



Mitosis

Scope

Topic	Subtopic	Topic breakdown
Mitosis	Introduction	Revise the structure of the nucleus
	The process of Mitosis	<p>Define mitosis.</p> <p>Describe the cell cycle as including interphase, mitosis, cytokinesis and growth.</p> <p>Describe the significance of interphase as doubling of genetic material so that it can be shared equally by the new cells formed during mitosis</p> <p>Differentiate between replicated  and unreplicated  chromosomes</p> <p>State that each replicated chromosome is made up of two chromatids joined by a centromere.</p> <p>Describe the following phases of mitosis using diagrams to show chromosome changes:</p> <ul style="list-style-type: none"> • prophase • metaphase • anaphase • telophase <p>State the difference between telophase in plant and animal cells.</p> <p>Use microscope slides, micrographs, posters, and models to observe different phases and make drawings of different phases of mitosis.</p>
	Importance of mitosis	<p>Describe the importance of mitosis as follows</p> <ul style="list-style-type: none"> • new cells are formed for growth • to allow for repair and replacement of damaged cells • to allow for simple unicellular organisms to reproduce asexually eg. binary fission and vegetative reproduction
	Cancer	Define cancer- uncontrolled cell division.

Mitosis

Notes

Introduction

Cells have the ability to divide continuously. There are two types of cell division:

- mitosis
- meiosis.

In Mitosis (nuclear division)

One cell (mother cell) undergoes division to form **two identical cells** (daughter cells)

There is **no change** in the chromosome number

This usually takes place to **form** new **somatic/body cells**

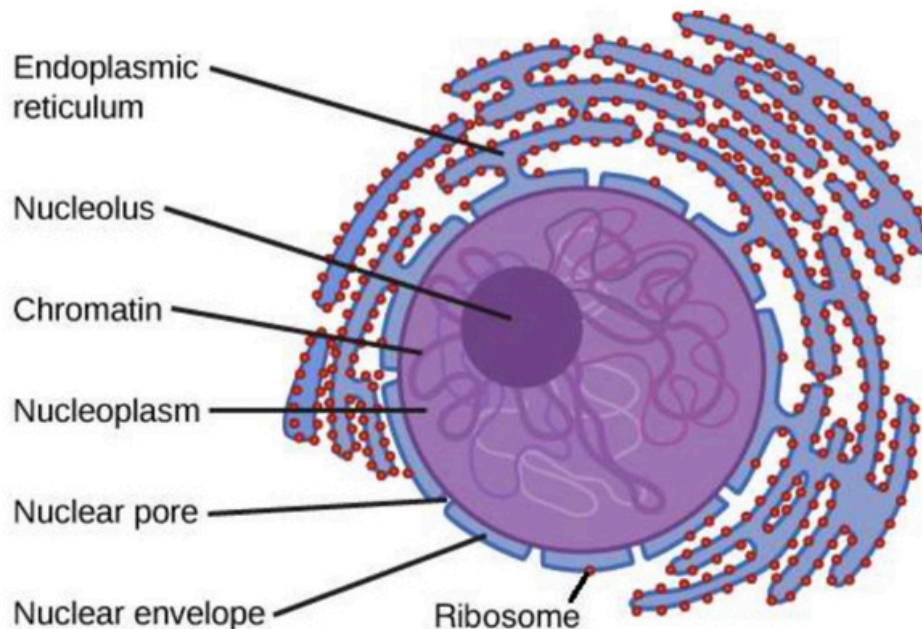
In Meiosis (reduction division)

One cell (mother cell) undergoes division to form **four dissimilar cells** (daughter cells)

The daughter cells have **half the chromosome number** as the mother cell

This usually takes place to **form** **gametes**

The nucleus

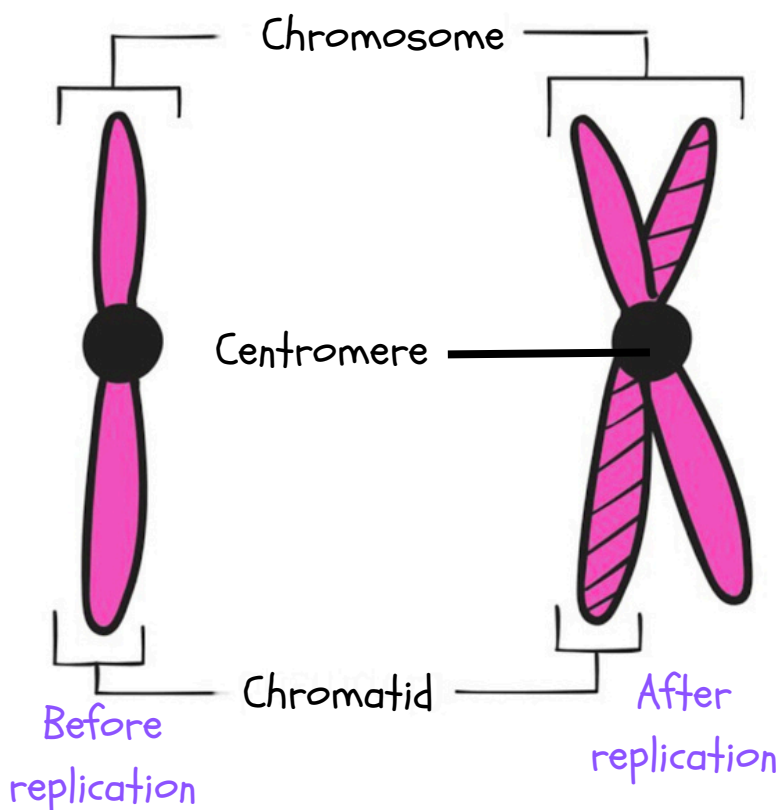


Mitosis is the process of nuclear division by which two genetically identical daughter cell nuclei are produced that are also genetically identical to the parent cell nucleus (they have the same number of chromosomes as the parent cell)

Mitosis Notes

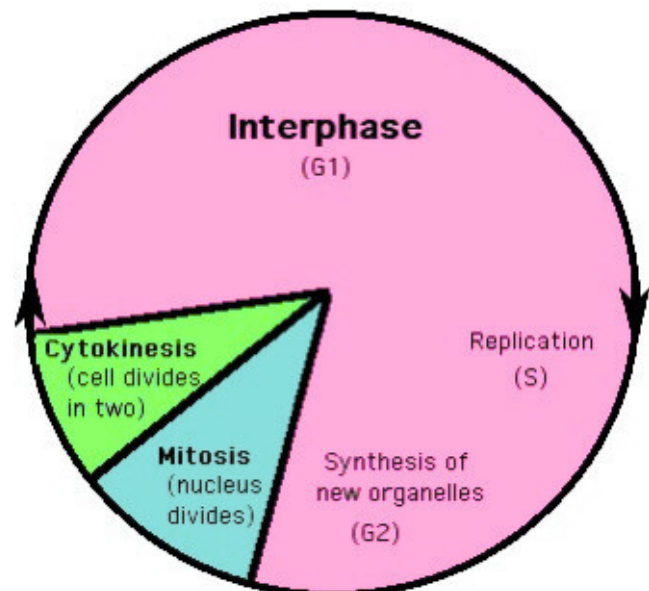
Chromosomes

- **Chromosomes** are thread-like structures found in the nucleus of a cell.
- body cells have two copies of each chromosome(**diploid**)
- When cells are not dividing the chromosomes appear as a mass of threads, the **chromatin network**.
- A chromosome consists of the nucleic acid DNA and proteins
- Before a cell divides, the DNA (chromosomes) has to be **replicated**.
- This ensures that when the cell splits in two, each new cell still has two copies of each chromosome (is still diploid). The process during which a DNA molecule makes an identical replica (copy) of itself is known as **DNA replication**
- After replication has taken place the single - stranded chromosome consists of two strands which are called **chromatids**.
- The two chromatids of a double-stranded chromosome are joined by a **centromere**.



