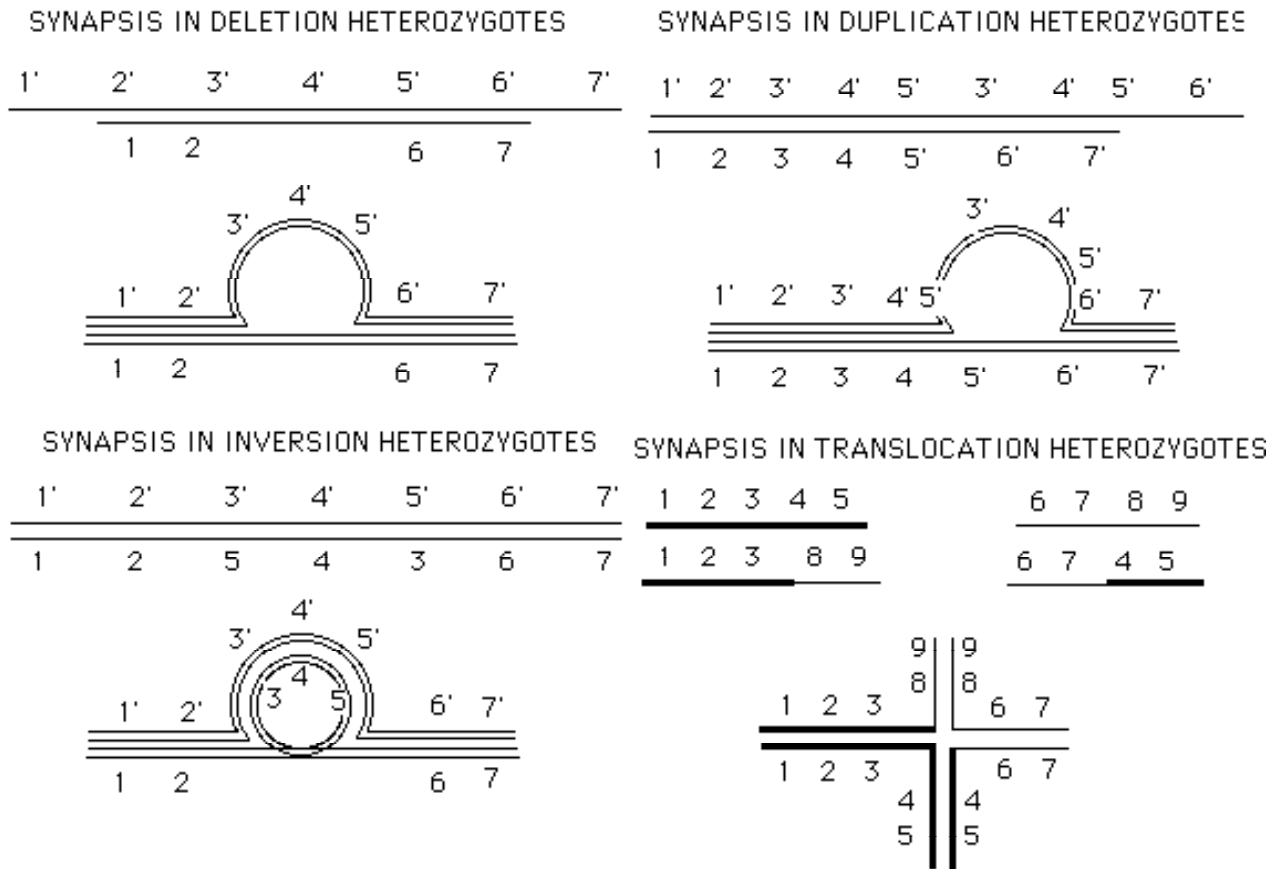


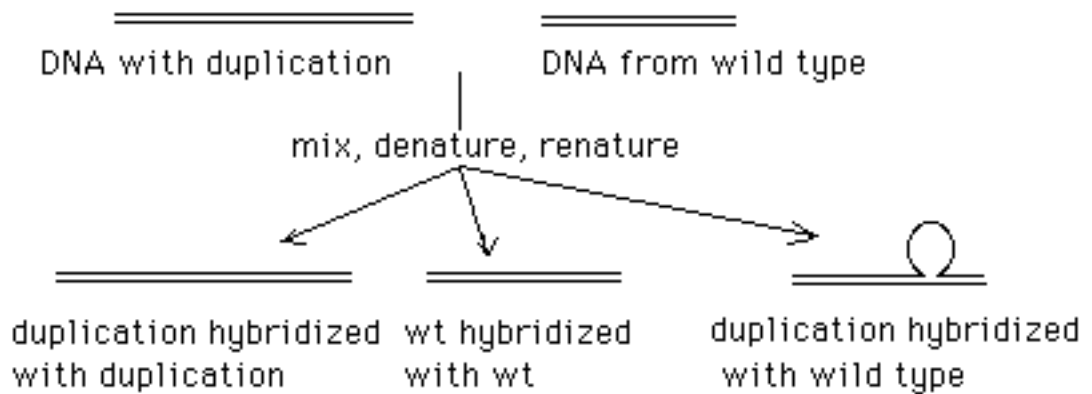
### Practice Problems 4 Answers

- (a) trisomic; (b) tetraploid; (c) monosomic
- (a) inversion (of FED); (b) transposition (of C); (c) deletion or deficiency (of C)
- Remember that the rule is that homologous portions of chromosomes synapse with each other. Each diagram shows first, the relevant chromosomes, and below that, the appearance of the synapsed chromosomes.



(each line represents 2 sister chromatids)

- Each chromosome will have replicated but the sister chromatids will not be segregated into separate cells. The cell and its mitotic descendants will be an allotetraploid: A A B B A' A' B' B'.
- There would be a mixture of ordinary molecules that are double-stranded throughout their entire length and molecules that are partly double-stranded with a single-stranded loop projecting out. The following diagram illustrates the experiment; actually, in the EM one would not see the separate strands.



