Chapter 9

Review the Concepts

Exercise 1: 1. S 2. G 3. C 4. Q 5. X 6. K 7. W 8. L 9. A 10. T 11. H 12. U 13. D 14. E 15. V 16. B 17. Y 18. M 19. N 20. F 21. I 22. Z 23. J 24. R 25. P 26. O

Exercise 2: 1. a. green, yellow b. *GG*, *gg* c. all *Gg* 2. a. 1 *GG*:2 *Gg*:1 *gg* b. 3 green:1 yellow 3. a. both *Bb* b. white *bb*

Exercise 3: 1. *BBSS* 2. *bbss* 3. *BS* 4. *bs* 5. *BbSs* 6. *BS* 7. *Bs* 8. *bS* 9. *bs* 10. *BS* 11. *Bs* 12. *bS* 13. *bs* 14. *BBSS* 15. *BBSs* 16. *BBSs* 17. *BbSS* 18. *BBss* 19. *BbSS* 20. *BbSs* 21. *BbSs* 22. *BbSs* 23. *BbSs* 24. *Bbss* 25. *bbSS* 26. *Bbss* 27. *bbSs* 28. *bbSs* 29. *bbss* 30. 9/16 31. brown, short-haired 32. 3/16 33. brown, long-haired 34. 3/16 35. white, short-haired 36. 1/16 37. white, long-haired

Exercise 4: 1. a. white b. brown 2. a. *bb* b. *Bb* or *BB* 3. white 4. *Bb* 5. all brown, 0 white 6. heterozygous 7. homozygous

Exercise 5: 1. 0 2. 1 3. 1 4. 1/6 5. 5/6 6. independent 7. product 8. 1/6 9. 1/6 10. 1/36 11. multiplication 12. 1/2 13. 1/2 14. homozygous 15. multiplication 16. 1/2 17. 1/2 18. 1/4 19. addition 20. sum 21. 1/36 22. 1/36 23. 2/36 (1/18) 24. 1/2 25. 1/2 26. 1/2 27. 1/2 28. 1/4 29. 1/4 30. 1/4 31. 1/4 32. 1/2

Exercise 6: 1. none 2. *Ww* and *Ww* 3. 1/4

Exercise 7: 1. *ss* 2. ? 3. ? 4. ? 5. *Ss* 6. *Ss* 7. *Ss* 8. *ss* 9. ? 10. *ss* 11. *Ss* 12. ? 13. *Ss* 14. *SS* 15. ? 16. ? 17. half colored 18. half colored 19. ? 20. half colored 21. fully colored 22. ? 23. ? 24. half colored 25. half colored 26. blank 27. fully colored 28. fully colored

Exercise 8: 1. T 2. F (one-fourth) 3. F (thousands) 4. F (normal parents who are heterozygous) 5. T 6. F (Caucasians) 7. F (not evenly distributed) 8. T 9. T 10. F (not necessarily more common) 11. T 12. F (less common) 13. T 14. F (There is debate among geneticists.) 15. T 16. F (cystic fibrosis) 17. T 18. T 19. F (There is now a test) 20. T

Exercise 9: 1. testing (screening) 2. carrier 3. fetal 4. AFP 5. Tay-Sachs 6. one-fourth 7. phenylketonuria 8. amino acid 9. diet 10. environment 11. amniocentesis 12. amniotic 13. cells 14. karyotype 15. Down 16. chorionic villus 17. ultrasound 18. 35

Exercise 10: 1. B 2. A 3. D 4. B 5. C 6. C 7. E 8. D 9. E 10. A

Exercise 11: 1. *B* 2. *b* 3. *S* 4. *s* 5. *B* 6. *b* 7. *S* 8. *s* 9. *B* 10. *S* 11. *b* 12. *s* 13. *S* 14. *B* 15. *S* 16. *B* 17. *s* 18. *b* 19. *s* 20. *b* 21. *b* 22. *B* 23. *S* 24. *s* 25. *b* 26. *B* 27. *S* 28. *s* 29. *b* 30. *S* 31. *B* 32. *s* 33. *S* 34. *b* 35. *S* 36. *b* 37. *s* 38. *B* 39. *s* 40. *B*

Exercise 12: 1. B 2. C 3. E 4. A 5. D

Exercise 13: 1. E 2. D 3. D 4. A 5. C 6. B 7. A

Exercise 14: 1. X 2. dominant 3. X^CY 4. X^cY 5. daughters 6. sons 7. X 8. Y 9. carriers 10. X^CX^c 11. half 12. half 13. half 14. all 15. father 16. carriers 17. mother 18. X 19. *c* 20. *SRY* 21. X 22. ancestry

Test Your Knowledge

Multiple Choice: 1. c 2. e 3. d 4. b 5. e 6. b 7. b 8. a 9. d 10. e 11. c 12. a 13. b 14. b 15. e 16. a 17. c

Essay: 1. Mendel studied peas, which are easy to grow and come in many readily distinguishable varieties. He studied seven characteristics that each occur in two distinct forms. He first made sure that he had true-breeding varieties. Mendel carefully controlled which plant mated with which and kept scrupulous records of the matings and their results. Finally, he analyzed and interpreted his results mathematically, devising hypotheses that he tested and retested experimentally.

