MEIOSIS

- Gametes must have half the number of chromosomes (haploid or monoploid)
- after fertilization when gametes unite, the full number of chromosomes is restored (diploid)

Somatic cells (body cells) have their chromosomes in pairs called **homologous chromosomes** (2n)

Homologous chromosomes are similar in shape, size, and genetic content.

Gametes (sex cells) have only one homologous chromosome from each pair (n)

This is done through meiosis (reduction division)

- at the start the cell is diploid (2n)
- each cell divides twice
- chromosomes replicate only once
- results in four cells, each with the haploid (n) number of chromosomes
- the stages are similar to the stages of mitosis

Prophase 1

- ♦ each chromosome has already replicated (during the end of interphase)
- ♦ each pair of chromatids lines up with its homologous pair and fastens together as a **tetrad** (the process is called **synapsis**)
- ♦ the four chromatids twist around each other and may exchange pieces of chromosomes in a process called **crossing-over**
- ♦ the nuclear membrane disappears
- ♦ spindle forms
- ♦ tetrads move toward the equator

Metaphase 1

- tetrads fasten to the spindle equator by their centromeres

Anaphase 1

- homologous chromosomes separate and move to opposite poles (called **disjunction**)
- there are half the numbers of chromosomes, but they are double-stranded

Telophase 1

- cytoplasm divides giving two daughter cells
- each daughter cell has half the number of chromosomes, but they are in replicated form
- spindle disintegrates, nuclear membrane may reform

Division stages begin again, similar to mitosis, but **no replication takes place**

Prophase 2

- each daughter cell forms a spindle and the double-stranded chromosomes move to the centre

Metaphase 2

- centromeres attach to the equator of the spindle

Anaphase 2

- centromeres divide and separate chromosomes move to opposite poles

Telophase 2

- both cells pinch-in and become four cells, each with half the number of chromosomes as the original parent cell
- nuclear membrane reforms
- chromosomes return to thread-like structures

Differences between mitosis and meiosis:

Mitosis diploid cells	**Meiosis** haploid cells, one member from each homologous pair
occurs in body cells	occurs only in sex cells
homologous pairs don't line up	homologous pairs line up
no exchange of parts between chromosomes	"crossing-over" of parts between homologous chromosomes
one cell division resulting in two cells	two cell divisions resulting in four cells

Importance of meiosis:

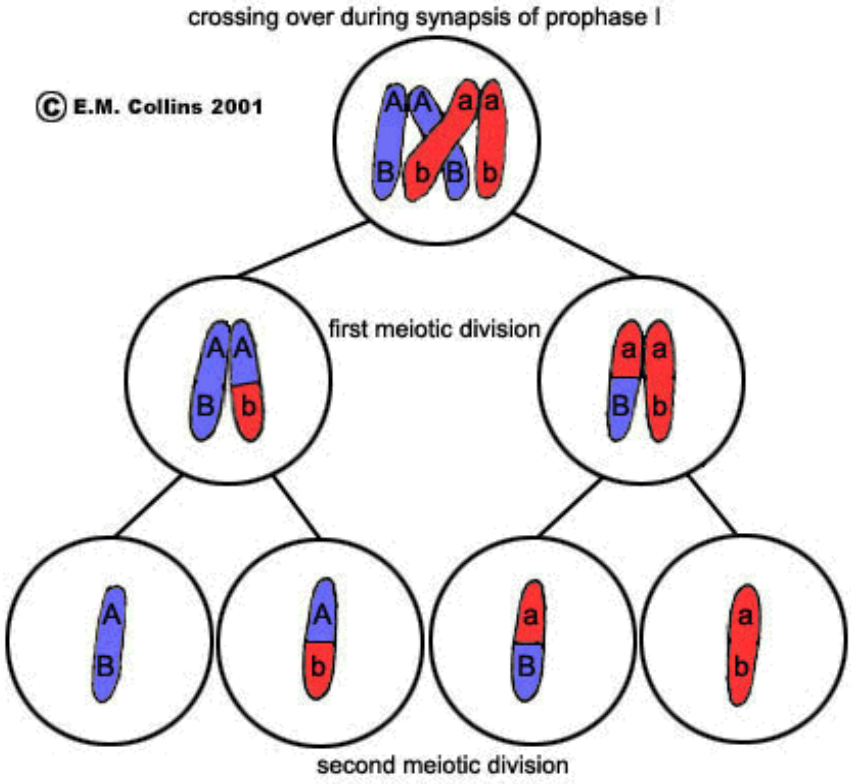
1. Restores the diploid number of chromosomes following fertilization

2. Since homologous chromosomes separate, each gamete will contain alleles for each trait, no trait will be missing

3. There is increased variation in the offspring because different chromosomes combinations each time, even with the same parents

4. Crossing-over during synapsis adds to variation

5. The separation of homologous pairs during meiosis and the recombination during fertilization confirms the separation and recombination of the factors Mendel spoke of


crossing over during synapsis of prophase I
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A A a a
B b B b
first meiotic division
A A
B b
a a
B b
A
B
A
b
a
B
a
b
second meiotic division