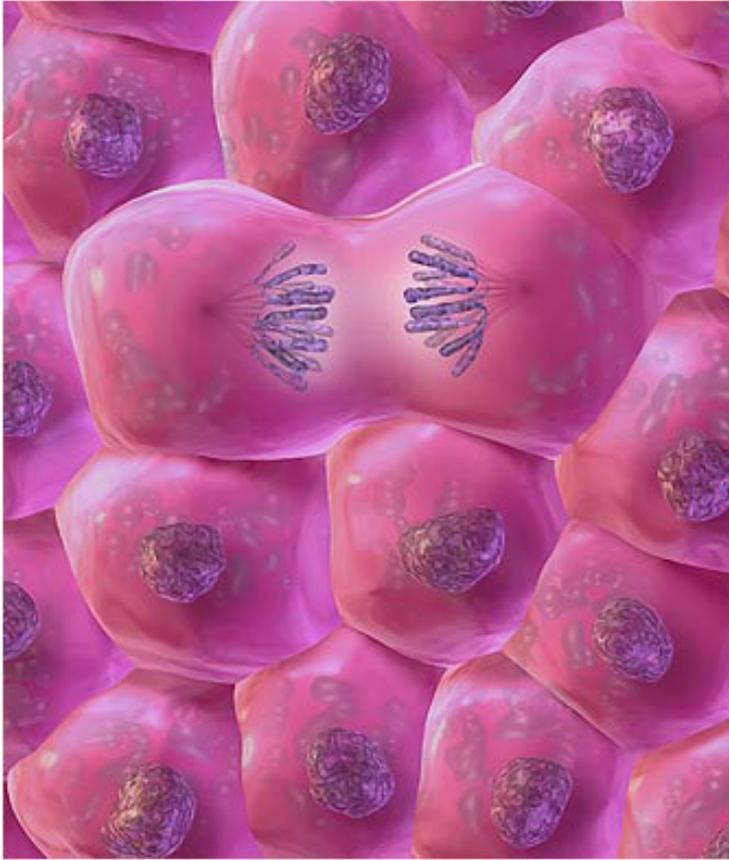
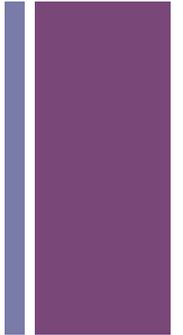




Cell Division

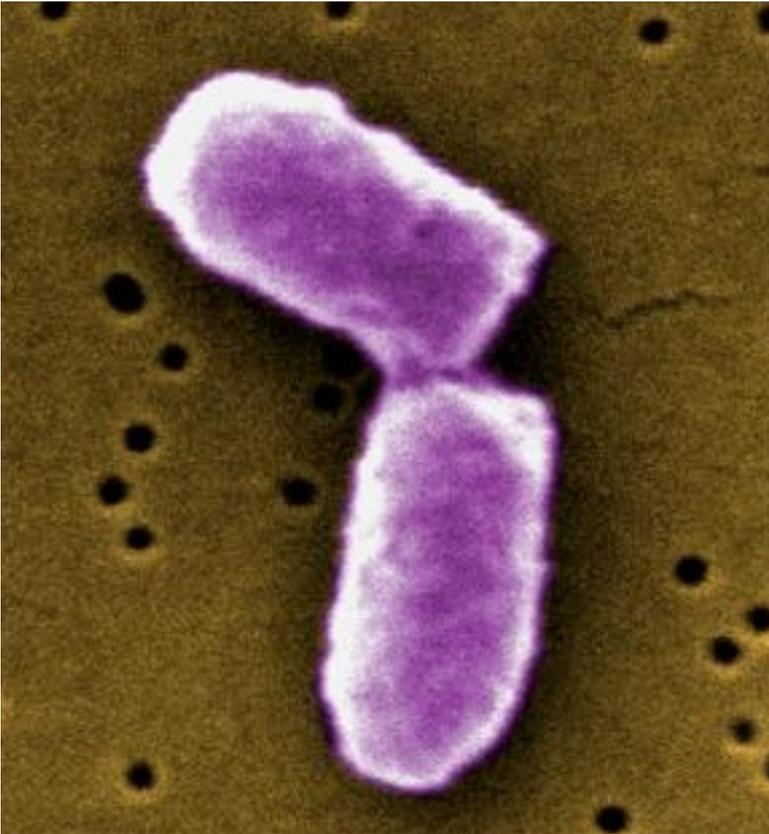
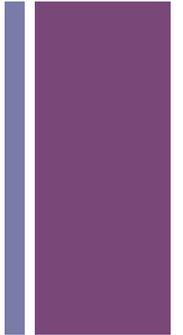


= Process by which one cell divides into two cells.

- includes the division of the nucleus and the organelles



Reasons for Cell Division



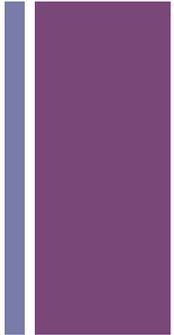
1. Unicellular organisms

- Means of reproduction in simple organisms

* bacteria → binary fission
(asexual reproduction)