2. Each flip is an independent event, with a probability of 1/2. The probability of getting two heads is the product of the individual probabilities, $1/2 \times 1/2 = 1/4$. The probability of coin 1 coming up heads and coin 2 coming up tails is also the product of the individual probabilities, $1/2 \times 1/2 = 1/4$. But there is another way that you can get one head and one tail—coin 1 could come up tails and coin 2 could come up heads. The combined probability of this occurring is also $1/2 \times 1/2 = 1/4$. There are two different ways to get one head and one tail. The probability of an event that can occur two different ways is the sum of the separate probabilities of the different ways, in this case $1/4 + 1/4 = 1/2$.

3. Peas and fruit flies are easy to raise in a small space at little expense. They have many easy-to-spot characteristics, and it is easy to control matings between different varieties. They both produce many offspring in a relatively short time.

4. Humans who inherit X chromosomes from both mother and father (XX) are female. Humans who inherit an X chromosome from the mother and a Y chromosome from the father (XY) are male. The *SRY* gene on the Y chromosome appears to trigger testis development. In the absence of this gene, an

individual develops ovaries and is female. In grasshoppers and crickets, an individual with one sex chromosome (XO) is male, and one with two sex chromosomes (XX) is female. Sperm cells with or without sex chromosomes determine the sex of the offspring. In certain fishes, butterflies, and birds, a ZZ individual is male, a ZW individual is female, and eggs determine the sex of offspring. In ants and bees, diploid individuals are female and haploid individuals are male.

5. Many genetic tests detect conditions (Huntington's disease) that are not yet treatable; does every afflicted individual need or want to know? Then what? Tests should always be accompanied by counseling; is this always the case? Are there enough counselors? What about "do-it-yourself" tests, from mail-order or online labs? A "bad" result might stigmatize an individual; might she lose her job or be denied health or life insurance? Will genetic testing only be available to those who can afford it?

Apply the Concepts

Multiple Choice: 1. c 2. d 3. c 4. b 5. a 6. d 7. c 8. c 9. c 10. c 11. d 12. b

Essay: 1. The parents are both heterozygous, *Aa*. The daughter is homozygous recessive, *aa*. The probability is 1/4.

2. 9/16 purple green, 3/16 purple yellow, 3/16 white green, 1/16 white yellow

3. The man is heterozygous, *Ff*. His wife is homozygous recessive, *ff*. The children with freckles are *Ff*; those without freckles are *ff*.

4. Pink × pink yields 1/4 red, 1/2 pink, 1/4 white. Pink × white yields 1/2 pink, 1/2 white.

5. The man is I^Ai, the woman I^Bi. The probability of a type B child is 1/4.

6. All four individuals have about the same skin color. Couple 2 could have children with the widest range of skin colors, ranging from *AABBCC* to *aabbcc*. (Couple 1 could have children ranging only from *aaBBCC* to *aabbCC*.)

7. Prediction: 1/4 red eyes and straight wings, *RrSs*; 1/4 red eyes and curled wings, *Rrss*; 1/4 pink eyes and straight wings, *rrSs*; and 1/4 pink eyes and curled wings, *rrss*. The actual results of the cross indicate that the genes for eye color and wing shape are linked. In the heterozygous parent, *R* and *S* are on one chromosome, and *r* and *s* on the homologous chromosome. Most gametes were *RS* and *rs*, but crossing over resulted in a small percentage of *Rs* and *rS* gametes being produced.

8. Genes *s* and *b* are farther apart than *h* and *b*. The order of the genes on the chromosome is *shb* (or *bhs*).

9. The genes for sex-linked disorders are on the X chromosome. If both parents are normal but have a child with a sex-linked disorder, the mother must carry the allele for the disorder on one of her X chromosomes, and she will pass it on to half of her children. Half of her daughters will carry the allele for coloboma iridis, but they will be of normal phenotype because they will inherit the normal allele from their father. Half of her sons will also inherit the coloboma iridis allele. Because they inherit Y chromosomes from their father (and no normal allele that could mask the coloboma iridis allele), half the sons will exhibit coloboma iridis. Thus, one-fourth of their children—all boys—will have coloboma iridis.

10. If Diane's brother has hemophilia (and presumably her father does not), her mother must be a carrier of the hemophilia allele, and she would pass this allele on to half her daughters. The probability that Diane is a carrier is 1/2. If Diane is a carrier, there is a probability of 1/4 that she and Craig will have a child—a son—with the disease. The probability both that Diane is a carrier and that Diane and Craig will have a child with hemophilia is $1/2 \times 1/4 = 1/8$.

Chapter 10

Review the Concepts

Exercise 1: 1. N 2. D 3. DR 4. SPB 5. B 6. I 7. D 8. SP 9. ACGT 10. A 11. K 12. L 13. S 14. D 15. W 16. C 17. E 18. B (or N) 19. L 20. F 21. J 22. O 23. H 24. ACGU 25. U 26. Q (or D or R) 27. V

Exercise 2: 1. sugar-phosphate backbone 2. phosphate group 3. sugar (deoxyribose) 4. double helix 5. complementary base pair 6. adenine (A) 7. guanine (G) 8. thymine (T) 9. hydrogen bond 10. cytosine (C) 11. nucleotide 12. polynucleotide 13. pyrimidine bases 14. purine bases

Exercise 3: See Figure 10.4A in the text.

Exercise 4: 1. D 2. D 3. A 4. F 5. E 6. B 7. C

Exercise 5: