

**Breakage-fusion-bridge Cycle:** Extensive studies on broken chromosome-9 in corn have been made by Barbara Mc Clintock. In the gametophyte (pollen) and endosperm of corn, ends of chromosome that are recently broken tend to be “sticky,” as is shown by their tendency to adhere to one another. She found that following reduplication of a broken chromosome the two sister chromatids may fuse at the point of previous breakage. The fused sister chromatids would be unable to separate readily. In effect, they constitute a single chromatid with two centromeres, a dicentric chromatid. As the centromeres move to opposite poles at anaphase I or anaphase-II, the dicentric chromatid stretches out, forming a chromatin bridge from one pole toward the other. This bridge eventually breaks, but the break does not always occur at the point of previous fusion. The break usually occurs near one of the two poles resulting two daughter cell with one cell having duplication and the other cell has deletion. Therefore, chromosomes may be formed that show structural aberrations such as duplications and deficiencies if compared with an original type.

Thus, if the original chromosome is **C B A**

the type **C B A A**

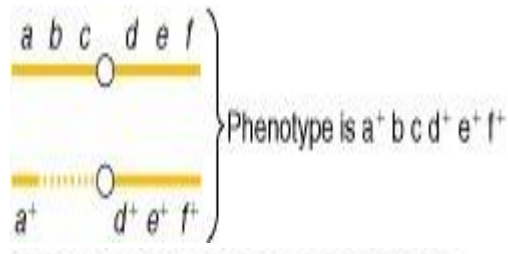
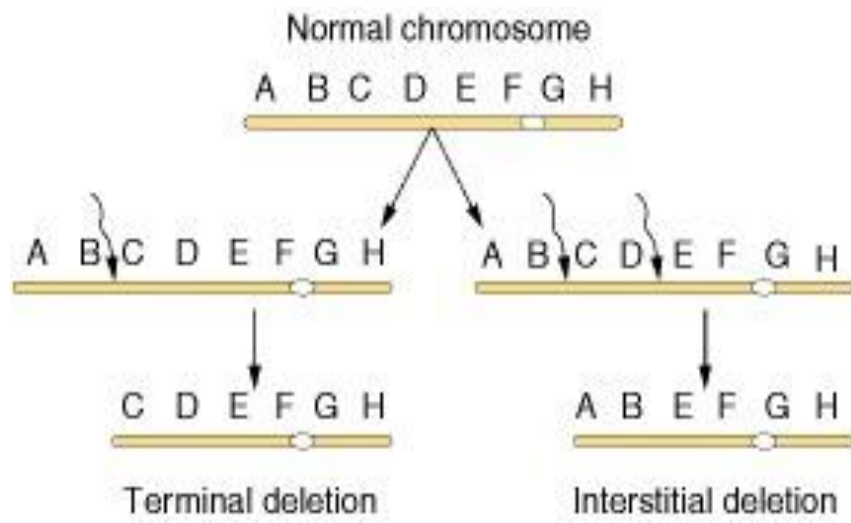
is a duplication type, since region A is represented twice.

The type **C B**

is a deficiency, since region A is absent.

Now two new broken ends of chromosomes are also sticky and these sticky broken ends do not heal in gametophyte or endosperm B. This situation permits repetition of more similar events as described above, in cyclic series. Spontaneous production of chromosome aberrations through breakage-fusion-bridge cycle may occur in this manner for some time. But when a broken chromosome is introduced into the sporophytic generation such cycles cease, as the broken ends heal in the zygote. Breakage-fusion-bridge cycle has phenotypic effects on maize endosperm such as colourless spots in the seed due to deletion of genes.

### **Deletions: Terminal Vs Intercalary Deletions**



**(a) Meiotic chromosomes**



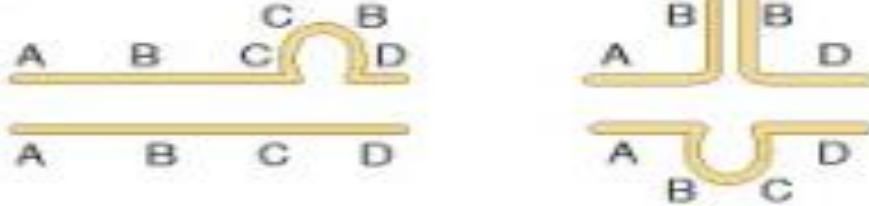
Looped configuration

**Duplications:**

**(a) Tandem**



**(b) Reverse**



Duplicated segments may be (a) in tandem or (b) in reverse order.

