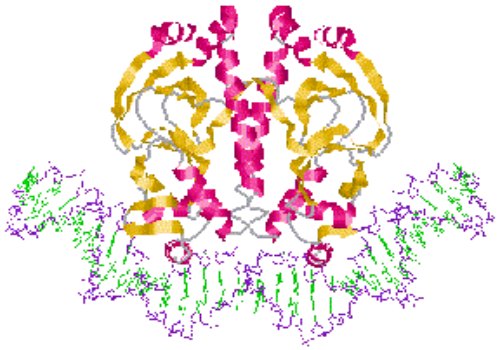
# Chromosome mapping and segregation of genes linked on the same chromosome



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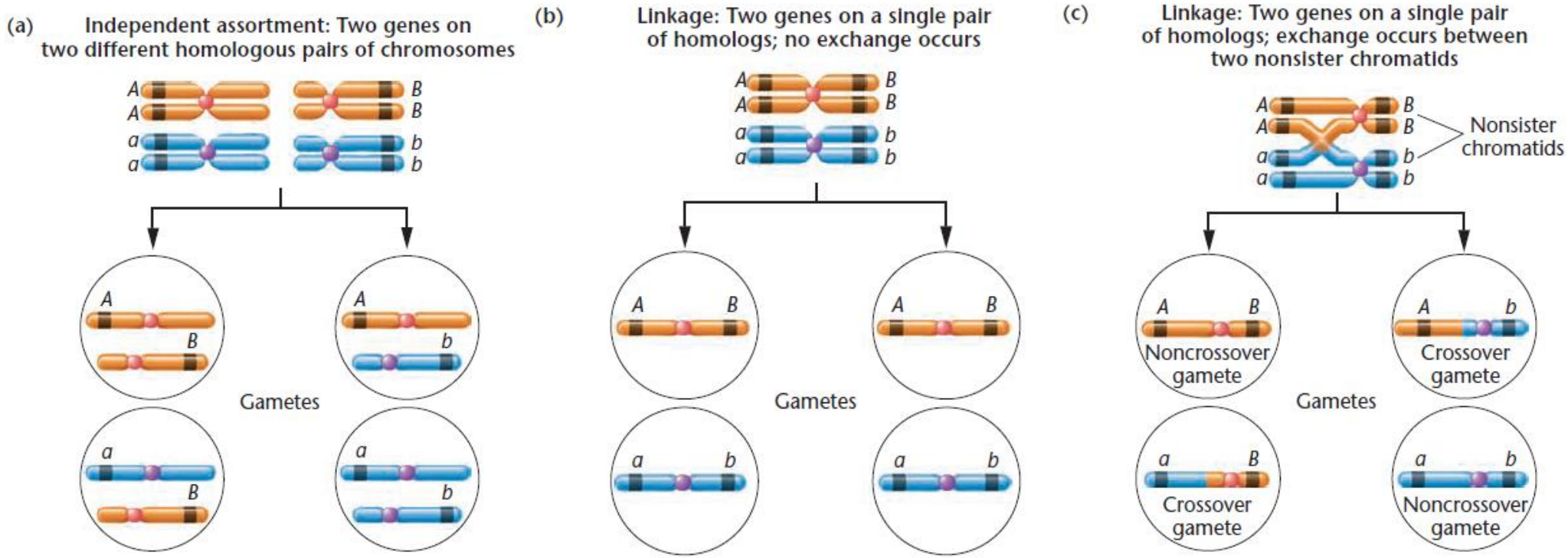
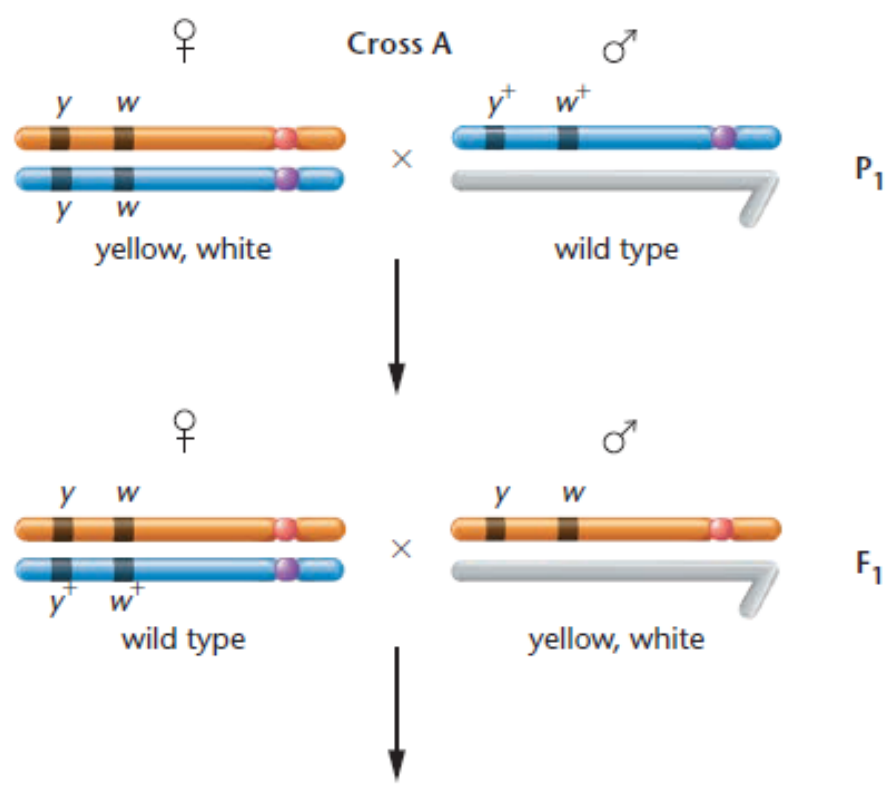
# Outline of course

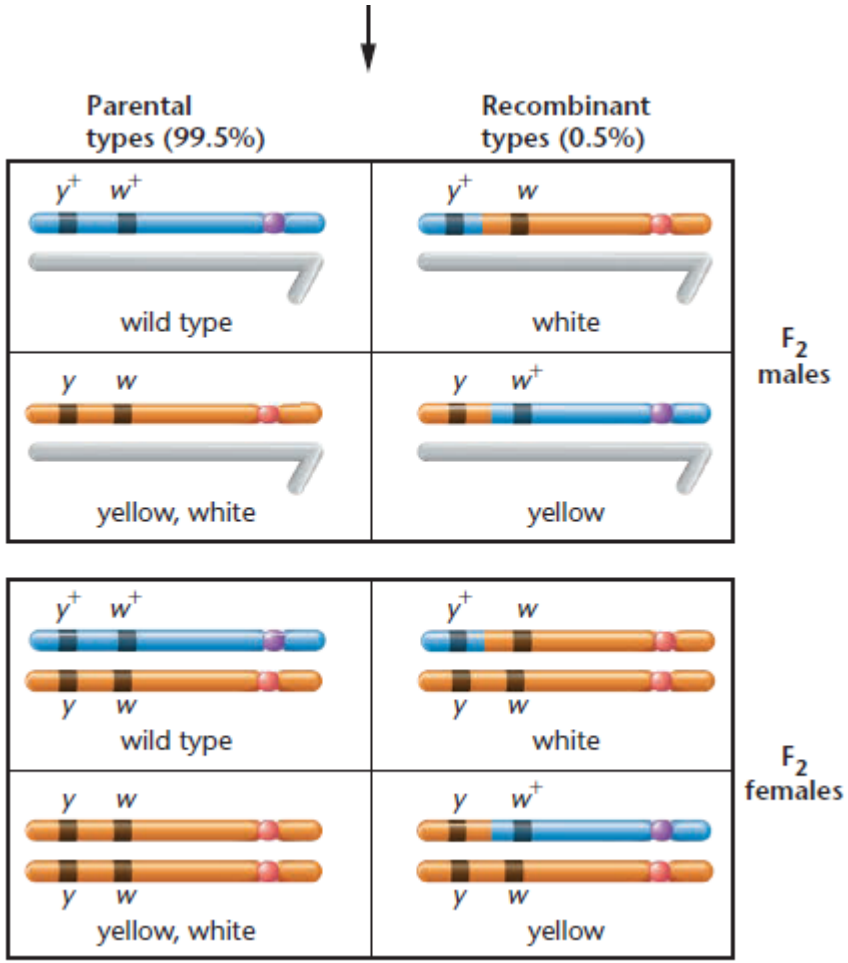
- Chromosomes in eukaryotes contain large numbers of genes, whose locations are fixed along the length of the chromosomes.
- Unless separated by crossing over, alleles on the same chromosome segregate as a unit during gamete formation.
- Crossing over between homologs during meiosis creates recombinant gametes with different combinations of alleles that enhance genetic variation.
- Crossing over between homologs serves as the basis for the construction of chromosome maps. The greater the distance between two genes on a chromosome, the higher the frequency of crossing over is between them.
- While exchanges also occur between sister chromatids during mitosis, no new recombinant chromatids are created.