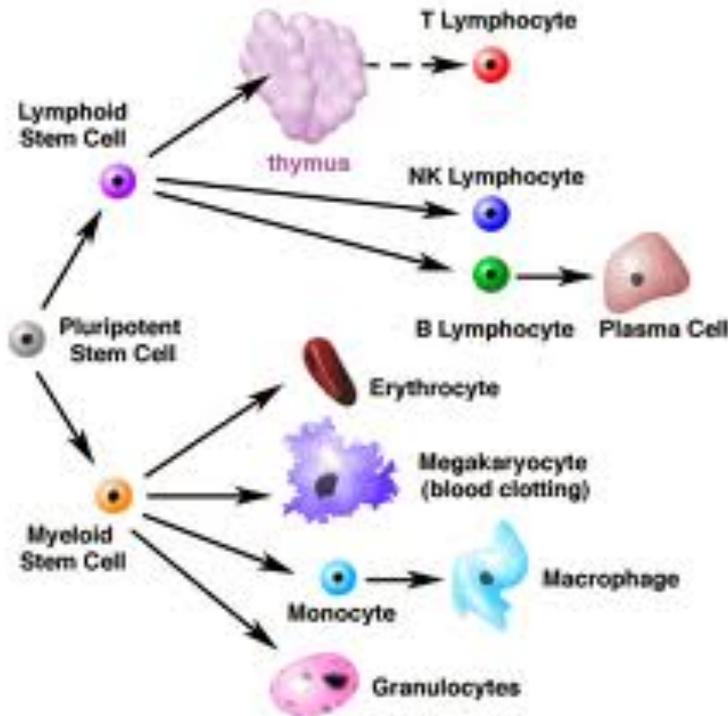
Reasons for Cell Division



2. Multicellular Organisms

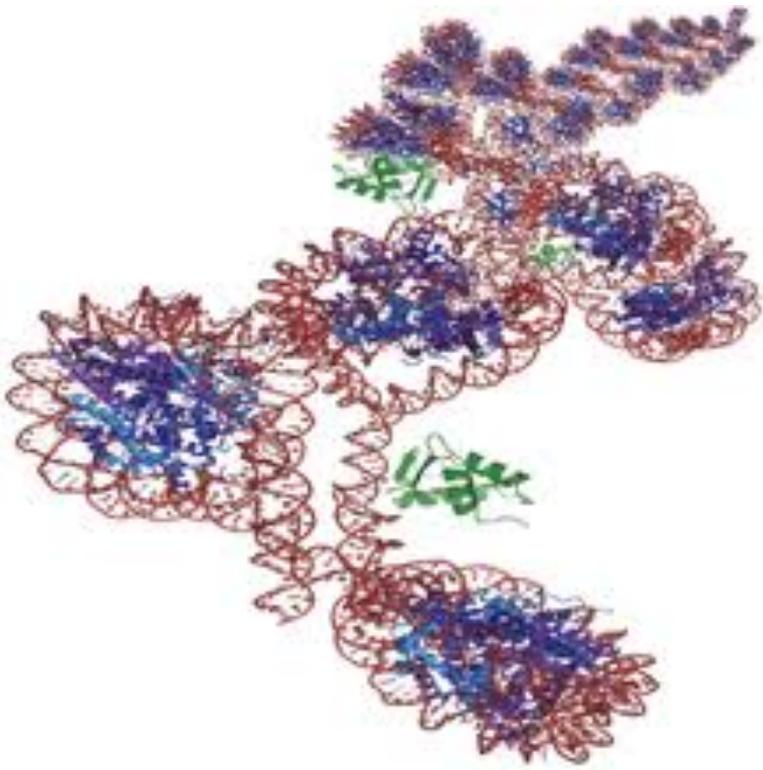
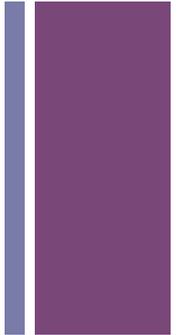
-Growth and development

* leads to differentiation in cells → cells become specialized



+

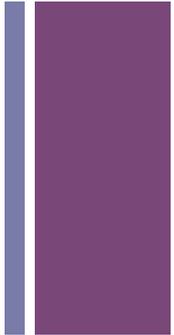
B. DNA



1. Chromatin = thin form of DNA found in cells that are NOT dividing.

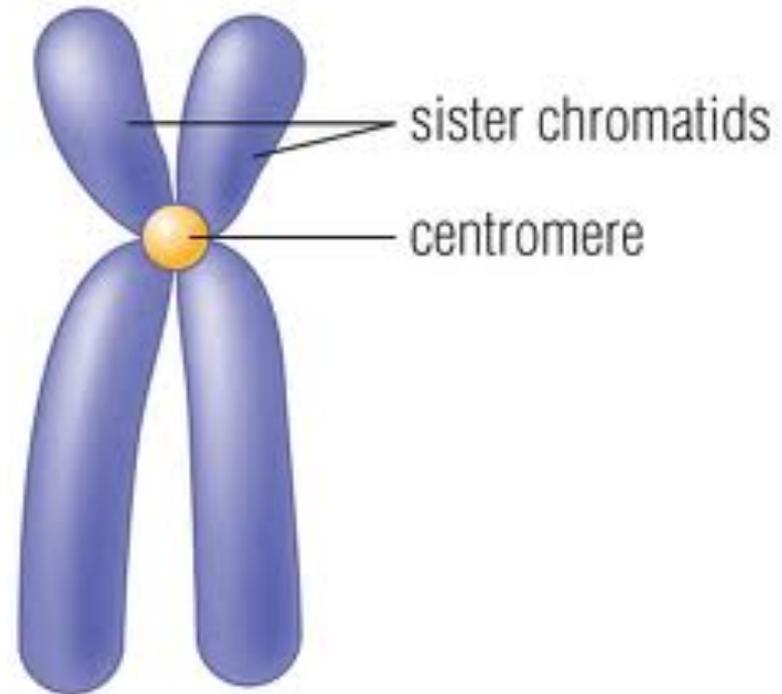


B. DNA



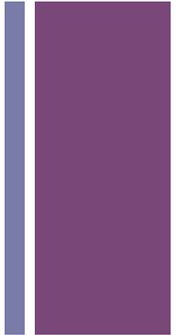
2. Chromosomes = thick form of DNA found in cells that ARE dividing

- each chromosome is made up of 2 identical chromatids





C. Chromosome Number(human)



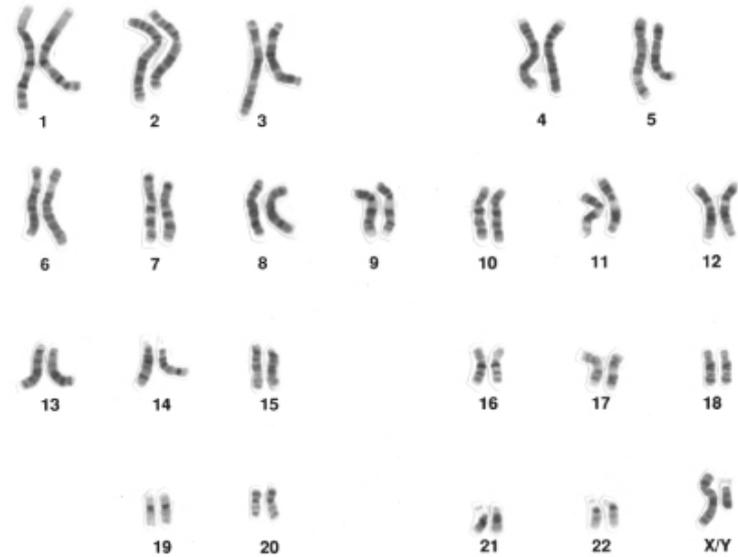
1. 46 chromosomes in human cells = diploid

- 44 are autosomes = control body characteristics

- 2 are sex chromosomes = control gender

- exist as homologous pairs → 23 pair

* one from your mom, one from your dad



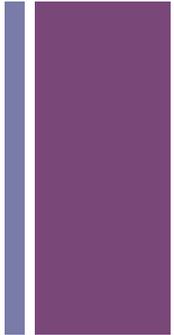
+ C. Chromosome Number

2. Some cells have just 23 chromosomes = haploid (sperm and eggs)

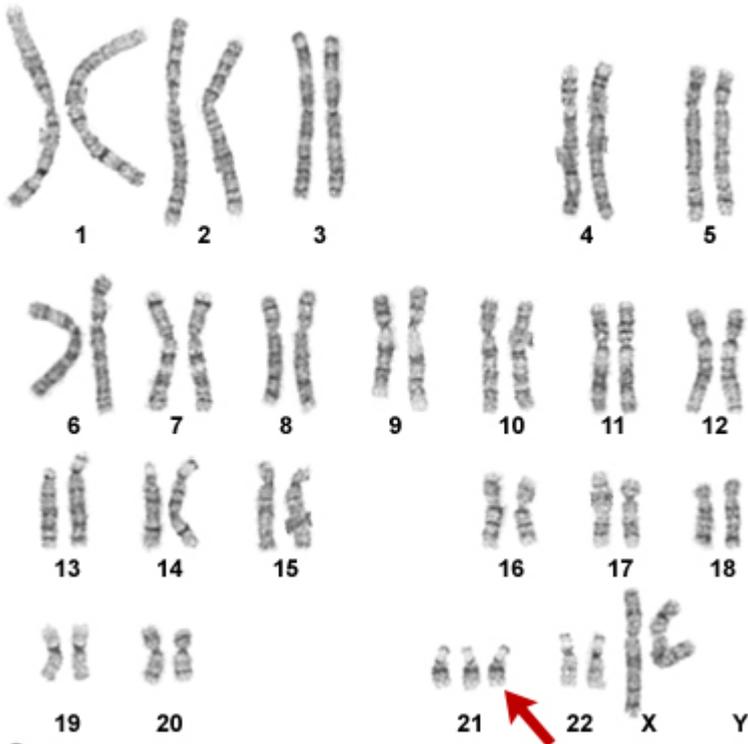




D. Differences in chromosome number



Karyotype From a Female With Down Syndrome (47,XX,+21)



