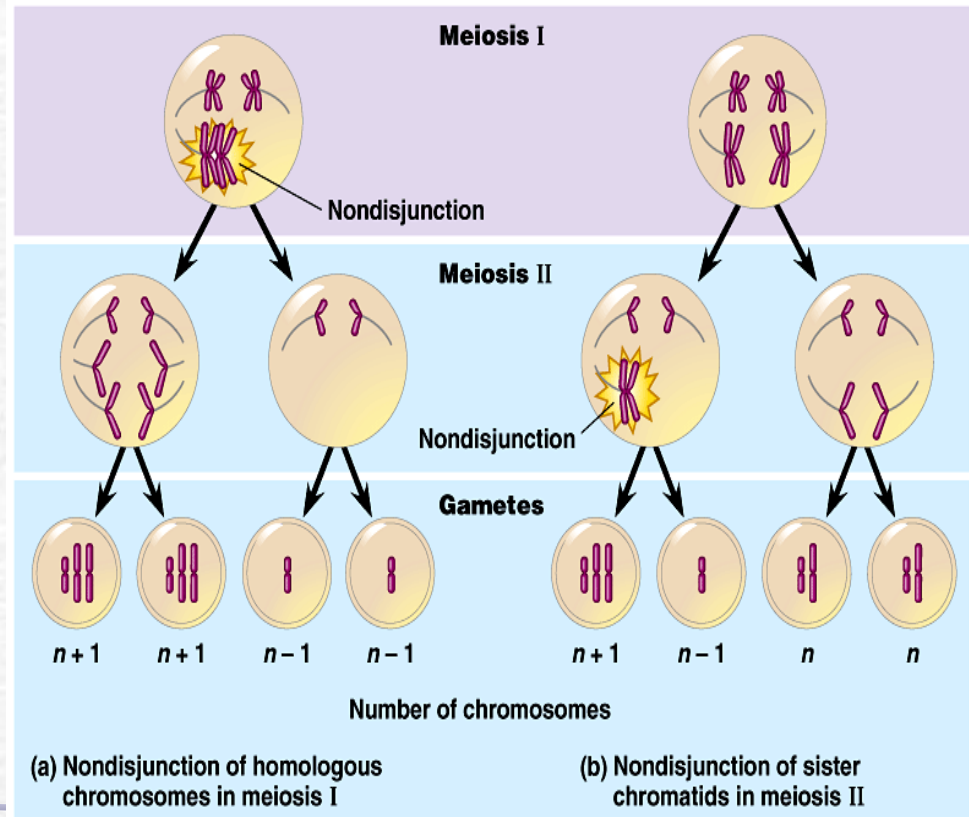


**Aim: What are some errors
with chromosomal
inheritance?**

Alterations of chromosome number or structure cause some genetic disorders

Nondisjunction

occurs when tetrad chromosomes do not separate properly during meiosis I or when sister chromatids fail to separate during meiosis II



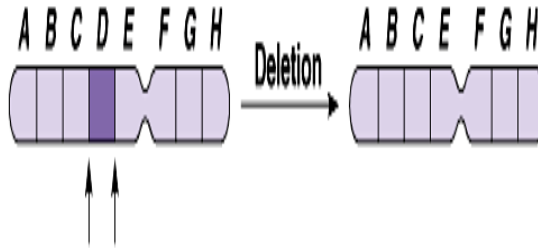
- As a consequence of nondisjunction, some gametes receive two of the same type of chromosome and another gamete receives no copy.
- Offspring results from fertilization of a normal gamete with one after nondisjunction will have an abnormal chromosome number or **aneuploidy**.
 - **Trisomic** cells have three copies of a particular chromosome type and have $2n + 1$ total chromosomes.
 - **Monosomic** cells have only one copy of a particular chromosome type and have $2n - 1$ chromosomes

Polyploidy

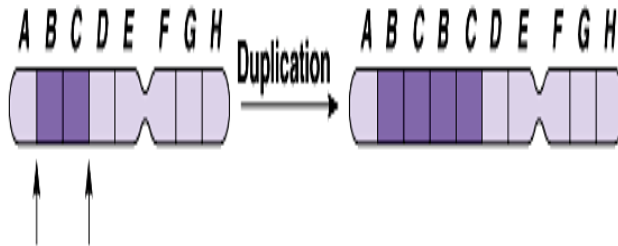
- Organisms with more than two complete sets of chromosomes, have undergone **polyploidy**.
- Triploid – three complete sets of chromosomes
- Tetraploid – four complete sets of chromosomes
- Polyploidy is relatively common among plants and much less common among animals.
 - The spontaneous origin of polyploid individuals plays an important role in the evolution of plants.

Chromosome fragmentation

(a) A **deletion** removes a chromosomal segment.



(b) A **duplication** repeats a segment.



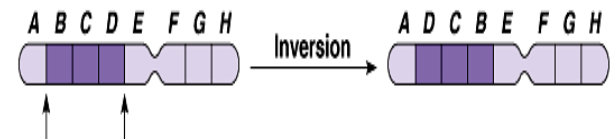
Chromosome breakage:

- 1) A **deletion** occurs when a chromosome fragment lacking a centromere is lost during cell division.
- 2) A **duplication** occurs when a fragment becomes attached as an extra segment to a sister chromatid

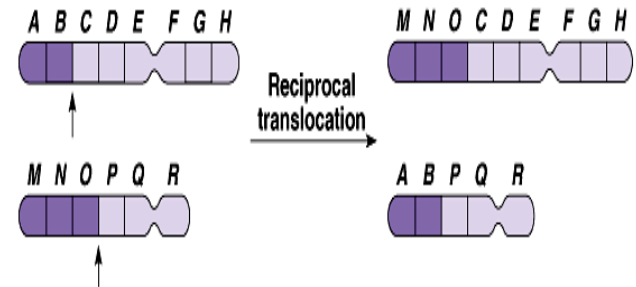
Chromosome fragmentation

- An **inversion** occurs when a chromosomal fragment reattaches to the original chromosome but in the reverse orientation.
- In **translocation**, a chromosomal fragment joins a nonhomologous chromosome.

(c) An **inversion** reverses a segment within a chromosome.



(d) A **translocation** moves a segment from one chromosome to another, non-homologous one.



Aneuploid conditions

- 1) **Down syndrome**, is due to three copies of chromosome 21.
- 2) *Klinefelter's syndrome*, an XXY male, occurs once in every 2000 live births.
 - These individuals have male sex organs, but are sterile.
 - There may be feminine characteristics, but their intelligence is normal.

Aneuploid conditions

- 3) Males with an extra Y chromosome (XYY) tend to be somewhat taller than average
- 4) Trisomy X (XXX), which occurs once in every 2000 live births, produces healthy females.
- Monosomy X or *Turner's syndrome* (X0), which occurs once in every 5000 births, produces phenotypic, but immature females.

Chromosomal translocations

- Chromosomal translocations have been implicated in certain cancers, including *chronic myelogenous leukemia (CML)*.
 - CML occurs when a fragment of chromosome 22 switches places with a small fragment from the tip of chromosome 9.