Ngalan (name in Cebuano - Philippines) _____

Cell Structure and Function Unit Opener

Textbook chapter reference →

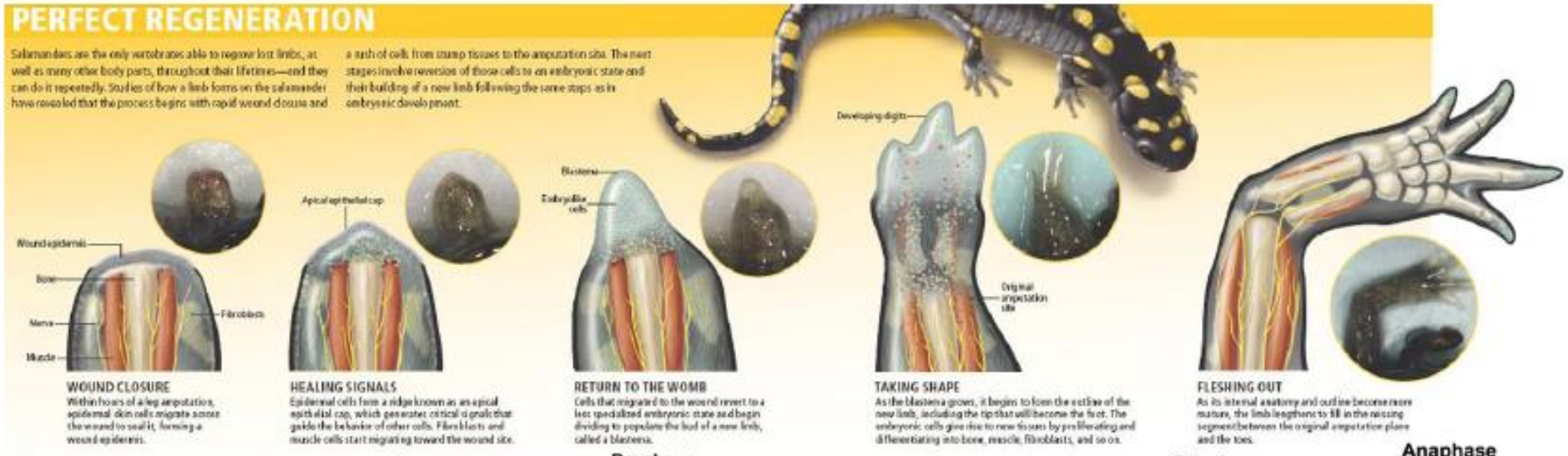
	Limb Regeneration Video 1	Normal vs. Cancer Cells Video 2 Normal vs. Cancer Cells Video 3
What do you see going on here?		
Have you seen anything like this before? When does it seem to occur?		
What might be going on here that cannot be seen?		
Why might this phenomenon occur? Can you bring in any of last unit's material?		
What are some things we are not sure about? Questions?		

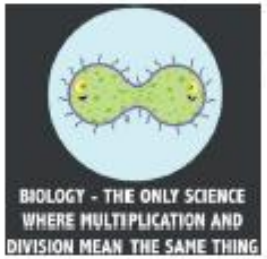
In the videos, this term was used repeatedly, define the word prefix (re-) and root (generate).

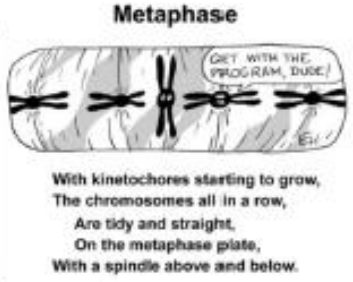
Re generate

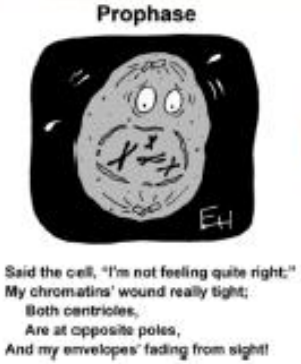
How might these two phenomena be connected?

What are some of the different tissues in the body that could be affected by either phenomenon? Describe how.







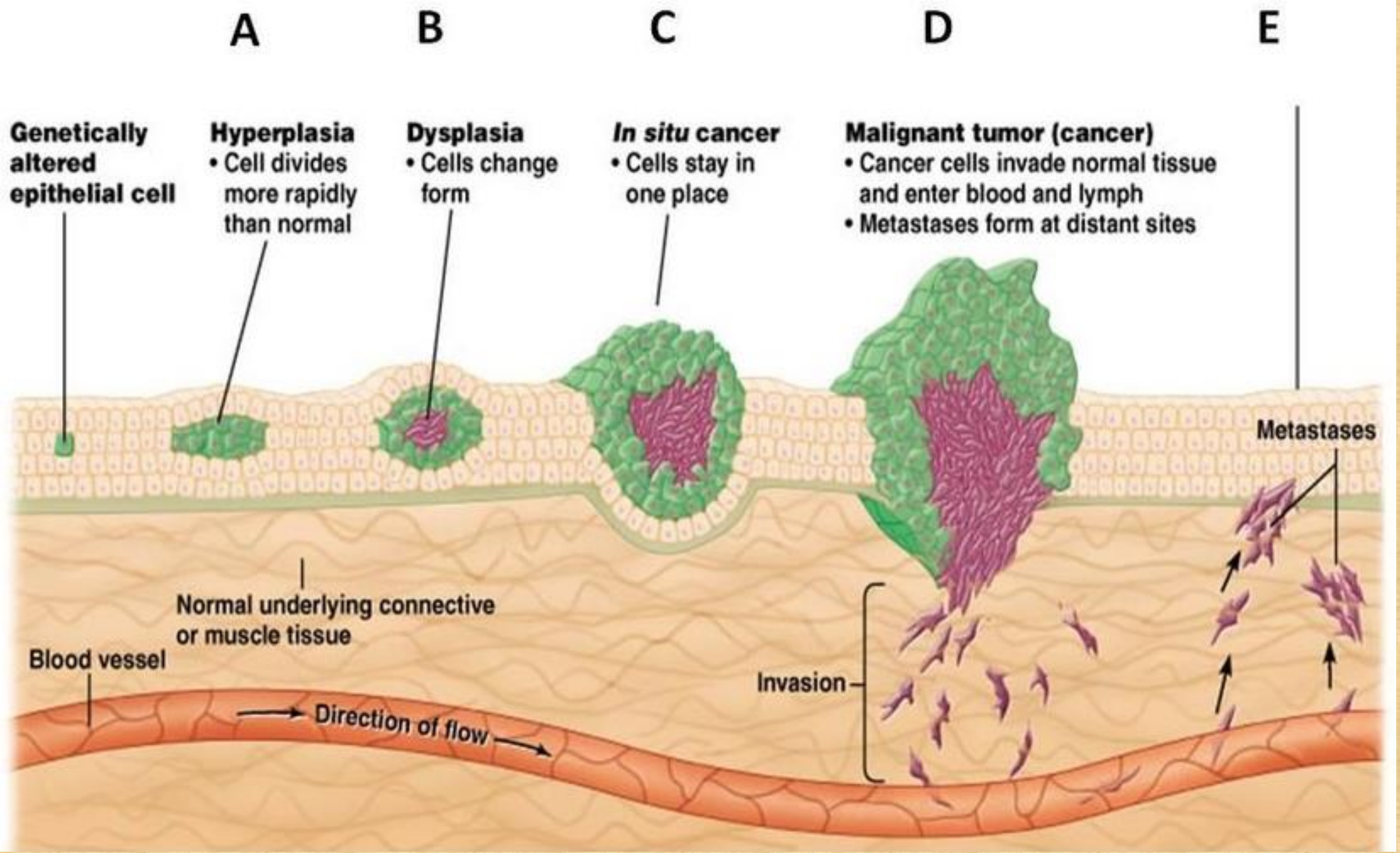


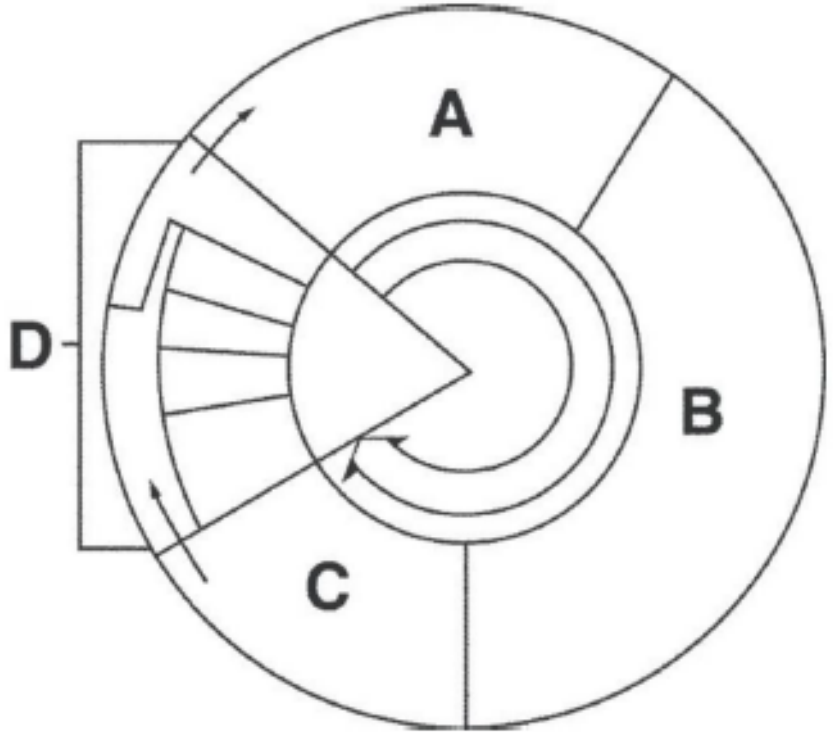
Cell Cycle and Checkpoints Notes

What do you know about cancer?	
Major observations about the phenomena? What inferences can you draw?	What questions do you still have?
How are the two phenomena related?	

