

Difference Between Metacentric and Submetacentric Chromosomes

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Key Difference - Metacentric vs Submetacentric Chromosomes

The organized cellular structure in which the [Deoxyribose Nucleic Acid \(DNA\)](#) molecules are tightly packaged is known as a [Chromosome](#). Chromosomes reside in the [nucleus](#) and contain all the [genes](#) that are responsible for the production of [proteins](#) required for different functional aspects of the cell. The total number of chromosomes in organisms differs according to the species. In humans, there are 23 pairs of chromosomes accounting a total of 46 chromosomes. These 23 pairs are composed of 22 autosomal chromosome pairs and one [sex chromosome](#) pair. Chromosomes can be categorized based on different criteria taking different aspects into consideration. Based on the position of the centromere, chromosomes are categorized into four groups; Metacentric Chromosomes, Submetacentric Chromosomes, Acrocentric chromosomes and Telocentric chromosomes. In metacentric chromosomes, the centromere is located in the exact middle of the chromosomes giving rise to two equal length arms. Submetacentric chromosomes are the chromosomes in which the centromere is located a little away from the midpoint, thus resulting in unequal length arms. In humans, most chromosomes belong to this type. The **key difference** between the Metacentric and Sub-metacentric chromosomes is based on the positioning of the centromere in the chromosome. **In Metacentric chromosomes, the centromere is located right at the midpoint of the chromosome, whereas in Submetacentric chromosomes, the centromere is located a little away from the midpoint.**

What are Metacentric Chromosomes?

Metacentric chromosomes are the chromosomes in which the centromere is located in the middle position of the chromosome. The centromere is composed of a DNA region, and it is the structure which holds the two [sister chromatids](#) together in place. In addition, the centromere is involved in the spindle formation process during the [cell division](#). The centromere binds to the kinetochore proteins to form the spindle apparatus during both [mitosis and meiosis](#).

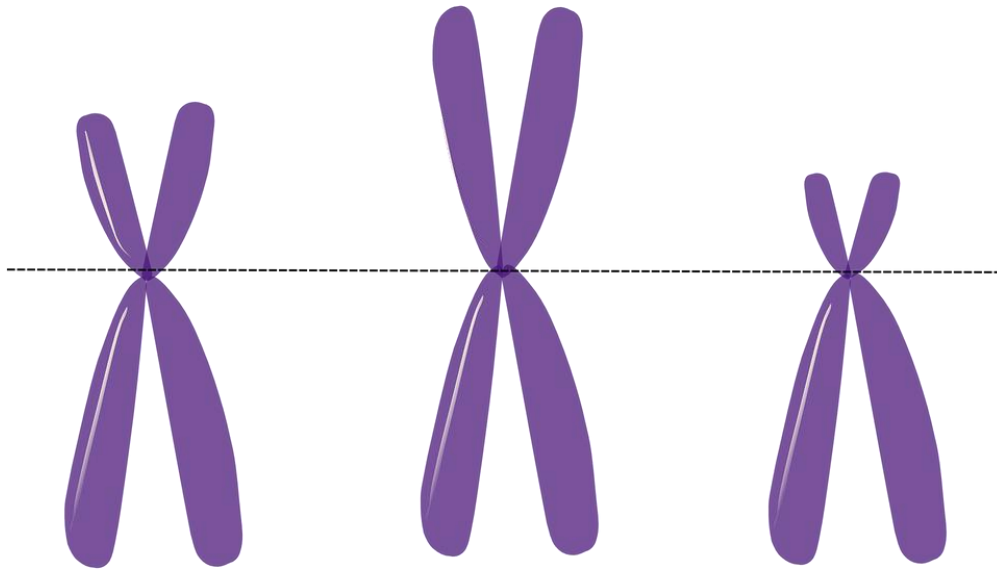


Figure 01: Metacentric Chromosome is indicated at the Middle Position

Owing to the structure of the metacentric chromosomes, they are composed of two equal-sized arms, and in the cell division phase, they appear as 'v' shaped structures during the [metaphase](#) of the cell division. The presence of metacentric chromosomes is mostly observed in primitive organisms. Karyotyping using [Giemsa staining](#) has enabled the [cytogenetics](#) to characterize these chromosomes. The karyotyping done on primitive organisms to observe metacentric chromosomes is referred to as 'symmetric karyotype'. The human chromosomes 1 and 3 belong to this type and amphibians are composed mainly of metacentric chromosomes.

What are Submetacentric Chromosomes?

In Submetacentric chromosomes, the centromere is located slightly away from the midpoint of the chromosome. Therefore, this positioning of the centromere results in unequal sized arms of the chromosome. In usual structure analysis after karyotyping, the submetacentric chromosomes appear to have shorter p arms and longer q arms.

