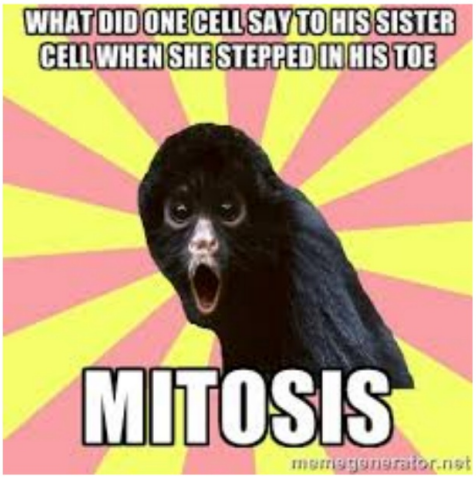
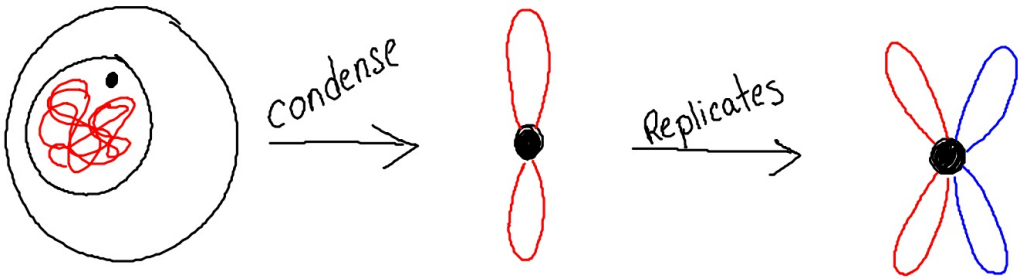
Cell Cycle and Mitosis



Important Vocab:

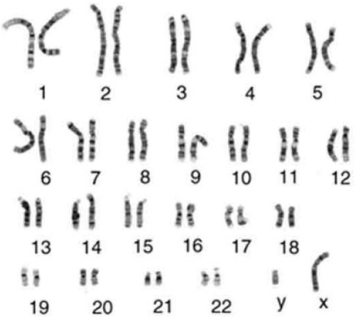


Mitosis- Nuclear division resulting in two identical daughter cells.

Meiosis- The process of making four genetically different haploid sex cells.

Chromosome-A DNA molecule that contains many **genes**.

Homologous chromosomes- organisms have **two** of the same chromosomes in every cell (one from each parent).



Diploid-Normal number of chromosomes (in humans=**46**)
-includes body cells (somatic cells)

Haploid-Half the number of chromosomes (in humans=**23**)
-includes sex cells (gametes)

Gamete- A haploid sex cell (egg/sperm). Two haploid sex cells join together to make a diploid zygote.

Cell Division

The process by which a cell divides into 2 new cells

Why do cells need to divide?

1. Living things <u>grow</u> by producing more cells, NOT because each cell increases in size
2. <u>Repair/replacement</u> of damaged tissue
3. If cell gets too big, it cannot get enough nutrients into the cell and wastes out of the cell.

The Cell Cycle:

The cell cycle is split into 3 stages:

1) **Interphase (G_1 + S + G_2)**
   -The cell prepares to divide.
   -Longest of all the stages.

   G_1- The cell grows
   S- The DNA and organelles are replicated.
   G_2- Cell growth, and checks to make sure the cell is ready to divide.

