



Mitosis and Asexual Reproduction

Looking into the Cell Cycle

Bellwork Question

What are the two reasons cells undergo mitosis? What type of cells undergo mitosis? (prokaryotes/eukaryotes)



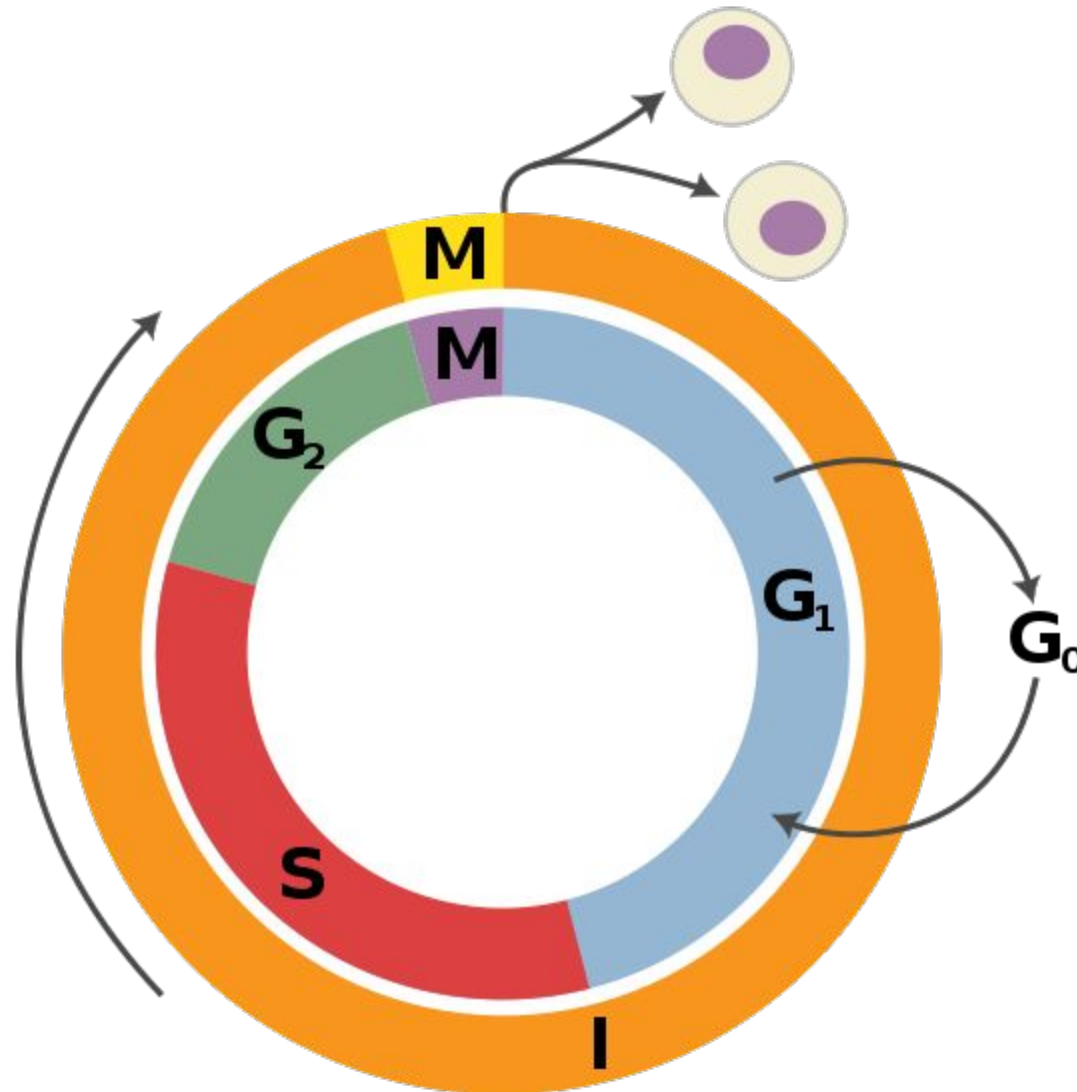
The Cell Cycle and Mitosis

- Due to the loss and death of cells → must replace them.
- How many cells in your body?
 - 50-100 million trillion
 - Every minute your body produces about 300 million new cells

Three stages in the cell cycle:

- 1. Interphase:** cell carries out normal functions.
- 2. Mitosis:** nucleus contents duplicated and divided into two equal parts.
- 3. Cytokinesis:** separation of two nuclei and cell contents into two daughter cells.

