

# The Cell Cycle

Packet #9

Thursday, August 20, 2015

# Introduction

- Cell Cycle
  - An ordered sequence of events in the life of a dividing eukaryotic cell and is a cellular asexual reproduction.
  - The contents of the parent's cell nucleus is duplicated and two new, identical nuclei are produced.
    - Two daughter cells are produced the parent cell.

# Cell Cycle

## Three General Phases

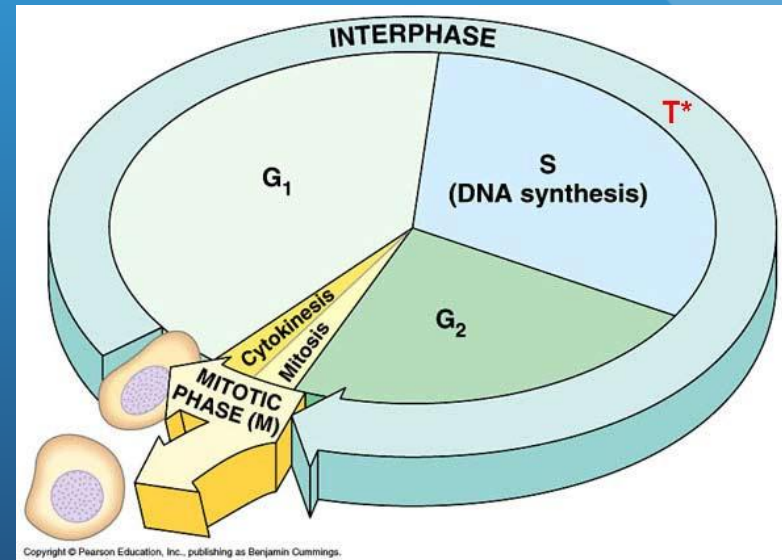
- **Interphase**

- G<sub>1</sub> phase
  - Gap phase #1
- S phase
  - DNA synthesis {replication}
- G<sub>2</sub> phase
  - Gap Phase #2

