

BW #16

- What are the phases of mitosis in order?





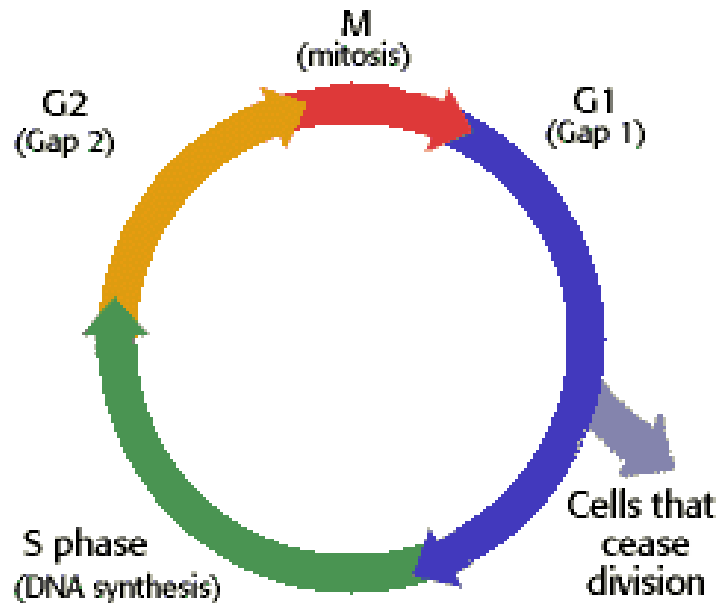
COMPARING MITOSIS & MEIOSIS

CELL DIVISION!

Cell Cycle....how living things GROW!!

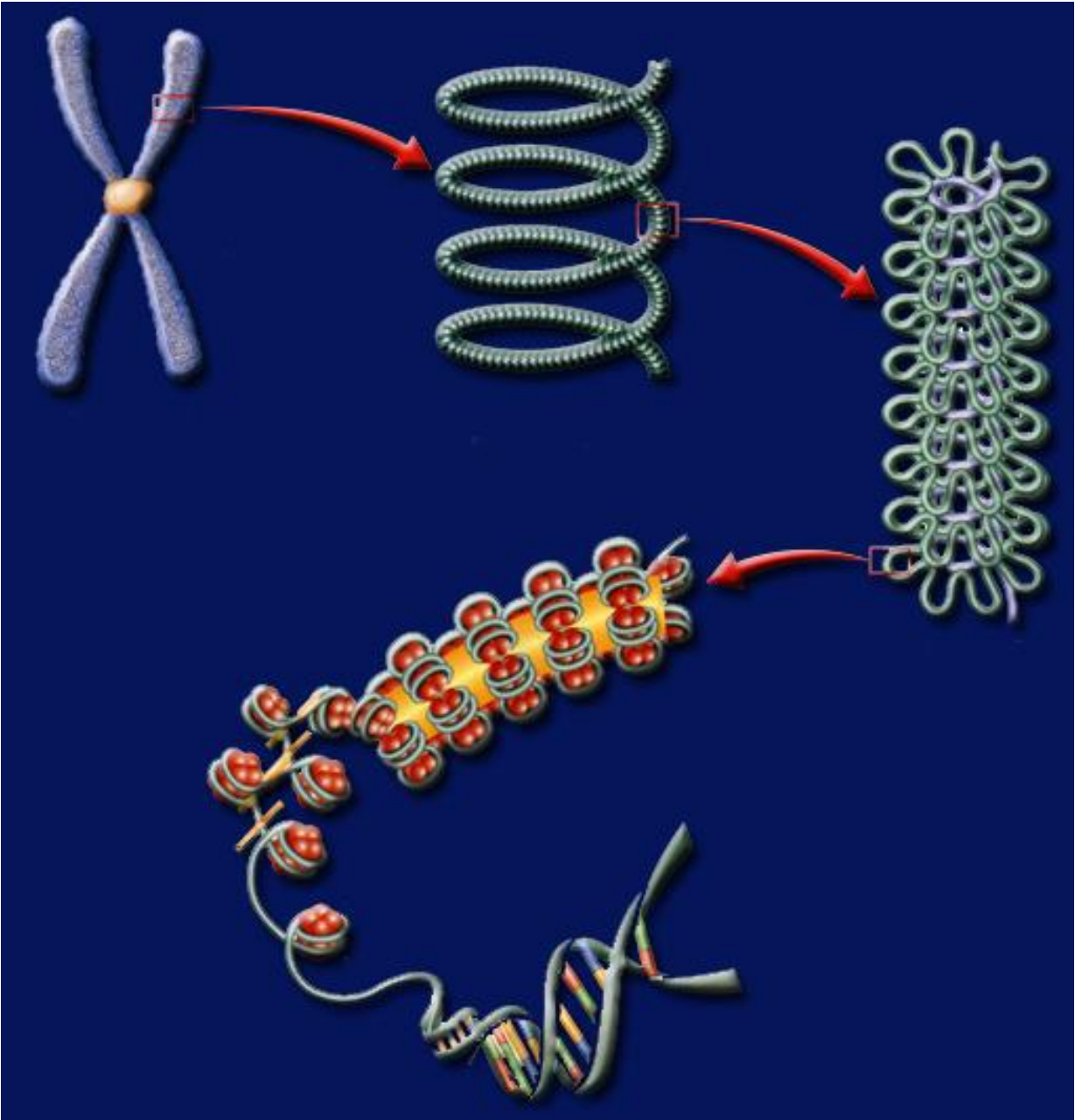
Interphase
Prophase
Metaphase
Anaphase
Telophase