Why do cells reproduce?	1. 2. 3.
Why do all cells reproduce?	Cells that reproduce frequently: Cells that reproduce rarely, if at all:

The Cell Cycle	Stage	Checkpoint
	Go	None
	G1	
	S	None
	G2	
	M-phase (mitotic phase)	
	Cytokinesis	None


A
B
C
D
E
Genetically altered epithelial cell
Hyperplasia
• Cell divides more rapidly than normal
Dysplasia
• Cells change form
In situ cancer
• Cells stay in one place
Malignant tumor (cancer)
• Cancer cells invade normal tissue and enter blood and lymph
• Metastases form at distant sites
Metastases
Normal underlying connective or muscle tissue
Blood vessel
Direction of flow
Invasion

Chromosomes, DNA, & Genes		
Single Chromosome Structure (draw & label)	Homologous Pair of Chromosomes (one from each parent – draw & label)	Copied homologous pair (draw & label)
Label parts of the cell cycle, including all phases. Add Go. Add all checkpoints.		

Name:_____ **Per:**_____ **Date:**_____

Cell Cycle for Dinner Activity

Learning Target: Students will be figuring out what proportion of cell cycle steps occur and what happens at each step.

Science and Engineering practices: Developing and using models, Using mathematics and Computational Thinking

Cross-Cutting Concepts: Patterns, Scale and Proportions

Materials: Ruler, Paper plate, Colored pencils, pipe cleaner chromosomes, beads and thread.

Your Task: Label and take notes on your model to help understand the importance of the cell cycle. Be sure to include on your model:

- Each phase of the cell cycle
- What happens at each stage (use slide show notes and class notes)
- Add Checkpoints symbolized by a stop sign
- Practice forming DNA, single and duplicated chromosomes as they would appear at each stage.

Cycle Cycle Phase		**Time**	**Ridges on plate (1 hour =3 ridges)**	**Proportion of time in each stage (%)**
Interphase	G1	11 hours	33	
	S	6 hours	18	
	G2	4 hours	12	
Mitosis	Prophase	1 hours	3	
	Metaphase	20 min	1	
	Anaphase	20 min	1	
	telophase	20 min	1	
Cytokinesis		1 hour	3	
Total Time		**24 hours**	**72**	**100%**

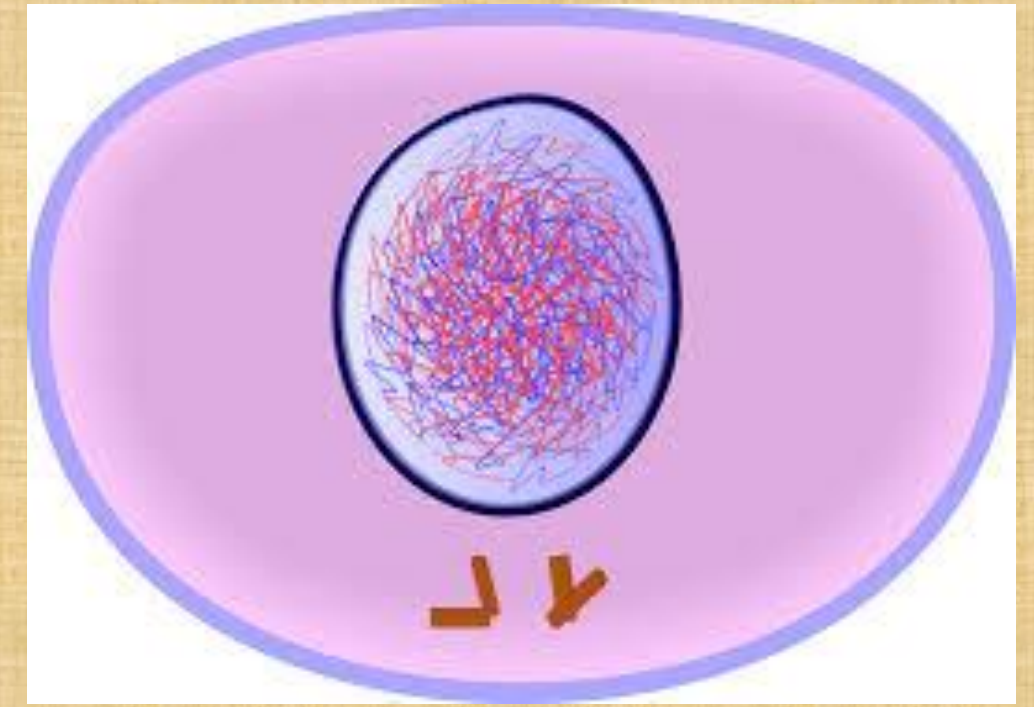
Content: Use the linked Slide show to take notes for each stage and to include on your model.

Cell Cycle

Interphase

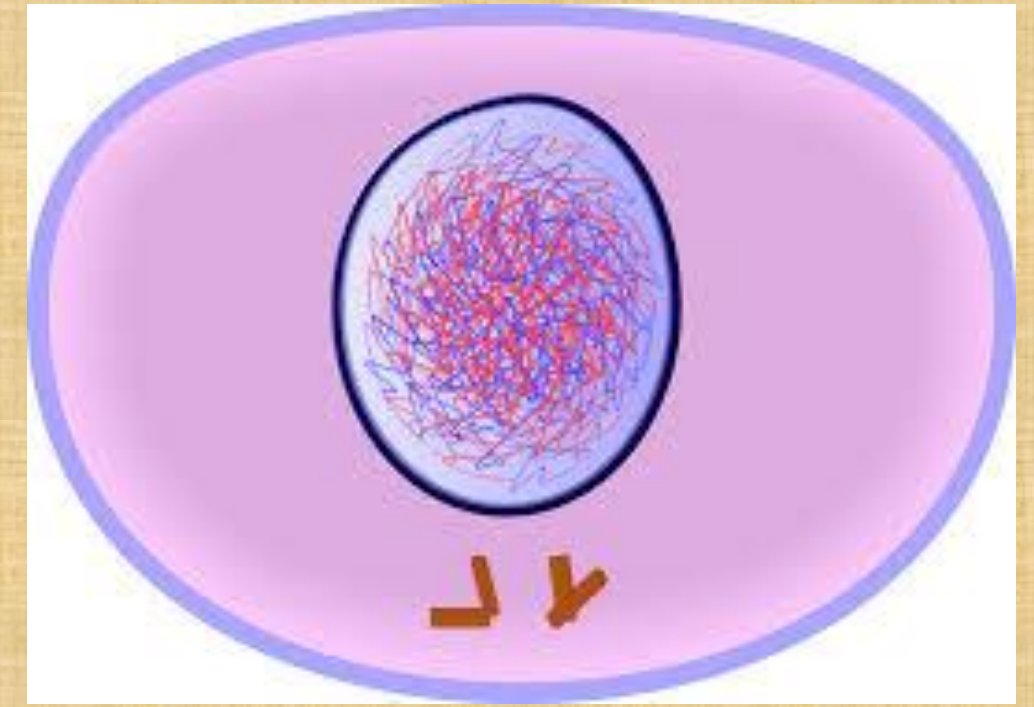
Contains 3 subphases

- **G1 (Gap 1):** growth and new organelles. At the end of G1 the cell is committed to go through reproduction.
- **S:** Synthesis or reproduction of DNA. There are now two copies of each strand.
- **G2 (Gap 2):** Preparation for Cell Division



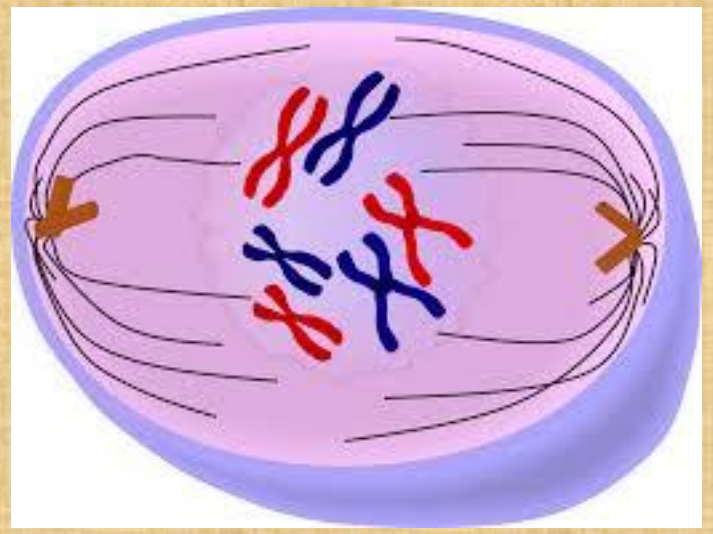
Phase G0

- Cells that are mature and will not reproduce again stay indefinitely in a phase called G-0.
- Usually cells that are in this phase cannot replace themselves once damaged.
- *Honors know the difference between senescent, quiescent and labile cells.



