CHAPTER 15
THE CHROMOSOMAL BASIS OF INHERITANCE

Learning objectives:

Relating Mendelian Inheritance to the Behavior of Chromosomes

1. Explain how the observations of cytologists and geneticists provided the basis for the chromosome theory of inheritance.
2. Explain why *Drosophila melanogaster* is a good experimental organism for genetic studies.

Sex Chromosomes

3. Describe how sex is genetically determined in humans and explain the significance of the *SRY* gene.
4. Explain why sex-linked diseases are more common in human males.
5. Describe the inheritance patterns and symptoms of color blindness, Duchenne muscular dystrophy, and hemophilia.
6. Describe the process of X inactivation in female mammals. Explain how this phenomenon produces the tortoiseshell coloration in cats.

Linked Genes

7. Distinguish between linked genes and sex-linked genes.
8. Describe the independent assortment of chromosomes during Meiosis I. Explain how independent assortment of chromosomes produces genetic recombination of unlinked genes.
9. Distinguish between parental and recombinant phenotypes.
10. Explain why linked genes do not assort independently. Explain how crossing over can unlink genes.
11. Explain how Sturtevant created linkage maps. Define a map unit.
12. Explain why Mendel did not find linkage between seed color and flower color, despite the fact that these genes are on the same chromosome.
13. Explain how genetic maps are constructed for genes located far apart on a chromosome.
14. Explain the effect of multiple crossovers between loci.
15. Explain what additional information cytogenetic maps provide.

Errors and Exceptions in Chromosomal Inheritance

16. Explain how nondisjunction can lead to aneuploidy.
17. Define trisomy, triploidy, and polyploidy. Explain how these major chromosomal changes occur and describe possible consequences.
18. Distinguish among deletions, duplications, inversions, and translocations.
19. Describe the type of chromosomal alterations responsible for the following human disorders: Down syndrome, Klinefelter syndrome, extra Y, trisomy X syndrome, Turner syndrome, *cri du chat* syndrome, and chronic myelogenous leukemia.
20. Define genomic imprinting. Describe the evidence that suggests that the *Igf2* gene is maternally imprinted.
21. Explain why extranuclear genes are not inherited in a Mendelian fashion.