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Meiosis

Meiosis is cell division in the gonads (the ovaries or testes) that results in genetically unique gametes (eggs or sperm) containing only ONE copy of each gene.

Homologous pairs are numbered in order of size.

- Humans have 23 homologous pairs, numbered from biggest to smallest, except for the last pair, which are set apart specially because they are the sex chromosomes, and in males, they are not homologous.

Different genes are represented with different letters

- different versions of a gene with capital or lowercase letters.
    - **Homozygous dominant -** the same version of a dominant form gene for both copies (2 capital letters)
        - homo means same, and dominant means that this form of the gene gets preferentially transcribed
    - **Heterozygous** - two different forms of the gene (capital and lowercase)
    - **Homozygous recessive -** the same version of the recessive form of the gene **-** two lower case letters

Human genomes have about 22,000 genes (we still aren't sure exactly the number)

- We have two copies of each of those 22,000 genes.
    - back-up in case one of these versions doesn't work right
    - even when both of your copies of a gene work fine, then it is handy to have such nice variation in order to produce genetically adaptable offspring
- Diploid - When an organism has two copies of each gene; write it as 2N (the N stands for "number of copies of each gene).
    - meiosis is all about - splitting each of these gene copies into eggs or sperm.

DNA replication in S of interphase, just like all cells do before they divide.

- identical sister chromatids are held together by the centromere DNA sequence.

In females, all of her oocytes get to this point while she is still in her mother's womb! I'm just speculating, but I think this happens because it gets all the eggs' DNA replicated while they are young and fresh and haven't yet accumulated mutations that might increase their mistake rate. Then they pause at this point of prophase 1 of meiosis 1 until the girl reaches puberty, after which meiosis happens every month and one egg gets to completely mature and be ovulated.

Gonad's cells line up the homologous pairs.

- This is metaphase 1 of meiosis 1. During this time, the floppy ends of each sister chromatid can stick to the other copy of that gene on the homologous chromosome.
    - The longer the arm of the sister chromatid, the more likely those gene copies are to get "swapped".
    - We call this crossing over! In Greek, chiasmata for "cross".

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During anaphase 1 and telophase 1

- the homologous chromosomes are pulled apart by spindle fibers into opposite sides of the cell
- Then cytokinesis occurs, so after meiosis 1, homologous pairs have been separated into two cells.
    - Sister chromatids are still attached with the centromere,
        - they are no longer identical after crossing over before the division occurred.
            - Compare this with mitosis, which will separate identical sister chromatids in order to produce identical cells.

Second division!

- Each sister chromatid is separated into its own cell by spindle fibers that pull them apart at the centromere.
    - includes a prophase 2, metaphase 2, anaphase 2, and telophase 2.
    - After meiosis II, the sister chromatids are pulled apart.
    - You end up with 4 haploid cells (1N).
        - Haploid means each gamete only has 1 copy of each gene.
        - These cells can find their homologous partner at conception! One egg is fertilized by one sperm, and a 2N Baby's genomic DNA is produced.

In summary, meiosis

- only occurs in the gonads
- includes 2 divisions (not just one like mitosis)
- 4 cells are produced (not 2 cells like mitosis)
    - these 4 cells are haploid (1N) (not diploid cells like mitosis)
    - these 4 cells are genetically unique (compared with mitosis which produces genetically identical daughter cells).