



WHO AM I?

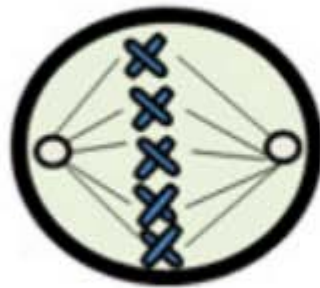
The story of you!

# MITOSIS!

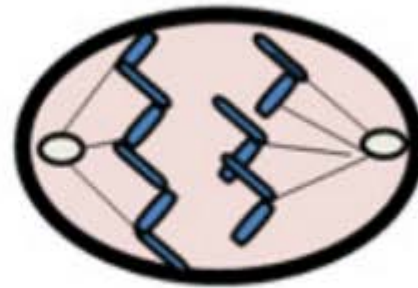
- All the Cells of your Body (except for your oocytes or spermatozoa) Reproduce by MITOSIS!



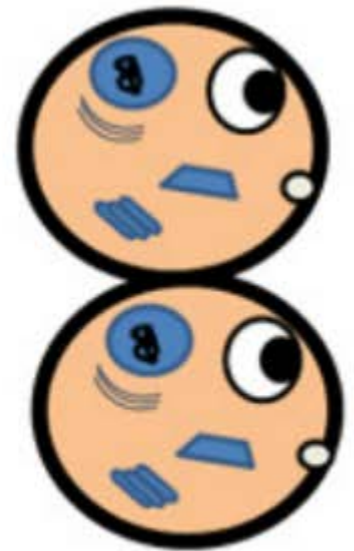
PROPHASE



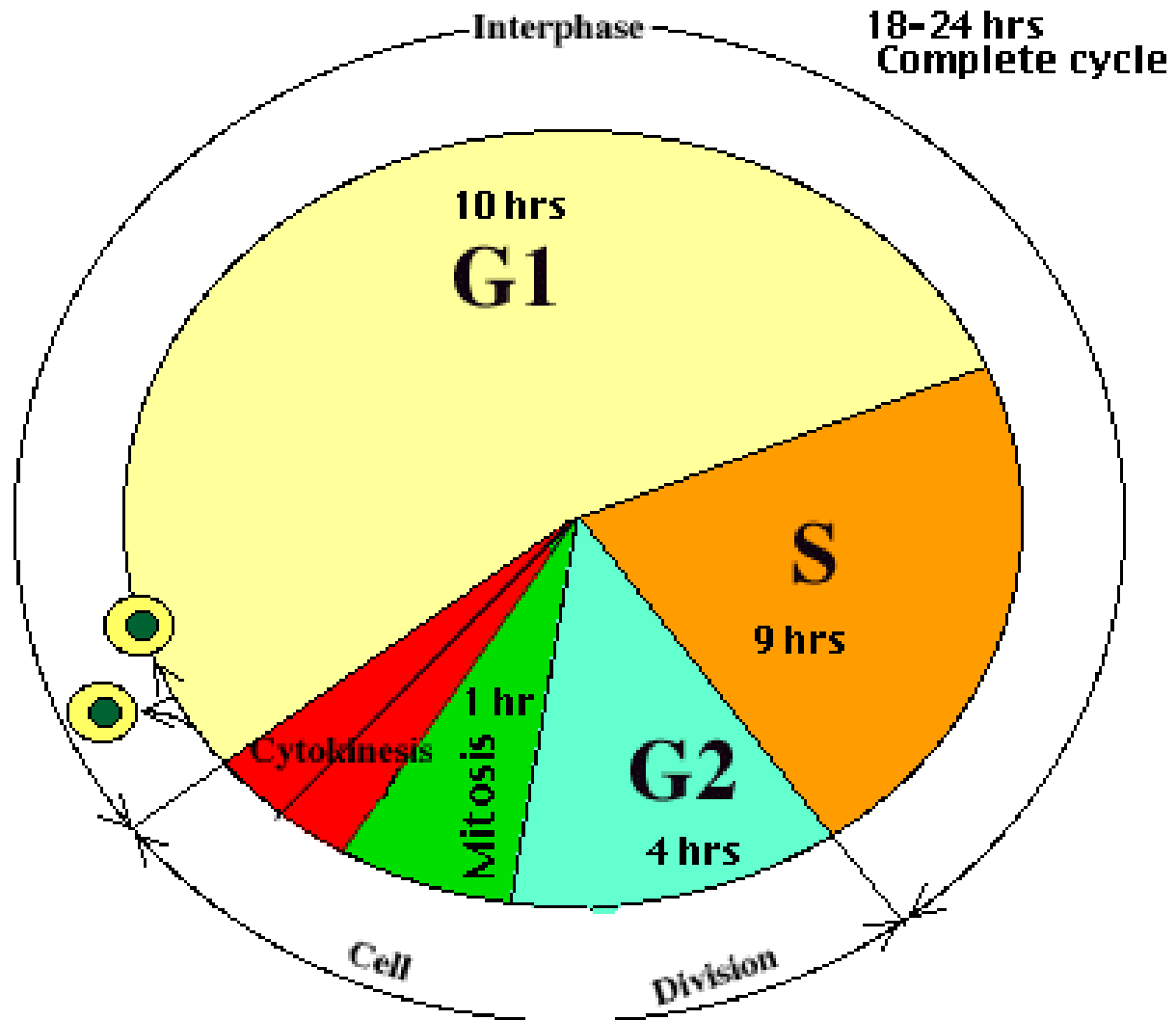
METAPHASE



ANAPHASE

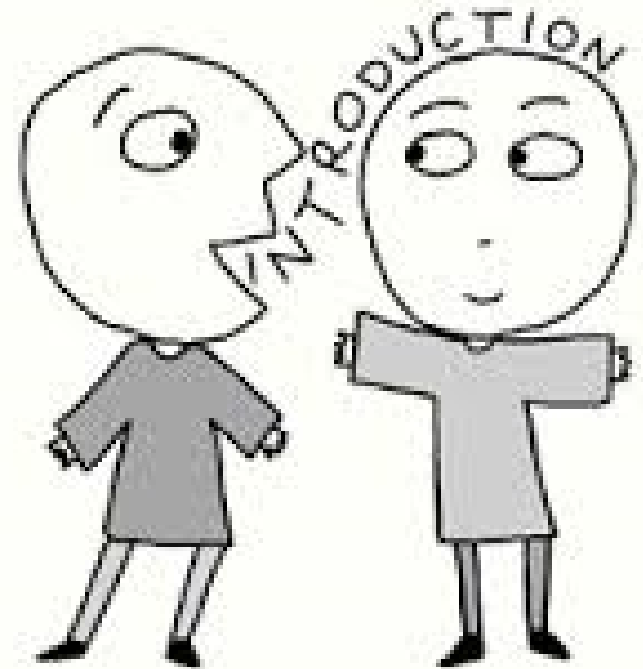


TELOPHASE



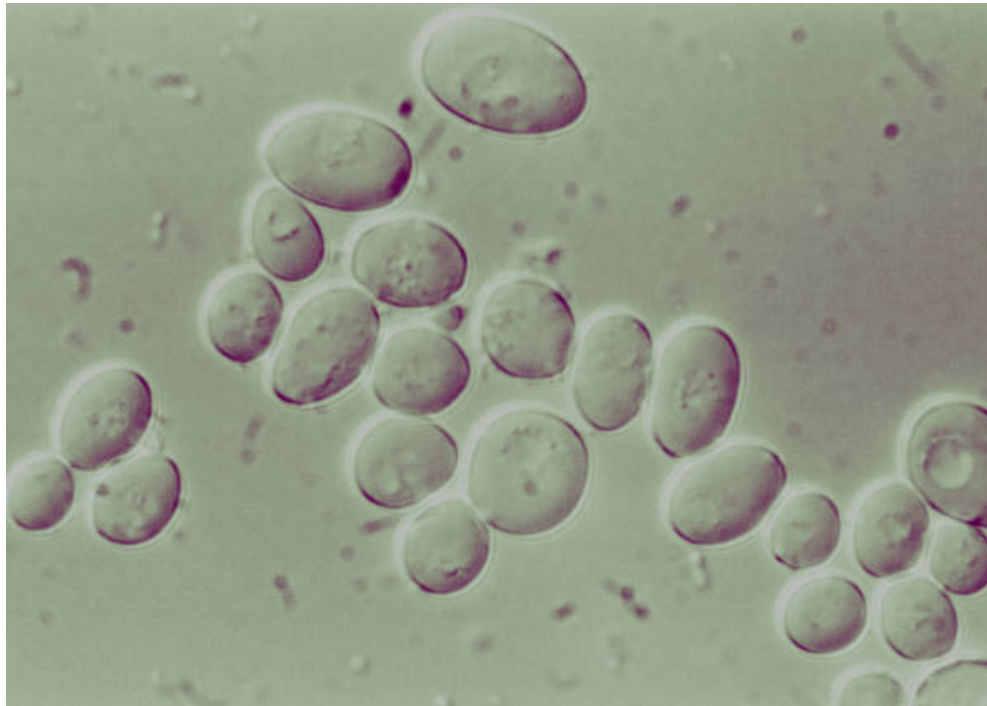
# How would you describe YOU?