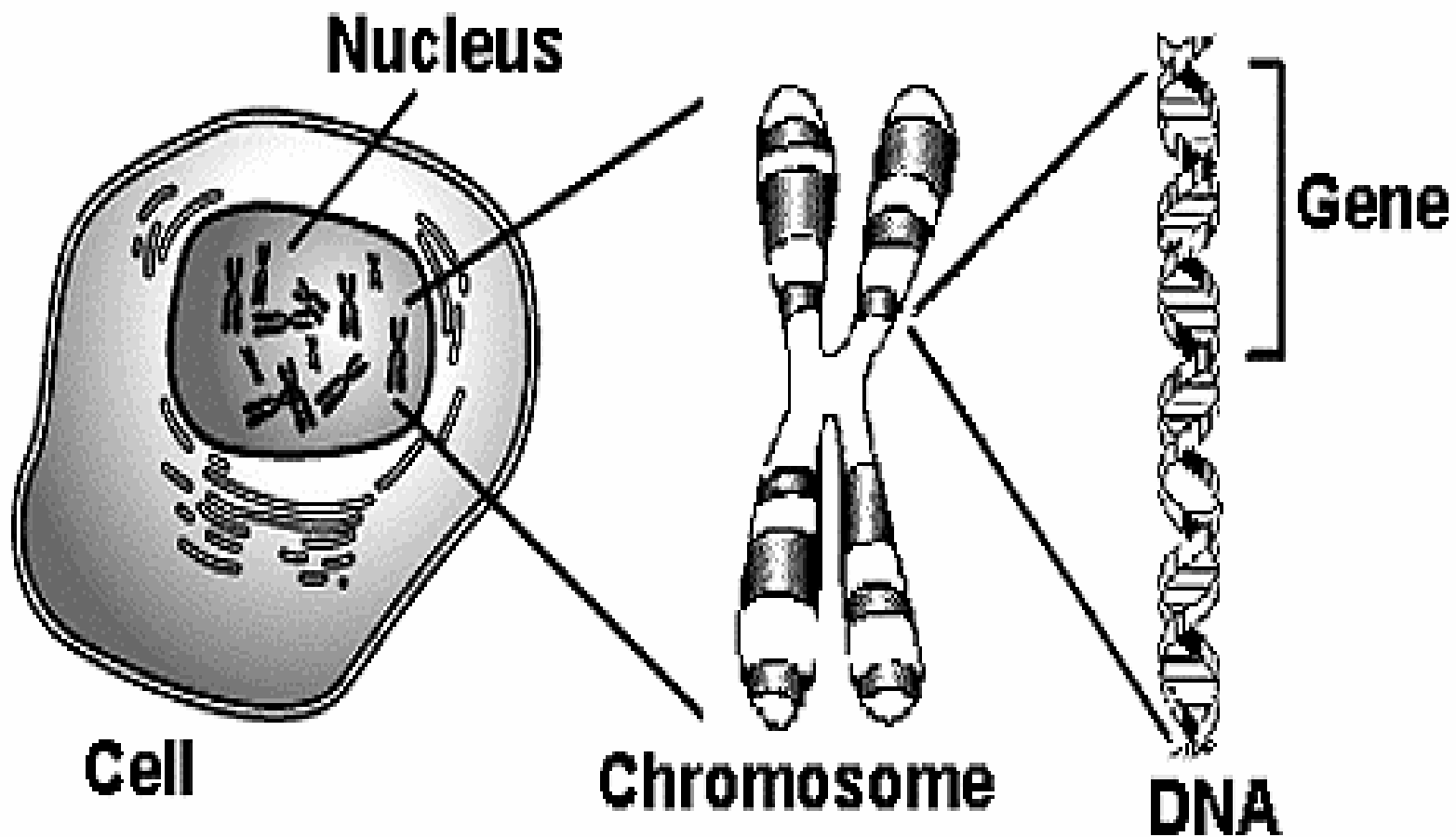
Cytokinesis



<https://www.youtube.com/watch?v=L0k-enzoeOM>





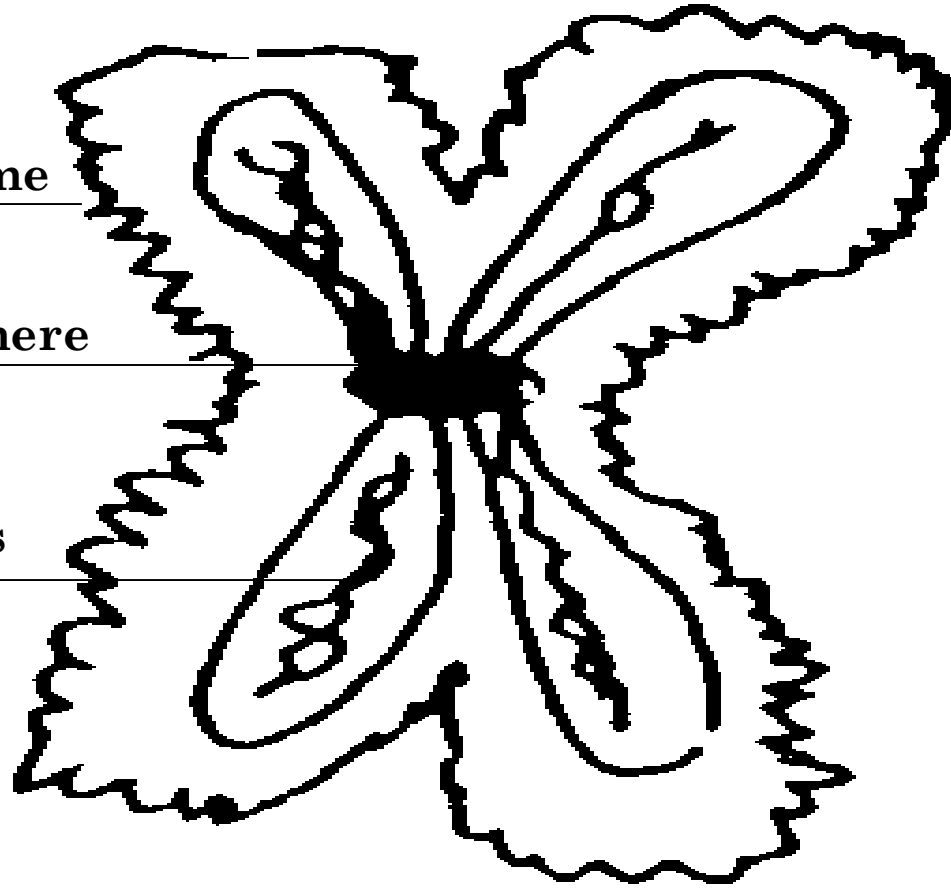


THE STRUCTURE OF CHROMOSOMES

Chromosome

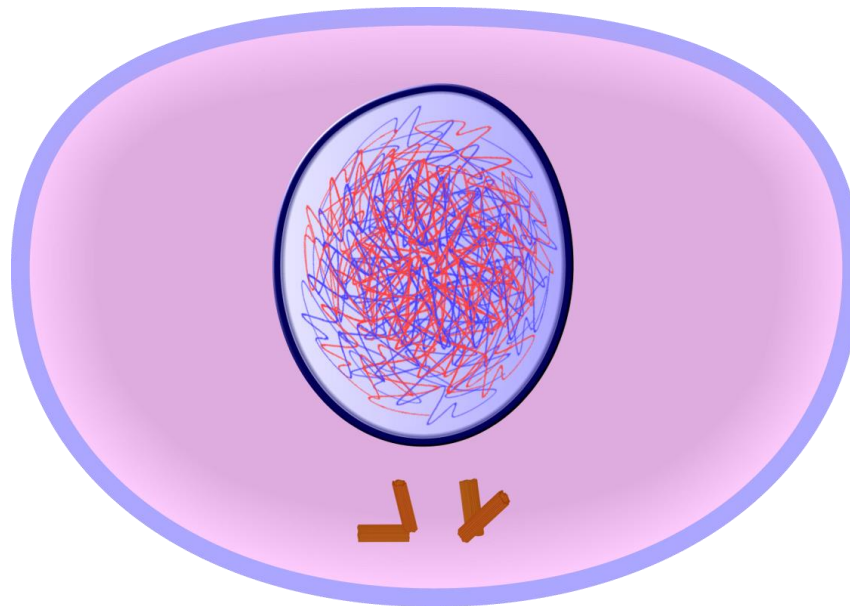
centromere

Sister chromatids



INTERPHASE

- DNA gets replicated



MITOSIS - WHERE THE ACTION HAPPENS!

P-Prophase

M- Metaphase

A- Anaphase

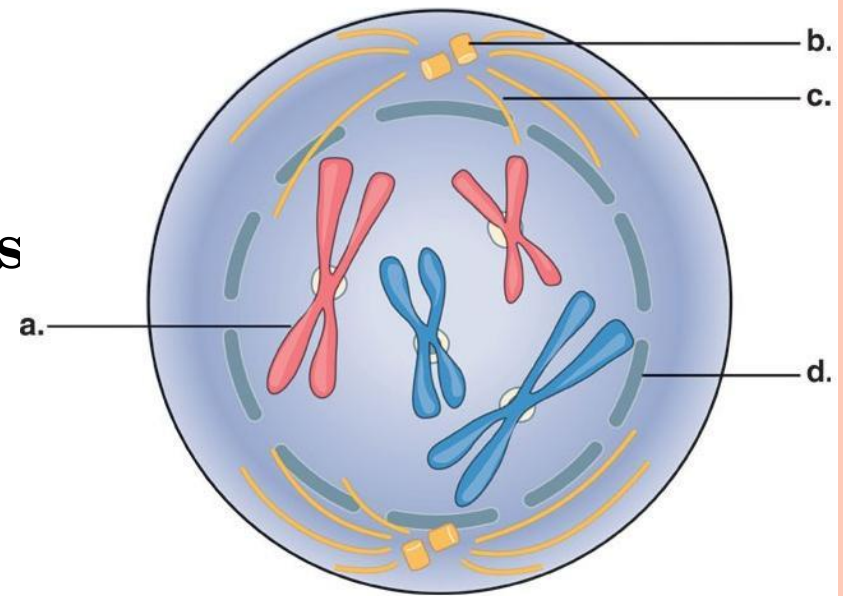
T- Telophase



MITOSIS

STEP 1 - Prophase

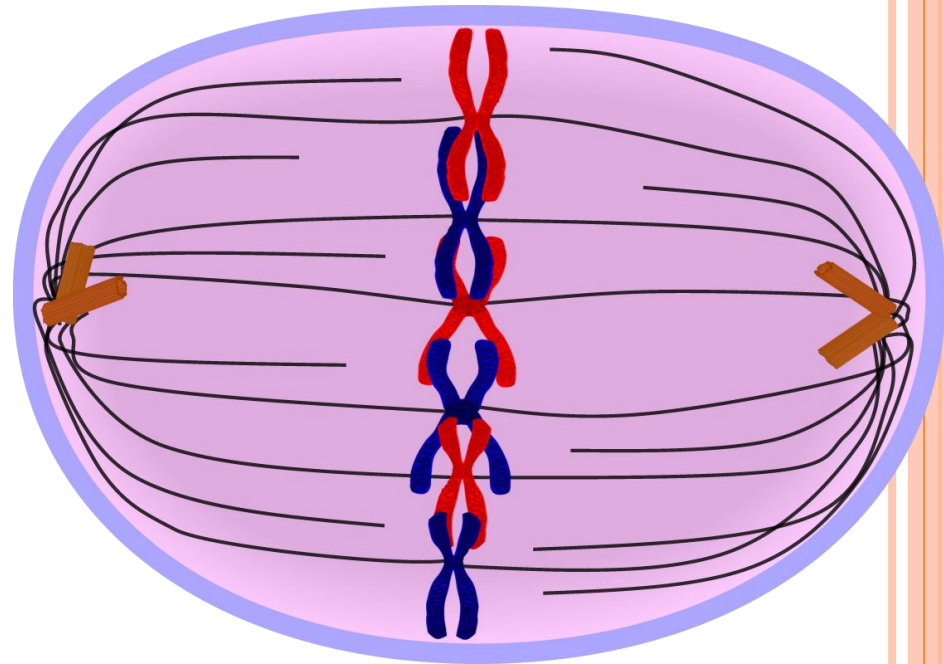
- Duplicated strands of **sister chromatids** pair up and condense into **chromosomes**
- Strands are connected in middle by a **centromere**
- **Centrioles** move to either end
- Nucleus and Nucleolus dissolve
- “**P**”rophase=“**P**”repare



MITOSIS

STEP 2 - Metaphase

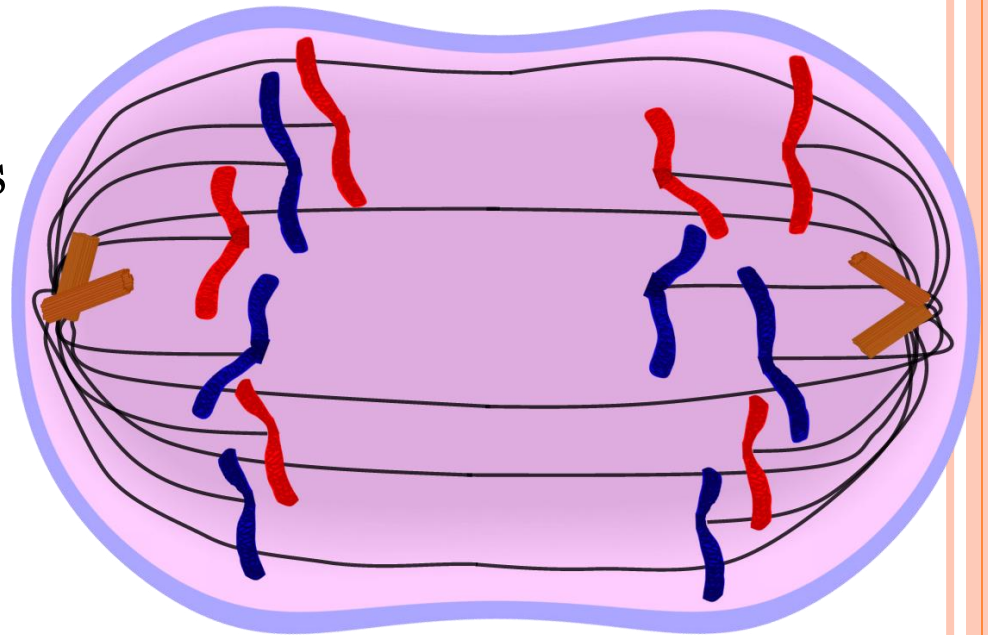
- Chromosomes line up in the middle of the cell in a straight line
- “M”etaphase=”M”iddle
- Chromosomes attach to **spindle fibers** at **centromere**



