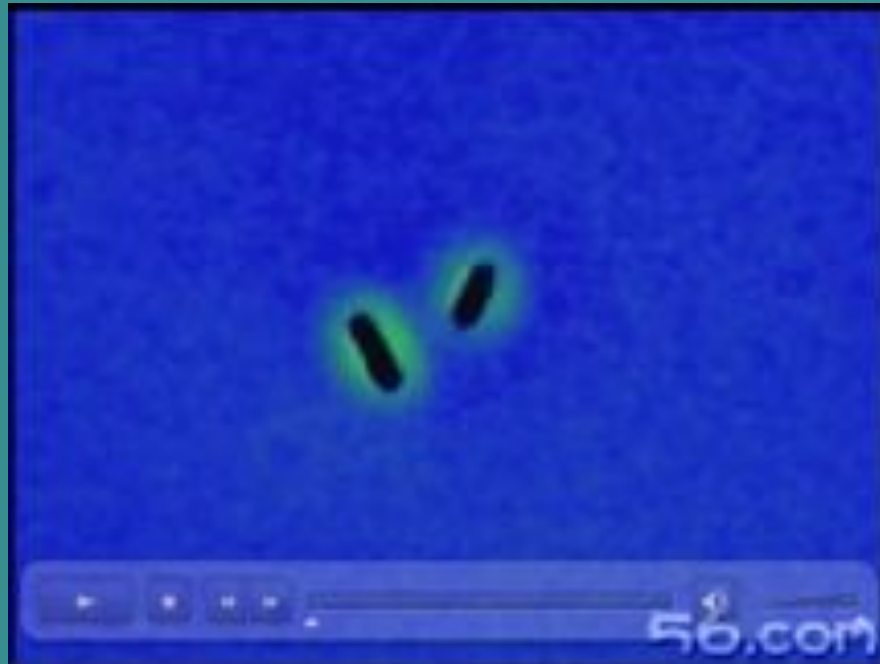


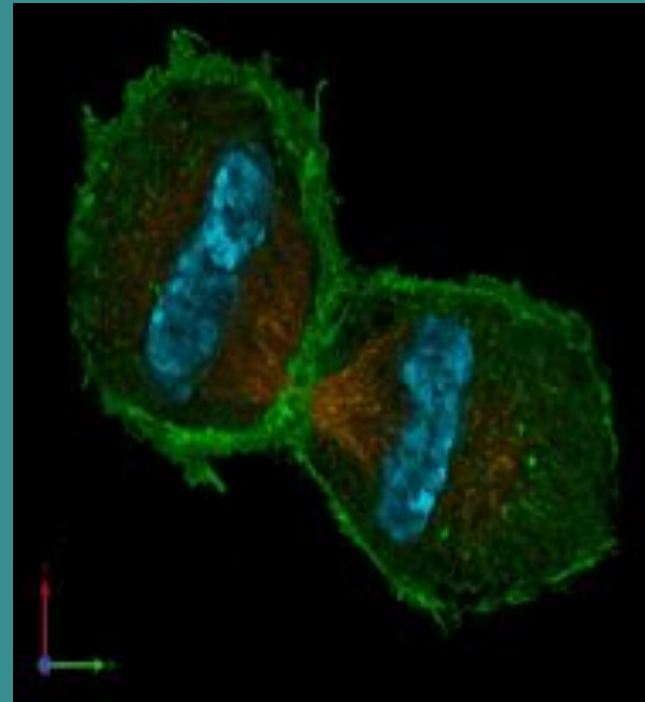
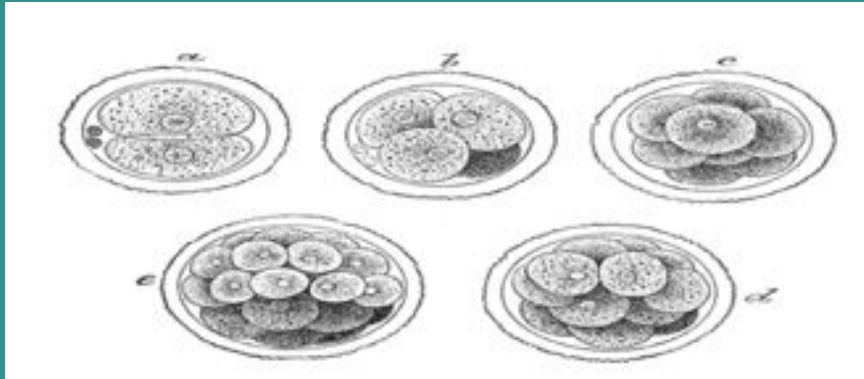
Chapter 5 - The Cell Cycle, Mitosis, and Meiosis

Section 1 - Cell Division and the Cell Cycle



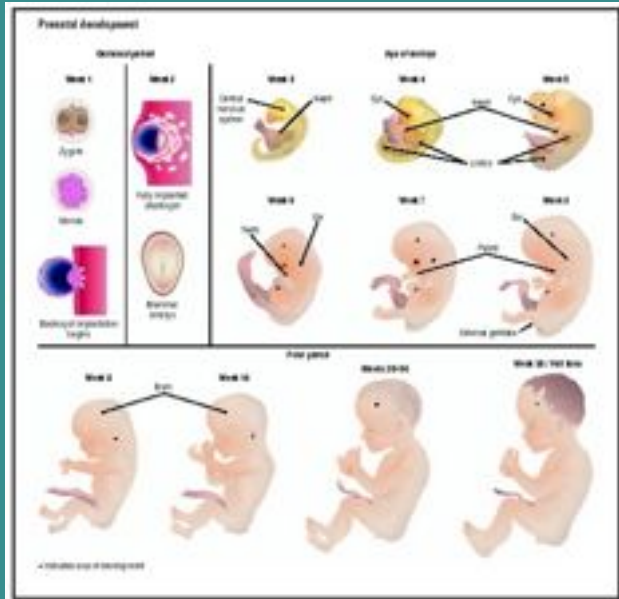
Why are new cell created?

How are new cells created?



Reasons Cells Divide:

1.) Growth and Development



2.) Repair



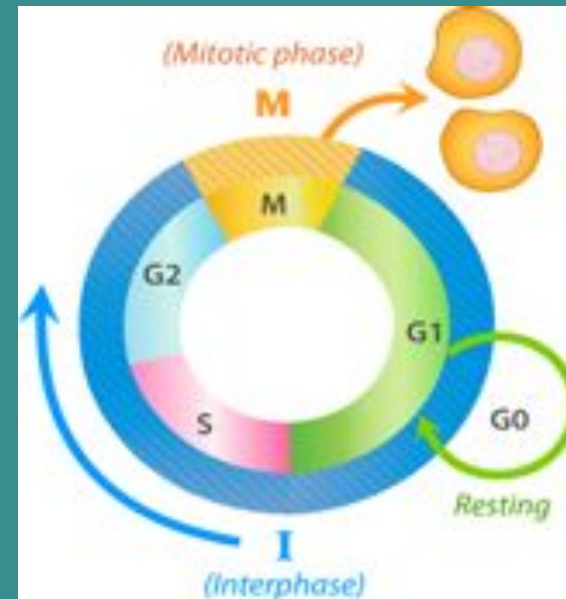
3.) Replace worn-out cells

Cell Cycle

Lifecycle of a cell is known as the cell cycle

Two main parts:

- 1.) **Interphase**: Cell mostly performs "everyday" functions
- 2.) **Mitosis**: Cell divides to become two cells



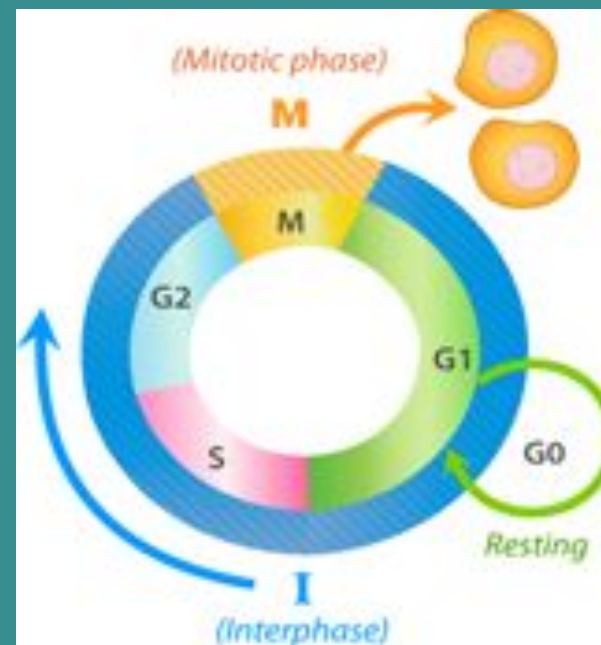
Interphase:

Longest part of cell cycle

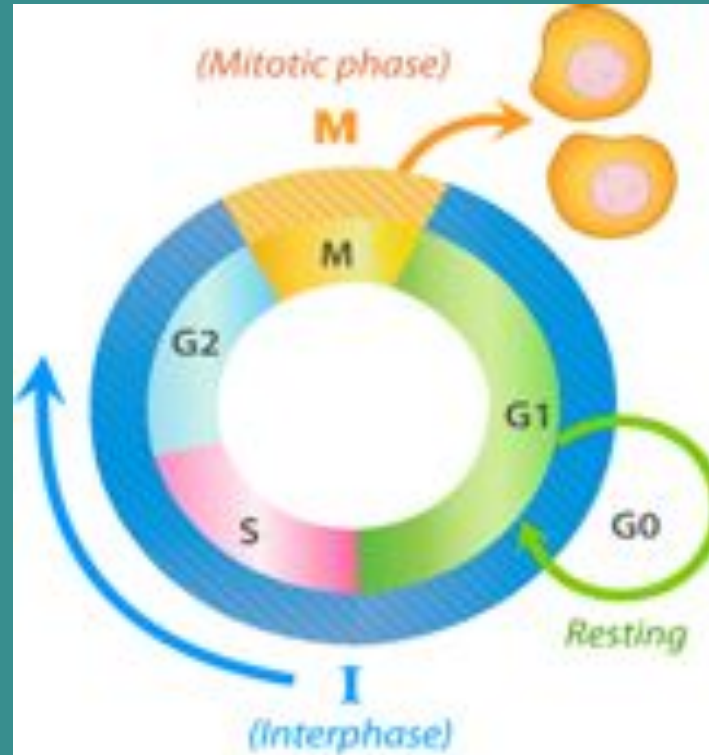
Is also getting ready for mitosis

3 stages

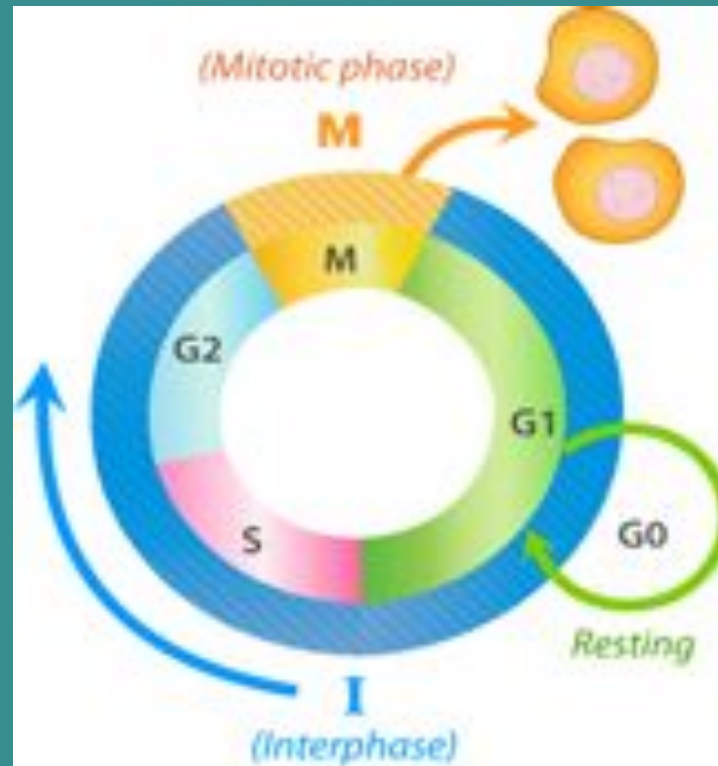
1.) **G1 (First Growth Phase):** Cell doubles in size & doubles # of organelles