- Think about it... you meet someone for the first time and they ask you to describe yourself.



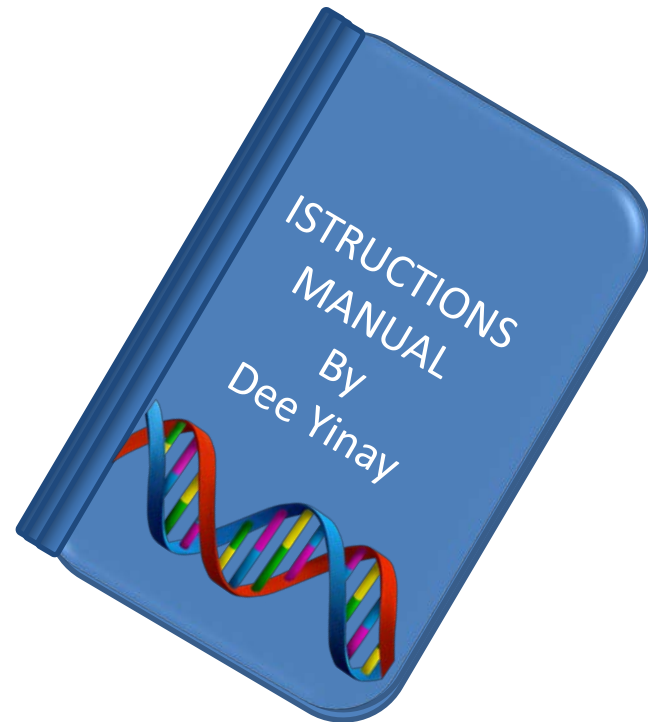
# But... who are you REALLY??

- You are made up of trillions of cells.
- That's 1,000,000,000,000's of cells!
- *Each and every one of your cells has a lot more in common with YOU than you might think!*



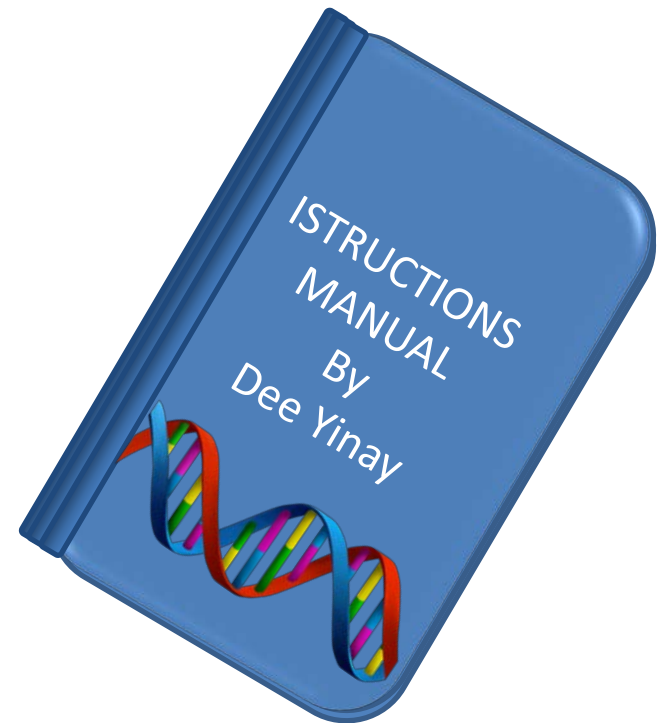
# All of Your Cells have the same DNA

- So how come we get so many different types of cells, if all our cells have the same set of “instructions”?



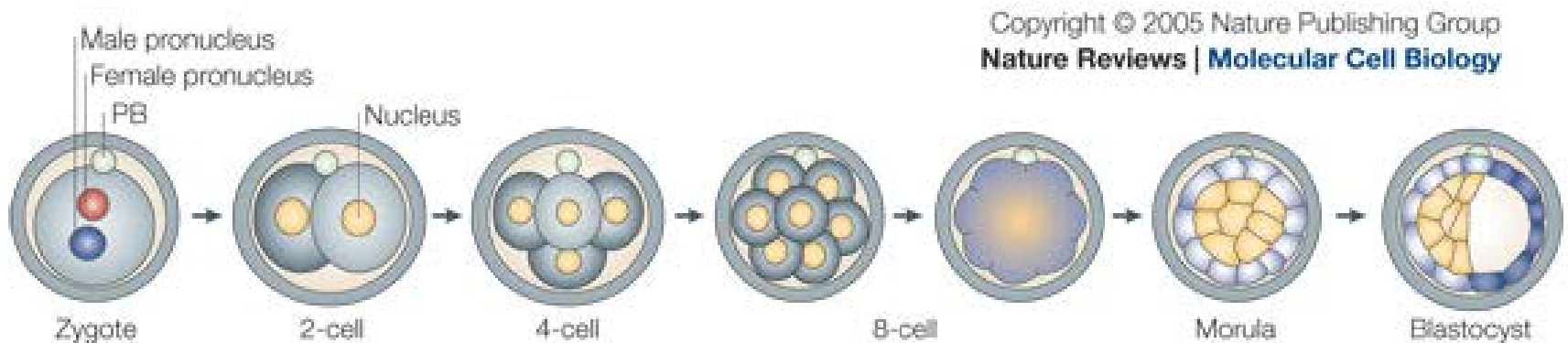
# All of Your Cells have the same DNA

- Each cell will end up “reading” only part of the “instruction manual”.  
During development and throughout each cell’s life, each cell will come across different chemical signals (like growth factors) that activate certain parts of the genome.



# Zygote to Blastocyst

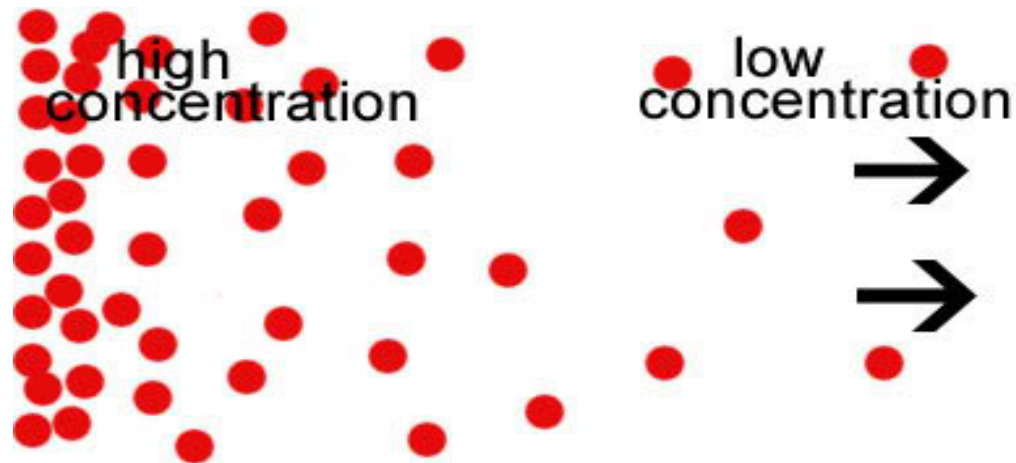
- A fertilized cell is called a zygote.
- The zygote then becomes 2 cells, then 4 cells, then 8 cells, then 16 cells and then 32 cell followed by 64 cells.
- Between the 32 to 64 cell stage, the mass of cells is called a blastocyst.