MITOSIS

STEP 3 - Anaphase

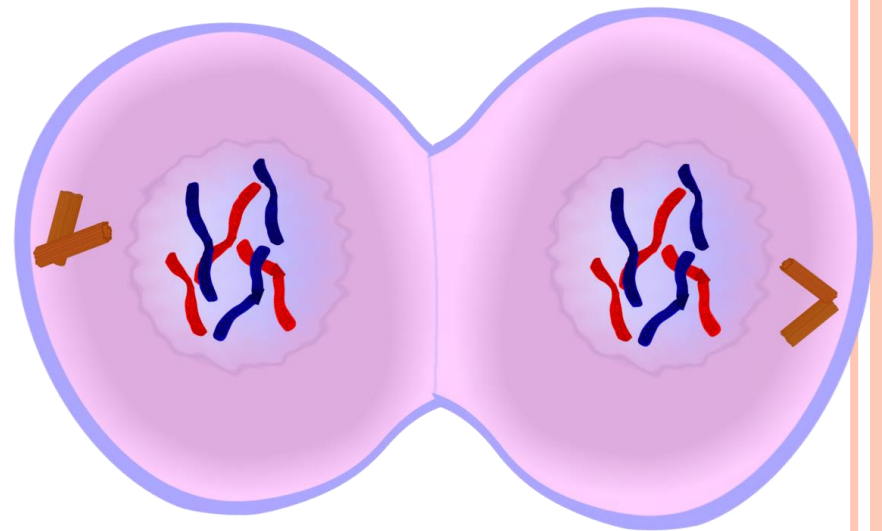
- Chromatids are pulled to opposite sides of the cell by spindle fibers
- “A”naphase=“A”part
- Become **Daughter Chromosomes**



MITOSIS

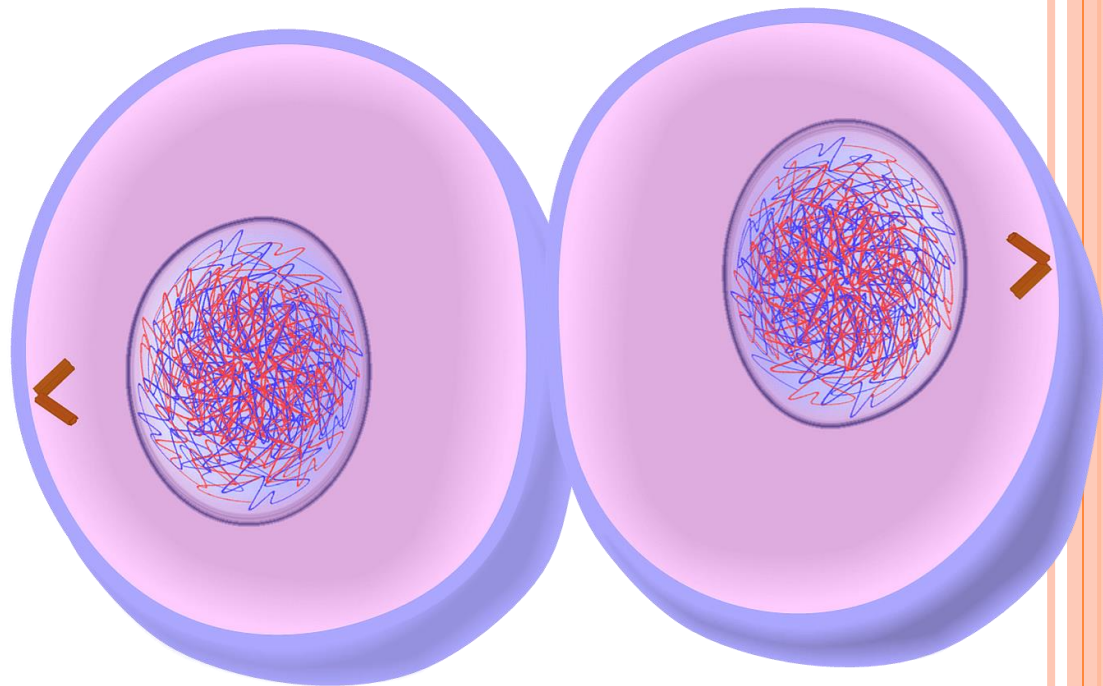
STEP 4 - Telophase

- Nucleus reforms around daughter chromosomes
- “T”elophase=“T”wo nuclei
- Daughter chromosomes uncoil to form chromatin



CYTOKINESIS

The cytoplasm
divides forming 2
daughter cells



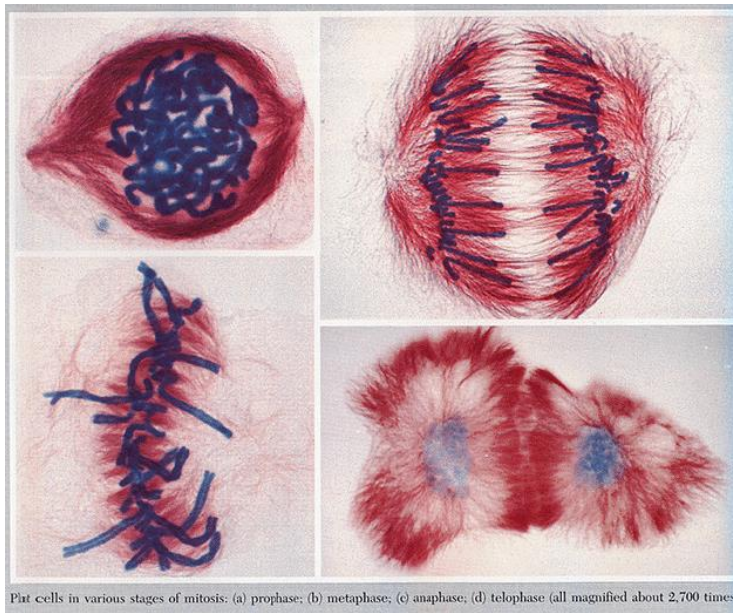
Each daughter cell is an exact copy of
original



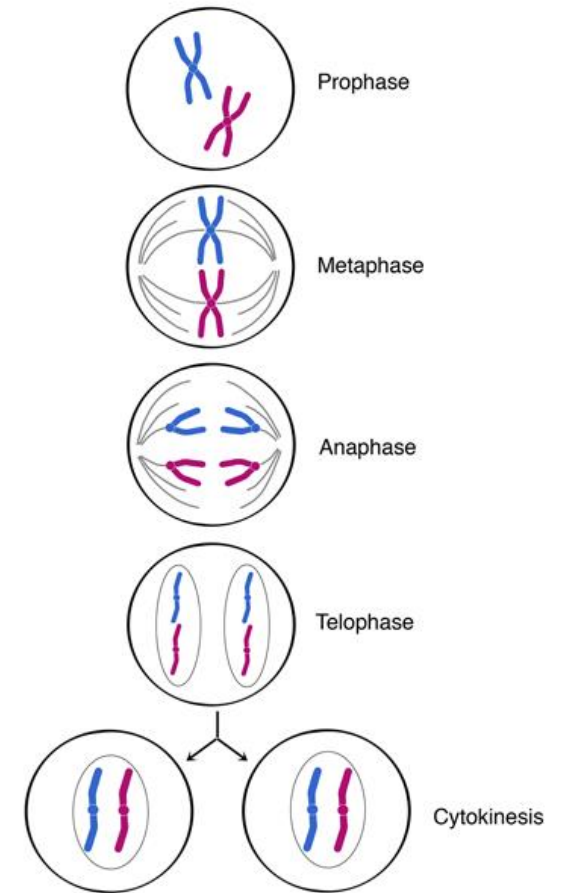
STAGES OF MITOSIS

Amimation:

<https://www.youtube.com/watch?v=NR0mdDJMHIQ>

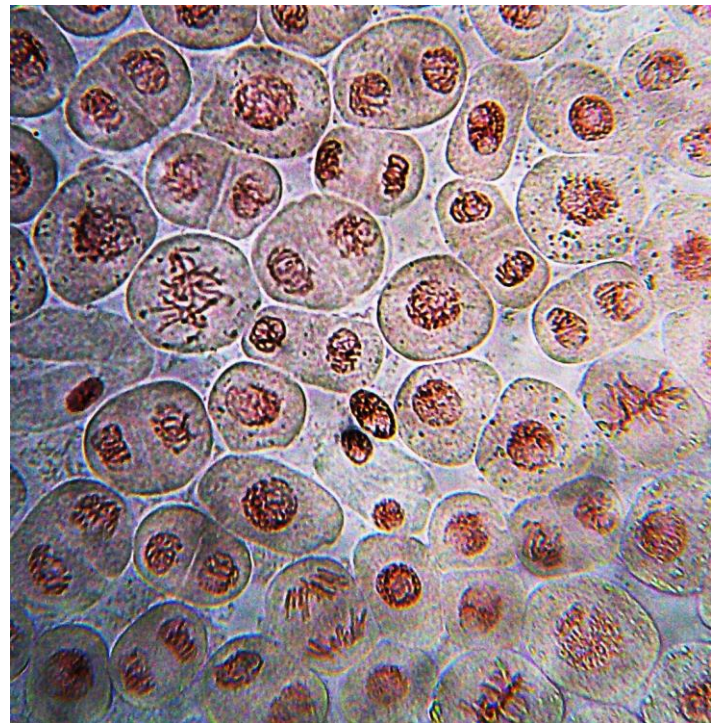
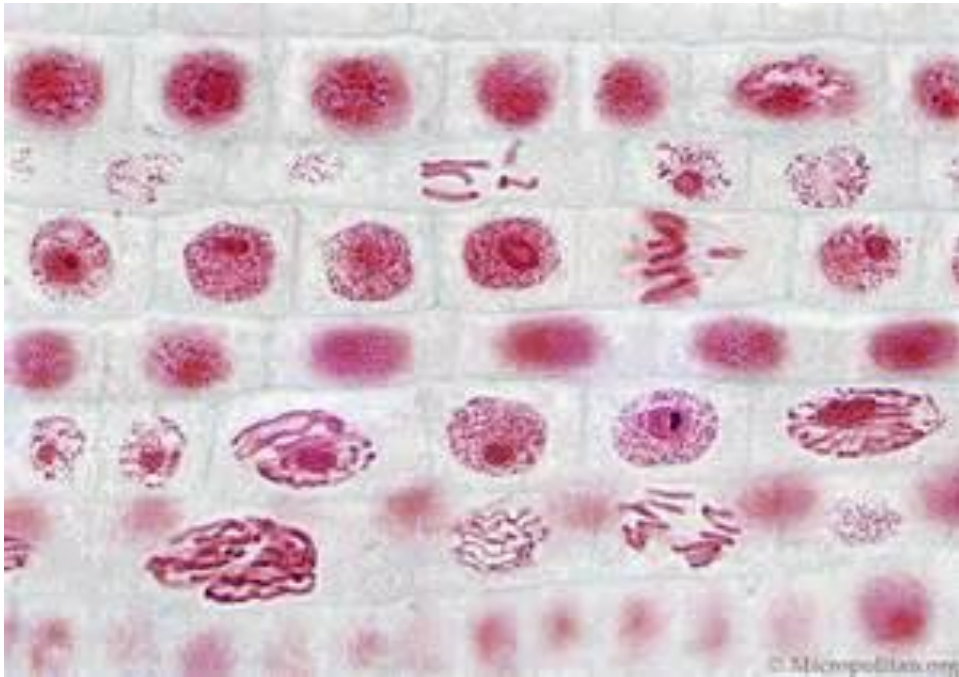


Plant cells in various stages of mitosis: (a) prophase; (b) metaphase; (c) anaphase; (d) telophase (all magnified about 2,700 times).



