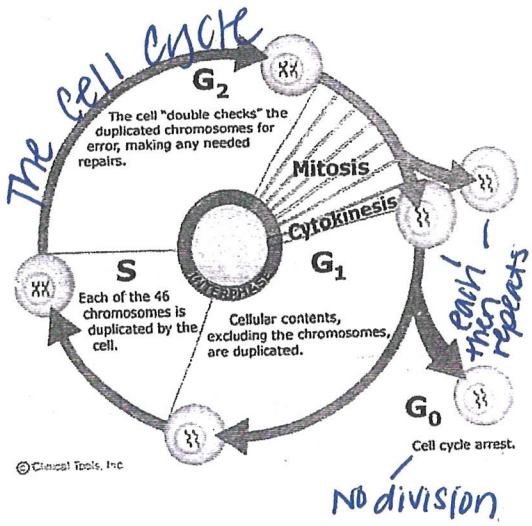
OPHS Biology
Unit 5 Notes

Name: _____
The Cell Cycle (Division)

Unit 5, Topic 2: Mitosis

che end of this topic, you should be able to...

- *Explain why cells must divide*
- *Draw and label the stages of mitosis*
- *Compare and contrast animal cell division and plant cell division (cytokinesis)*
- *Compare and contrast prokaryotic and eukaryotic cell division*



Purpose of Mitosis

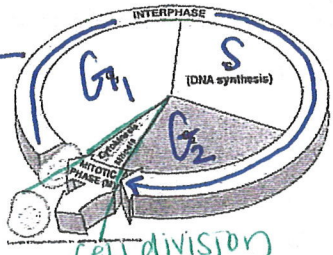
- To create two IDENTICAL daughter cells from one parent cell
- Cells begin Diploid (2 sets of chromosomes) — di=2
- and end Diploid — again, identical to parent!
  - 1 set from bio mom
  - 1 set from bio dad

Vocabulary to know

- Diploid (2n): 2 sets of chromosomes (one from each parent)
  - Example: Human body (somatic) cells – bone, skin, brain, nerve...
  - What kinds of cells are diploid? somatic / NON-reproductive cells
- Haploid (n): 1 set of chromosomes (example: sex cells)
  - Example: egg / sperm (gametes)
  - What kinds of cells are haploid? sex cells
- Sex Chromosomes: determine the sex of an organism; either X or Y (Male = XY; Female = XX)
- Autosomes: all the other chromosomes in an organism
- Cell cycle: the series of events that cells go through as they grow and divide
  - A cell grows, preps for division, and divides to form TWO genetically identical daughter cells; each of them then goes through the same process

Humans = 23 pairs of chromosome
22 pairs autosomes
1 pair sex chromo.

Stages of the Cell Cycle

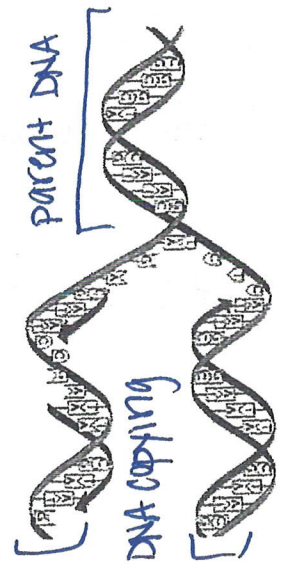


- G1, S and G2 = Interphase (majority of a cell's life)
- Mitosis
- Cytokenesis } cell division
  - nucleus
  - cytoplasm

The Steps prior to Cell Division

- the cell doubles in size (G1 / Growth 1 / gap)
- chromosomes replicate (S phase)
- the number of organelles doubles (G2 / Gap 2 / growth 2)
  - most doubling is directed by the Nucleus (houses DNA/directions)

What is DNA Replication?



- A chromosome is unzipped and thus starts as one strand of DNA
- Each daughter cell needs it's OWN COPY of the DNA strand.
- The DNA strand is duplicated and the two parts are "tied" together

each copy goes to 1 daughter cell so there are 2 identical daughter cells

Important Details

- DNA replication occurs during the S phase of interphase
- Mitosis and cytokinesis overlap. (typically in telophase)
- ✱ Cells may also enter a G0 phase where they no longer divide.
- Cells move onto the next stage of the cycle when enough trigger protein builds up.

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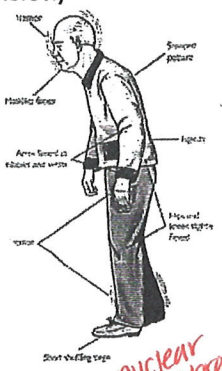
The Cell Cycle (Division)

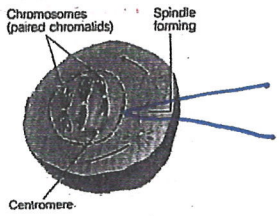
- Cells of the brain (adult central nervous system) and spinal cord (& lens of eyes) do not divide.
- Parkinsons is a disease where brain cells dies, and because nervous system cells do NOT replicate so the body is unable to replace the dead cells.
- Mitosis is the process of dividing just the NUCLEUS, not the entire cell.