2) **M-Phase or Mitosis (PMAT)**

-Nuclear division

Prophase

Metaphase

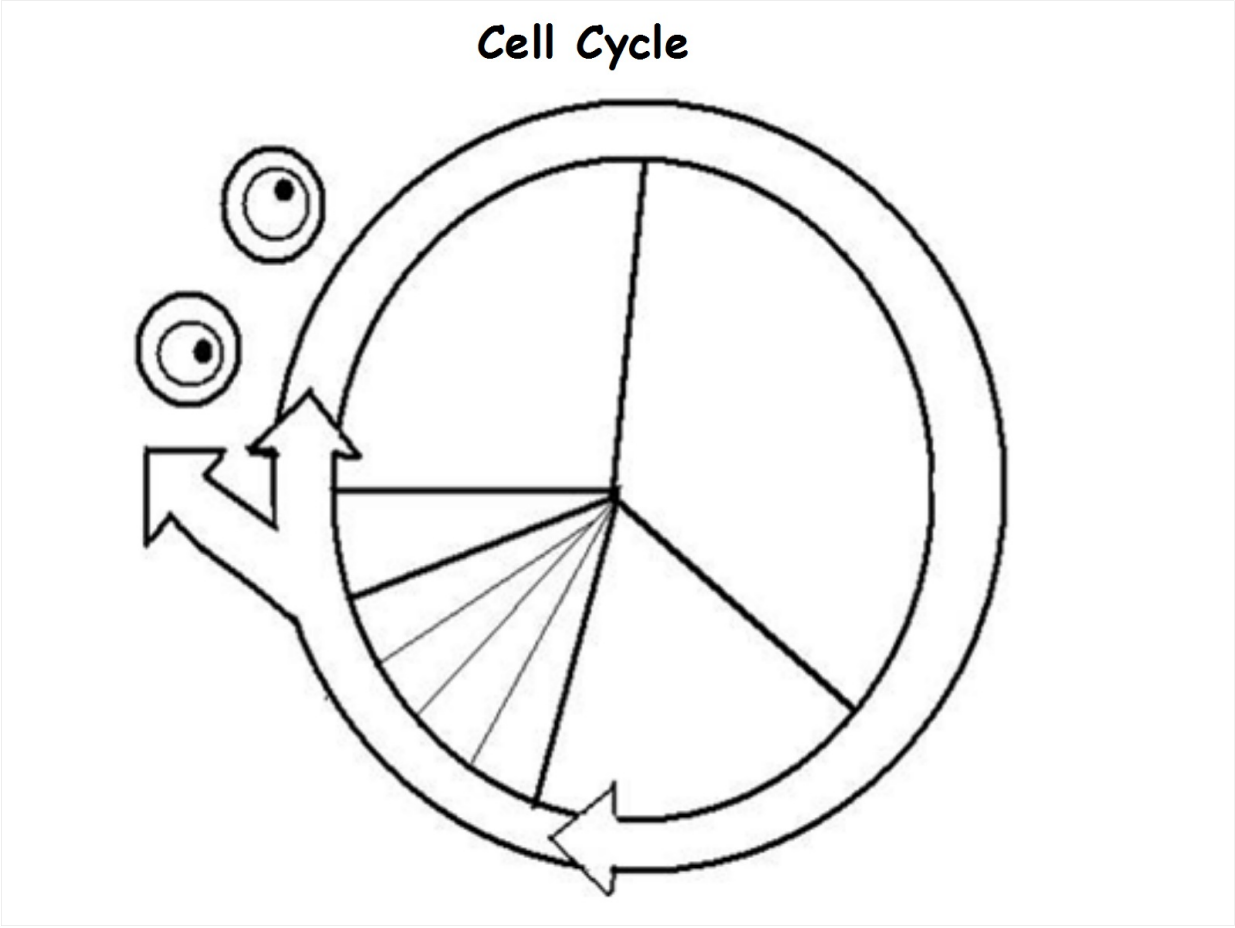
Anaphase

Telophase

3) **Cytokinesis**

-Cell splits (cytoplasm splits) into 2 identical cells called daughter cells.

Cell Cycle



Mitosis

The division of the nucleus into 2 nuclei, each with the same number of chromosomes.

-Mitosis occurs in all the somatic (body) cells.

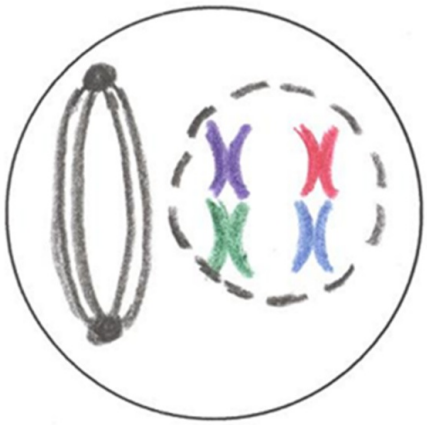
-Needs to occur so each new daughter cell has a nucleus with a diploid (complete) set of chromosomes.