Practice:

http://www.biology.arizona.edu/cell_bio/activities/cell_cycle/cell_cycle.html



MITOSIS

○ Where???

- Occurs in somatic (body) cells

○ WHY??

- Produces cells for repair, maintenance, growth, asexual reproduction

○ Final Product??

- 2 identical cells



○ Why is there another type of cell division (meiosis)?

○ meiosis intro



TERMS TO KNOW (PAGE122-125)

- Diploid
- Haploid
- Gametes
- Fertilization
- Zygote
- Crossing over



DIPLOID VERSUS HAPLOID

- Diploid cells have two of each kind of chromosome. $2n$
- Haploid cells have only one of each kind of chromosome. N

Haploid (n)

- One copy of genetic material subdivided into chromosomes
- Eg. *Gametes* (sperm and eggs)



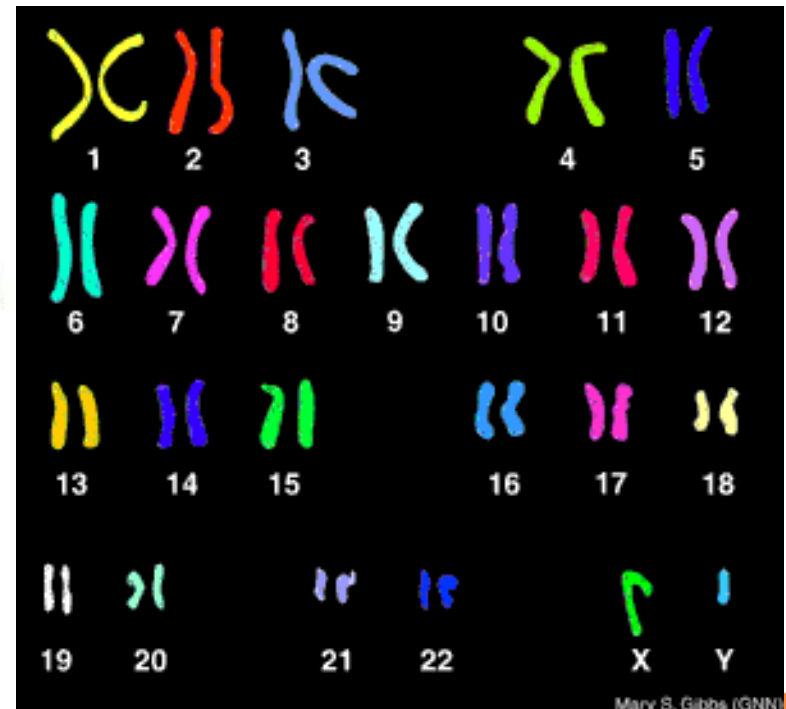
Three *nonhomologous* chromosomes

Diploid ($2n$)

- Two copies of genetic material subdivided into chromosomes
- *Somatic cells*



Three pairs of *homologous* chromosomes



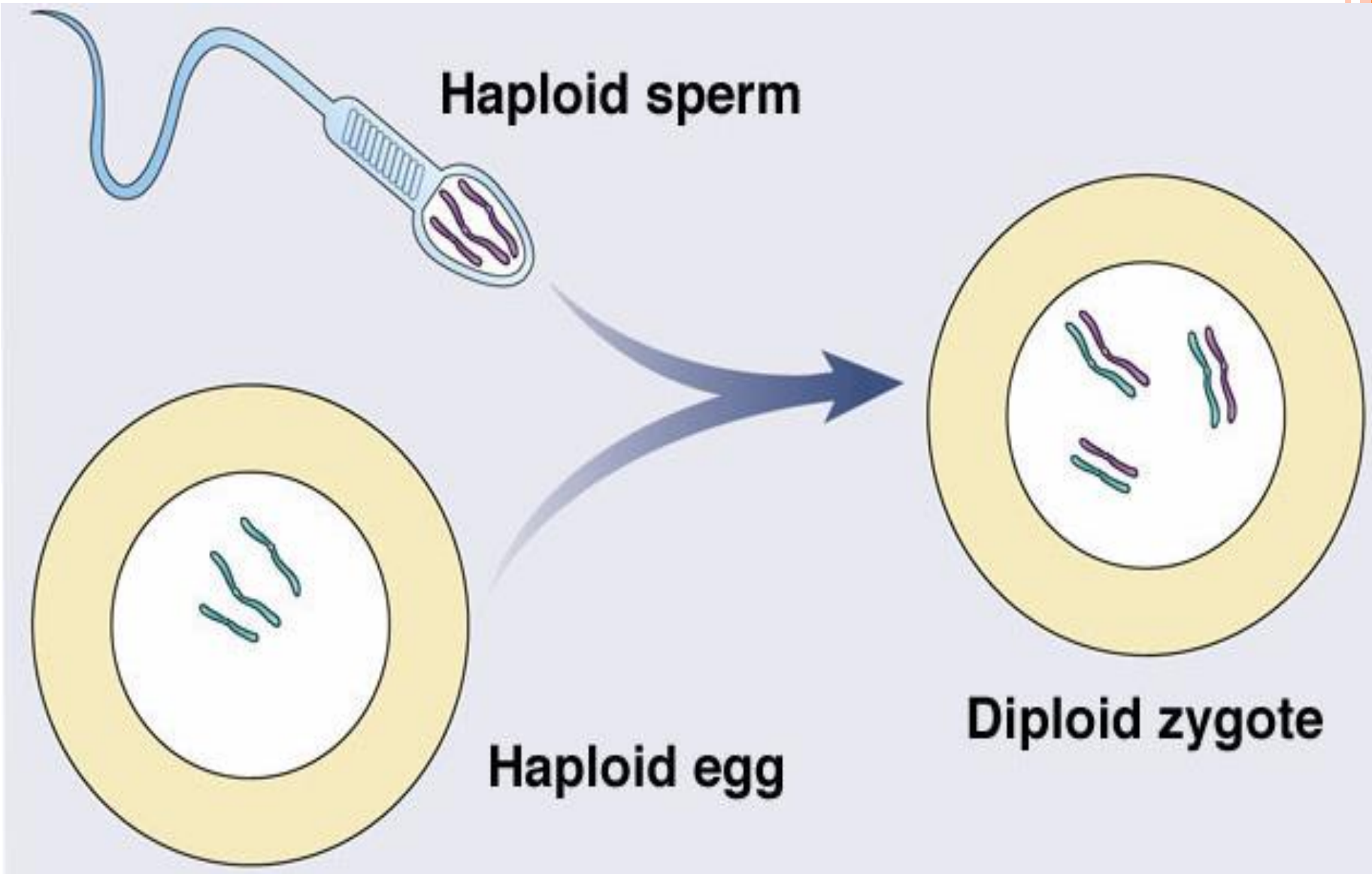
Mary S. Gibbs (GNN)

NUMBER OF CHROMOSOMES IN COMMON ORGANISMS

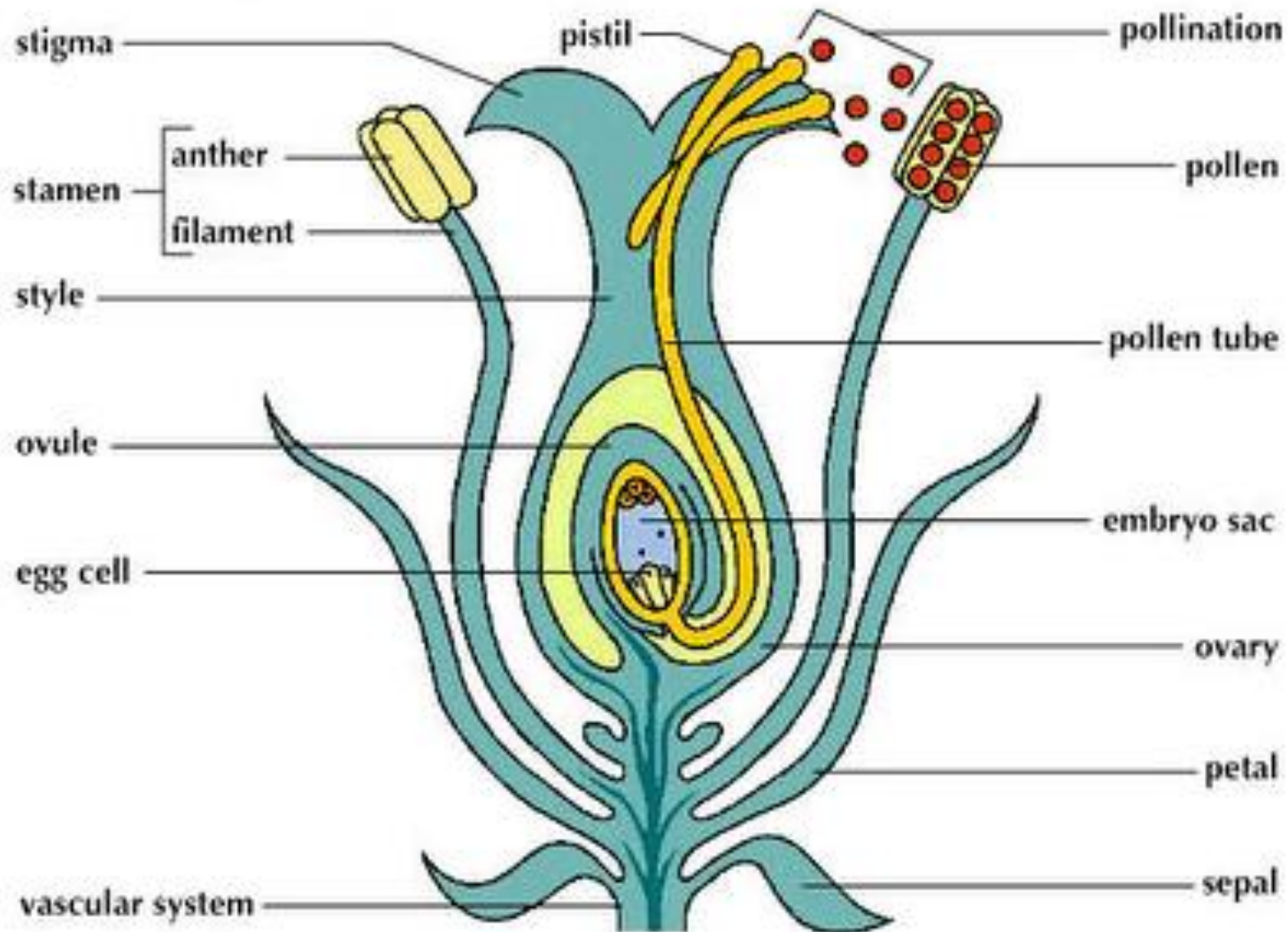
Organism	Body Cell (2n) Diploid	Gamete (n) haploid
Fruit Fly	8	4
Garden Pea		7
Corn	20	
Leopard Frog		13
Apple	34	
Human		23
Chimpanzee	48	
Dog		39
Adder's tounge Fern	1260	



"Putting It All Together" - Fertilization



How Fertilization Takes Place



WHY DON'T SIBLINGS LOOK EXACTLY ALIKE IF THEY HAVE THE SAME PARENTS?