2.) **S (Synthesis Phase):** DNA is replicated, so each future cell will have a full copy

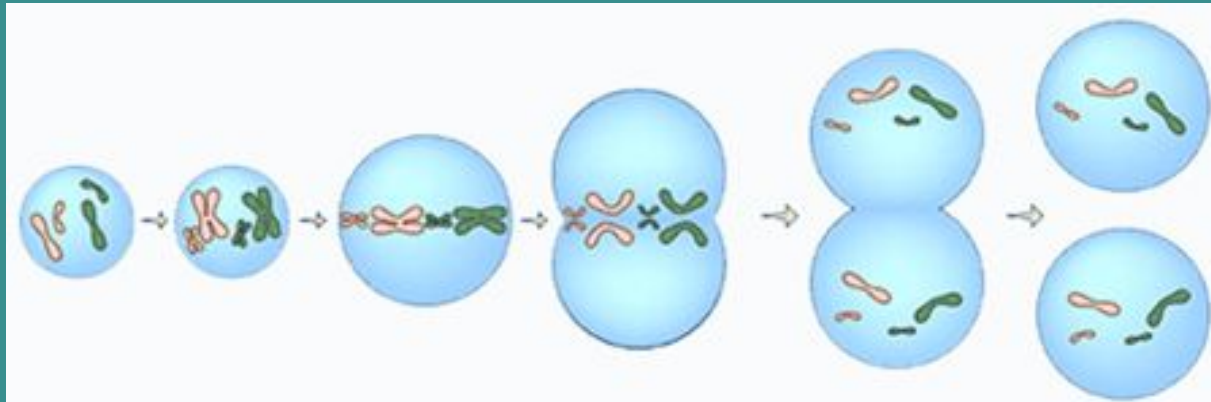


3.) **G2 (Second Growth Phase):** Proteins are made to help cell divide. Now ready for mitosis



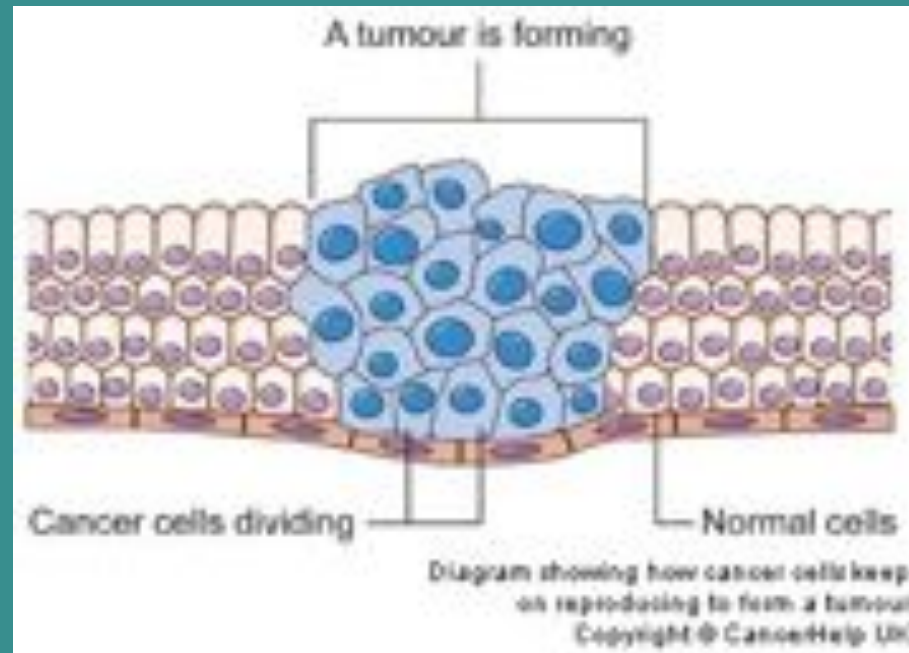
In mitosis, the nucleus divides into two, then the cell divides in half

Parent cell creates two "genetically identical" daughter cells



Cell cycle must be carefully controlled.

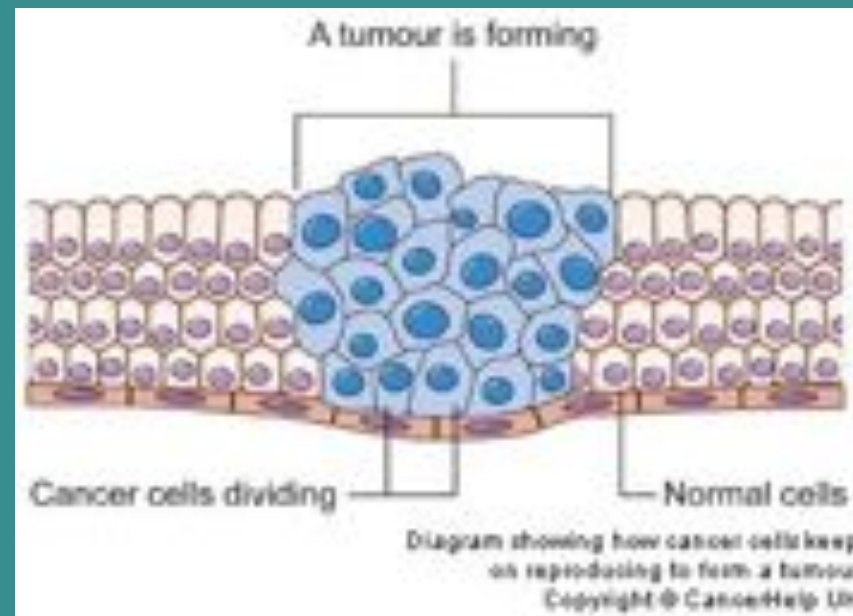
If it gets out of control, cancer can occur



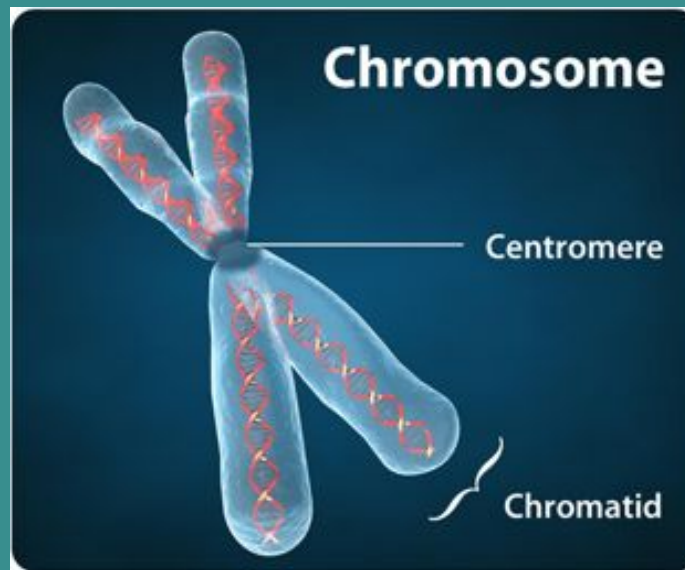
Tumors are masses of abnormal cells

Cells become cancerous when the DNA is mutated

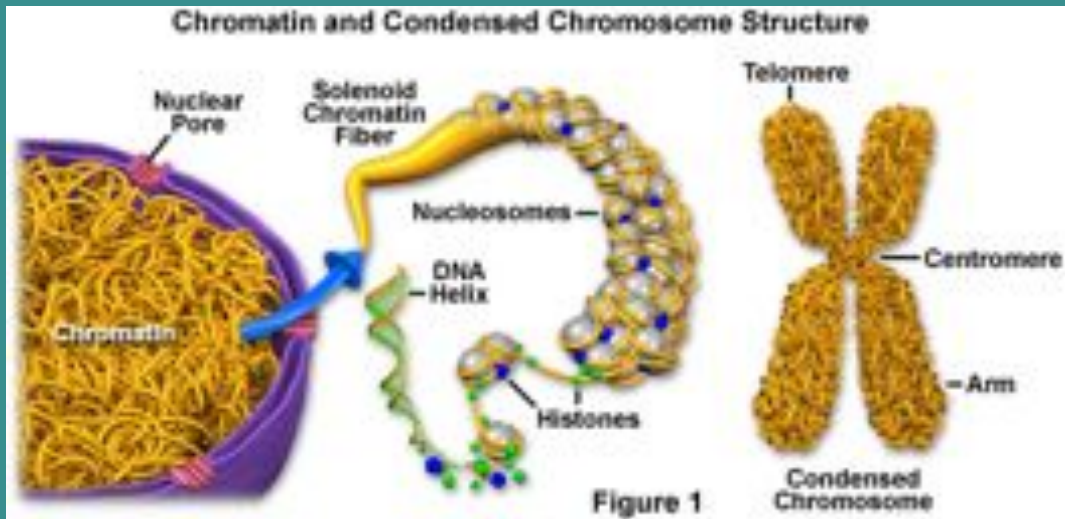
Various causes: UV light, chemicals, radiation,
and even naturally



Section 2 - Chromosomes and Mitosis

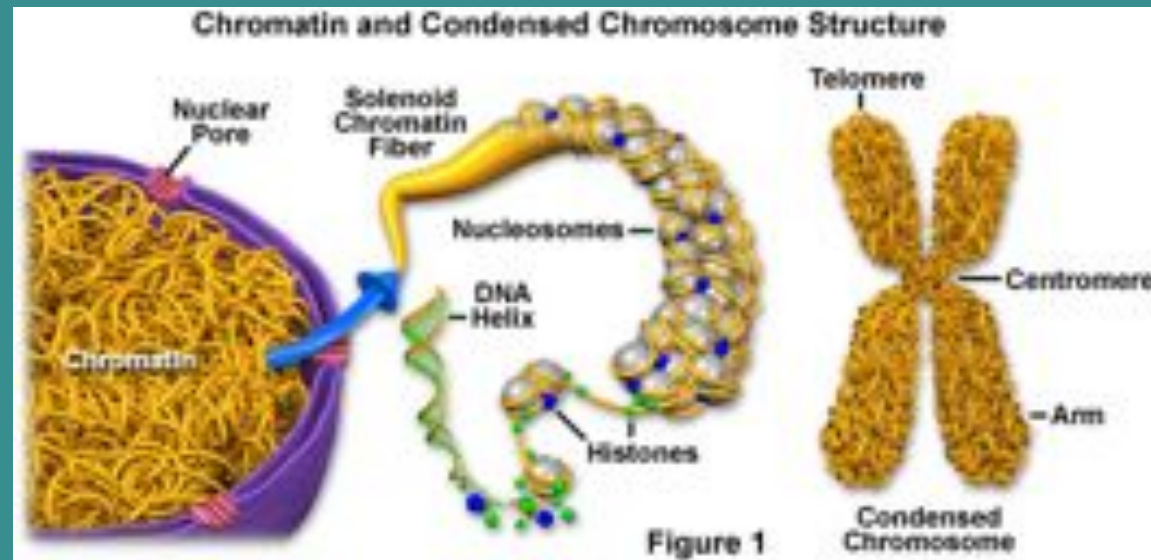


Most of the time, DNA exists as chromatin (slightly coiled)

