

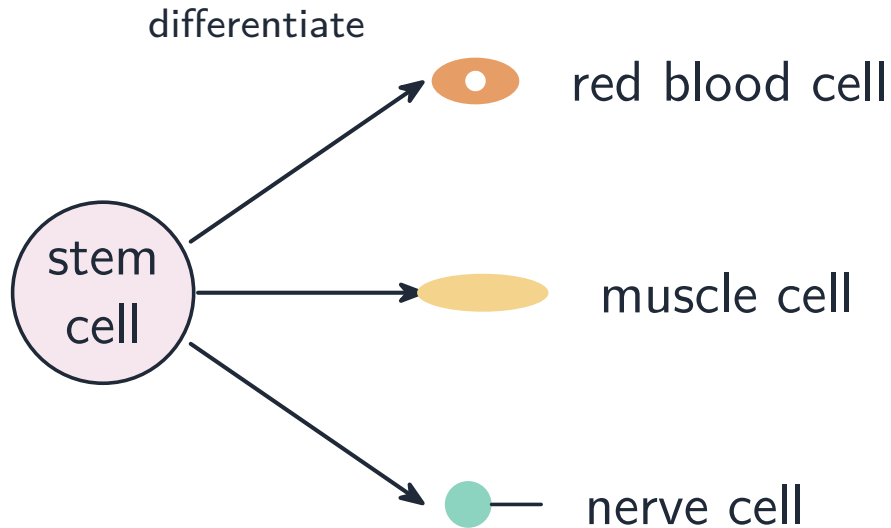
Exercise walk-through

5.1

Replication and division of nuclei and cells

A-Level Biology

Stem cells

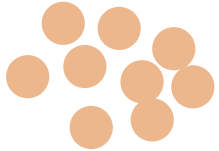


A **stem cell** is unspecialised. It keeps dividing and can **differentiate** into many specialised cell types. They are the source of new cells for repair & replacement.

Uncontrolled division and tumours



controlled: cells stop dividing

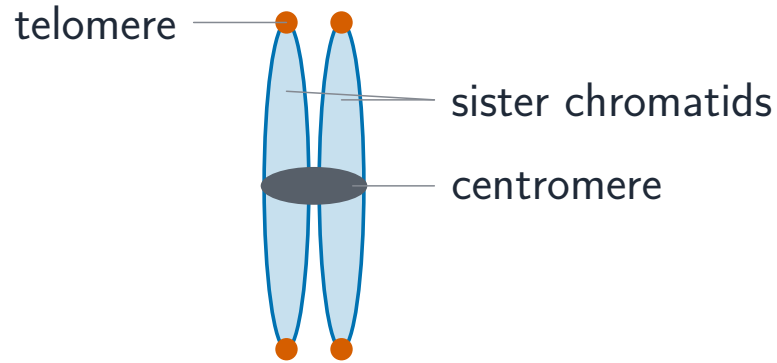


uncontrolled: a tumour grows

The cell cycle is normally tightly controlled, so cells divide only when needed.

If that control is lost, a cell divides again and again, forming a lump of cells – a **tumour**.

The structure of a chromosome



one chromosome = two identical copies after DNA replication

After replication a chromosome is two sister chromatids joined at the centromere, with telomeres at the tips

Chromosome structure, and why mitosis matters

a chromosome

one very long DNA molecule wound tightly around **histones**

why wound

so two metres of DNA fits inside a nucleus, and can be moved without tangling

the cell cycle

interphase (G1, S, G2), mitosis, then cytokinesis

growth

of **multicellular** **organisms** – more cells, genetically identical

repair and replacement

and asexual reproduction in many species

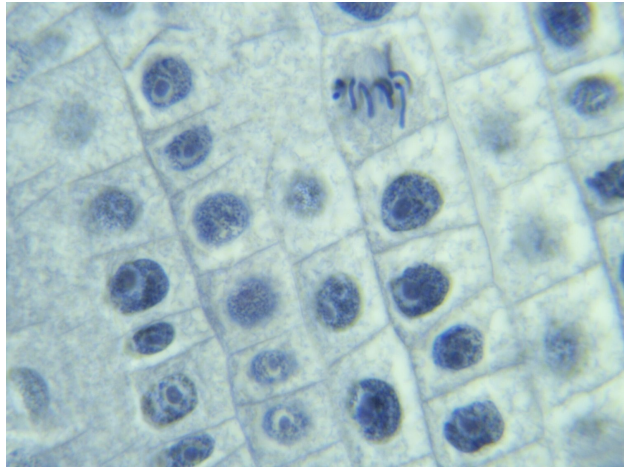
cytokinesis

in an animal cell the membrane **pinches inwards**; in a plant cell a **new wall forms** across the middle

Mitosis produces genetically identical **daughter cells**
asexual reproduction – depends on that identity.

. Every use of it – growth, repair,

Why mitosis matters



Onion root tip at metaphase: mitosis produces identical body cells for growth and repair

Exercises 2.1-2.2

2.1 Name the parts of a chromosome labelled by these descriptions: (a) where two sister chromatids are joined; (b) the protective caps at the tips. [2]

2.2 State what happens in the **S phase** of interphase. [1]

Exercises 2.1-2.2

2.1 Name the parts of a chromosome labelled by these descriptions: (a) where two sister chromatids are joined; (b) the protective caps at the tips. [2]

2.1

(a)

- centromere

(b)

- telomeres

2.2 State what happens in the **S phase** of interphase. [1]

2.2

- the DNA is replicated / copied

Exercises 3.1-3.2

3.1 During which phase of the cell cycle is DNA replicated?

[1]

☐

A G₁

B S

C G₂

D mitosis

3.2 Why does the loss of a small length of telomere during replication **not** harm the cell?

[1]

☐

A telomeres are made of protein

B telomeres carry no genes

C telomeres are replaced by histones

D the lost DNA is copied later

Exercises 3.1-3.2

3.1 During which phase of the cell cycle is DNA replicated?

[1]

☐

A G₁

B S

C G₂

D mitosis

3.1 B

- DNA is replicated in the S phase

3.2 Why does the loss of a small length of telomere during replication **not** harm the cell?

[1]

☐

A telomeres are made of protein

B telomeres carry no genes

C telomeres are replaced by histones

D the lost DNA is copied later

3.2 B

- Telomeres carry no genes, so losing a little does not lose genes

Exercise 3.3

3.3 Explain why mitosis produces two genetically identical daughter cells, and give **two** situations where this is important. [3]

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3.3

- mitosis copies the DNA exactly (S phase) and separates identical sister chromatids, so each daughter gets an identical set of genes; any two of: growth / replacement of dead cells / tissue repair / asexual reproduction

Exercise 3.4

3.4 (a) State what is meant by a stem cell. [2]

(b) Explain how the loss of control of the cell cycle can lead to a tumour. [2]

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3.4

(a)

- an unspecialised cell that can keep dividing and can differentiate into specialised cells

(b)

- the cell divides repeatedly without stopping, forming an uncontrolled mass of cells – a tumour