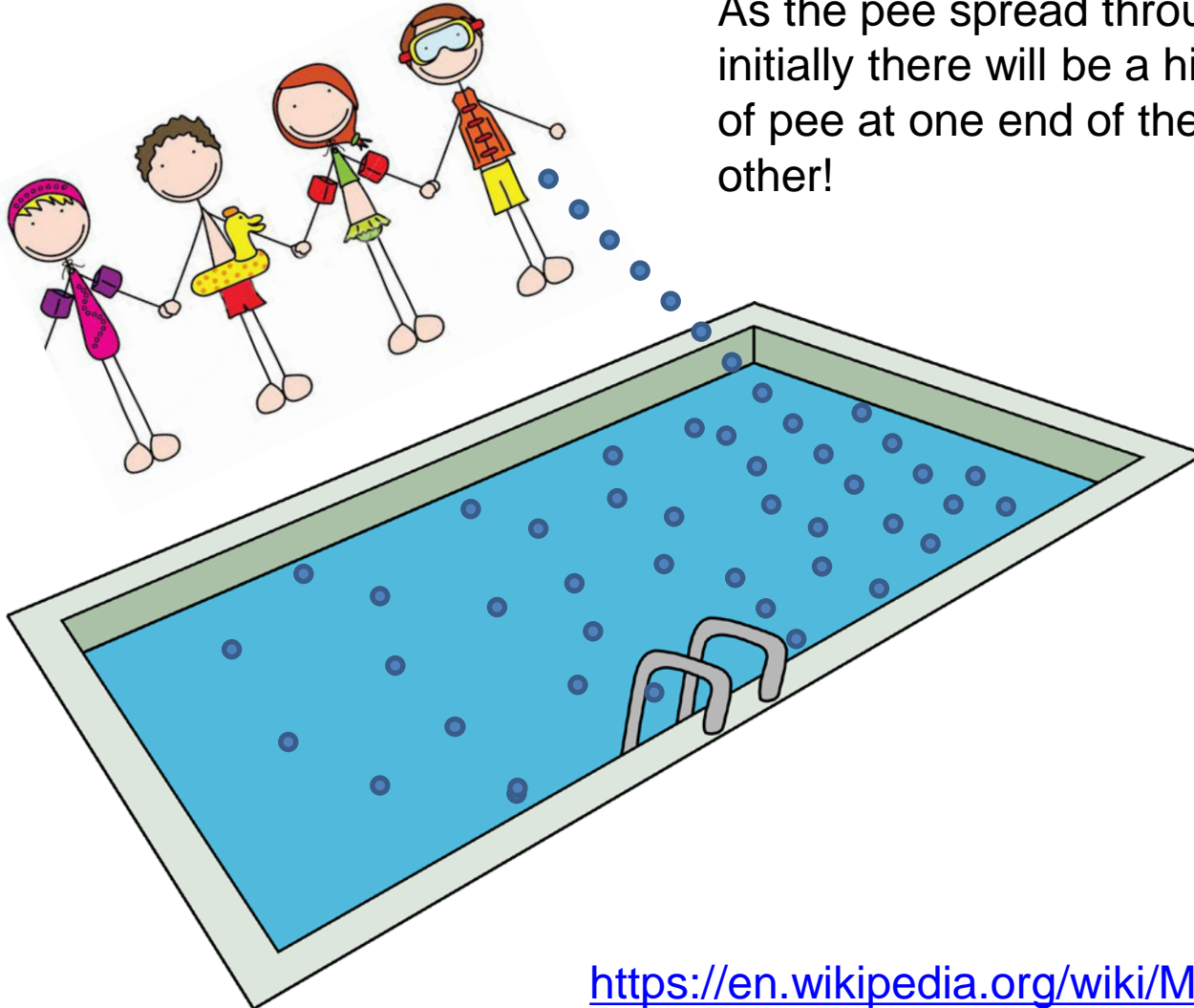
# Sonic hedgehog (SHH)

- At the blastocyst stage the cells begin secreting growth factors like Sonic hedgehog (SHH). The strongest cell will continue to secrete SHH as the other cells stop making SHH, causing a **concentration gradient**.



# Concentration Gradient

You can think of a concentration gradient like this. A kid pees at one end of the pool. As the pee spread through the pool, initially there will be a higher concentration of pee at one end of the pool than the other!

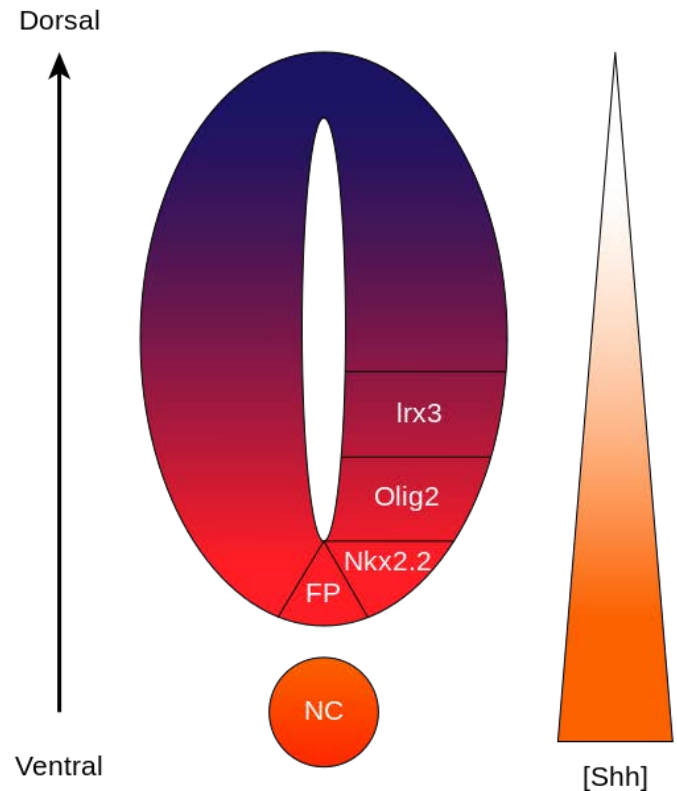


[https://en.wikipedia.org/wiki/Molecular\\_diffusion#/media/File:DiffusionMicroMacro.gif](https://en.wikipedia.org/wiki/Molecular_diffusion#/media/File:DiffusionMicroMacro.gif)

# Sonic hedgehog (SHH)

The cells secreting SHH will become the head. Each of the cells in the blastocyst will be getting a different concentration of SHH depending on where it is in relation to the head.

It is at this point that the cells will begin to **differentiate** from stem cells to into different types of cells. The different concentrations of SHH “turn on” only certain genes in certain cells.



# Mitosis for Wound Repair

- When you are an adult, your body will still undergo mitosis for cell repair and cell replacement.

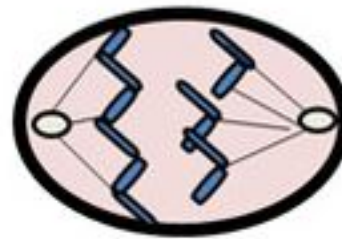
## MITOSIS



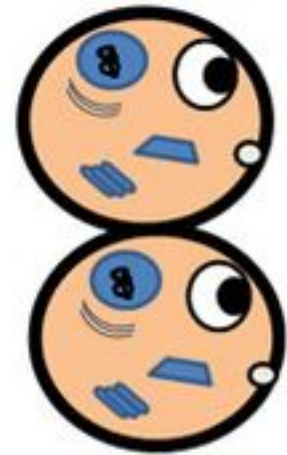
PROPHASE



METAPHASE



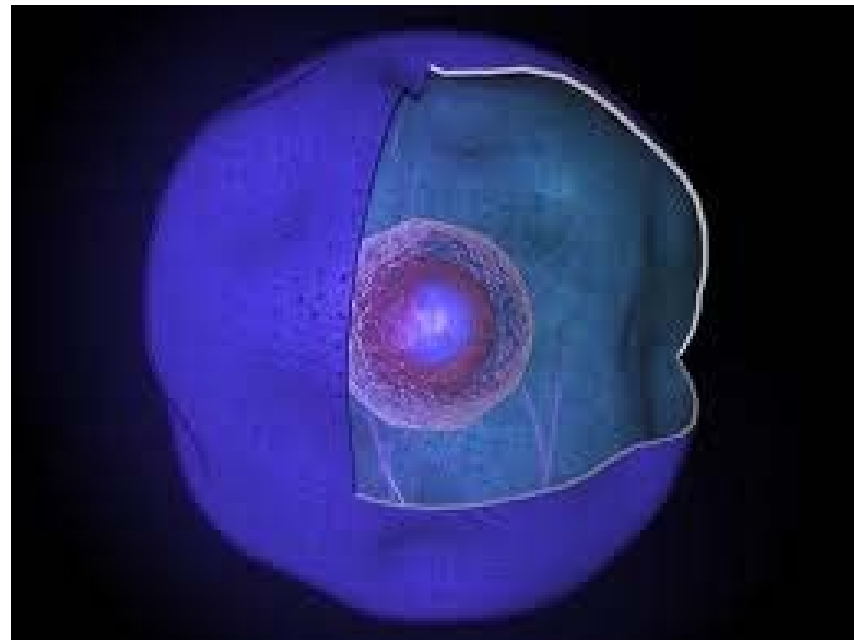
ANAPHASE



TELOPHASE

# Each and every cell in your body...

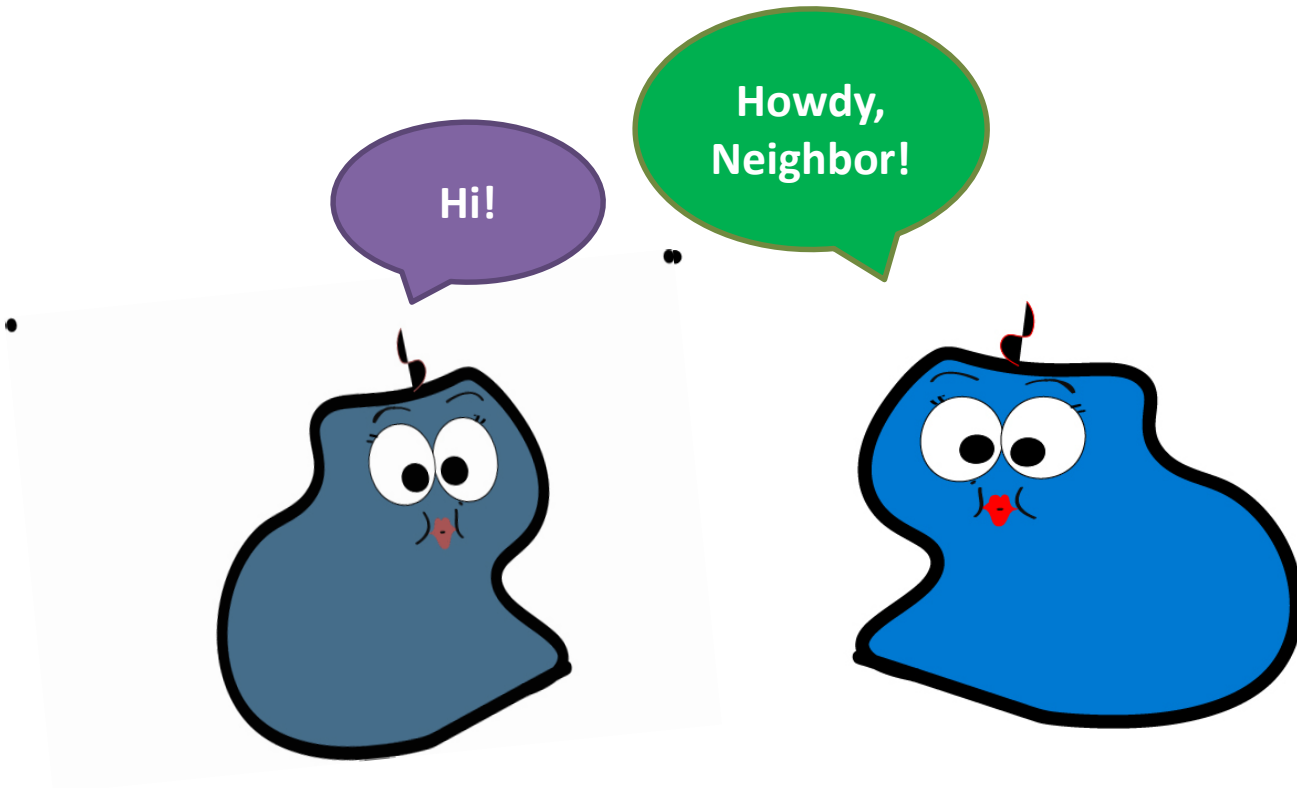
- THINKS!
  - YES! Your cell has a sort of '*brain*' which is called the nucleus.
  - The nucleus houses the DNA (di-ribonucleic acid) which has instructions about what it should do.
  - Cells react and respond to changing environments.



- **How does your body know when it need to grown more cells to heal a wound?**

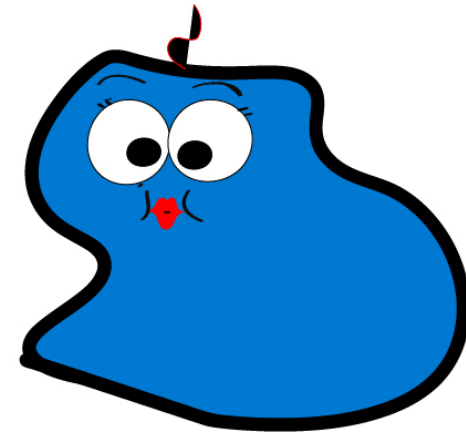


- **Cells communicate to each other using chemical signals.**



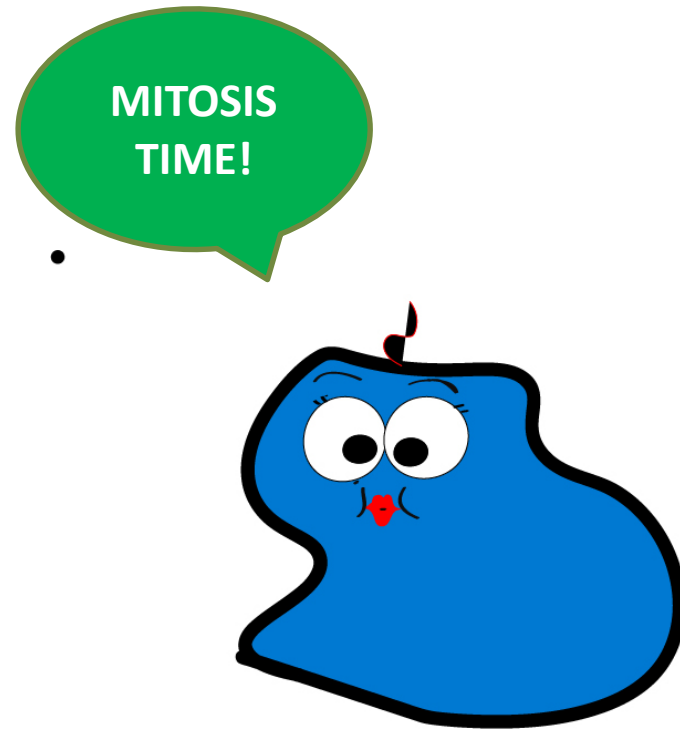
- **Cells communicate to each other using chemical signals.**
- **When you cut yourself, the cells along the edge notice that their neighbor is gone.**

Where did she go??



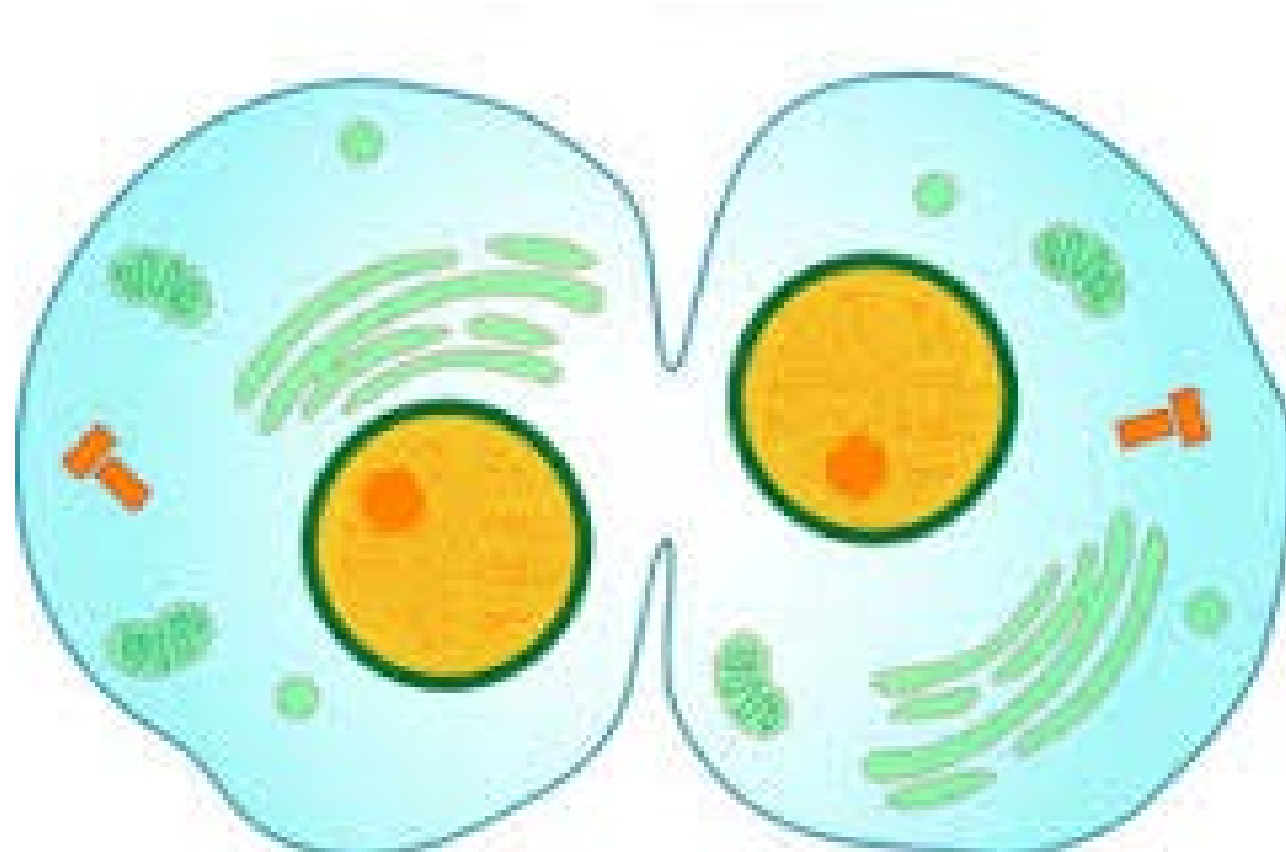


- Then the cell will enter the cell cycle and mitosis to make more cells to fill in the 'gap'.