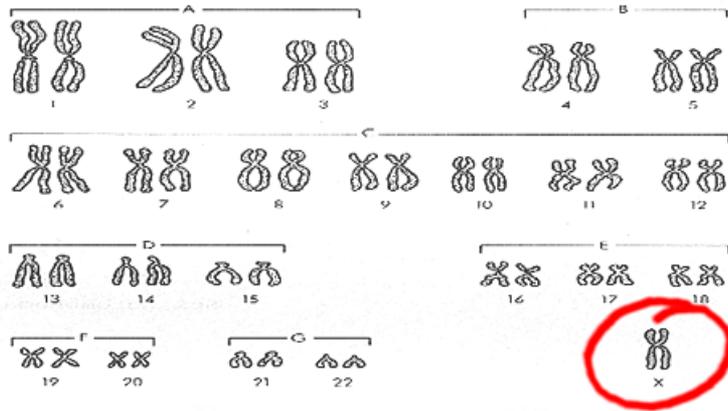
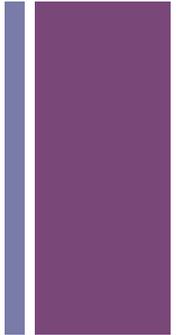
© Clinical Tools, Inc.

1. Trisomy = One too many chromosomes (47 instead of 46)

2. Trisomy 21 = Down's Syndrome



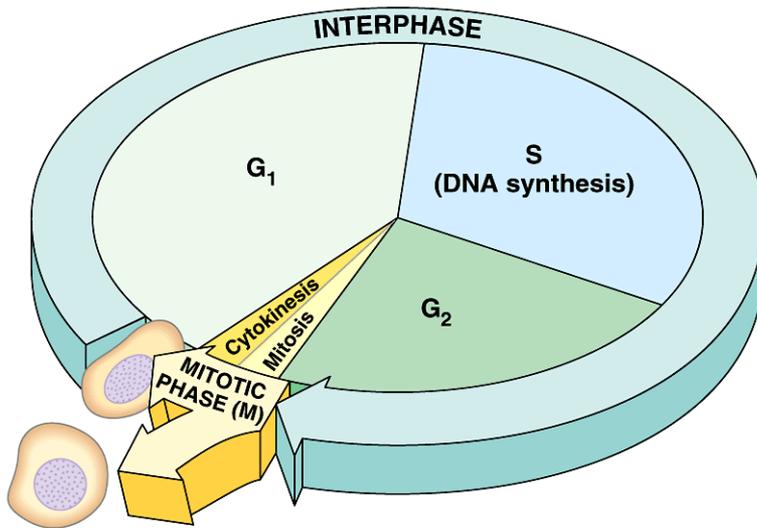
D. Differences in chromosome number



2. Monosomy = One too few chromosomes (45 instead of 46)

- Turner's syndrome = X0

+ II. Cell Cycle



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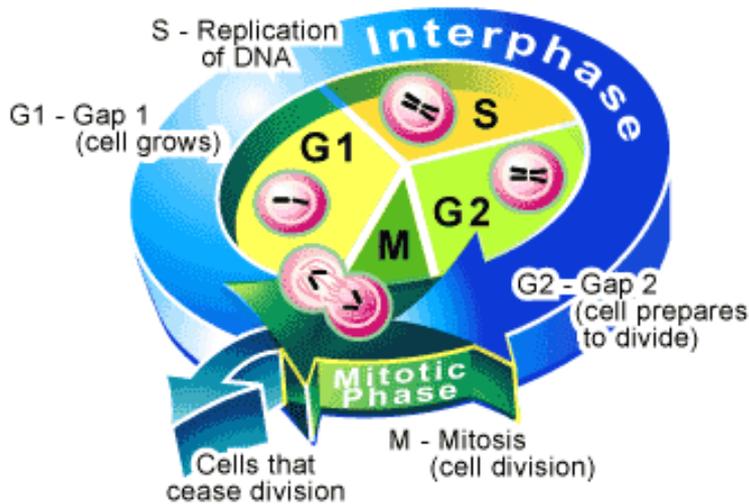
= The “life cycle” of the cell.

- 6 steps



A. Interphase = the resting phase of the cell – 90% of cells are in this phase

- 90% of all cells are in this phase



1. G1 = growth & development

- longest phase

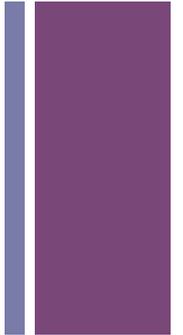
2. S = DNA makes a copy of itself

- 2 chromatids form

3. G2 = further growth



B. Mitosis = division of the chromosomes



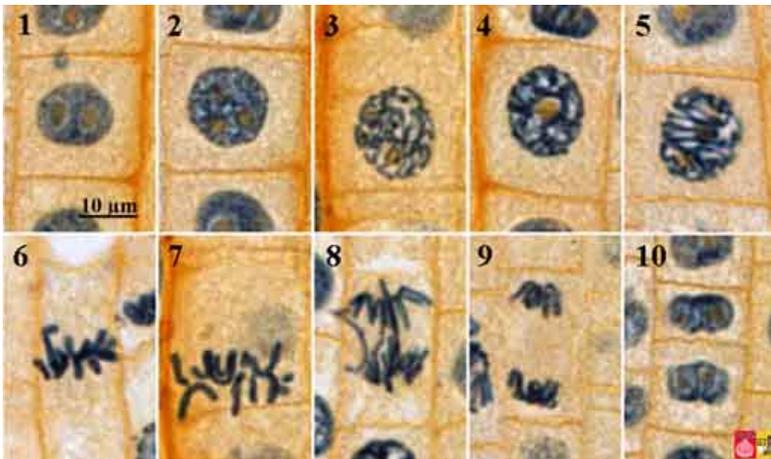
1. Prophase

- chromatin is converted into chromosomes

- Nucleus disappears

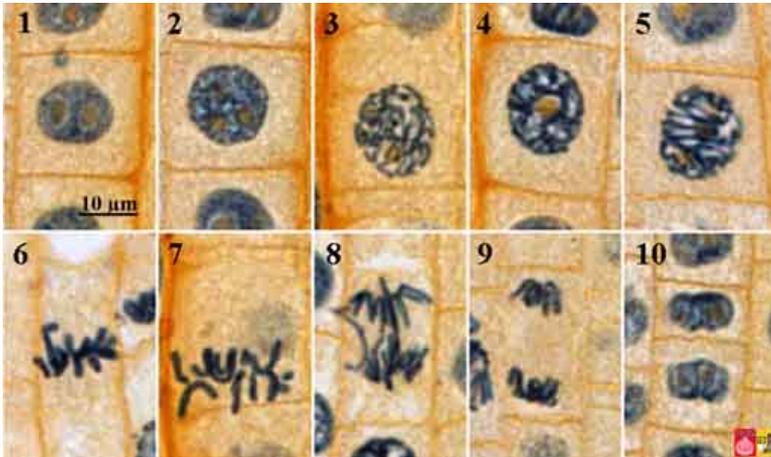
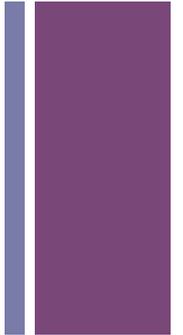
- Centrioles move to poles