THE PROCESS OF MEIOSIS

- Meiosis is divided into two phases:
 - Meiosis I and Meiosis II

Interphase



MEIOSIS I

Prophase I

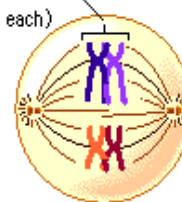
Synapsis and crossing over occur.



Tetrad (paired homologous chromosomes with two chromatids each)

Metaphase I

Tetrads line up on the metaphase plate.



Anaphase I

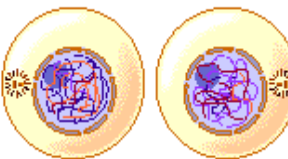
Homologous pairs separate.



Telophase I



Cytokinesis I



To Prophase II

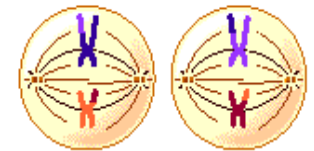
MEIOSIS II

Prophase II



Metaphase II

Chromosomes line up on the metaphase plate.



Anaphase II

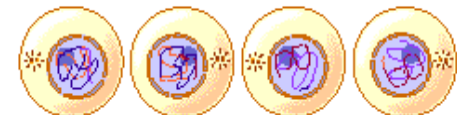
Sister chromatids separate.



Telophase II

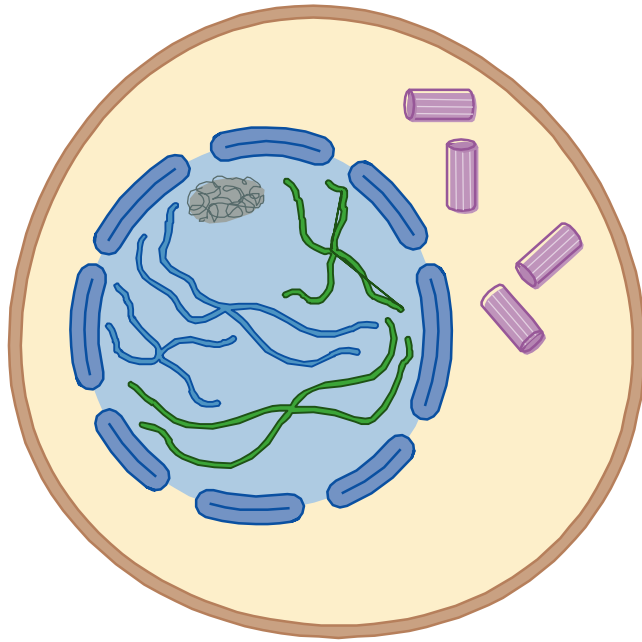


Cytokinesis II



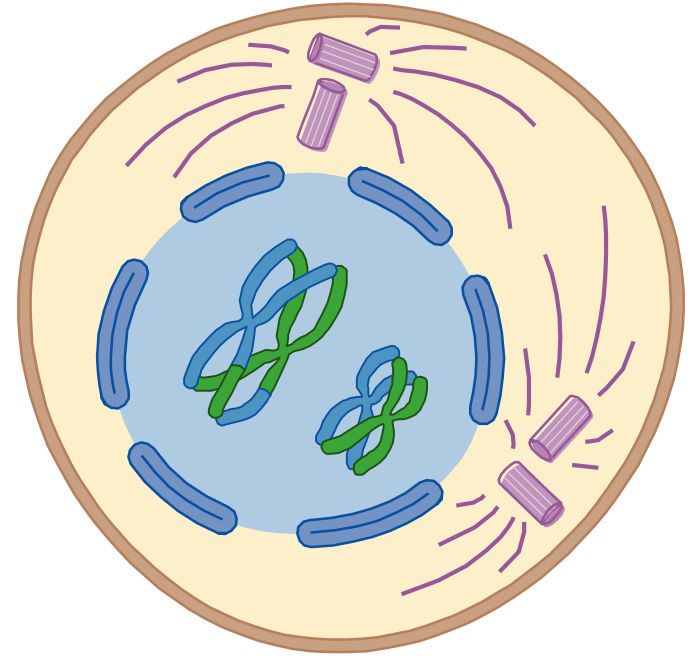
4 haploid daughter cells are formed, each having only one chromosome of each homologous pair.

PROPHASE I



Early prophase

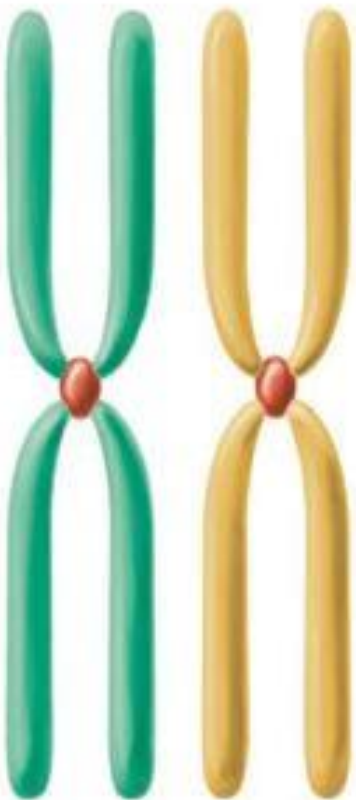
Chromatids pair.
Crossing over occurs.



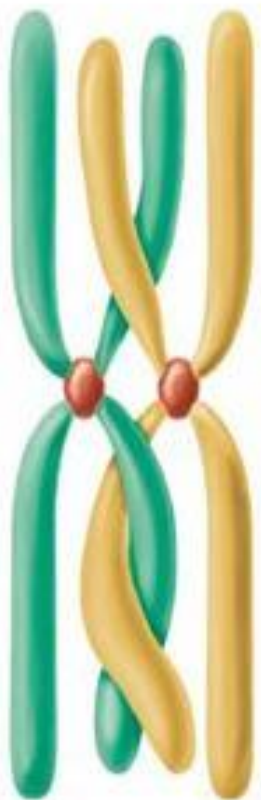
Late prophase

Chromosomes condense.
Spindle forms.
Nuclear envelope fragments. ●

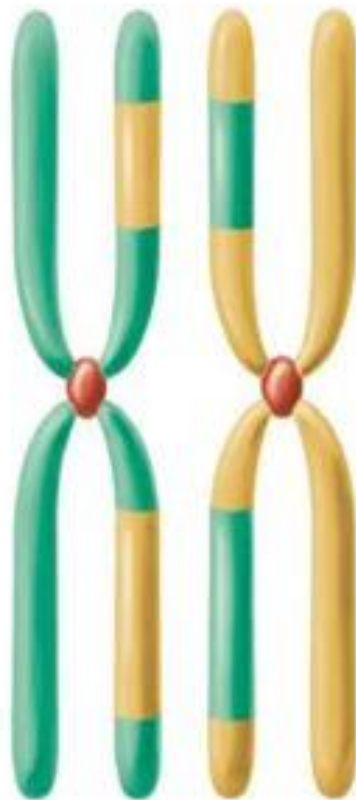
CROSSING OVER IN MEIOSIS I



homologous chromosome pair



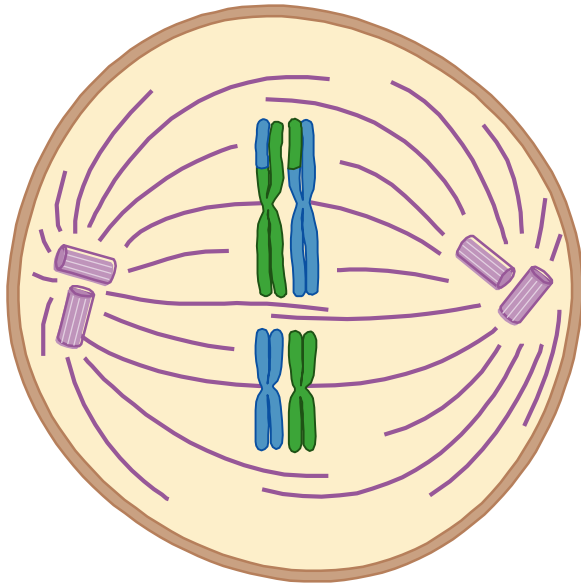
As the chromosomes move closer together, synapsis occurs.



Chromatids break, and genetic information is exchanged.



METAPHASE I



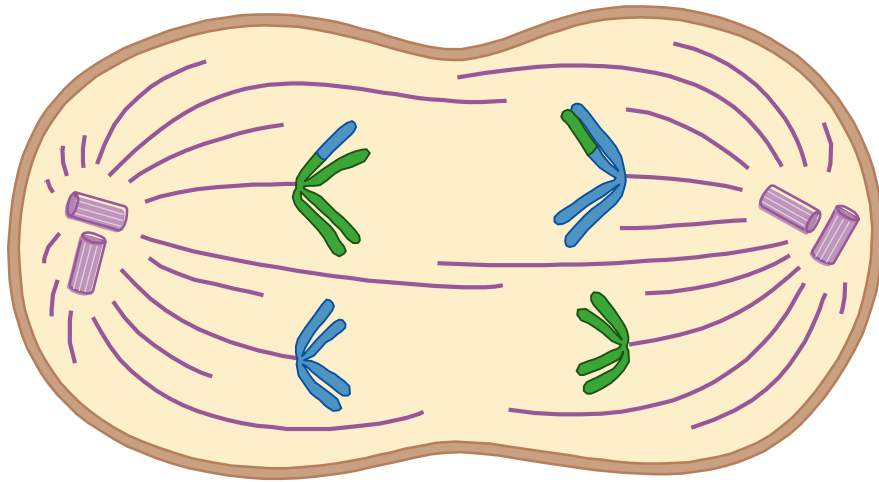
Chromatid pairs align
along the equator of the cell.



