

## **Chromosomes**

- In the nucleus of each cell, the **DNA** molecule is packaged into thread-like structures called chromosomes.
- Chromosomes are the nuclear components of the special organization, individuality, and function that are capable of self-reproduction and play a vital role in heredity, mutation, variation and evolutionary development of the species.
- Each chromosome is made up of DNA tightly coiled many times around proteins called histones that support its structure.
- Chromosomes were first described by Strasburger (1815), and the term ‘chromosome’ was first used by Waldeyer in 1888.
- They appear as rod-shaped dark stained bodies during the metaphase stage of mitosis.
- Each chromosome typically has one centromere and one or two arms that project from the centromere.

## **Structure of chromosome**

Structurally, each chromosome is differentiated into three parts—

1. Pellicle
2. Matrix
3. Chromonemata

### **1. Pellicle**

- It is the outer envelope around the substance of chromosome.
- It is very thin and is formed of achromatic substances.

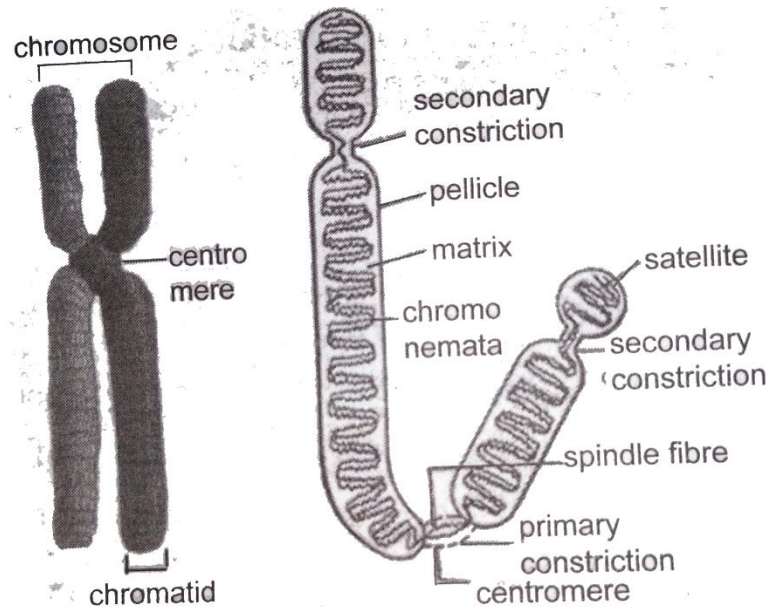
### **2. Matrix**

- It is the ground substance of chromosome which contains the chromonemata.
- It is also formed of non-genic materials.

### **3. Chromonemata**

- Embedded in the matrix of each chromosome are two identical, spirally coiled threads called chromonemata.
- The two chromonemata are also tightly coiled together that they appear as single thread of about 800Å thickness.

- Each chromonemata consists of about 8 microfibrils, each of which is formed of a double helix of DNA.



### Structure of Chromosome

In mitotic metaphase chromosomes, the following structures can be seen under the light microscope:

- (1) Chromatid,
- (2) Chromonema,
- (3) Chromomeres,
- (4) Centromere,
- (5) Secondary constriction or Nucleolar organizer,
- (6) Telomere and
- (7) Satellite.

#### (1) Chromatid

- Each chromosome has two symmetrical structures called chromatids or sister chromatids which is visible in mitotic metaphase.
- Each chromatid contains a single DNA molecule
- At the anaphase of mitotic cell division, sister chromatids separate and migrate to opposite poles

## (2) Chromonema

- At prophase, the chromosomal material is visible as thin filaments known as **chromonemata**

## (3) Chromomeres

- At interphase, bead-like structures are visible, which are an accumulation of chromatin material called **chromomere**. Chromatin with chromomere looks like a necklace with beads

## (4) Centromere

- A small structure in the chromonema, marked by a constriction which is recognised as permanent structure in the chromosome is termed as the centromere.
- At this point the two chromonemata are joined together.
- It is known as **centromere or kinetochore or primary constriction.**
- It divides the chromosome into two sections, or “arms.” The short arm of the chromosome is labeled the “p arm.” The long arm of the chromosome is labeled the “q arm.”
- The chromosomes are attached to spindle fibres at this region during cell division.

## (5) Secondary constriction or Nucleolar organizer

- The chromosome besides having the primary constriction or the centromere possesses secondary constriction at any point of the chromosome.
- Constant in their position and extent, these constrictions are useful in identifying particular chromosomes in a set.
- The chromosome region distal to the secondary constriction i.e., the region between the secondary constriction and the nearest telomere is known as satellite.
- Therefore, chromosomes having secondary constrictions are called satellite chromosomes or sat-chromosomes.
- Nucleolus is always associated with the secondary constriction of sat-chromosomes. Therefore, secondary constrictions are also called nucleolus organiser region (NOR) and sat-chromosomes are often referred to as nucleolus organiser chromosomes.

## (6) Telomere

- Terminal part of a chromosome is known as a telomere.
- Telomeres are polar, which prevents the fusion of chromosomal segments
- If a chromosome breaks, the broken ends can fuse with each other due to lack of telomere.

**(7) Satellite.**

- It is an elongated segment that is sometimes present on a chromosome at the secondary constriction.
- The chromosomes with satellite are known as **sat-chromosome**