

CHROMOSOMES

coloured bodies

- made of two chromatids
- Each chromatid contains one DNA molecule
- two chromatids held by centromere
- made of chromatin (chromatin → chromatids → chromosome)
- Combination of DNA and proteins → histones (basic, react with acidic DNA)
- DNA wound around histones to prevent tangling
- most condensed during metaphase.
- Function → tightly pack information so the info is easier to separate into two new cells.



CHROMATID x 2 → CHROMOSOME

TELOMERES

- caps the ends of chromosome
- made of DNA with short base sequences that are repeated many times
- Function → prevent loss of genes during cell division
 - allow continued replication of a cell (ends of molecule not left out)
- telomerase adds this extra DNA → telomerase activity ↓ as age ↑
- why cells die?
 - ↳ Copying enzyme cannot run to end of DNA
 - ↳ Part of DNA not copied, telomeres become shorter
 - ↳ until vital DNA is no longer protected → cell dies.

CENTROMERE

- needed for separation of chromatids
- site of attachment of spindle microtubules
- contains 2 kinetochores (one on each chromatid)
 - ↳ Proteins which bind to DNA & microtubules
 - ↳ construction begins in S phase
 - ↳ lost again afterwards
- Centrosome
 - ↳ MTOC for construction of spindle
 - ↳ consists of a pair of centrioles
 - ↳ not present in plants.

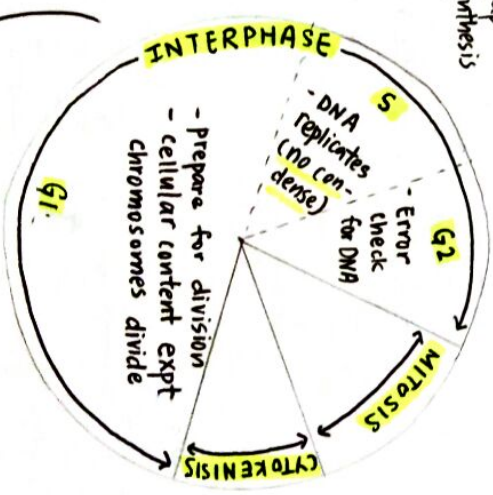
THE MITOTIC CELL CYCLE

SPINDLES

- Attach to centromere of chromosomes
- shorten to pull chromatids to poles
- Arrange chromosomes at equator

CELL CYCLE

* G = gap
S = synthesis

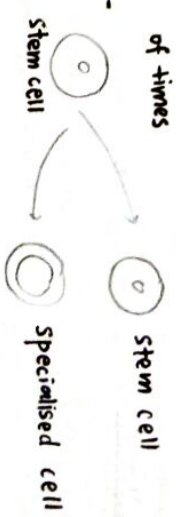


SIGNIFICANCE OF MITOSIS

- Growth
- Replacement of cells
- Repair of tissues
- Asexual reproduction
 - ↳ budding, vegetative propagation
 - ↳ binary fission
- Immune response
 - ↳ cloning of B- and T- lymphocytes.

STEM CELLS

- a cell that can divide an unlimited number of times
- power of stem cell to produce different kinds of cells → potency



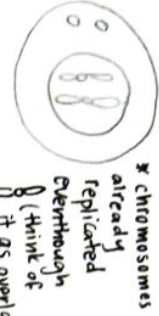
CANCER

- result of uncontrolled mitosis
- cancerous cells divide repeatedly to form a tumour → an irregular mass of cells
- benign tumours → no spread
- malignant tumours → spread
- due to a mutated gene → oncogene
- mutation by carcinogens
- cells of tumour can break off to form secondary growths → metastasis
- How uncontrolled mitosis results in cancer:
 - Due to mutation, oncogenes switched on
 - cells with oncogene do not respond to extracellular signals to control mitosis.
 - Divide uncontrollably → tumour
 - Cells break off → secondary growth
 - metastasis.

MITOSIS

PROPHASE

Early prophase



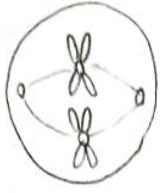
* chromosomes already replicated throughout (think of it as overlap)

Late prophase



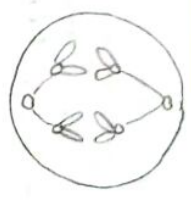
- chromatin shortens and thickens to become chromosomes
- centrosome move to opposite poles
- nuclear envelope breaks down into small vesicles
- nucleolus forms part of several chromosomes.
- chromosomes are seen to consist of two identical chromatids
- spindles start to form

METAPHASE



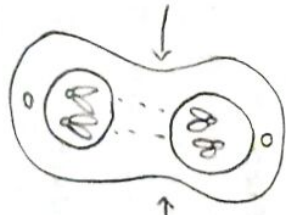
- centrosome reaches a pole
- spindles are fully formed
- spindles attach to centromeres of chromosomes
- chromosomes line up at the equator of the spindle.

ANAPHASE



- spindles shorten, pulling chromatids to the opposite poles. (centromeres leading)

TELOPHASE



- nucleolus / nuclear envelope reforms
- remains of spindle break down
- chromatids reach poles and uncoil

(not part of mitosis)
CYTOKINESIS - formation of cleavage furrow
 - cytoplasm divides.