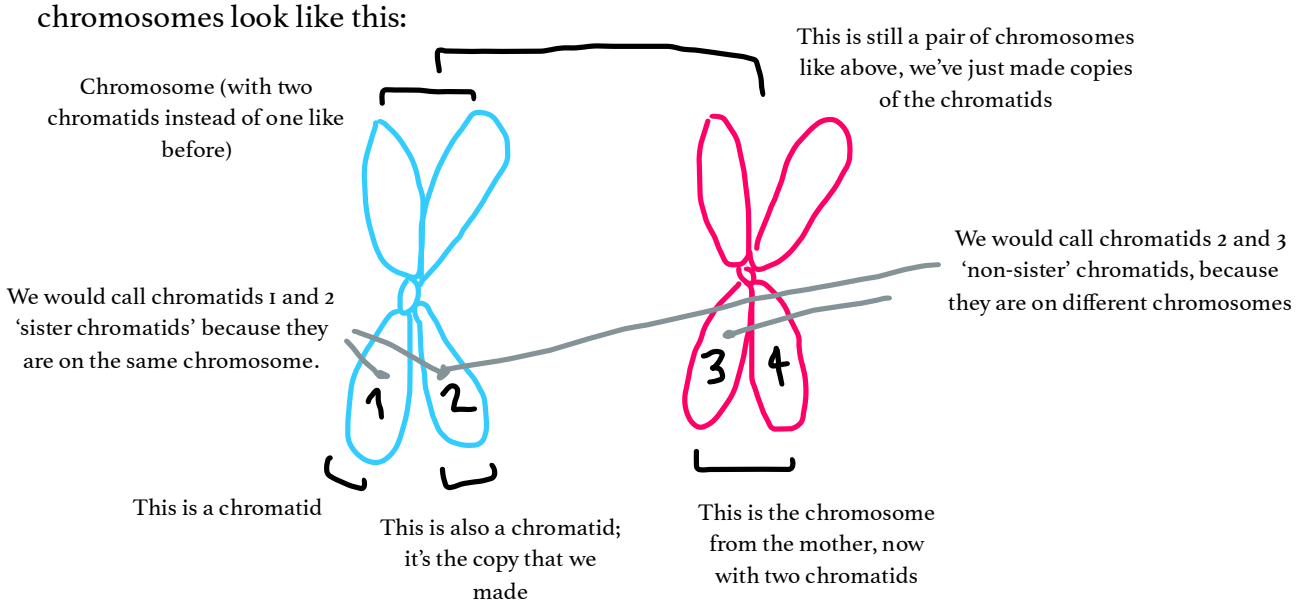
If you recall, a somatic cell has 46 chromosomes or 23 pairs, and when this cell wants to divide, it has to go through the cell cycle.

The cell cycle has three main stages, Interphase (where it copies its DNA so now it has two copies), Mitosis (where it creates two identical versions of itself) and Cytokinesis (where the two identical versions physically separate).

Chromosomes are just coiled up DNA, and when the somatic cell hasn't done interphase yet, these chromosomes look like this:



Once the somatic cell does interphase and copies its DNA (chromosomes) for mitosis, the chromosomes look like this:



MCQ

Question 1

What is the main purpose of mitosis in multicellular organisms?

A. To produce sex cells
B. To create genetic variation
C. To allow growth, repair, and replacement of cells
D. To reduce chromosome number

Question 2

Which of the following is a somatic cell?

A. Sperm cell
B. Egg cell
C. Skin cell
D. Pollen cell

Question 3

All somatic cells are diploid, meaning they contain a full set of chromosomes.

A. True
B. False

Question 4

How many chromosomes are found in a human somatic cell?

A. 23
B. 46
C. 46 pairs
D. 44

Question 5

Why does mitosis produce two identical daughter cells?

A. To increase genetic variation
B. To reduce the chromosome number
C. To preserve all genetic information
D. To create sex cells

Question 6

Which stage of the cell cycle involves copying of DNA?

A. Mitosis
B. Cytokinesis
C. Interphase
D. Telophase

Question 7

Cytokinesis is the stage where chromosomes line up in the middle of the cell.

A. True
B. False

Question 8

During which stage of mitosis do chromosomes line up along the middle of the cell?

A. Prophase
B. Metaphase
C. Anaphase
D. Telophase

Question 9

What happens during anaphase?

A. Chromosomes condense
B. Nuclear membranes reform
C. Sister chromatids separate and move apart
D. DNA is copied

Question 10

Which event occurs during telophase?

A. Chromosomes line up at the equator
B. Sister chromatids separate
C. Nuclear membranes reform and chromosomes unwind
D. DNA replication occurs