

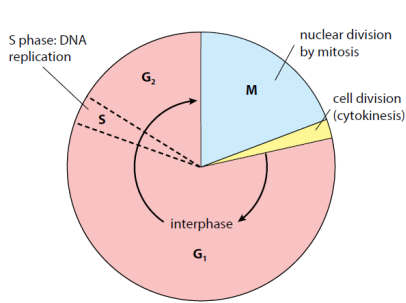
UNIT 5 - THE MITOTIC CELL CYCLE

Chromatid - one of two identical parts of a chromosome, held together by a centromere, formed during interphase by the replication of DNA strands.

Telomere - repetitive sequence of DNA at the end of a chromosome that protects genes from the chromosome shortening that happens at each cell division.

Mitosis - the division of a nucleus into two so that the two daughter cells have exactly the same number of chromosomes as the parent cell.

Cell cycle - the sequence of events that takes place from one cell division until the next; it is made up of interphase, mitosis, and cytokinesis.



G = gap

M = mitosis

S = synthesis [of DNA]

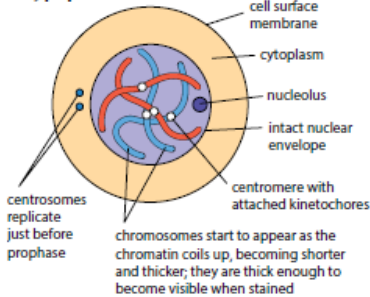
- L $G_1 + S + G_2 =$ interphase
- L G_1 - the cell receives a signal and commits to cell replication. The cell grows and prepares to enter the S phase.
- L S - the DNA undergoes replication and by the end of this phase, the entire genome is completely duplicated.
- L G_2 - the cell continues to grow and all the DNA replicated in the S phase is checked. Preparations to start mitosis are also made e.g. there is a spike in tubulin production (the protein required to make microtubules which form the spindle during mitosis)

Cytokinesis - the division of the cytoplasm and cell into two by constriction from the edges of the cell.

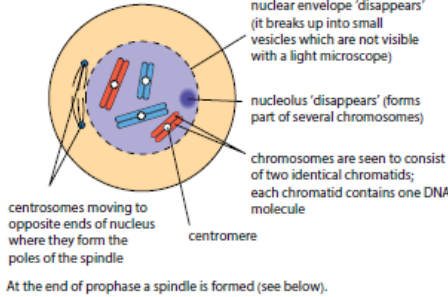
The behaviour of chromosomes in plant cells is identical to that in animal cells. However, plant cells differ in 2 main ways:

- 1) Plant cells do NOT have centrosomes (cylindrical structures responsible for organising microtubules)
- 2) After the nuclear division of a plant cell, a new cell wall must form between the daughter nuclei.