DNA replication takes place during Interphase of a cell cycle. This is before mitosis

The cell cycle is the series of events that takes place in a cell that results in DNA replication and cell division.

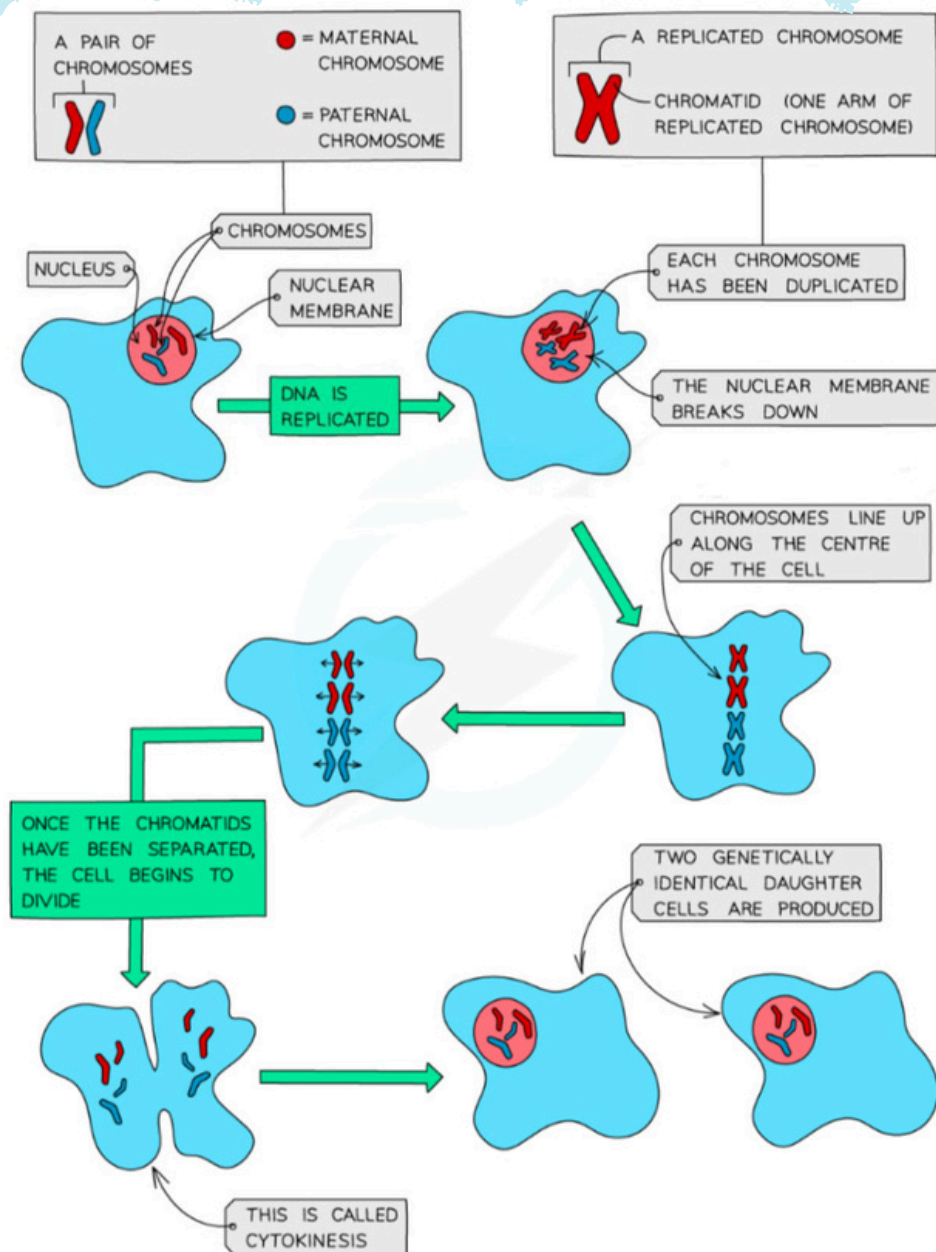


Humans have 46 chromosomes

The process of mitosis

Notes

Mitosis is the process of nuclear division by which two genetically identical daughter cell nuclei are produced that are also genetically identical to the parent cell nucleus (they have the same number of chromosomes as the parent cell)



Although mitosis is, in reality, one continuous process, it can be divided into four main stages.

These stages are:

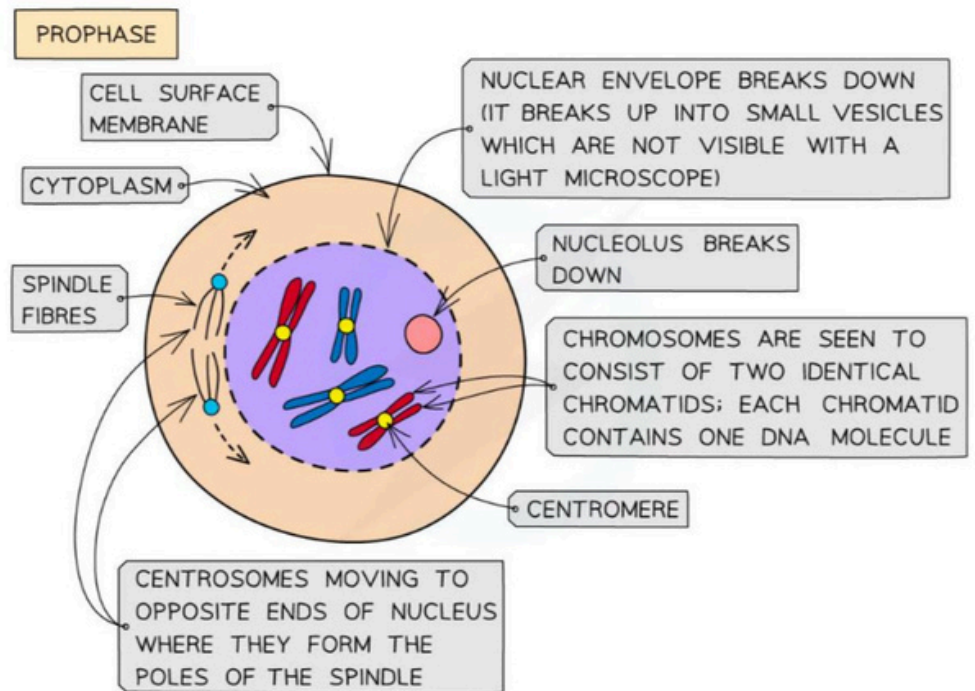
- Prophase
- Metaphase
- Anaphase
- Telophase