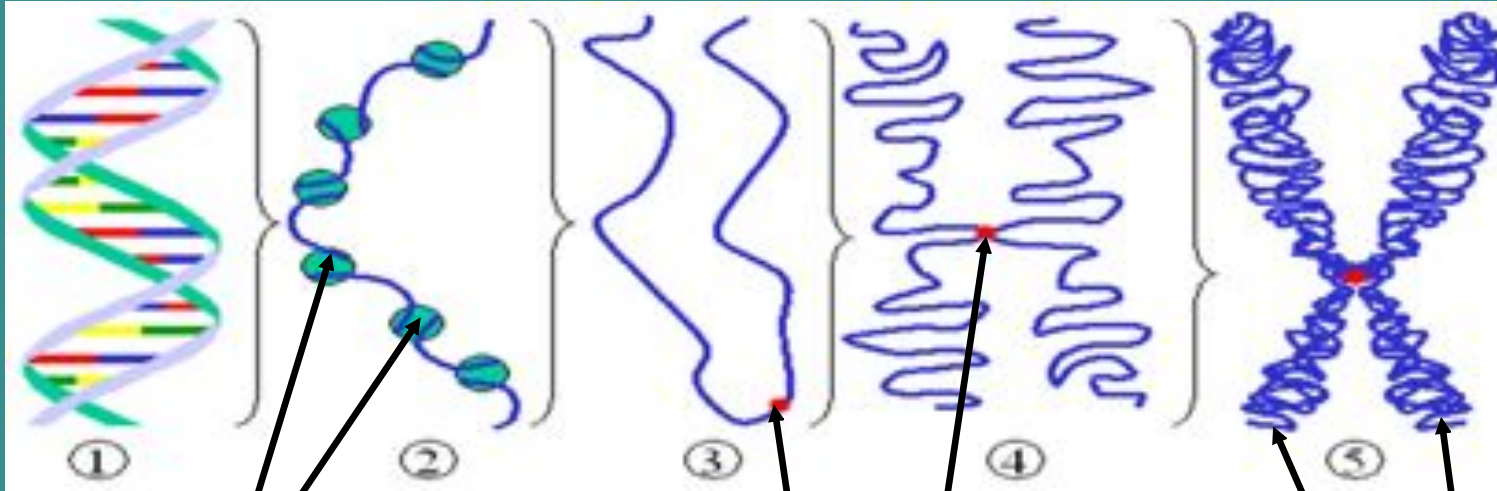


DNA wraps around proteins called histones, then loosely wraps upon itself into a "solenoid"

During cell division, the chromatin (DNA) condenses into a structure called chromosome



The X shape is created because the DNA has already replicated and it is two sister chromatids linked together at the centromere



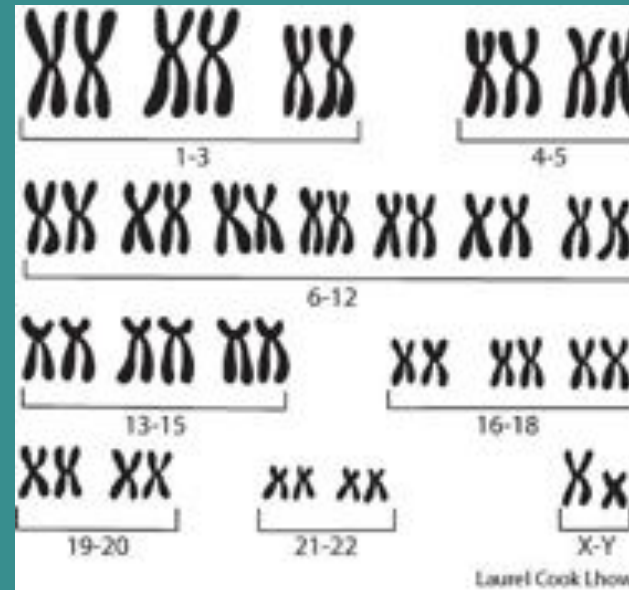
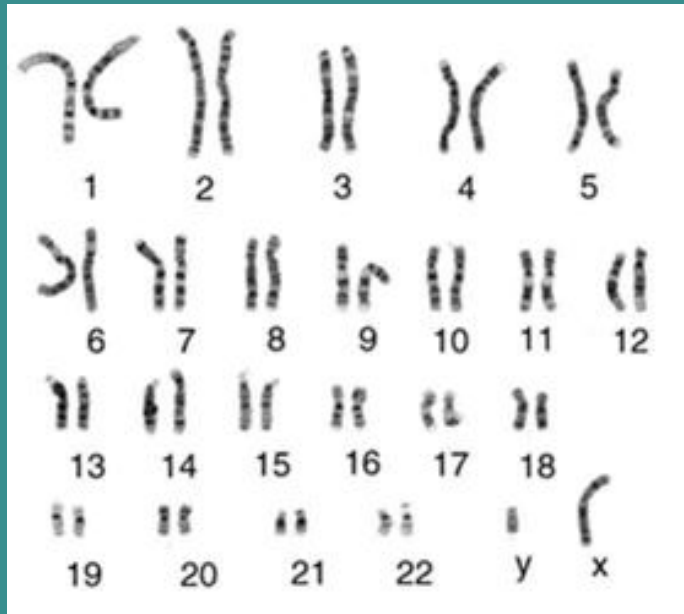
Proteins (Histones)

Centromere (attachment point of two DNA molecules)

chromatids

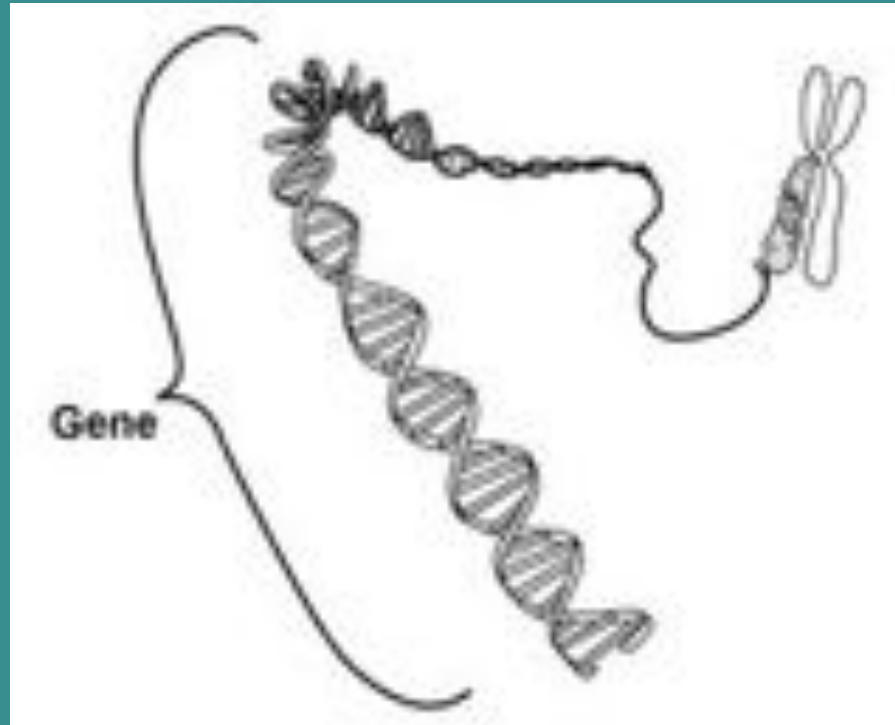
Humans have 23 pairs of chromosomes

Each chromosome within a pair is called a homologous chromosome



Remember, DNA contains information in "genes"

A gene is a segment of DNA that codes for a specific protein

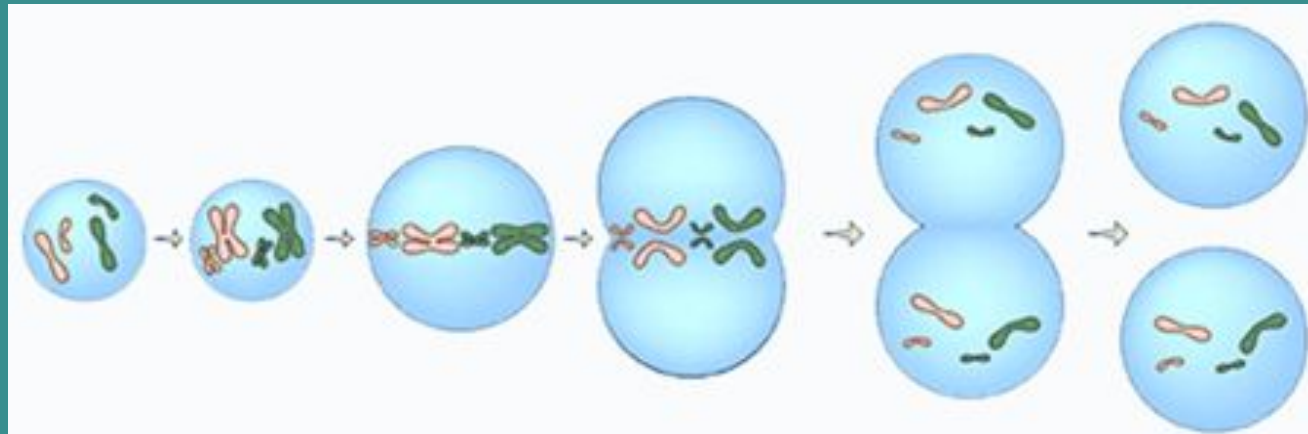


Chromosomes contain hundreds or even thousands of genes

How does mitosis actually occur? 4 Stages

PMAT

Prophase, Metaphase, Anaphase, & Telophase



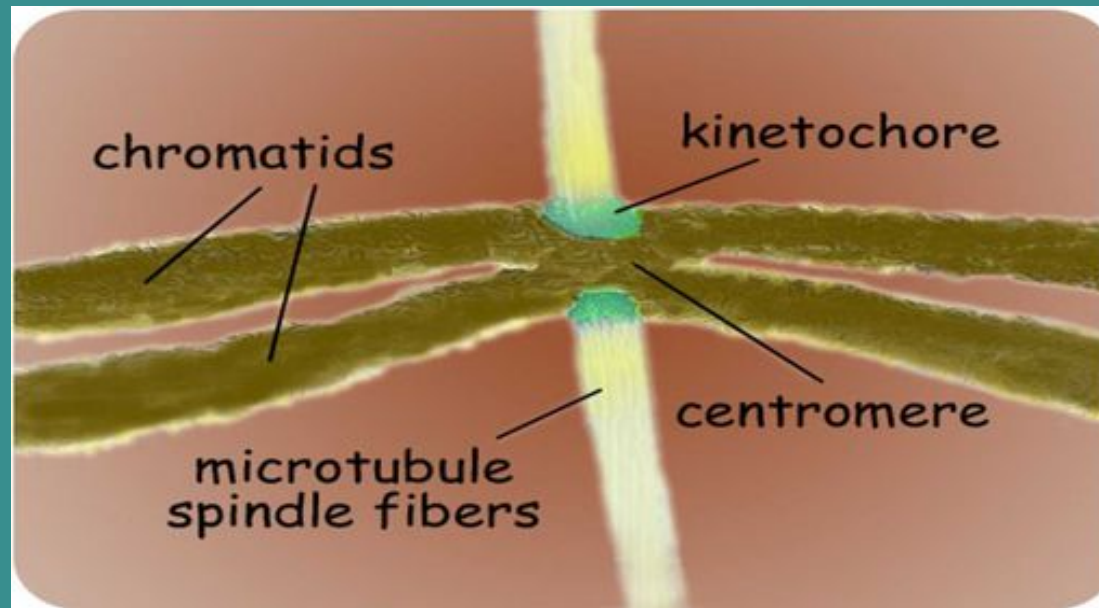
Remember, we actually have double DNA at this point

