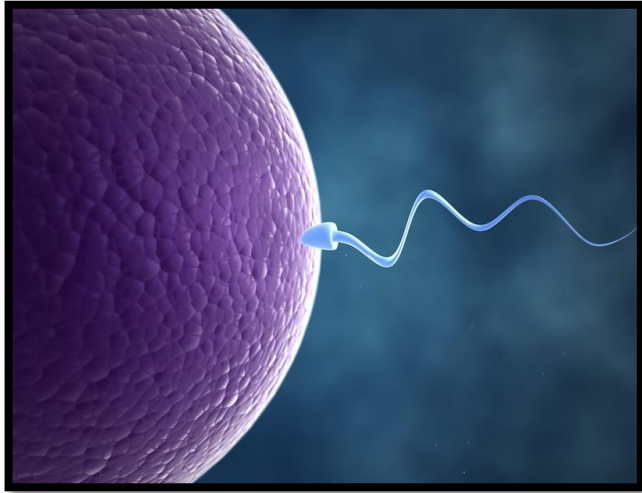


Unit 2: Cells



The Cell Cycle

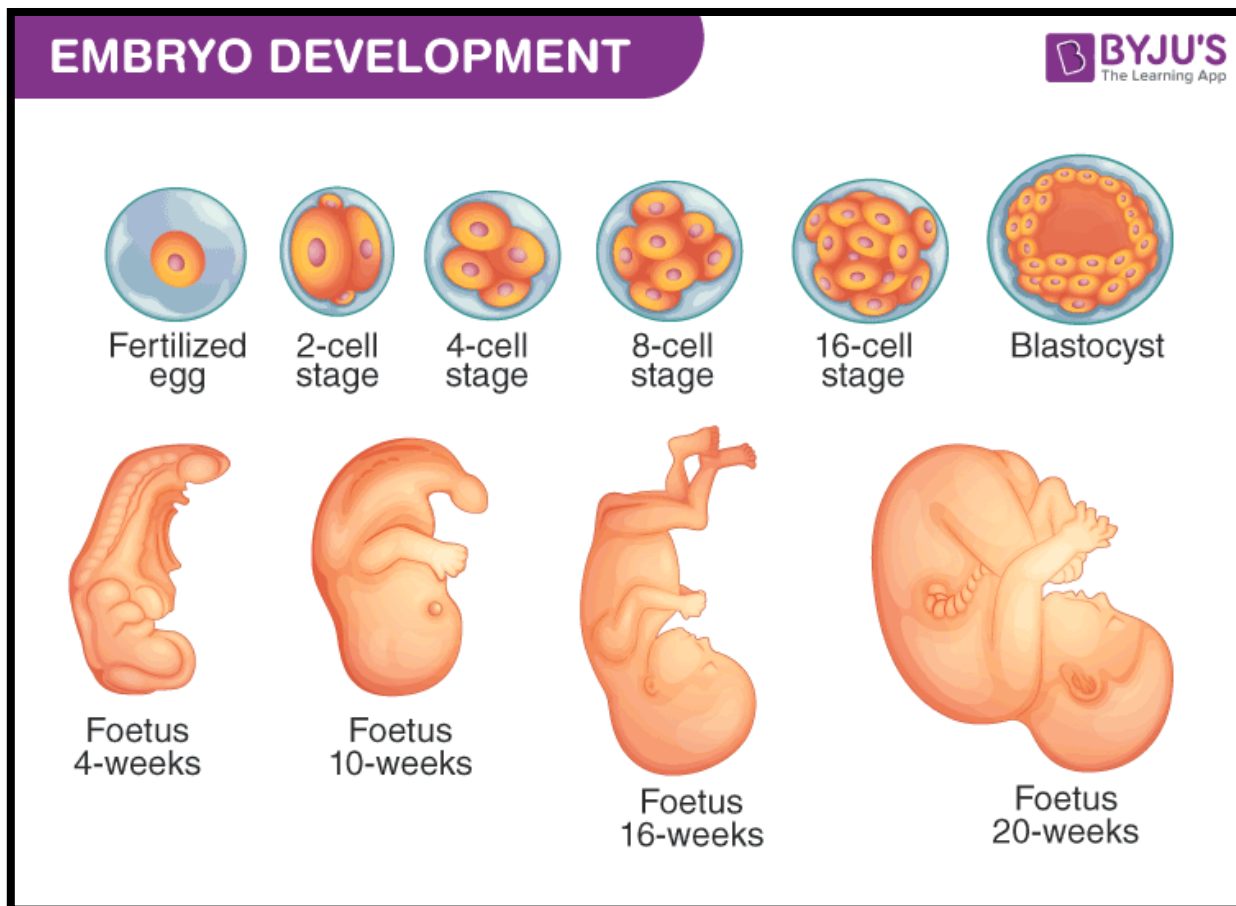
How does it happen?



The answer: Cell Division

How does it happen?

Once a female egg is fertilized, cell division (through mitosis) creates many identical cells. The cells continue to divide, creating a blastocyst of cells. At this point, a key process (known as differentiation) takes place and the cells begin to become “specialized.”