6. Inserted in a gene, the element would certainly cause major changes in the amino acid sequence of the protein, and very likely shorten it, as does a frameshift mutation. Inserted upstream from a gene, the element might modify the sequences that control the action of the gene. In either case, it would look like a mutation in the gene itself that rendered the gene nonfunctional.

7. All the resulting organisms will be triploid.

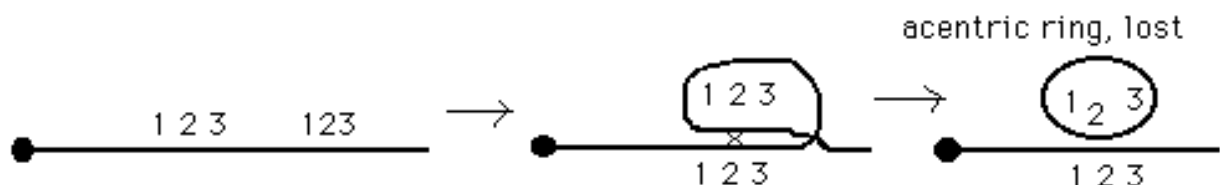
(a) Two sperm, each  $N$ , fertilize an  $N$  egg; if the three nuclei fuse, the resulting nucleus is  $3N$ .

(b) The chromosomes in the germ line cell have replicated but there is no anaphase so the cell is  $4N$ . This cell undergoes mitosis to produce a clone of  $4N$  cells. If one of these undergoes meiosis, the resulting egg will be  $2N$ , and after fertilization the zygote will be  $3N$ .

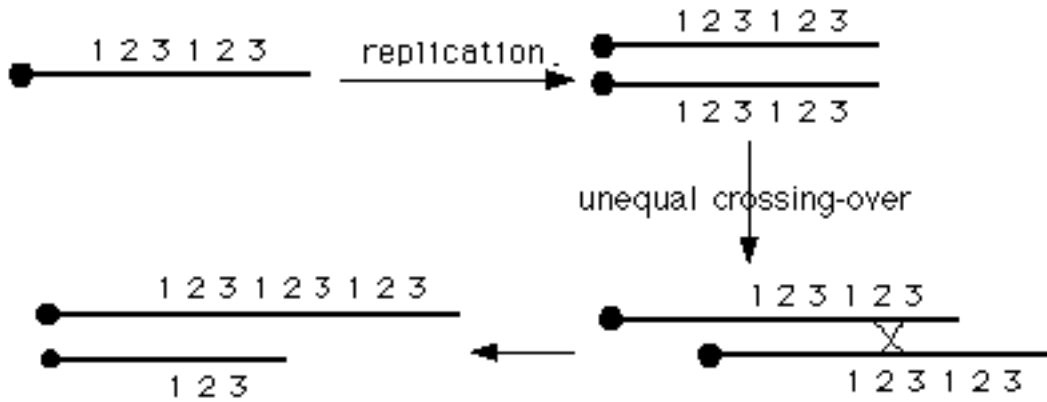
(c) The sperm will be  $2N$  (but it will have two *identical* sets of chromosomes). Fertilization results in a  $3N$  zygote.