Prophase

Chromosomes "condense" (wind tightly)

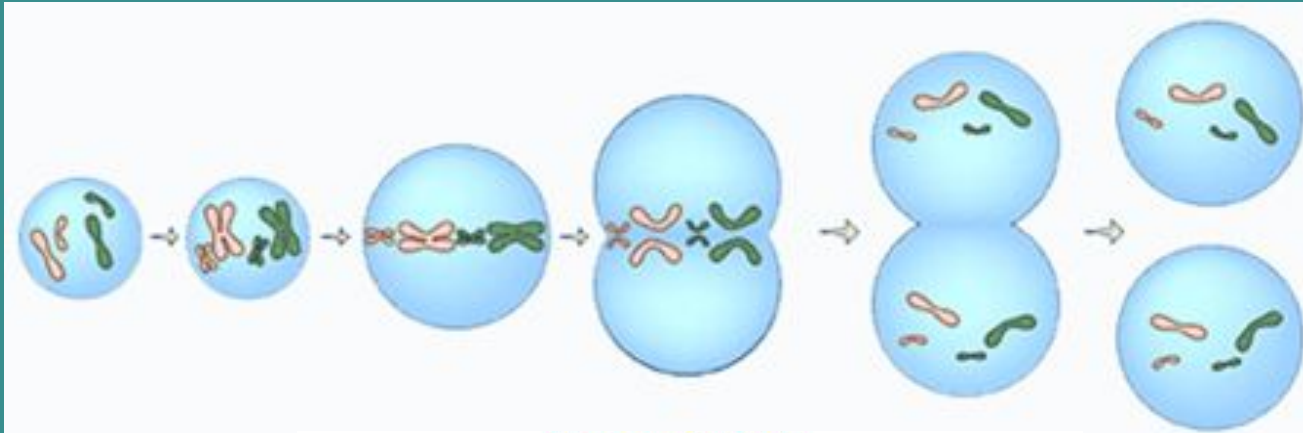
Nuclear envelope breaks down

Spindle Fibers form from the centrioles, attaching to chromosomes

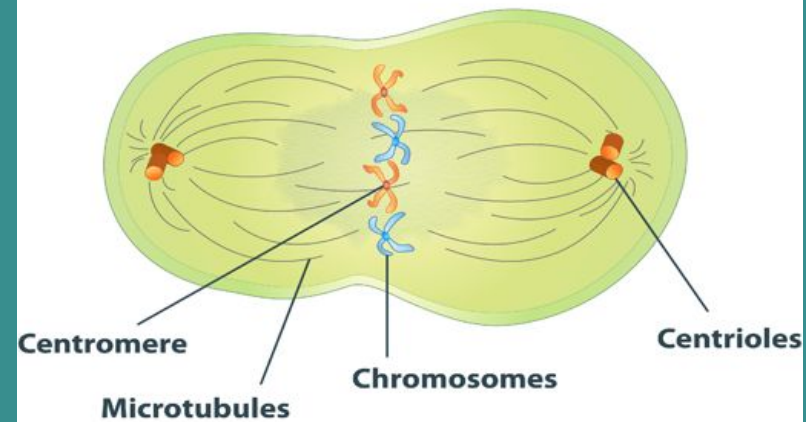


Metaphase

Chromosomes line up in middle of the cell

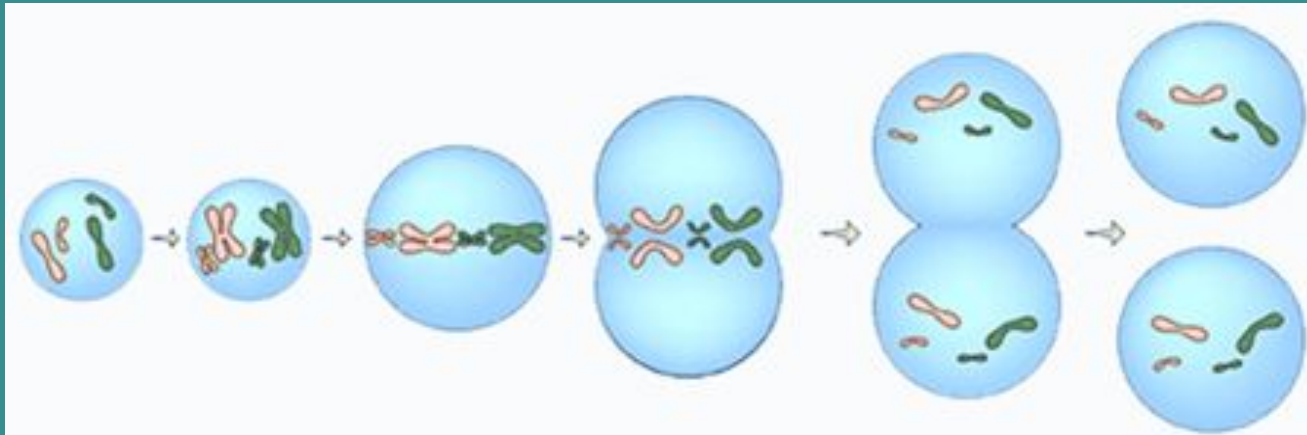


METAPHASE



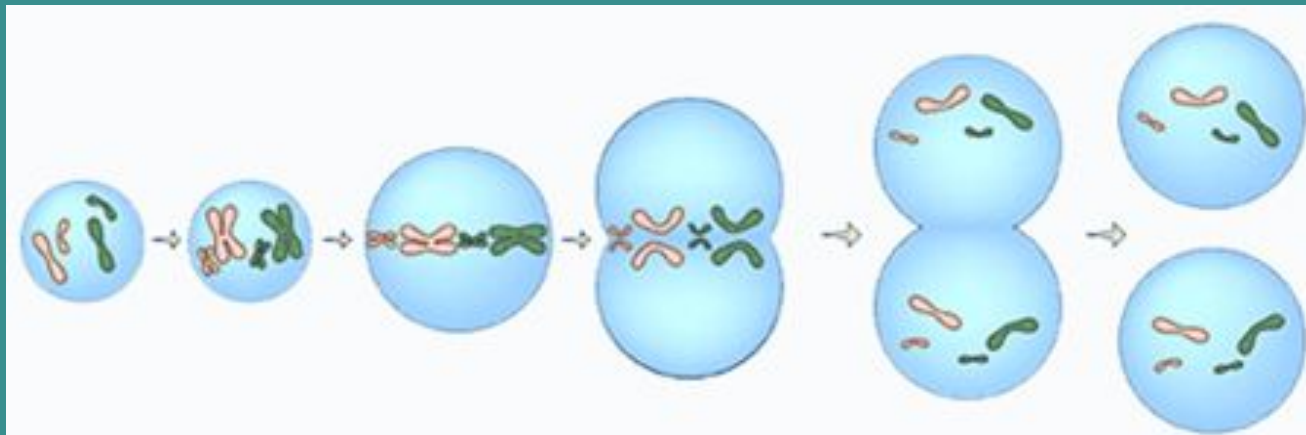
Anaphase

Sister chromatids of each chromosome are pulled apart



Telophase

Spindle fibers dissolve, new nucleus forms in both both cells
Chromosomes uncoil

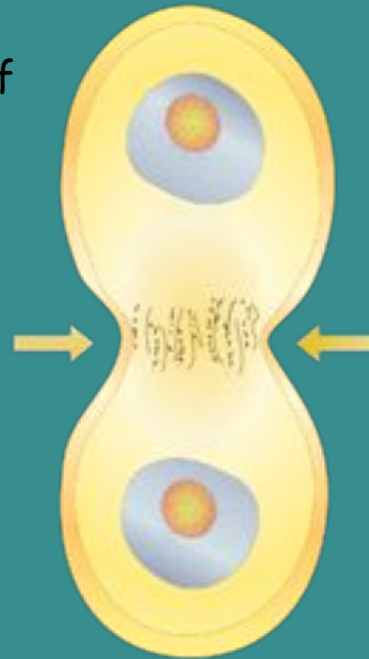


Cytokinesis - Cell finishes dividing
(not technically part of mitosis)

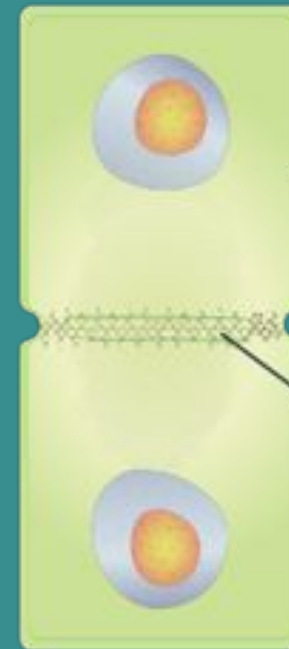
CYTOKINESIS

Animal cell - cytoplasm pinches off

Plant cell - "Cell Plate" forms



Animal cell

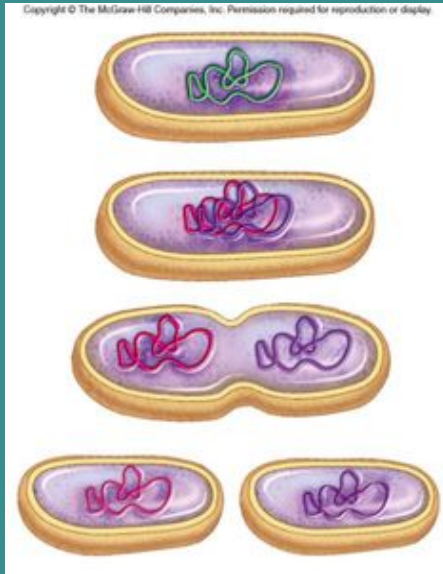


Plant cell



Section 3 - Reproduction and Meiosis

Two types of reproduction:



Asexual - Single parent

Sexual - Two parents

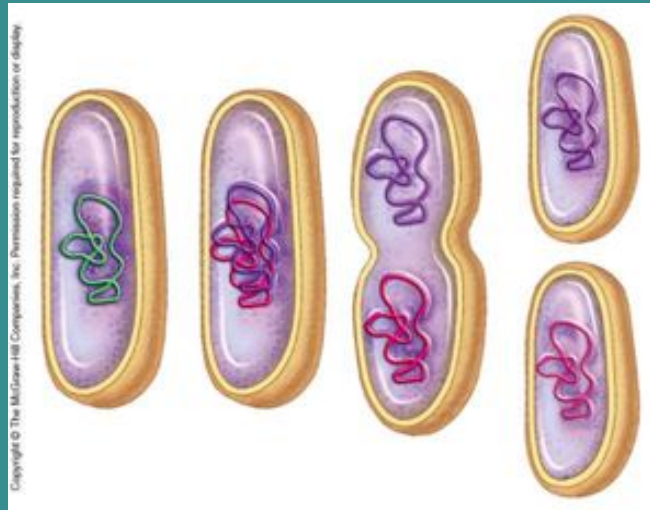
Both have + and -



Asexual Reproduction

Very Quick

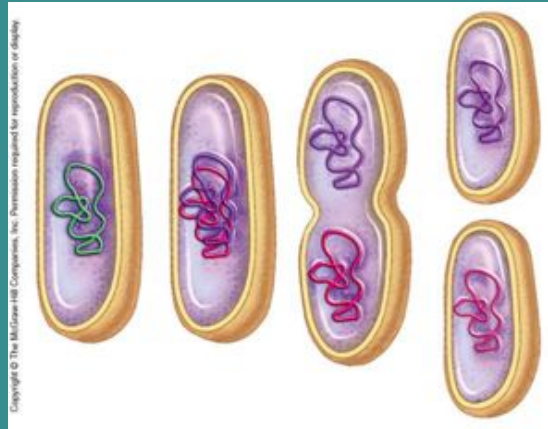
Does not require meeting of male & female



Cannot mix beneficial traits from two parents (Is genetically identical to parent)

Examples:

Bacteria - Binary Fission - Grow, chromosome doubles, divide in half



Fragmentation - Flatworms (animals) divide in two, each half regenerates into a new flatworm

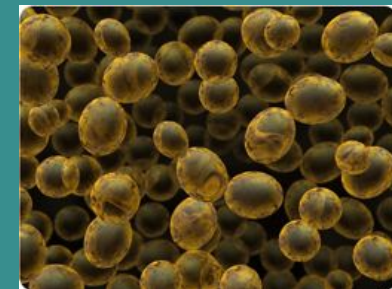


Parthenogenesis - Unfertilized egg can grow into new organism



Some insects, fish, & lizards

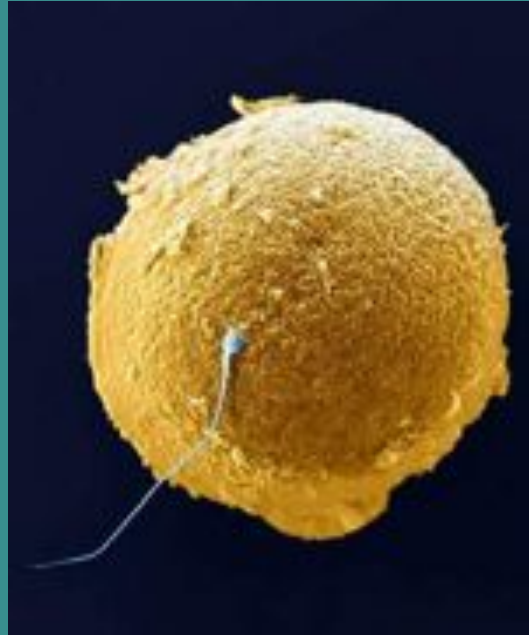
Offspring has only half DNA



Budding - Yeast ("bud" grows on adult, falls off)

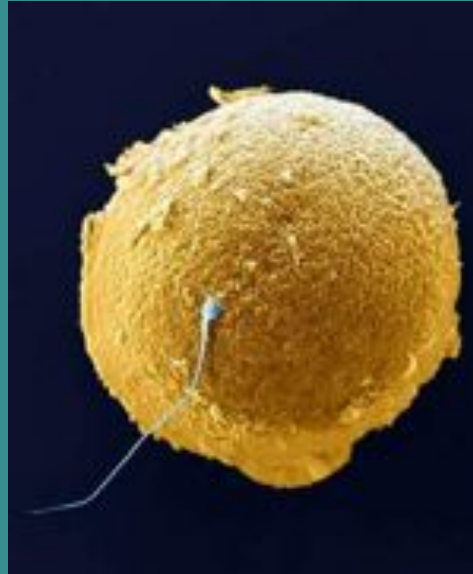
Sexual Reproduction

sperm cell + egg cell \longrightarrow zygote (first cell of new organism)



Animals, plants, and fungi all reproduce this way

Sperm & egg cells are called gametes (sex cells)

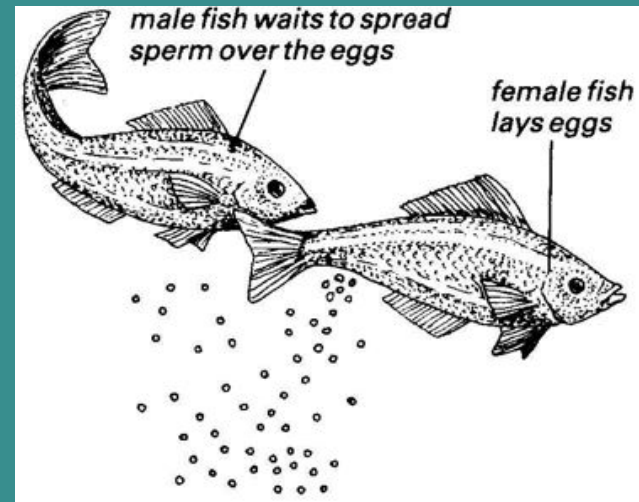


Produced in gonads

Males - Testes

Females - Ovaries

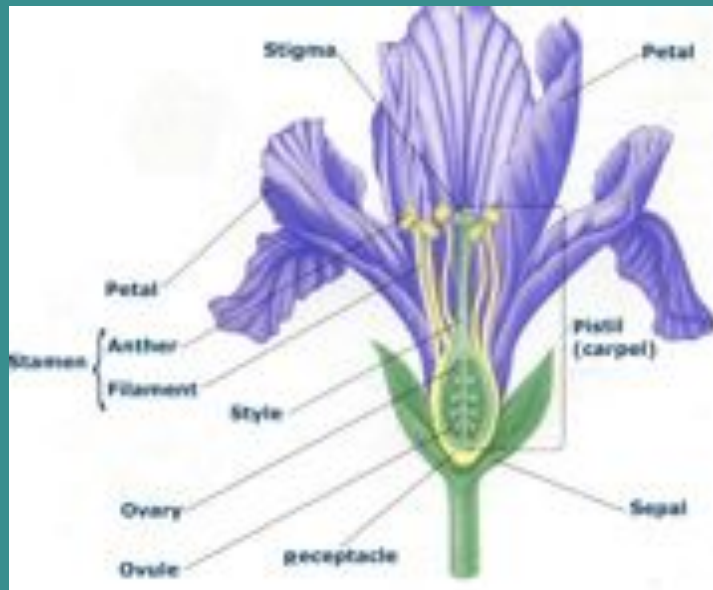
Aquatic animals release their gametes in water and will combine by chance. External fertilization



Land animals reproduce by internal fertilization (sexual intercourse must take place)

Plants can reproduce sexually

Flowers contain reproductive parts



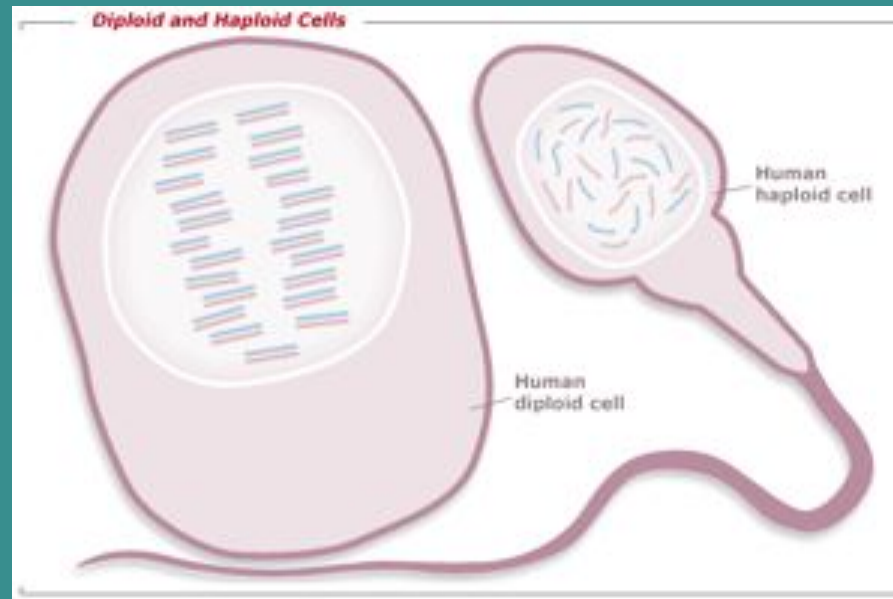
Sperm is in pollen

Egg is in ovary

Self-pollination versus Cross-pollination

Gametes (sperm & eggs) must have half the # of chromosomes

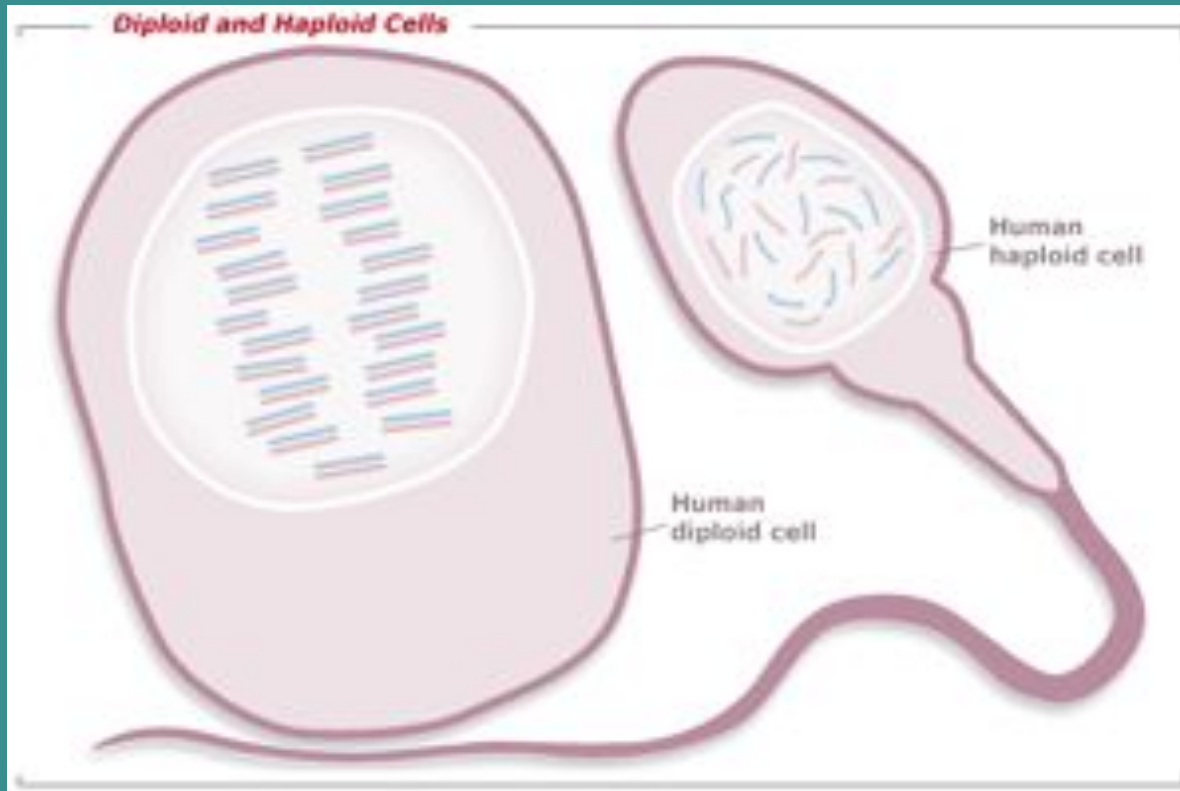
Why?



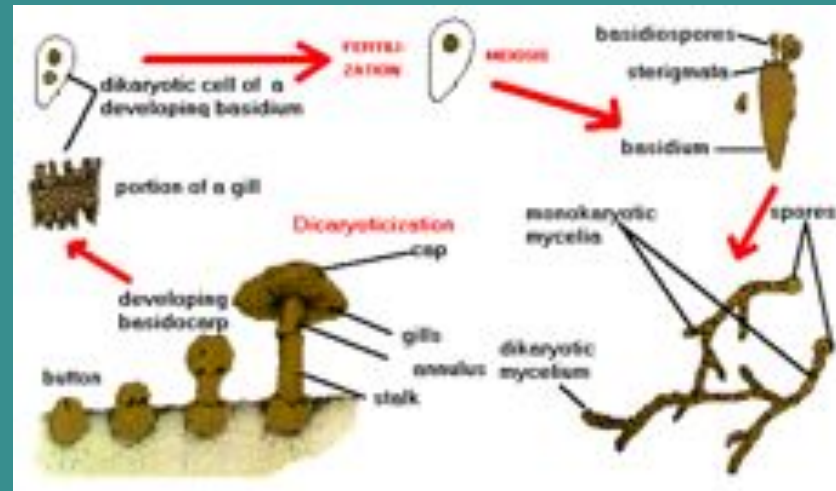
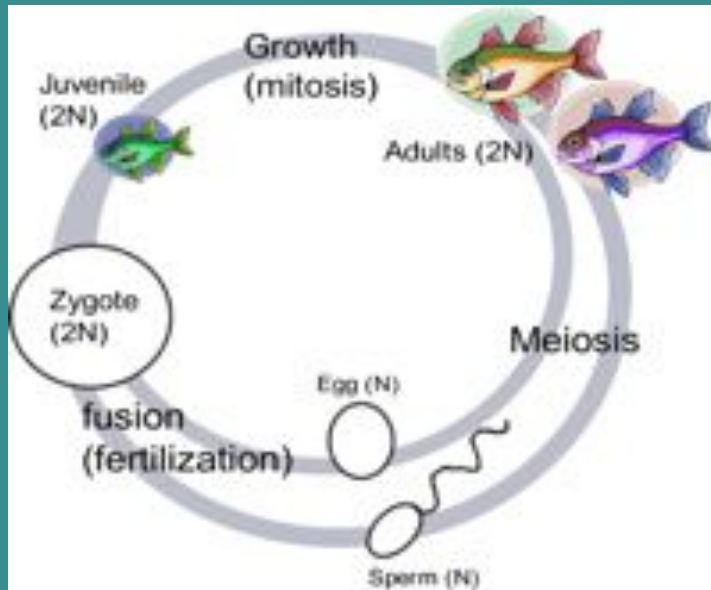
Diploid ($2n$) - A cell with two of each chromosome

Haploid (n) - A cell with one of each chromosome

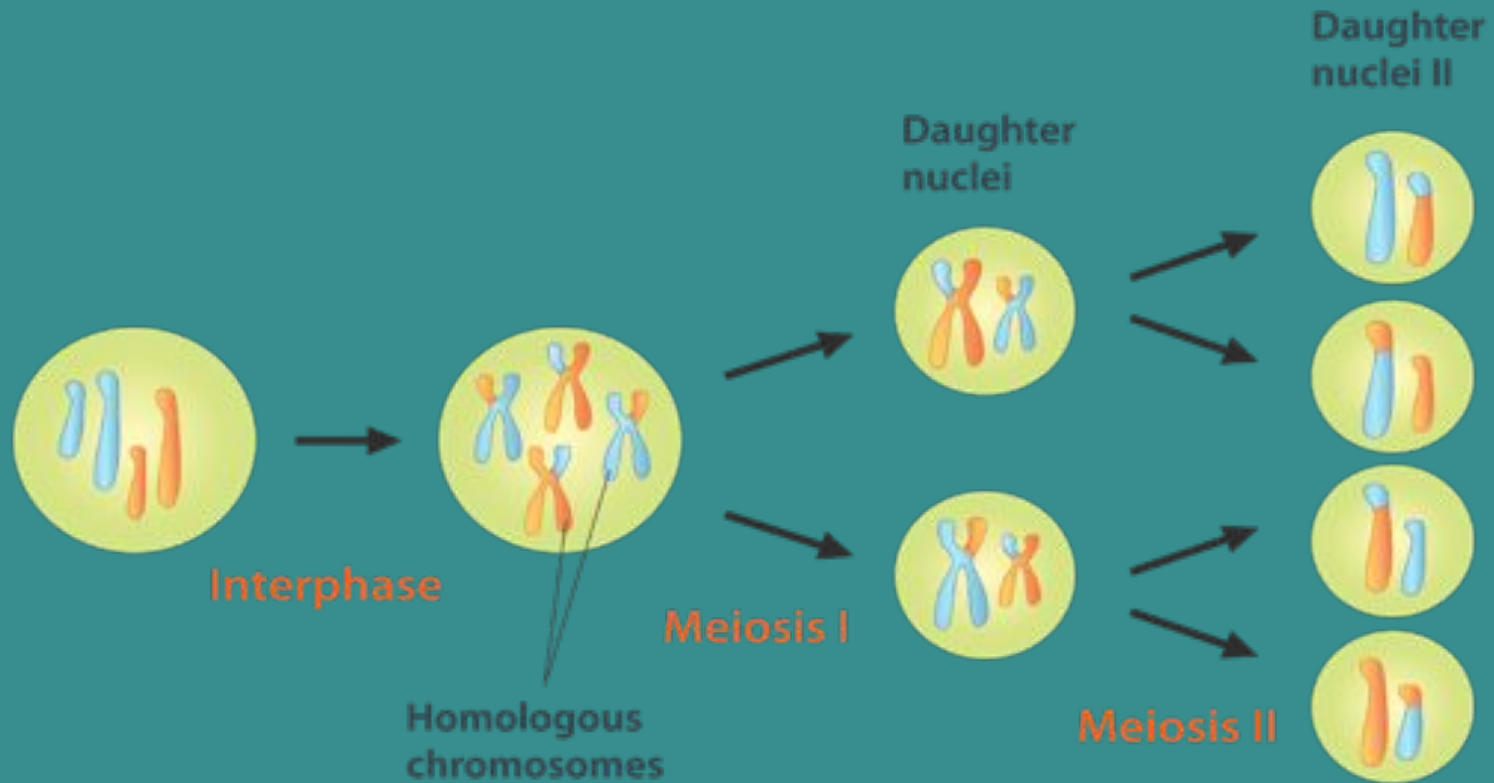
$$n + n = 2n$$



Diploid vs Haploid Life Cycles

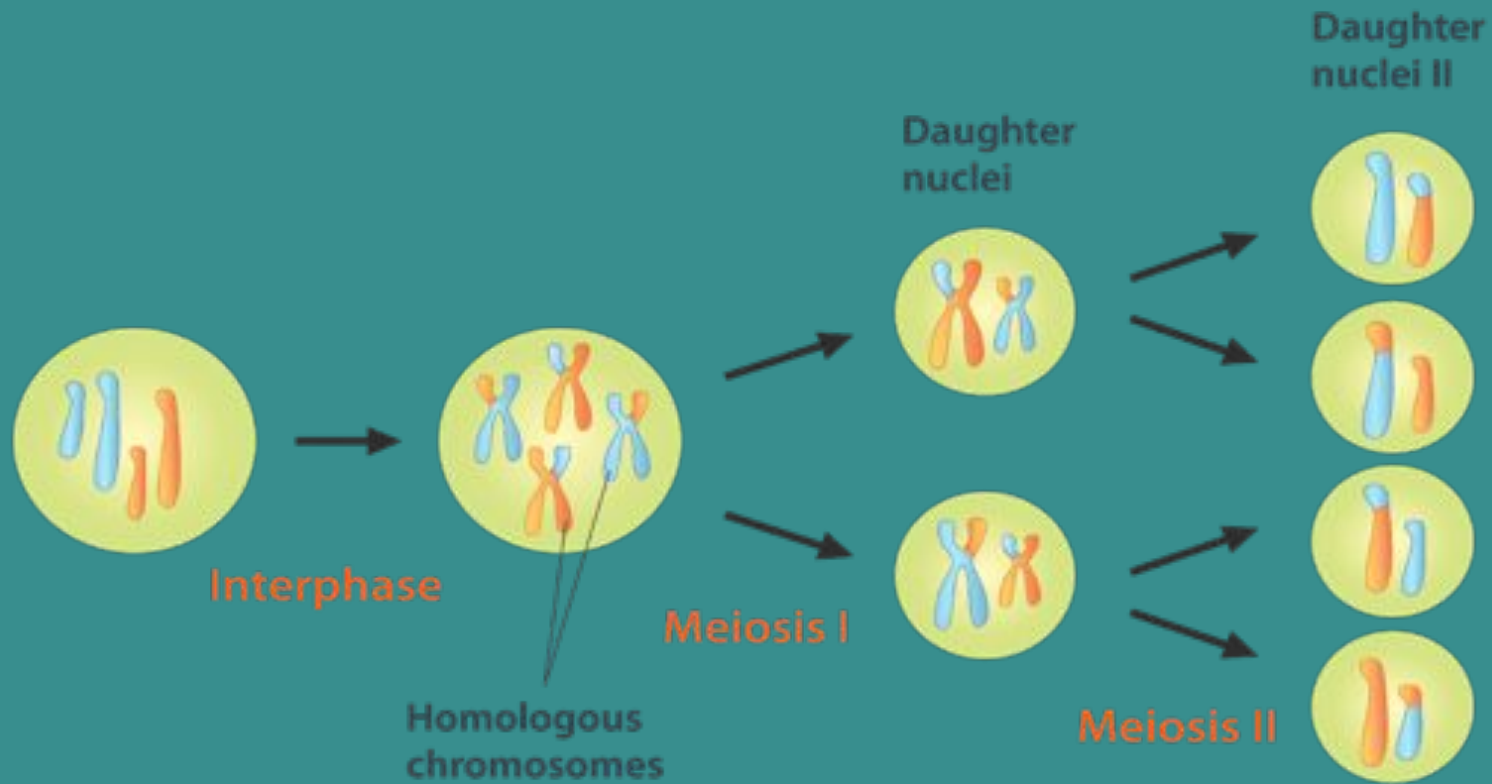


Gametes are formed through a process called meiosis



Meiosis is basically mitosis happening twice

Goal is to make gametes

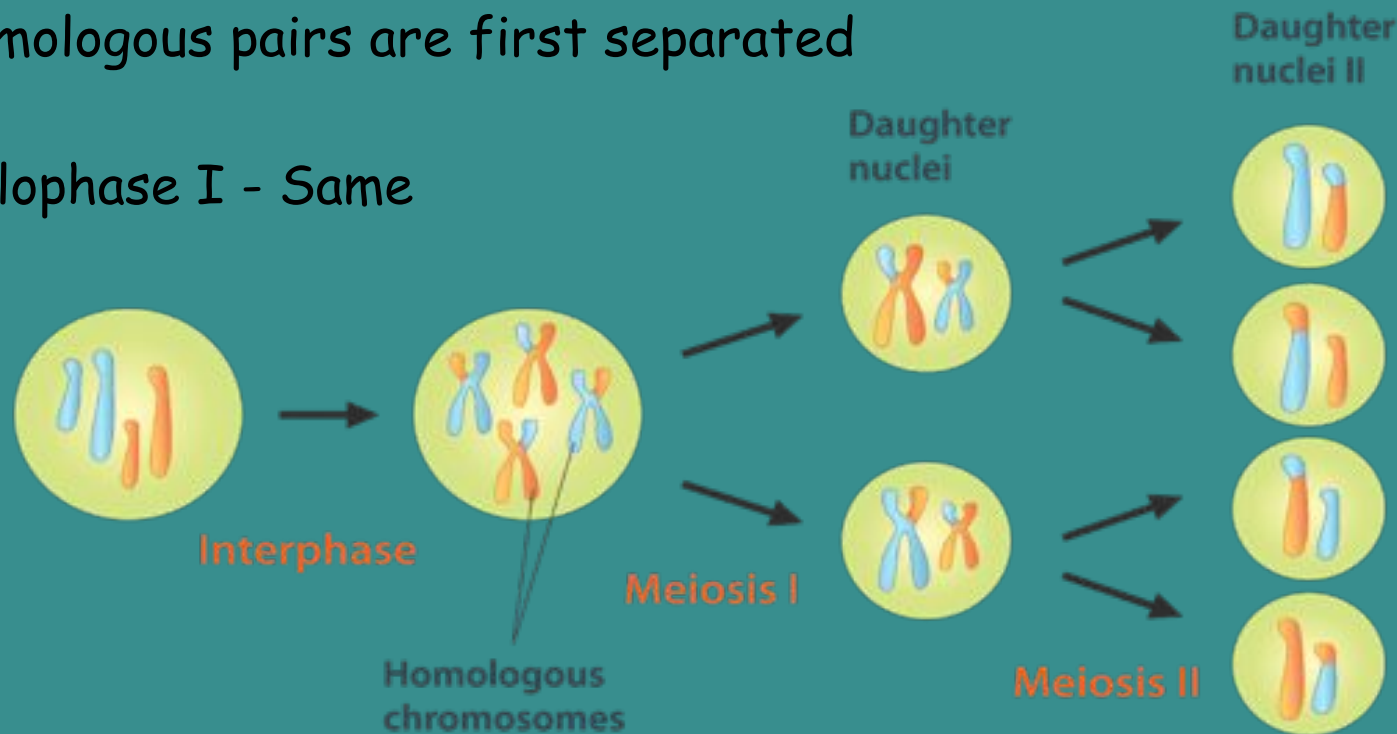


Prophase I - Only main difference is that the homologous pairs line up next to each other.

Metaphase I - Crossing Over can occur (segments of the chromosomes trade places)

Anaphase I - Instead of separating sister chromatids, the homologous pairs are first separated

Telophase I - Same

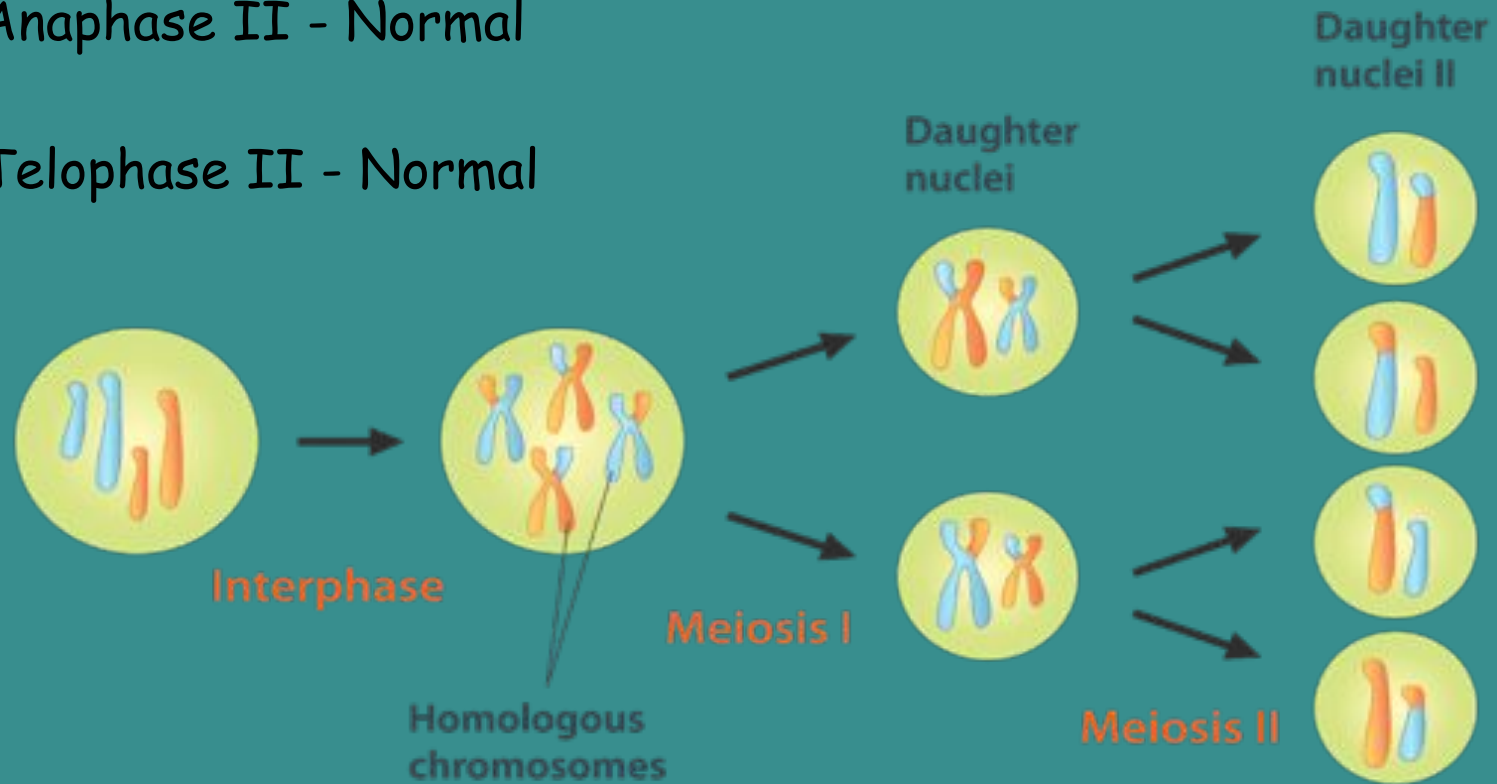


Prophase II - Normal

Metaphase II - Normal

Anaphase II - Normal

Telophase II - Normal





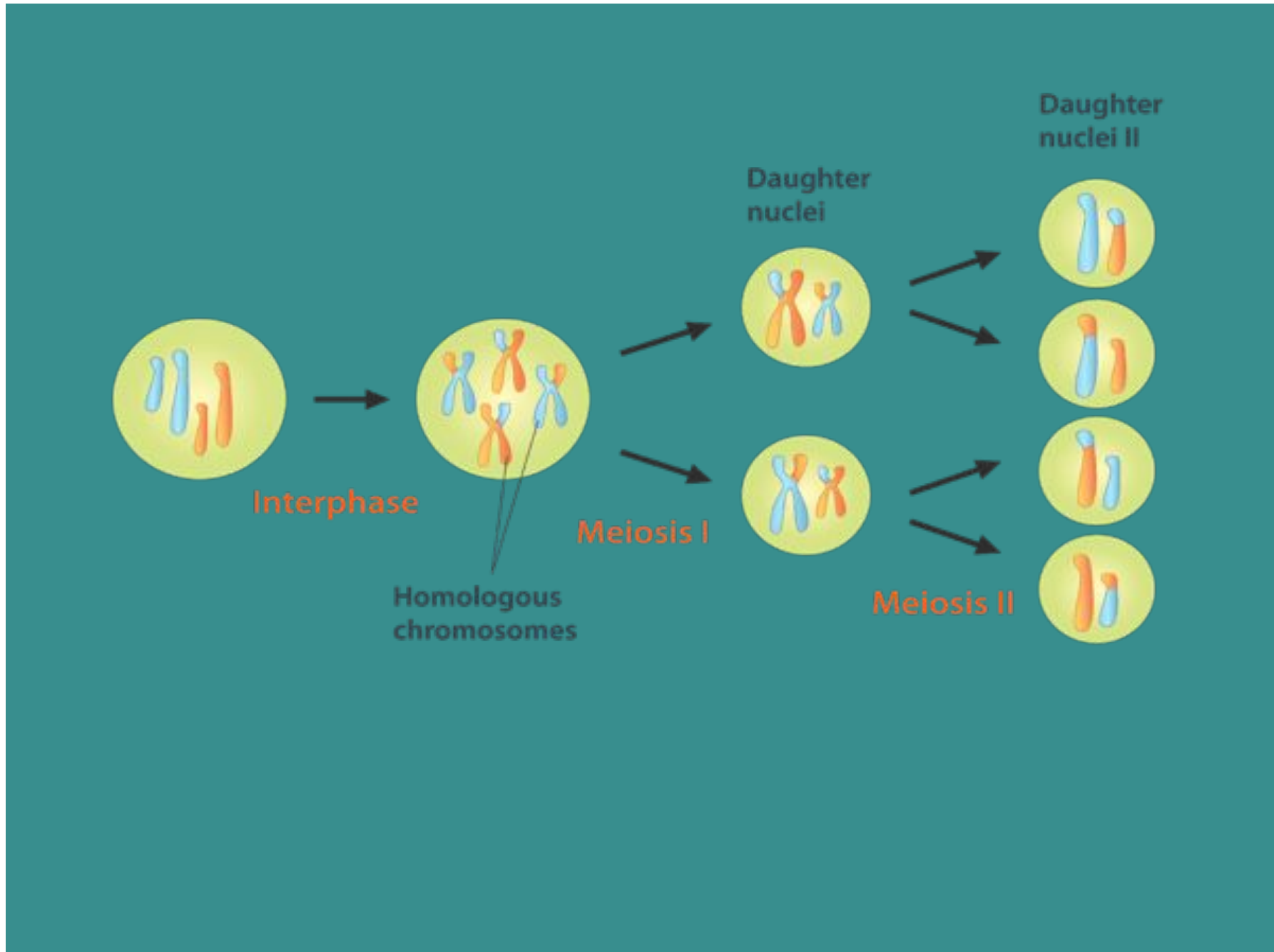
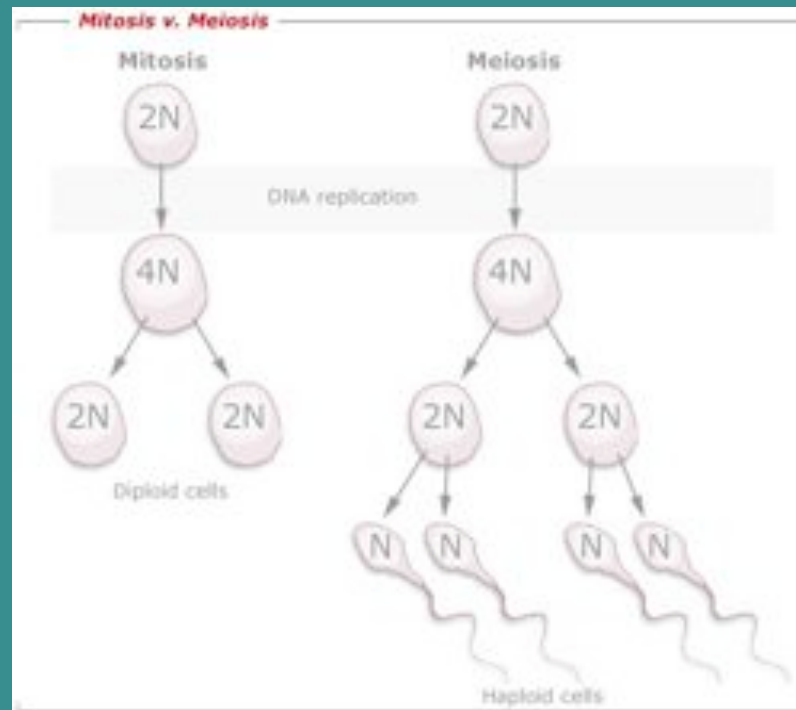


