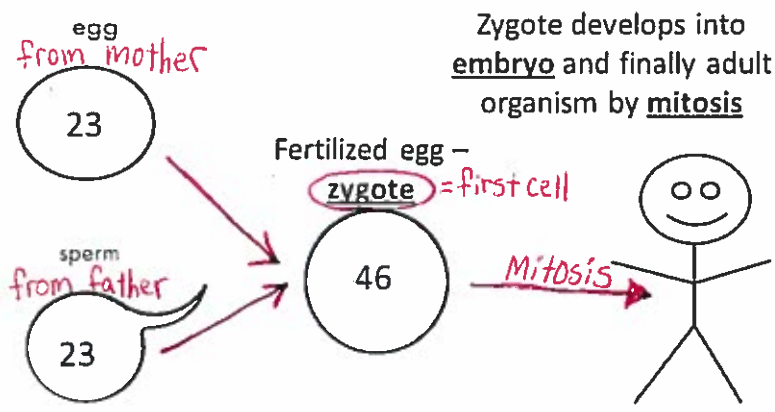


9 & 10.1) Cellular Reproduction Notes – Meiosis (Formation of Sex cells)

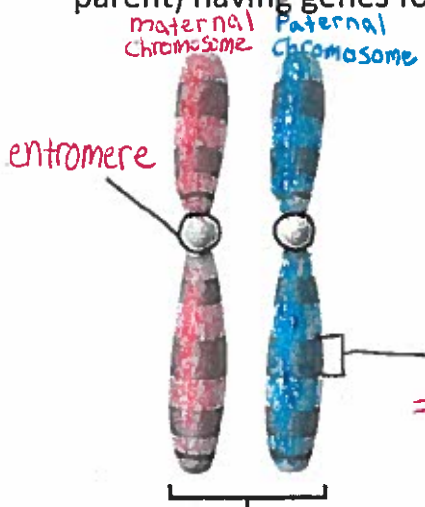
Chromosomes and Chromosome Number

Human body cells (somatic cells) have 46 chromosomes. Each parent contributes 23 chromosomes in their gamete or sex cell. Therefore, body cells having 2 copies of each chromosome (2n) are called diploid cells. Sex cells or gametes having only 1 copy of each chromosome (n) are called haploid cells.

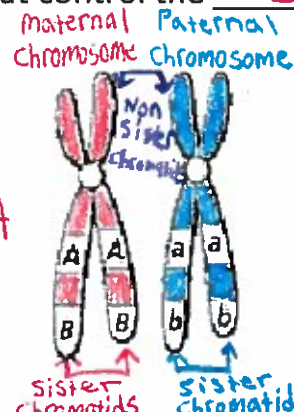


Fertilization – process by which an egg and sperm unite
Zygote – fertilized egg
Embryo – organism in early stage of development

Homologous Chromosomes = pair of chromosomes (1 chromosome from each parent) having genes for the same traits.



- Same Size
- Same Centromere position
- Carry genes that control the Same inherited traits

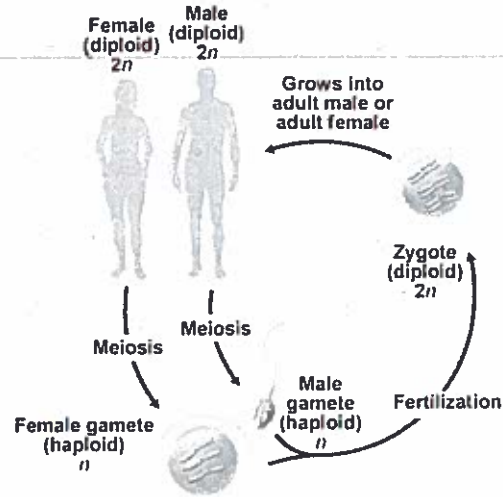


Homologous chromosomes after DNA replication during S of Interphase

Gene = functional unit of DNA that controls inherited trait expression that is passed on from one generation to another.

