

## Cell Cycle: M Phase

Mitosis and Cytokinesis.

## Mitosis:

- ♦ The process by which a nucleus of a body cell divides into two identical nuclei, each containing the same number and type of chromosomes as the parent.
  - Parent cells are what we call the original cell that is preparing to divide.
  - Body cells are all the cells of an organism except for sex cells (gametes.)
- ♦ Nuclear division.
- ♦ The process that divides threadlike nuclear material equally between two new nuclei.
- ♦ Comes from the Greek word *mitos* meaning thread.

## Cytokinesis:

- ♦ Cell division where the cytoplasm is pinched in half.
- ♦ Results in the formation of two daughter cells.
  - The new cells formed by cell division.
  - Exactly alike to each other and the parent cell. (Natural cloning.)

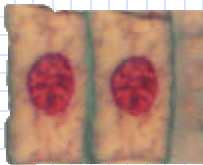
## Mitotic Stages:

- ♦ 4 stages
  - Prophase
  - Metaphase
  - Anaphase
  - Telophase



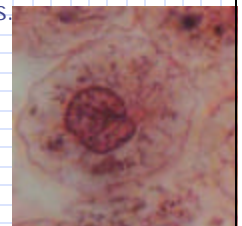
## Remember!!!!

- ♦ Interphase: Precedes mitosis. It is not part of mitosis.
- ♦ Cytokinesis: Follows mitosis!!! It is not a stage of mitosis!!!



## Recall Interphase ( $G_1$ , $S$ , $G_2$ ):

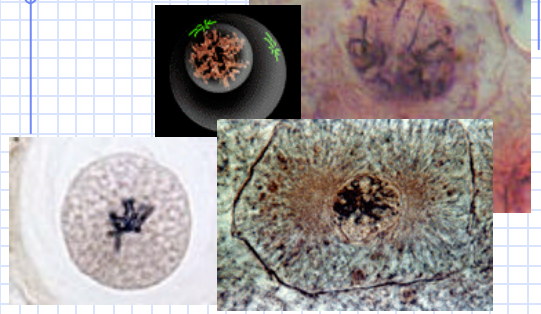
- ♦ Before mitosis.
- ♦ Like cells we have previously seen under the microscopes.
- ♦ Increasing cell size
- ♦ Duplicating DNA



## Prophase:

- Chromatin shortens and thickens (coils) becoming visible under the microscope as chromosomes.
- Each individual DNA molecule is now called a chromatid and sister chromatids attach to each other at the centromere and are called chromosomes.
  - Sister chromatids are the matching chromatids, exact copies of each other.
- Centrioles move to opposite ends of the cell (in animal cells.)
- Spindle fibers begin to appear (made of microtubules) between two sets of centrioles.
- Nuclear membrane begins to break down and disappear.

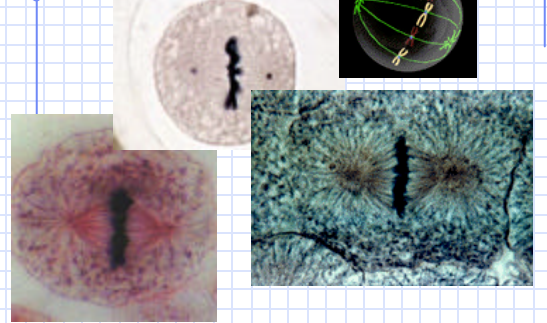
## Prophase:



## Metaphase:

- The nuclear membrane has been completely dissolved by this point.
- Spindle fibers are stretched completely across the cell.
- Each sister chromatid becomes attached to spindle fibers at the centromere.
- Chromosomes move to the center of the cell and line up (along the equator) in pairs with their duplicate copies, perpendicular to the spindle fibers (as the spindle fibers push and pull them into position.)

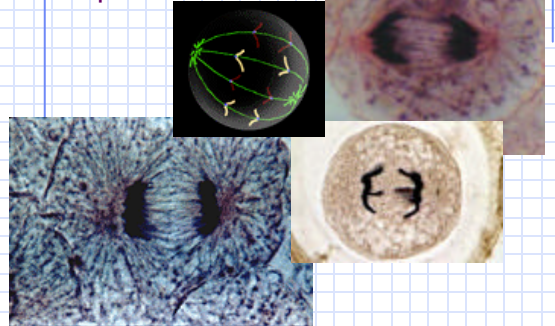
## Metaphase:



## Anaphase:

- Sister chromatids are pulled by the spindle fibers in opposite directions.
- The centromeres split.
- Chromosomes begin to pull apart toward opposite ends of the cell.