# Mitosis - When Cells Split Apart and Become 2 Cells!

Mitosis is the simple duplication of a cell and all of its parts. It duplicates its **DNA** and the two new cells (**daughter cells**) have the same genetic code.

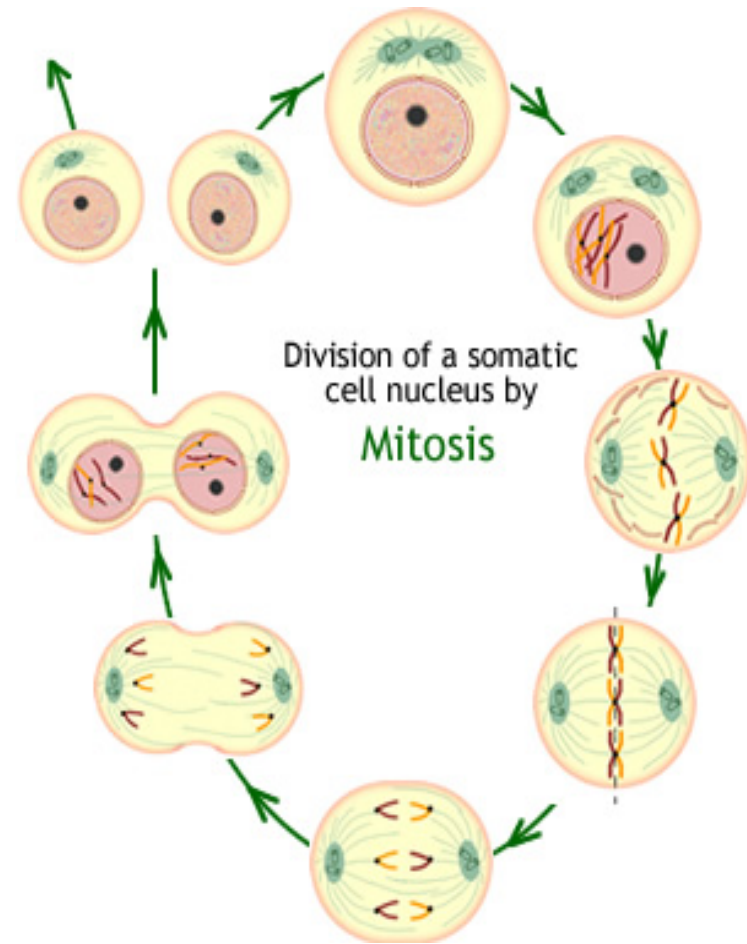


# Animated Mitosis Cycle

<http://www.cellsalive.com/mitosis.htm>

Mitosis has 4 Phases

1. Prophase
2. Metaphase
3. Anaphase
4. Telophase



# We need mitosis for...

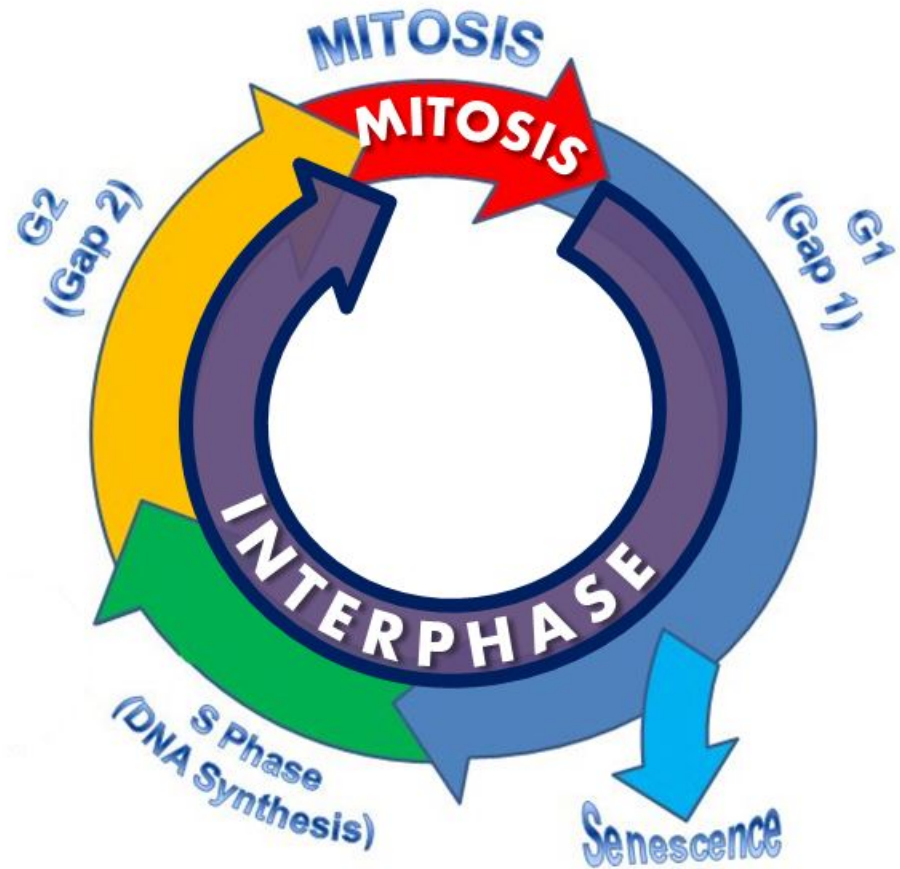
1. Growth
2. Repair
3. Replacement

10  $\mu\text{m}$

A light micrograph of plant cells stained with a purple dye. The cells are roughly rectangular and arranged in a grid. Several cells show different stages of mitosis. One cell in the center shows a clear metaphase plate with chromosomes aligned. Other cells show prophase and telophase. A scale bar in the bottom left corner indicates 10 micrometers.

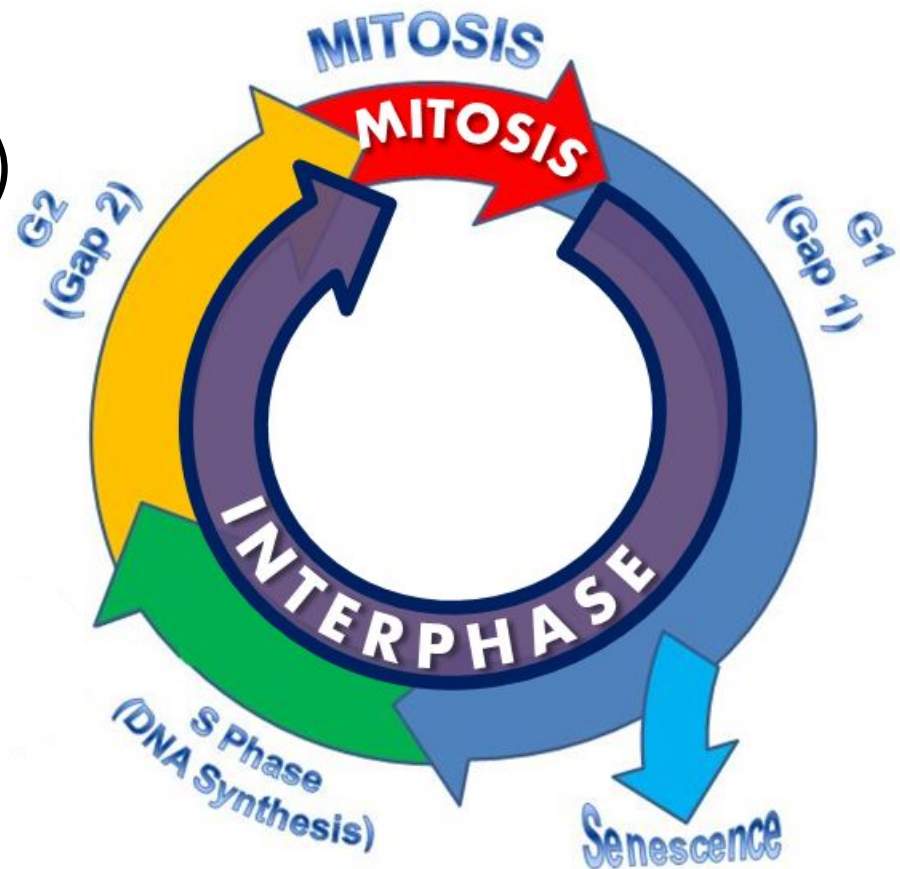
# Quick Review

- The Cell Cycle has 2 parts
- Interphase
- Mitosis



# Quick Review

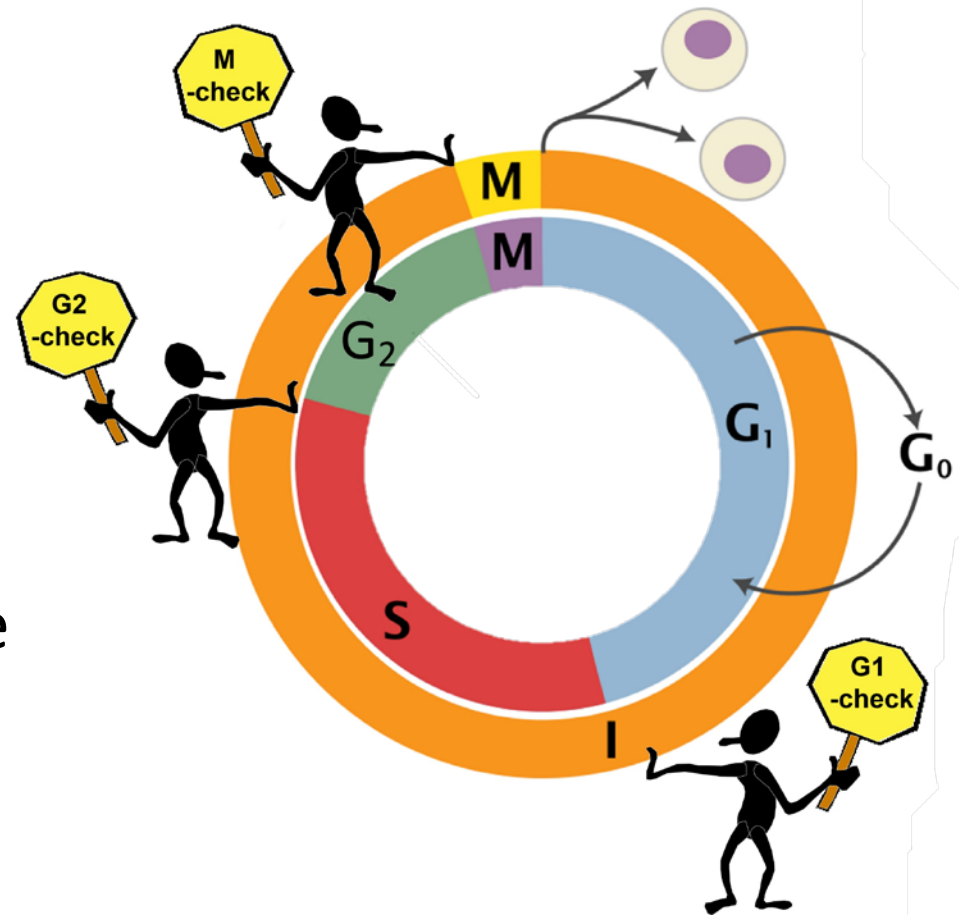
- Interphase has 3 parts
  - G1 (Gap 1)
  - S-Phase (DNA Synthesis)
  - G2 (Gap 2)
- Mitosis has 4 phases
  - Prophase
  - Metaphase
  - Anaphase
  - Telophase





# Quick Review

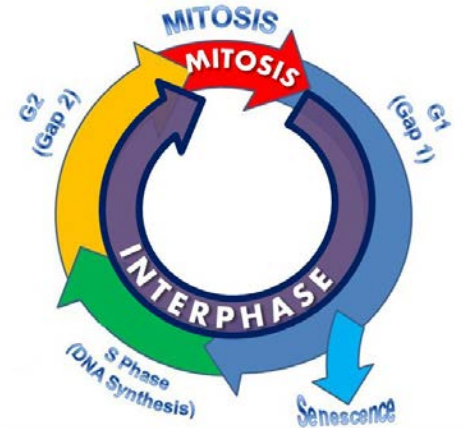
- The Cell Cycle has 3 checkpoints
  1. G1 checkpoint is at the end of G1
  2. G2 checkpoint is at the end of G2
  3. M checkpoint is between metaphase and anaphase of mitosis



# Interphase

occurs before mitosis begins

- The cell cycle starts with G1. Then is S-Phase DNA synthesis occurs. Here is where the cell makes copies of its DNA so the chromosomes in the nucleus each consist of two connected copies, called **sister chromatids**. You can't see the chromosomes very clearly at this point, because they are still in their long, stringy, decondensed form. Chromosomes in the decondensed form are called chromatin.



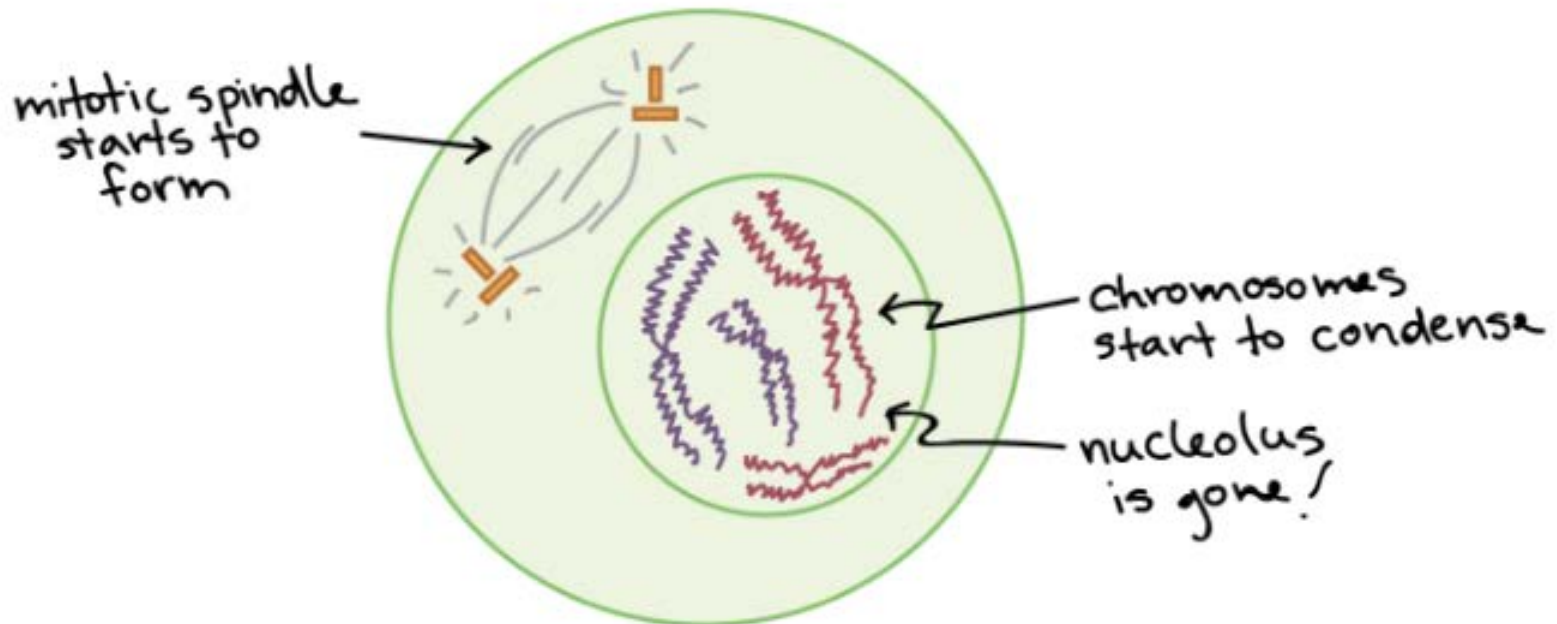


# What is Mitosis?

- **Mitosis** is the asexual process of cell reproduction (cell division) in which one “parent” cell divides to produce two new “daughter” cells.
- The daughter cells are clones of the parent cell. In other words, they are genetically identical to the parent.

# Prophase

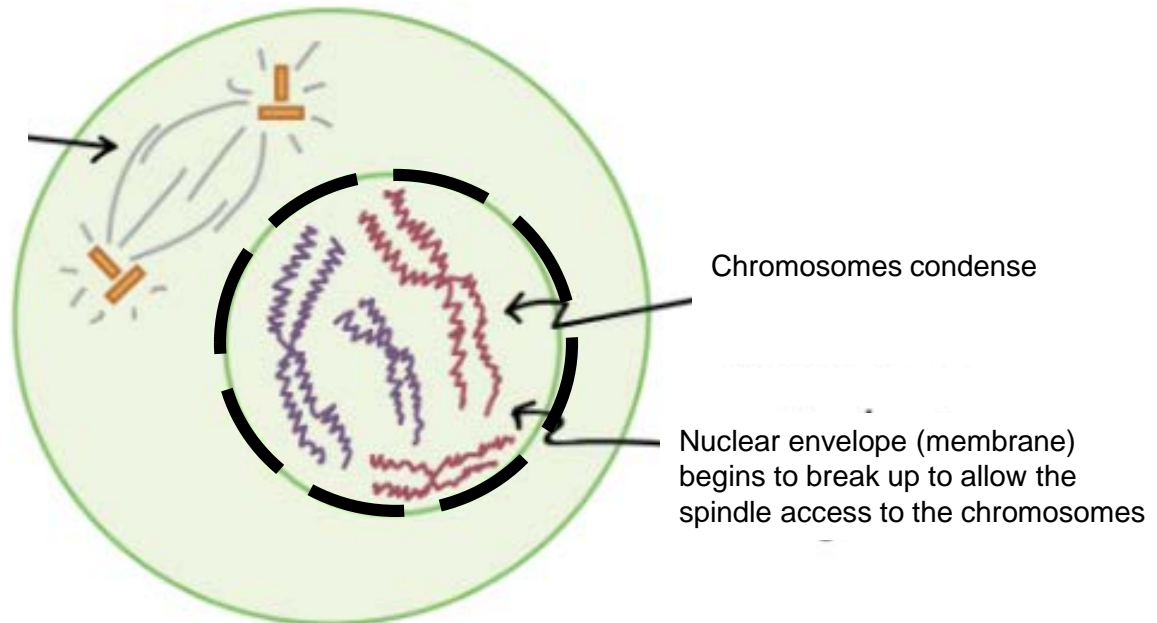
- DNA condenses to form chromosomes.
- Centrioles and spindles form
- Nuclear envelope (membrane) begins to break up.