-4 phases of nuclear division (mitosis), directed by the cell's DNA (**PMAT**)

Stages of Mitosis

PMAT

1. _____



Chromosomes form. (DNA condenses) Nuclear envelope breaks down

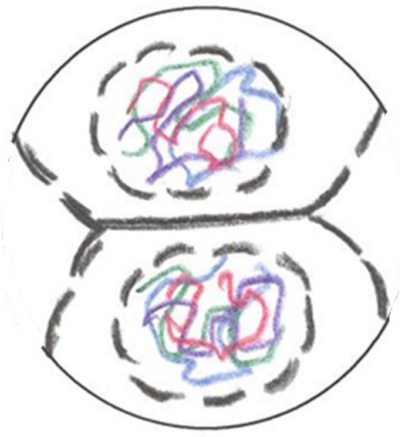
2._____

Chromosomes line up down the middle (equator) of the cell.

3. _____

Chromosomes are pulled to opposite ends of the cell (sister chromatids separate).

4. _____

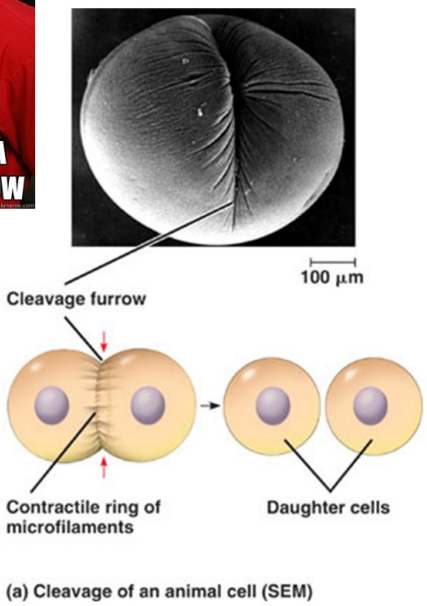


2 new cells begin to form. Nucleus reappears.

In animal cells: cleavage furrow.

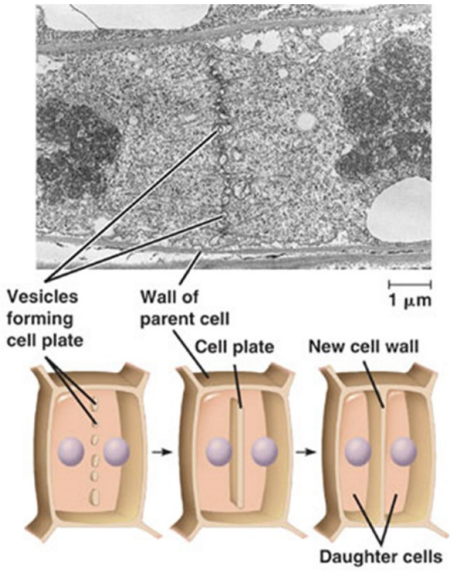
In plant cells: cell plate forms the cell wall.

Cleavage Furrow



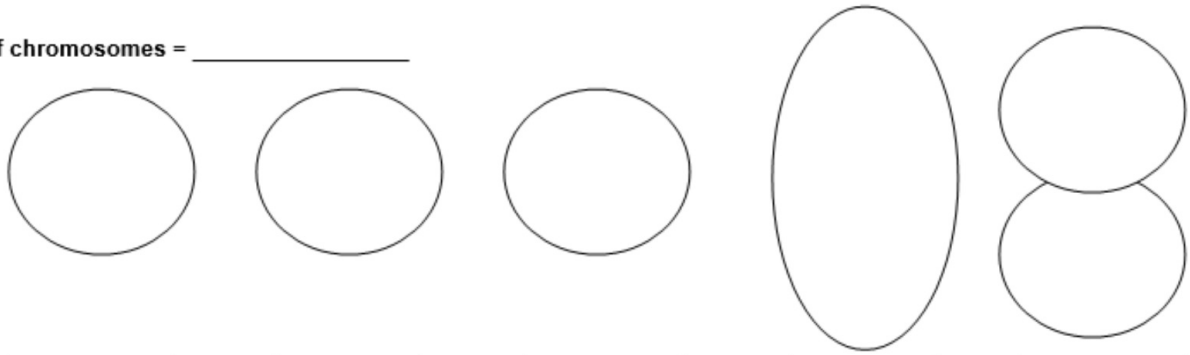
(a) Cleavage of an animal cell (SEM)

