

# Difference Between Inversion and Translocation

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## Key Difference - Inversion vs Translocation

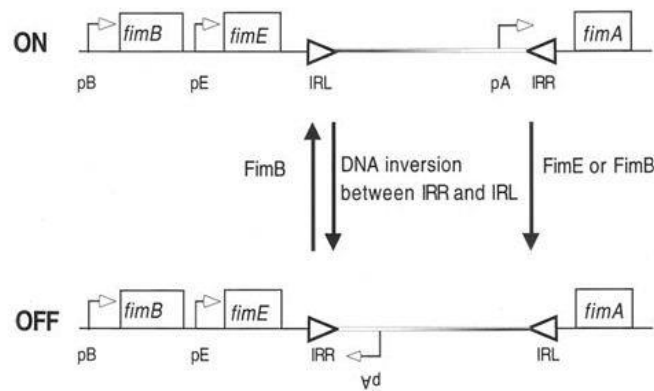
In the context of [genetics](#), chromosomal rearrangement is a kind of abnormality that deviated from the native structure of the chromosomes. Some rearrangements create [mutations](#) that are lethal and lead to deleterious diseases such as cancers, [syndromes](#) etc. There are different types of chromosomal rearrangements namely deletions, inversions, translocations, duplications etc. In all these rearrangements, [DNA](#) double-strand breaks from two different locations and separates from the original chromosome. Then the broken fragment rejoins with the same [chromosome](#) or with a different chromosome to produce new chromosomal gene arrangement. Different factors cause these types of double-strand breaks. One factor is ionizing radiation that includes energetic [X rays and gamma rays](#). Inversion is a rearrangement in which broken double-stranded DNA fragment flips in 180 degrees and rejoins in the same chromosome at the same point. Translocation is another type of rearrangement in which broken double-stranded fragment of one chromosome joins at a new position of the nonhomologous chromosome. The **key difference** between inversion and translocation is **inversion occurs on the same chromosome, and it does not change the location while the translocation occurs between non-homologous chromosomes and it changes the location.**

## What is an Inversion?

Inversion is a type of chromosomal rearrangement that causes new gene arrangement in the native chromosome. Due to different causes, double-stranded DNA sequences break at two points creating broken fragments. Then a broken sequence flips in 180 degrees and rejoins at the same location. In other words, a broken fragment of a chromosome rejoins within the same location in the reversed end to end manner. This creates an abnormality in the gene arrangement of the chromosome.

Inversion does not cause the loss of genetic information. It simply rearranges the gene order or the gene sequence. There are two types of inversions namely paracentric and pericentric inversions. A paracentric inversion occurs in one arm of the chromosome without involving the centromere. Both arms of the chromosome break including the centromere during the pericentric inversion.

## Phase variation – Site specific inversion



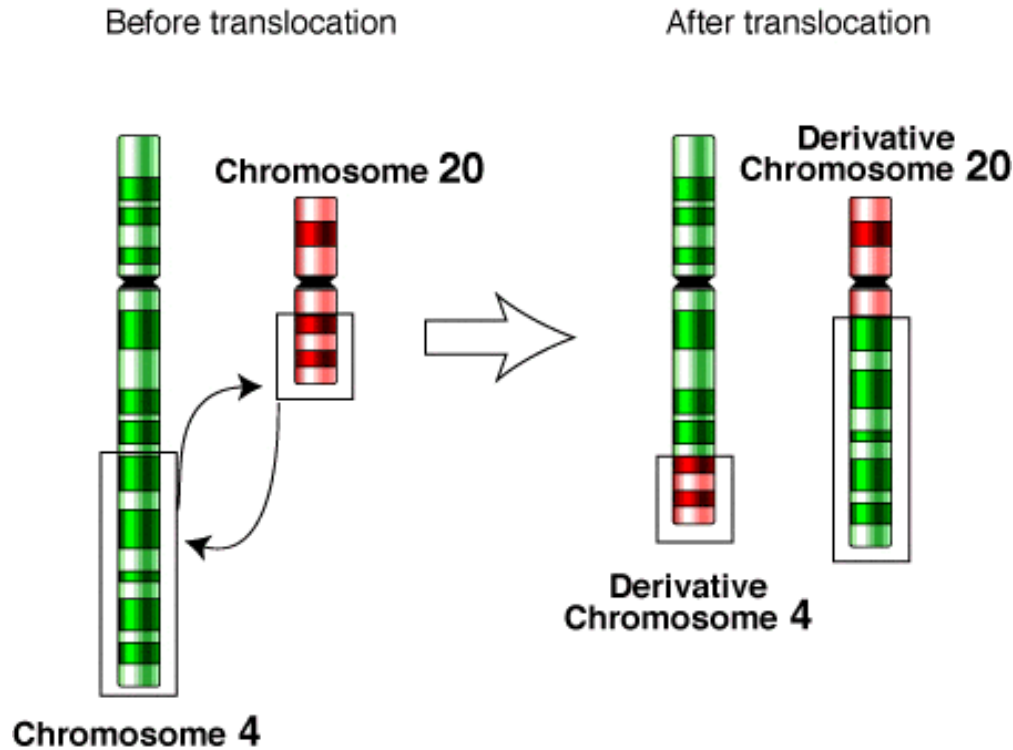
Phase variation – site specific inversion. pB, pE and pA are promoters for the genes *fimB*, *fimE* and *fimA* respectively. IRL and IRR are inverted repeats. FimB and FimE are recombinases that bind to the open triangles IRL and IRR. The result is an inversion of the DNA sequence (shaded bar) that turns ON or OFF the transcription of *fimA*.