Meiosis = reduction division, occurring only in reproductive cell (gametes), in which 1 diploid ($2n$) cell produces 4 haploid (n) cells that are not genetically identical.

- The sexual life cycle in organisms involves meiosis.
- Meiosis produces gametes (sperm/egg).
- When gametes combine during fertilization the chromosome number is restored.
- Meiosis occurs in 2 divisions called Meiosis I and Meiosis II.



Interphase



- DNA is in relaxed (string) form called Chromatin.
- Chromosomes are not visible yet.

- G_1 (Growth 1) - Cell grows in size; organelles (centrioles) double in #
- S (Synthesis) - DNA replication (DNA is copied)
- G_2 (Growth 2) - Cell continues to grow in size; Protein Synthesis.

Meiosis I (1st Cell Division: 1 cell \rightarrow 2 cells)

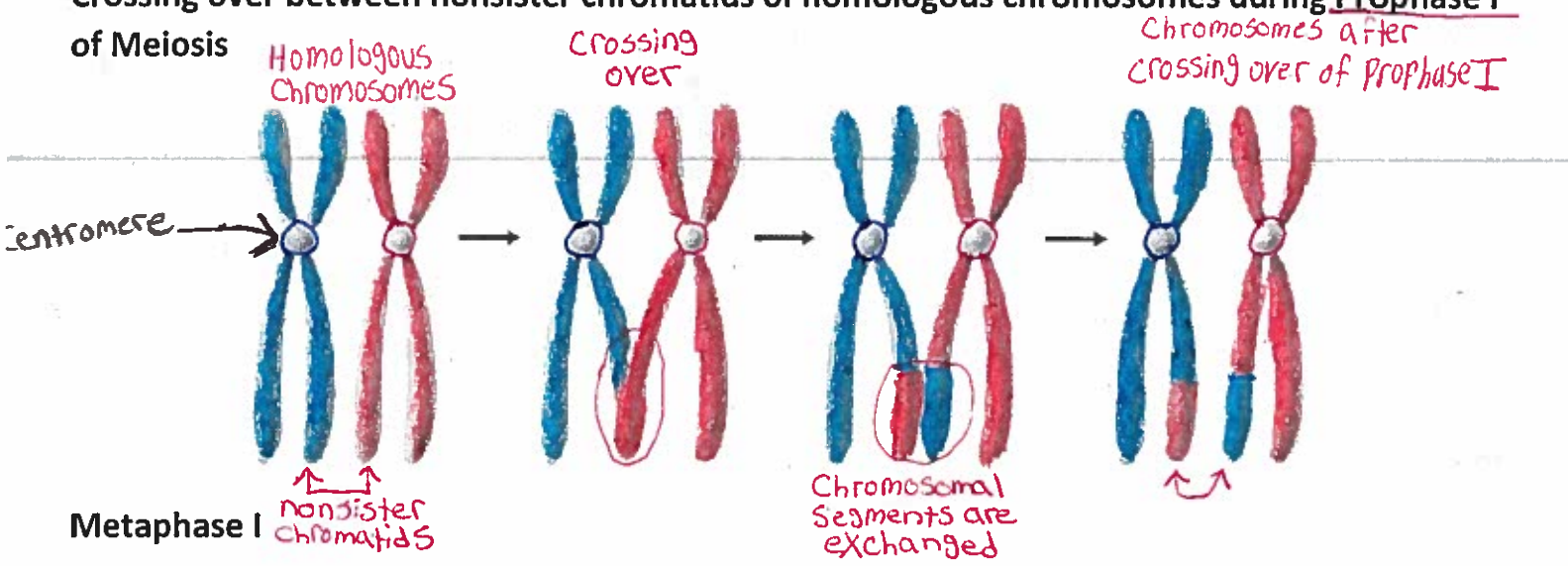
Prophase I



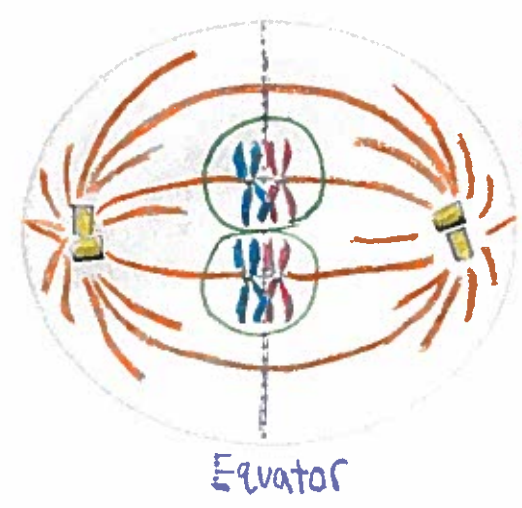
- Centrioles (in pairs) move toward poles
- Spindle apparatus (fibers) begins to form
- Nuclear envelope (nucleus) breaks down