Cell Plate

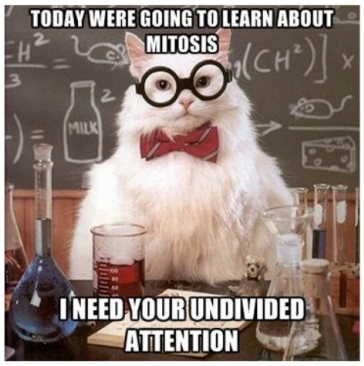


(b) Cell plate formation in a plant cell (TEM)

of chromosomes = _____

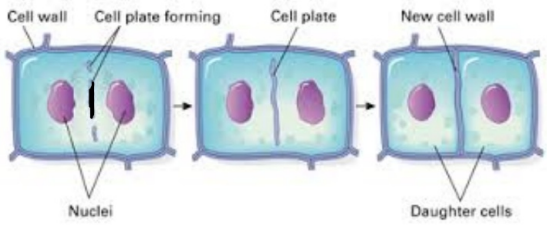


Interphase | Prophase | Metaphase | Anaphase | Telophase



Animal vs. Plant Mitosis

Animal	Plant
-Have centrioles -Cleavage furrow appears during telophase.	-No centrioles -Cell plate forms during telophase. turns into the cell wall.

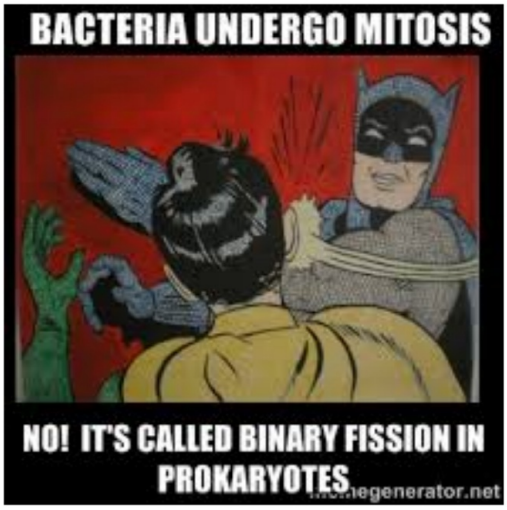


Asexual Reproduction

The process where one parent splits into 2 genetically identical individuals. This produces clones and there is no genetic variation. It is mitosis!

Types of asexual reproduction:
1. Budding
2. Binary Fission
3. Sporulation
4. Regeneration
5. Vegetative Propagation

*See upco reading!



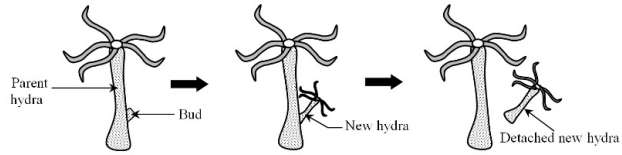
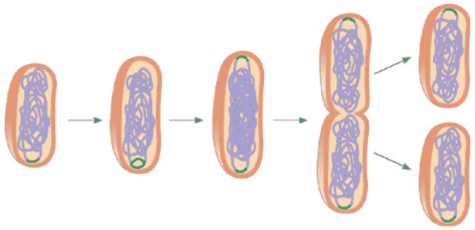
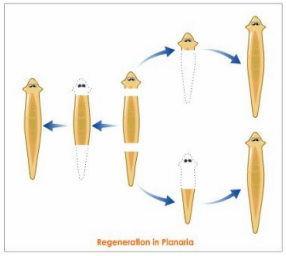
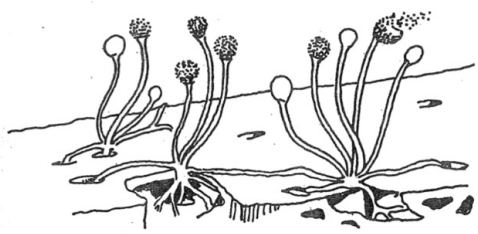
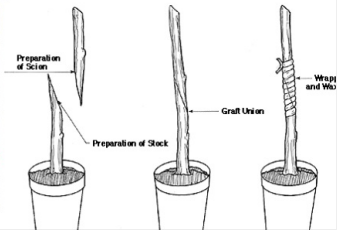