Parts of the Cell Cycle

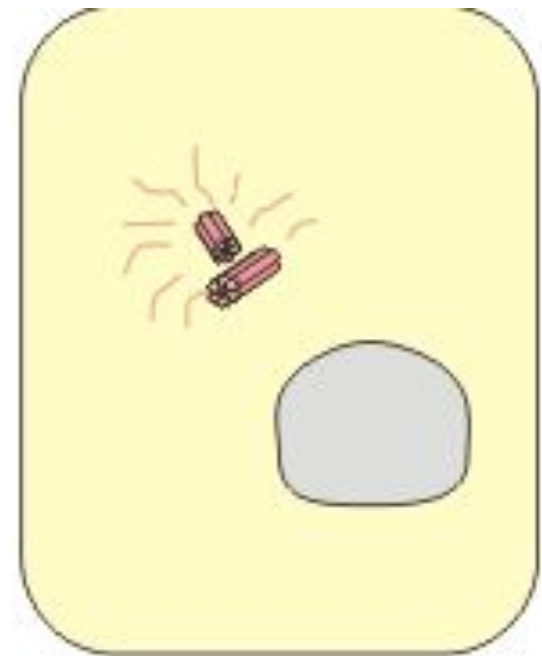


Interphase

- Interphase - the **longest** cell cycle stage (lasts 15 hrs. – months).
 - cell performs normal functions and grows.
- During Interphase, the cell will grow (G_1 phase) to prepare for cell division. The cell will then duplicate its DNA (S phase) and enter the second Gap (G_2 phase) prior to beginning Mitosis.

Late Interphase cont'd.

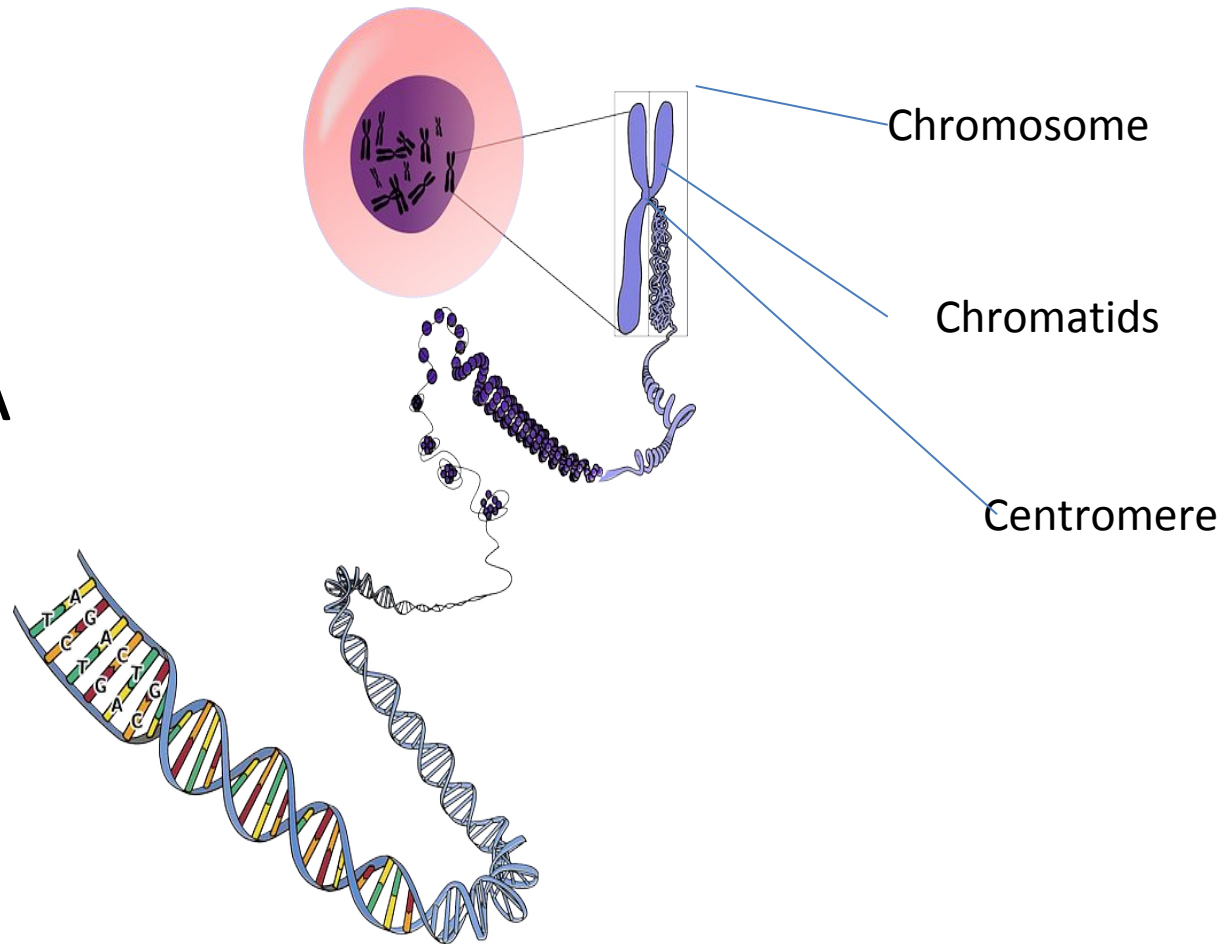
- **Chromatin** is in its **loosely coiled** form so that DNA can be copied into RNA for proteins to be made in preparation for cell division.
- At the end of interphase, the **cell continues to grow and make proteins** in preparation for mitosis and cytokinesis.
- Reminder, most (~95%) of the time the cell is in interphase (doing its job, growing, surviving, etc.)