# Prophase

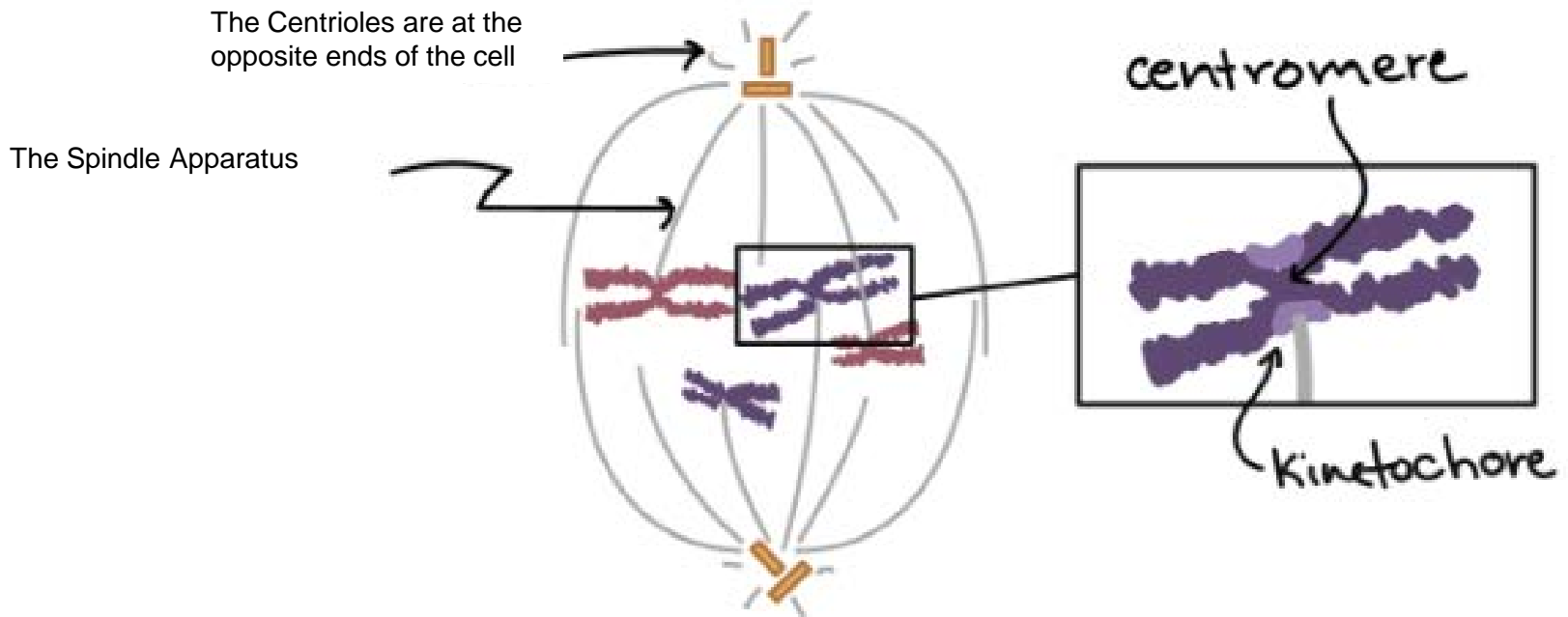
- DNA condenses to form chromosomes.
- Centrioles and spindles form
- Nuclear envelope (membrane) begins to break up.

The Centrioles form and begin forming the mitotic spindle



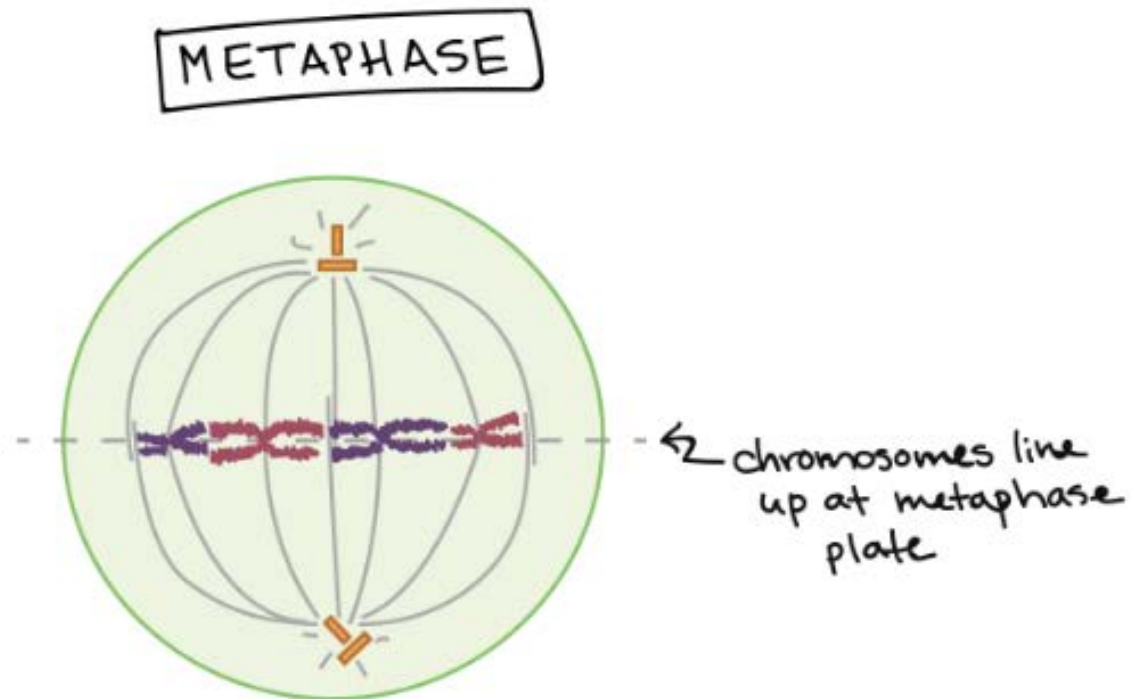
# Spindle Anatomy

## SPINDLE ANATOMY



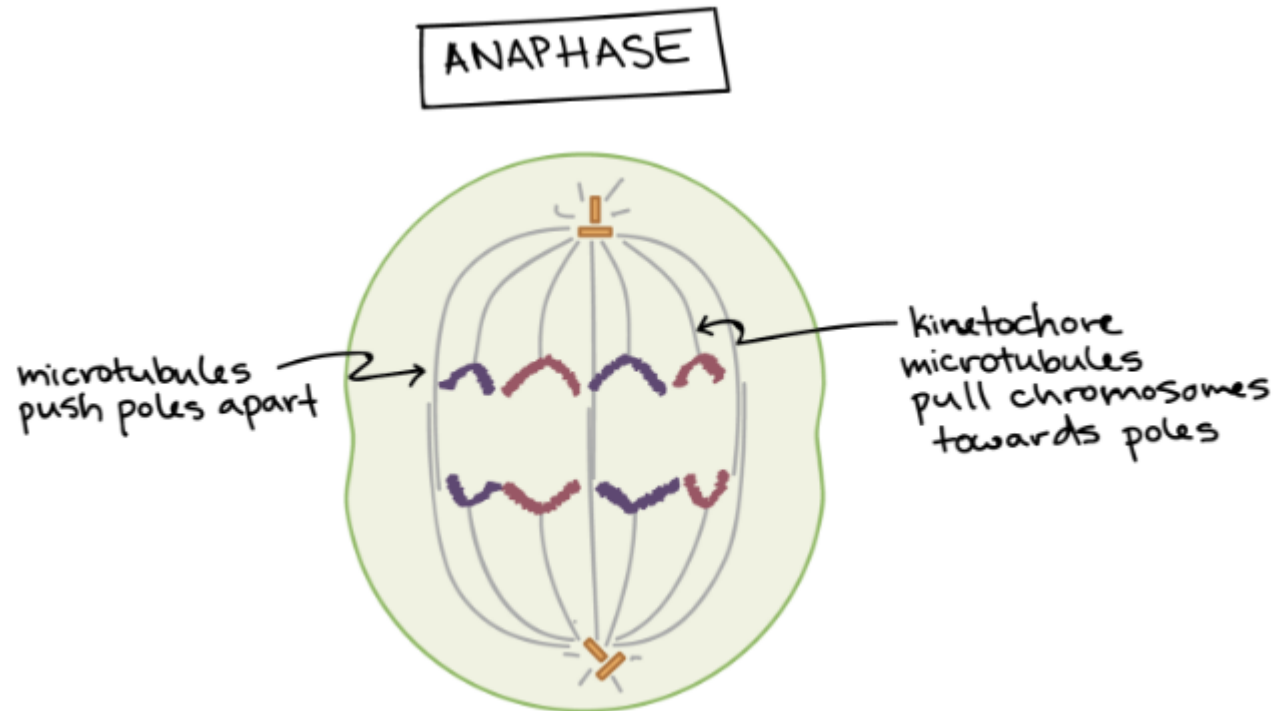
# Metaphase

- The Spindle attaches to the kinetochores of the chromosomes and lines the chromosomes up along the midline.