Fig. 3 Budding in hydra





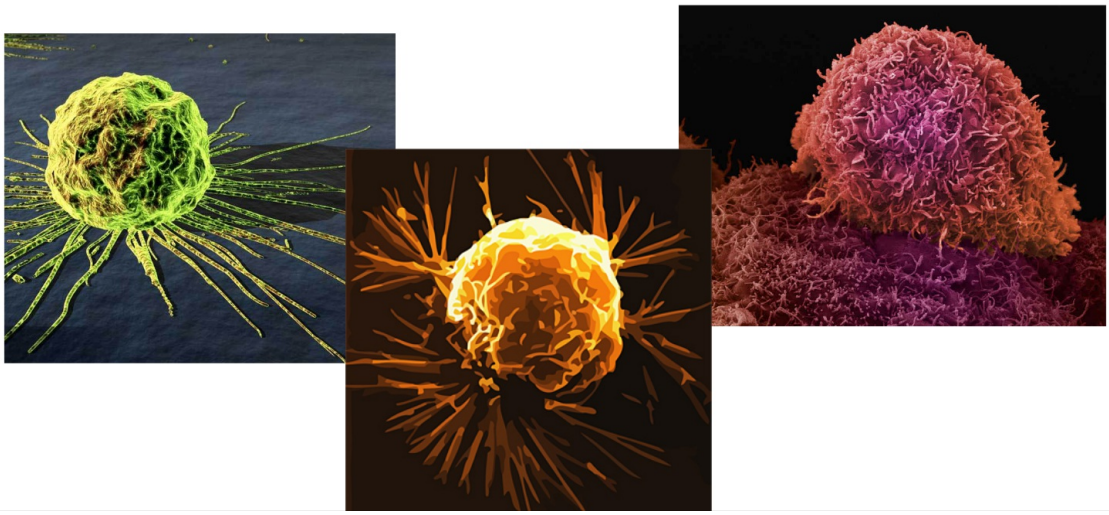




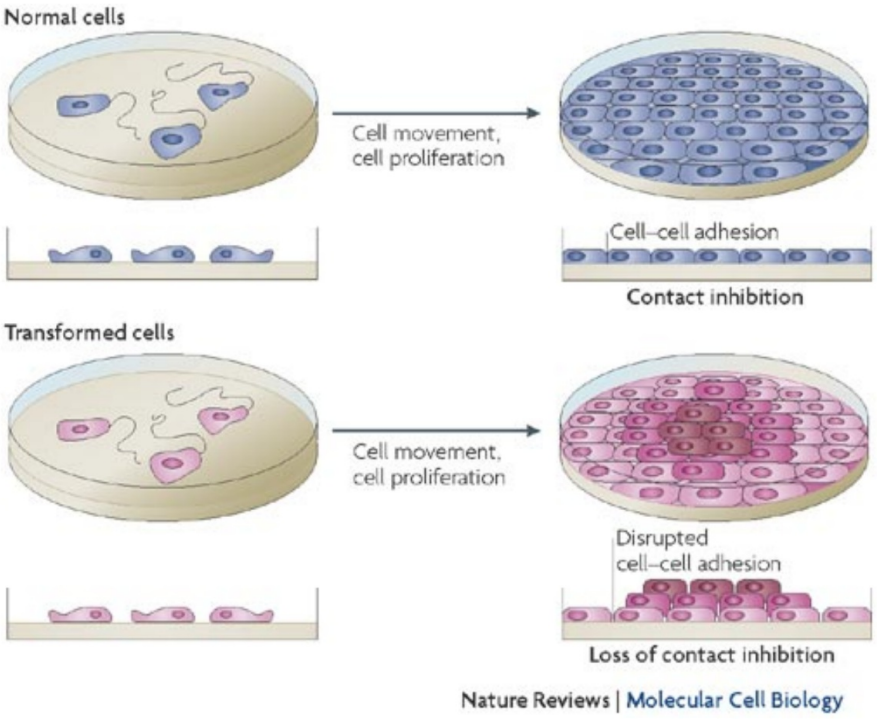
Cancer

If the cycle is messed up, the cells can divide uncontrollably!