The process of mitosis

Notes

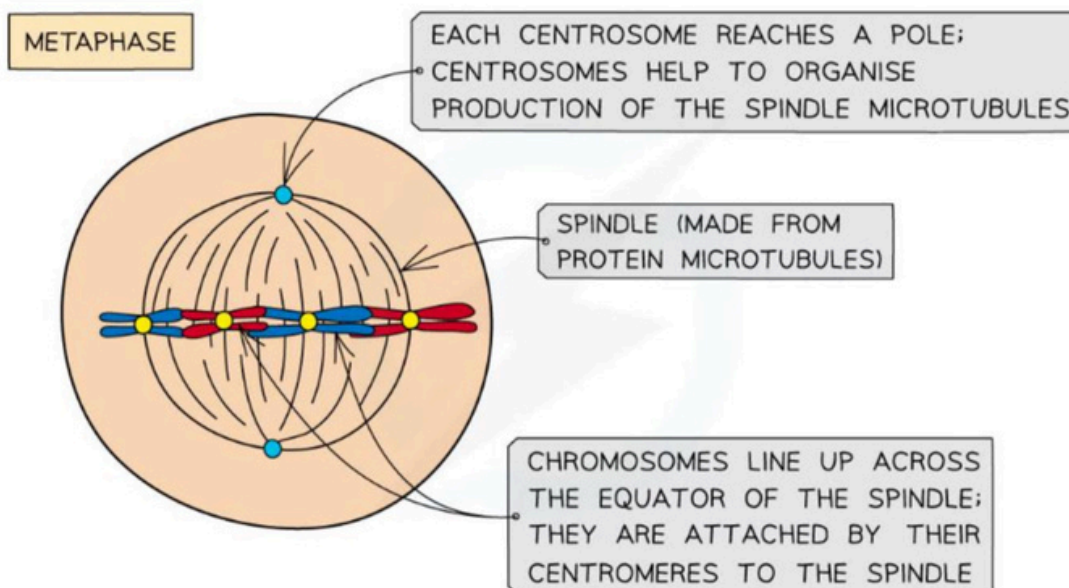
PROPHASE

- **Chromosomes** condense and are now visible when stained
- The chromosomes consist of two identical **chromatids** (each containing one DNA molecule) that are joined together at the **centromere**
- The two centrosomes move towards opposite poles (opposite ends of the nucleus)
- **Spindle fibres** begin to emerge from the centrosomes (consists of two centrioles in animal cells)
- The nuclear envelope (nuclear membrane) breaks down into small vesicle



METAPHASE

- **Centrosomes** reach opposite poles
- Spindle fibres continue to extend from centrosomes
- Chromosomes line up at the **equator** of the spindle
- Spindle fibres attach to the centromeres

