

## 2. Duplication

**2.1 Definition**—The presence of same block of genes more than once in a haploid complement is known as duplication and the additional block of genes is called a repeat. The deleted portion from one chromosome might get attached to the other chromosome of the pair or may exist as an acentric fragment of the chromosome in the nucleus, thereby adding to the normal chromosome complement.

**2.2 Types of Duplication**—Three types of duplications have been recognised on the basis of attachment of chromosome segment.

(i) **Tandem duplication**—In tandem duplication the added segment has the same genetic sequence as is present in the original state in the chromosome. Moreover, the added segment lies in close association with the original segment. For example, if duplication piece (repeat) is ABC, a tandem duplication will be ABCABCDEF.

(ii) **Reverse tandem duplication**—In such a duplication the sequence of genes aligned in the attached chromosome piece is just the reverse of the original alignment. For example, if duplicated piece (repeat) is ABC, the reverse tandem will be ABC**CCBA**DEF.

(1) A B C A B C D E F

—TANDEM DUPLICATION

(2) A B C C B A D E F

—REVERSE TANDEM DUPLICATION

(3) L M N A B C O P Q R

—DISPLACED DUPLICATION

Fig. 30.6. Different kinds of duplications.

(iii) **Displaced duplication**—In displaced duplication the chromosomal segment gets attached to some nonhomologous chromosome, as for example, LMN**ABC**OPQR.

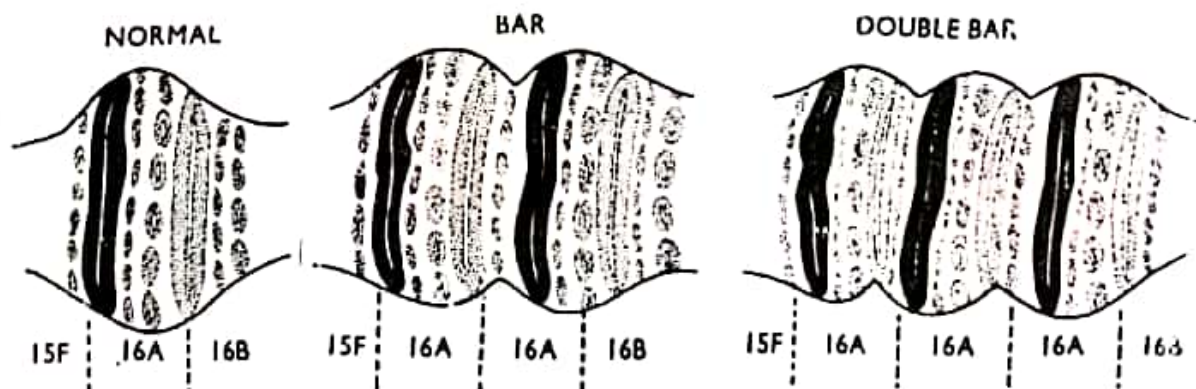


Fig. 30.7. A part of salivary gland chromosome of *Drosophila* showing duplication of 16 A region.