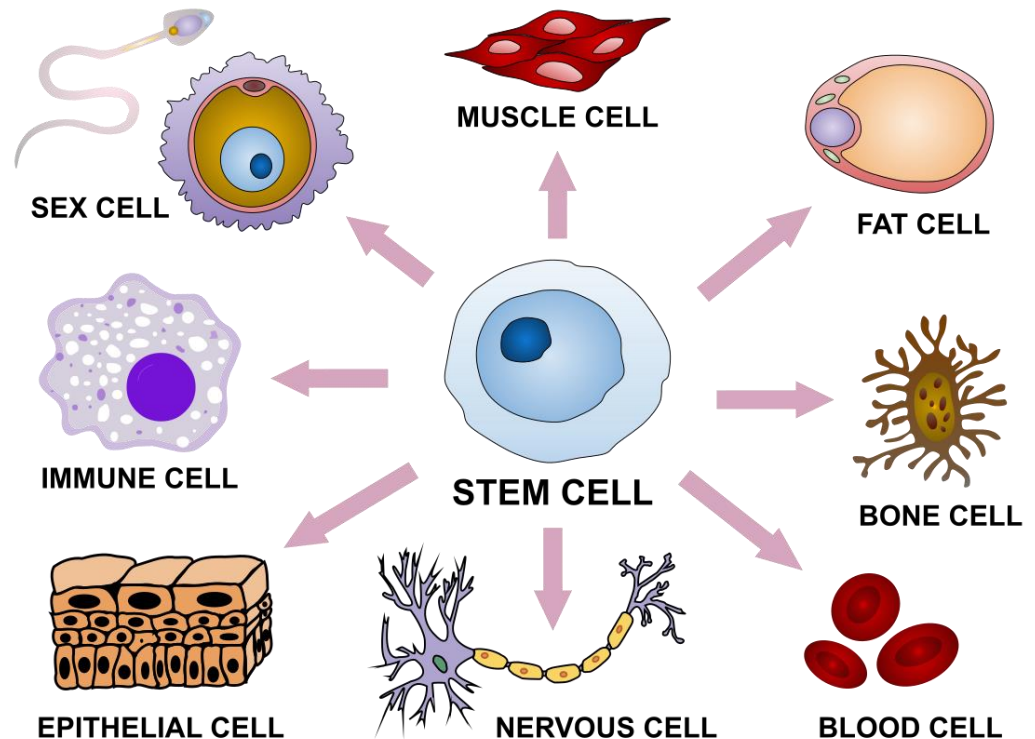


Cell Differentiation

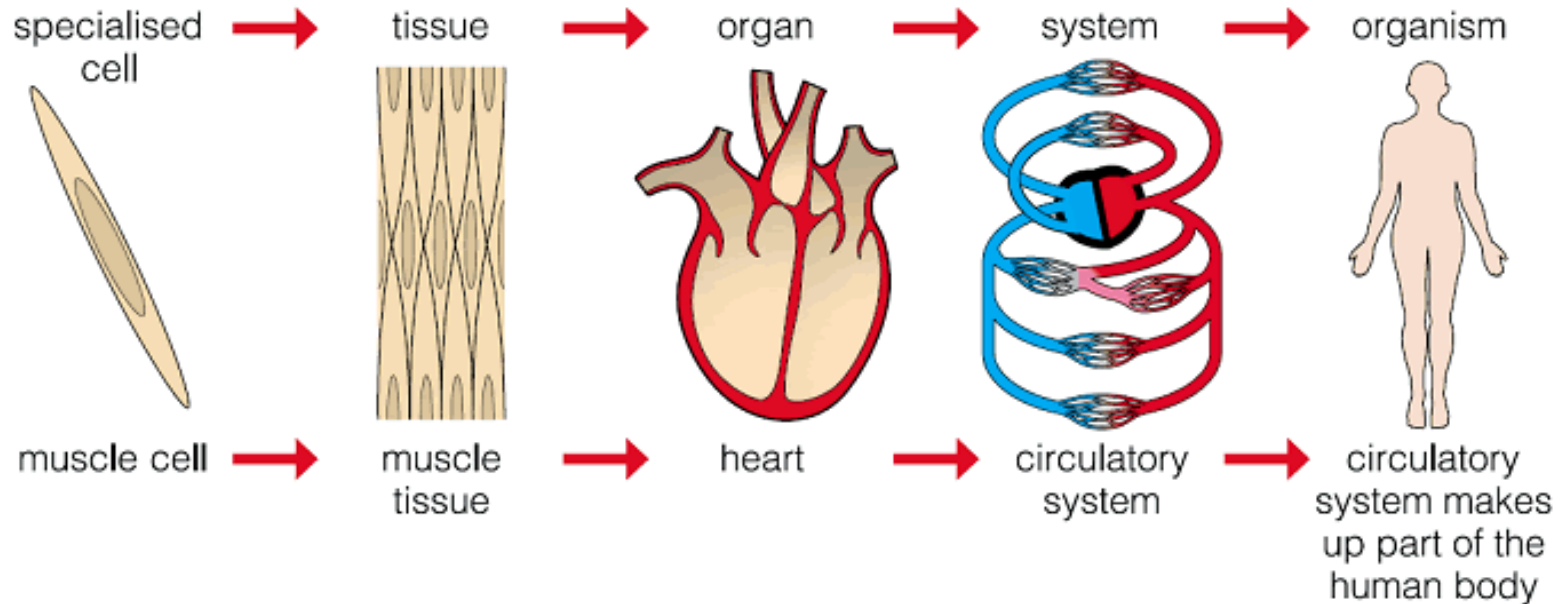
- During development, the cells of multicellular organisms lack specialized functions- stem cells

- These cells differentiate- develop into cells with a specialized function.
Ex. Muscle cell

We will soon be talking more about the potential of stem cells.



Cell Differentiation



A Cell's Life Span

- After cells differentiate, they have unique life spans.
- For example:
 - Skin cells: 2 weeks
 - Red blood cells: 4 months
 - Liver cells: 300-500 days
 - Neurons: often do not divide
- The shorter the lifespan of the cell, the more frequently it must be replaced by cell division.

Why do cells divide?

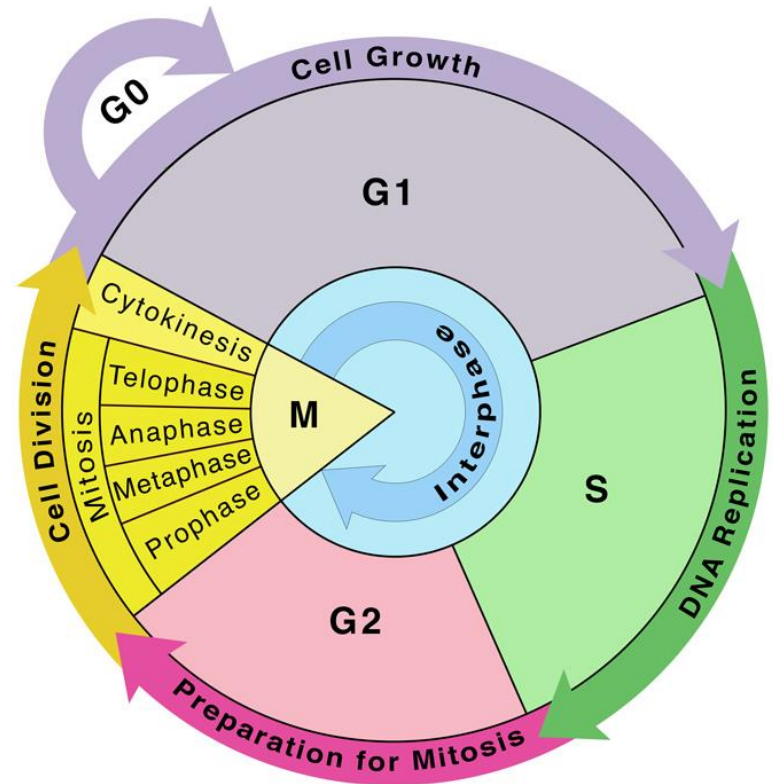
- Cells divide for different reasons:
 - In multicellular organisms
 - **Growth**
 - **Repair**
 - In unicellular organisms
 - **Asexual Reproduction**
 - Asexual reproduction of bacteria- binary fission

happens before
& after
differentiation



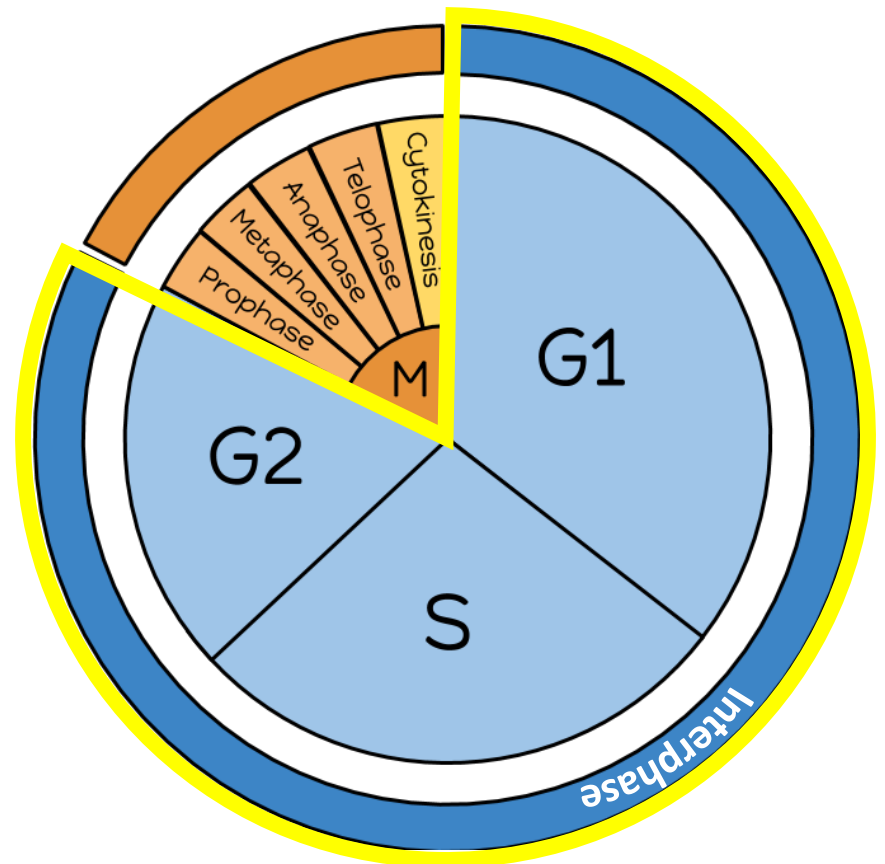
The Cell Cycle

- **Cell cycle**: a repeated pattern of growth, DNA duplication, and cell division that occurs in eukaryotic cells (plants, animals, fungi, and protists)
- 3 phases
 - Interphase- (cell growth)
 - Mitosis- (cell division)
 - Cytokinesis- (cytoplasm separation)

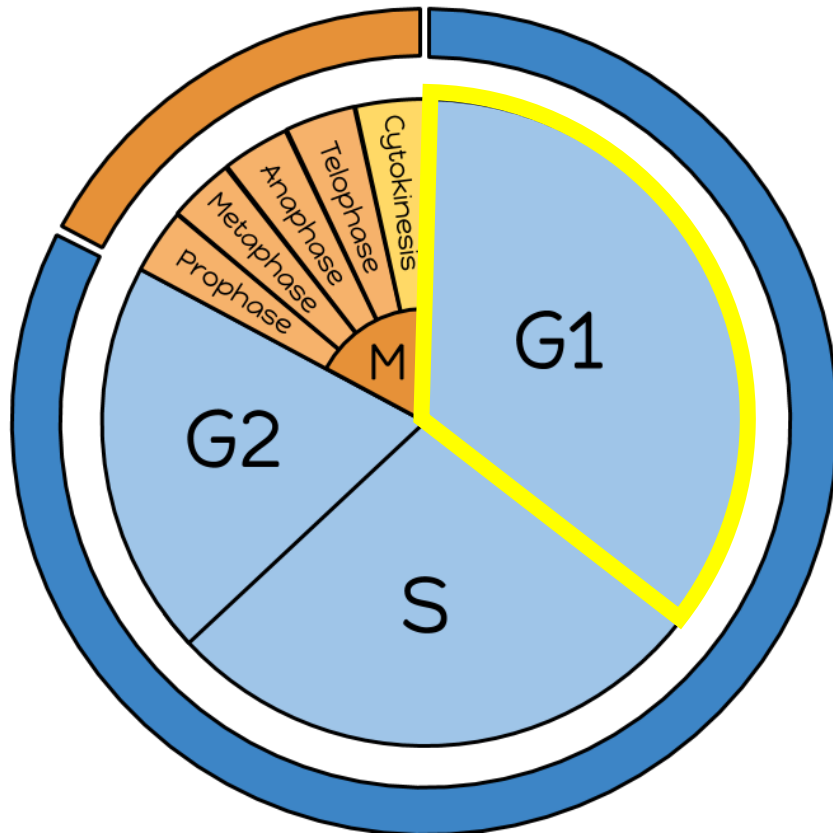


Interphase

- The growth phase
- 90% of a cell's life is spent in interphase
- 3 stages within interphase:
 - G1 (Gap 1)
 - S (Synthesis)
 - G2 (Gap 2)



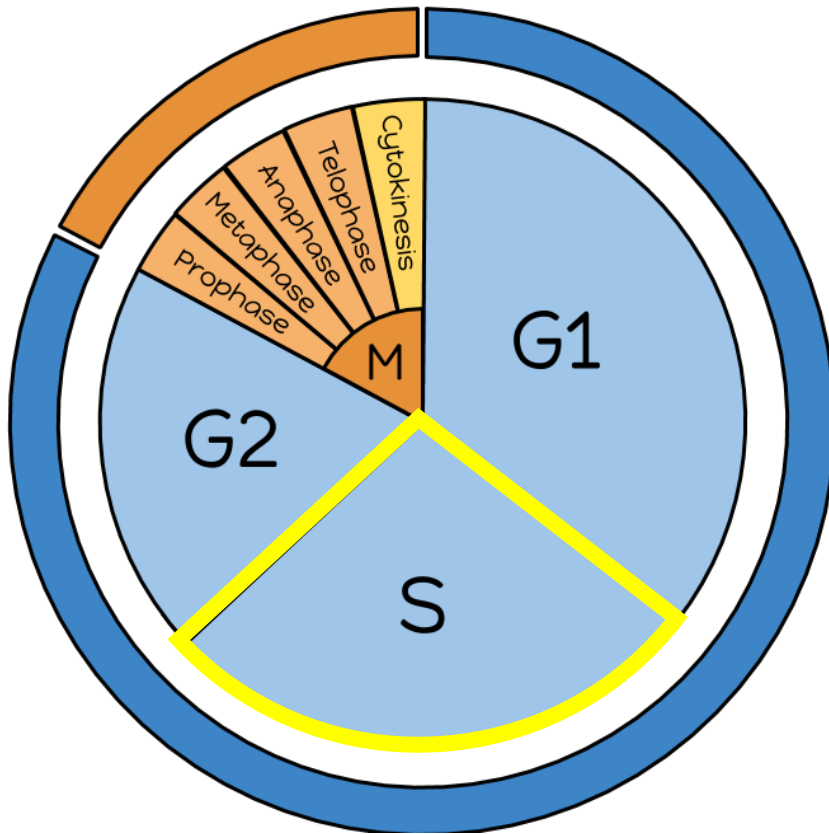
Gap 1 Phase



1st part of interphase

- Cells
 - Carry out functions
 - Grows & makes proteins

Synthesis Phase



2nd part of interphase

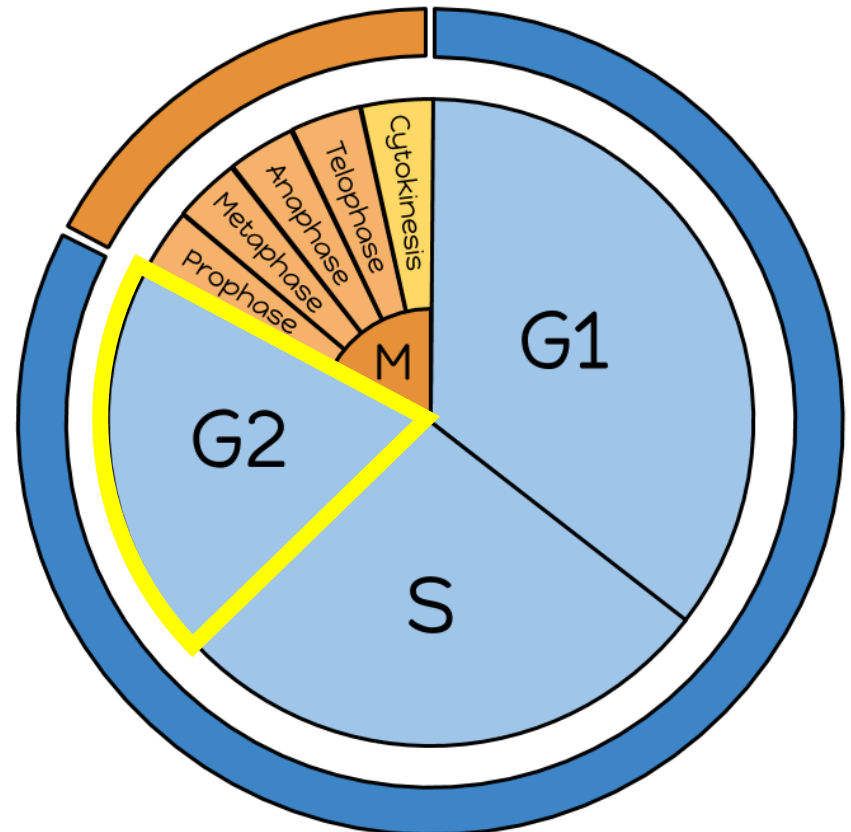
- Cells
 - Undergo DNA replication (make a copy of DNA)

Doubles the number of chromosomes

Gap 2 Phase

3rd Part of Interphase

- Cells
 - More growth
 - Protein synthesis
 - Prepare for division (enough organelles)



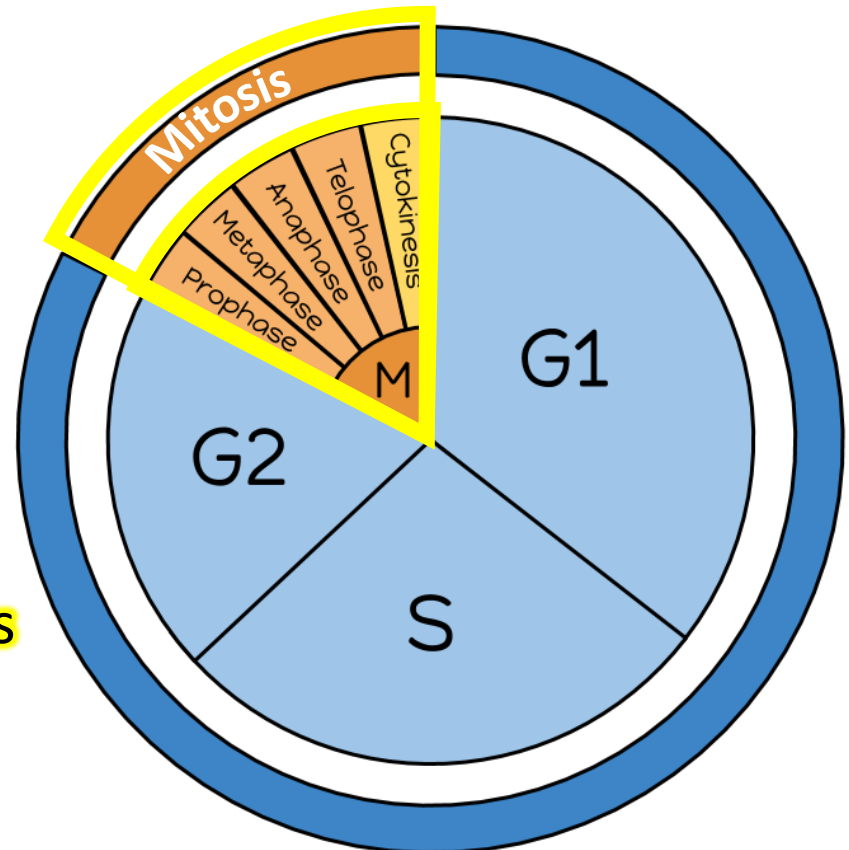
***At the end of interphase, the cell has 2 full sets of chromosomes.

Mitotic Phase- Division

Mitosis & Cytokinesis

- Cells
 - Divide nucleus (mitosis)
 - Divide cytoplasm (cytokinesis)

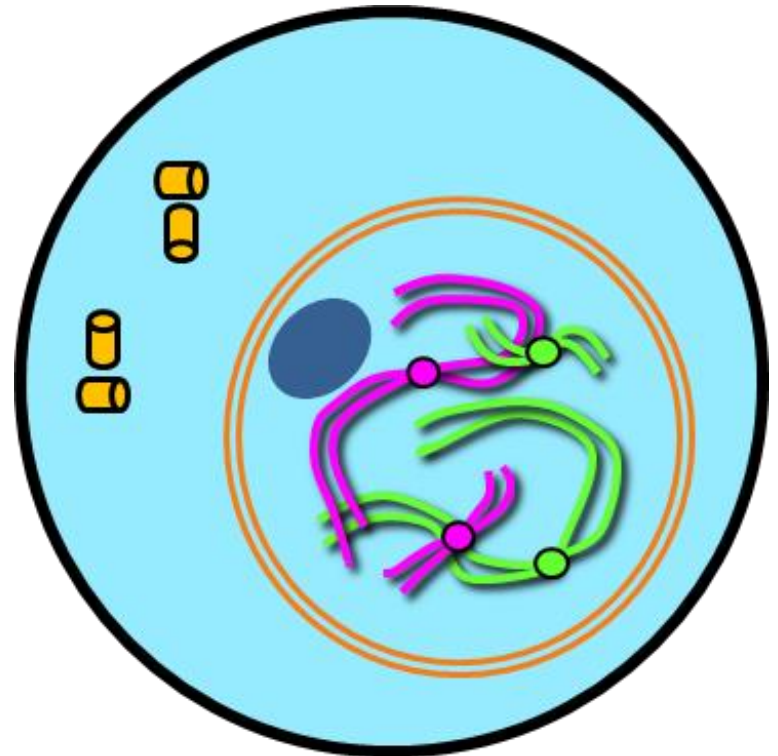
Result= 2 identical daughter cells



We will go into more detail about the stages of mitosis.

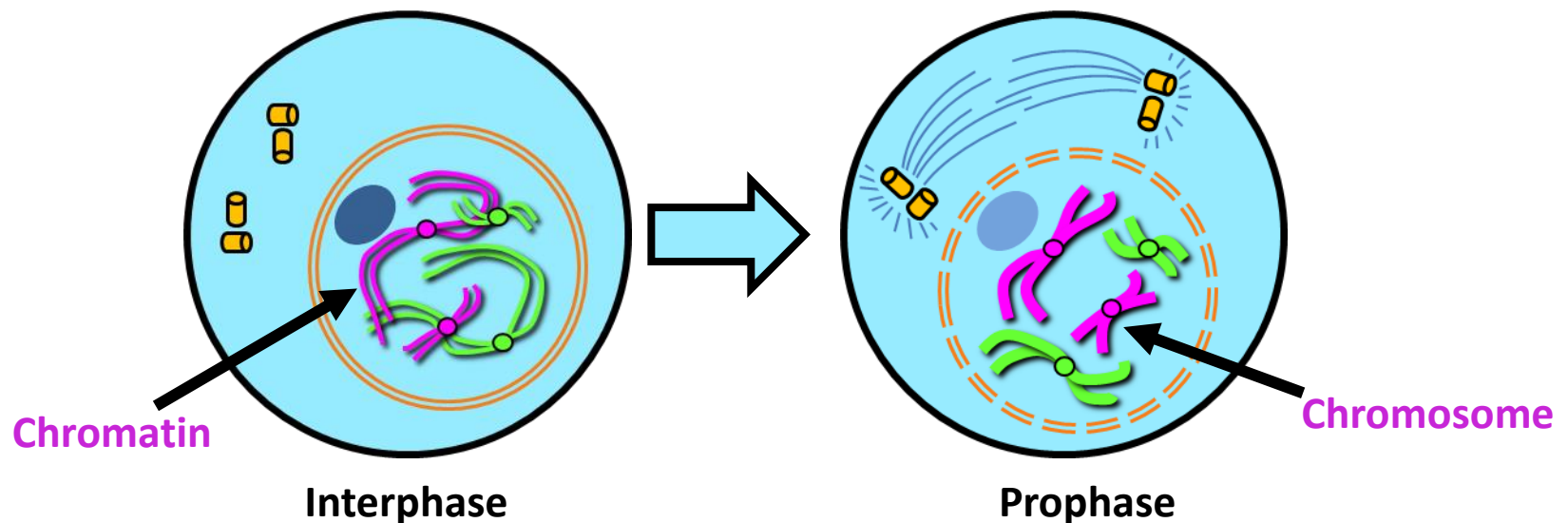
Important Vocab

- During interphase, DNA is in a loose form called **chromatin**
- **Chromatin**- a loose form of DNA
 - Also with some proteins