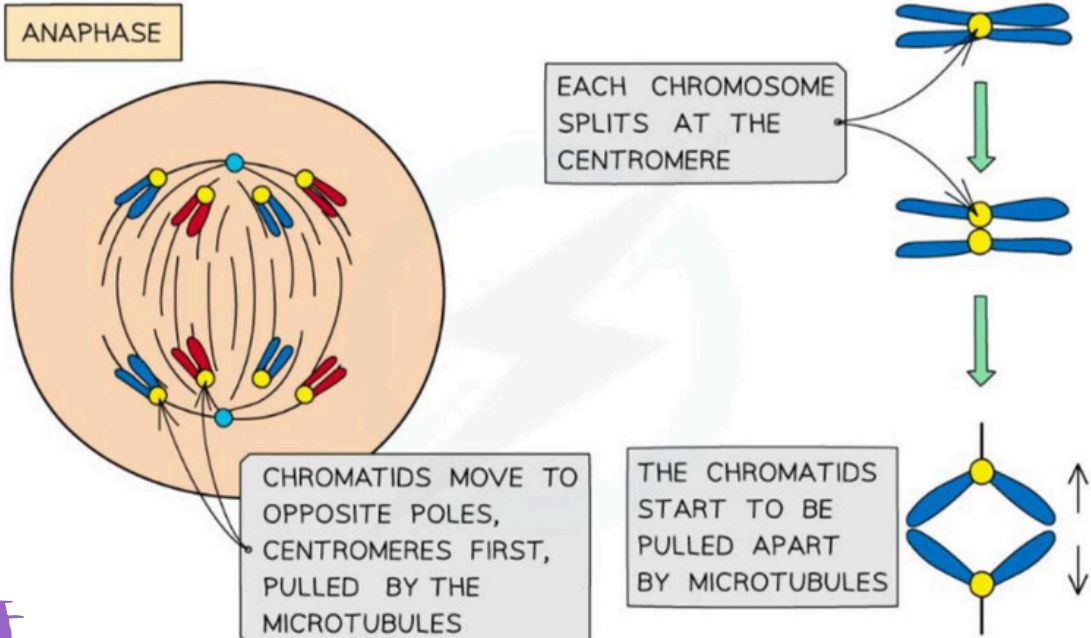


The process of mitosis

Notes

ANAPHASE

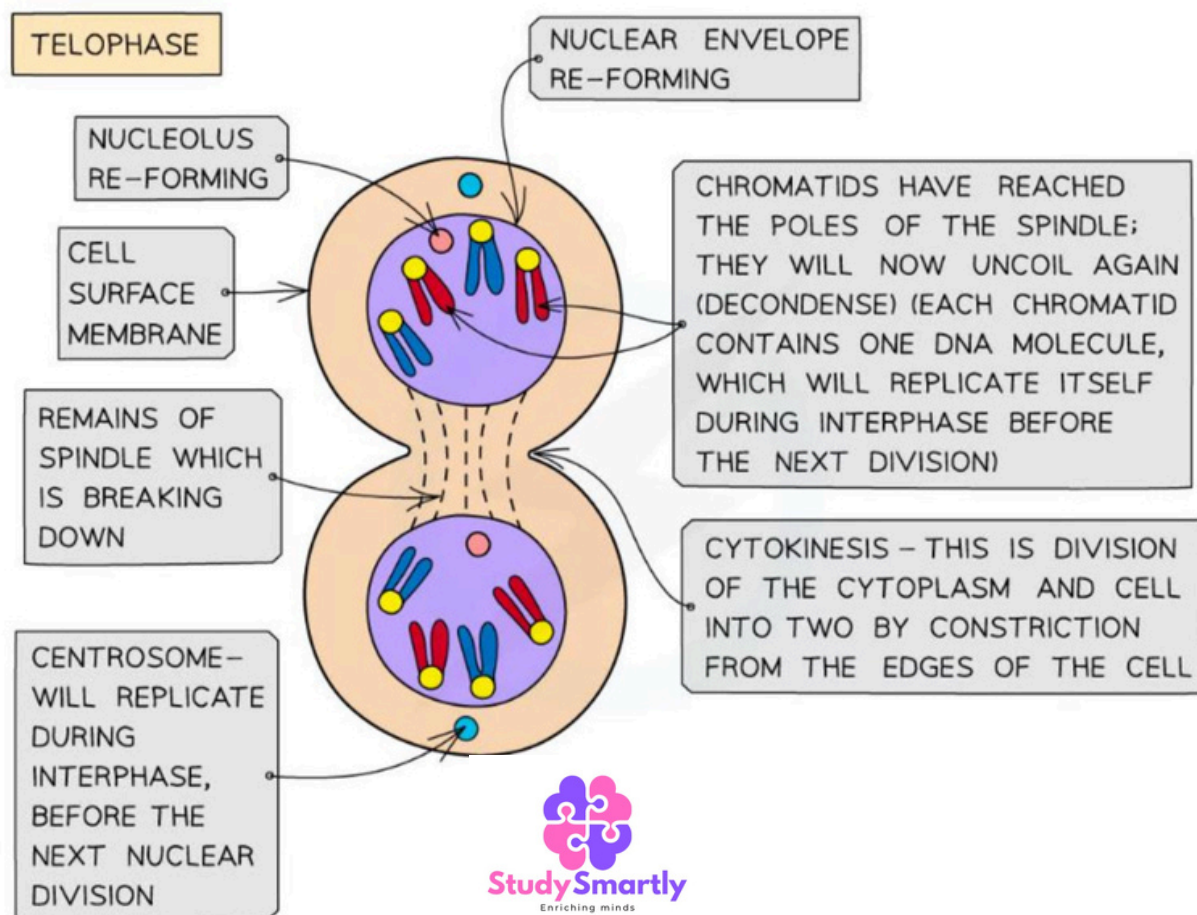
- **Spindle fibre contract & centromere splits** chromatids separate and move to opposite poles



TELOPHASE

Chromosomes arrive at opposite poles and begin to decondense

- **Cytokinesis** takes place
- Nuclear envelopes (nuclear membranes) begin to reform around each set of chromosomes
- The spindle fibres break down



The process of mitosis

Notes

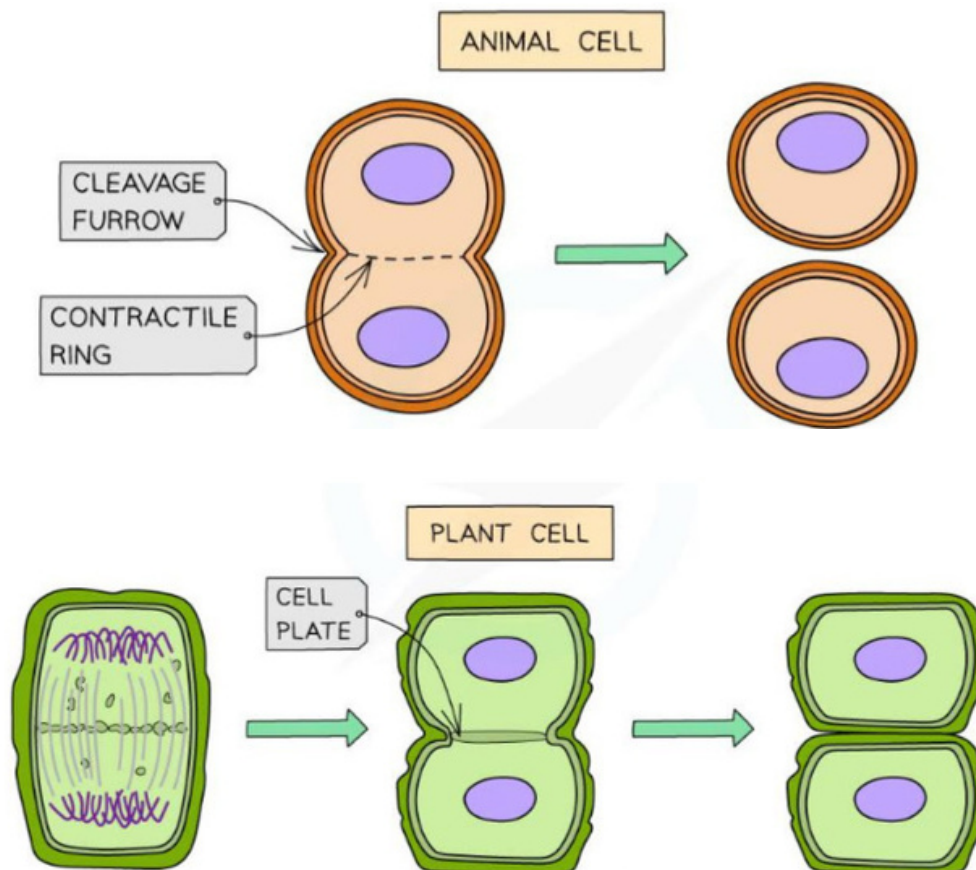
Cytokinesis

Cytokinesis is the division of the cytoplasm

This is the physical separation of the parent cell into two genetically identical daughter cells and occurs once a new nucleus has completely re-formed at each pole of the parent cell at the end of telophase.

The process differs slightly in animal and plant cells:

- In **animal cells**, a 'cleavage furrow' forms and separates the daughter cells
- In **plants**, a 'cell plate' (the precursor to a new cell wall) forms at the site of the metaphase plate. Once the cell plate reaches the cell walls of the parent cell, new cell walls are produced, separating the new daughter cells



Role of mitosis

Important for the following reasons:

- Growth of cells
- Repair damaged cells/tissues
- Reproduction (asexual)

