

## Meiosis Notes

### MEIOSIS

- DNA doubles ONCE, divides the cell TWICE, and results in 4 non-identical, haploid cells that are used for sexual reproduction

Diploid ( $2n$ ) = cells with 2 of each kind of chromosome

- One from mom and one from dad
- Normal Body Cells = skin, muscle, nerve, etc.

Haploid ( $1n$ ) = cells with 1 of each kind of chromosome

- Reproductive (Gamete) Cells
  - o In humans: eggs and sperm
- When gametes later fuse during fertilization, a zygote ( $2n$ ) is formed

Homologues (or "homologous chromosomes") = a pair of chromosomes that carry the same genes

*homo = same      hetero = different*

- Humans have 46 chromosomes in their body cells
  - o Make 23 sets of homologues
    - 22 are autosomes = non-sex chromosomes
    - 1 pair of sex chromosomes
      - may be identical (XX) or different (XY)  
*female                      male*

### STEPS of MEIOSIS

Interphase - Chromosomes replicate and same as mitosis

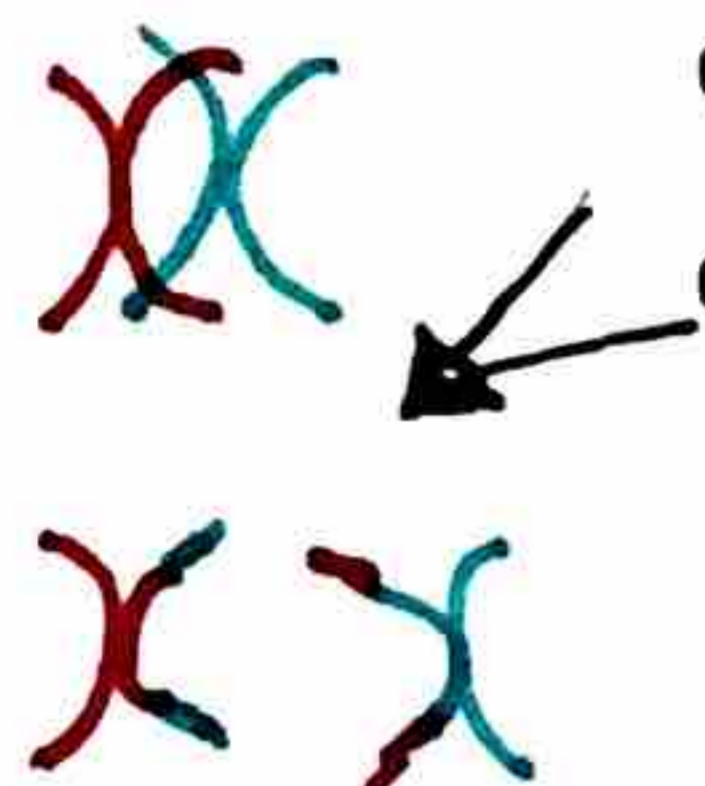
### MEIOSIS I

#### Prophase I (The Game Changer!!!)

- Chromosomes condense, nuclear envelope and nucleoli disappear, spindle starts to form, and centrioles start to move apart

- Synapsis occurs = homologous chromosomes come together as pairs

o Form a tetrad (four chromosomes together)

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- o Crossing over may occur here = exchange of genetic material between strands
    - Good because it changes the genetic makeup of the chromosome, which means it increases genetic diversity!

#### Metaphase I

- Tetrads line up on the metaphase plate

## Anaphase I

- Homologues <sup>(pairs)</sup> separate and are dragged to opposite poles
- Sister chromatids remain attached to their sister X

## Telophase I and Cytokinesis

- separate homologous chromosomes reach the poles
- each pole now has a haploid set of chromosomes that are still made of two sister chromatids
- usually cytokinesis occurs simultaneously with telophase I

## MEIOSIS II – very, very, very much like Mitosis

### Prophase II - new spindle forms

Metaphase II - chromosomes align in single file on the metaphase plate

Anaphase II - Sister chromatids are pulled apart and dragged to opposite ends

### Telophase II and Cytokinesis

- Nuclei form at opposite poles of cell
- Cytokinesis occurs, producing 4 haploid daughter cells

## Genetic Variation

Sexual life cycles produce genetic variation among offspring by:

- 1) Crossing Over → Produce chromosomes that have genes from both parents, resulting in an all new combination
- 2) Independent Assortment of Chromosomes = each homologous pair of chromosomes separates independently of the other pairs around it during meiosis I.
  - Each pair consists of one mom and one dad chromosome
  - Therefore the possible combinations =  $2^n$  (where  $n$  = haploid #)

Ex. In humans:  $2n = 46$ , so  $n = 23$

Possible combinations for EACH sperm and EACH egg:

$$2^{23} = 8,388,608 !!!$$

- 3) Random Fertilization

Ex. In humans: Which lucky egg meets which lucky sperm?   
 Fertilization = when egg + sperm meet and combine

## Human Meiosis:

Spermatogenesis = sperm formation

- The process is the same as above, except after completing meiosis, a special additional step occurs, called flagellation = the addition of a tail to the sperm to help it swim
- Occurs in the testes

Oogenesis = egg (ovum) formation

- occurs in the ovaries

- the steps are the same, but the cytokinetic divisions are unequal.
  - Meiosis I: occurs during embryo development and produces 1 large cell and one smaller one → “polar body” → discarded
  - Meiosis II: Occurs after fertilization
    - produces one large cell and another polar body, which is also discarded
  - Result: 2 divisions results in 1 large egg cell
  - Advantage: Large cell will contain as much cellular material as possible to give the zygote a good head start.

**Mitosis v. Meiosis**

	MITOSIS	MEIOSIS
Original cell chromosome number		
Number of Divisions		
Number of Nuclei/New Cells Formed		
New cell chromosome number		
Synapsis of Chromosomes?		
New cell compared to original cell		