ANAPHASE I

Chromosomes separate and move to opposite poles.

Sister chromatids remain attached at their centromeres.

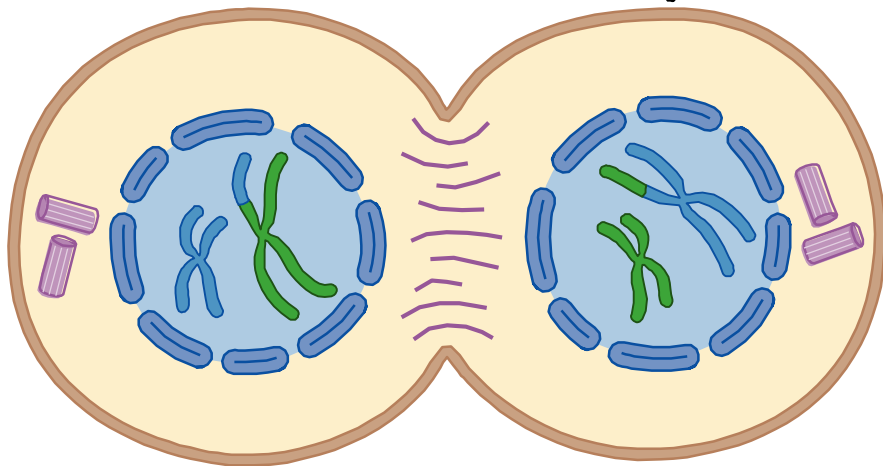


TELOPHASE I

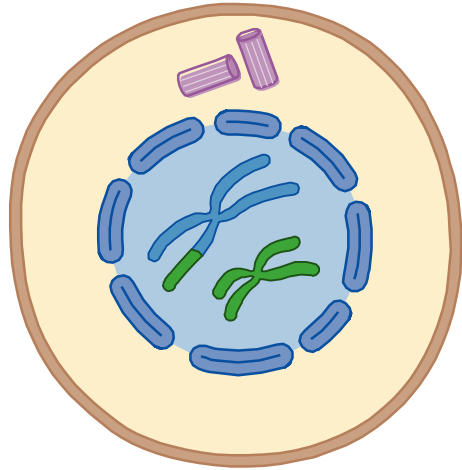
Nuclear envelopes reassemble.

Spindle disappears.

Cytokinesis divides cell into two.

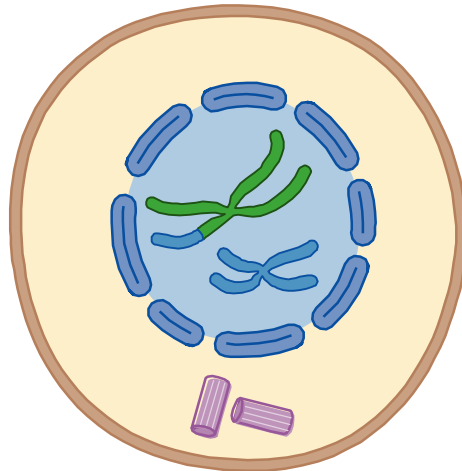


PROPHASE II

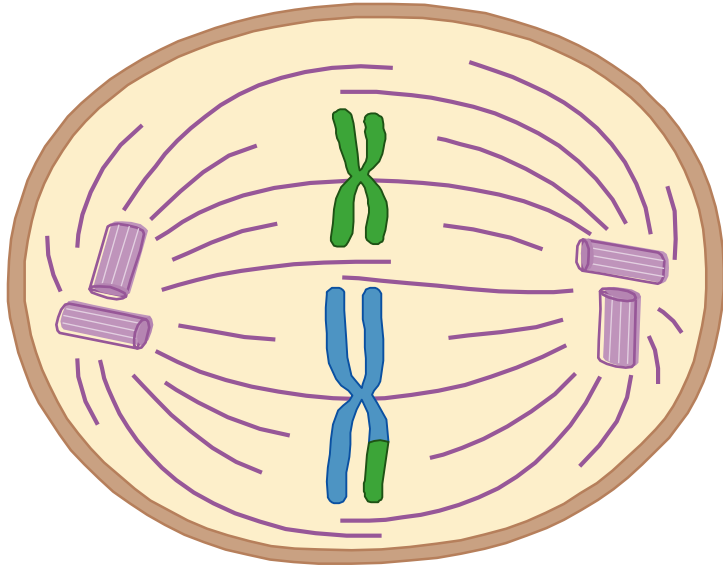


Nuclear envelope fragments.

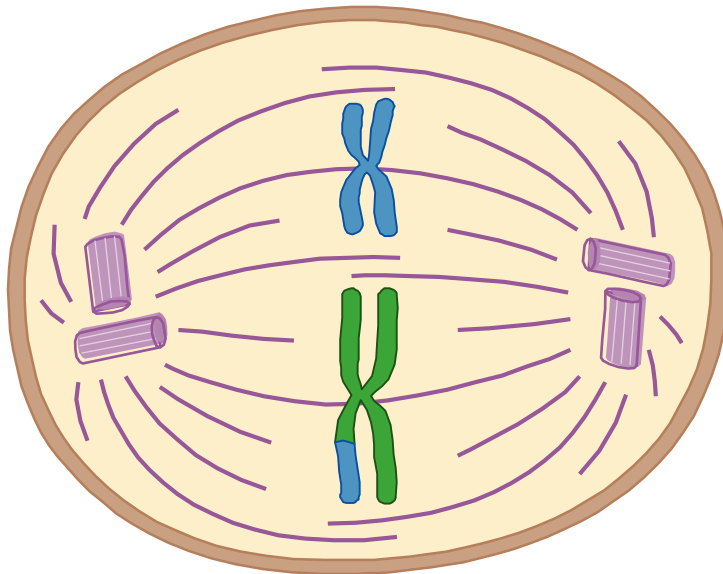
Spindle forms.



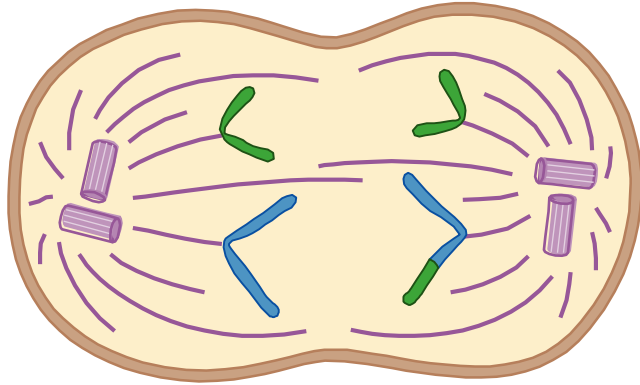
METAPHASE II



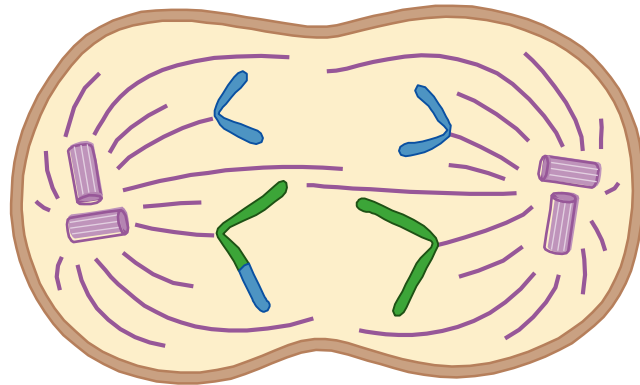
Chromosomes align
along equator of cell.