- Spindle fibers stretch across the cell





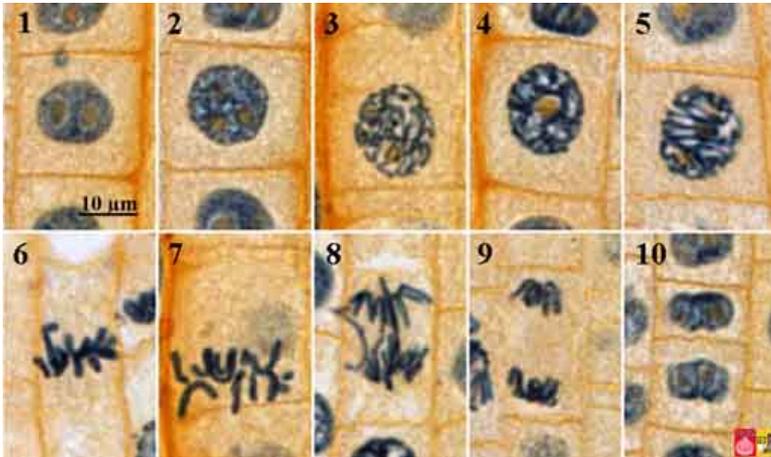
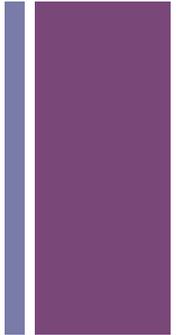
B. Mitosis



2. Metaphase

- Chromosomes line up along the equator of the cell by the spindle fibers

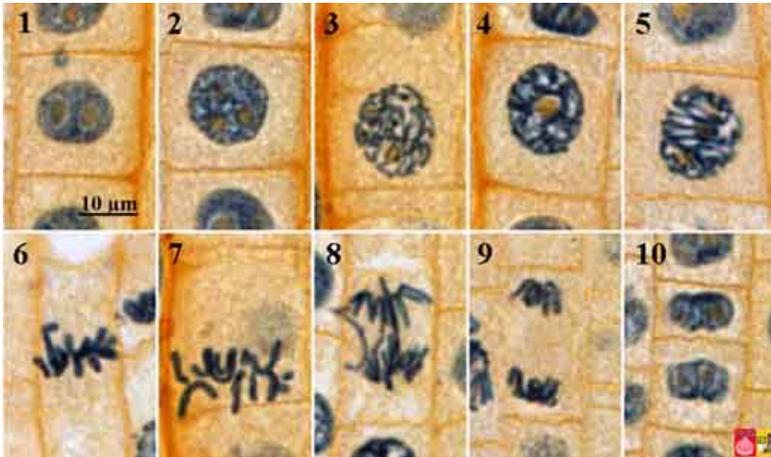
+ B. Mitosis



3. Anaphase

- Chromatids separate and are pulled to opposite ends of the cell.

+ B. Mitosis



4. Telophase

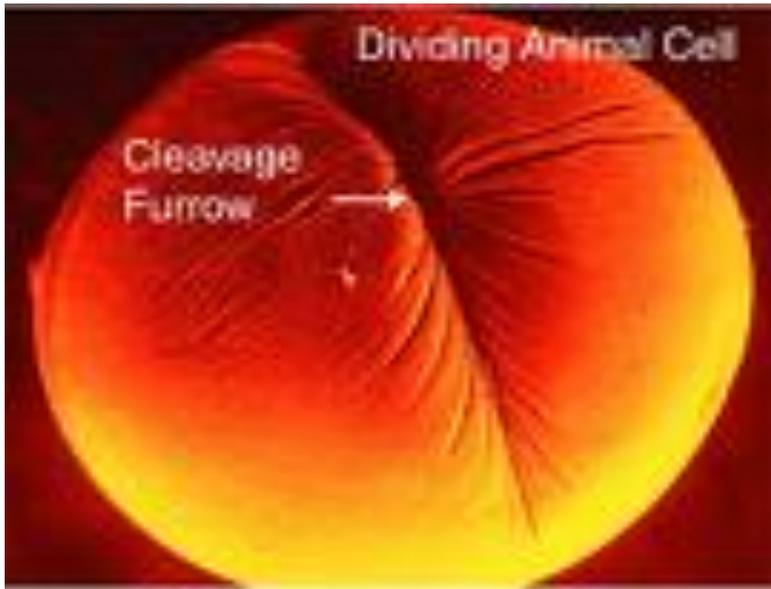
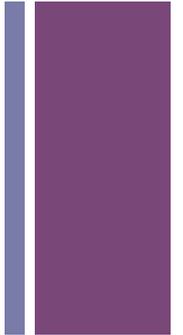
- nuclei reappear

- Spindle fibers disappear

- Chromosomes begin to relax into chromatin

+

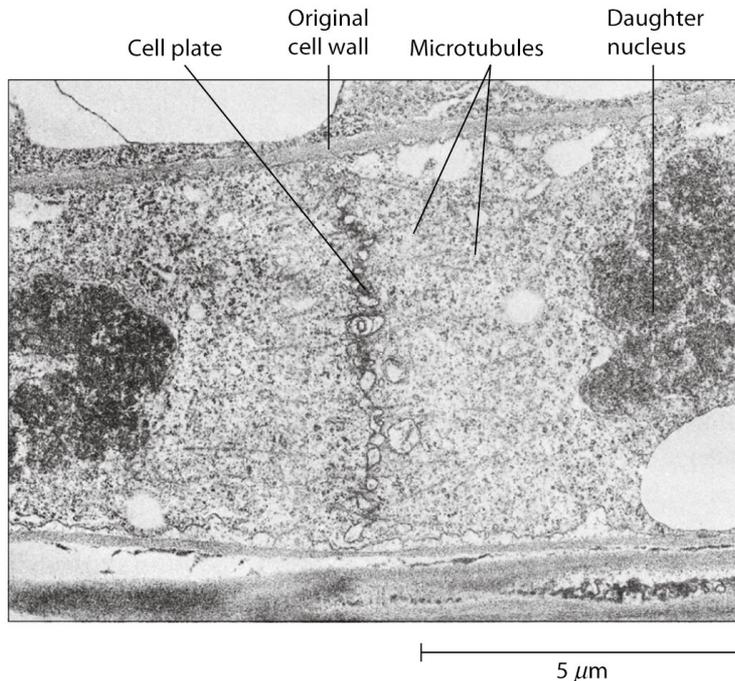
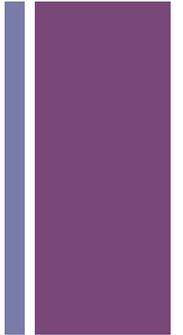
C. Cytokinesis = division of the cytoplasm and the organelles