Table 1 - Mitosis vs. Meiosis: A Comparison		
	Mitosis	Meiosis
Purpose:	To produce new cells	To produce gametes
Number of cells produced:	2	4
Rounds of Cell Division:	1	2
Haploid or Diploid:	Diploid	Haploid
Daughter cells identical to parent cells?	Yes	No
Daughter cells identical to each other?	Yes	No



<http://www.pbs.org/wgbh/nova/baby/divide.html>



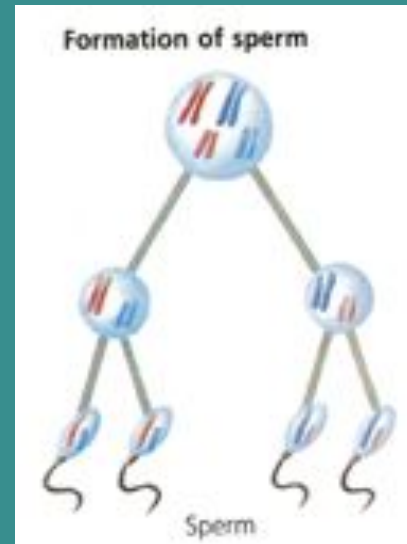
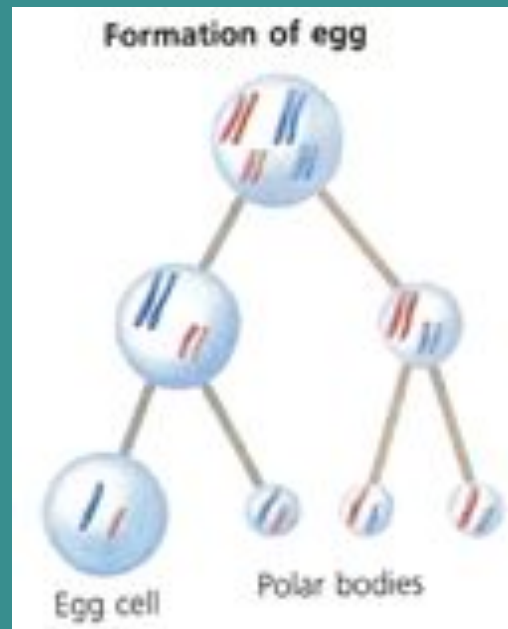
The random nature of the division of the chromosomes leads to genetic diversity

It can lead to new traits in species which can help a species survive

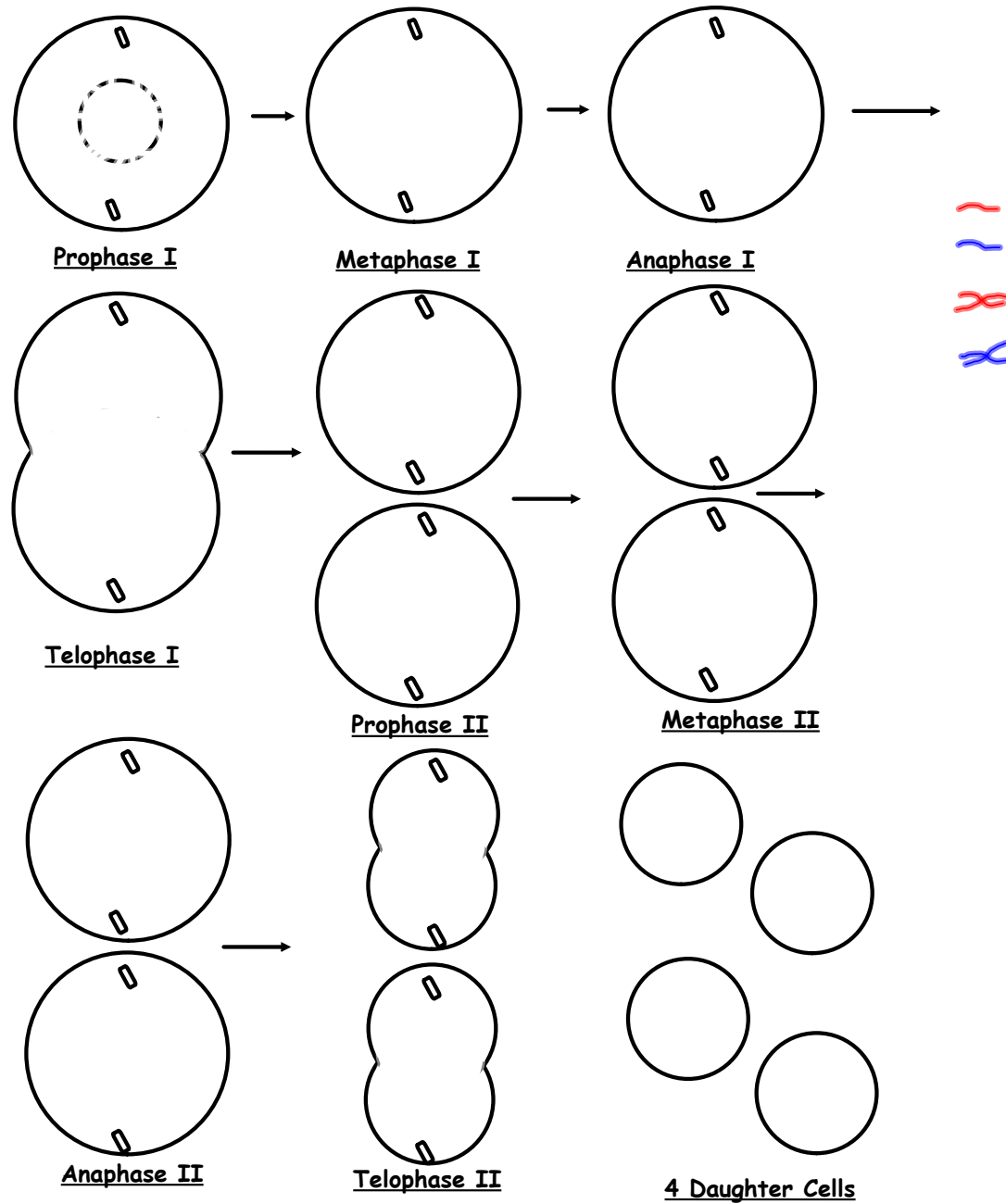


During the production of female gametes (eggs), the cytoplasm of the parent cell that undergoes meiosis divides unequally

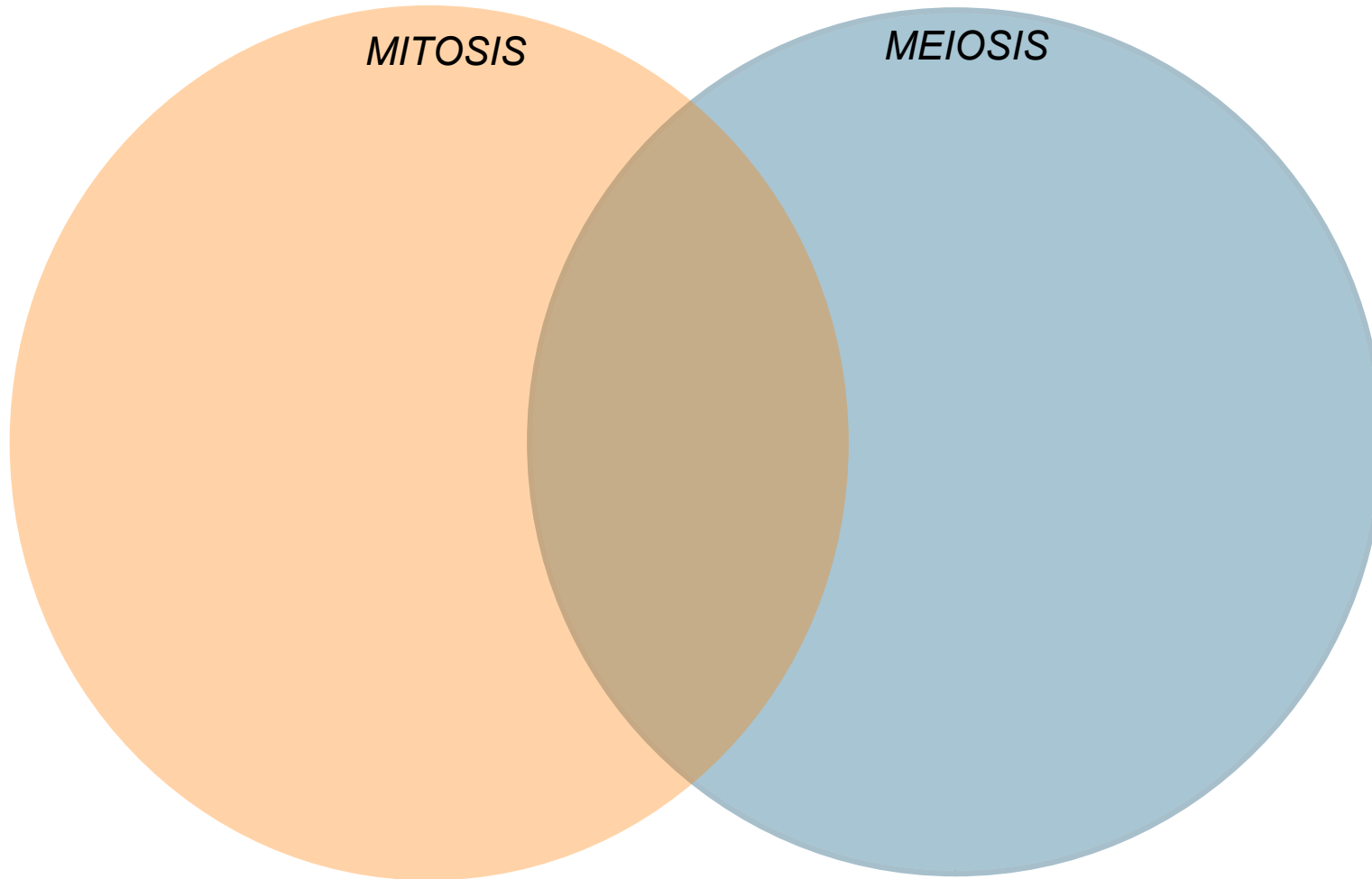
The egg cell (ootid) receives most of the cytoplasm, the other polar bodies receive little and eventually die



Ch. 5 Notes



Ch. 5 Notes



results in diploid cells in body cells in reproductive cells	occurs in phases 4 daughter cells chromosome replication	type of cell division spindle involved involves 1 cell division	involves 2 cell divisions results in haploid cells 2 daughter cells
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