Chromosomes

- Hofmeister identified (1848) deeply stained dark red structures in a dividing nucleus of pollen mother cells of Tradescantia.
- Waldeyer (1888) named them as chromosomes because of their affinity for basic dyes
- They control or regulate the activities of the cells
- Chiefly involved in the transfer of genetic material from one generation to other hence refered as physical basis of heredity.
- Stton & Boveri (19920 proposed Chromosomal theory which states chromosomes are vehicles of heredity
- Structure shape and number of chromosomes different in different species
- But in species they maintain constancy, specificity and stability
- Plant chromosomes are bigger than animal chromosomes
- Longest chromosomes observed in Trillium during metaphase 30 microns
- Thick and rod shaped during metaphase but acquire V, L, I, J shapers during anaphase
- Based on the number they are Haploid (one set) Diploid (two sets)
- A haploid set of chromosome called Genome. So one genome present in gametophyte and two genomes present in somatic cells of sporopyte
- The diploid component of an organism which depicts their size, shape, structure and number is called Karyotype
- The diagrammatic representation of karyotype is called Idiogram
- Most ideal stage for studying chromosomes is metaphase or anaphase
- Both the chromatids can be studied in metaphase where as shapes can be studied in anaphase
- The region of the chromosome where two chromatids are held together at a point along the length is called primary constriction or centromere
- The position of the centromere is constant for a particular chromosome
- Two disc like structures made of proteins present on either side of the centromere called Kinetochore
- Kinetochore are the sites of implantation of the microtubules of spindil fibres
- Constriction developed other than primary is called secondary constriction
- Secondary constriction donot bend during anaphase and so easily distinguished from primary constrictions
- Some secondary constriction help in formation of nucleoli called Nucleolar organizers
- Round nob like portion separated by secondary constriction is called satellite
- The repulsive ends of the chromosomes present at the tip of each arm are called Telomeres
- They exhibit polarity and prevent the adhesion of chromosomes with one another
- Polar ends are found only Eukaryotes but absent in Prokaryotes
- Brocken ends of chromosomes can be fused due to lack of telomeres
- Lack of polarity helps the prokaryotes to develop circular chromosomes

Chromosomes are of following types

a) Acentric: In which centromere is absent

b) Monocentric: One centromere per chromosome (most common)
c) Dicentric: Two centromere per chromosome
d) Polycentric: Many centromeres more than two centeromeres per chromosome

Based on the position of the centromere Monocentric type again divided in to

i. Metacentric: centromere in the middle point and in anaphase they form V shape
ii. Sub-metacentric: centromere slightly aeay from the center and in anaphase forms L shape
iii. Acrocentric: centromere towards one side and forms J shape during anaphase
iv. Telocentric: centromere at the end of the arm and forms I shape during anaphase

Nucleosome Model:

- DNA and basic histone proteins form chromatin.
- Chromatin have a string of repeating bead like structures called Nucleosomes.
- This model was proposed by R. D. Kornberg and J. O. Thomas (1974)
- The term nucleosome was coined by Oudet
- Each nucleosome consist core of 8 histones called octmer (two copies of H2A, H2B, H3 and H4).
- H2A, H2B slightly Lysine rich H3 and H4 Arginine rich
- The DNA that joins two nucleosomes is called Linker DNA or Spacer DNA or Inter Nucleosomal DNA
- H1 seals the two full turns of DNA by binding at the point where the DNA enters and leaves
- Functions
- Chromosomes control most of the biological and genetic activities at molecular and physiological level
- Capable of self replication and so important in heredity, mutation, variations and evolutionary development of the species