Interphase

Chromosomes

- As the nucleus prepares to divide, replicated DNA in interphase joins to form **sister chromatids**, joined by a **centromere**.

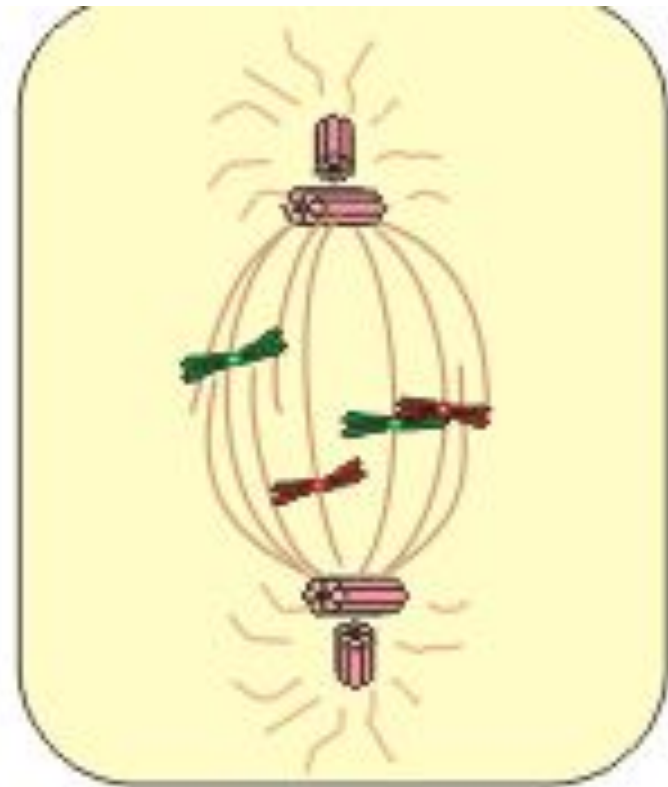


Mitosis Overview:

- Mitosis is the shortest stage of the cell cycle where the nuclear contents divide, and two daughter nuclei are formed.
- It occurs in 4 stages:
 1. Prophase
 2. Metaphase
 3. Anaphase
 4. Telophase
- Helpful saying to remember the order:
 - *“I plucked my apple today.”*

Mitosis - Prophase

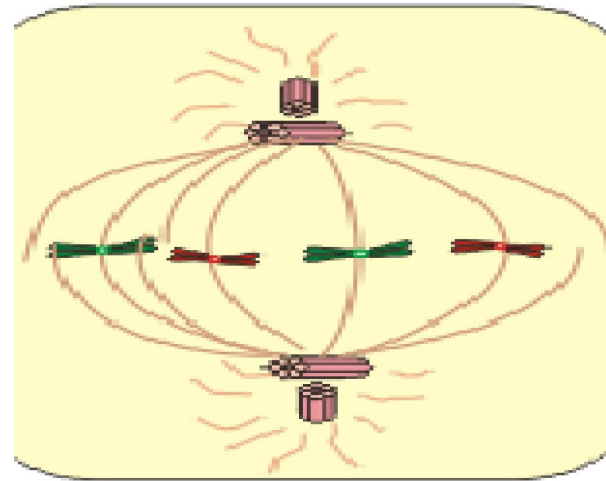
- **Chromosomes** start to coil and become visible.
- Pairs of **centrioles** start to separate.
- The **nuclear membrane disappears**.
- **Spindle fibers** start to form between the centriole pairs.
- Chromosomes move more evenly throughout the nucleus.



Late prophase

Mitosis - Metaphase

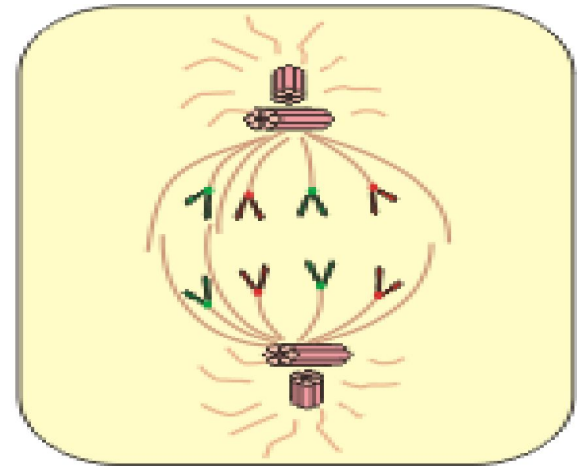
- Centriole pairs move to opposite ends of the cell.
- Spindle fibers are still attached to the centriole pairs.
- **Chromosomes line up along the midline** of the cell and are attached to the spindle fibers.



Metaphase

Mitosis - Anaphase

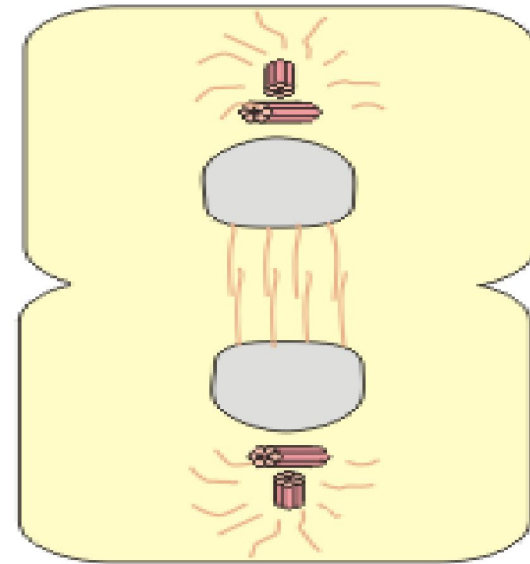
- The pair of **chromatids split** at the centromere and move to opposite ends of the spindle.
- Now there are twice the number of chromosomes within the cell membrane.
- Movement of the chromosomes towards the opposite ends of the cell membrane is aided by the spindle fibers.



Anaphase

Mitosis - Telophase

- Nuclear membranes form around the two new sets of chromosomes.
- The spindle fiber disappears.
- Chromosomes start to uncoil (chromatin) and become less visible.
- Cell starts to make a groove (furrow) in the middle to eventually split into two identical cells.



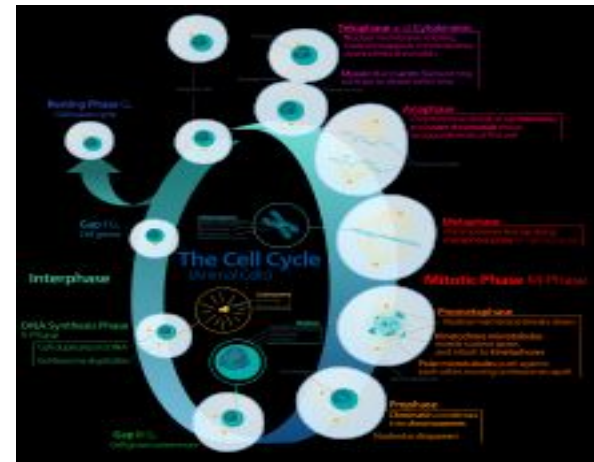
Telophase

Cytokinesis

- The division of material **outside** of the nucleus.
 - Occurs after telophase.
- Divides the organelles and other substances in the cytoplasm into roughly two equal halves.
- **Animal cells furrow while plant cells form a cell plate**
- **# chromosomes in daughter cell = the # chromosomes in parent cell.**
- **Daughter cells are genetically identical to parent.**

Cell Cycle Problems

- Checkpoints in the cell cycle will prevent cell division if:
 - If the cell is short of nutrients
 - If the DNA within the nucleus has not been replicated
 - If the DNA is damaged



Stop! Some of the chromosomes have not attached themselves to spindle fibres in metaphase. Stop! Some of the chromosomes have not moved to the poles in anaphase. The cell must be repaired or destroyed.