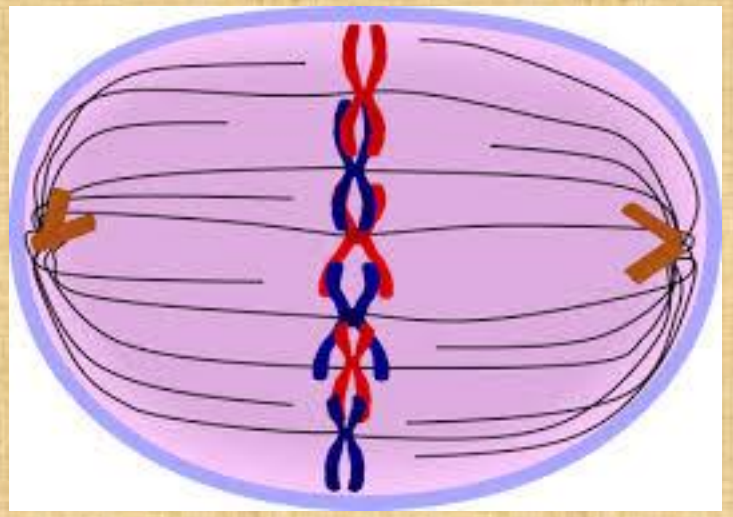
Prophase

- Nuclear membrane breaks down
- Spindle fibers become visible
- Duplicated chromosomes appear
- Centrioles visible



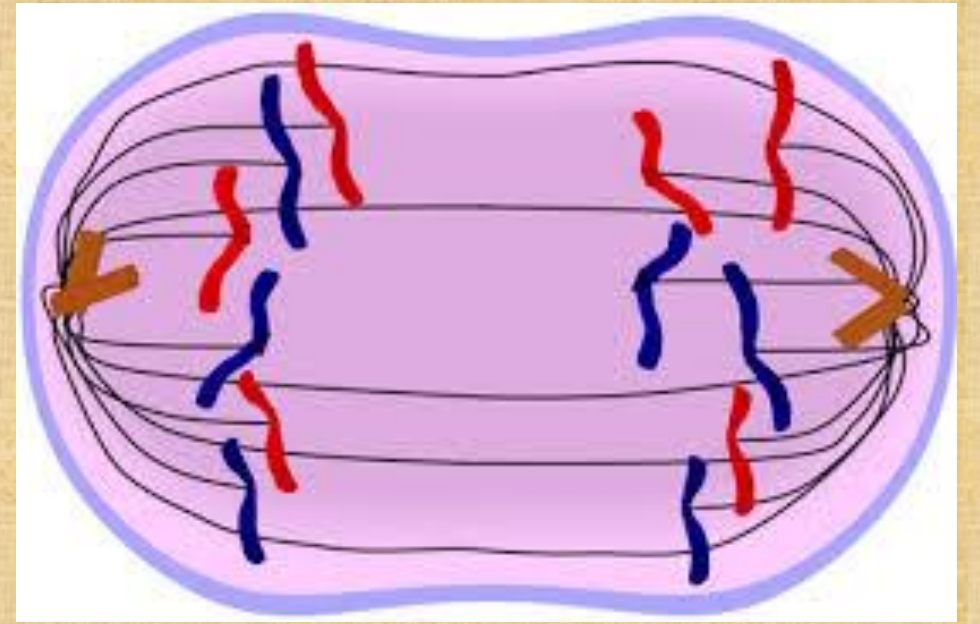
Metaphase

- Duplicated chromosomes line themselves along the middle or equator of the cell.
- Each centromere is attached to a spindle fiber.
- *Honors: the spindle fiber attached to the centromere are called kinetochore microtubules and spindle fibers that are not are called polar microtubules



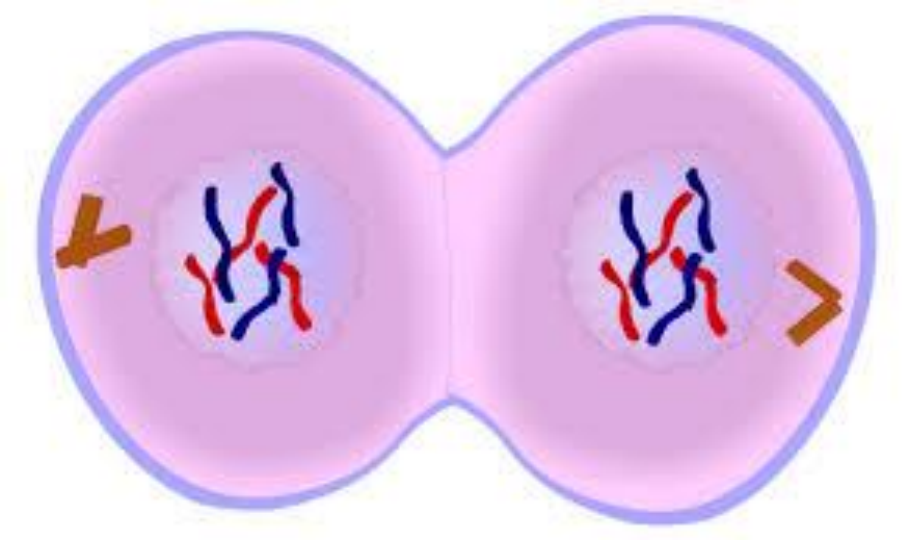
Anaphase

- Single chromosomes are pulled apart by spindle fibers
- Each chromosome has its own centromere.



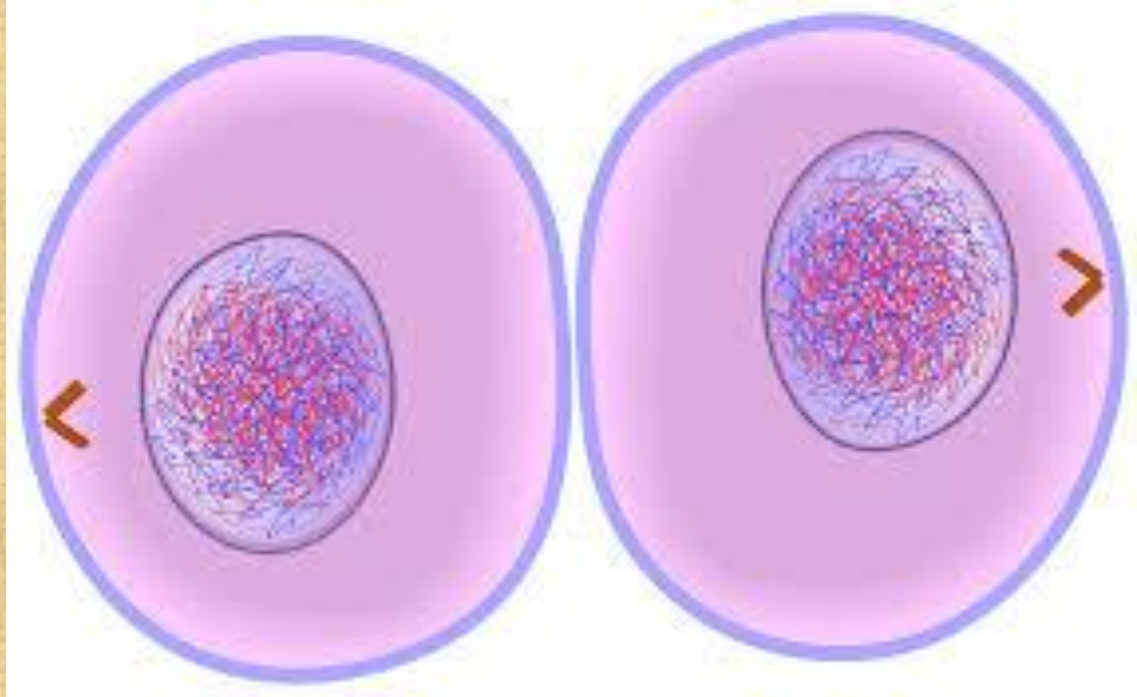
Telophase

- New nuclei form at each end of the cell.
- Spindle fibers and centrioles disappear.
- The cell membrane pinches in forming a cleavage furrow.
- *Honors a contractile ring made of actin and myosin constrict around the membrane forming the cleavage furrow.



Cytokinesis

- Cytoplasm divides forming two identical daughter cells.
- Plants form a cell plate that will eventually make a cell wall.

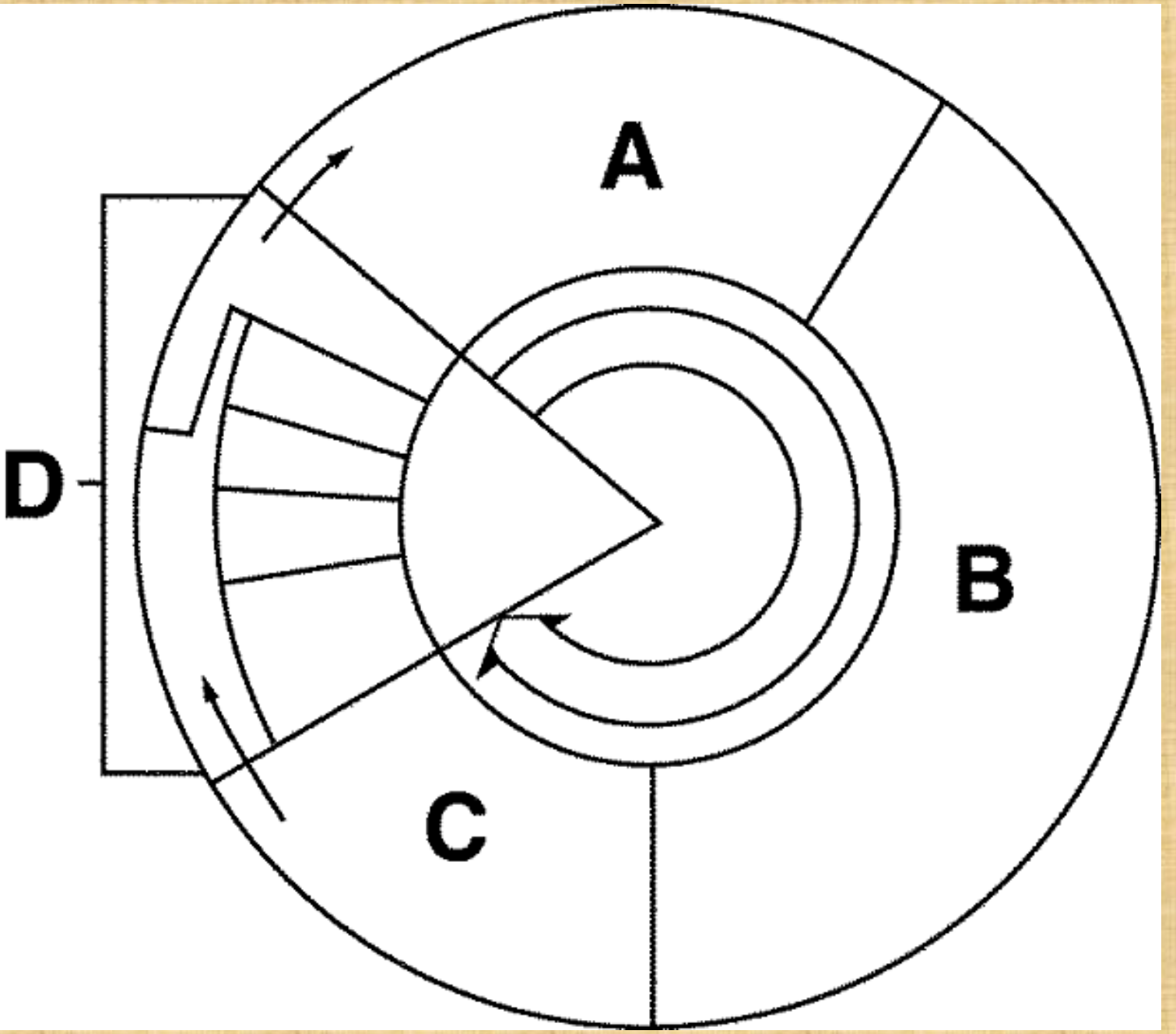


Checkpoints

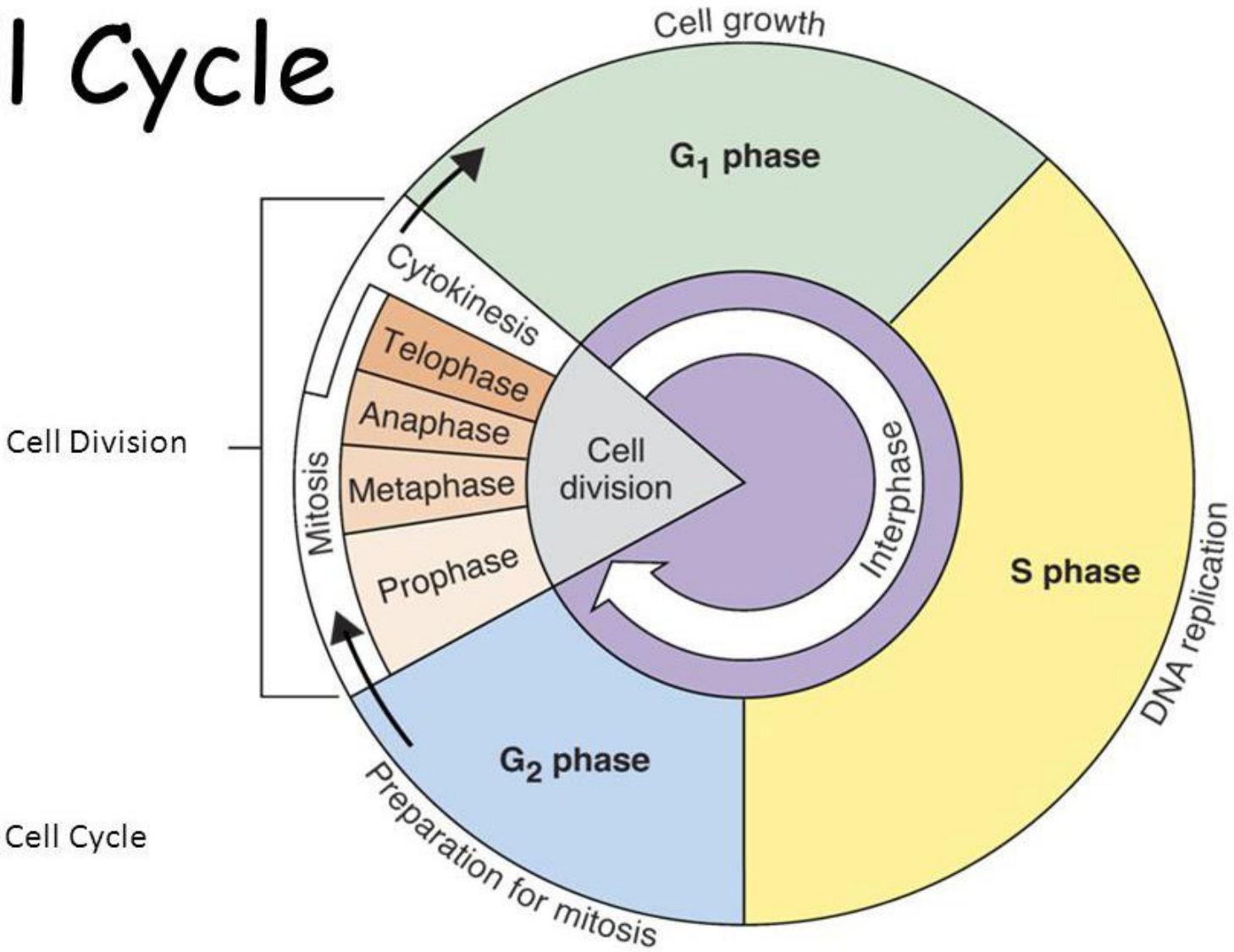
- G1: Checks if DNA is damaged
- G2: Checks if DNA is replicated correctly
- M: Checks if chromosomes are lined up correctly

Summary

- Mitosis produces 2 daughter cells that contain the exact same number of chromosomes as the original parent cell.
- Daughter cells are called DIPLOID because they have DI (two) copies of each chromosome, one from the mother and the other from the father.
- Cells that are not actively dividing stay in interphase.
- Checkpoints are necessary to ensure that cell division works properly.