- **M Phase**

- Mitotic phase

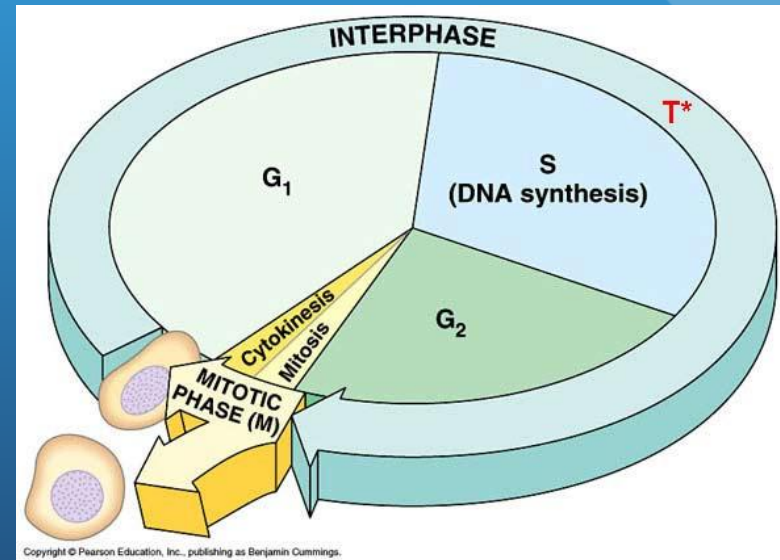
- **Cytokinesis**



# Interphase

# Interphase

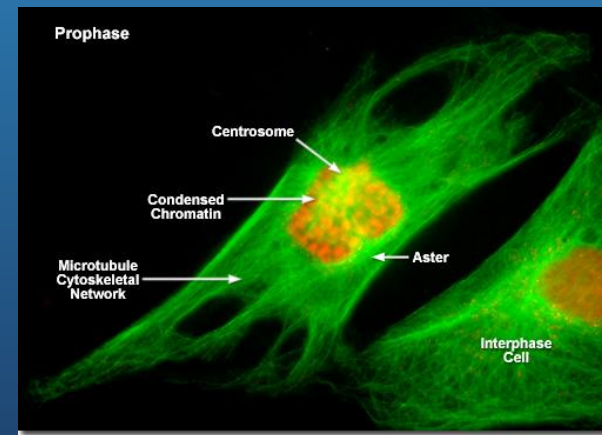
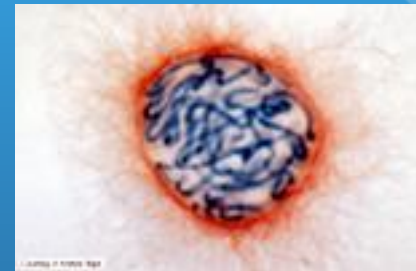
- Interphase
  - Accounts for about 90%\*\* of the cell cycle
  - G<sub>1</sub> Phase
    - Gap Phase I
      - Cell grows in size
  - S Phase
    - Synthesis Phase
      - Copies of chromosomes and DNA are made
        - DNA Replication
  - G<sub>2</sub> Phase
    - Gap Phase II
      - Cell grows in size



# Mitotic Phase

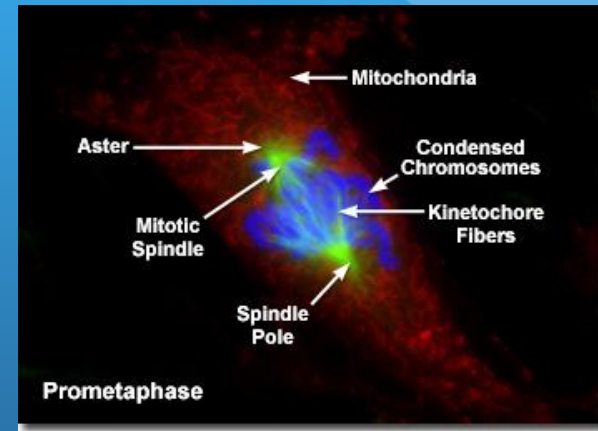
# Mitotic Phase (Mitosis)—Prophase

- Prophase
  - Remember, the chromosomes have already been replicated during interphase.
  - The nuclear membrane begins to dissociate into small vesicles.
  - The nucleolus becomes less visible.
  - The chromatids condense, become more condense and become more visible.
  - The centrosomes move apart and the mitotic spindle begins to form.



# Mitotic Phase (Mitosis)— Prometaphase

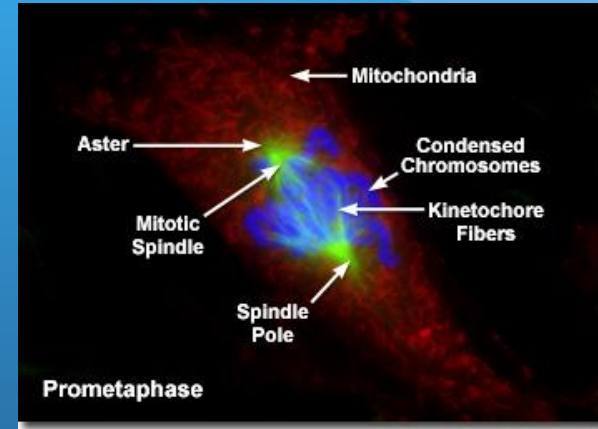
- Prometaphase
  - The centrosomes move to opposite ends of the cell.
  - The two spindle poles form.
  - The nuclear membrane is completely dissociated into vesicles allowing spindle fibers to interact with the sister chromatids.