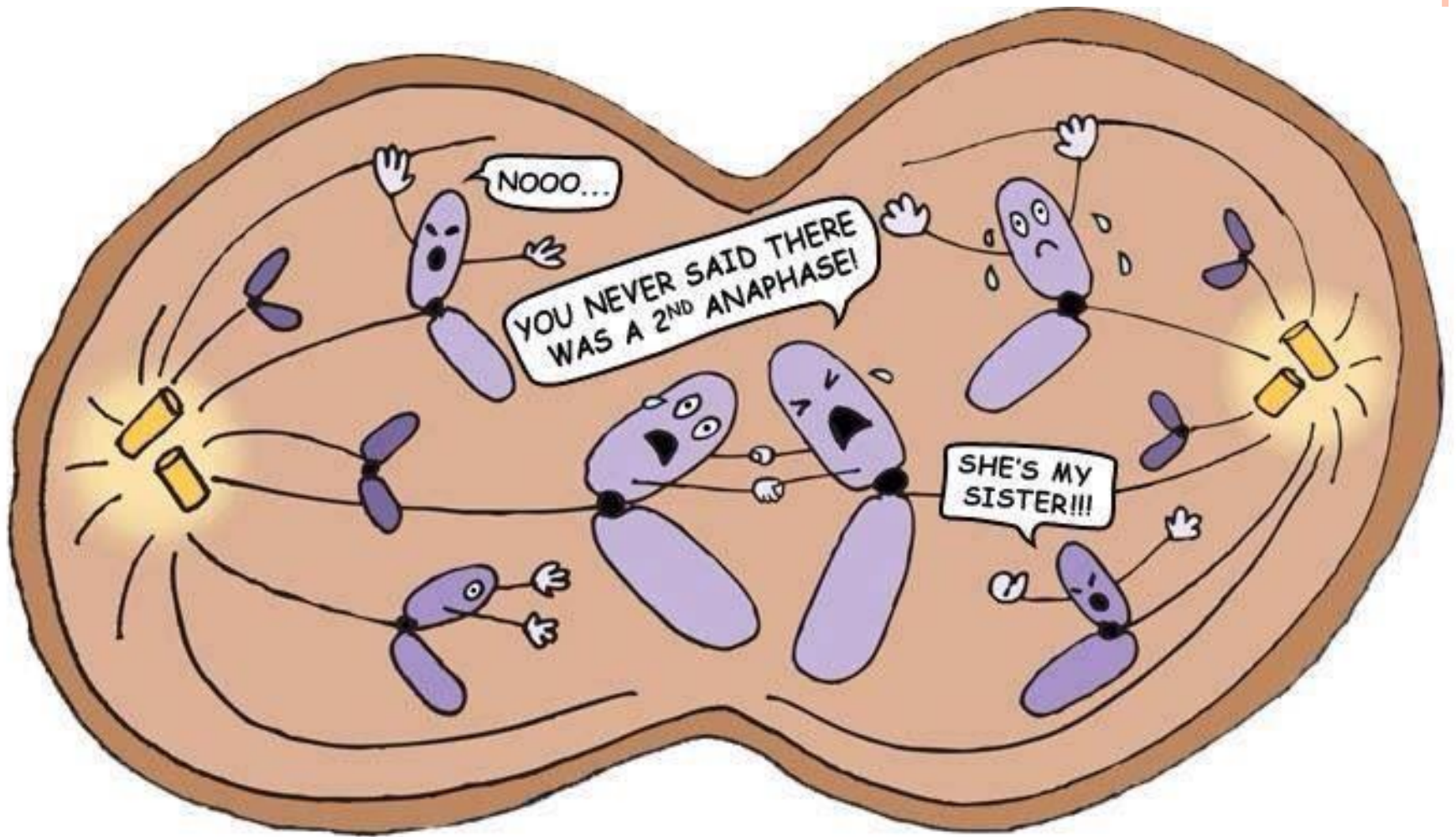


ANAPHASE II

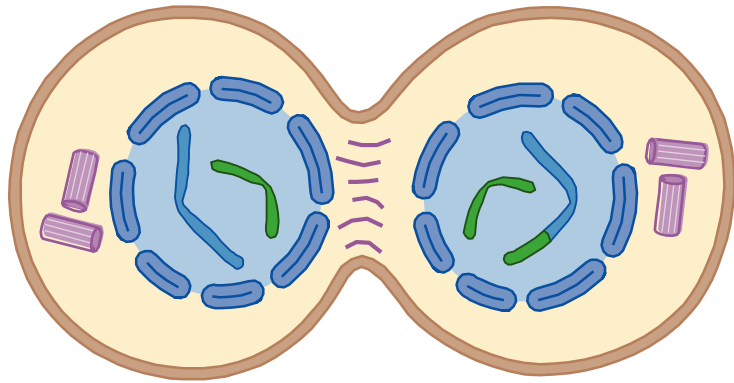


Sister chromatids separate and move to opposite poles.





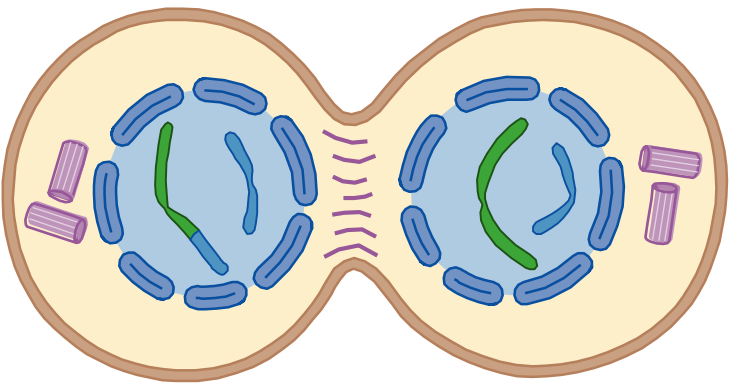
TELOPHASE II



Nuclear envelope assembles.

Chromosomes unravel.

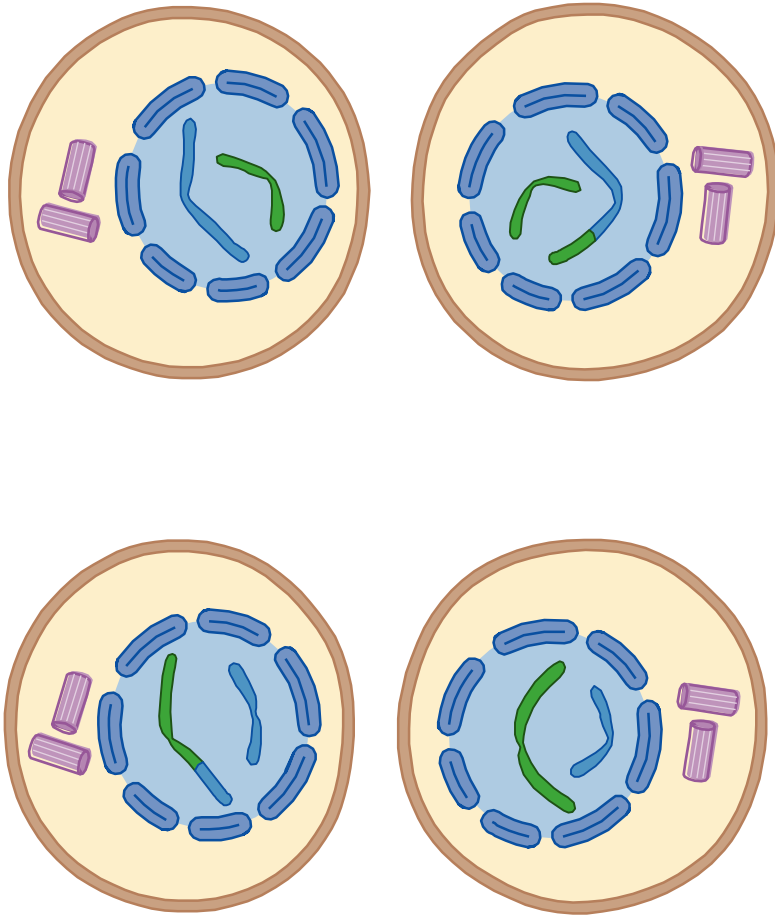
Spindle disappears.



Cytokinesis divides cell into two.



RESULTS OF MEIOSIS



- ◇ Four haploid cells
- ◇ One copy of each chromosome
- ◇ animation



MEIOSIS


- Each phase (**PMAT**) happens **twice**
- End with **4 daughter cells**
- Each cell in the end (**gamete**) only has **half** the number of chromosomes (**Haploid**)



MEIOSIS

- **Where???**
 - **Only in REPRODUCTIVE ORGANS**
 - **Testes, Ovaries, flower (plants)**
- **WHY??**
 - **Produces cells required for sexual reproduction**
 - **Gametes cells**
 - **Sperm, egg**
 - **Pollen, Ovule**
- **Final Product??**
 - **4 Haploid cells that are different**



	Mitosis	Meiosis
Number of divisions	1	2
Number of daughter cells	2	4
Genetically identical?	Yes	No
Chromosome #	Same as parent DIPLOID	Half of parent HAPLOID
Where	Somatic cells (Body Cells)	Reproductive Organs
When	Throughout life	At sexual maturity 
Function	Growth and repair	Sexual reproduction

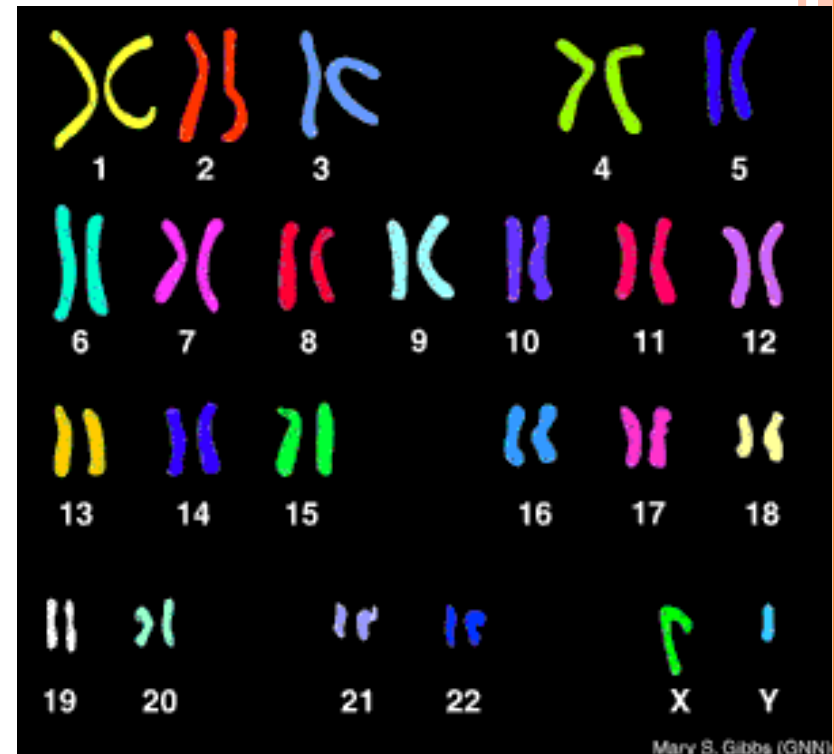
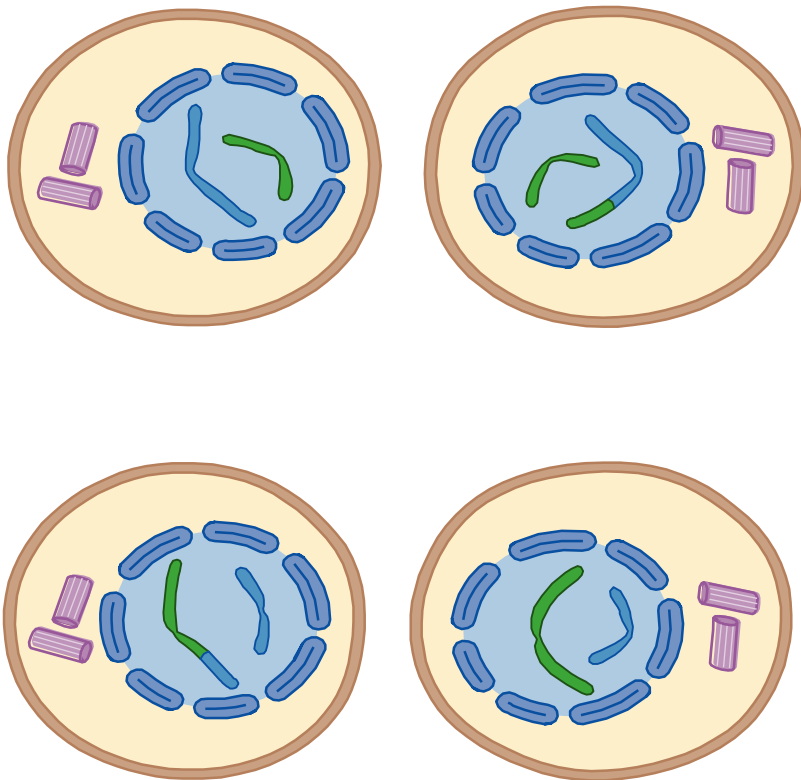
BACK TO OUR ORIGINAL QUESTION...