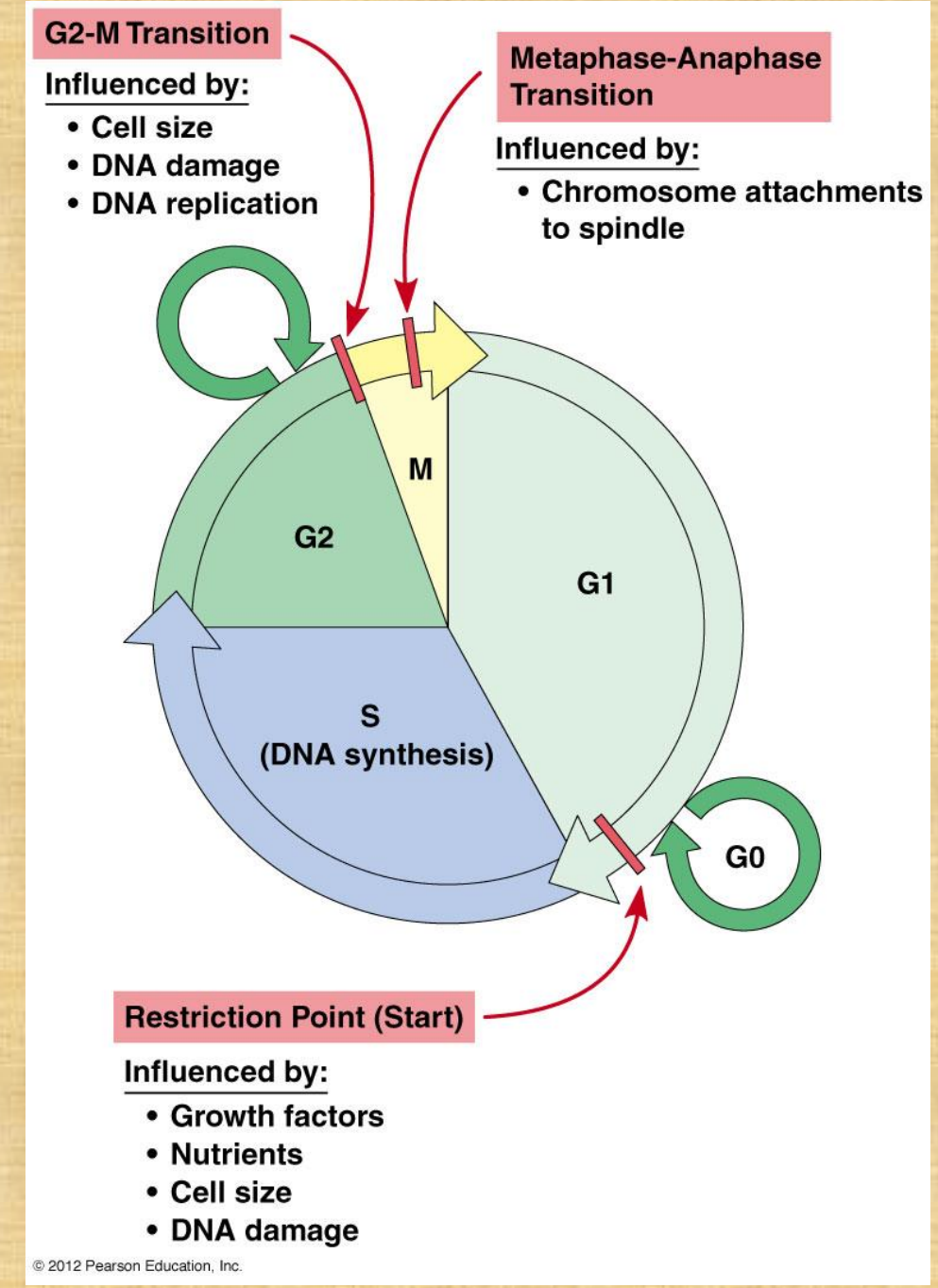

A
B
C
D

Cell Cycle



Cell Division

Label the Cell Cycle


G2-M Transition
Influenced by:
• Cell size
• DNA damage
• DNA replication
Metaphase-Anaphase Transition
Influenced by:
• Chromosome attachments to spindle
M
G2
G1
S
(DNA synthesis)
G0
Restriction Point (Start)
Influenced by:
• Growth factors
• Nutrients
• Cell size
• DNA damage
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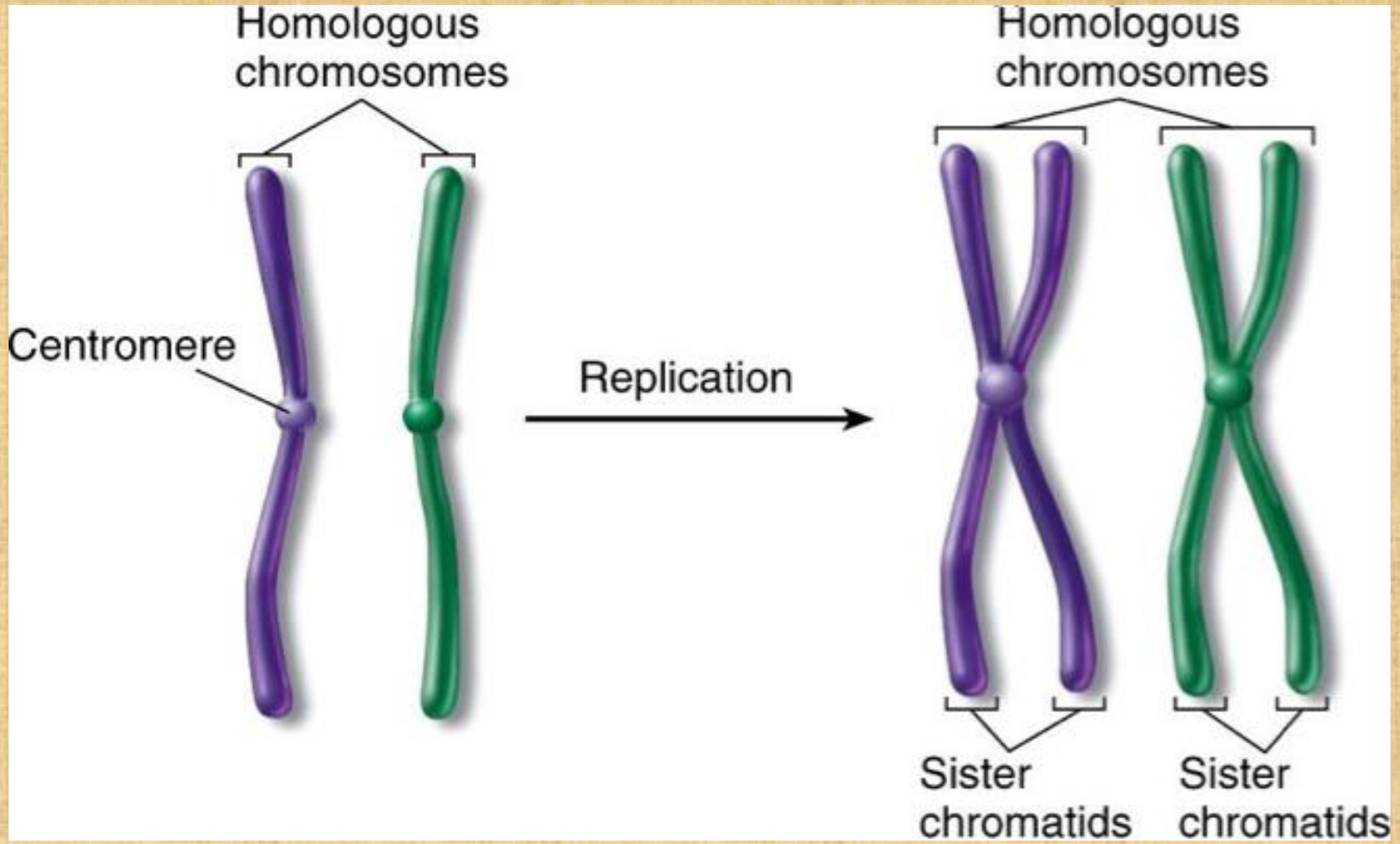
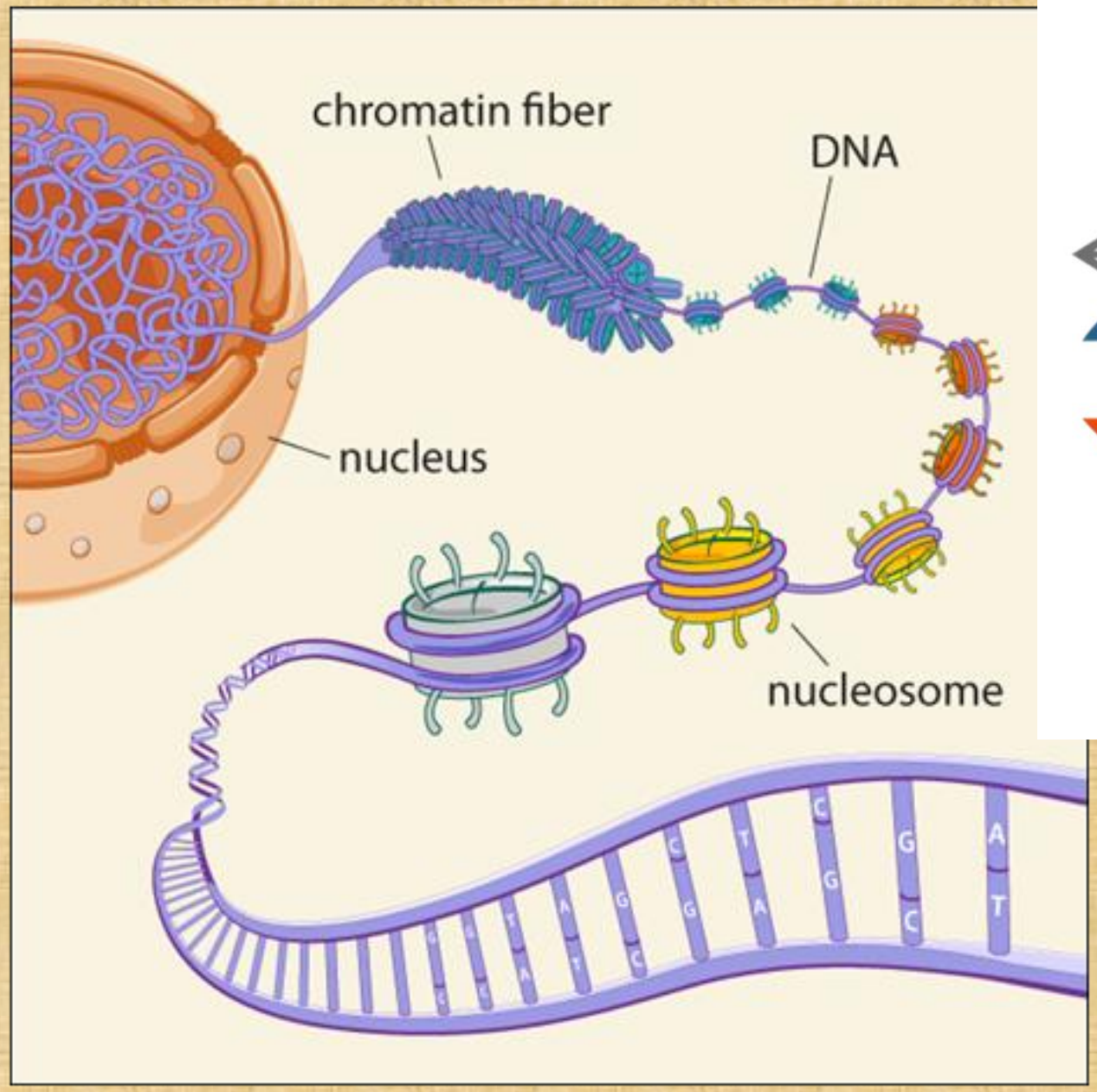
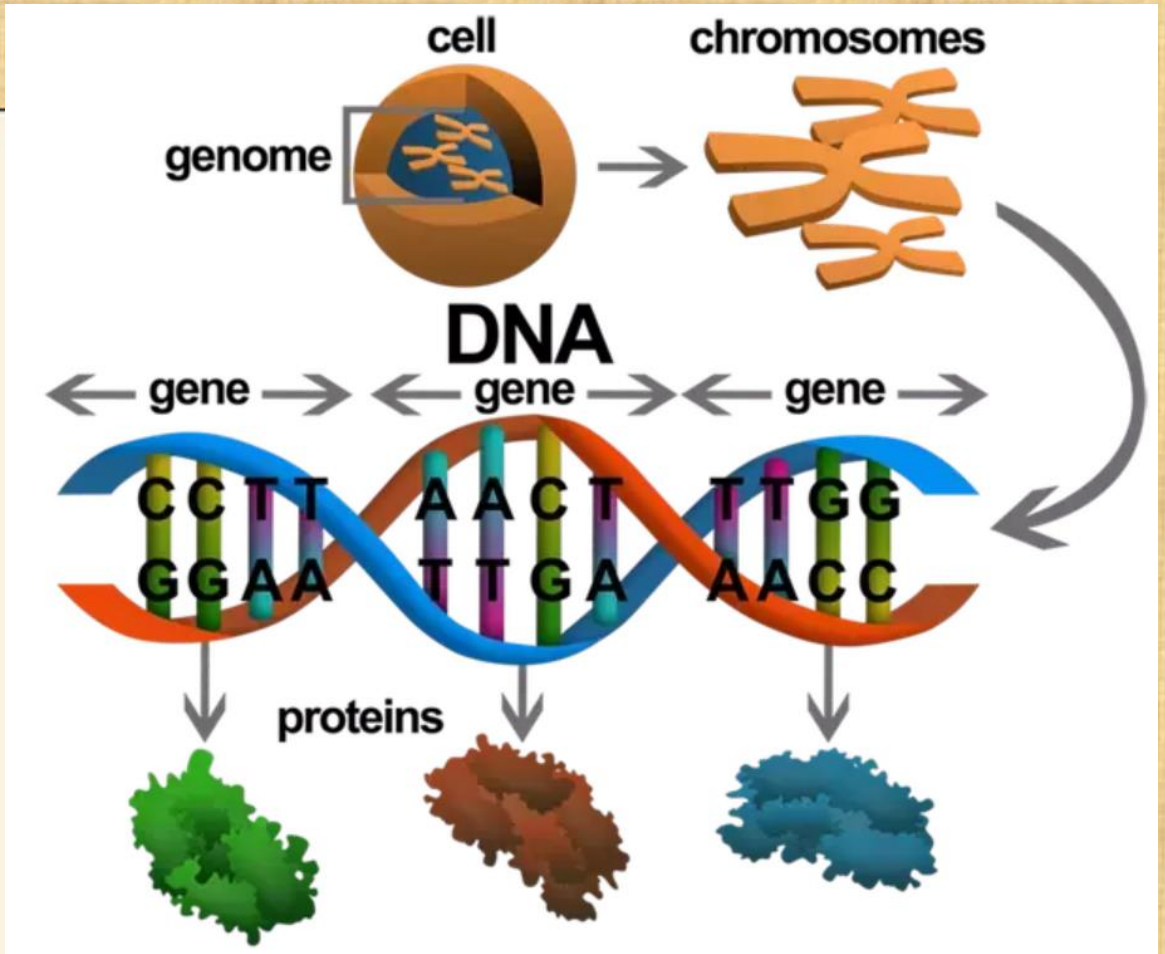
HOMOLOGOUS CHROMOSOMES
VERSUS
SISTER CHROMATIDS