(d) The egg nucleus and polar body nucleus are both  $N$ , and fuse to produce a  $2N$  egg, which after fertilization becomes a  $3N$  zygote. Again, the two sets of chromosomes contributed by the egg are identical.

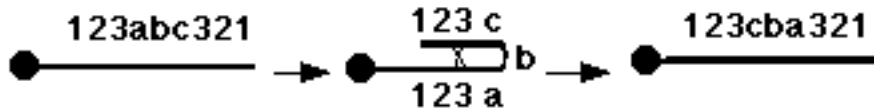
8. (a) A crossover between direct repeats gives a deletion. If the centromere lies between the repeats, unlike the case shown here, the result is a centric ring chromosome and an acentric linear chromosome. The acentric is lost immediately; the acentric ring is lost due to failure to migrate to the pole somewhat more frequently than a normal chromosome, but may be retained for a long time.



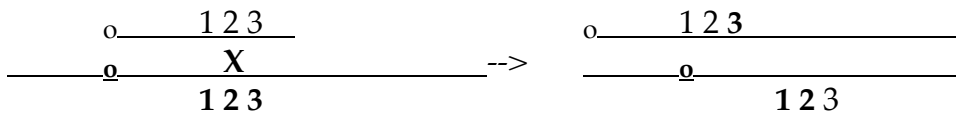
(b) Unequal sister-strand crossing-over results in expansion and contraction of series of tandem repeats:



(c) Intrachromosomal crossing-over between inverted repeats produces an inversion:

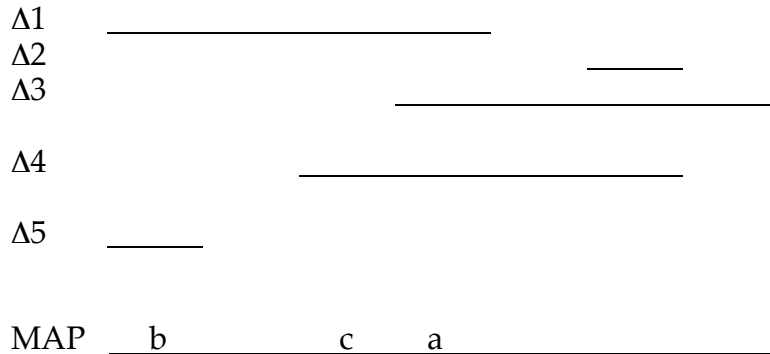


(d) Crossing-over between repeats on different chromosomes can give reciprocal translocations:



9. (a)  $5/6 Su : 1/6 su$ ; because only  $1/6$  of the gametes of the trisomic will be  $su$ , while the remainder will carry at least one  $Su$ .  
 (b)  $1/2 Su : 1/2 su$ .

10. Locus a lies within 1, 3, and 4, i.e. in the only region where they overlap. Locus b lies within the overlap of 1 and 5. Locus c is covered by 1 and 4 but not 3. Hence the locations are:



11. You can write the cross using the knob as a marker, just as you do any kind of genetic marker. Then this becomes a two-factor cross, beginning with

$Pr\ Pr\ 9\ 9 \times pr\ pr\ 9k\ 9k$  and the F1 is  $Pr\ 9/pr\ 9k$ . If the  $pr$  and knob were unlinked, the four genotypes of F1 gametes would be in equal numbers, but they are not: the parental types ( $Pr\ 9$  and  $pr\ 9k$ ) are much more common than the recombinants. Hence the knob and  $pr$  loci are linked, and therefore they must be on the same chromosome.

12. Each entry in the table represents a diploid genotype, e.g.  $ade1\ ade3$ . If  $ade1$  and  $ade3$  are in different genes, they complement each other; if they are in the same gene, they will not because the diploid will have two mutant copies of that gene.

- (a) The complementation groups are 1 and 2, 3 and 5, and 4.
- (b) Since there are three complementation groups, there are three genes.
- (c) Yes; No. If two mutant genes complement each other, the mutations are in different genes and they are not alleles.