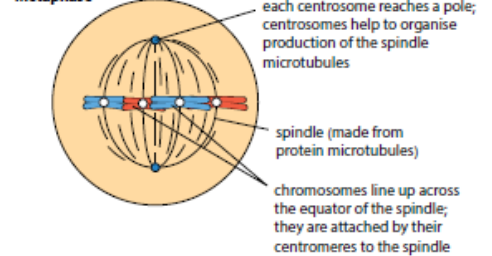
Early prophase



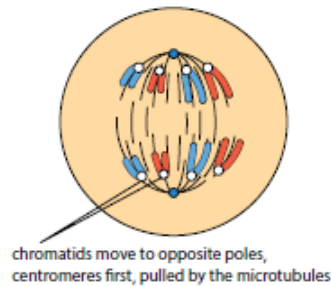
Late prophase



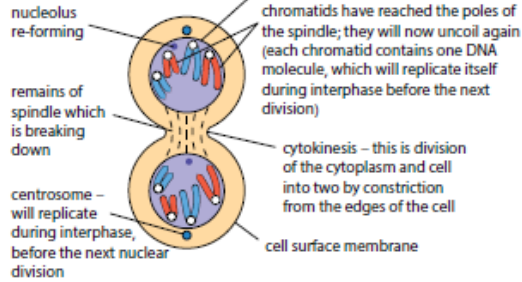
Metaphase

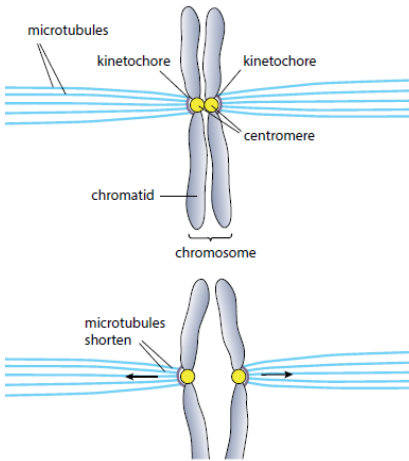


Anaphase



Telophase





Kinocore - a protein structure found at the centromere of a chromatid to which microtubues attach during nuclear division.

The microtubules attached to the kinetochores shorten and so pull the centromeres to opposite poles during anaphase.
The centromere also duplicates during prophase to allow this.

The importance of mitosis:

- L Growth - allows for the growth of multicellular organisms from unicellular zygotes
 - L Replacement & repair - cells in tissue can be replaced by the identical daughter cells if the tissue is damaged.
 - L Asexual reproduction - mitosis is the basis of asexual reproduction
- Asexual reproduction** - the production of new individuals of a species by a single parent organism.
- L Immune response - cloning B and T lymphocytes during clonal expansion

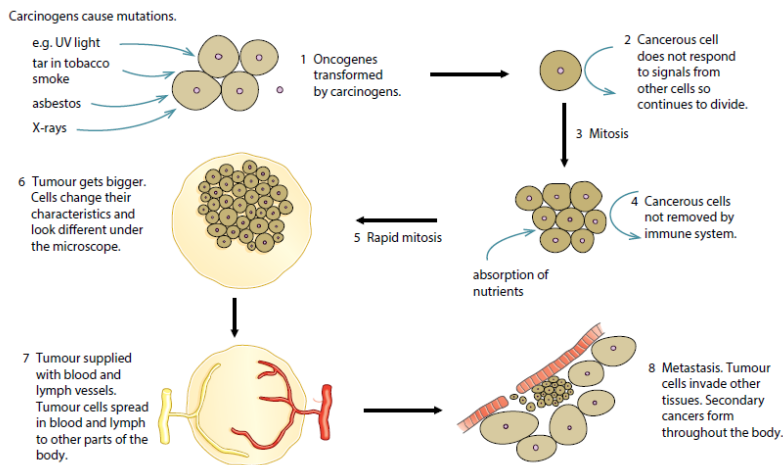
Telomeres

- L They prevent the DNA from being lost after each replication
- L The length of a telomere gets a bit shorter after each division until the vital DNA is no longer protected and the cell dies

Stem cells

Stem cells - a relatively unspecialised cell that retains the ability to divide an unlimited number of times and which has the potential to become a specialised cell (such as a blood cell or muscle cell)

- L Stem cells can divide an unlimited number of times by mitosis and each new cell produced has the ability to stay as a stem cell or differentiate into a specialised cell.
- L Embryonic stem cells can differentiate into any cell while stem cells in adults can only differentiate into a few.
- L Adult stem cells reside in the bone marrow



Cancers

Cancers - a group of diseases that result from a breakdown in the usual control mechanisms that regulate cell division; certain cells divide uncontrollably and form tumours from which cells may break away and form secondary tumores in other areas of the body (metastasis).

- L Cancers are a result of uncontrollable mitosis
- L Cancers occur when changes (mutations) occur in genes that cause cell division

Mutation - a random change in the base sequence (structure) of DNA (a gene mutation), or in the structure and/or number of chromosomes (a chromosome mutation).

- L Mutations that cause cancers are called oncogenes
- L Oncogenes can be inherited or caused by carcinogens

Carcinogens - substances or environmental factors that can cause cancer e.g. UV light, X-rays, chemicals in cigarette smoke, and asbestos.