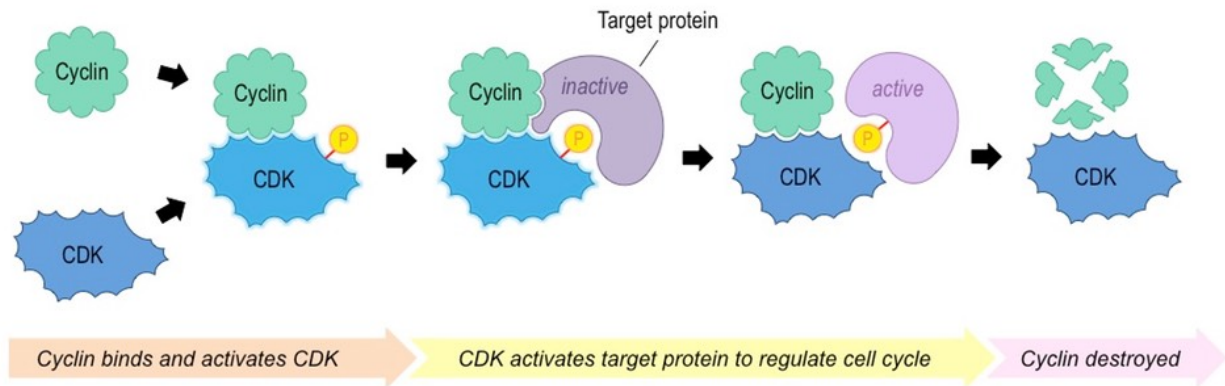


Cyclins and the Cell Cycle

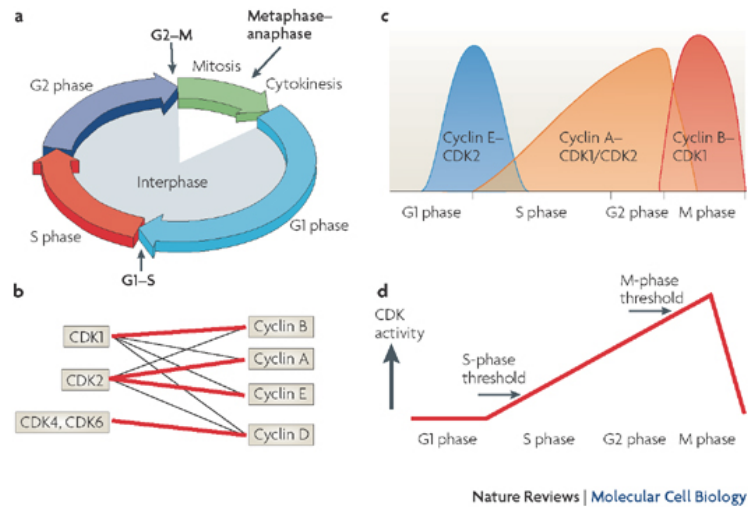
Cyclins are a family of regulatory proteins that control the progression of the cell cycle

Cyclins activate *cyclin dependent kinases (CDKs)*, which control cell cycle processes through phosphorylation. This is an example of an *allosteric activator*.



- When a cyclin and CDK form a complex, the complex will bind to a target protein and modify it via phosphorylation
- The phosphorylated target protein will trigger some specific event within the cell cycle (e.g. centrosome duplication, etc.)
- After the event has occurred, the cyclin is degraded and the CDK is rendered inactive again
- There are 3 checkpoints that cyclins help control in the cell cycle: G1 checkpoint (G1-S), G2 (G2-M) checkpoint and MA-checkpoint.