Neuron

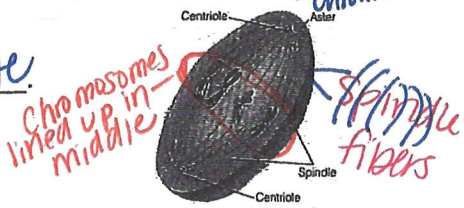


STEPS OF MITOSIS (PMAT):

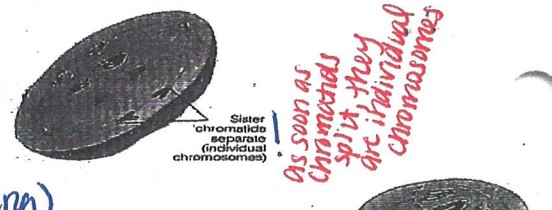
- **PROPHASE:** (before (happens 1st in mitosis))
  - Nuclear membrane (and nucleolus) is broken down.
  - Chromosomes (coiled) appear for the first time.
  - Centrioles migrate - (Plant cells don't have centrioles). they still have spindle fibers, though



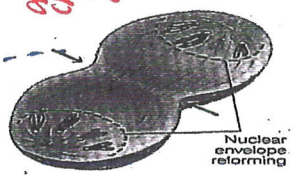
- **METAPHASE:**
  - Chromosomes align on the metaphase/equatorial plane/plate.
  - Spindle fibers attach to the centromere of chromosomes.



- **ANAPHASE:**
  - Chromatids move to opposite ends of the cell (with the help of spindle fibers).



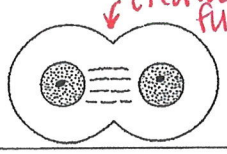
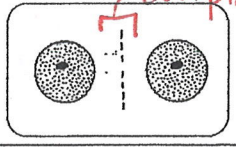
- **TELOPHASE:** (end (last in mitosis))
  - Chromosomes stop moving. (begin uncoiling)
  - Nuclear membrane reforms.



Cytokenesis is the division of the entire cell after the nucleus divides.

- Differs for plants and animals because plants cells have cell walls

CYTOKINESIS →

Animal Cells	Plant Cells
The cell membrane constricts to make a groove and divide.	Vesicle produced by golgi bodies form a midline in the cell.
The groove is referred to as the cleavage furrow	Vesicles fuse to make a cell plate which attached to the cell wall
	

← CYTOKINESIS

How does the beginning cell differ from the ending cells?

They are all genetically identical, but the original cell is no longer present
- each daughter cell is part original, part new

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DO ON OWN (practice)

Name: _____
The Cell Cycle (Division)

[[Language Target for Topic 2: I can discuss the impact of surface area to volume ratios; I can diagram the cell cycle, identifying key structural components while describing the events within; I can diagram the four stages of mitosis; I can create a Venn diagram to explain the difference between plant and animal cell division; I can differentiate between prokaryotic and eukaryotic cell division.]]

1. Surface area to volume ratios: Most of this has been completed using our in-class POGIL, but take a moment to write what size cells are *most* efficient: _____
   a. What do we mean when we say these cells are most efficient?

      _____

      _____

   b. How does DNA overload relate to this?

      _____

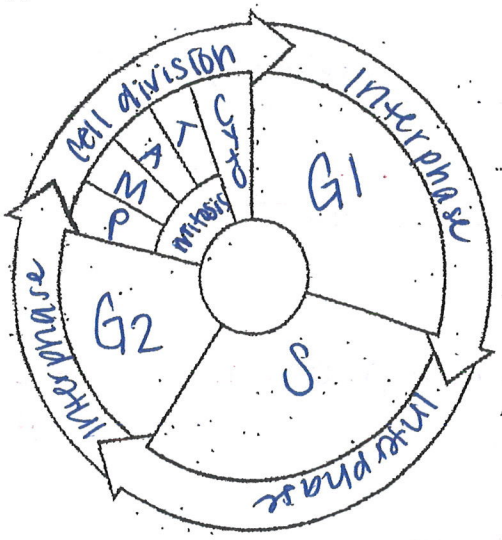
      _____

   c. Why can eukaryotic cells be larger than prokaryotic cells?

      _____

      _____

2. Place the appropriate component of the cell cycle in each sliver of the following image. Draw or describe what happens at each point (use the space to the right of the image, if needed).



3. Complete the following table comparing plant and animal cell division:

	PLANT CELLS	ANIMAL CELLS
Centrioles used?		
Cleavage furrow forms?		
Cell plate forms?		

4. Complete the following table comparing prokaryotic and eukaryotic cell division:

	PROKARYOTIC CELLS	EUKARYOTIC CELLS
Involves dividing the nucleus?		
Produces identical daughter cells?		
Uses binary fission?		
Uses mitosis?		
Produces two organisms?		
Involves PMAT (pro, meta, ana...)?		
Requires duplicating DNA?		