

Difference Between Recombination and Crossing Over

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Key Difference - Recombination vs Crossing Over

Genes are mixed during the gamete formation or the sex cell formation by meiosis. The composition of the genetic materials in the gametes change and resulting offsprings show genetic variation. Genetic recombination is a process of genetic material exchange that results in new gene combinations than parental gene combinations. Recombination can occur between different chromosomes or between the different regions of the same chromosome. Chromosomes occur in two homologous sets. During meiosis, homologous chromosomes arrange in the middle of the cell and form bivalents. The contact points are known as chiasmata and chiasmata can exchange genetic materials due to crossing over. Crossing over is the process of exchanging matching segments of chromosomes between homologous chromosomes in the first division of the meiosis. It happens during the gamete formation, and it results in recombinant chromosomes. The **key difference** between recombination and crossing over is that **recombination is the process that produces new gene combinations or recombinant chromosomes while cross over is the process that produces recombination**. Sometimes these two words are used as synonyms.

What is Recombination?

Recombination is referred to the exchange of genetic material and production of new gene combinations. Recombination occurs between homologous chromosomes. When genetic material exchange does not occur, the resulting chromosomes are known as non-recombinant chromosomes. When recombination occurs between non-sister chromatids, the resulting chromosomes are known as recombinant chromosomes. Recombination is important since it is responsible for genetic variation among the organisms.

Recombinant chromosomes gather in gametes resulting new gene combinations in the gametes. It occurs during the chiasmata break. One segment of the mother chromosome attaches to the matching region of the parental homologous chromosome. A broken segment of the father chromosome attaches to the matching region of the mother chromosome. These new recombined chromosomes are produced as the result of crossed chromatids.

What is Crossing Over?

Crossing over is the process of exchange segments of chromosomes between non-sister chromatids during the meiosis or gamete formation. This is also known as homologous

recombination. As a result of crossing over, new combinations of the genes are created in the gametes. These new gene combinations result in genetic diversity among the offsprings. During meiosis, homologous chromosomes pair up with each other and forms bivalents. Non-sister chromatids fall with each other. They form contact points known as chiasmata. Chiasmata formation facilitates the genetic material exchange between matching segments of the homologous chromosomes (non-sister chromatids). Then the resulting chromosomes are known as recombinant chromosomes. They consist of new gene combinations compared to parental gene combinations. Hence the resulting offspring differ from parents. And also between offsprings, there will be a genetic diversity. Since crossing over occurs between homologous chromosomes or matching chromosomes, it does not create [mutation](#) or cause any disease. Instead, it results in genetic diversity that is an important factor for survival and adaptability of offsprings.

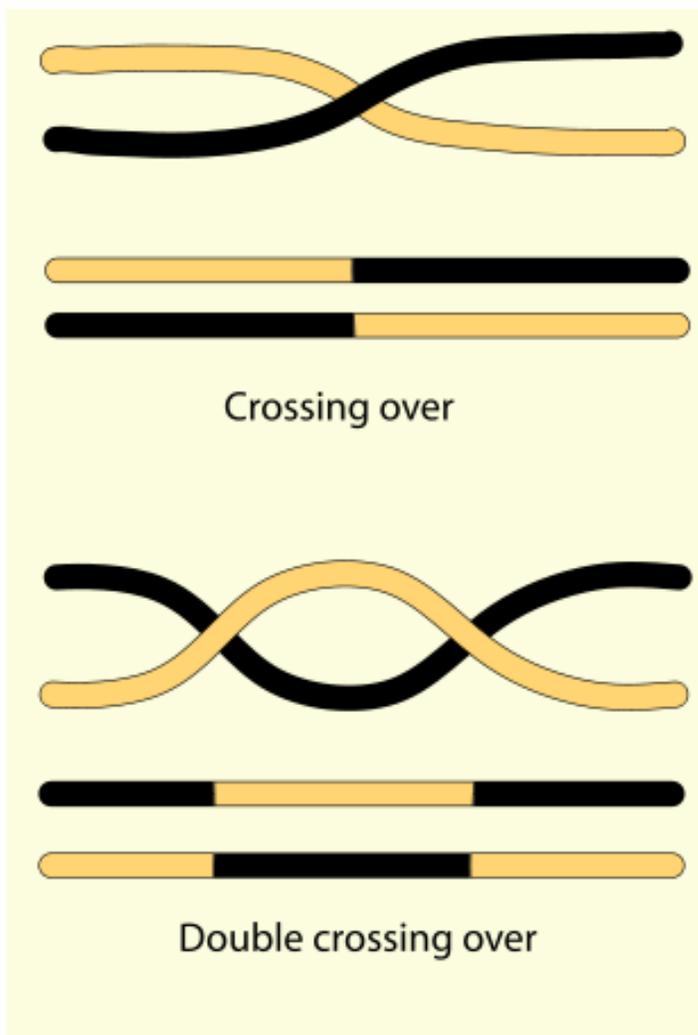


Figure 01: Crossing Over

Crossing over can occur in [mitosis](#) as well. When crossing over occurs between non-homologous chromosomes, it creates a mutation. It is a type of [translocation](#). A fragment of chromosome detaches from one chromosome and attaches with non-homologous chromosome creating a big change in the gene composition of that chromosome. Therefore, these kind of crossing over are deleterious and can cause severe diseases such as acute and chronic leukaemia, Duchenne muscular dystrophy etc.

What are the Similarities Between Recombination and Crossing Over?

- Both recombination and cross over produce new gene combinations
- Both processes occur during the meiosis.
- Both are responsible for genetic diversity among the offsprings.
- Both processes refer to exchange of genetic materials between homologous chromosomes.
- Recombination and crossing over can be seen during the [sexual reproduction](#).

What is the Difference Between Recombination and Crossing Over?

Recombination vs Crossing Over	
Recombination refers to the process of recombining genes to produce new gene combinations that differ from those of either parent.	Crossing over is the process of exchanging segments of chromosomes between homologous chromosomes.

Summary - Recombination vs Crossing Over

Recombination is the process of producing new gene combinations in gametes that differ from those of either parent. Recombination results in recombinant chromosomes. Recombinant chromosomes are caused by genetic variation in offspring. Crossing over is the process that produces recombination. When homologous chromosomes form cross chromatids during the [prophase I](#) of meiosis, genetic material exchange occurs. The exchange of nonsister chromatids of homologous chromosomes in the cross chromatids produces new gene combinations, and it is known as crossing over. This is the difference between recombination and crossing over.

Reference:

1. Alberts, Bruce. "General Recombination." Molecular Biology of the Cell. 4th edition., U.S. National Library of Medicine, 1 Jan. 1970. [Available here](#)
2. Bailey, Regina. "What Is Crossing Over and How Are Genes Recombined?" ThoughtCo. [Available here](#)
3. "Crossing Over." Genetics, Encyclopedia.com. [Available here](#)

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