

# CAIE Biology A-level

## Topic 5: The Mitotic Cell Cycle

### Flashcards

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State the components that make up a chromosome.



State the components that make up a chromosome.

- DNA
- Histone protein
- Sister chromatids
- Centromere
- Telomeres



# What is the purpose of mitosis?



# What is the purpose of mitosis?

Produces two genetically identical daughter cells for:

- Growth
- Cell replacement / tissue repair
- Asexual reproduction



# What is the cell cycle?



# What is the cell cycle?

Regulated cycle of division with intermediate periods of growth.



Outline the stages of the cell cycle.





Outline the stages of the cell cycle.

1. Interphase
2. Mitosis or meiosis (nuclear division)
3. Cytokinesis (cytoplasmic division)



Outline what happens during interphase.



## Outline what happens during interphase.

- **G1** - Cell synthesises proteins for replication (e.g. tubulin for spindle fibres), **cell size doubles**
- **S** - DNA replicates, chromosomes consist of two sister chromatids joined at a centromere
- **G2** - Organelles divide



Name the stages of mitosis.



Name the stages of mitosis.

1. **Prophase**
2. **Metaphase**
3. **Anaphase**
4. **Telophase**



Outline what happens during prophase.



## Outline what happens during prophase.

1. **Chromosomes condense** and becoming **visible**, X-shaped, two sister chromatids joined at centromere
2. **Centrioles** move to opposite poles of cell (animal cells) and **mitotic spindle fibres** form
3. **Nuclear envelope** and **nucleolus** break down, chromosomes free in cytoplasm



Outline what happens during metaphase.





Outline what happens during metaphase.

Sister chromatids line up at **cell equator** attached to the mitotic spindle by their centromeres.



Outline what happens during anaphase.



# Outline what happens during anaphase.

Requires energy from ATP hydrolysis

1. Spindle fibres contract, **centromeres divide**
2. Sister chromatids separate into two distinct chromosomes and pulled to opposite poles of the cell (appear as 'V' shapes facing each other)
3. Spindle fibres break down



Outline what happens during telophase.



## Outline what happens during telophase.

1. Chromosomes **decondense** and can no longer be observed
2. New nuclear envelopes form around each set of chromosomes - **two new nuclei**, each with one copy of each chromosome



# What happens during cytokinesis?



# What happens during cytokinesis?

1. Cell membrane cleavage furrow forms
2. Contractile division of cytoplasm



What are telomeres? Refer to their structure.





What are telomeres? Refer to their structure.

Multiple repeat units of short sequence DNA that cap chromosome tips. The DNA that makes up telomeres is rich in guanine and cytosine.



State the role of telomeres.



## State the role of telomeres.

- Prevent the progressive loss of DNA in replication
- The enzyme responsible for replication cannot replicate the full length of the chain
- Telomeres provide protection against any loss of coding DNA



# What are stem cells?



# What are stem cells?

Cells that are unspecialised and retain the ability to differentiate into a range of cell types.



Name and define the four types of stem cell.



## Name and define the four types of stem cell.

- **Totipotent** - can develop into any cell type including the placenta and embryo
- **Pluripotent** - can develop into any cell type excluding the placenta and embryo
- **Multipotent** - can only develop into a few different cell types
- **Unipotent** - can only develop into one type of cell



Where can stem cells be found in adult humans?





# Where can stem cells be found in adult humans?

- Bone marrow
- Skin
- Gut
- Heart
- Brain



Suggest some uses of stem cells.



## Suggest some uses of stem cells.

- Repair of damaged tissue e.g. cardiomyocytes after myocardial infarction
- Drug testing on artificially grown tissues
- Treating neurological diseases e.g. Alzheimer's & Parkinson's
- Researching developmental biology e.g. formation of organs, embryos



Describe the two groups of specialised cells in blood.



## Describe the two groups of specialised cells in blood.

- **Erythrocytes** (red blood cells) - biconcave and no nucleus to maximise SA for oxygen uptake. Lots of haemoglobin to carry oxygen.
- **Leucocytes** (white blood cells) - lymphocytes, eosinophils, neutrophils to engulf foreign material, monocytes.



# How do the specialised cells in blood form?



# How do the specialised cells in blood form?

Multipotent stem cells in the bone marrow differentiate into:

- **Erythrocytes** - short lifespan, cannot undergo mitosis as they have no nucleus
- **Leucocytes**, including neutrophils



State the relationship between a system and specialised cells.





State the relationship between a system and specialised cells.

Specialised cells → tissues that perform specific function → organs made of several tissue types → organ systems



# Why is the regulation of the cell cycle important?



# Why is the regulation of the cell cycle important?

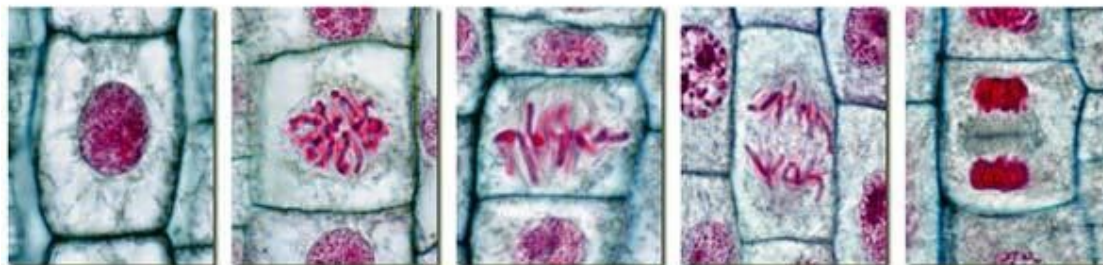
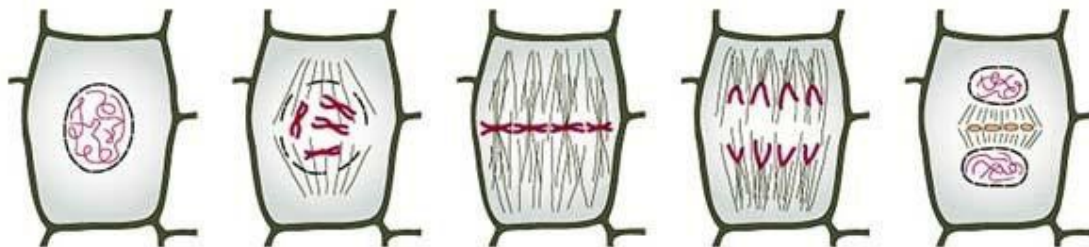
Irregular growth of cells where growth or repair is not required can result in the formation of cell masses (tumors). This may lead to cancer.



Draw diagrams of the appearance of plant cells at each stage of mitosis.



Draw diagrams of the appearance of plant cells at each stage of mitosis.



Interphase

Prophase

Metaphase

Anaphase

Telophase

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