-This results in tumors (balls of cells) that can lead to **cancer.**



Normal cells have contact inhibition and stop growing when they touch.



Chromosome Number

- Every organism has its own specific number of chromosomes

  Examples: Human = 46 chromosomes or 23 pairs
  Dog = 78 chromosomes or 39 pairs
  Goldfish = 94 chromosomes or 47 pairs
  Lettuce = 18 chromosomes or 9 pairs

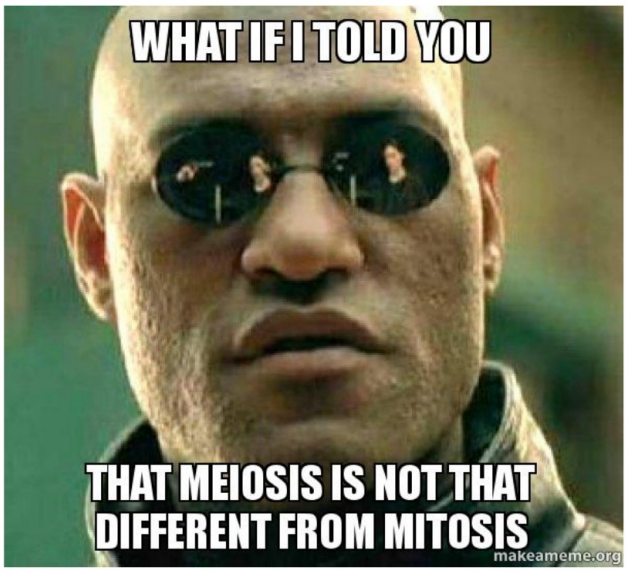
The total number of chromosomes is called the diploid (2n) number. The number of pairs or half number is called the haploid (n) number.

All body cells are diploid, and all sex cells or gametes (egg/sperm) are haploid.

Examples: Human = 46 chromosomes
Human skin cell = _____ chromosomes
Human heart cell = _____chromosomes
Human muscle cell = _____chromosomes
Human egg cell= _____chromosomes
Human gamete cell= _____ chromosomes

Organism	Body Cell	Gamete	Sperm	Diploid	Egg
A chimpanzee liver cell has 48 chromo.					
A frog sex cell has 26 chromo.					
A diploid duck cell has 80 chromo.					

