

Chromosomal Arrangements:

Errors in replication or in cell division can result in large changes to the genetic information in a cell. Sometimes, genes are reorganized on a chromosome. Other times, cells can have loss or gain of genetic material. These changes in the genetic material can be changes in a few genes, large chunks of a chromosome, or even the total number of chromosomes in the cell.

Movement of Genes: Inversions vs Translocations

Rearrangements can exist when small portions of DNA change location. While a gene is supposed to be located at a specific locus, sometimes it being moved to a new location resulting in a rearrangement. When genetic material from one chromosome is moved to another chromosome, a translocation is said to occur. This results in genes being on different chromosomes than they typically are. An inversion is a type of rearrangement where genes change location within the same chromosome. In an inversion, a chunk of a chromosome is flipped.

Two types of inversions exist. A pericentric inversion is an inversion where the flip spans the centromere. A paracentric inversion only affects one side of a chromosome and does not affect the centromere.

Arrangements that Affect Chromosome Number

Some large-scale chromosomal rearrangements can alter chromosome number. In meiosis, the first round of cell division is supposed to separate homologues and the second round is supposed to separate sister chromatids. Non-disjunction, an incorrect separation of genetic material, in meiosis I results in half of the produced gametes having two similar copies of a chromosome and the other half not having any copies of the affected chromosome. A non-disjunction in meiosis II results in some of the produced gametes having two identical copies of a chromosome and others without any copies of the affected chromosome.

In cases of non-disjunction, only one chromosome is affected. There is one more copy of a chromosome or a lack of a chromosome in gametes. When only one or a few extra or fewer chromosomes, aneuploidy is said to exist. In some cases, the full set of chromosomes is affected. If there are a full extra set of chromosomes or a loss of a full set of chromosomes, aberrant euploidy explains the mutated chromosome count.

Learning Objectives:

- Understand and be able to identify the different types of rearrangements.
- Be able to draw examples of and explain euploidy, aberrant euploidy, and aneuploidy.
- Correctly state number of chromosomes in cases of aberrant euploidy and aneuploidy.
- Be able to predict if an example of aneuploidy is a result of non-disjunction in meiosis I or meiosis II. Be able to explain your answer.

Order of Activities:

1. Read the following website to review some types of chromosomal rearrangements.
<https://courses.lumenlearning.com/wm-biology1/chapter/reading-chromosomal-structural-rearrangements-2/>
2. Complete a [hands-on activity](#) to identify type of chromosomal rearrangement.
3. Test your knowledge by completing the [inversions worksheet](#). Attempt to first complete this on your own, then pair up with a partner or group to discuss when possible before viewing the [answer key](#).
4. Test your knowledge by completing the [chromosome number worksheet](#). Attempt to first complete this on your own, then pair up with a partner or group to discuss when possible before viewing the [answer key](#).
5. Think about which types of chromosomal rearrangements classify as a relocation of genetic material, loss of genetic material, and gain of genetic material.
6. After reviewing any topic, it is a good idea to have a metacognition check. Ask yourself the following questions:
 - What are my emotional responses to learning this material? Which material am I frustrated with and need aid in understanding?
 - What difficulties have I had with the learning tasks? What specific tasks will I do to master this content?
 - Do I understand all of the learning goals? Can I explain each of them out loud to someone clearly and concisely?
 - How is what I learned related to other things I have learned in this class? How is it related to other classes, my career, and my life?
7. If you would like to have more aid in learning this material, please reach out. There are numerous individuals who want to help you feel confident in your understanding. If your course has learning assistants or teaching assistant(s), you should reach out to them to review concepts you want to learn more about. Your professor is also a great resource to go to when you do not understand a topic. You can study with your peers or receive academic support through the LRC as well. If you would like help identifying how to receive the support you need, do not hesitate to contact the CU Denver Learning Resources Center at LRC@ucdenver.edu or stop by our front desk in the learning commons building.