1. Animal cells = cell forms a cleavage furrow and “pinches” in the middle

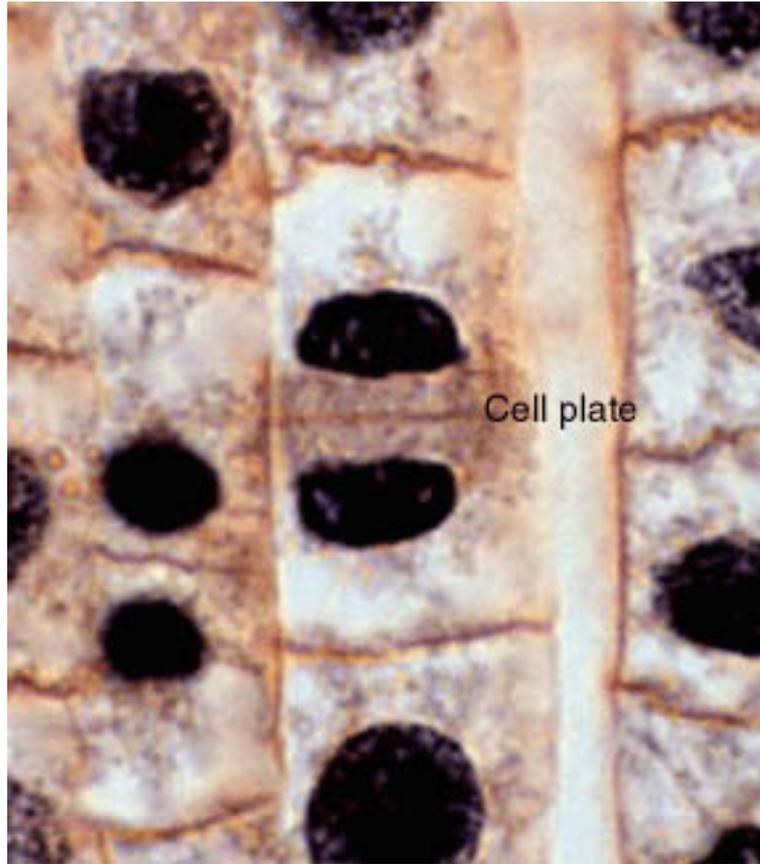


C. Cytokinesis

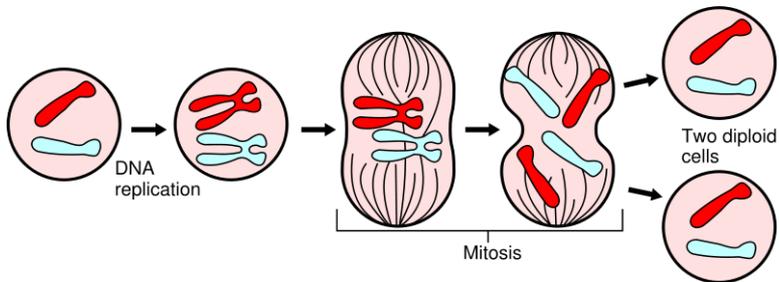


2. Plant cells = cells form a “cell plate” in the center of the cell (cell wall too tough to “pinch”)

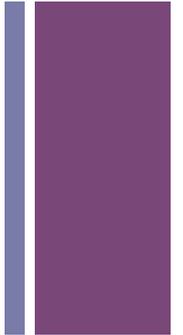
+ Cytokinesis in plant cell (onion root tip)



+ Mitosis

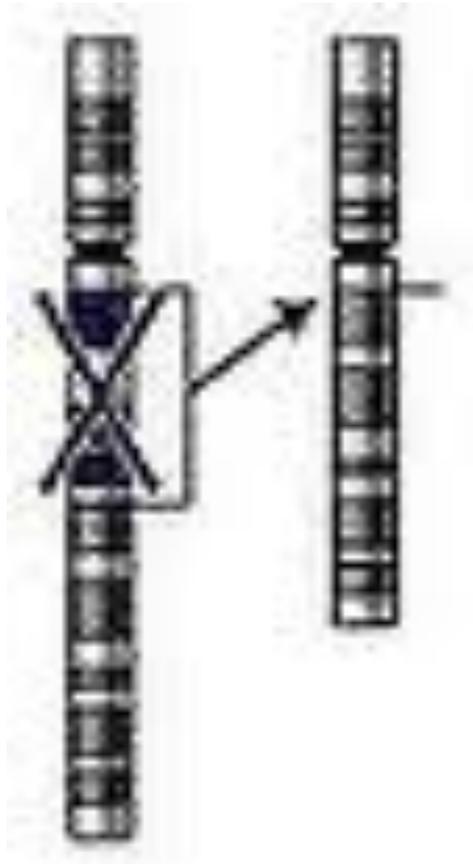
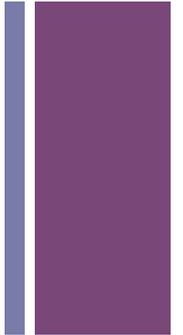


- Cell division that results in 2 identical, diploid cells.



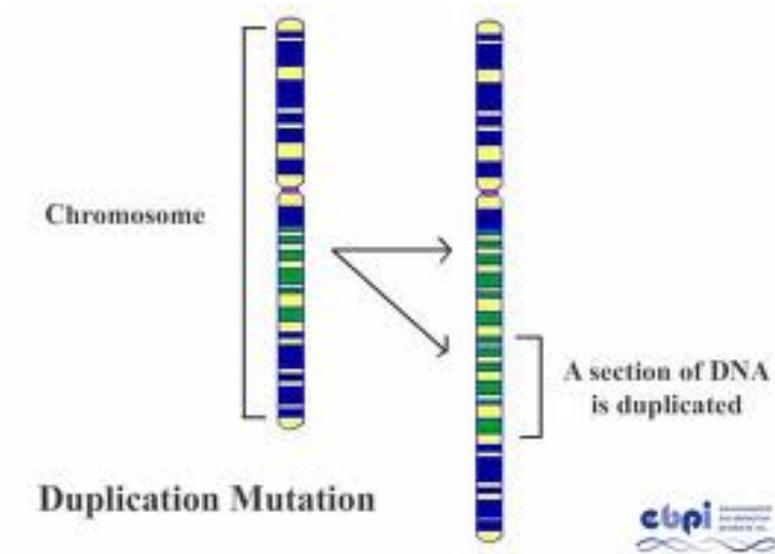
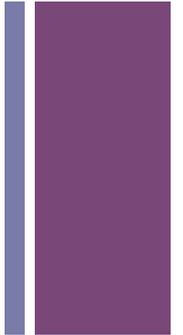


I. Mutations



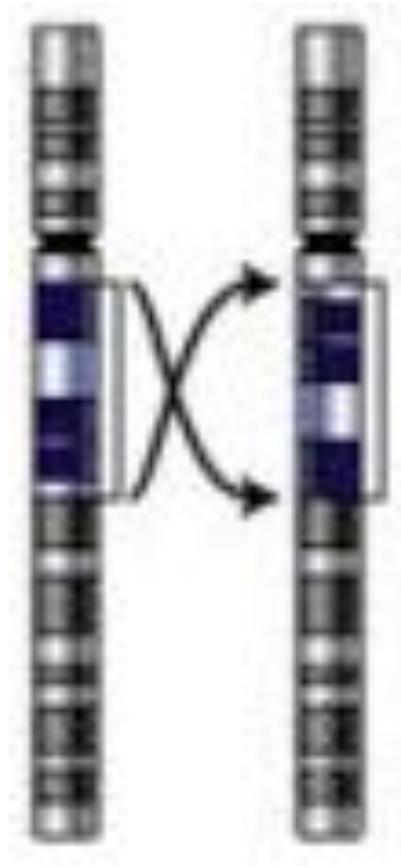
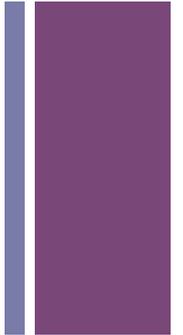
A. Deletion = part of a chromosome breaks off and is lost

+ Mutations



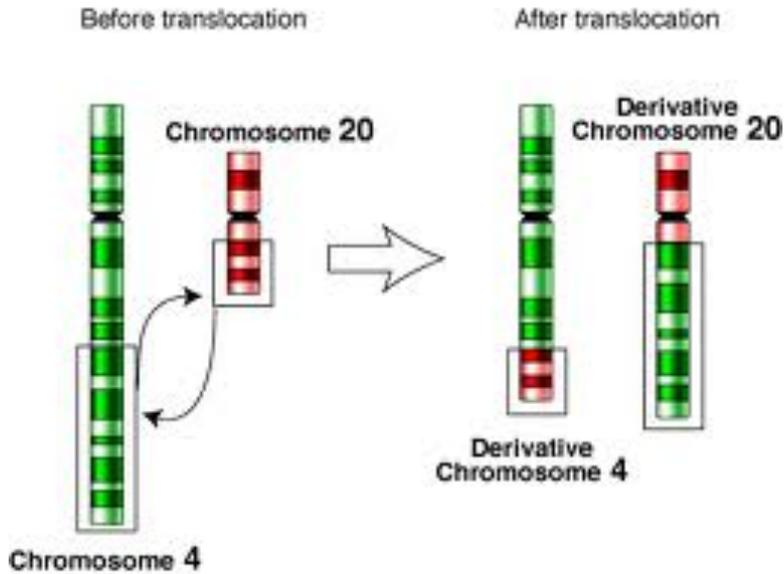
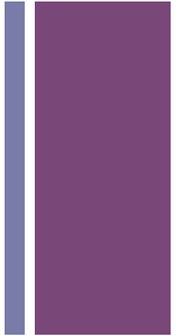
B. Duplication = Part of a chromosome breaks off and attaches to the homologous chromosome