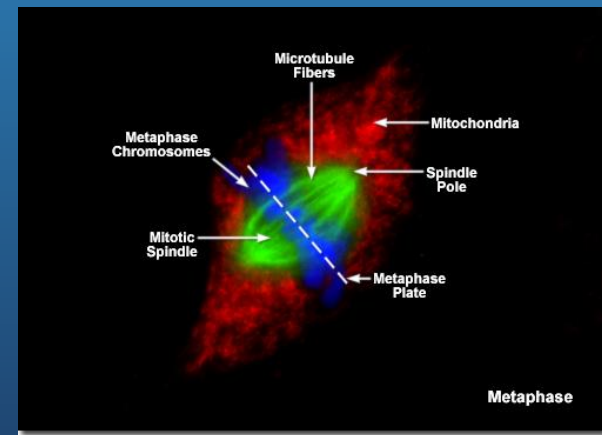
# Mitotic Phase (Mitosis)— Prometaphase

- How do the sister chromatids become attached to the spindle?
  - The microtubules initially grow rapidly from the two poles.
  - As it grows, the end of the microtubule makes contact with a kinetochore and remains firmly attached.
    - If there is no attachment, the microtubule retracts back to the centrosome and tries again.
  - By the end of prometaphase, the spindle is completely formed.



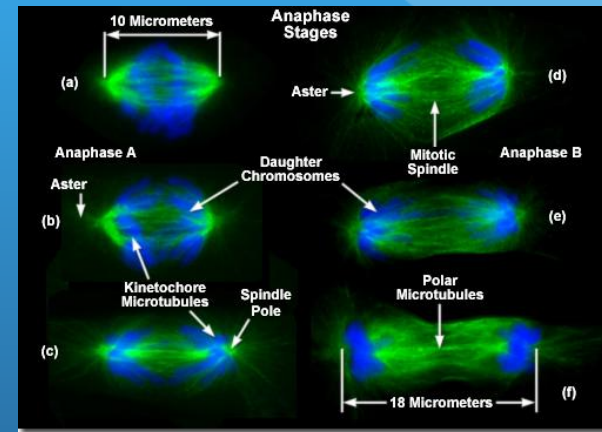
# Mitotic Phase (Mitosis)— Metaphase

- Chromosomes (sister chromatids) align along the middle (equatorial plane) of the cell.
  - The equatorial plane is called the metaphase plate.
- Remember, by this time, the microtubules have attached the chromosomes (sister chromatids) to the spindle poles.



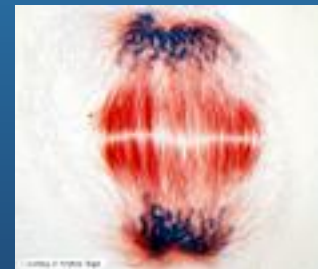
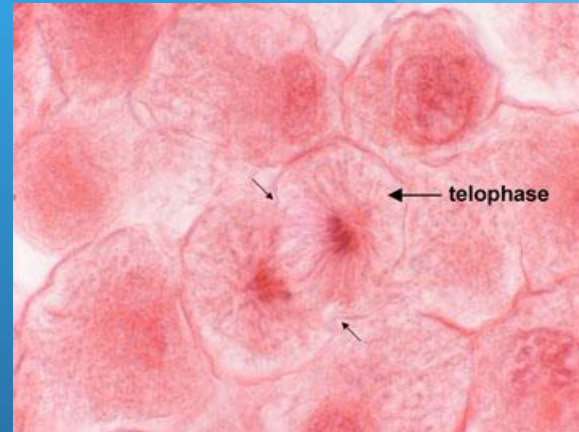
# Mitotic Phase (Mitosis)—Anaphase

- Anaphase
  - Chromosomes are pulled to the poles of the cell
    - The kinetochore microtubules shorten causing the sister chromatids are separated.
    - Centromeres divide
    - Each sister chromatid, once separated, now becomes an individual chromosome.