- Chromatin condenses into visible Chromosomes.
- Homologous chromosomes pair up (synapsis)
- Crossing over between non-sister chromatids of homologous chromosomes occurs and leads to Genetic Recombination (Variety)
- How many chromosomes total in this cell? 4

★ = does not happen in mitosis

Crossing over between nonsister chromatids of homologous chromosomes during Prophase I of Meiosis

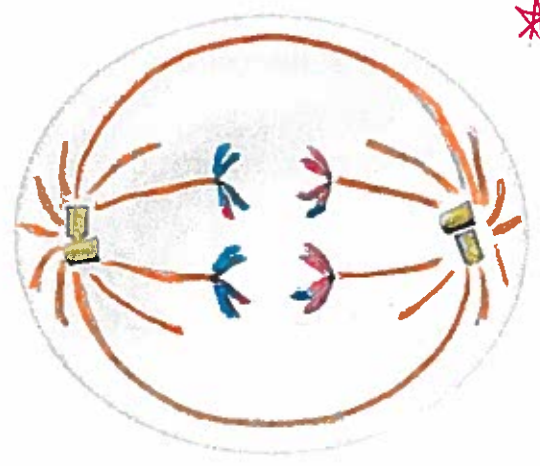


Metaphase I



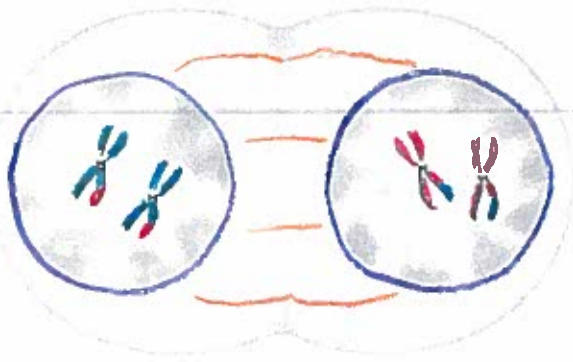
- Centrioles (in pairs) are at opposite poles of cell
- Spindle fibers attach to centromeres of chromosomes
- ★ Homologous Chromosome pairs line up side-by-side at the equator (see picture)
- Homologous chromosome pairs line up randomly by independent assortment which leads to more genetic variety in the gametes or sex cells.

Anaphase I



- ★ • Homologous Chromosomes separate toward opposite poles of the cell so that each new cell will have one set of chromosomes.