# Genes Linked on the Same Chromosome Segregate Together



# Crossing Over Serves as the Basis for Determining the Distance between Genes in Chromosome Mapping



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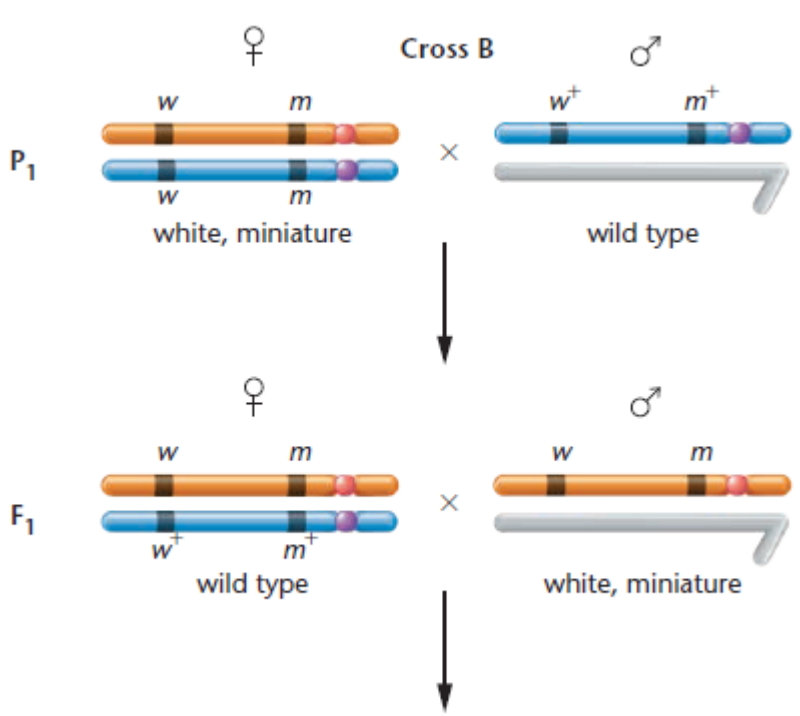