+ Mutations



C. Inversion = part of a chromosome breaks off and reattaches backwards

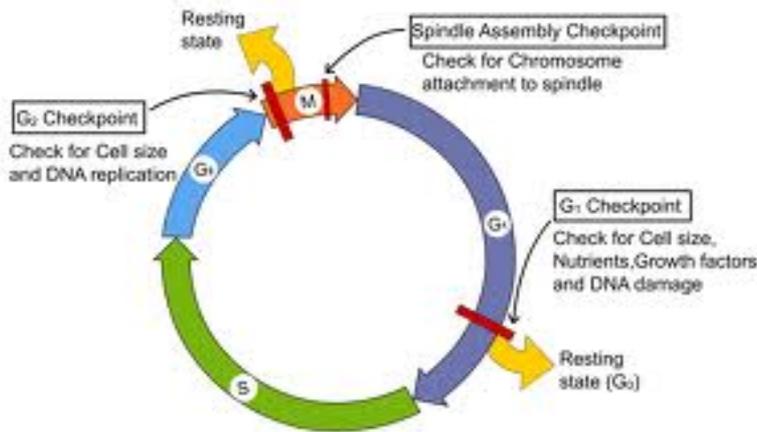
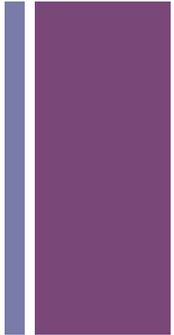
+ Mutations



D. Translocation = Part of a chromosome breaks off and attaches to a non-homologous chromosome



II. Control of Cell Division

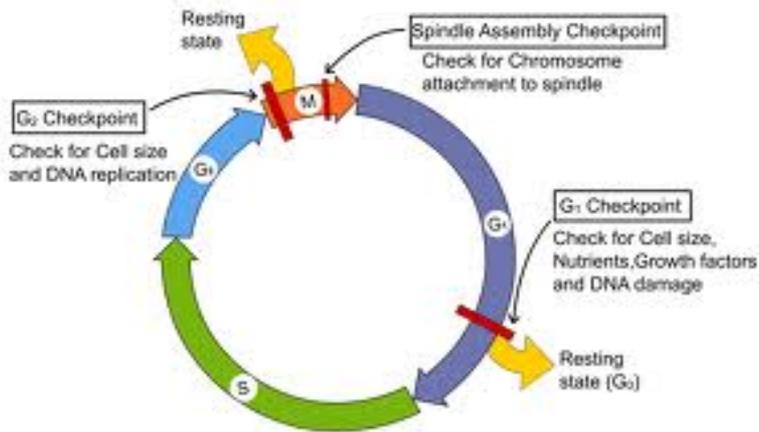
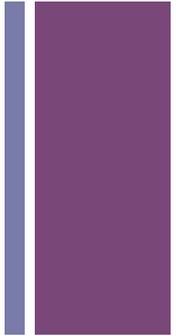


A. Checkpoints = stop cell division if something goes wrong

1. G₁ Checkpoint = stops cell division if cell is not big enough



Checkpoints



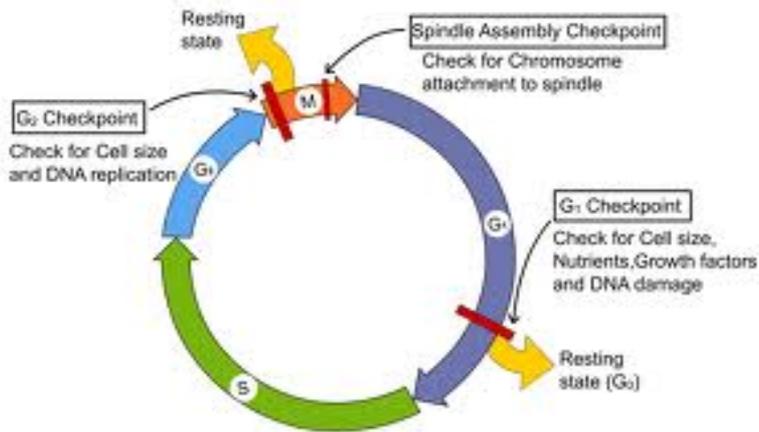
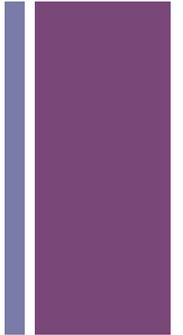
2. G₂ checkpoint = stops if cell has not duplicated DNA

- stops if errors in DNA

- stops if cell is not large enough



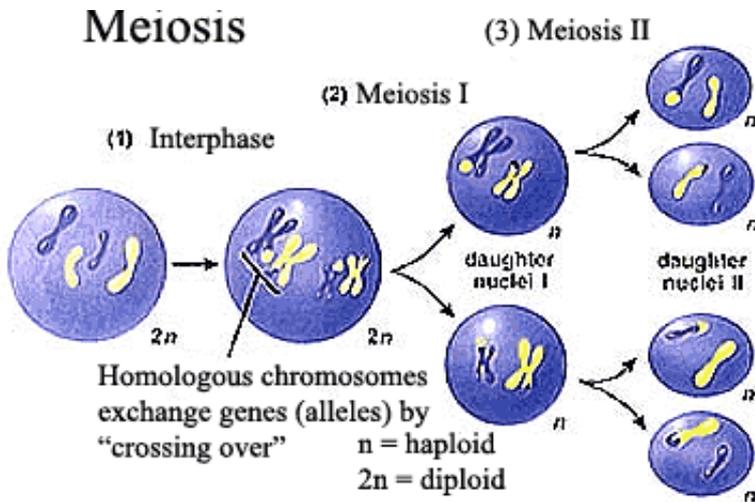
Checkpoints



3. Spindle checkpoint = stops if chromosomes not aligned properly

- stops if spindle fibers not attached properly

+ Meiosis

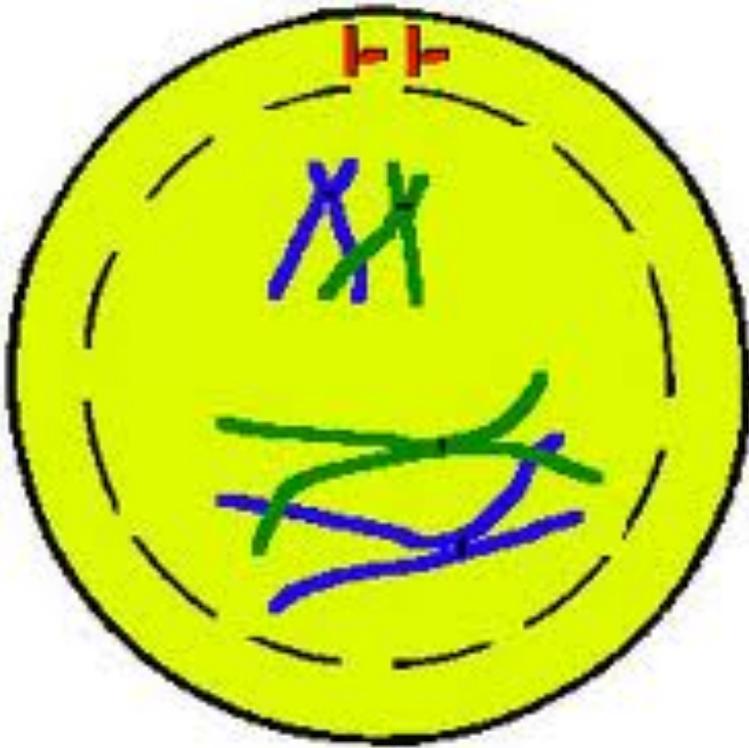


- Cell division that results in 4 unique, haploid (n) cells.