# Mitotic Phase (Mitosis)—Telophase

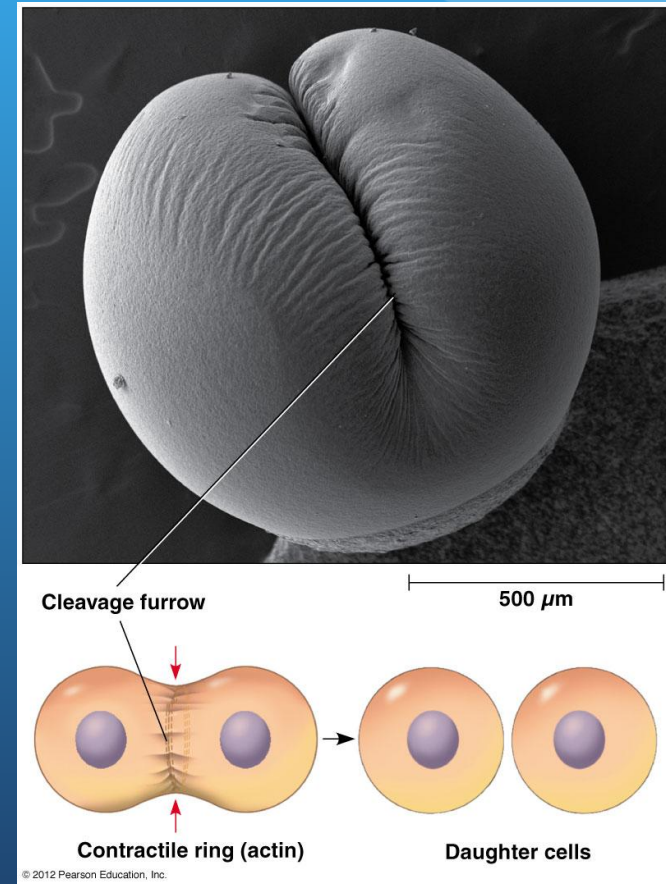
- Telophase
  - The chromosomes reach their respective poles and decondense.
  - Nuclear membrane reforms.
  - Nuclei (nucleus) and, nuclear envelope, reforms in daughter cells.



# Cell Cycle—Cytokinesis

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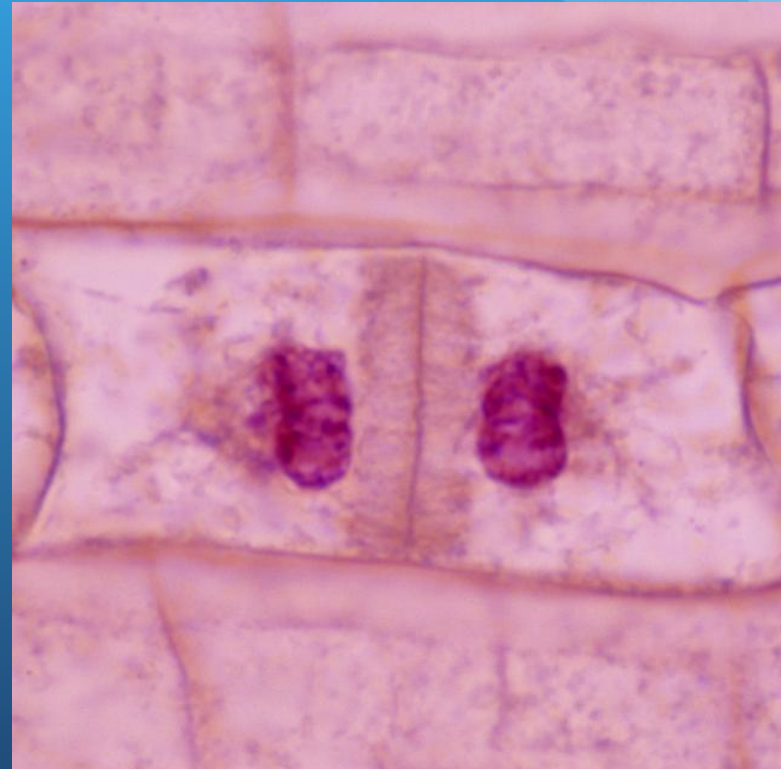
- Cytokinesis
  - The nuclei and other organelles segregate into the respective cell.
  - In animal cells, the cleavage furrow starts to form as a result of the contraction myosin proteins and actin filaments.
  - Both daughter cells are separated and two distinctive cells are formed.
    - Daughter cells are pinched off from each other.