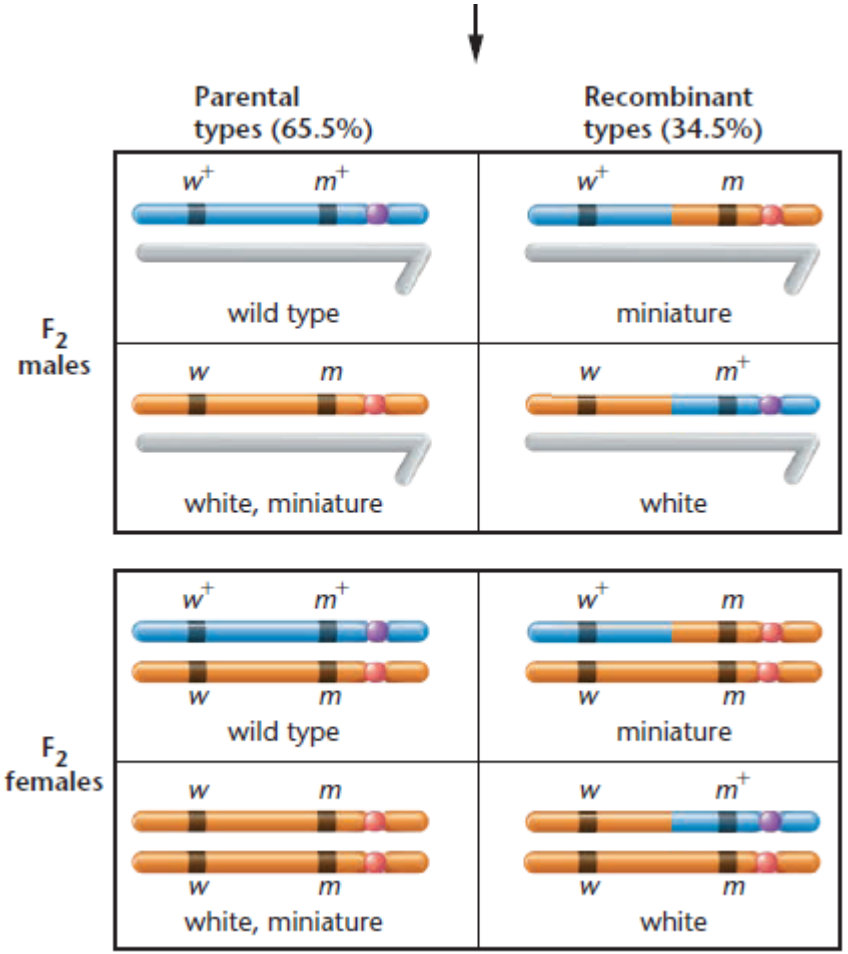

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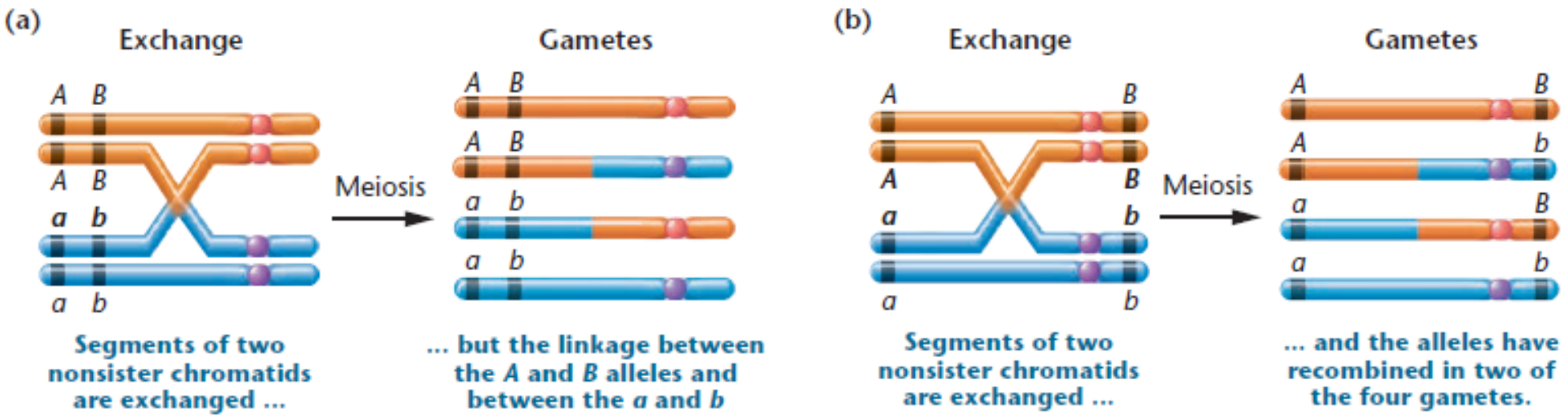



**FIGURE 5.5** Two examples of a single crossover between two nonsister chromatids and the gametes subsequently produced. In (a) the exchange does not alter the linkage arrangement between the alleles of the two genes, only parental gametes are formed, and the exchange goes undetected. In (b) the exchange separates the alleles, resulting in recombinant gametes, which are detectable.