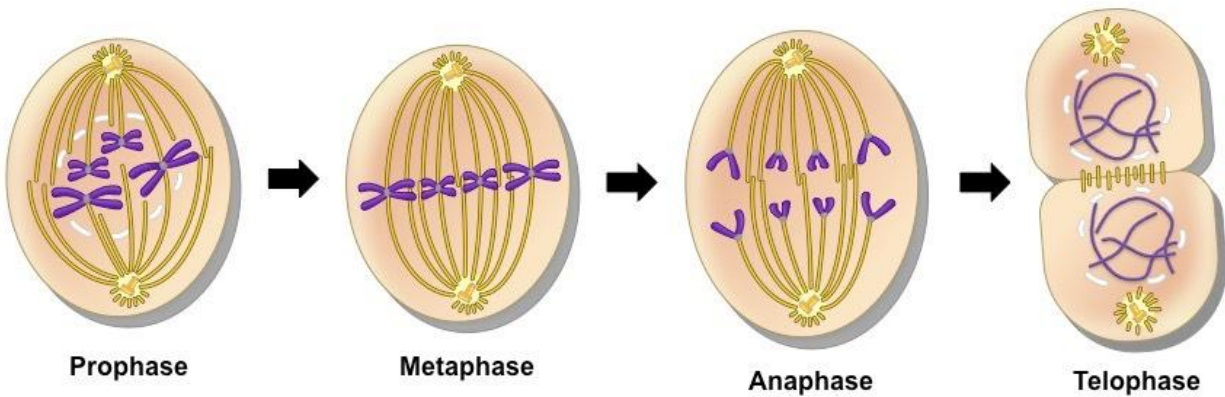
Cyclin	Description
Cyclin A	-activates DNA replication during S phase
Cyclin B	-helps to get spindles built
Cyclin D	-triggers cells to move from G1to S



Interphase:

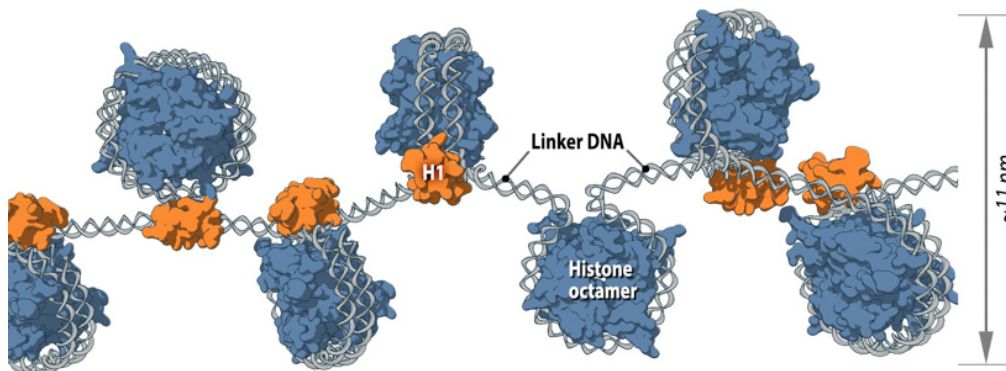
- DNA is present as uncondensed chromatin (not visible under microscope)
- DNA repair, cell is enlarged, organelles are replicated in preparation for division - G₁-phase
- DNA is duplicated - S-phase
- Centrosomes duplicate, proteins are made, and the cell continues to grow - G₂-phase
- G₀ phase - the cell is neither dividing nor preparing to divide

Stages of Mitosis



Prophase:

- DNA supercoils and chromatids condense (becoming visible under microscope)



- Sister chromatids are comprised of genetically identical chromatids (joined at a centromere)
- Paired centrosomes move to the opposite poles of the cell and form microtubule spindle fibres
- The nuclear membrane breaks down and the nucleus dissolves

Metaphase:

- Microtubule spindle fibres from both centrosomes connect to the centromere of each sister chromatid.
- Microtubule depolymerisation causes spindle fibres to shorten in length and contract
- This causes sister chromatids to align along the centre of the cell (equatorial plane or metaphase plate)

Anaphase:

- Continued contraction of the spindle fibres causes genetically identical sister chromatids to separate
- *Once the chromatids separate, they are each considered an individual chromosome in their own right*
- The genetically identical chromosomes move to the opposite poles of the cell

Telophase:

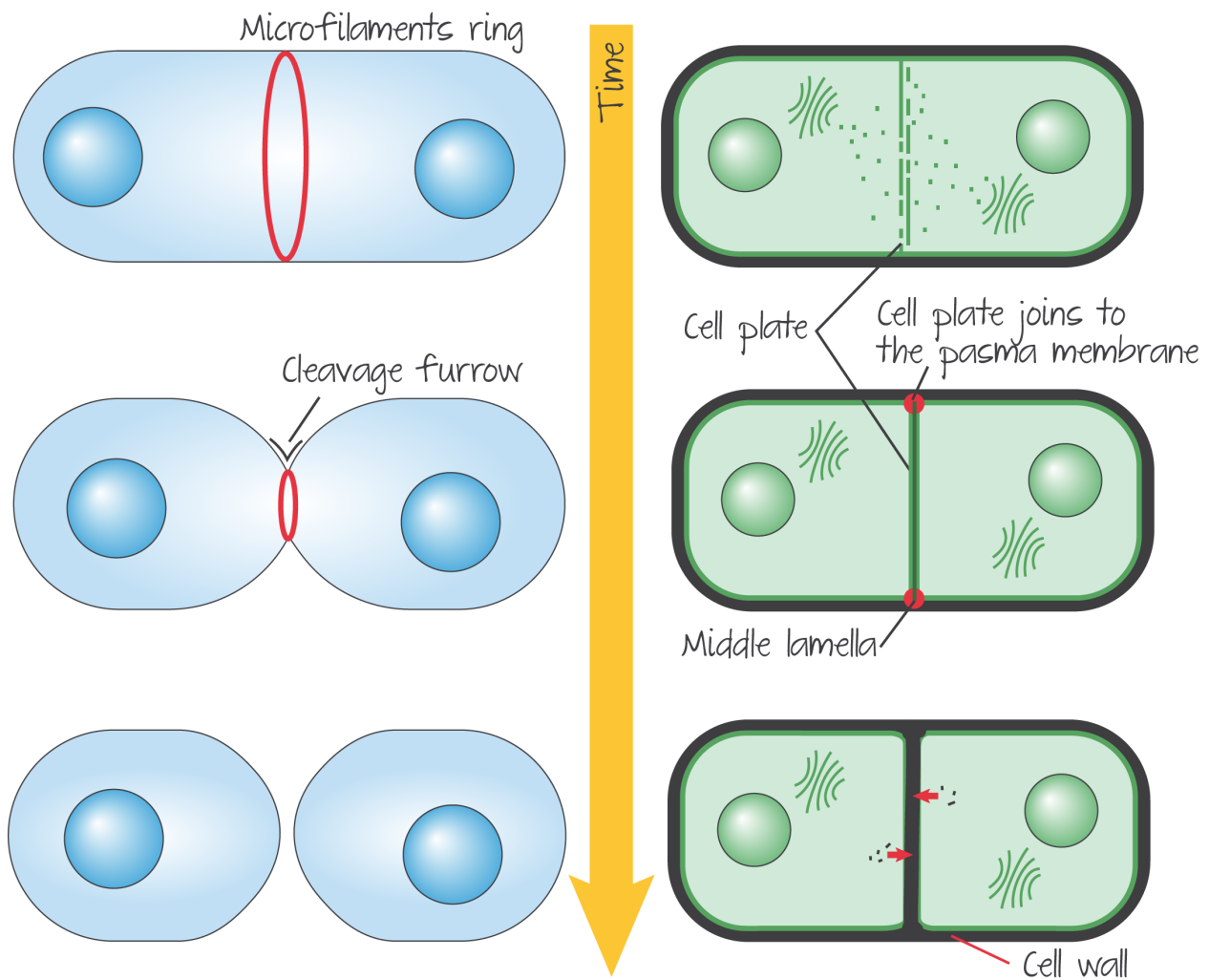
- Once the two chromosome sets arrive at the poles, spindle fibres dissolve
- Chromosomes decondense (no longer visible under light microscope)
- Nuclear membranes reform around each chromosome set
- Cytokinesis occurs concurrently, splitting the cell into two

END OF MITOSIS

Cytokinesis

- Occurs when the cell splits into two. This is different in plants and animals.

Plants	Animals
The division of cytoplasm takes place by cell plate (which is constructed out of cellulose) formation	Division of the cytoplasm takes place by cleavage
Cell plate formation starts as the center of the cell and grows toward the walls.	Cleavage starts at the periphery and moves inward and divides the cell into two parts.



Cancer

Cancer - Cancer is uncontrolled cell growth. In the cases, genes that regulate the cell cycle become mutated and do not work properly.

Mutagens - can change the structure of DNA and lead to cancer.

Oncogenes - a gene that has the potential to cause cancer (eg. p53) if it becomes mutated.

Two basic classes:

Proto-oncogenes code for proteins that stimulate the cell cycle and promote cell growth and proliferation.

Tumour suppressor genes code for proteins that repress cell cycle progression and promote apoptosis

Primary tumor - cancer in one location

Secondary tumor - cancer that spreads (via Metastasis) to another location.