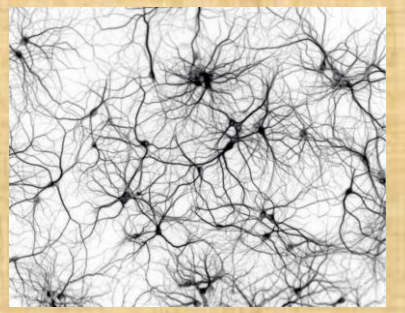
Homologous chromosomes are made up of both maternal and paternal chromosomes	Sister chromatids are made up of either a maternal or paternal chromosome
May contain same or different alleles of the same gene	Contain identical gene sequence throughout the chromatids except in the chromosomal crossover
Appear in the metaphase I of meiosis I	Formed during the DNA replication in the S phase of interphase
Do not stick together	Joined together by their centromere
Composed of four DNA strands	Composed of a single DNA strand
Segregated during the anaphase I of meiosis I	Separated from their centromere during anaphase II of meiosis II and the anaphase of mitosis




chromatin fiber
DNA
nucleus
nucleosome


cell
chromosomes
genome
DNA
gene
gene
gene
CCTT
GGAA
AACT
TTGA
TTGG
AACC
proteins

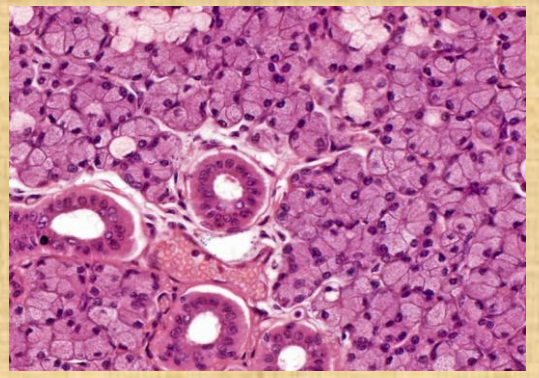
HONORS ONLY!



Quiescent cells → in a G0 state (resting state).

- CAN re-enter cell cycle when mitotic stimulation (MPF) is applied.

Examples: liver tissue, alveoli (lung sacs), skeletal & smooth muscle tissue, cardiac tissue, neurons



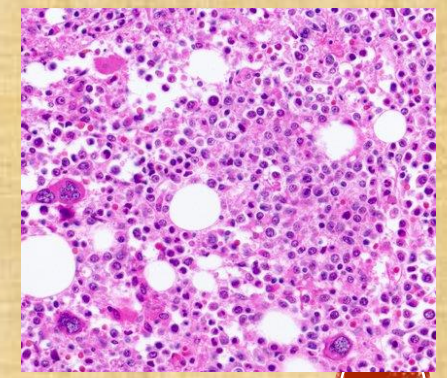
Senescent cells → Cell has aged and is no longer capable of dividing EVER AGAIN.

Due to telomeres (DNA caps at the ends of chromosomal arms) being too short due to breakdown over its life, which doesn't allow DNA to be copied fully.

Labile cells → Constanstly divide throughout entire lifetime.

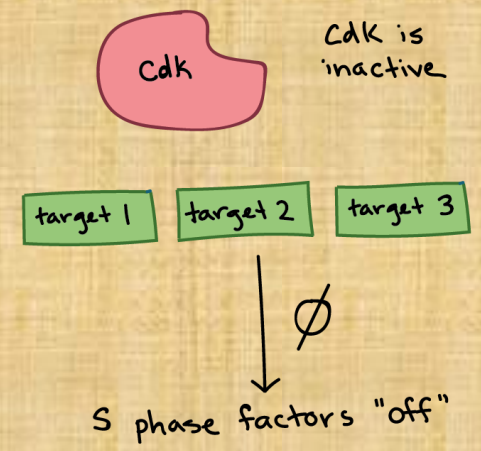
- Can produce stem cells!
- Chemotherapy inhibits M & S phases which causes collateral damage in labial cells that are not part of the cancer being treated.

Examples: Skin, mouth tissue, intestinal cells, bone marrow.

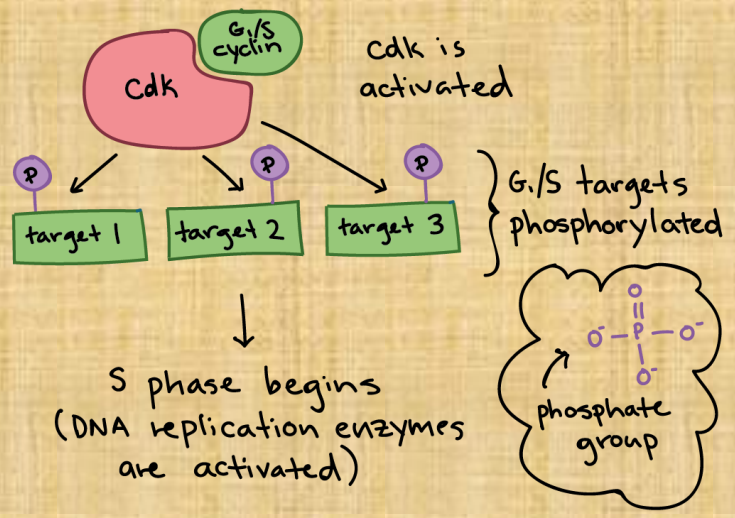


What jumpstarts mitosis

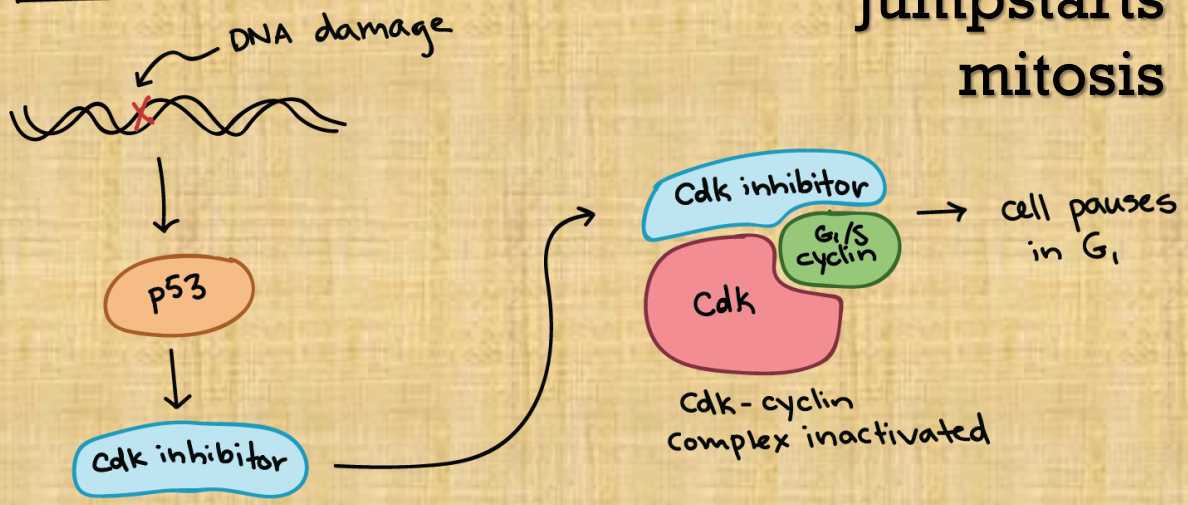
NO CYCLIN:



+ G_1/S CYCLIN:

