3. Chromosomal Basis of Inheritance

Learning Objectives

The Learner will be able to

- ❖ Understand chromosomal theory of inheritance.
- ❖ Analyze the three- point test crosses and appreciate results in linkage map construction.
- ❖ Describe the sex determination in plants.
- ❖ Observe and calculate recombination frequency.
- ❖ Differentiate mutation types with examples.

Important Notes and Points

- ❖ In eukaryotic cells, worm-shaped structures formed during cell division are called **chromosomes** (colored bodies, visualized by staining).
- ❖ The linked genes connected together on sex chromosome is called **sex linkage.**

- **Fossil Genes:** Some of thejunk DNA is made up of pseudogenes, the sequences presence in that was once working genes. They lost their ability to make proteins. They tell the story of evolution through fossilized parts.
- The two dominant alleles or recessive alleles occur in the same homologous chromosomes, tend to inherit together into same gamete are called **coupling or *cis* configuration.**
- If dominant or recessive alleles are present on two different, but homologous chromosomes they inherit apart into different gamete are called **repulsion or *trans* configuration.**
- Homologous chromosomes are aligned side by side resulting in a pair of homologous chromosomes called **bivalents**. This pairing phenomenon is called **synapsis or syndesis.**
- Each homologous chromosome of a bivalent begin to form two identical sister chromatids, which remain held together by a centromere. At this stage each bivalent has four chromatids. This stage is called **tetrad stage.**

- After tetrad formation, crossing over occurs in pachytene stage. The non-sister chromatids of homologous pair make a contact at one or more points.
- Crossing over is a precise process that includes stages like synapsis, tetrad formation, cross over and terminalization.
- Genes are present in a linear order along the chromosome. They are present in a specific location called **locus.**
- The diagrammatic representation of position of genes and related distances between the adjacent genes is called **genetic mapping**.
- The unit of distance in a genetic map is called a **map unit** (m.u).
- When any of the three or more allelic forms of a gene occupy the same locus in a given pair of homologous chromosomes, they are said to be called **multiple alleles**.
- Horsetail plant (***Equisetum***) grown under good conditions develop as female and those grown under stress condition develop into males.
- The factors which cause genetic mutation are called **mutagenic agents or mutagens**.

- Addition of one or more chromosomes to diploid sets are called **hyperploidy**.
- **Colchicine** , an alkaloid is extracted from root and corms of ***Colchicum autumnale***, when applied in low concentration to the growing tips of the plants it will induce polyploidy. Surprisingly it does not affect the source plant *Colchicum,* due to presence of anticolchicine.