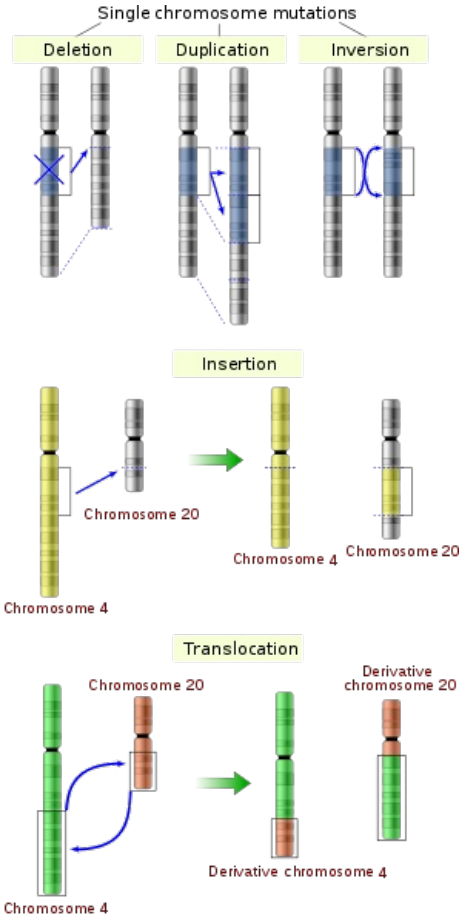
# Evolution and speciation at the chromosomal level

**By chromosomal evolution**we mean changes in DNA, molecules that occurred during the development of a species. Although changes in chromozomes occur very often, only a few of them become a permanent part of the karyotype of a given species. Transient changes are found only in a given individual. Permanent changes are passed on to subsequent generations and can therefore be a means of tracing the common ancestry of multiple species.

Among the individual means of chromosomal evolution are: translocations, inversions, changes in telomeres and centromeres, duplikacations, changes in the number of repeats, etc.

The instability of genomes, which enables all the aforementioned DNA modifications, is the basis of evolution. This is often a very fast process that is able to purposefully change the order of genes on the chromosome. As part of the changes, however, forms can arise that harm the wearer. In the case of some duplications or inversions, certain genes may be duplicated or, conversely, missing.

**Speciation** is the biological process of species formation.



Types of chromosome mutations

## Causes of DNA changes

The basis for changes and combinations of chromosomes is disruption of DNA cohesion - chromosomal breaks. They can be evoked by radiation or the action of mutagens. Changes are noticeable when it comes to inversions in pericentric or paracentric regions. If movements occur at the ends of chromosomes, i.e. in the region of telomeres, the effect is often not apparent. **Telomeres** are a certain defense mechanism that is made up of groups of repetitive sequences. Another function of telomeres is to prevent the joining of individual chromosomes.

## Consequences of DNA changes

The consequences of inversions that occur on chromosomes are dependent on whether or not crossing-over. has occurred . If this happens, the result is unbalanced gamete mutations, that cause problems in subsequent generations. If crossing-over does not occur during inversion, the gametes are usually fine.

Crossing-over is genetic recombination during meiosis. Part of the maternal chromatid can be exchanged for the corresponding part of the paternal chromatid. This process normally favors the emergence of individuals with a new arrangement genes.[1]

In general, we can say that changes at the chromosomal level lead to the emergence of different heterozygotes. If the DNA of these individuals is damaged, their ability to reproduce is often affected.

## Differences in the number of chromosomes of individual species

In addition to changes in the arrangement of genes on chromosomes, we also encounter different numbers of chromosomes between individual species. The human genome contains 23 pairs of chromosomes (n = 23), but mammals in general are highly variable in the number of pairs. Simpler organisms can do with significantly lower numbers. For example, drosophila mhas 4 pairs of chromosomes (n = 4). However, one of the pairs (sex chromosomes) is the same for each species.

The number of chromosomes is a form of adaptation that allows for a different number of genome recombinations. The more chromosomes we have, the more recombination takes place.

An interesting example is the relationship between humans and chimpanzees. The human genome contains 2n = 46 chromosomes. Chimpanzees have a genome larger by one pair of chromosomes, i.e. 48 chromosomes. Humans diverged from the ape branch a long time ago. We differ from our close relatives by only 9 pericentric inversions and one centric fusion. [2][2]

## Links

## Related articles

- DNA
- Chromozome
- Karyotype
- Genome
- Translocation
- Inversion
- Evolution and speciation at the molecular level

## External links

- Speciace

## References


1. ALBERTS, B – BRAY, D – JOHNSON, A. *Základy buněčné biologie.* 2. edition. Espero Publishing, 2005. 740 pp. ISBN 80-902906-2-0.
2. http://www.ucl.ac.uk/~ucbhdjm/courses/b242/ChromEvol/ChromEvolPP.pdf


## Sources

- Humane Chromosome Evolution (http://www.els.net/WileyCDA/ElsArticle/refId-a0001447.html)
- Structural Dynamics of Eukaryotic Chromosome Evolution (http://science.sciencemag.org/content/301/5634/793)
- Chromozomal Evolution (http://www.ucl.ac.uk/~ucbhdjm/courses/b242/ChromEvol/ChromEvolPP.pdf)
- ABC (https://slovnik-cizich-slov.abz.cz/web.php/slovo/speciace)

## Reference


- ALBERTS, B – BRAY, D – JOHNSON, A. *Základy buněčné biologie.* 2. edition. Espero Publishing, 2005. 740 pp. ISBN 80-902906-2-0.