### Figure 01: DNA Inversion

Inversions do not cause harmful effects since DNA repair mechanisms work easily to repair these types of rearrangements. And also inversions simply rearrange the gene sequences without creating losses or extra sequences.

## What is a Translocation?

Translocation is a type of chromosomal rearrangement that occurs between nonhomologous chromosomes. Broken segments are exchanged between two nonhomologous chromosomes. It creates two chromosomes that are genetically different from the native chromosomes. Reciprocal and Robertsonian are two types of translocations. Reciprocal translocation is the exchange of broken DNA segments between two nonhomologous chromosomes. It does not cause loss or gain of genetic material. Hence it is a type of balanced rearrangement.



**Figure 02: Reciprocal Translocation**

During the Robertsonian translocation, long arms of the two acrocentric chromosomes fuse with each other. Short arms can be lost. Hence it is a type of imbalanced chromosomal rearrangement. Compared to the Robertsonian translocation, reciprocal translocation is a common type of chromosomal rearrangement. Some translocations are inherited while some newly occur. Certain translocations cause diseases such as cancer, [Down syndrome](#), [infertility](#) and XX male syndrome.

## What are the Similarities Between Inversion and Translocation?

- Inversion and Translocation are two types of chromosomal abnormalities.
- Both types cause chromosomal rearrangement.
- Inversions and translocations are resulted due to double-strand
- Both inversions and translocation can occur in the genetically balanced manner.

## What is the Difference Between Inversion and Translocation?

Inversion vs Translocation	
Inversion is a type of chromosomal	Translocation is another type of chromosomal

rearrangement in which broken fragment flips in 180 degrees and joins again within the chromosome at the same location.	rearrangement in which parts of nonhomologous chromosomes are exchanged between each other.
<b>Location of Rejoining</b>	
An inversion occurs in the same location within the same chromosome.	Translocation changes the location of the DNA fragment between chromosomes.
<b>Harmful Effects</b>	
Inversion is believed to have not caused any harmful effects.	Translocation can cause harmful effects such as cancers, infertility etc.
<b>Chromosomes Involved</b>	
An inversion occurs within the same chromosome.	Translocation occurs between nonhomologous chromosomes.
<b>Chromosomal Imbalance</b>	
Chromosome rearrangement is caused due to inversion is balanced, because no extra or missing DNA is involved in the invasion.	Chromosome rearrangements are caused due to translocation can be balanced or unbalanced.
<b>Types</b>	
Inversion is two types; paracentric and pericentric.	Translocation can be reciprocal or roberstonian.

## Summary - Inversion vs Translocation

Inversion and translocation are two types of chromosomal abnormalities caused due to double-strand breaks. During the inversion, a fragment of chromosome breaks at two points and flips in 180 degrees and joins again with the chromosome. Translocation is the exchange of broken segments of chromosomes between nonhomologous chromosomes. An inversion occurs within the same chromosome. Translocation occurs between nonhomologous chromosomes. This is the difference between inversion and translocation.

### Reference:

- 1.Griffiths, Anthony JF. "Chromosomal Rearrangements." Modern Genetic Analysis., U.S. National Library of Medicine, 1 Jan. 1999. [Available here](#)
- 2.Griffiths, Anthony JF. "Translocations." An Introduction to Genetic Analysis. 7th edition., U.S. National Library of Medicine, 1 Jan. 1970. [Available here](#)

### **Image Courtesy:**

- 1.'Phase variation site specific recombination - inversion' By Marjan W. van der Woude and Andreas J. Baumler - Clinical Microbiology Reviews, [\(CC BY 3.0\)](#) via [Commons Wikimedia](#)
- 2.'Translocation-4-20'By Courtesy: National Human Genome Research Institute, (Public Domain) via [Commons Wikimedia](#)

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