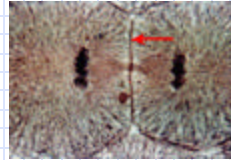
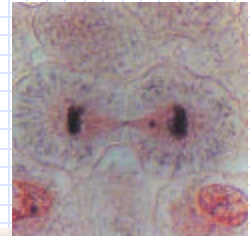
## Anaphase:



## Telophase:

- ◆ Chromosomes are at complete opposite ends of the cell. (Each end of the cell has a complete set of chromosomes which are identical to the parent cell.)
- ◆ Nuclear membranes assemble around each set of chromosomes.
- ◆ A "pinching" begins to occur at the center of the cell.
- ◆ Spindle fibers breakdown.
- ◆ A nucleolus reappears in each nuclei.
- ◆ Chromosomes begin to stretch out and uncoil.
- ◆ Other organelles move to the ends of the cell.

## Telophase:



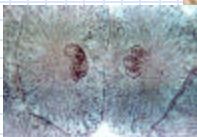
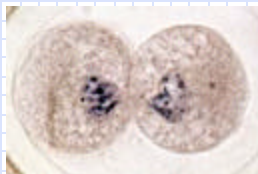
## End Mitosis

Move onto Cytokinesis....

## Cytokinesis:

- ◆ After mitosis, the cytoplasm divides and the pinching in at the center of the cell completely breaks the cell membrane into two smaller cells.
- ◆ The actual splitting or dividing of the cell into two identical daughter cells.
- ◆ The daughter cells are identical to each other and to the original parent cell.

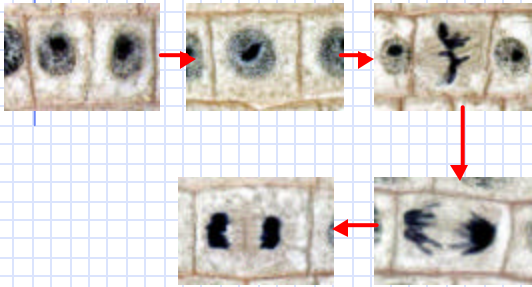
## Cytokinesis:



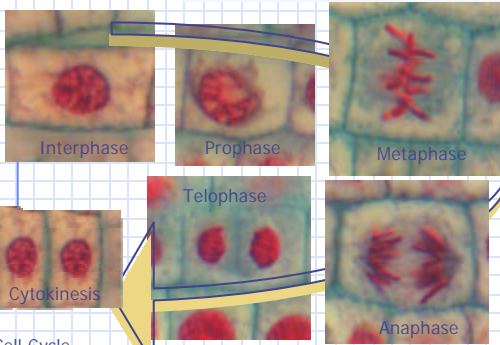
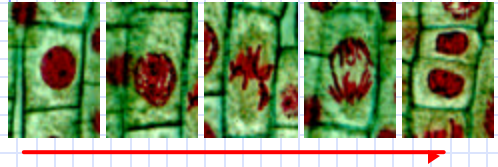
## Plant Cell Mitosis:

- ◆ Occurs as animal cell mitosis does, except, the cell does not simply split into two.
- ◆ In plants, a cell plate is formed in the middle of the cell around which a new cell wall and plasma membrane forms.
  - Vesicles from the golgi apparatus fuse forming the cell plate.
  - The cell plate grows outward until it joins the old cell wall; it then makes new cell wall material until the cells separate.
- ◆ Thus the new daughter cells are on each side of the cell plate.

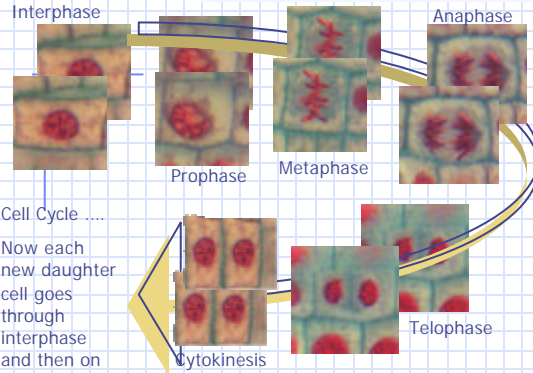
**Plant Cell Mitosis:** (Includes interphase photo.)



**Onion Mitosis:** (Includes interphase photo.)



Cell Cycle ....  
Remember, after cytokinesis, each new daughter cell will go through the cell cycle! Back to the beginning of interphase: G<sub>1</sub>...



Cell Cycle ....  
Now each new daughter cell goes through interphase and then on to the division stage....