

AS 91157

GENETIC VARIATION AND CHANGE

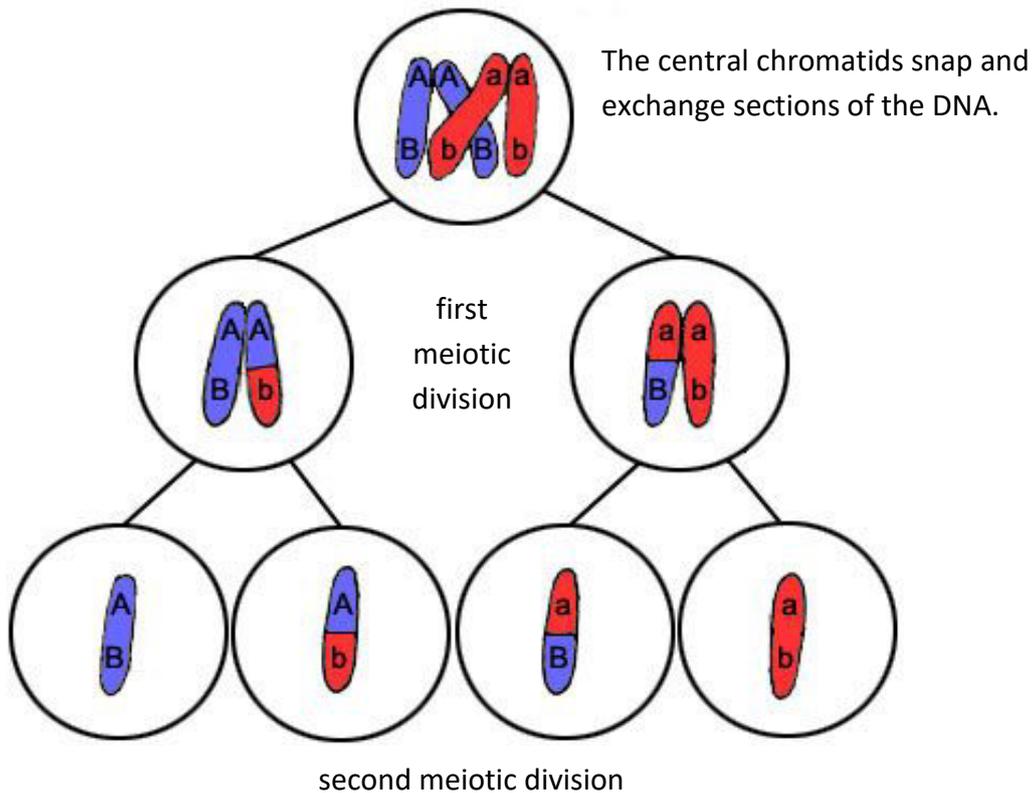
Genetic variation is the genetic difference of alleles both within the organism and within the population. It is the raw material for evolution as it is needed for natural selection.

Sources of Variation

- **Crossing Over/Recombination:**

This occurs during Metaphase of meiosis: sometimes the central chromatids of a homologous pair of chromosomes snap and exchange pieces of their DNA mixing the information on the central chromatids.

This process just mixes the existing alleles into new combinations, creating four unique gametes at the end of meiosis. This greatly increases variation.



At the end of meiosis you get four unique gametes – two recombinants (mixture of both parents) and two non-recombinants (unaltered by crossing over).

- **Independent Assortment:**

Again during Metaphase I of meiosis the way each homologous pair of chromosome line up at the equator – maternal or paternal, is independent of the other homologous pairs.

e.g.



This process mixes the existing alleles from the mother and father into new combinations creating four unique gametes at the end of meiosis greatly increasing variation.

In humans without crossing over there are 2^{23} different ways our 23 pairs of chromosomes could be arranged in the gametes.

- **Segregation:**

During the second stage of meiosis, Metaphase II, the way each chromatid lines up (recombinant and non-recombinant) is random and again, mixes existing alleles into new combinations.

- **Mutation:**

Mutation can be defined as a permanent change in the nucleotide sequence in a gene or a chromosome.

Mutations are very important as they are the **only way of creating new alleles** and increasing variation.

For mutations to be passed on to the offspring they must occur in the gametes (sperm or egg) so they become part of the offspring's genetic makeup and may enter the gene pool.

If the mutation occurs in the somatic cell (non-sex cells / body cells) it will only affect *that* organism and will not be passed on to the offspring.

Most mutations are harmful and will be selected against by natural selection. A few may be useful and as a result of natural selection become part of the gene pool.