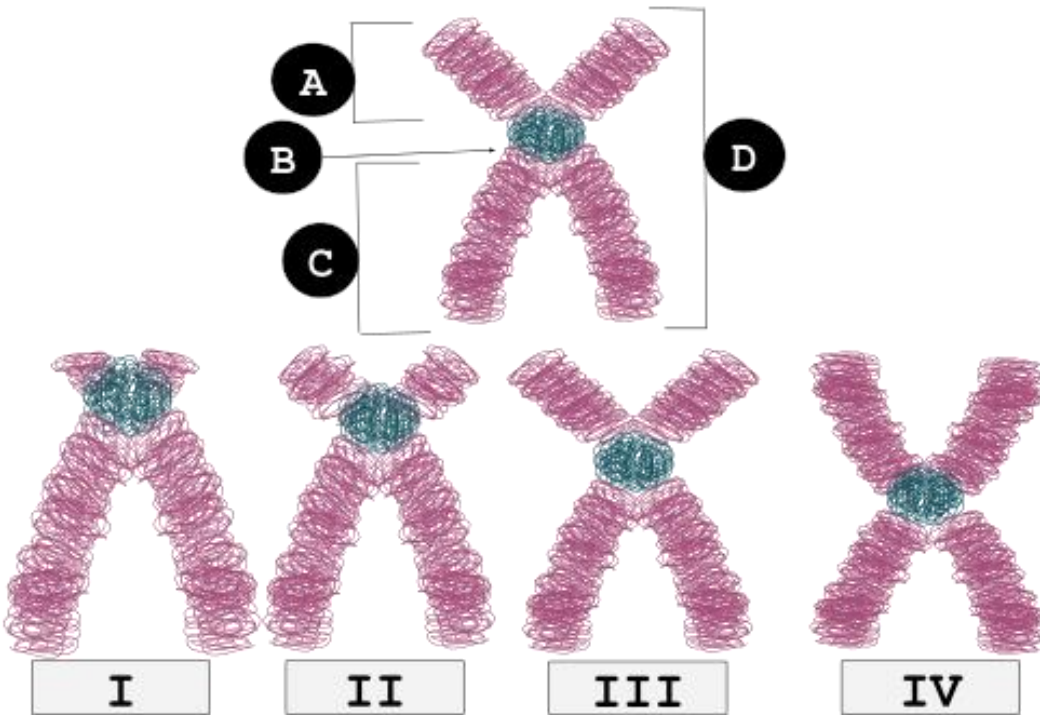


Figure 02: Submetacentric Chromosomes is indicated in the Third Position

During the mitosis and meiosis phases, the submetacentric chromosomes assume an 'L' shaped structure in the metaphase stage. When the metaphase chromosomes are observed under the microscope, this type of chromosome can be distinguished easily from the others. Most of the human chromosomes belong to this type.

What are the Similarities Between Metacentric and Submetacentric Chromosomes?

- Both Metacentric and Submetacentric Chromosomes types are composed of highly compact DNA.
- Both Metacentric and Submetacentric Chromosomes structures are categorized based on the position of the centromere.
- Both Metacentric and Submetacentric chromosomal types are present in humans.
- Both Metacentric and Submetacentric Chromosomes structures can be identified by karyotyping using Giemsa
- Both Metacentric and Submetacentric Chromosomes structures can be subjected to different chromosomal aberrations or mutations leading to different health complications.

What is the Difference Between Metacentric and Submetacentric Chromosomes?

Metacentric vs Submetacentric Chromosomes	
In Metacentric chromosomes, the centromere is placed in the exact middle point of the chromosomes giving rise to two equal length arms.	Submetacentric chromosomes are the chromosomes in which the centromere is placed a little away from the midpoint, thus resulting in unequal length arms.
Structure Formed During Metaphase of Cell Division	
Metacentric chromosomes appear as V-shaped in metaphase.	Submetacentric chromosomes appear as L shaped in metaphase.
p and q arms	
Metacentric chromosomes have equal sized p and q arms.	Submetacentric chromosomes have shorter p arm and comparatively lengthier q arm.

Summary - Metacentric vs Submetacentric Chromosomes

Chromosomes are highly compact DNA structures that are responsible for housing the genes. Based on the positioning of the centromere, chromosomes are categorized as metacentric, submetacentric, acrocentric and telocentric chromosomes. Metacentric chromosomes are the ones having the centromere placed in the middle of the chromosome. Therefore, this results in equal sized p and q arms. Submetacentric chromosomes are the chromosomes in which the centromere is placed slightly away from the centre. Thus, this type of chromosomes is composed of a short p arm and a longer q arm. Both types are found in humans, and they can be observed via karyotyping. This is the difference between metacentric and submetacentric chromosomes.

Reference:

1. "Easy Biology Class." Easybiologyclass. [Available here](#)
2. "Types of Chromosomes." BiologyWise, biologywise.com/types-of-chromosomes. [Available here](#)

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1. '156403' by OpenClipart-Vectors (Public Domain) via [Pixabay](#)
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