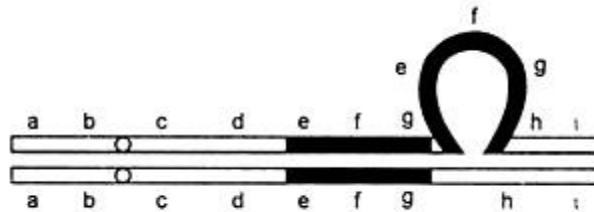
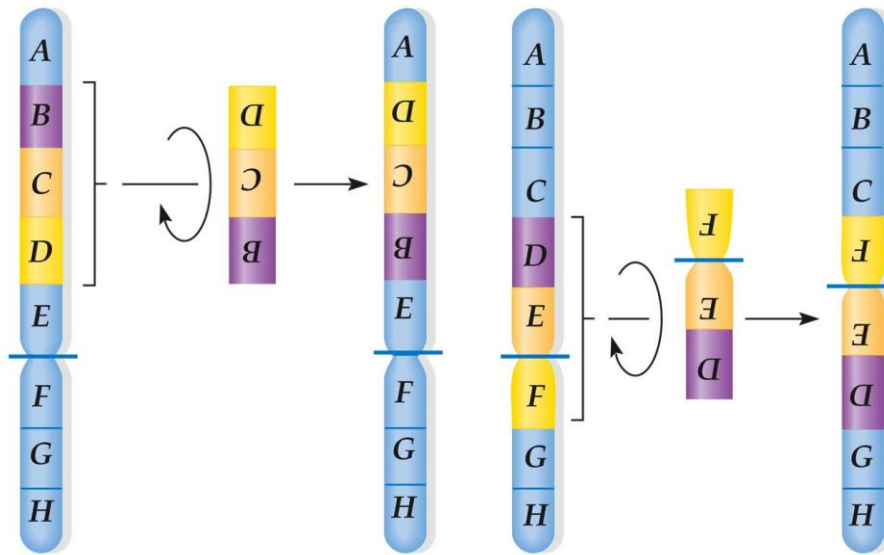


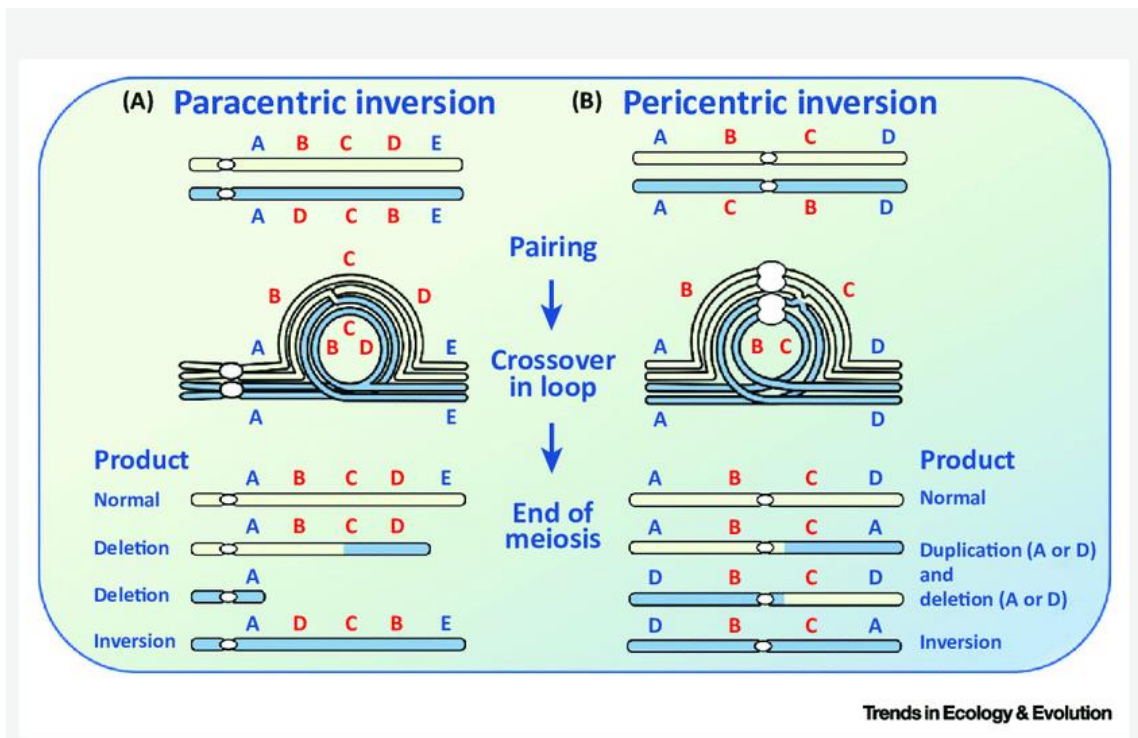
Fig. 13.3. Pachytene configuration in a duplication heterozygote. The duplicated region forms a loop.