Stop! The cell lacks nutrients to support its growth. Stop! The DNA is damaged. The cell must be destroyed!

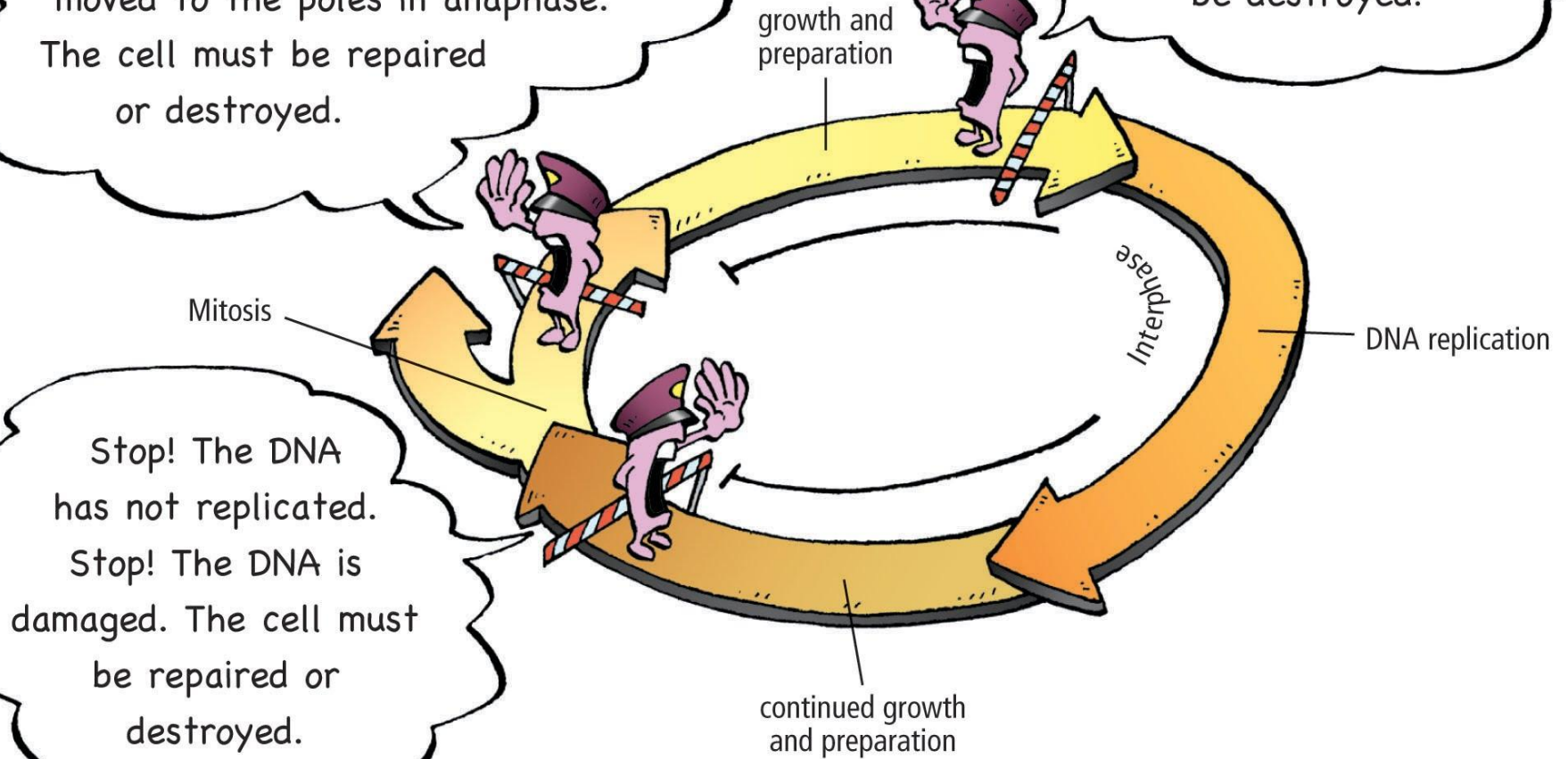


Figure 5.11 Checkpoints in the cell cycle

Cell Cycle Problems

- Mutations in genes involving checkpoints can result in an out-of-control cell cycle. The result can be uncontrolled cell division: **cancer**
 - Cancer cells have large, abnormal nuclei.
 - Cancer cells are not specialized, so they serve no function.
 - Cancer cells attract blood vessels and grow into tumors.
 - Cells from tumors can break away to other areas of the body.