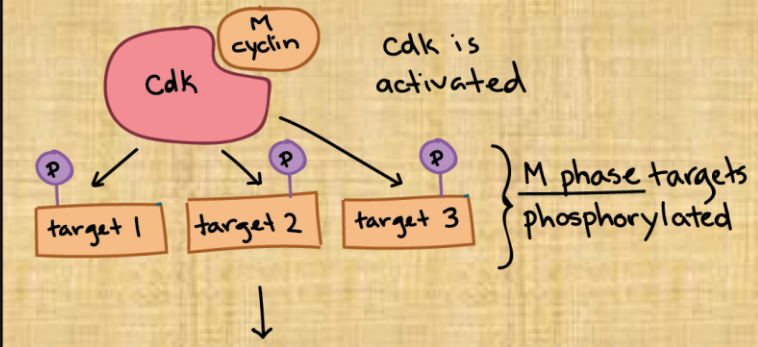


G_1 CHECKPOINT: DNA DAMAGE

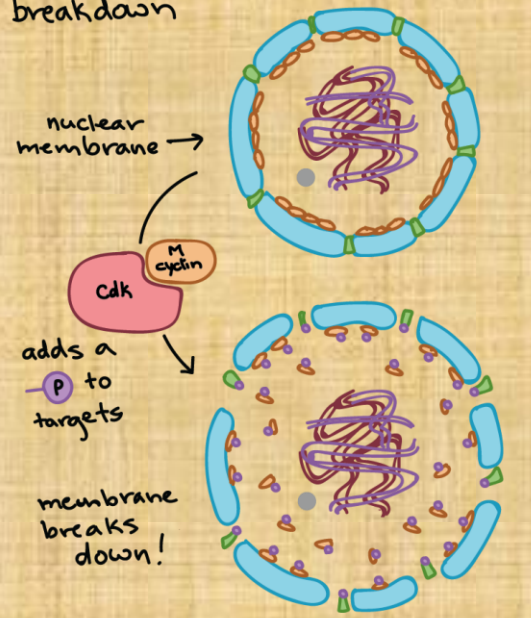


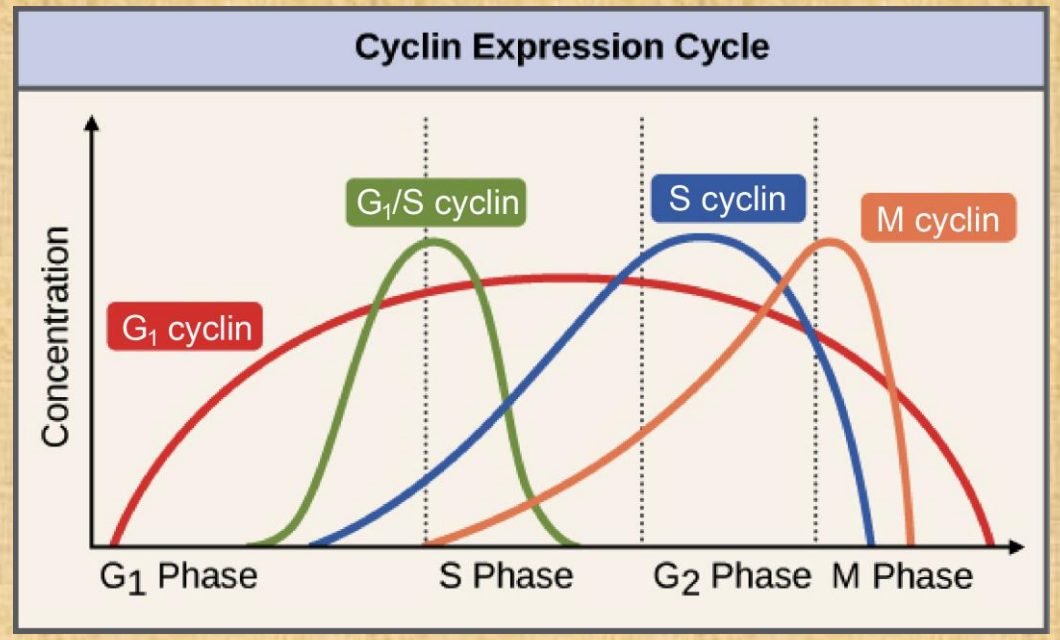
HONORS ONLY!

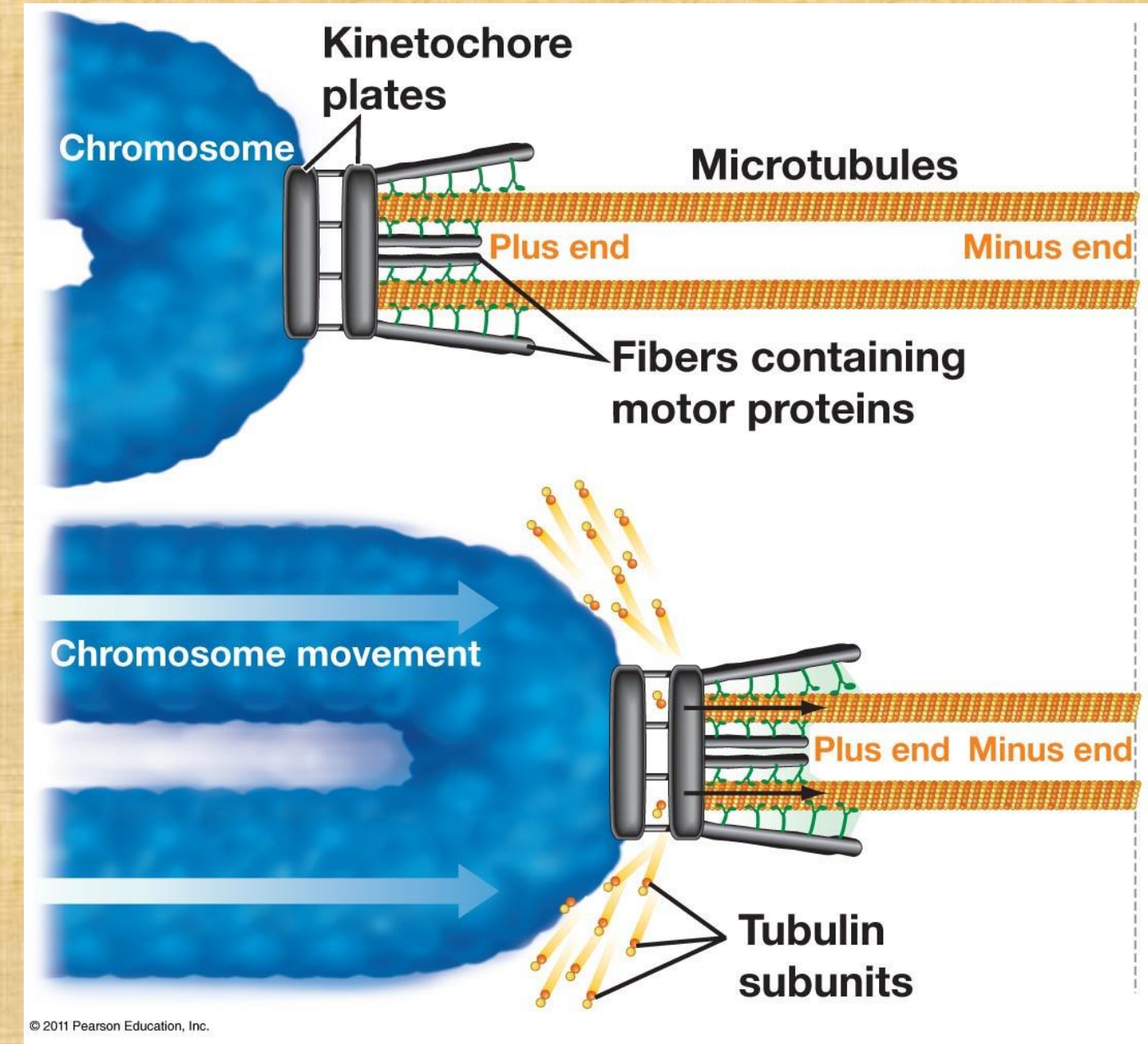
+ M CYCLIN:

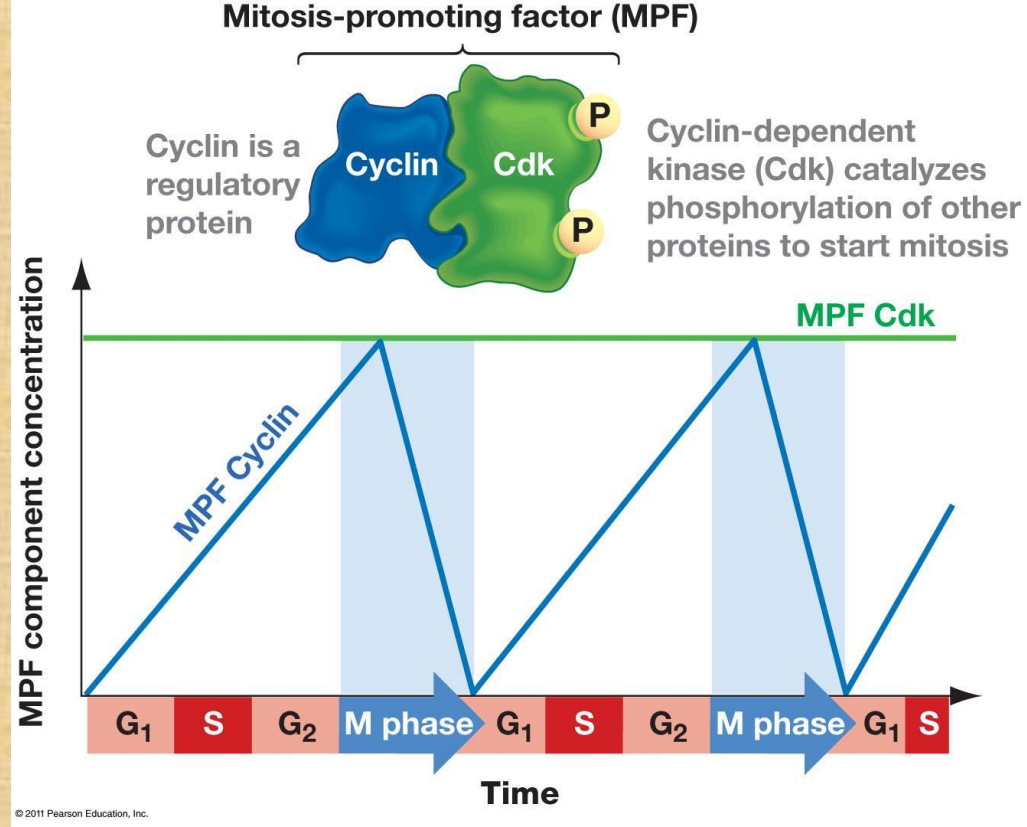


Example: nuclear membrane breakdown







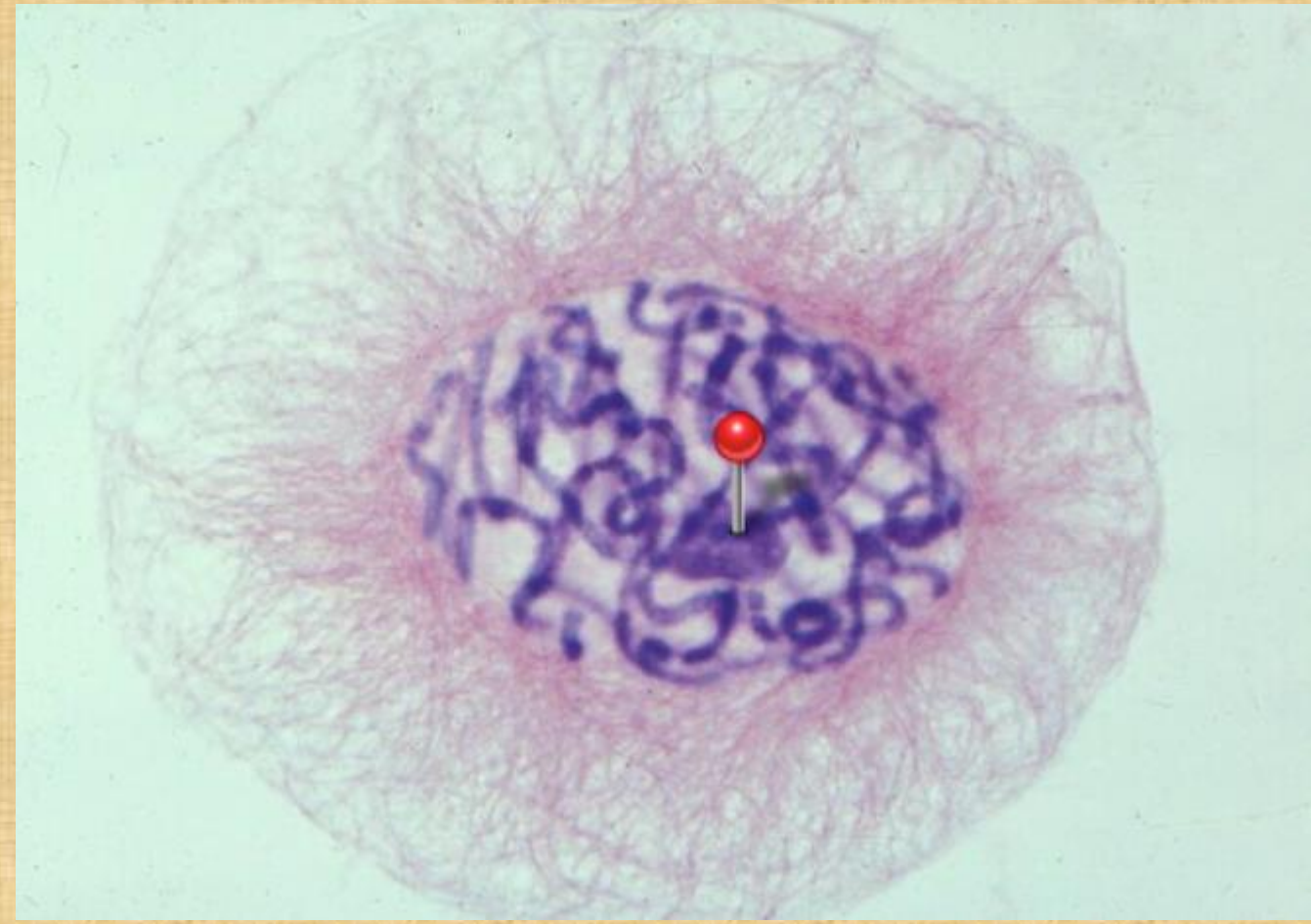


HONORS ONLY!

Kinetochore function: the pulley system behind chromosome movement

I. WHAT MITOSIS PHASE AM I IN?

1.

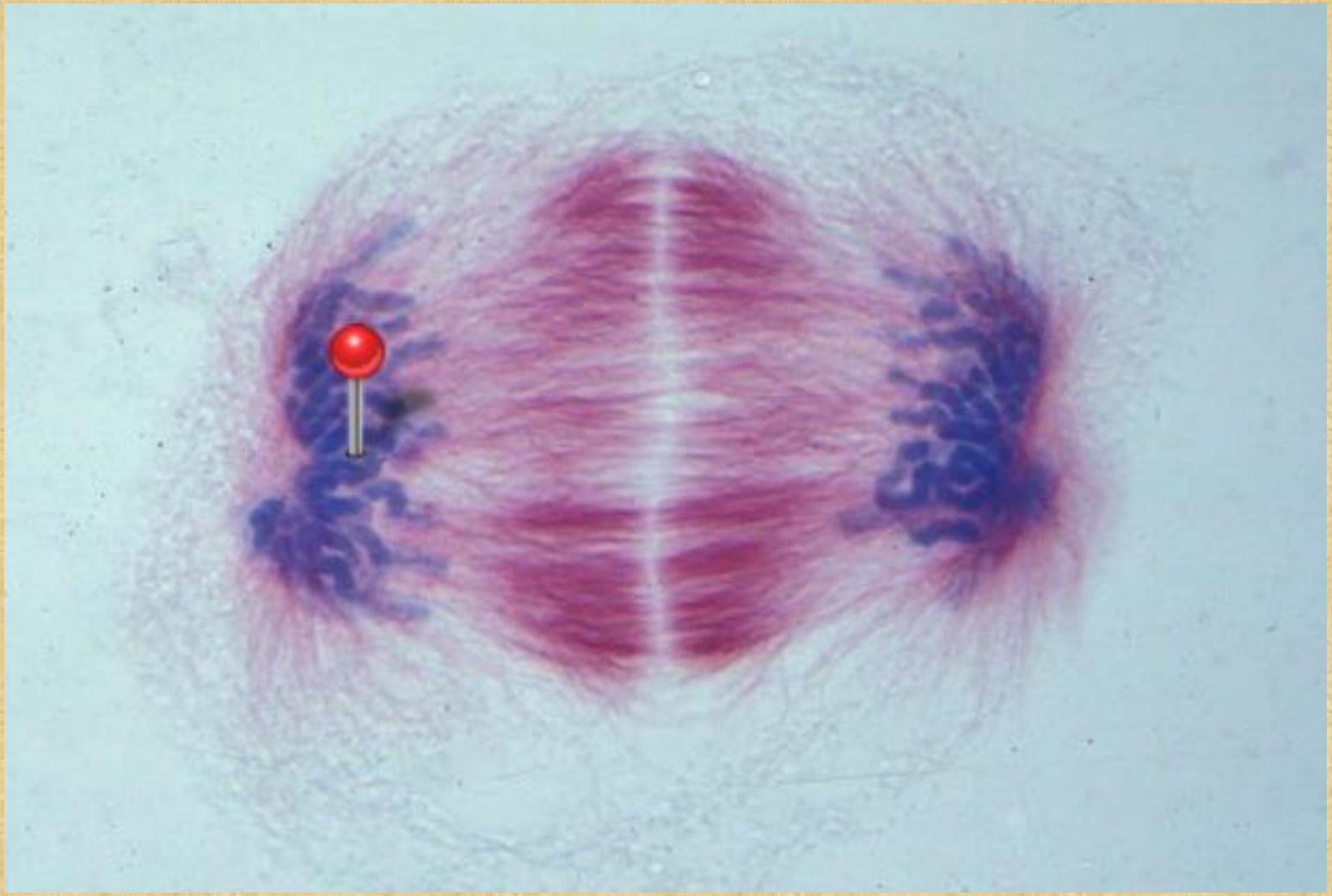


2.

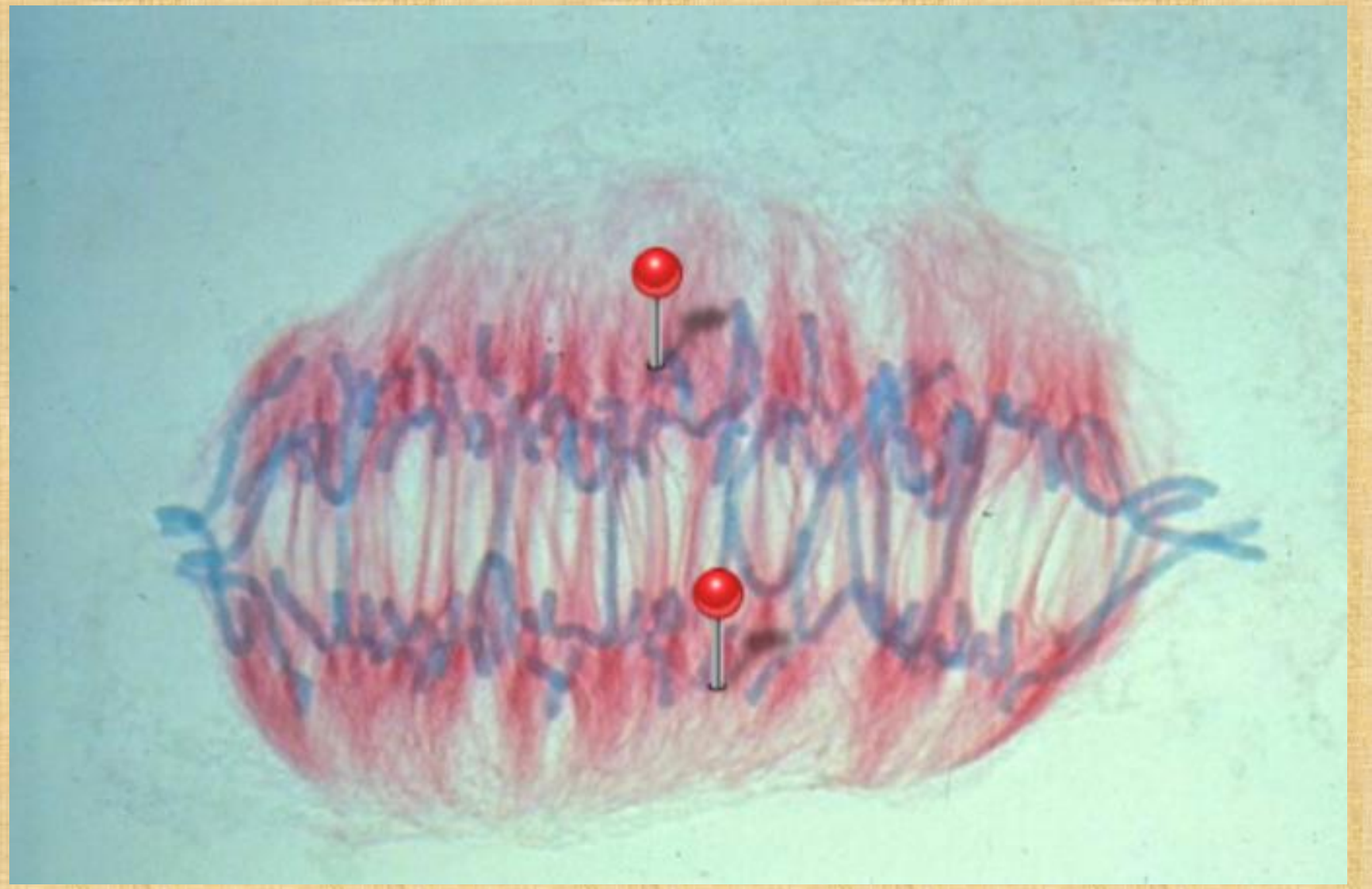
3.

4.

5.



7.



CAN YOU GET THEM ALL?

In the picture to follow, add text boxes and arrows to label as many cells correctly as you can. I know some of you, maybe even all of you will be able to label them all! The more you label the more points you'll earn!