a) Paracentric inversion  
(does not include centromere)

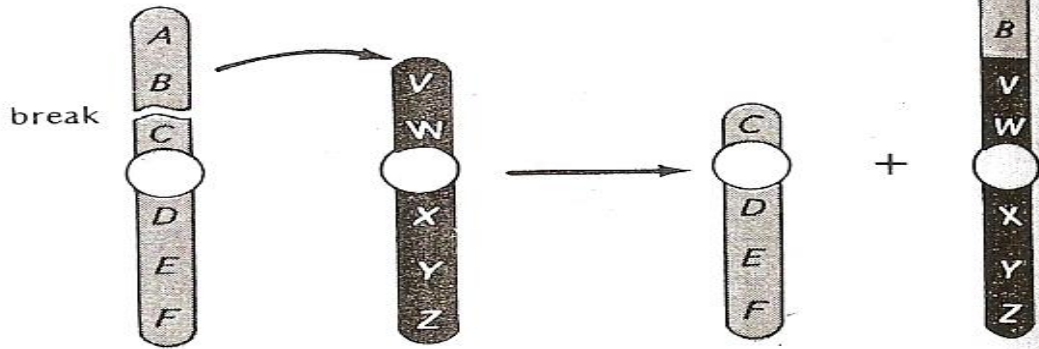
b) Pericentric inversion  
(includes centromere)



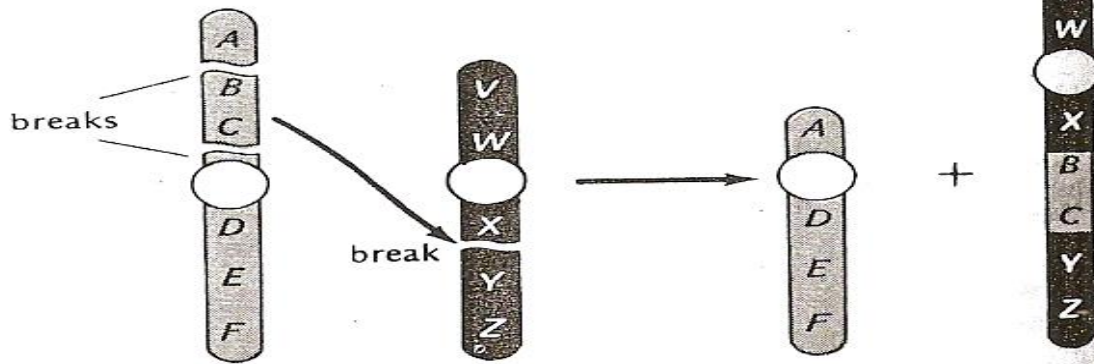
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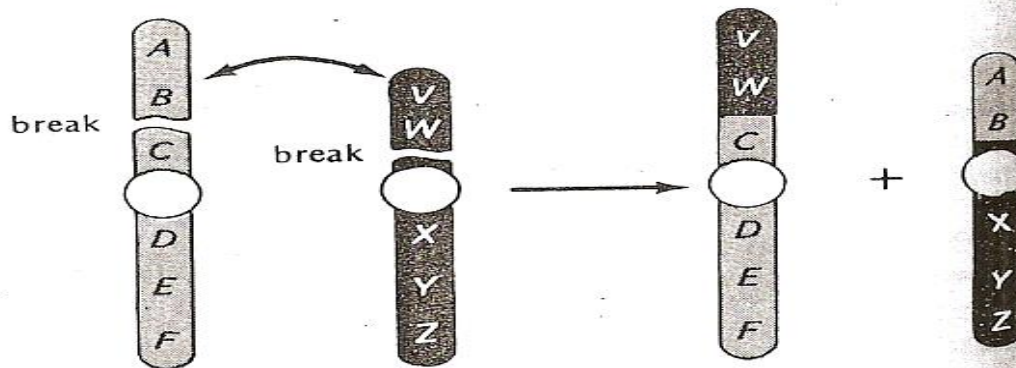
(a) simple translocations



(b) shifts



(c) reciprocal translocations





a translocation heterozygote