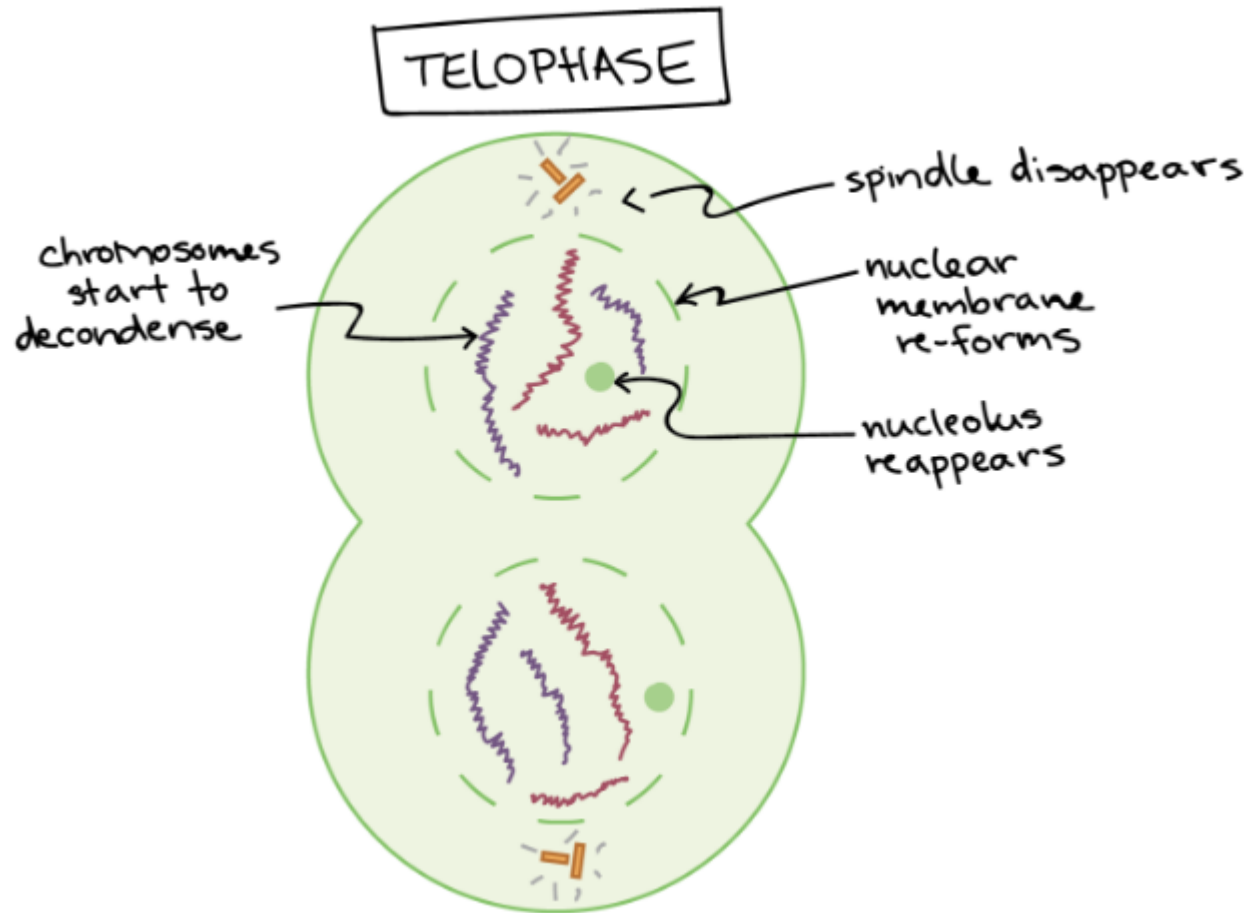
# Anaphase

- The Spindle pulls sister chromatids to opposite sides of the cell.



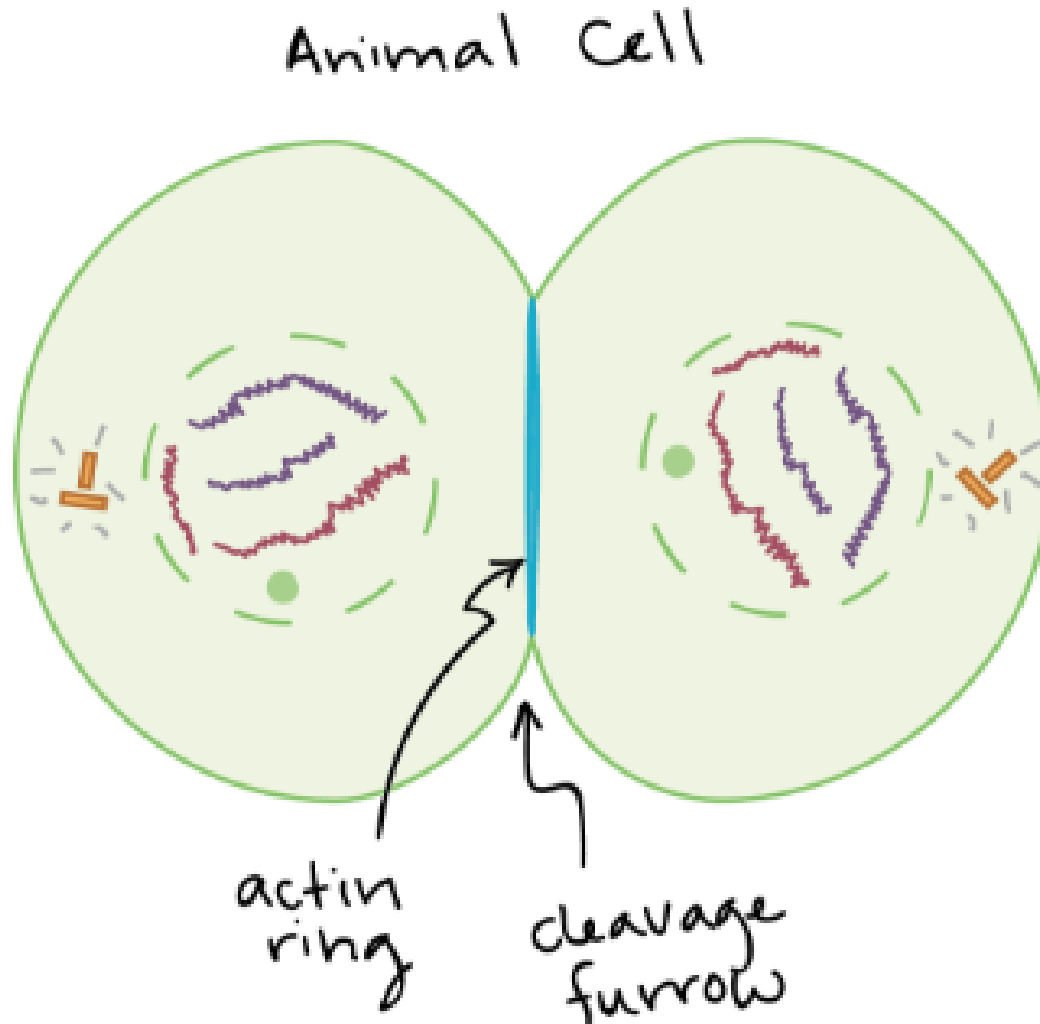
# Telophase

- The chromosomes decondense back into chromatin form.
- Spindle disappears.
- Nuclear envelope (membrane) reforms.



# Cytokinesis

- **Cytokinesis** occurs after telophase and is the process of proteins “pinching” the single cell into 2 newly formed daughter cells.





# Mitosis Animation and Games

<http://www.cellsalive.com/mitosis.htm>

<http://www.sciencegeek.net/Biology/Mitosis/Mitosis1.shtml>

Mitosis Game

<http://www.nobelprize.org/educational/medicine/2001/cellcycle.html>