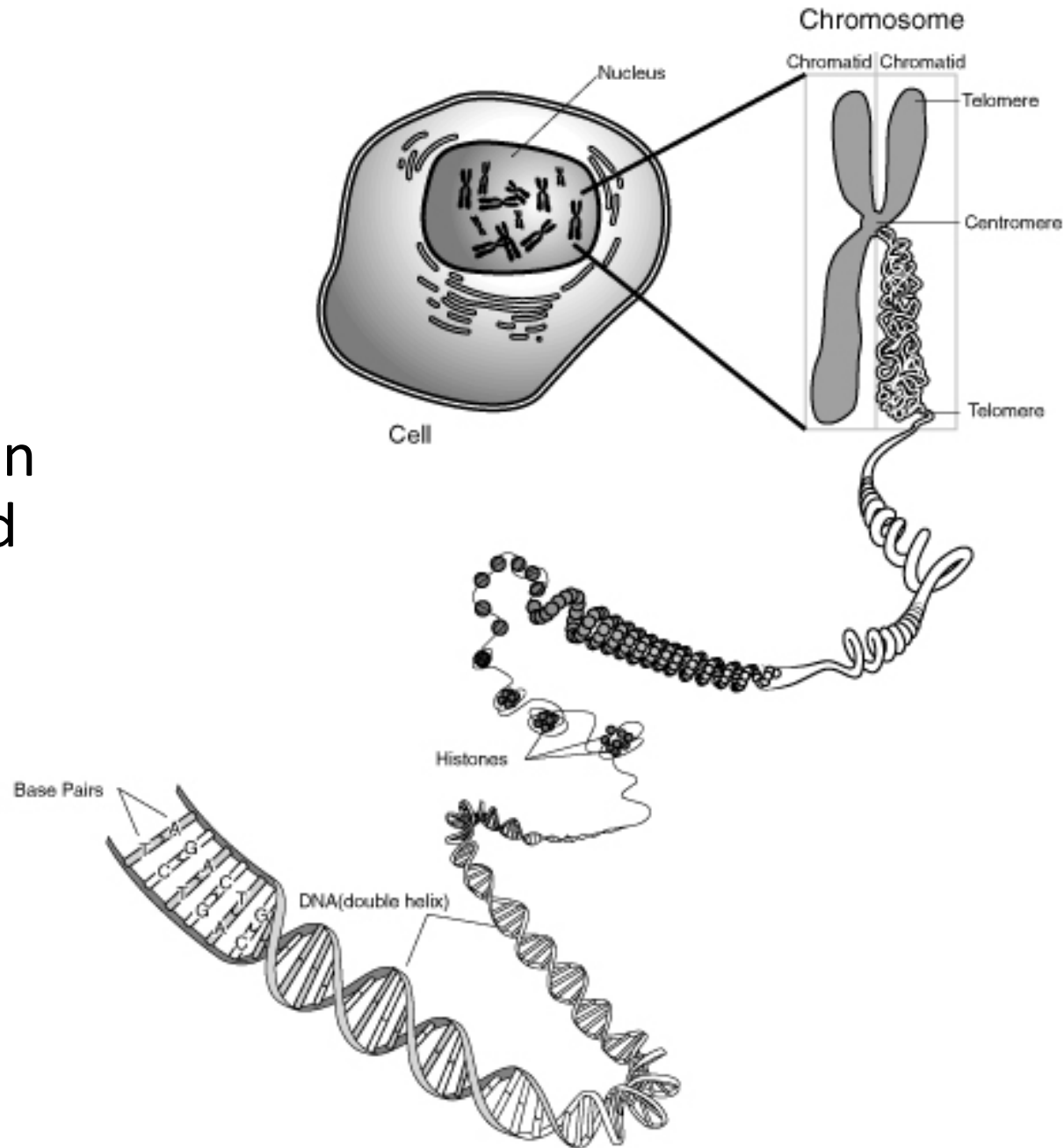


Important Vocab

- During prophase, the DNA condenses from chromatin into chromosomes.
- **Chromosome**- a highly condensed (packed) form of DNA
 - The DNA is wrapped up with special proteins
 - Easier to move DNA as chromosomes to avoid damage



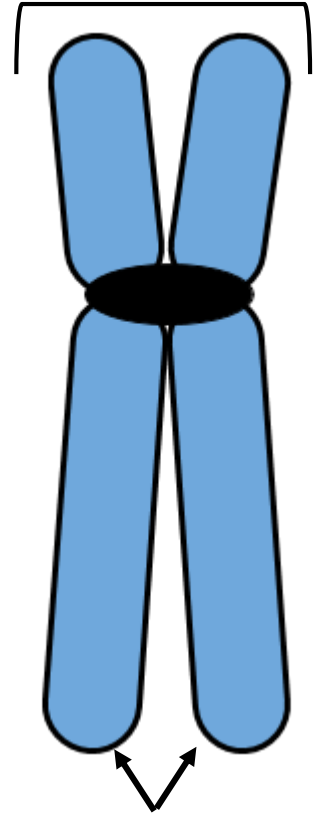
Relationship between DNA, chromatin and chromosomes



Important Vocab

- **Duplicated chromosome-** a chromosome that consists of two sister chromatids
 - DNA was duplicated during S phase of interphase
 - The two chromatids contain the same genetic information
- **Sister chromatids-** two halves of a chromosome that have the same genetic information
 - Become chromosomes when they separate

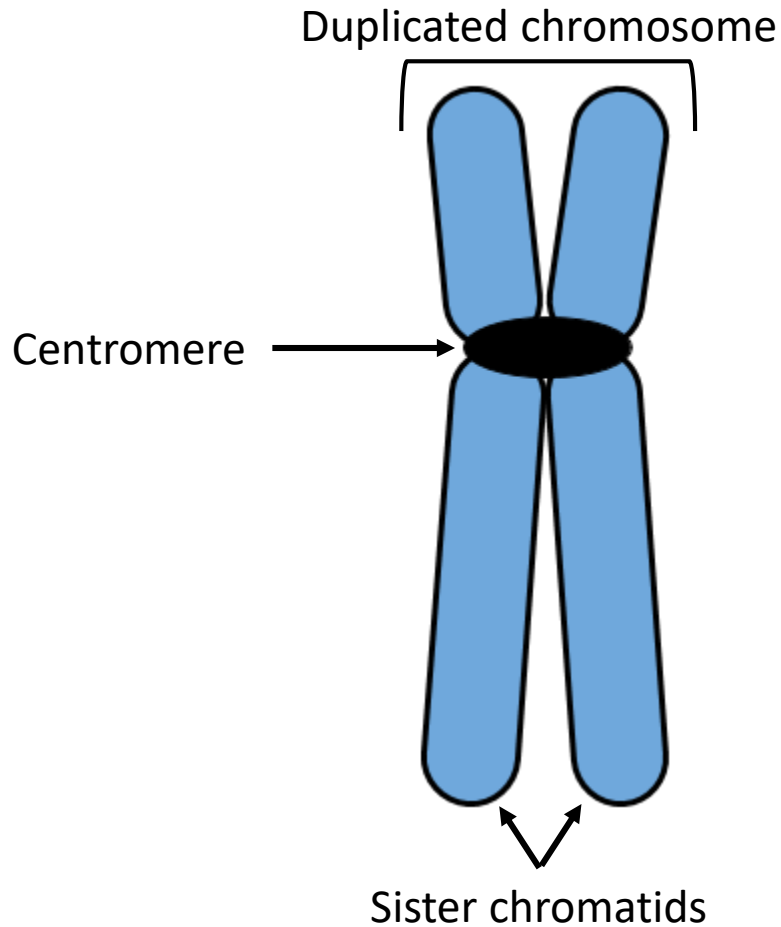
Duplicated chromosome



Sister chromatids

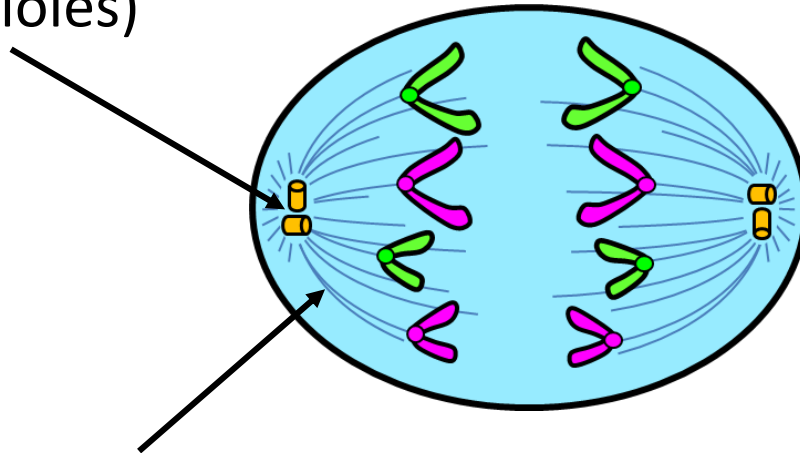
Important Vocab

- **Centromere**- connects two sister chromatids



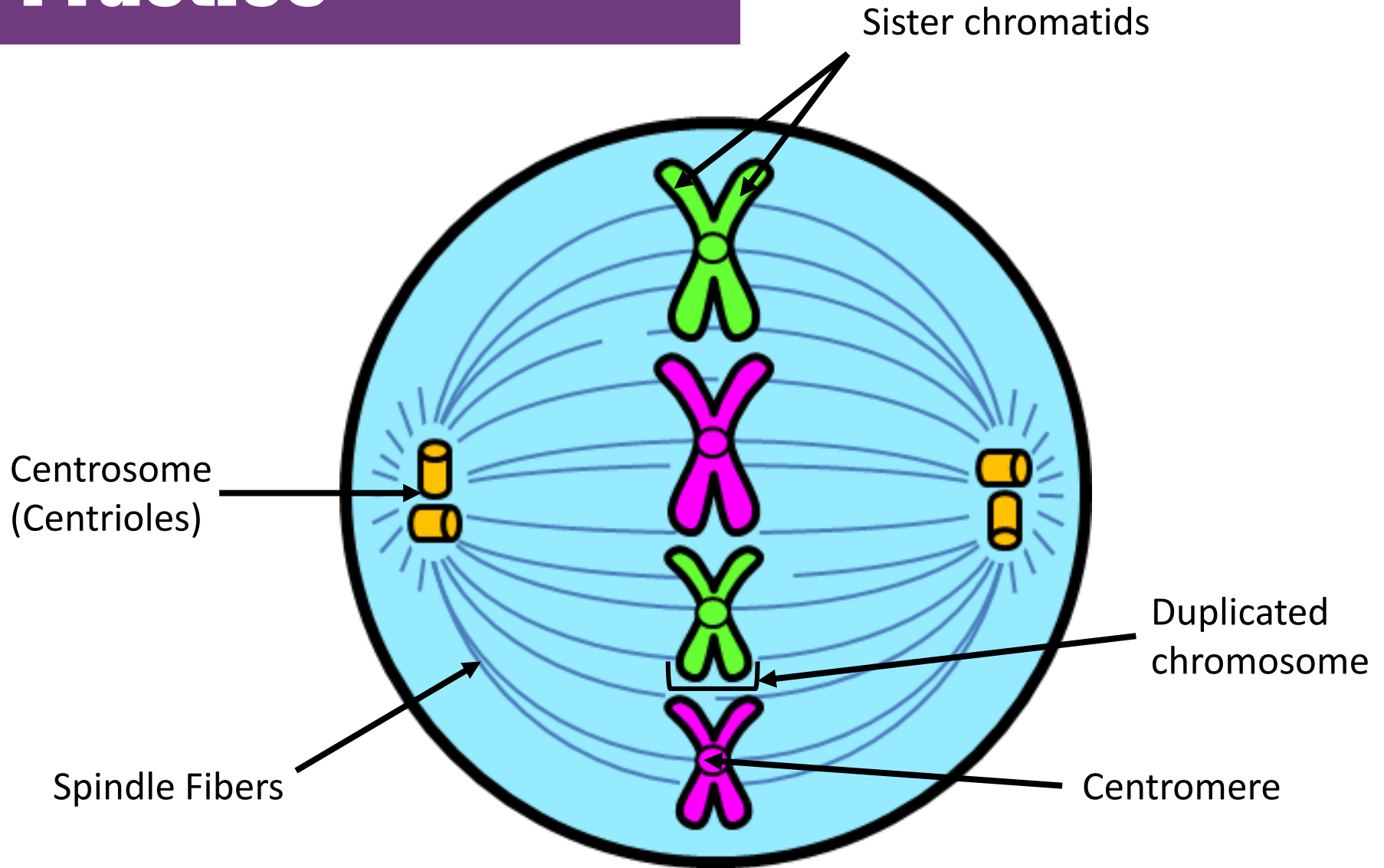
Important Vocab

- **Centrosome**- organelles that make structural proteins (microtubules) such as spindle fibers
 - Made of two **centrioles** (may see centrosome or centrioles)



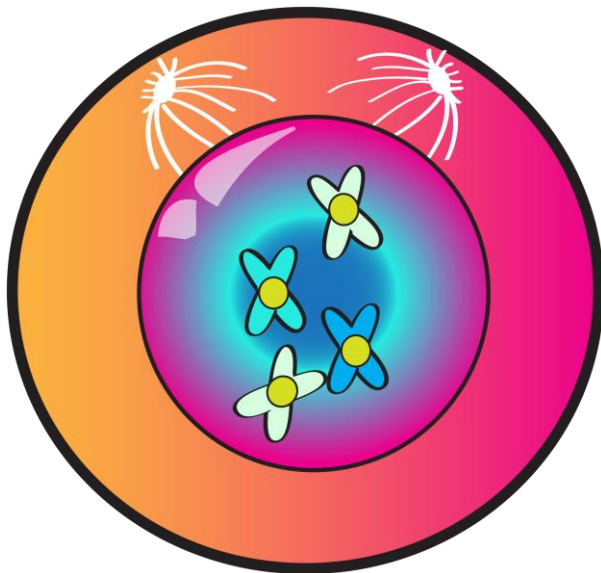
- **Spindle fibers**- special proteins that move chromosomes during mitosis

Practice

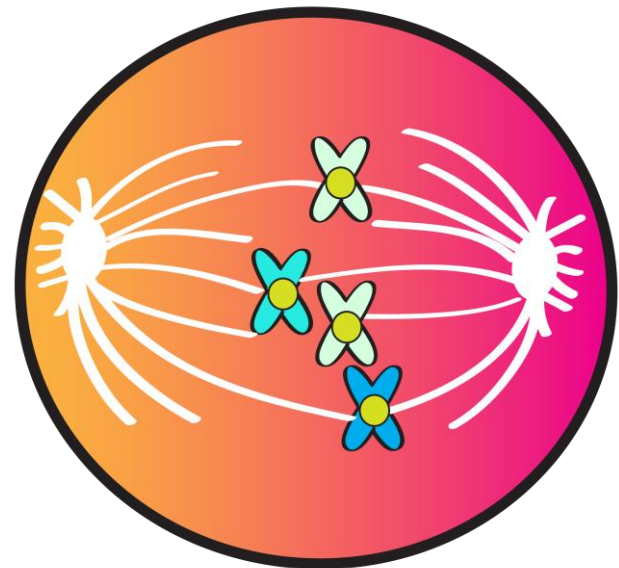


Prophase

- The membrane around the nucleus disintegrates.
- The chromosomes condense and become sister chromatids.
- The centrosomes migrate to opposite poles of the cell.
- Spindle fibers emerge from the centrosomes.



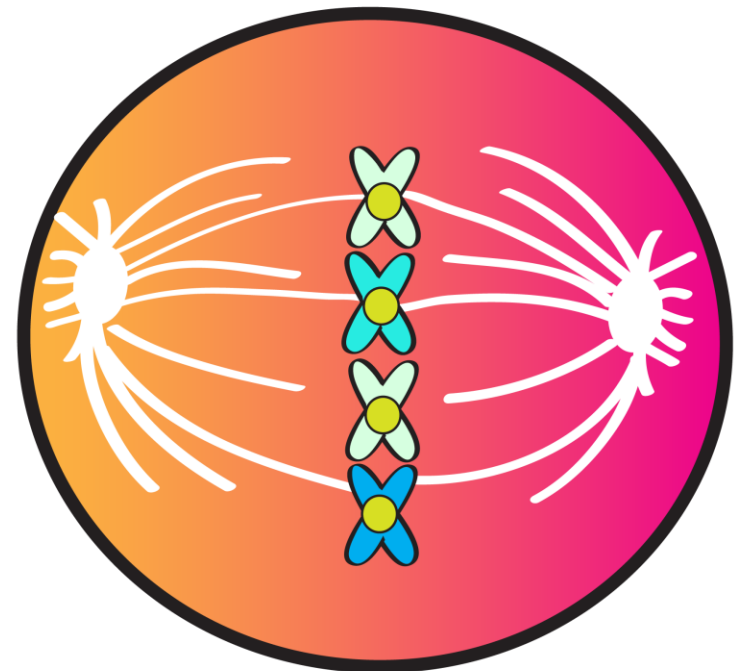
Beginning of prophase



End of prophase

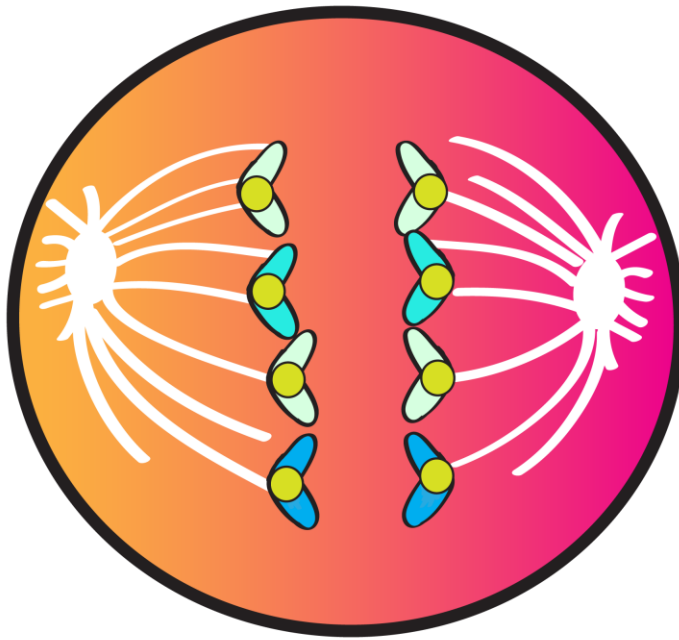
Metaphase

- Sister chromatids move toward the middle of the cell on a line called the *metaphase plate*.
- Centrosomes send out thread-like projections called spindle fibers that attach to the centromere of each sister chromatid.

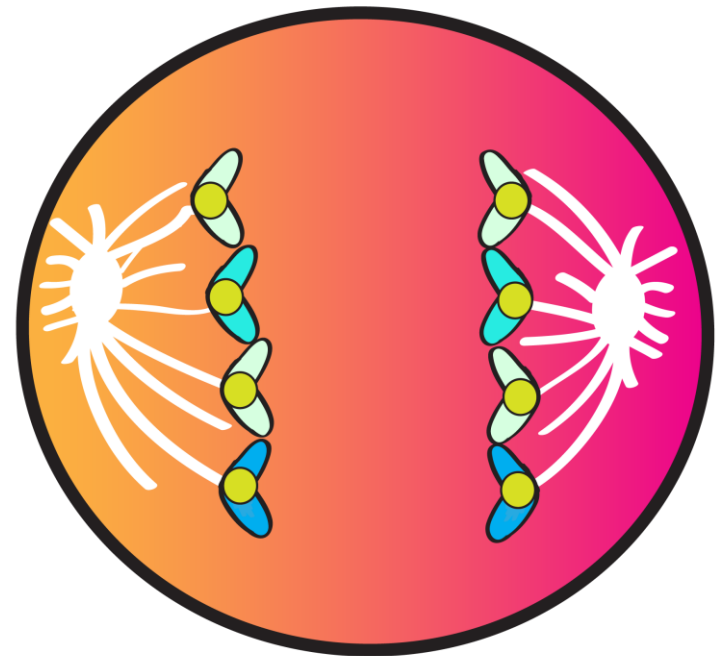


Anaphase

- Centrosomes start pulling on the spindle fibers to pull the sister chromatids apart (at this point, they are now called chromosomes).



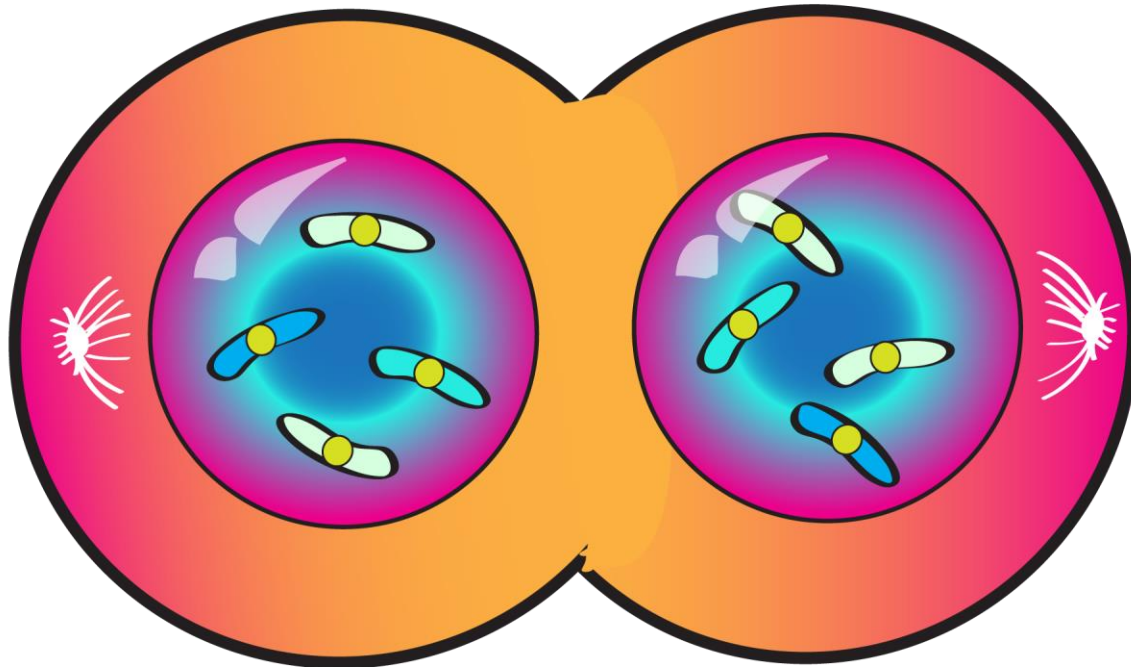
Early anaphase



Late anaphase

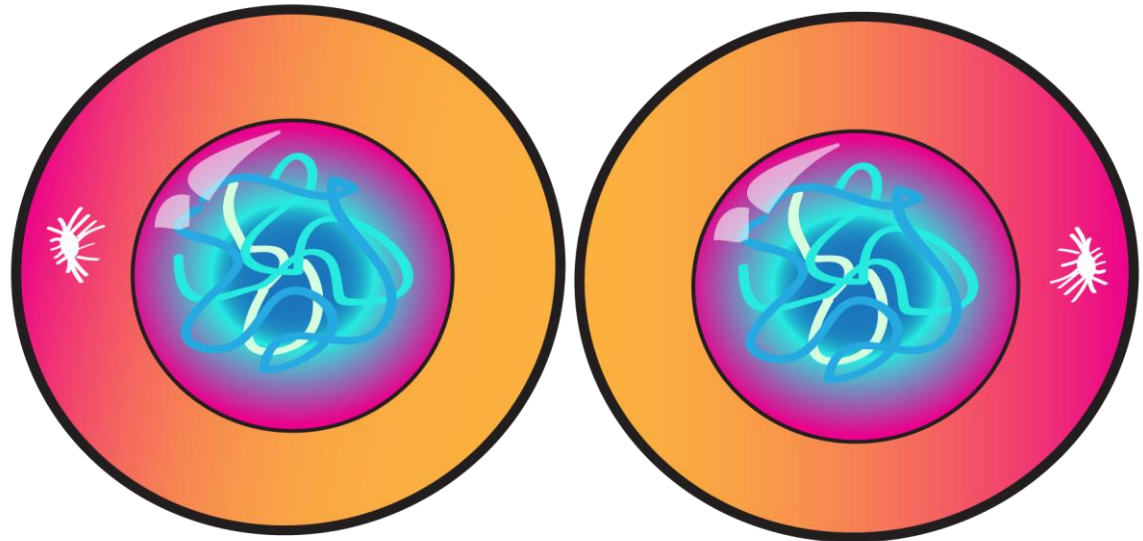
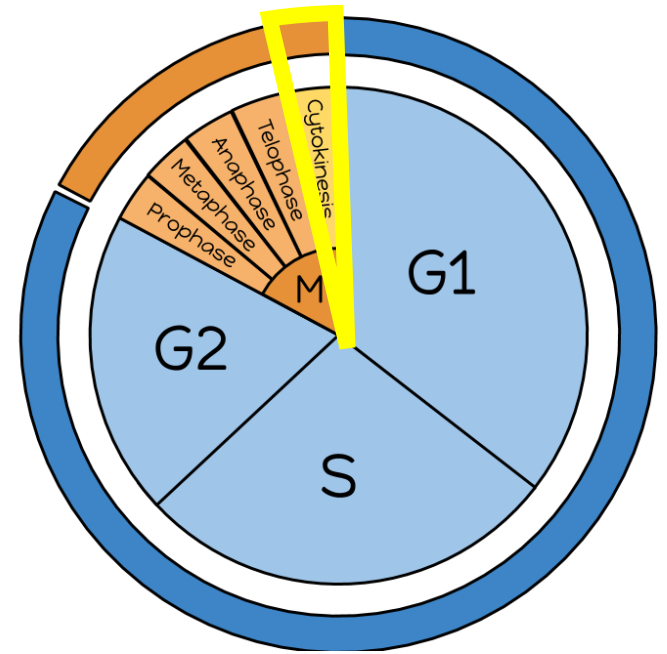
Telophase

- The nuclear membrane forms around each new set of chromosomes.

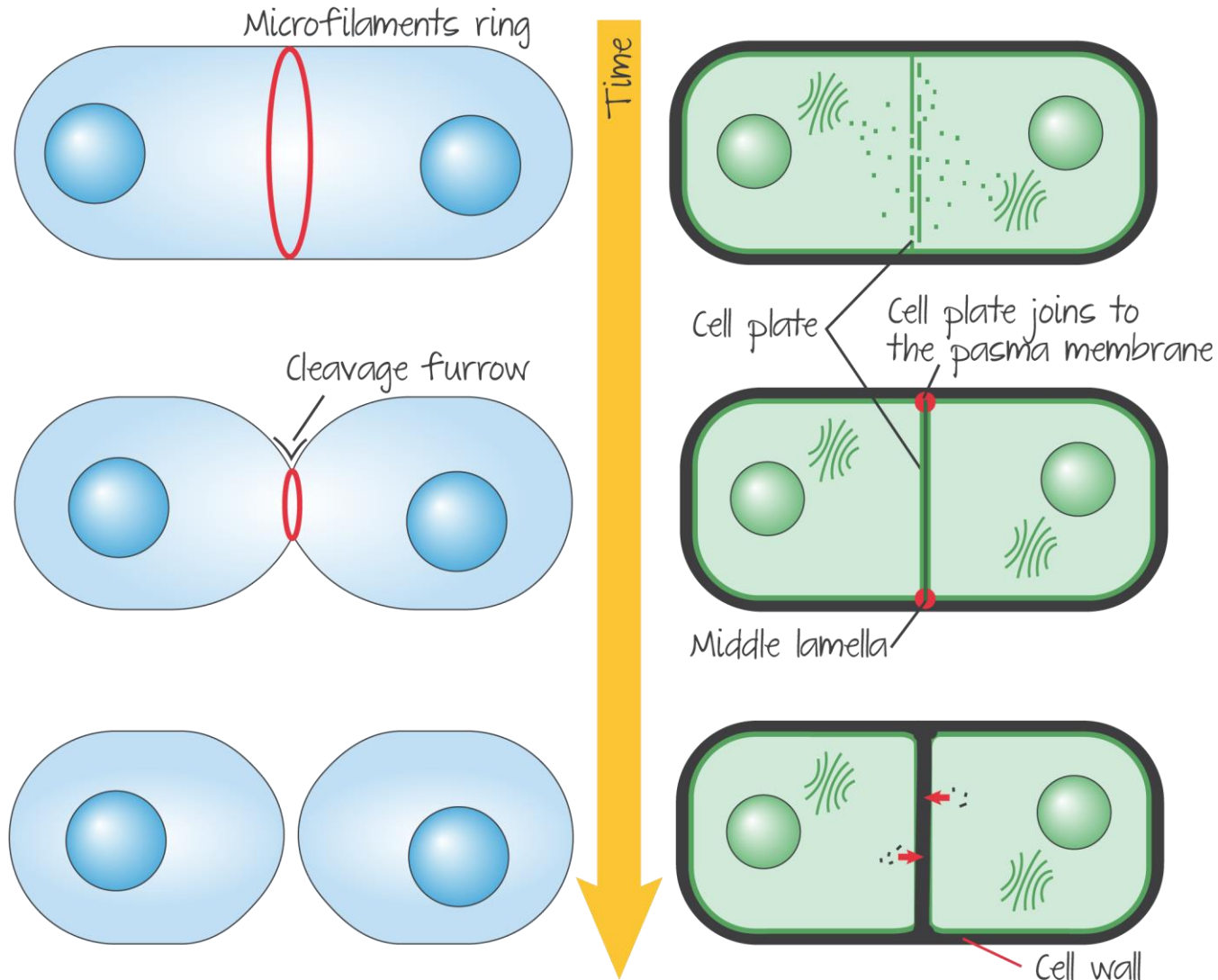


Cytokinesis

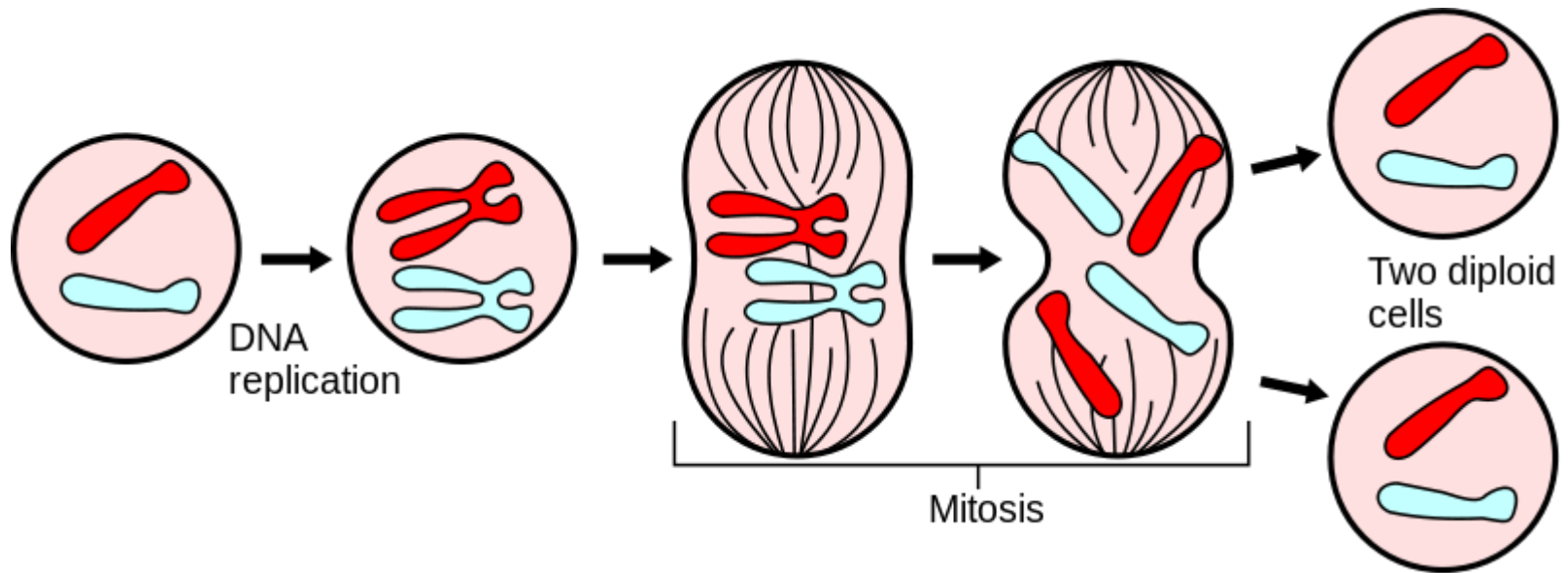
- The cell membrane pinches in until the two daughter cells separate.
- At this point, both daughter cells can enter the cell cycle once more.



Cytokinesis (Plant Cells vs. Animal Cells)



End result?



2 IDENTICAL DAUGHTER CELLS

Meet Stella



Stella the starfish has an amazing adaptation! When threatened by a predator, Stella can detach her arms!

But wait.....

What will happen to Stella's remaining limb?

Take a minute to research "starfish limb regeneration" to find out what will happen to Stella.

Video about limb regeneration: <https://youtu.be/byLDgtSMI0w>