- meiosis begins with the process of interphase

* DNA is replicated in the "S" period of interphase (same as mitosis)

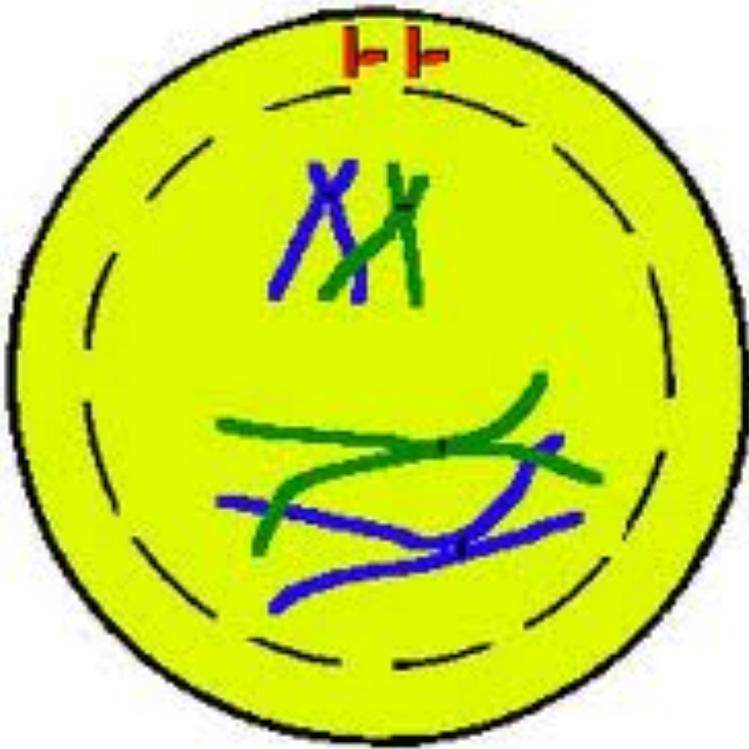
+ Meiosis



A. Prophase I

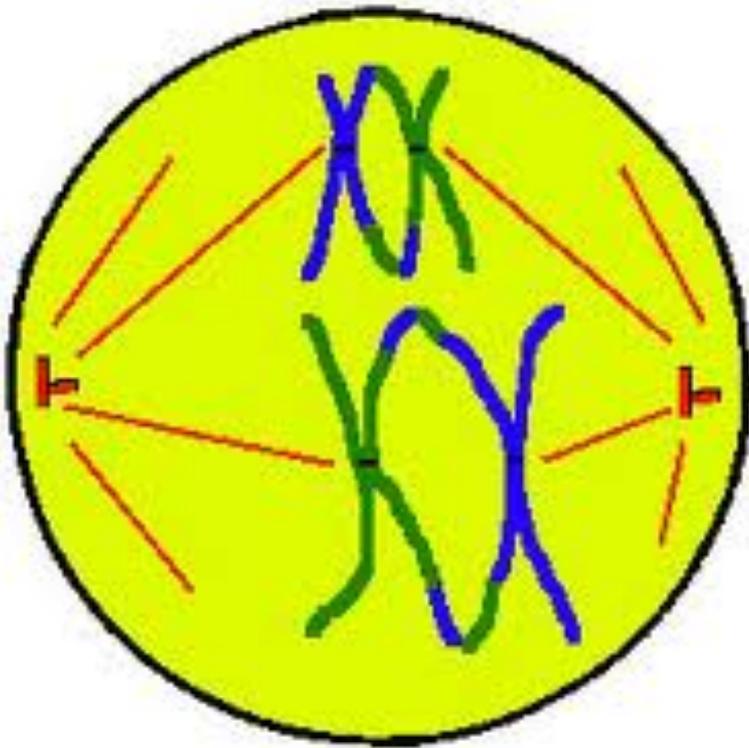
1. Nucleus disappears
2. Spindle fibers appear and stretch across the cell
3. DNA condenses into chromosomes
4. Homologous pairs of chromosomes (one from mom, one from dad) match up
 - homologous pairs form a tetrad

+ Meiosis



5. “Crossing over” occurs as the homologous pairs are matched up
 - creates genetic diversity as every sperm or egg is unique

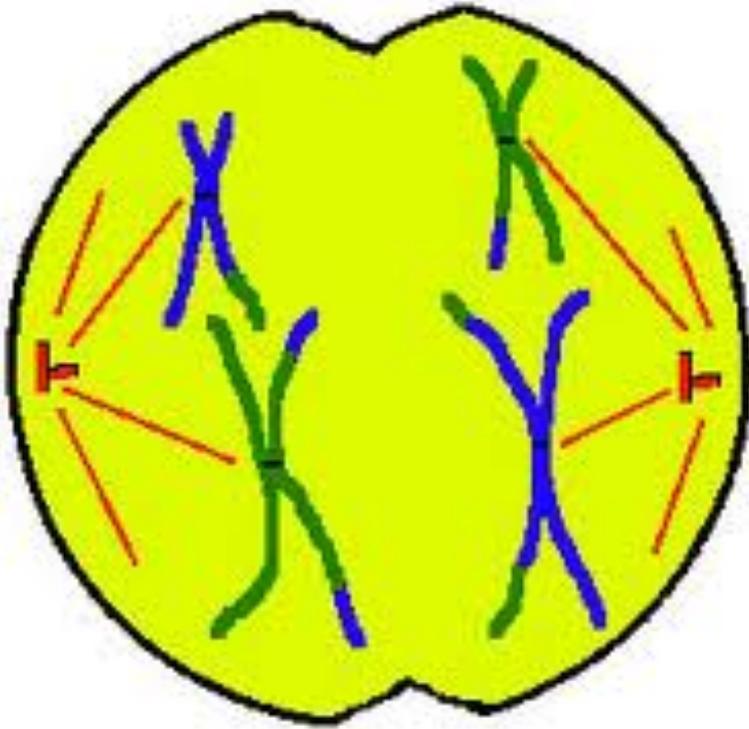
+ Meiosis



B. Metaphase I

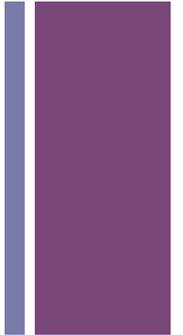
1. tetrads line up in the middle of the cell