Telophase I



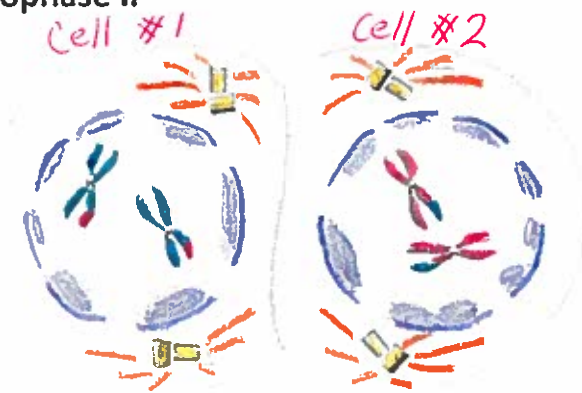
- Nuclei reform at each pole of the cell
- Spindle apparatus breaks down
- Centrioles double in number

Cytokinesis occurs and splits the cell into 2 cells each with the haploid (n) number of chromosomes. Chromosome number is reduced by half in each cell.

How many chromosomes are in each cell now? 2

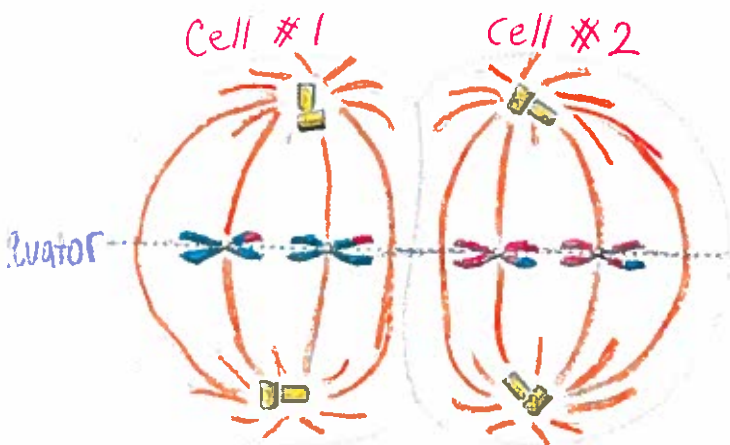
Meiosis II (2nd Cell Division: 2 cells → 4 cells) SAME AS MITOSIS!

Prophase II



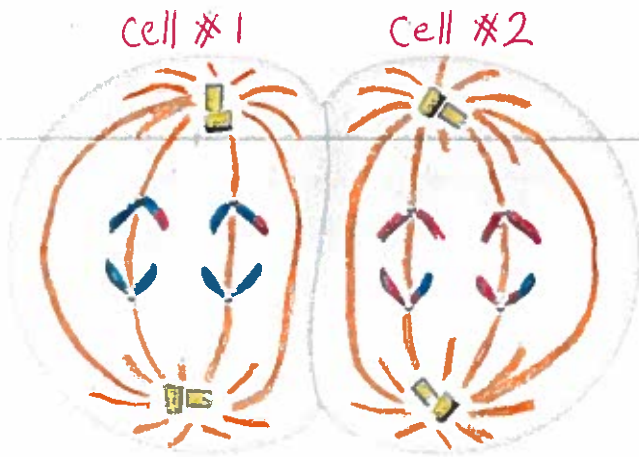
- Centrioles (in pairs) begin moving apart to opposite poles of cells
- Nuclear membrane breaks down and the nucleus and nucleolus disappear
- Spindle apparatus begins to form again

Metaphase II



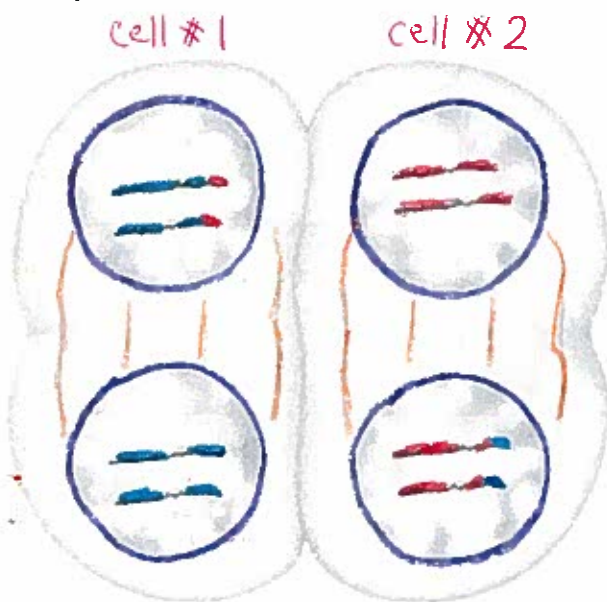
- Centrioles (in pairs) are at opposite poles of cells
- Spindle fibers attach to centromeres of chromosomes
- Chromosomes line up in a straight line along the center or equator of the cells

Anaphase II



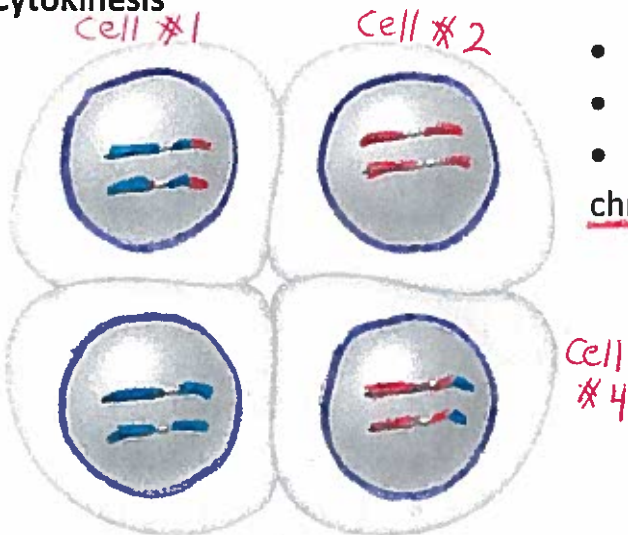
- Chromatids separate and move toward opposite poles of the cells

Telophase II



- Nuclei reform around chromosomes on both sides of cells
- Spindle apparatus breaks down

Cytokinesis



- Two cells divide into four cells
- Each gamete or sex cell is different / unique
- These four cells have the haploid (n) chromosome number.

How many chromosomes are in each one of these gametes or sex cells after meiosis?

2

Determine if the event listed is Mitosis, Meiosis, or Both. Place check(s) in the appropriate column.

Event	Mitosis	Meiosis
Interphase happens before	✓	✓
Creates body cells (somatic cells)	✓	
Creates sex cells		✓
Forms daughter cells that are haploid (n) with one set of chromosomes		✓
Forms daughter cells that are diploid (2n) with two sets of chromosomes	✓	
Creates identical daughter cells	✓	
Creates unique or different daughter cells		✓
Involves the movement of chromosomes in cell	✓	✓
Cell division	✓	✓
1 division (cell cycle)	✓	
2 divisions		✓
Forms 4 daughter cells per cycle		✓
Forms 2 daughter cells per cycle	✓	
DNA replication must occur before (S of Interphase) to maintain chromosome number	✓	✓
Crossing over between homologous chromosomes		✓
Homologous chromosomes pair (synapsis) and line up side-by-side		✓
Associated with sexual reproduction		✓
Homologous chromosomes separate during Anaphase I		✓

✶ Compare and contrast mitosis and meiosis (4 similarities and 4 differences).

Mitosis	Compare/Same	Meiosis
<ul style="list-style-type: none"> • Forms 2 daughter cells • Makes body cells • Identical daughter cells • 1 division/cycle • Creates diploid (2n) chromosomes in cell • No crossing over between chromosomes 	<ul style="list-style-type: none"> • Cell division • Interphase happens before • DNA replication happens before in S of Interphase • Movement of chromosomes in a cell • Begin with a diploid (2n) body cell 	<ul style="list-style-type: none"> • Forms 4 daughter cells • Makes gametes (sex cells) • Different daughter cells • 2 divisions/cycles • Creates haploid (n) chromosomes in cell • Crossing over of homologous chromosomes during Prophase I