# Crossing Over Serves as the Basis for Determining the Distance between Genes in Chromosome Mapping

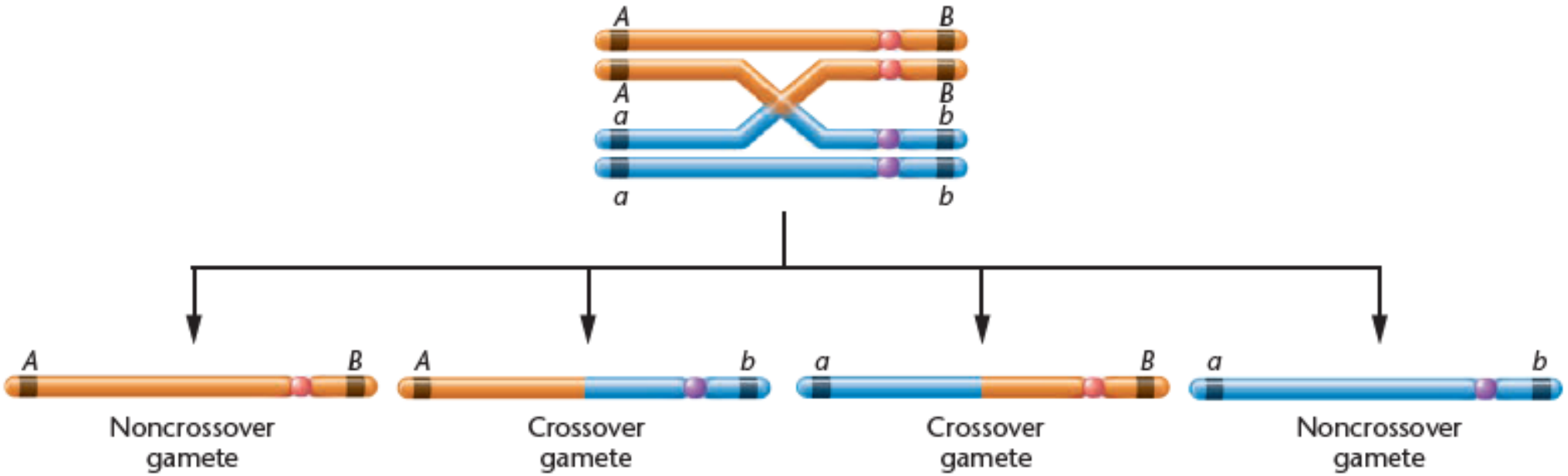



**FIGURE 5.6** The consequences of a single exchange between two nonsister chromatids occurring in the tetrad stage. Two noncrossover (parental) and two crossover (recombinant) gametes are produced.