Cancer Notes

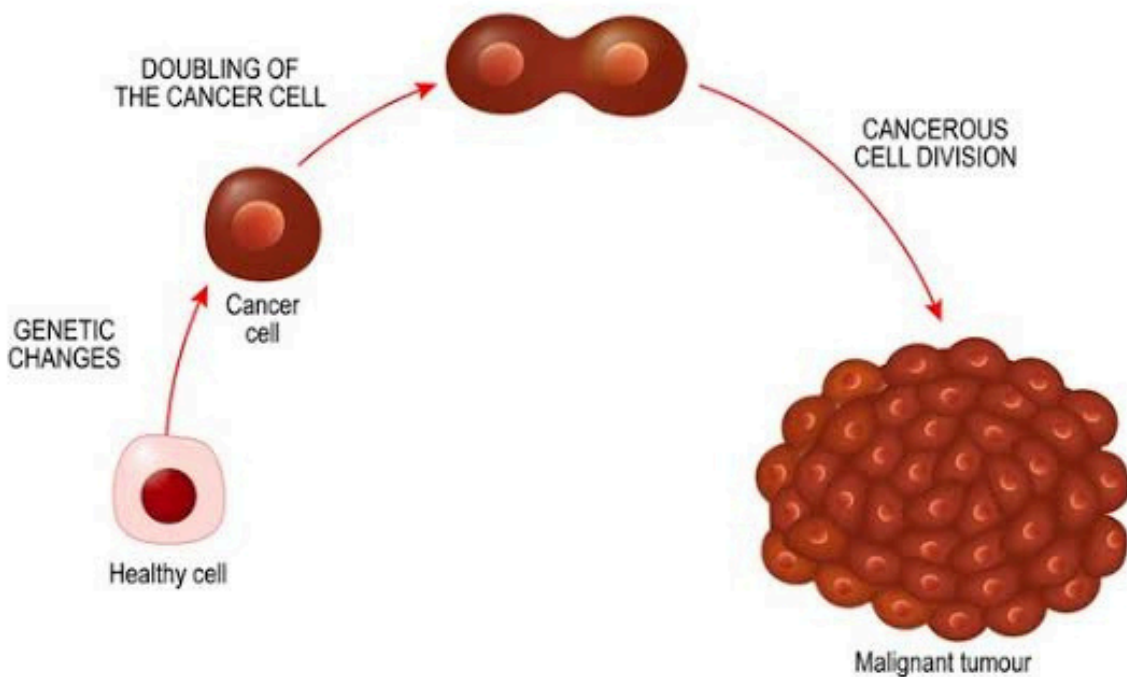
Cell division usually takes place in a controlled way but sometimes it can go out of control. When dividing cells divide too quickly, a lump of cells called a tumour can develop.

Tumours

Cancer: Uncontrolled cell division

There are two main types of tumours:

- **Benign tumours** - are growths cells that are enclosed in a membrane or capsule. The cells cannot escape and spread to other parts of the body. Benign tumours can usually be removed surgically and the person is cured.
- **Malignant tumours** - are growths of cells that are not enclosed in a membrane or capsule. The cells can break away from the tumour. They are carried in the blood or lymph to other parts of the body where they grow and form new malignant tumours. This growth of tumours is a disease called **cancer**.



Treatment

The most common types of treatment are:

Surgery - is often used in combination with some other therapy in order to make sure all of the cancer cells are gone.

Chemotherapy - is a form of aggressive cancer treatment that uses medications that are toxic to cells to kill rapidly dividing cancer cells. It may be used to shrink the size of a tumor or the number of cells in your body and lower the likelihood of the cancer spreading.

Mitosis

Terminology

Key Terminology

Chromosomes	are present in the nuclei of all cells and consist of two identical strands called chromatids joined by a centromere.
Mitosis	is the process by which cells distribute their replicated DNA to two daughter cells.
Cytokinesis	Division of the cytoplasm, organelles and cell membrane
Centrioles	Cell structures that form the spindle during cell division
Centromere	The structure that joins two chromatids to form a chromosome
Metaphase	The phase of mitosis where chromosomes arrange themselves in a single row on the equator
Cancer	The growth or tumour that forms as a result of uncontrolled mitosis