+ Meiosis

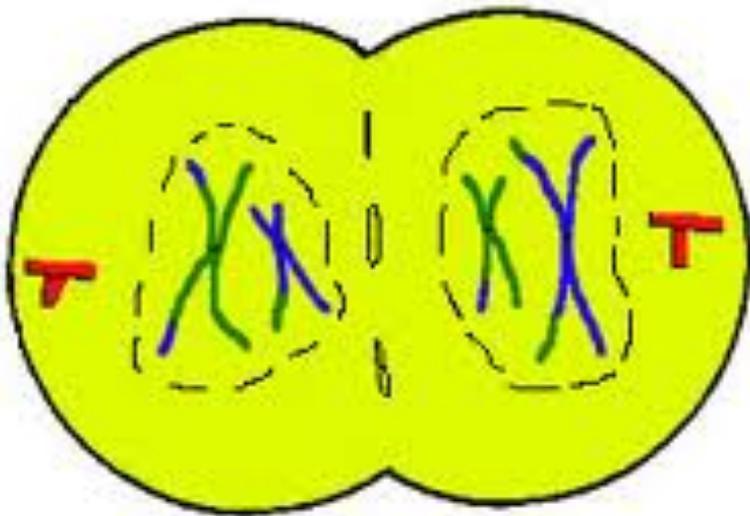


C. Anaphase I

1. homologous pairs separate and travel to opposite ends of the cell



+ Meiosis

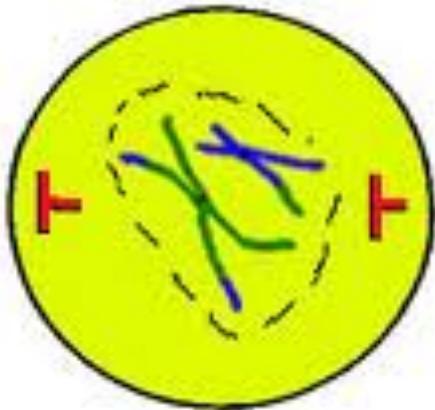
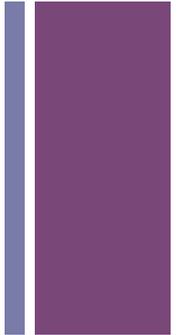


D. Telophase I

1. nuclei reform around chromosomes

2. cell splits (cytokinesis) into 2 haploid cells

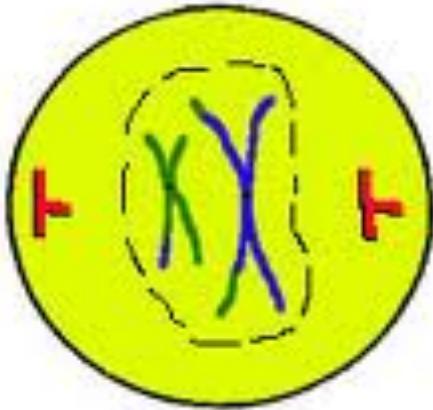
+ Meiosis



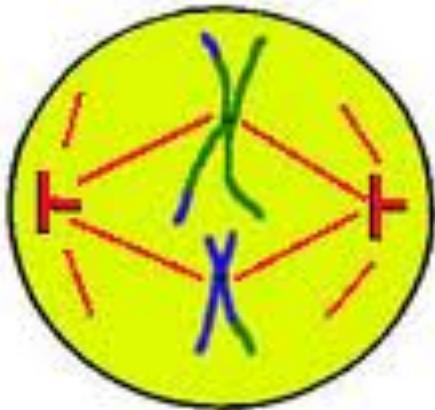
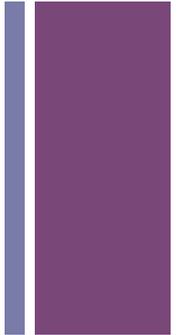
E. Prophase II

1. nuclei disappear

2. spindle fibers appear

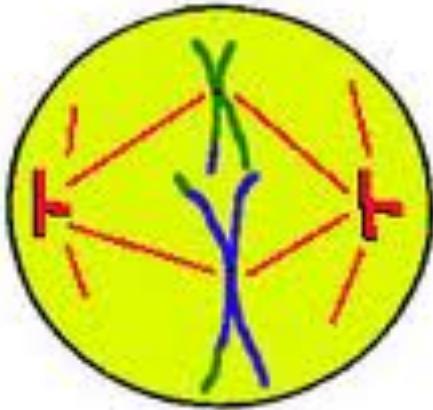


+ Meiosis

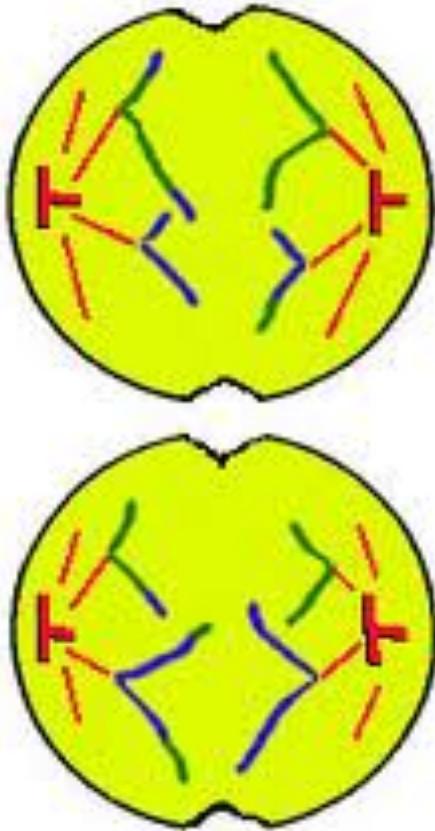
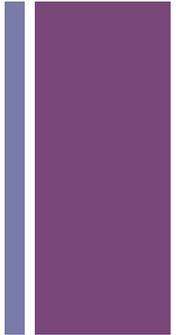


F. Metaphase II

1. Chromosomes line up in the middle of the cell



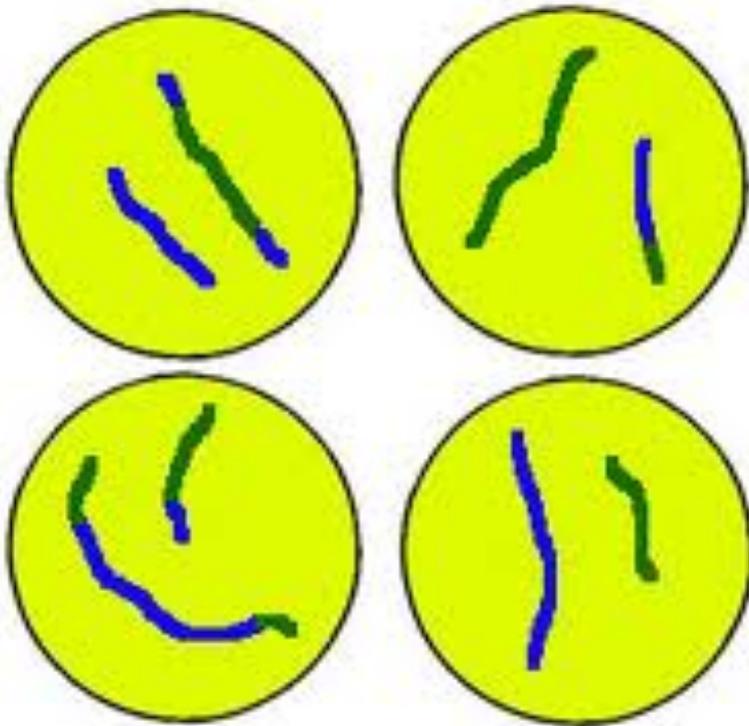
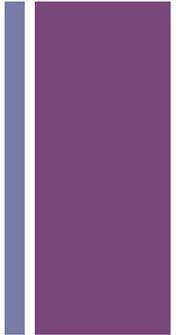
+ Meiosis



G. Anaphase II

1. Chromatids separate and travel to opposite ends of the cell

+ Meiosis



H. Telophase II

1. Nuclei reform around chromosomes

2. cell splits (cytokinesis) to form 4, unique haploid cells