

Crossing-over, its mechanism and significance

Crossing-over is the process during which a piece of **DNA is exchanged** between two homologous chromosomes. The exchange takes place during the **prophase (pachytene) in the I. meiotic division**.

This process is controlled randomly; the place where both parent descriptions "split" and then "glue" together is chosen by the invisible hand of evolution.

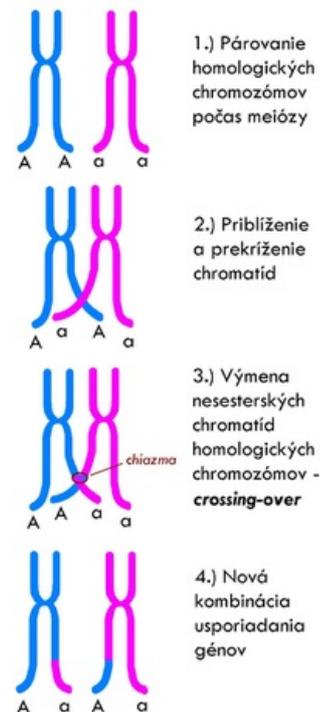
Mechanism

'Pairing of homologous chromosomes **occurs in prophase**. Thanks to the **synaptonemal complex, they combine into one formation called bivalent**. **Crossing over (recombination)** of chromosome parts occurs in non-sister chromatids. A **chiasm** will form at this point (0-2 per crossing-over). After recombination, the chiasmata disappear and **reduction division is completed**.

The result of correctly executed crossing-over is the exchange **of corresponding sections of chromatids** and thus the exchange of alleles on these sections of localized genes between the chromatids of homologous chromosomes: i.e. **disruption of the linkage of genes** and the emergence of a new combination of alleles on one chromosome, which increases the **variability of the offspring**.

In the case of an incorrectly performed crossing over (different sections of chromatids are exchanged), a **mutation** occurs, the danger of which varies from case to case

- as a rule, it is a **chromosomal mutation**, however, if one of the chromosomes loses its centromere due to crossing-over, the entire defect can result in a **genomic mutation** in the daughter cells.



The course of crossing over

Recombination can be **single** or **double**. In simple recombination, only one chromatid crossover occurs, while in multiple recombination, several crossovers occur (most often 2).

Crossing-over occurs approximately once or twice for each chromosome. The exceptions are the **sex** chromosomes, where recombination **cannot occur**.

Meaning

Crossing-over is, along with mutations and the random separation of chromosomes into gametes, one of the main sources of **genetic variability**.

Many geneticists believe that the entanglement created by crossing-over is a way to keep members of the bivalent together during prophase I. In some organisms, prophase I is prolonged. For example, it can take up to 40 years for women. ^[1]

Although it does not create **new alleles**, it enables the creation of new combinations of already existing alleles of genes located on the **same chromosome**.

Links

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Source

- ŠTEFÁNEK, Jiří. *Medicína, nemoci, studium na 1. LF UK* [online]. [cit. 2009]. <<http://www.stefajir.cz>>.

References

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1. Template:Cite monograph