Why don't siblings look exactly alike if they have the same parents?

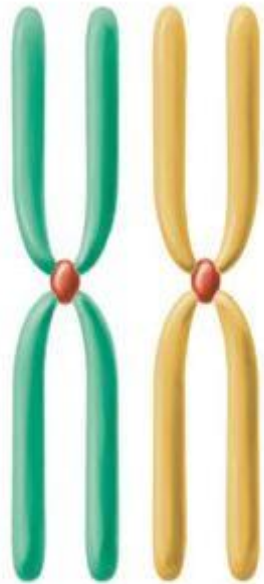


MEIOSIS CREATES GENETIC VARIATION

- **Crossing Over** - creates new genetic combinations
- **Random Alignment** - Chromosomes line up **randomly** during Metaphase I so all chromosomes from mother or father **do not** end up in same gamete



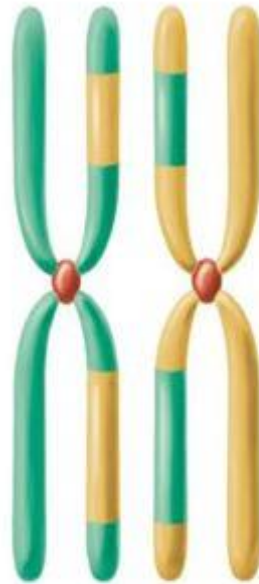
CROSSING OVER IN MEIOSIS



homologous chromosome pair

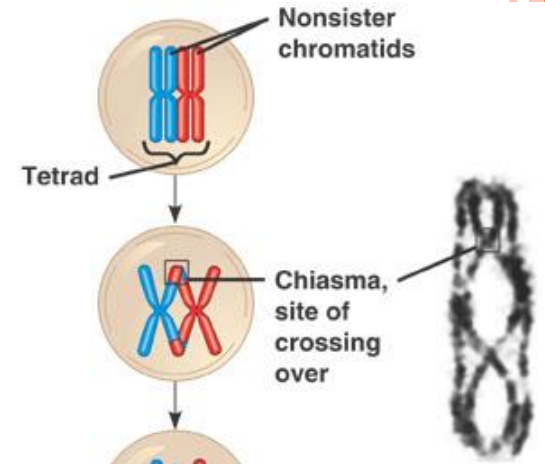


As the chromosomes move closer together, synapsis occurs.

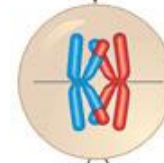


Chromatids break, and genetic information is exchanged.

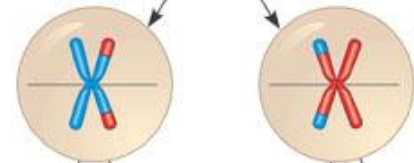
Prophase I of meiosis



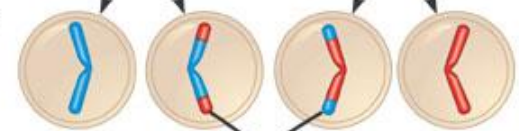
Metaphase I



Metaphase II



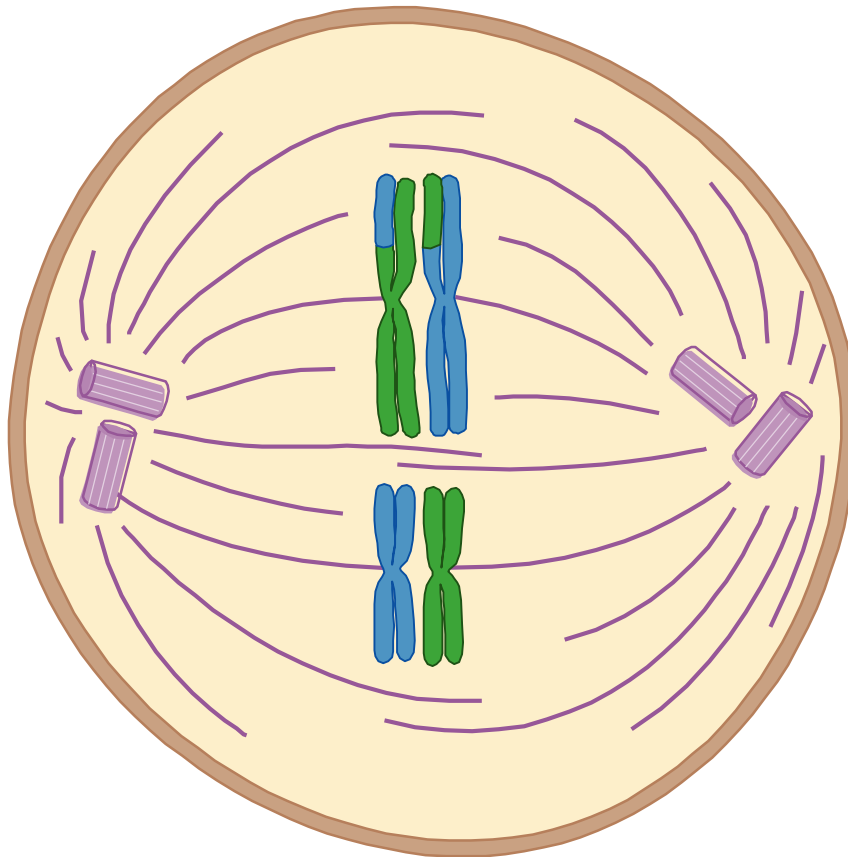
Daughter cells



Recombinant chromosomes

MEIOSIS CREATES GENETIC VARIATION

- **Crossing Over** - creates new genetic combinations
- **Random Alignment** - Chromosomes line up **randomly** during Metaphase I so all chromosomes from mother or father **do not** end up in same gamete



BW #17

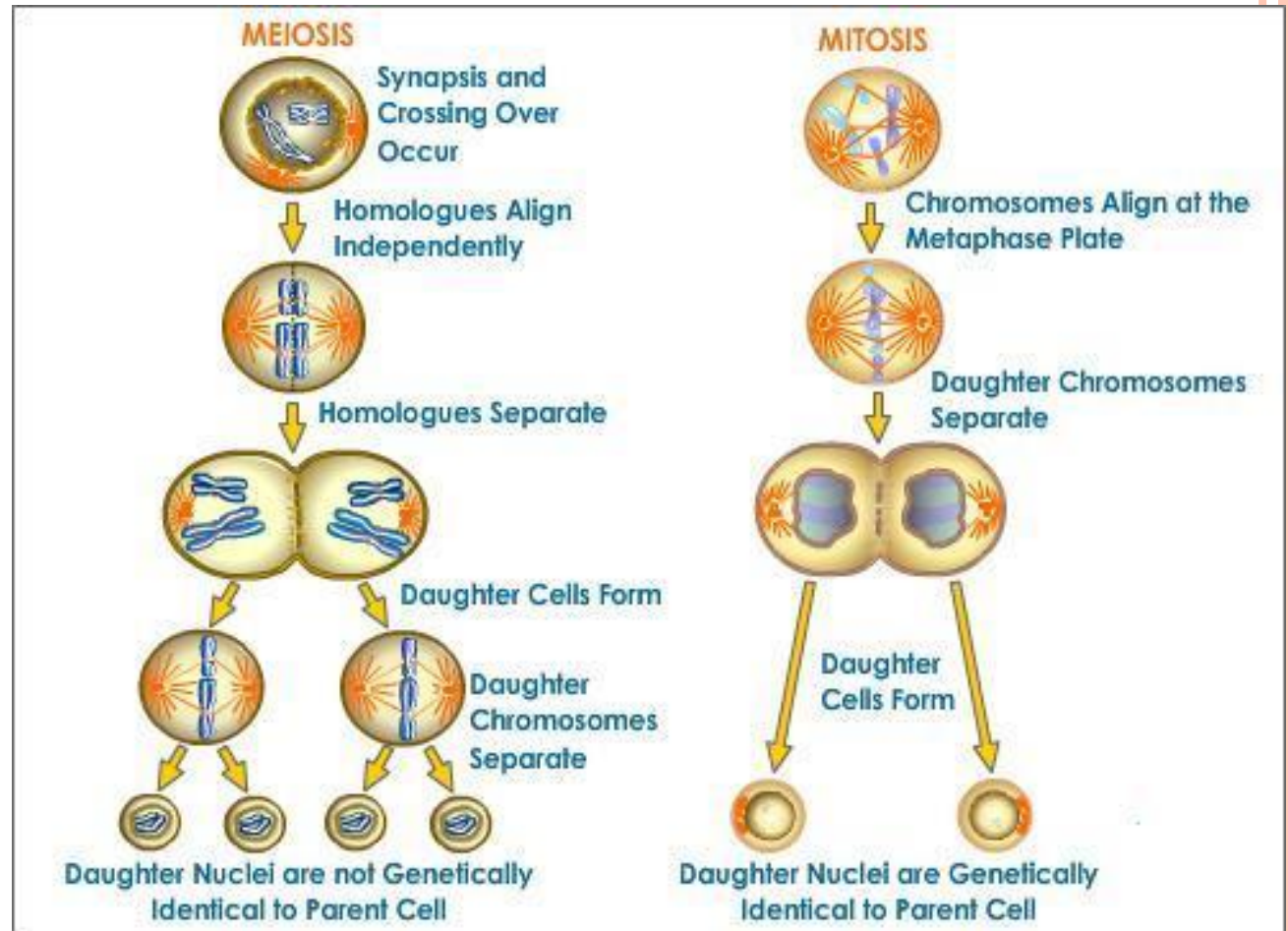
- Name one difference in mitosis and meiosis.

Mitosis
vs.
Meiosis
Animation



MITOSIS VS. MEIOSIS

Mitosis
vs.
Meiosis
Animation 1
Animation 2



Crash Course: Meiosis and Sexual Reproduction

<https://www.youtube.com/watch?v=qCLmR9-YY7o>



CANCER

<https://www.youtube.com/watch?v=lpAa4TWjHQ4>