# Multiple Exchanges

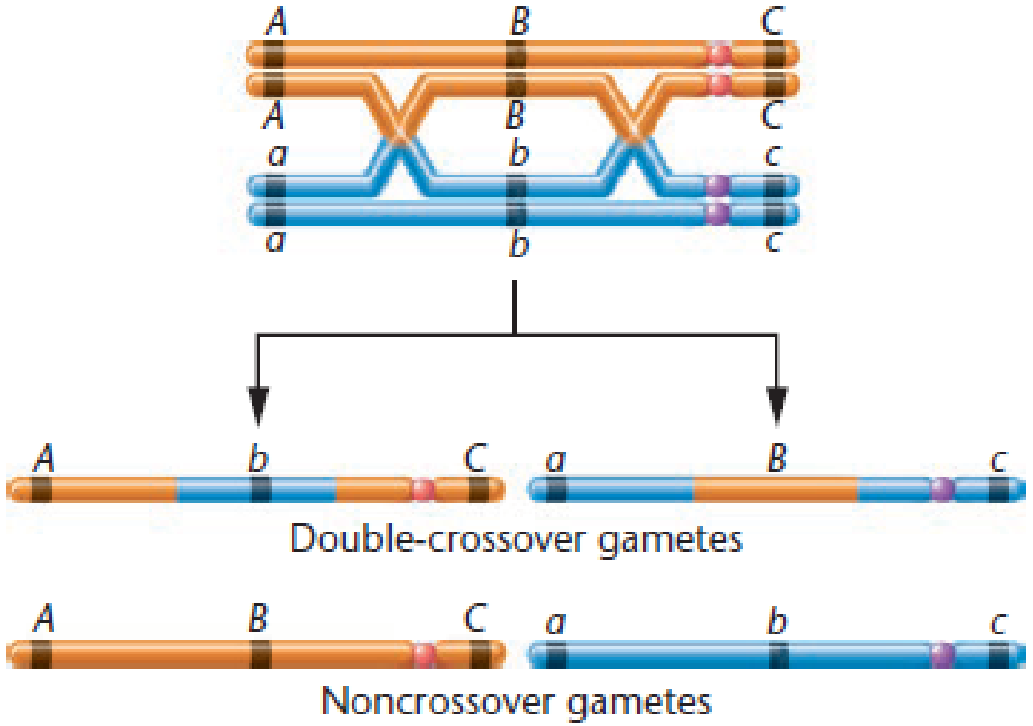
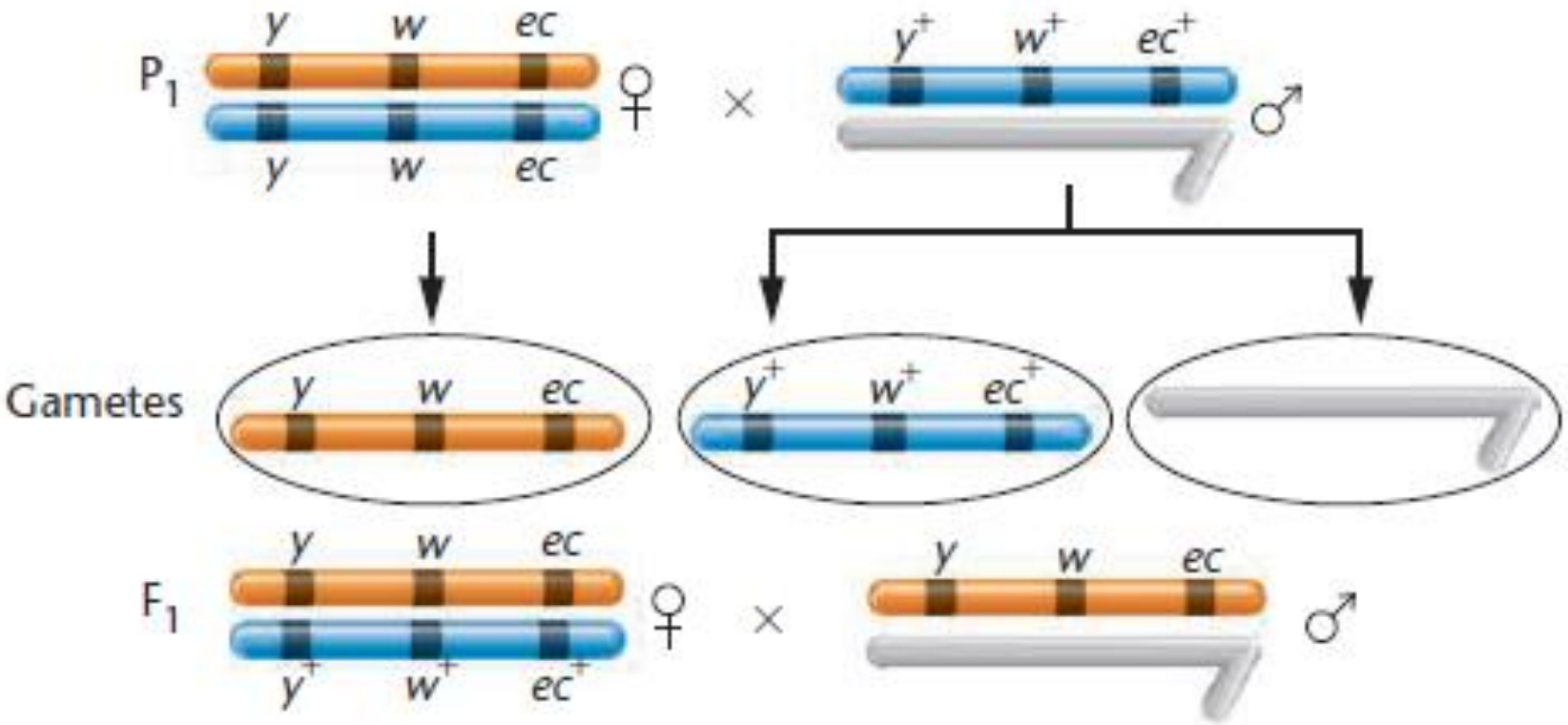



**FIGURE 5.7** Consequences of a double exchange occurring between two nonsister chromatids. Because the exchanges involve only two chromatids, two noncrossover gametes and two double-crossover gametes are produced. The chapter-opening photograph on p. 94 illustrates two chiasmata present in a tetrad isolated during the first meiotic prophase stage.