# Cell Cycle

## Cytokinesis—Plant Cells

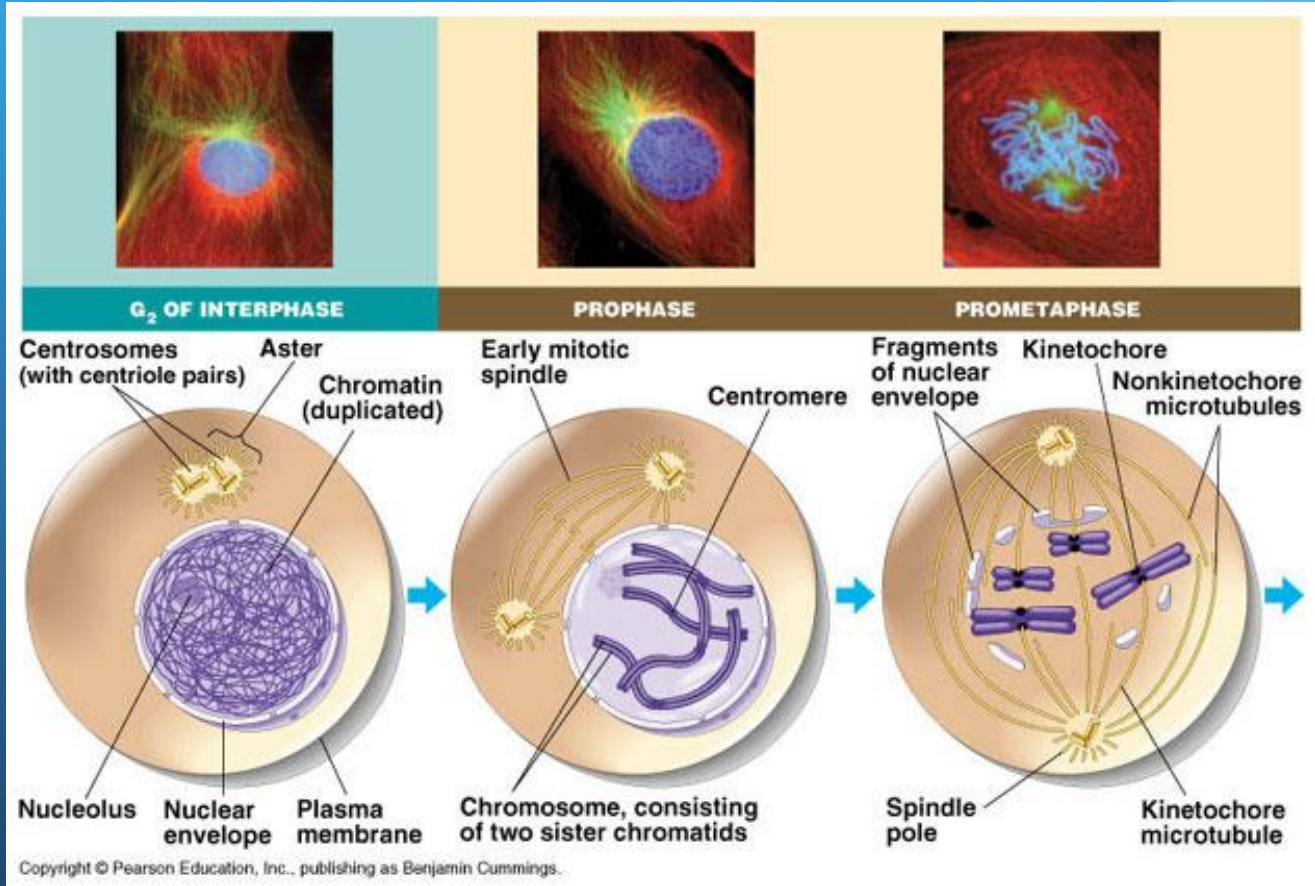
- Cytokinesis
  - In plant cells, the two daughter cells are separated by the formation of the cell plate.
  - The Golgi apparatus transports cell wall materials in vesicles.
  - The cell plate begins in the middle of the cell and expands until it reaches the cell wall.
  - Once the attachment has taken place, the cell plate undergoes a process of maturation and eventually separates the “mother cell” into two “daughter cells.”



