DEPARTMENT OF ZOOLOGY

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B.Sc. Zoology Part III

CHROMOSOMAL ABERRATIONS

- Any change in the number or structure of chromosome from its normal number or structure is known as chromosomal aberration.
- These are possible due to certain accidents or irregularities at the time of cell division.
- These changes are brought about by following two processes:-

A. CHANGE IN THE STRUCTURE OF CHROMOSOMES

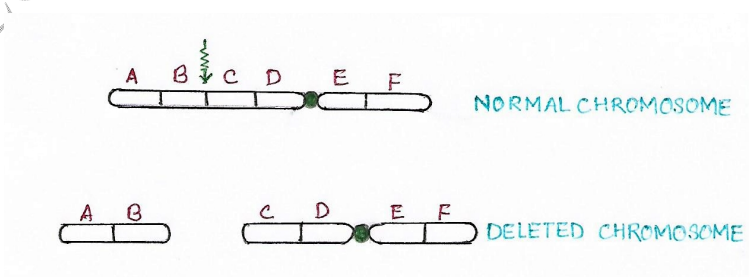
- This type of chromosomal aberrations are of following types:-

(a) Deletion:-

- It contributes a loss of segment which may be:-

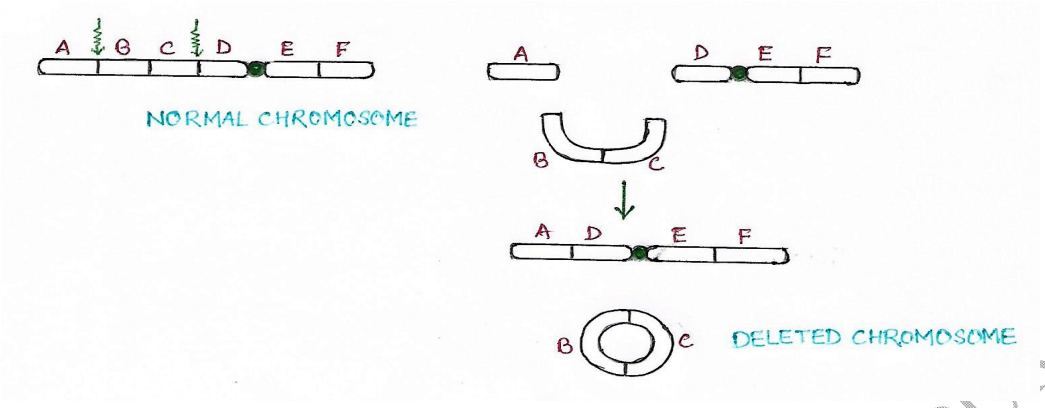
(i) Terminal deletion:-

- A small acentric piece separates from the end of the chromosome by a single break including loss of a normal telomere and transformation of bipolar chromosome into a unipolar structure.



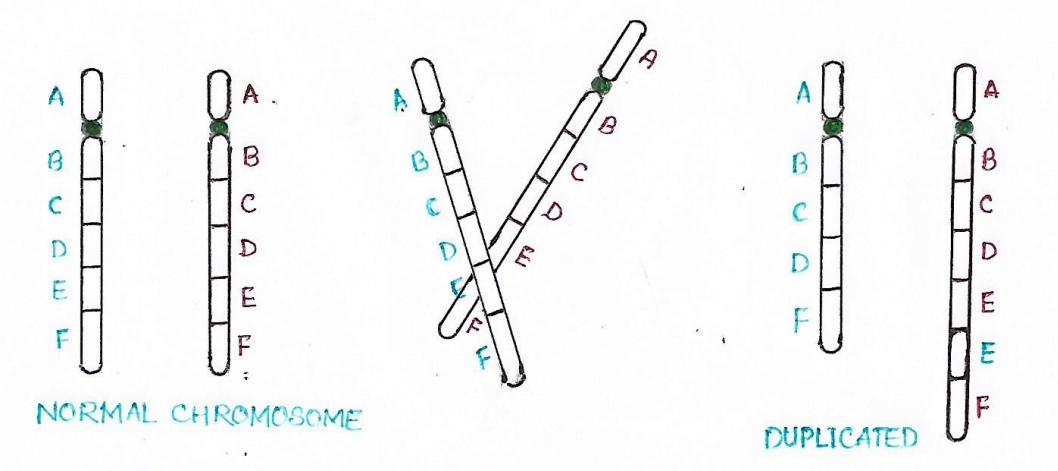
(ii) Intercalary deletion:-

- The chromosomal portion is lost from within the chromosome.
- It arises by two breaks in the acentric part of the chromosome.
- The broken ends may unite into a ring shaped structure.



(b) Duplication:-

- When an intercalary part of chromosomes breaks and it transferred to its homologous chromosome there is a deletion in the first chromosome and duplication of other chromosome.

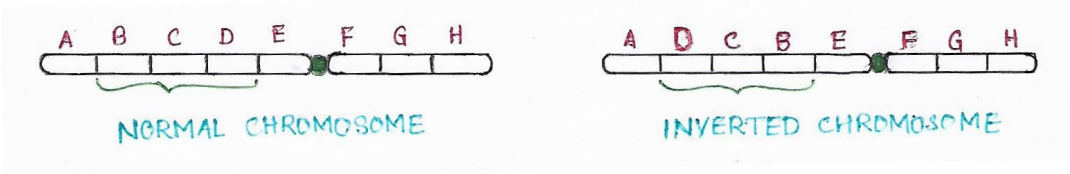


(c) Inversion:-

- When a segment of chromosome from intercalary region press and becomes reattach to the same position but the gene sequence is altered it is known as inversion.
- There are of two types of inversion:-

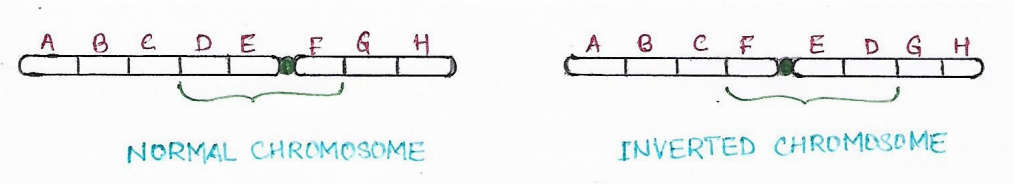
(i) Paracentric inversion:-

- In which the inverted region of chromosome belongs to only one arm known as paracentric inversion.

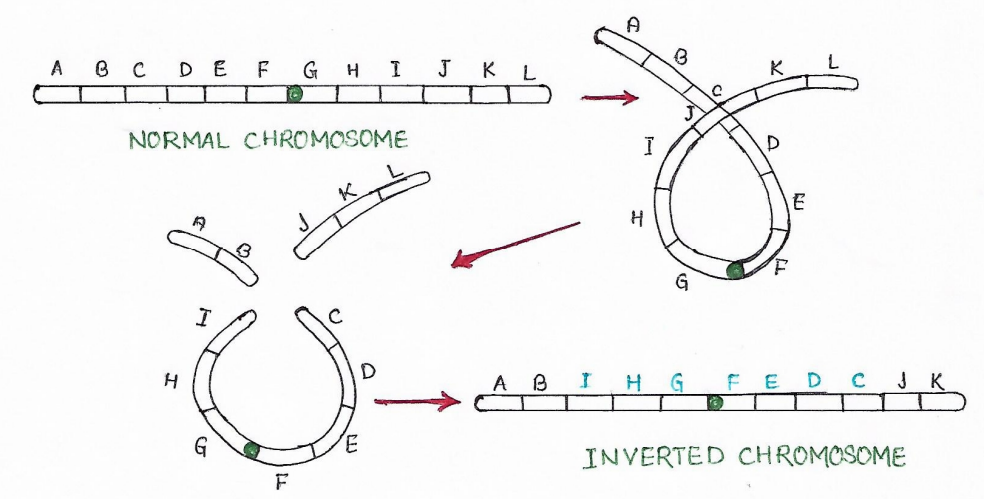


(ii) Pericentric inversion:-

- In which the inverted region of chromosome belongs to both arms including the centromere known as pericentric inversion.

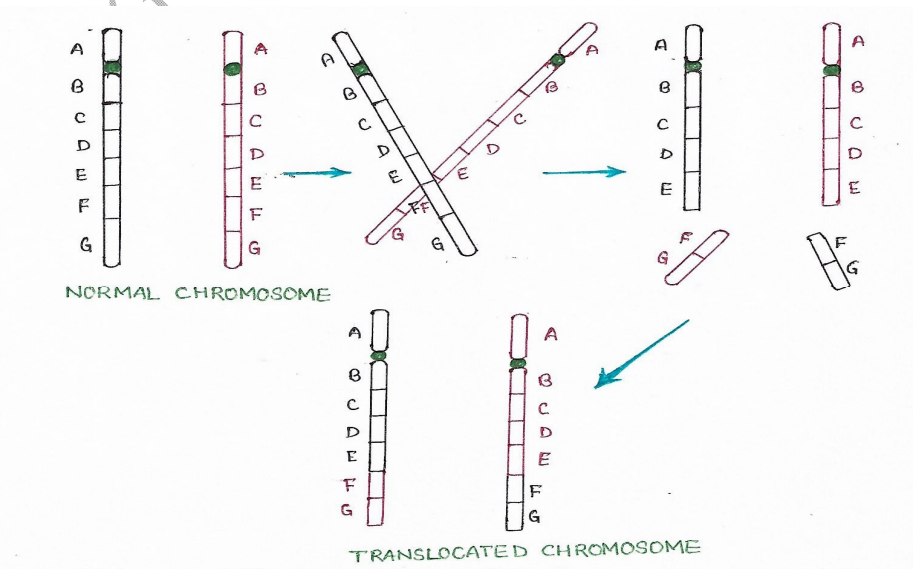


- In most of the cases the inversion occurs usually when a loop is formed and it breaks by factors like ionizing radiation.



(d) Translocation:-

- When parts of chromosome breaks and becomes attach to a non-homologous chromosome it is known as translocation.



B. CHANGE IN NUMBER OF CHROMOSOME

- Every species has one haploid set (n) of chromosomes in gametes and diploid set (2n) in somatic cells.
- Change in number of chromosomes is known as **ploidy**.
- It is of two types:-

1. Euploidy:-

- When the complete set of chromosome changed, it is called euploidy.
- It is of three types:-

(a) Haploidy or Monoploidy:-

- When organism has one set of genome (n) in the body cells, it is known as haploidy or monoploidy.
- Example:- Bee.

(b) Diploidy:-

- Organisms with two sets of genome (2n) are known as diploid.

(c) Polyploidy:-

- Organisms with more than two sets of genome in the multiples of 3, 4, 5 etc. are known as polyploidy.
- Polyploidy may be of following types:-

  (i) Triploids (3n)

  (ii) Tetraploids (4n)

  (iii) Pentaploids (5n)

  (iv) Hexaploids (6n)

- There are two types of polyploidy on the basis of their origin:-

I. Autopolyploids:-

- When the chromosome number of same species become duplicated due to fertilization of diploid gametes autopolyploid can develop.
- The diploid gametes are formed due to failure of meiosis one or two or due to disjunction of the whole set of chromosome because of failure of synthesis of spindle fibre due to temperature, X-ray, shocks, some chemicals like colchicine etc.

II. Allopolyploidy:-

- It develops when gametes of 2 related species genus are family are cross together naturally or artificially because the chromosome compliment of these two types of gametes differ from each other so in zygote there will be no homologous pairing.
- Such type of zygote produce in the laboratories for crop improvement.
- Example:- In classical experiment the *Raffanus sativus* and *Brassica olaracia* were cross together and a hybrid called *Raffalo brassica* was prepared.

Raffanus sativus X *Brassica olarcia*

(24 R) (24 B)

↓

(12R + 12B)

Zygote

↓ Cultured and treated With colchicine (0.02)

12 R 12 B

12 R 12 B

Raffalo brassica

2. Aneuploidy:-

- When the number of only a few chromosomes changes and other chromosomes behave normal are called aneuploidy.
- These occurs following 3 types:-

(i) Monosomics:-

- The loss of one chromosome from diploid set (2n-1) is known as monosomics.

(ii) Polysomics:-

- The addition of one or more chromosomes to a diploid set i.e., (2n+1), (2n+2) etc. are known as polysomics.

(iii) Nullisomics:-

- The loss of one pair of homologous chromosomes from a diploid set i.e., (2n-2) is known as nullisomics.

SIGNIFICANCE OF CHROMOSOMAL ABERRATION

- It results in the formation of new species.
- It may cause sterility due to unbranched distribution of chromosomes during gamete formation.
- It helps to study and understand doses effect.