

# Difference Between Bivalent and Chiasmata in Meiosis

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## Key Difference - Bivalent vs Chiasmata in Meiosis

Meiosis is the process of cell division followed by gamete cells. During meiosis, the chromosome number is reduced by half in order to maintain the chromosome number during sexual reproduction. The male and female chromosomes segregate and then divide into the successive generation. There are two main phases of meiosis namely meiosis I and meiosis II. Similar to mitosis, meiosis is also comprised of the stages namely prophase, metaphase, anaphase, and telophase. The chromosomes are obtained from two different gamete cells; the female ova and the male sperm. Therefore, during the meiosis process, these homologous chromosomes undergo crossing over. During the meiotic prophase, bivalents are formed and the genetic composition is mixed at points known as the chiasma. Bivalent or tetrad is an association of homologous chromosomes formed during the prophase I of meiosis. Chiasma is the contacts point where to homologous chromosomes form a physical connection or a crossing over. The **key difference** between a bivalent and chiasmata in meiosis is based upon its structural functionality. **Bivalents are associations of homologous chromosomes, whereas Chiasmata are the junctions where the homologous chromosomes contact and DNA crossing over take place.**

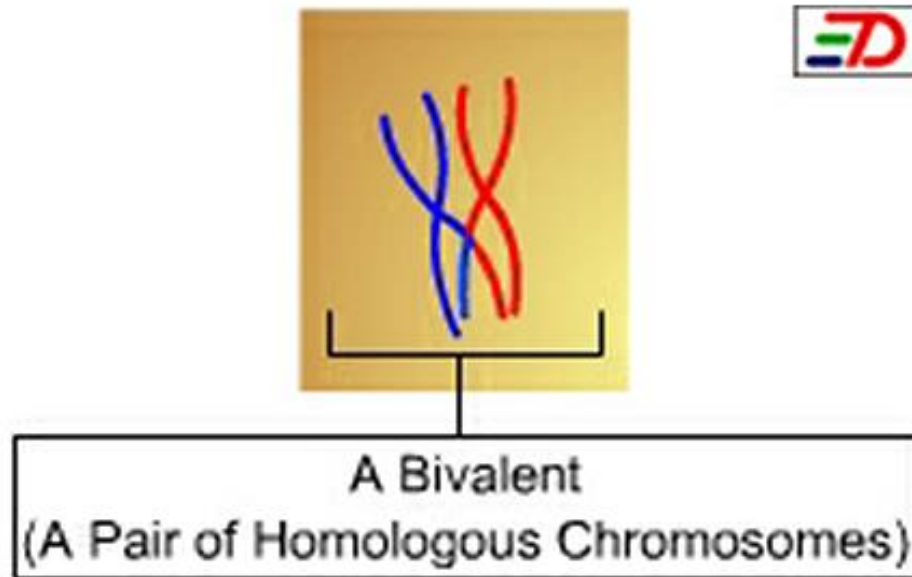
## What is Bivalent in Meiosis?

Bivalent is formed during the meiosis process between homologous chromosomes. In meiosis, two sets of chromosomes from male and female gamete are involved. The bivalent is formed as an association between male and female homologous chromosomes. The bivalent is also referred to as the tetrad. Under normal cell division conditions, each bivalent contains at least one crossover points known as chiasma. The number of chiasma in the bivalent gives an idea of the cross over the efficiency of the DNA during meiosis. Formation of a bivalent in meiosis is vital as it allows the segregation of chromosomes during meiosis.

Formation of a bivalent is a complex process and involves the following steps.

1. Formation of the synaptonemal complex containing the two homologous chromosomes.

2. The pairing of the two homologous chromosomes which takes place between the leptotene and the pachytene phase of prophase I of meiosis.
3. DNA is exchanged at certain points known as chiasma.
4. A physical connection is established in the diplotene phase of prophase I of meiosis.
5. At the end of the diplotene phase, a bivalent is formed.

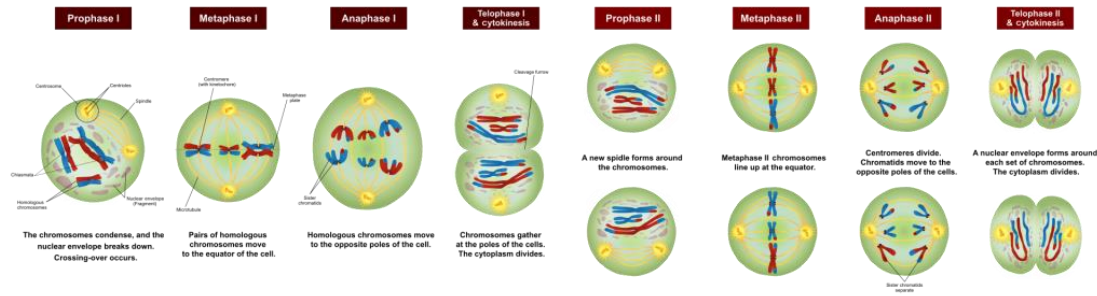


**Figure 01: Bivalent**

The formation of bivalents will ensure that the genetic composition is mixed between the gamete cells. Upon the formation of bivalents, a tension is created and each chromatid is pulled in the opposite direction. This will allow the bivalents to arrange in the center of the cell.

## **What are Chiasmata in Meiosis?**

Chiasma is referred to the point of contact between two homologous chromosomes. Frans Alfons Janssens first introduced the concept of Chiasma in 1990. Chiasmata are formed between two non-sister chromatids belonging to two homologous chromosomes. Chiasmata are important in DNA crossover during meiosis. At these junction points, the genetic material is exchanged between the maternal and the paternal chromosomes.



**Figure 02: Chiasmata**

The formation of chiasma in bivalents takes place in the prophase I of meiosis. Chiasmata formation is a rare occurrence in mitosis. Due to the absence of chiasma formation, chromosomal aberrations may take place. Chiasmata are formed as a result of the contact points that remain when the bivalents begin to split. The Chiasmata becomes visible during the pachytene stage of prophase I.

## What are the Similarities Between Bivalent and Chiasmata in Meiosis?

- Both are formed during the prophase I of meiosis.
- Both results in DNA cross over and allow segregation of chromosomes in meiosis.

## What is the Difference Between Bivalent and Chiasmata in Meiosis?

Bivalent vs Chiasmata Meiosis	
Bivalents or tetrads are associations of homologous chromosomes formed during the prophase I of meiosis.	Chiasmata are the contact points where two homologous chromosomes form a physical connection.

## Summary - Bivalent vs Chiasmata in Meiosis

The process of meiosis is important to ensure the continuity of life. The prophase I of meiosis is an important stage where the DNA crossover between the maternal and paternal chromosomes takes place. During the prophase I, two homologous chromosomes come into close association forming the bivalent structures known as tetrads. The non-sister chromatids of homologous chromosomes in the

bivalents exchange genetic material at points known as chiasma. This allows segregation of chromosomes during meiosis. This is the difference between bivalent and chiasmata in meiosis.

**Reference:**

- 1.“Chiasma (Genetics).” Chiasma (Genetics) - an overview | ScienceDirect Topics. [Available here](#)
- 2.Meiosis Tutorial. [Available here](#)

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