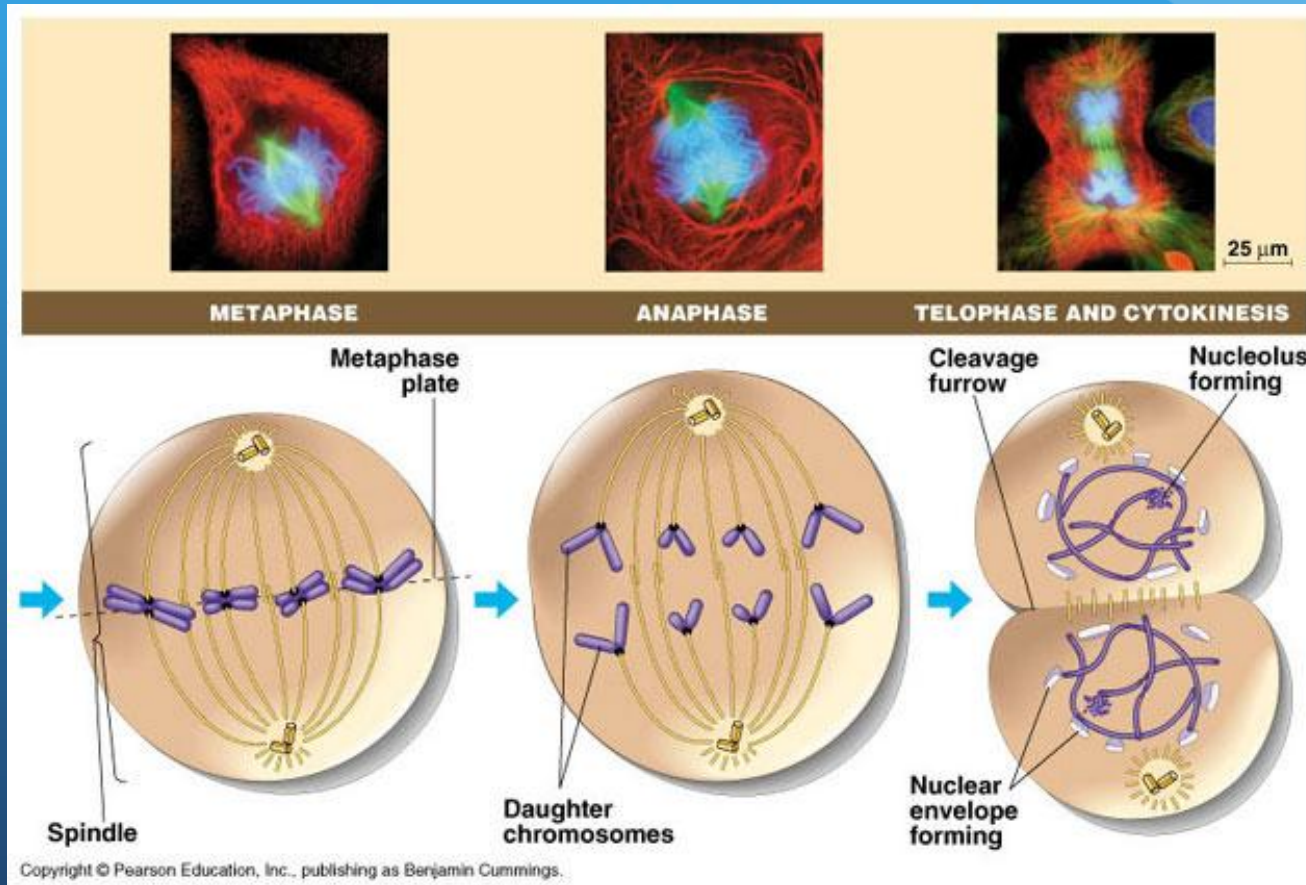
# Review



# Review I

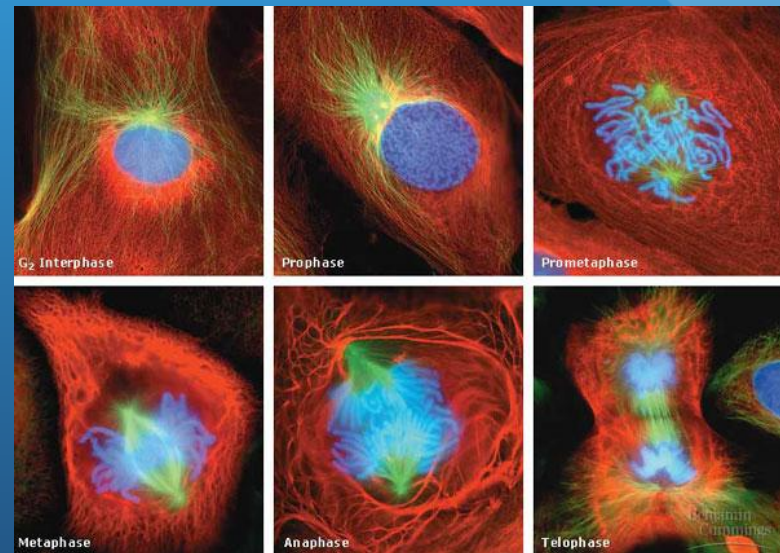


# Review II

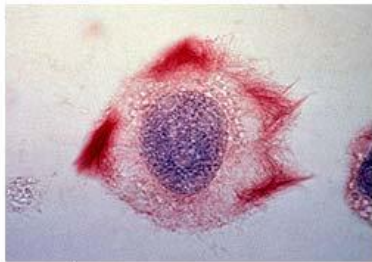


# Review III

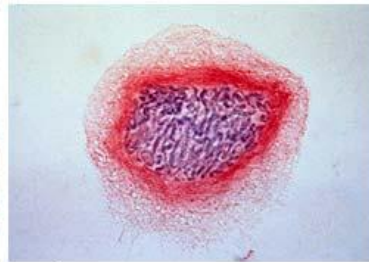
- One cell division resulting in two daughter cells
- Chromosome number, per nucleus, remains the same
  - Haploid results in haploid
  - Diploid results in diploid
- In most cases, crossing over does not occur, but it is possible during prophase.
  - More details to come in meiosis.



# Review IV



Interphase



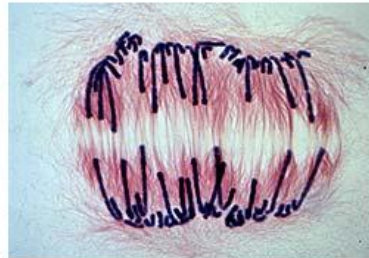
Prophase



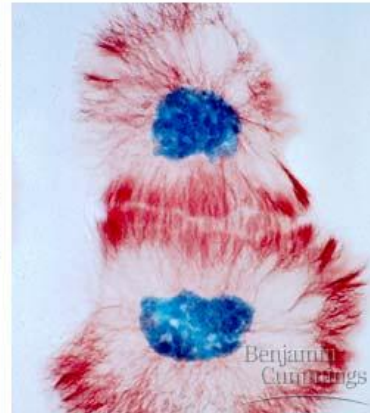
Prometaphase



Metaphase



Anaphase



Telophase