Meiosis


WHAT IF I TOLD YOU
THAT MEIOSIS IS NOT THAT DIFFERENT FROM MITOSIS
makeameme.org

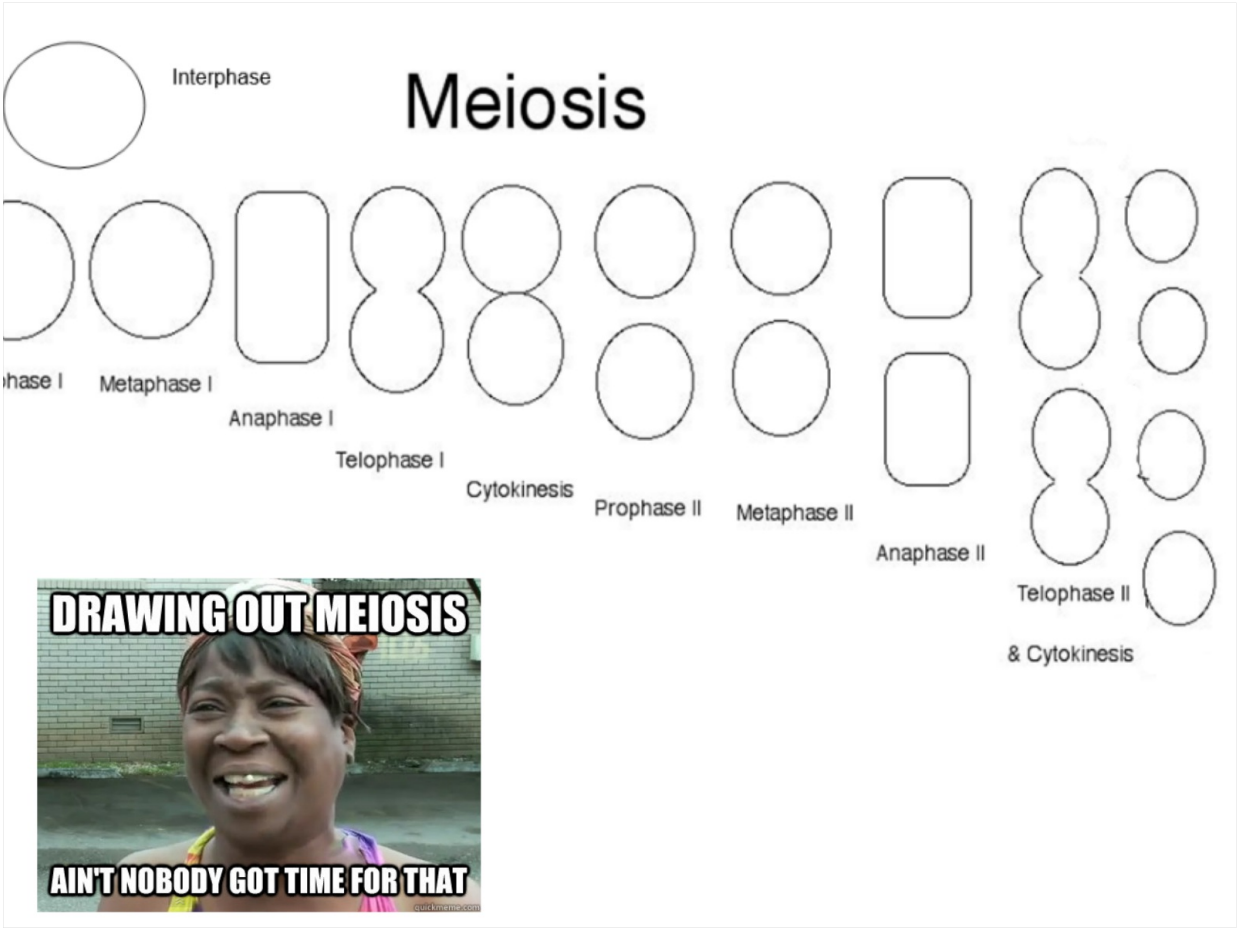
Meiosis

The division of a body cell into four genetically different haploid gametes or sex cells. Increases variation within the species!

-Considered a reduction division. It halves the chromosome number. (2n --> n)

-Needs to occur so that the fertilized egg has the correct number (diploid) number of chromosomes. (23 chromo. + 23 chromo. = 46 chromo.)

-Preceded by interphase. Broken down into 2 divisions. ($P_1M_1A_1T_1$ & $P_2M_2A_2T_2$)


Meiosis
Interphase
hase I
Metaphase I
Anaphase I
Telophase I
Cytokinesis
Prophase II
Metaphase II
Anaphase II
Telophase II
& Cytokinesis
DRAWING OUT MEIOSIS
AIN'T NOBODY GOT TIME FOR THAT

Crossing Over

Occurs during prophase 1 of meiosis. Homologous pairs line up forming a tetrad and exchange genetic information. This increases variation!

Spermatogenesis and Oogenesis

Spermatogenesis:
Occurs in the male testes. It occurs until death. Produces four sperm that are all capable of fertilization.

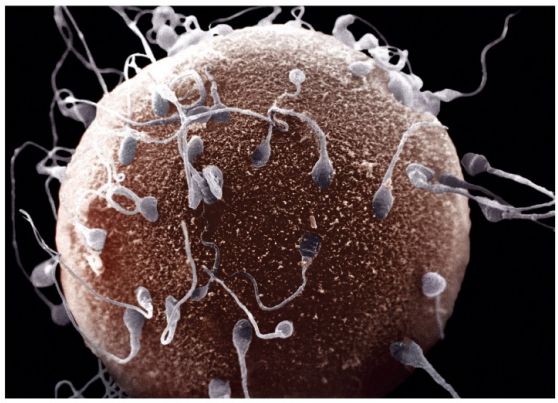
Oogenesis:
Occurs in the ovaries of females before birth. Produces one fertilizable egg and three small useless polar bodies.

Sexual Reproduction

The process where two genetically different parents form a genetically different offspring.

Haploid + Haploid = Diploid

Sperm + Egg = Zygote (fertilized egg)



Mitosis vs. Meiosis

Mitosis	Meiosis