Chapter 12 Exercises

Review Questions

1. Mendel performed hybridizations by transferring pollen from the _____ of the male plant to the female ova.

a. anther
b. pistil
c. stigma
d. seed

2. Which is one of the seven characteristics that Mendel observed in pea plants?

a. flower size
b. seed texture
c. leaf shape
d. stem color

3. Imagine you are performing a cross involving seed color in garden pea plants. What F_1 offspring would you expect if you cross true-breeding parents with green seeds and yellow seeds, assuming yellow seed color is dominant over green?

a. 100% yellowish green seeds
b. 100% yellow seeds
c. 50% yellow; 50% green seeds
d. 25% green; 75% yellow seeds

4. Consider a cross to investigate the pea pod texture trait, involving constricted or inflated pods. Mendel found that the traits behave according to a dominant/recessive pattern in which inflated pods were dominant. If you performed this cross and obtained 650 inflated-pod plants in the F_2 generation, approximately how many constricted-pod plants would you expect to have?

a. 600
b. 165
c. 217
d. 468

5. In pea plants, violet flowers are dominant to white flowers, and axial flowers are dominant to terminal flowers. The genes controlling these traits lie on separate chromosomes. A scientist pollinates a true-breeding pea plant with violet, terminal flowers with pollen from a true-breeding pea plant with white, axial flowers. Which of the following observations would most accurately describe the F_2 generation?

a. 75% violet flowers; 75% terminal flowers
b. 75% white flowers in a terminal position
c. 75% violet flowers; 75% axial flowers
d. 75% violet flowers in an axial position

6. The observable traits expressed by an organism are described as its _____.

a. phenotype
b. genotype
c. alleles
d. zygote

7. A recessive trait will be observed in individuals that are _____ for that trait.

a. heterozygous
b. homozygous or heterozygous
c. homozygous
d. diploid

8. If black and white true-breeding mice are mated and the result is all gray offspring, what inheritance pattern would this be indicative of?

a. dominance
b. codominance
c. multiple alleles
d. incomplete dominance

9. The ABO blood groups in humans are expressed as the I^A, I^B, and i alleles. The I^A allele encodes the A blood group antigen, I^B encodes B, and i encodes O. Both A and B are dominant to O. If a heterozygous blood type A parent (I^Ai) and a heterozygous blood type B parent (I^Bi) mate, one quarter of their offspring will have AB blood type (I^AI^B) in which both antigens are expressed equally. Therefore, ABO blood groups are an example of _____.

a. multiple alleles and incomplete dominance
b. codominance and incomplete dominance
c. incomplete dominance only
d. multiple alleles and codominance

10. In a mating between two individuals that are heterozygous for a recessive lethal allele that is expressed in utero, what genotypic ratio (homozygous dominant:heterozygous:homozygous recessive) would you expect to observe in the offspring?

a. 1:2:1
b. 3:1:1
c. 1:2:0
d. 0:2:1

11. If the allele encoding polydactyly (six fingers) is dominant why do most people have five fingers?

a. Genetic elements suppress the polydactyl gene.
b. Polydactyly is embryonic lethal.
c. The sixth finger is removed at birth.
d. The polydactyl allele is very rare in the human population.

12. A farmer raises black and white chickens. To his surprise, when the first generation of eggs hatch all the chickens are black with white speckles throughout their feathers. What should the farmer expect when the eggs are laid after interbreeding the speckled chickens hatch?

a. All the offspring will be speckled.
b. 75% of the offspring will be speckled, and 25% will be black.
c. 50% of the offspring will be speckled, 25% will be black, and 25% will be white.
d. 50% of the offspring will be black, and 50% of the offspring will be white.

13. Assuming no gene linkage, in a dihybrid cross of *AABB* x *aabb* with *AaBb* F_1 heterozygotes, what is the ratio of the F_1 gametes (*AB*, *aB*, *Ab*, *ab*) that will give rise to the F_2 offspring?

a. 1:1:1:1
b. 1:3:3:1
c. 1:2:2:1
d. 4:3:2:1

14. The forked-line and probability methods make use of what probability rule?

a. test cross
b. product rule
c. monohybrid rule
d. sum rule

15. How many different offspring genotypes are expected in a trihybrid cross between parents heterozygous for all three traits when the traits behave in a dominant and recessive pattern? How many phenotypes?

a. 64 genotypes; 16 phenotypes
b. 16 genotypes; 64 phenotypes
c. 8 genotypes; 27 phenotypes
d. 27 genotypes; 8 phenotypes

16. Labrador retrievers' fur color is controlled by two alleles, *E* and *B*. Any dog with the *ee* genotype develops into a yellow lab, while *B*?*E*? dogs become black labs, and *bbE* dogs become chocolate labs. This is an example of _____.

a. epistasis
b. codominance
c. incomplete dominance
d. linkage

17. Which of the following situations does *not* follow the law of independent assortment?

a. A blond person and a brown-haired person produce three offspring over time, all of whom have blond hair.
b. A white cow crossed with a brown bull produces roan cattle.
c. Mating a hog with a sow produces six female piglets.
d. Men are more likely to experience hemophilia than women.

Critical Thinking Questions

18. Describe one of the reasons why the garden pea was an excellent choice of model system for studying inheritance.

19. How would you perform a reciprocal cross for the characteristic of stem height in the garden pea?

20. Mendel performs a cross using a true-breeding pea plant with round, yellow seeds (both dominant traits) and a true-breeding pea plant with green, wrinkled seeds (both recessive traits). What is the probability that the offspring will have green, round seeds? Calculate the probability for the F_1 and F_2 generations.

21. Calculate the probability of selecting a heart or a face card from a standard deck of cards. Is this outcome more or less likely than selecting a card that is both a heart and a face card? Keep in mind that a standard deck of cards contains 52 cards, 13 of which are hearts and 12 of which are face cards.

22. The gene for flower position in pea plants exists as axial or terminal alleles. Given that axial is dominant to terminal, list all of the possible F_1 and F_2 genotypes and phenotypes from a cross involving parents that are homozygous for each trait. Express genotypes with conventional genetic abbreviations.

23. In pea plants, the allele for tall plants (*T*) is dominant to the allele for short plants (*t*). Use a Punnett square to predict the offspring in a cross between a short pea plant (homozygous recessive) and a tall pea plant (heterozygous). What is the phenotypic ratio of the offspring?

24. Red-green color blindness is an X-linked recessive trait. Can a human male be a carrier of red-green color blindness?

25. Why is it more efficient to perform a test cross with a homozygous recessive donor than a homozygous dominant donor? How could the same information still be found with a homozygous dominant donor?

26. Use the probability method to calculate the genotypes and genotypic proportions of a cross between *AABBCc* and *Aabbcc* parents.

27. Explain epistasis in terms of its Greek language roots "standing upon."

28. In Lesson 12.3, an example of epistasis was given for the summer squash. Cross white *WwYy* heterozygotes to prove the phenotypic ratio of 12 white:3 yellow:1 green that was given in the text.

29. People with trisomy 21 develop Down's syndrome. What law of Mendelian inheritance is violated in this disease? What is the most likely way this occurs?

30. A heterozygous pea plant produces violet flowers and yellow, round seeds. Describe the expected genotypes of the gametes produced by Mendelian inheritance. If all three genes are found on the same arm of one chromosome, should a scientist predict that inheritance patterns will follow Mendelian genetics?