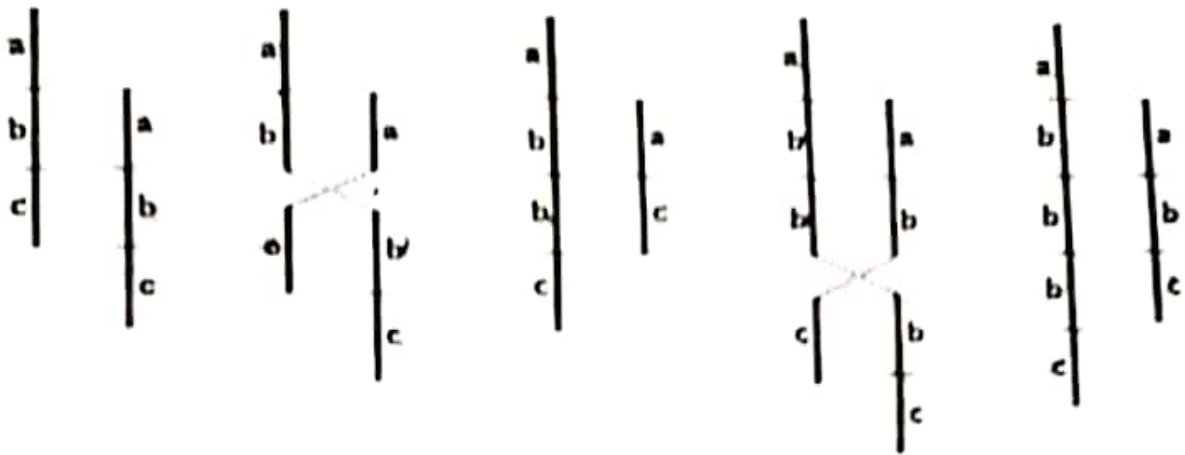


Fig. 30.9. Diagrammatic representation of origin of duplication by unequal crossing over.

**2.6 Significance** – Duplications are more frequent and less deleterious. These do not lower the viability, but do produce abnormality of structure and function.

Duplications play significant role in evolution, because duplication increases number of genes in the chromosome complement. These additional genes might get modified by mutations. Under these circumstances the lethal mutations might get converted either into tolerable or beneficial ones. In addition, the duplications may overcome the effect of deletion, thus reducing their effect to nonlethal.

### 3. Translocation

**3.1 Definition** – Translocation is a kind of chromosomal rearrangement in which a block of genes from one linkage group is transferred to another linkage group.

**3.2 Origin of translocation** – Translocation occurs as a result of interchange of chromosome segments in nonhomologous chromosomes. The phenomenon of translocation can be explained by supposing that the two chromosomes having gene **AB** and **CD** exchange segment and produce chromosomes **AD** and **CB**. Translocation is thus different from crossing over, which involves interchange between homologous parts of homologous chromosomes.

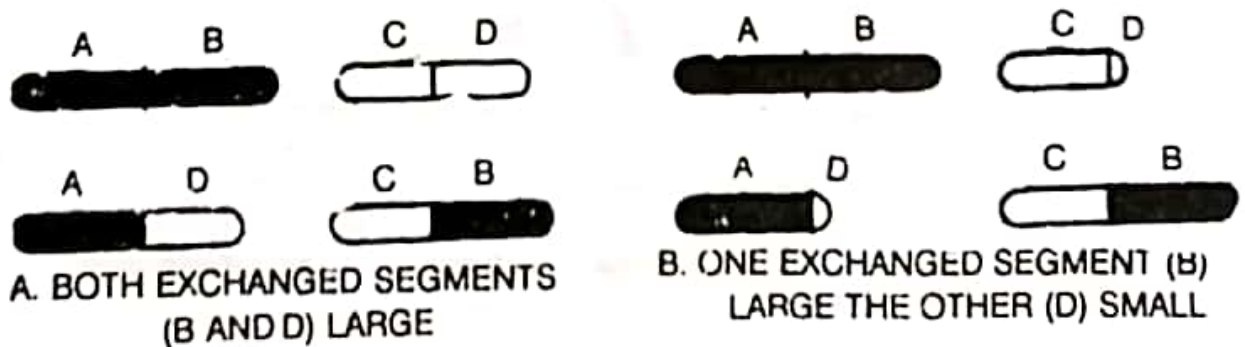


Fig. 30.10. Translocation.



**3.3 Types of translocation** – Depending upon which part or parts of nonhomologous chromosomes become detached and reunited the translocation can be : –

(i) **Simple translocation** – In such cases a small segment of a chromosome is added to the end of other nonhomologous chromosomes. This type of translocation is very rare in nature and is caused by a single break in one chromosome only.

(ii) **Shift translocation** – In shift translocation an interstitial segment of one chromosome is broken off and is inserted within the break in another nonhomologous chromosome. Thus it involves three breaks : two in one chromosome and one in nonhomologous chromosome.

(iii) **Reciprocal translocation** – It is the exchange of parts between nonhomologous chromosomes as for example, exchange of segments between 2nd and 3rd chromosomes of *Drosophila* is reciprocal translocation. These are most frequent and are produced by single break in each of the two nonhomologous chromosomes. Reciprocal translocations are of two types : –

(a) **Homozygous reciprocal** in which both the homologous chromosomes exchange parts with the two homologues of another pair.