# Three-Point Mapping in *Drosophila*



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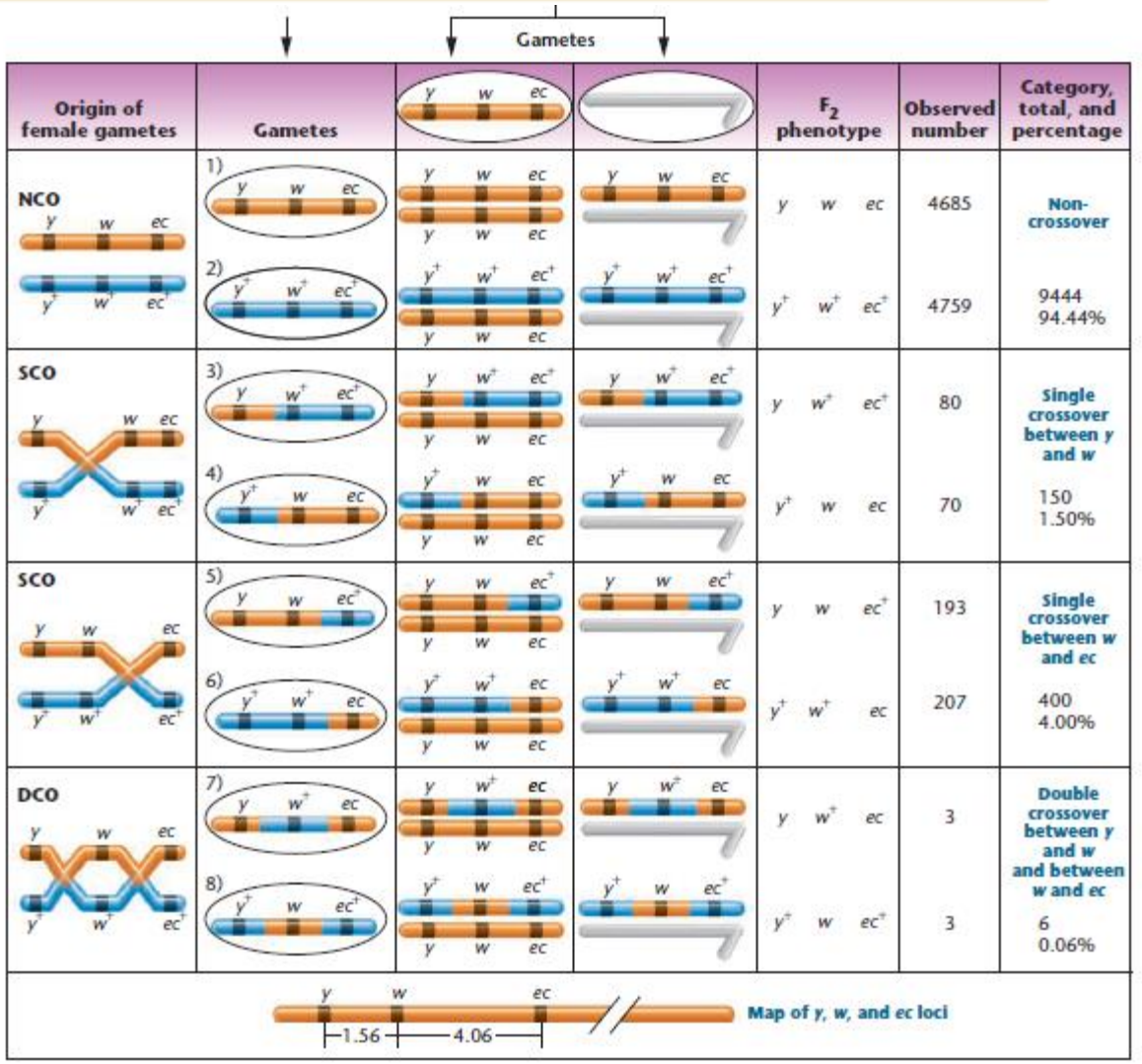


**FIGURE 5.8** A three-point mapping cross involving the *yellow* (*y* or $y^+$), *white* (*w* or $w^+$), and *echinus* (*ec* or $ec^+$) genes in *Drosophila melanogaster*. NCO, SCO, and DCO refer to noncrossover, single-crossover, and double-crossover groups, respectively. Centromeres are not drawn on the chromosomes, and only two nonsister chromatids are initially shown in the left-hand column.