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Chapter 2

Student: _____

1. The first generation of offspring from the parents is called

   A. P.
   B. F_1.
   C. F_2.
   D. testcross.
   E. backcross.

2. Which of the following terms is not a type of mating cross?

   A. reciprocal
   B. testcross
   C. monohybrid
   D. dihybrid
   E. dominant

3. A _____ is a cross between an unknown and a homozygous recessive.

   A. testcross
   B. dihybrid
   C. monohybrid
   D. backcross
   E. controlled

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4. If an individual has 10 gene pairs, how many different gametes can be formed if three of the gene pairs are homozygous and the remaining seven gene pairs are heterozygous?

   A. 49
   B. 100
   C. 128
   D. 1024
   E. 131,072

5. If the parents of a family already have two boys, what is the probability that the next two offspring will be girls?

   A. 1
   B. 1/2
   C. 1/3
   D. 1/4
   E. 1/8

6. In some genetically engineered corn plants, a dominant gene (BT) produces a protein that is lethal to certain flying insect pests that eat the corn plants. It was also found that the pollen could cause death in some flying insects. If the corn plant is heterozygous for BT, what proportion of the pollen would carry the dominant gene?

   A. all pollen
   B. 1/2
   C. 1/3
   D. 1/4
   E. 1/8

7. Suppose that in plants, smooth seeds (*S*) are dominant to wrinkled seeds (*s*) and tall plants (*T*) are dominant to short plants (*t*). A tall plant with smooth seeds was backcrossed to a parent that was short and wrinkled. Assuming independent assortment, what proportion of the progeny is expected to be homozygous for short and wrinkled?

   A. 1/2
   B. 1/4
   C. 1/8
   D. 1/16
   E. 0

8. A rare recessive trait in a pedigree is indicated by which pattern of inheritance?

   A. vertical
   B. horizontal
   C. diagonal
   D. both vertical and horizontal
   E. father to daughter inheritance

9. Sickle cell anaemia is a recessive trait in humans. The gene that causes this disease is not located on the sex chromosomes. In a cross between a father who has sickle cell anaemia and a mother who is heterozygous for the gene, what is the probability that their first three children will have the normal phenotype?

   A. 1/4
   B. 1/2
   C. none
   D. 1/8
   E. 1/16 will be albino

10. A dominant trait, Huntington disease, causes severe neural/brain damage at approximately age 40. The gene that causes this disease is not located on the sex chromosomes. A female whose mother has Huntington disease marries a male whose parents are normal. It is not known if the female has the disease. Assuming the female's mother was a heterozygote, and her father was normal, what is the probability that their firstborn will inherit the gene that causes Huntington disease?

    A. 25%
    B. 50%
    C. 75%
    D. 100%
    E. 0%

11. In a monohybrid cross *AA* × *aa*, what proportion of homozygotes is expected among the F_2 offspring?

    A. 1/4
    B. 1/2
    C. 3/4
    D. All are homozygotes.
    E. None are homozygotes.

12. An allele that expresses its phenotype even when heterozygous with a recessive allele is termed

    A. recessive.
    B. recombinant.
    C. dominant.
    D. D)parental.
    E. independent.

13. Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a black guinea pig with a homozygous brown guinea pig, what proportion of the progeny will be homozygous?

A. none
B. 1/4
C. 1/2
D. 3/4
E. all

14. In the dihybrid cross *AaBb* × *aabb*, what proportion of individuals are expected to be homozygotic for both genes in the F_1 generation?

A. 1/4
B. 1/2
C. 3/4
D. All are homozygotes.
E. None are homozygotes.

15. _____ is/are a cross(es) between parents that differ in only one trait.

A. Self-fertilization
B. Cross fertilization
C. Monohybrid crosses
D. Artificial selection
E. Reciprocal crosses

16. Assuming independent assortment, which of the crosses below will produce a 1:1 phenotypic ratio among the F_1 progeny?

A. *AABB* × *aabb*
B. *AaBb* × *AaBb*
C. *AaBb* × *aabb*
D. *AaBB* × *aaBB*
E. *AAbb* × *aaBB*

17. The actual alleles present in an individual make up the individual's

A. recombinant types.
B. zygote.
C. dominant allele.
D. allele.
E. genotype.

18. In a dihybrid cross *AAbb* × *aaBB*, what proportion of the F_2 offspring is expected to be homozygotic for at least one gene?

A. 1/4
B. 1/2
C. 3/4
D. All are homozygotes.
E. None are homozygotes.

19. A phenotype reflecting a new combination of genes occurring during gamete formation is called

    A. a recombinant type.
    B. an independent assortment.
    C. heterozygous.
    D. homozygous.
    E. a multihybrid cross.

20. Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a homozygous black guinea pig with a heterozygous brown guinea pig, what proportion of the progeny will be black?

    A. none
    B. 1/4
    C. 1/2
    D. 3/4
    E. all

21. The diploid cell formed by the fertilization of the egg by the sperm during sexual reproduction is a

    A. reciprocal.
    B. zygote.
    C. dihybrid.
    D. gamete.
    E. monohybrid.

22. In a dihybrid cross for which the parental cross is *AABB* × *aabb*, what proportion of F_2 offspring will be heterozygous for both genes? Assume independent assortment.

A. 1/4
B. 1/2
C. 3/4
D. All are heterozygotes.
E. None are heterozygotes.

23. An alternative form of a single gene is known as

A. parental.
B. dihybrid.
C. reciprocal.
D. allele.
E. recessive.

24. Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a homozygous black guinea pig with a homozygous brown guinea pig, what proportion of the progeny will be heterozygous?

A. none
B. 1/4
C. 1/2
D. 3/4
E. all

25. Which of the crosses listed below will give a 1:1:1:1 genotypic ratio in the F_1 generation? Assume independent assortment.

A. *AABB* × *aabb*
B. *AaBb* × *AaBb*
C. *AaBb* × *aabb*
D. *AaBB* × *aaBB*
E. *AAbb* × *aaBB*

26. For the cross *AaBb* × *aabb*, what proportion of F_1 offspring will be heterozygous for both gene pairs? Assume independent assortment.

A. 1/4
B. 1/2
C. 3/4
D. All are heterozygotes.
E. None are heterozygotes.

27. The purposeful control over mating by choice of parents for the next generation is called

A. artificial selection
B. natural selection
C. mutation
D. evolution
E. random selection

28. When both egg and pollen from the same plant produce a zygote, the process is called

A. cross-pollination
B. outcrossing
C. self-fertilization
D. recombination
E. trans-pollination

29. Which of the following was not involved in the rediscovery of Mendel's work?

A. Correns
B. de Vries
C. Tschermak
D. Morgan
E. Watson

30. What does a vertical pattern of inheritance in a pedigree likely indicate?

A. rare recessive trait
B. rare dominant trait
C. mulitgenic inheritance
D. environmental impact
E. common recessive trait

31. Calculate the probability of either all-dominant or all-recessive genotypes for the alleles A, B, E, and F in the following cross: *AaBbccddEeFf* × *AaBbCcddEeFf*

A. 1/32
B. 1/16
C. 1/64
D. 1/128
E. 1/256

32. In some plants, a purple pigment is synthesized from a colourless precursor. In a cross between two plants, one purple and the other colourless, an F_1 generation was produced that was all-purple. The F_2 produced from the F_1 had 775 purple, 200 red, and 65 colourless. What is the genotype of the parents?

A. *AABB* × *AABB*
B. *AABB* × *aabb*
C. *aabb* × *aabb*
D. *aaBB* × *aabb*
E. *AAbb* × *aabb*

33. Lines that produce offspring carrying specific parental traits that remain constant from generation to generation are called

A. maternal
B. indeterminate
C. heterozygous
D. pure-breeding
E. wild-type

34. After a cross between two corn plants, the F_1 plants all had a dwarfed phenotype. The F_2 consisted of 1,207 dwarf plants and 401 tall plants. Identify the phenotypes and genotypes of the two parents.

A. *DD* (dwarf), *dd* (tall)
B. *DD* (tall), *dd* (dwarf)
C. *dd* (dwarf), *dd* (tall)
D. *DD* (dwarf), *DD* (tall)
E. *dd* (dwarf), *Dd* (tall)

35. Rosy coloured eyes and forked bristles are unlinked, recessive traits in Drosophila. A rosy-eyed Drosophila with wild-type bristles was crossed with a forked Drosophila with wild-type eyes. All of the F_1 were phenotypically wild-type for both traits, whereas the F_2 consisted of 306 wild-type, 94 rosy-eyed, 102 fork-bristled, and 33 forked-bristled and rosy-eyed flies. Infer the genotypes of the parents.

A. *rrff*, *RRFF*
B. *Rrff*, *rrFf*
C. *RRFF*, *RRFF*
D. *rrff*, *rrff*
E. *RRff*, *rrFF*

36. Which of the following is not a phenotypic description of allele interactions affecting the expression of traits?

A. incomplete dominance
B. codominance
C. polymorphic
D. multifactorial
E. pleiotropic

37. An interaction between non-allelic genes that results in the masking of expression of a phenotype is

A. epistasis.
B. epigenetic.
C. dominance.
D. codominance.
E. incomplete dominance.

38. Which of the following diseases show pleiotropism?

A. albinism
B. muscular dystrophy
C. colour blindness
D. sickle cell anaemia
E. male pattern baldness

39. A deviation from normal Mendelian ratios, which may be resolved by counting and/or controlled crosses, is seen in which of the following terms?

A. pleiotropy
B. codominance
C. incomplete dominance
D. complete dominance
E. penetrance and expressivity

40. Which of the following phenotypic ratios show incomplete dominance?

A. 2:1
B. 3:1
C. 1:2:1
D. 1:1
E. 4:1

41. Which of the following ratios show codominance?

A. 2:1
B. 3:1
C. 1:2:1
D. 1:1
E. 4:1

42. Which of the following ratios indicates a lethal gene?

A. 2:1
B. 3:1
C. 1:2:1
D. 1:1
E. 4:1

43. A person who has type O blood has

A. anti-A antibodies.
B. anti-B antibodies.
C. anti-AB antibodies.
D. both anti-A and -B antibodies.
E. no surface antigens.

44. If two or more forms of the same gene exist, the different forms are called

A. incomplete dominance.
B. penetrance and expressivity.
C. pleiotropic.
D. alleles.
E. dihybrid.

45. The blood groups A, B, and O are different types of

A. incomplete dominance.
B. penetrance and expressivity.
C. pleiotropy.
D. alleles.
E. heterozygotes.

46. The blood groups A, B, and O show

A. complete dominance.
B. recessiveness.
C. codominance.
D. complete dominance, recessiveness, and codominance.
E. None of the choices are correct.

47. Which of the following monohybrid ratios can describe incomplete dominance and codominance?

A. 2:1
B. 3:1
C. 1:3
D. 1:2:1
E. 4:1

48. Which of the following ratios demonstrate gene interaction?

A. 2:1
B. 3:1
C. 1:2:1
D. 9:3:4
E. 1:3

49. A _____ results whenever the nucleotide sequence is changed.

A. phenotype
B. genotype
C. mutation
D. trait
E. character

50. When the same gene is related to respiratory problems and sterility, it can be described as

A. pleiotropy.
B. codominance.
C. incomplete dominance.
D. complete dominance.
E. penetrance and expressivity.

51. Another name for a normal gene is

    A. wild-type.
    B. pleiotropy.
    C. dominant.
    D. codominant.
    E. recessive.

52. The phenotypic ratio 1:2:1 may indicate

    A. complete dominance.
    B. codominance.
    C. epistasis.
    D. recessive lethal.
    E. codominance and epistasis.

53. The phenotypic ratio 3:1 may indicate

    A. complete dominance.
    B. codominance.
    C. epistasis.
    D. incomplete dominance.
    E. codominance and epistasis.

54. The phenotypic ratio 2:1 may indicate

    A. complete dominance.
    B. codominance.
    C. epistasis.
    D. recessive lethal.
    E. codominance and epistasis.

55. The phenotypic ratio 9:7 may indicate

    A. complete dominance.
    B. codominance.
    C. epistasis.
    D. recessive lethal.
    E. complementary gene action.

56. The phenotypic ratio 9:3:4 may indicate

    A. complete dominance.
    B. codominance.
    C. epistasis.
    D. recessive lethal.
    E. codominance and epistasis.

57. Which of the following phenotypic ratios show independent assortment?

A. 9:3:3:1

B. 9:7

C. 9:3:4

D. 13:3

E. All of the choices are correct.

58. Temperature sensitive (*ts*) alleles of the Drosophila *shibire* gene were isolated by David Suzuki. Under permissive conditions, what is the phenotype of flies homozygous for the *ts* alleles?

A. lethal

B. conditional on other factors

C. indistinguishablefrom wild-type

D. continuously variable

E. co-dominant

59. People may inherit a specific genotype that predisposes them to cancer. However, not everyone with this genotype develops cancer; the occurrence of cancer in these individuals is dependent on environment. This is an example of:

A. epistasis

B. incomplete penetrance

C. variable expressivity

D. incomplete dominance

E. complementation

60. Which of these is not an example of a continuous trait?

A. age at death
B. occurrence of phenylketonuria (PKU)
C. human skin colour
D. birth weight of mice
E. plant height

61. Which of the following statements about continuous traits is not true?

A. they do not obey Mendel's laws
B. they are called complex traits
C. they are also called quantitative traits
D. they are relevant to medicine
E. they are relevant to agriculture

62. Several alleles at several different loci all contribute additively to the same trait. Therefore, for this trait:

A. homozygotes cannot exist
B. heterozygotes cannot exist
C. only one phenotypic class is possible
D. only two phenotypic classes are possible
E. continuous variation may be observed

63. How does penetrance differ from expressivity?

A. expressivity is dependent on environment; penetrance is not

B. expressivity is qualitative (presence or absence); penetrance is quantitative

C. penetrance involves multiple genes; expressivity involves a single gene

D. penetrance is qualitative (presence or absence); expressivity is quantitative

E. penetrance is dependent on environment; expressivity is not

64. Wild-type pea flowers are purple. You find spontaneous, white-flowered mutants growing nearby in five different locations (numbered a-e). You establish pure breeding lines of each and perform crosses between them, and record the F_1 phenotype in the table below. Based on the data in the table, how many different genes in the pathway for purple flowers have been identified by mutation?

	a	b	c	d	e
a	white	purple	purple	white	purple
b	purple	white	purple	purple	purple
c	purple	purple	white	purple	white
d	white	purple	purple	white	purple
e	purple	purple	white	purple	white

A. 1

B. 2

C. 3

D. 4

E. 5

65. Which of the following is not useful in a complementation test?

A. recessive alleles
B. sexual reproduction
C. pure breeding lines
D. F_1 progeny
E. alleles dominant to wild-type

66. If two homozygous recessive mutants show the same phenotype, but are caused by mutations at different loci, what will be the phenotype ratio among their F_1 progeny?

A. 1 wild-type : 0 mutant
B. 1 wild-type : 2 mutant
C. 1 wild-type : 1 mutant
D. 2 wild-type : 1 mutant
E. 0 wild-type : 1 mutant

67. *AA* and *Aa* make red flowers, and *aa* makes white flowers. *BB* and *Bb* make tall plants, and *bb* makes short plants. What would be the expected ratios of phenotypes among the offspring of the cross of *AaBb* x *aaBb*? Note the genotypes in the cross carefully. Assume independent assortment of each gene.

A. 9 (red & tall): 3 (red & short): 3 (white & tall): 1 (white & short)
B. 3 (red & tall): 1 (white & tall)
C. 3 (red & tall): 1 (red & short): 3 (white & tall): 1 (white & short)
D. all (red & tall)
E. 1 (red & tall): 1 (red & short): 1 (white & tall): 1 (white & short)

68. Seeds of some lentils are speckled. A true breeding strain with small speckles is crossed with a true breeding strain with large speckles. All of the F1 progeny have both large and small speckles. Which of the following is true?

A. The trait is controlled by two genes and the alleles are co-dominant
B. The trait is controlled by one gene and the alleles are co-dominant
C. The trait is controlled by two genes and the alleles are incompletely dominant
D. The trait is controlled by one gene and the alleles are incompletely dominant
E. The trait is controlled by one gene and both alleles are dominant

69. The mating of parents with antagonistic traits produces hybrids.

True False

70. Mendel's law of segregation states that two alleles for each trait unite in a specific, predictable manner during gamete formation.

True False

71. Dihybrid crosses helped reveal the law of independent assortment.

True False

72. The Punnett square was introduced in 1906 by Reginald Punnett and provides a simple and convenient method of tracking possible combinations of gametes that might be produced in a given cross.

True False

73. Using the product rule, one would calculate the probability of parents having six children who are all boys as $(½)^6$.

True False

74. The sum rule states that the probability of both of two mutually exclusive events occurring is the sum of their individual probabilities.

True False

75. If you know the phenotype and the dominance relation of the alleles you can predict the genotype.

True False

76. An individual can be a heterozygote for one trait and a homozygote for another.

True False

77. A testcross is a cross between two heterozygotes.

True False

78. At fertilization, in the mating of dihybrids, four different kinds of eggs can combine with four different kinds of pollen, producing a total of sixteen different genotypes.

True False

79. During gamete formation, different pairs of alleles on different chromosomes segregate independently of each other.

True False

80. If yellow and round phenotypes in peas are dominant, and pea shape and colour are each controlled by a single gene, you know the genotype of all peas that are green and wrinkled.

True False

81. Several single-gene disorders are more common in some populations of people than in others.

True False

82. A lethal disorder does not include the inheritance of traits that cause death in adulthood.

True False

83. Cross-fertilization is the same as reciprocal cross.

True False

84. A zygote is a fertilized egg.

True False

85. A *YY* or *yy* genotype is called heterozygous.

True False

86. The progeny of the F_1 generation is also known as the second filial generation

True False

87. The law of segregation is a Mendelian law that states that both alleles must separate during gamete formation.

True False

88. Multifactorial inheritance is when a phenotype arises as a result of multiple genes interacting with each other and/or the environment.

True False

89. The flower colours white, pink, and red indicate codominant inheritance.

True False

90. When a late blooming pea and an early blooming pea are crossed and an intermediate phenotype occurs, this result would suggest incomplete dominant inheritance.

True False

91. In codominance, F_1 hybrids show the traits of both parents.

True False

92. Different alleles indicate unique genes.

True False

93. Mutations are the source of new alleles.

True False

94. A wild-type allele is any allele whose frequency is closest to 100%.

True False

95. A mutant allele has a rare occurrence in a population.

True False

96. Genes with more than one wild-type allele are termed polymorphic.

True False

97. The mouse *agouti* gene has one wild-type allele and several mutant alleles.

True False

98. The phenomenon of a single gene determining a number of distinct and seemingly unrelated characteristics is known as pleiotropy.

True False

99. In epistasis, one gene's alleles mask the effects of another gene's alleles.

True False

100. In complementary gene action, dominant alleles of two or more genes are required to generate a particular trait.

True False

101. You are a judge in a civil trial where a young man is attempting to prove that he is the illegitimate child of a very wealthy man who has recently died. He wishes to be included in the distribution of the wealth. After considering all the testimony about how this person was conceived, the key evidence seems to come down to two main facts. The wealthy man and the mother of the young man are both deaf but the young man is not. Therefore the lawyer of the family suggests that the wealthy man is not the father. The mother, wealthy man, and young man all have O, MM, and Rh Blood Type at the phenotypic level but a genotyping screen indicates that the wealthy man is actually $I^A I^A$ *hh* blood type. How do you interpret the evidence presented and how does it influence your decision in this case?

102. Calculate the probability of the production of a homozygous recessive genotype for the following cross: *AaBbccddEeFf* × *AaBbCcddEeFf*

103. In *Drosophila,* forked (*fk*) bristles are recessive to normal (fk^+) and glassy eyes (*gls*) are recessive to normal (gls^+). If an F_1 heterozygous female is backcrossed to the homozygous wild-type male parent, predict the genotypes and phenotypes of the offspring.

104. A science teacher is attempting to convince her class that alcoholism, which has long been known to be a disease of polygenic inheritance, really is partially genetically determined. You are asked to assist in the design of an experiment that will help show eighth graders genetic transmission of differences in alcohol drinking. You have been given outbred rats as your experimental model. Set up a quantitative experiment that would test the hypothesis that alcoholism, as determined by amount of alcohol drunk, is a quantitative trait.

105. In corn, liguleless (*l*) is recessive to ligules (*L*) and a green leaf (*G*) is dominant to the normal non-green (*g*). If a testcross is performed with a plant that is a dihybrid for both of these genes, what would be the phenotypes and genotypes of the progeny? Assume independent assortment.

106. Short hair in rabbits is produced by a dominant allele (l^+) and long hair by its recessive allele (*l*). Black hair results from the action of a dominant allele (b^+) and brown hair from its recessive allele (*b*). Determine the genotypic and the corresponding phenotypic ratios of the F_2 offspring, beginning with a parental cross of a rabbit with brown, short hair to a rabbit with long, black hair. Assume that the parent with short hair is homozygous for that allele, and that the parent with black hair is homozygous for that allele. Assume independent assortment.

107. What does a diamond symbol ◊ in a pedigree indicate?

108. You wish to know the genotype of some carrot plants that you have grown in your garden so that you might grow more of them. They have reddish orange flesh, are sweet in taste, long in root, and short in leaf. Using classical genetic techniques how would you determine the genotype?

109. In *Drosophila,* forked (*fk*) bristles are recessive to normal (fk^+) and glassy eyes (*gls*) are recessive to normal (gls^+). If a homozygous wild-type male is mated to a forked-bristled, glassy-eyed female, predict the genotypes and phenotypes of the F_2. Assume independent assortment.

110. In *Drosophila,* forked (*fk*) bristles are recessive to normal (fk^+) and glassy eyes (*gls*) are recessive to normal (gls^+). If a homozygous wild-type male is mated to a forked-bristle, glassy-eye female, predict the genotypes and phenotypes of the F_1.

111. Short hair in rabbits is produced by a dominant allele (l^+) and long hair by its recessive allele (*l*). Black hair results from the action of a dominant allele (b^+) and brown hair from its recessive allele (*b*). Determine the genotypic and the corresponding phenotypic ratios of the F_1 offspring, beginning with a parental cross of a rabbit with brown, short hair to a rabbit with long, black hair. Assume that the parent with short hair is homozygous for that allele, and that the parent with black hair is homozygous for that allele. Assume independent assortment.

112. Stem colour of tomato plants is known to be under the genetic control of at least one pair of alleles such that *A*_ results in the production of anthocyanin pigment (purple stem). The recessive genotype *aa* lacks this pigment and hence is green. The production of two locules (seed chambers) in the tomato fruit is controlled by the dominant allele *M*, and multiple locules is determined by *mm*. Determine the genotypic and phenotypic ratios of the F_1 from a cross between an inbred tomato plant with a purple stem and fruit with two locules crossed to a tomato plant with a green stem and fruit with multiple locules.

113. In corn liguleless, (*l*) is recessive to ligules (*L*) and a green leaf (*G*) is dominant to the normal non-green (*g*). If a plant homozygous for liguleless and green leaves is crossed to one homozygous for non-green with ligules, predict the phenotypes and genotypes of the F_1. Assume independent assortment.

114.A cross in which the traits carried by the male parent and the female parent are reversed.

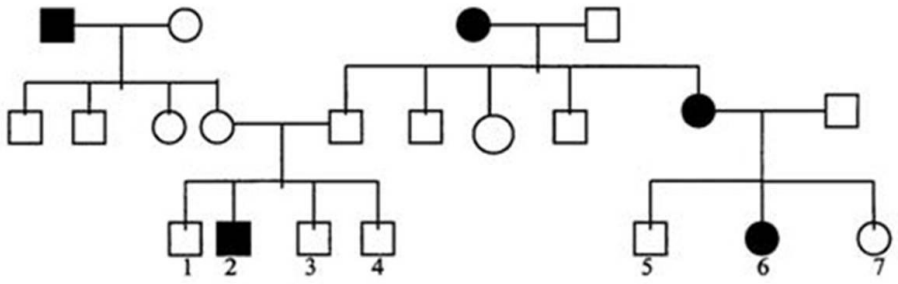
115.What are the four general themes that have arisen from Mendel's work?

116.You are out on a nature walk up in the mountains and you find a pretty wildflower in the lower altitude that is short and bushy with small, fragrant, bright purple flowers. In the higher altitude you find what seems to be the same plant, yet it is tall and sparse with larger flowers of the same colour and fragrance. A) Set up an experiment to test the hypothesis that the plants are different due to genetic but not environmental influences. B) Is it possible to tell if both genetic and environmental effects occur?

117. In corn liguleless, (*l*) is recessive to ligules (*L*) and a green leaf (*G*) is dominant to the normal non-green (*g*). If a plant homozygous for liguleless and green leaves is crossed to one homozygous for non-green with ligules, predict the phenotypes and genotypes of the F_2.

118. Stem colour of tomato plants is known to be under the genetic control of at least one pair of alleles such that *A*_ results in the production of anthocyanin pigment (purple stem). The recessive genotype *aa* lacks this pigment and hence is green. The production of two locules (seed chambers) in the tomato fruit is controlled by the dominant allele M, and multiple locules is determined by mm. Determine the genotypic and phenotypic ratios of the F_2 offspring beginning with a parental cross between an inbred tomato plant that has a purple stem and fruit with two locules, and a tomato plant that has a green stem and fruit with multiple locules. Assume independent assortment.

119. Below is a pedigree for a human trait. Shaded symbols are for individuals exhibiting the trait. Identify the mode of inheritance of the trait and apply the laws of probability to calculate the probability that individual #4 is a heterozygous carrier of the trait.



120. In corn, three dominant genes are necessary for aleurone colour. The genotype *B_D_R_* is coloured. Any homozygous recessive for one gene is colourless. Predict the genotypes and phenotypes of the offspring of the cross *BbDdRr* × *BbDdRr*

Phenotype: 27 coloured; 37 colourless

121. In corn, three dominant genes are necessary for aleurone colour. The genotype *B_D_R_* is coloured. Any homozygous recessive for one gene is colourless. Predict the genotypes and phenotypes of the offspring of the cross *BbDdRR* × *BbDdRR*

122. In corn, three dominant genes are necessary for aleurone colour. The genotype *B_D_R_* is coloured. Any homozygous recessive for one gene is colourless. Predict the genotypes and phenotypes of the offspring of the cross *BbDdRR* × *BbDdrr*

123. In rats, the gene for the pigment (*P*) is dominant to no pigment (*p*). The gene for black (*B*) is dominant to the gene for cream (*b*). If a pigment gene (*P*) is absent, genes *B* and *b* are inoperative. Predict the genotypes and phenotypes of the F_1 of a cross between a homozygous black rat and an albino homozygous for cream.

124. In rats, the gene for the pigment (*P*) is dominant to no pigment (*p*). The gene for black (*B*) is dominant to the gene for cream (*b*). If a pigment gene (*P*) is absent, genes *B* and *b* are inoperative. Predict the genotypes and phenotypes of the F_2 of a parental cross between a homozygous black rat and an albino homozygous for cream.

125. In the common daisy, the genes *A* and *a* and *B* and *b* represent two pairs of alleles acting on flower colour. *A* and *B* are required for colour. The alleles of these two genes show recessive epistasis. The two gene pairs together thus show duplicate recessive epistasis. Predict the genotypes and phenotypes of the F_1 of a cross between two colourless plants, one homozygous for *A* and the other homozygous for *B*.

126. In the common daisy, the genes *A* and *a* and *B* and *b* represent two pairs of alleles acting on flower colour. *A* and *B* are required for colour. The alleles of these two genes show recessive epistasis. The two gene pairs together thus show duplicate recessive epistasis. Predict the genotypes and phenotypes of the F_2 of a cross between two colourless plants, one homozygous for *A* and the other homozygous for *B*.

127. In poultry, if a Black Longshank male with feathered shanks is crossed with a Buff Rock female with unfeathered shanks the F_1 are all feathered and the F_2 show 90 feathered to 6 unfeathered. Infer the genotypes of the parents.

128. In a certain breed of plants, dark green is determined by the dominant gene *G* and light green is determined by the recessive gene *g*. The heterozygote shows 75% penetrance for the dominant phenotype. If the parental cross is *GG* × *gg,* what phenotype distribution would be expected in a population of 400 F_2 plants?

129. A man with blood type A whose father was blood type O married a woman of blood type B whose mother was blood type O. What are the possible blood types of their offspring?

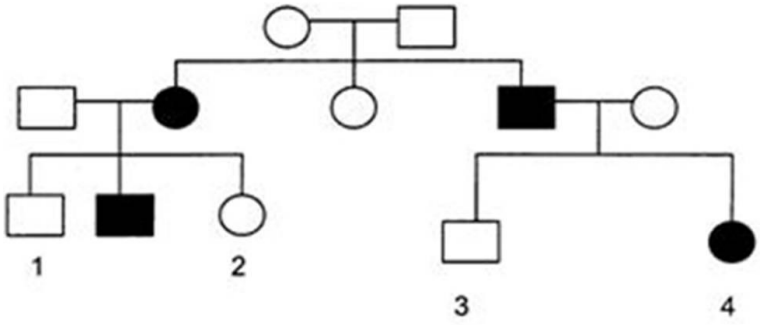
130. What phenotypes and genotypes would you expect from the following cross of blood-related genotypes?

$I^B\ i\ rh^+\ rh^+ \times I^A i\ rh^+\ rh$

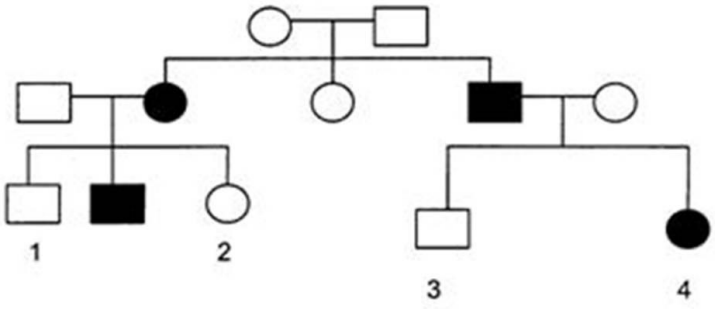
131. Coat colour in a certain species of rabbit is governed by multiple alleles. The dominance series for these alleles is as follows: coloured (c^+), chinchilla, (c^{ch}), himalayan (c^h) and albino (c). Give the phenotypes and ratios from the following crosses: (A) $c^+c \times c^h\ c^h$ (B) $c^+c^+ \times c^h\ c^{ch}$ (C) $c^+\ c \times c^hc$ (D) $c\ c \times c^hc^{ch}$ (E) $c^+\ c^h \times c^h\ c^{ch}$ (F) $c^+\ c^{ch} \times c^hc^{ch}$ (G) $c\ c \times c^+c^{ch}$.

132. Affected individuals in the following pedigree are homozygous for the allele that causes the trait.

What are the possible genotypes of persons 1, 2, 3 and 4?



133. The pedigree shown is for a human genetic disease in which solid colour indicates affected individuals. Affected individuals in the pedigree are homozygous for the allele that causes the trait. Apply the laws of probability and calculate the probability, the offspring of the cousin marriage (individual 2 × individual 3) will exhibit the disease.



134. The following five mothers, (a) through (e), with phenotypes given, each produced one child whose phenotype is described as to blood group (A, B, O), M or N antigens, and Rh factor. For each child, select as the father, one of the five males whose genotypes are given. For some children, more than one male may be a possible father.

(*ii* = Type O blood, *rr* = rh & **R** = rh$^+$]

	Maternal Phenotype	**Child Phenotype**	**Genotype of Male**
(a)	A M R	O M R	1. I^Ai MN rr
(b)	B N r	O N r	2. I^Bi MN RR
(c)	O M r	A MN R	3. iiNNrr
(d)	A N R	AB MN R	4. iiMMrr
(e)	AB MN r	A MN r	5. I^AI^AMNRR

135. You have obtained an interesting flower for your garden from your neighbour. The neighbour has given you two pure lines of the plant, one with red flowers and one with yellow flowers. You decide to cross them and find that you obtain all orange flowers. The curious molecular geneticist in you decides to test two independent hypotheses: Hypothesis 1: Incomplete dominance; Hypothesis 2: Recessive epistasis. The first step in your test is to self the F_1 orange plants, which you complete only to find that the results do not statistically distinguish the two hypotheses. a) What ratio of yellow, orange, and red would you expect in the F_2 population for each hypothesis and b) what crosses would you complete next to definitively test your two hypotheses?

136. Genes *A* and *B* are required for colour. If *A* or *B* is absent (that is, *aa* or *bb*) the result is colourless. Give the genotypes and phenotypes for each F_1 and F_2 progeny of the cross *AAbb* × *aabb*

137. Genes *A* and *B* are required for colour. If *A* or *B* is absent (that is, *aa* or *bb*) the result is colourless. Give the genotypes and phenotypes for each F_1 and F_2 progeny of the cross *aaBB* × *aabb*

138. Genes *A* and *B* are required for colour. If *A* or *B* is absent (that is, *aa* or *bb*) the result is colourless. Give the genotypes and phenotypes for each F_1 and F_2 progeny of the cross *AAbb* × *aaBB*

Chapter 2 Key

1. The first generation of offspring from the parents is called

A. P.

B. F_1.

C. F_2.

D. testcross.

E. backcross.

Accessibility: Keyboard Navigation

Blooms: Remember

Hartwell - Chapter 02 #1

Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

2. Which of the following terms is not a type of mating cross?

A. reciprocal

B. testcross

C. monohybrid

D. dihybrid

E. dominant

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #2

Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

3. A _____ is a cross between an unknown and a homozygous recessive.

A. testcross

B. dihybrid

C. monohybrid

D. backcross

E. controlled

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #3

Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

4. If an individual has 10 gene pairs, how many different gametes can be formed if three of the gene pairs are homozygous and the remaining seven gene pairs are heterozygous?

A. 49

B. 100

C. 128

D. 1024

E. 131,072

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #4

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

5. If the parents of a family already have two boys, what is the probability that the next two offspring will be girls?

A. 1

B. 1/2

C. 1/3

D. 1/4

E. 1/8

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #5

Learning Objective: 02-03 Explain Mendels law of segragation.

6. In some genetically engineered corn plants, a dominant gene (BT) produces a protein that is lethal to certain flying insect pests that eat the corn plants. It was also found that the pollen could cause death in some flying insects. If the corn plant is heterozygous for BT, what proportion of the pollen would carry the dominant gene?

A. all pollen

B. 1/2

C. 1/3

D. 1/4

E. 1/8

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #6

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

7. Suppose that in plants, smooth seeds (*S*) are dominant to wrinkled seeds (*s*) and tall plants (*T*) are dominant to short plants (*t*). A tall plant with smooth seeds was backcrossed to a parent that was short and wrinkled. Assuming independent assortment, what proportion of the progeny is expected to be homozygous for short and wrinkled?

A. 1/2

B. 1/4

C. 1/8

D. 1/16

E. 0

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #7

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

8. A rare recessive trait in a pedigree is indicated by which pattern of inheritance?

A. vertical

B. horizontal

C. diagonal

D. both vertical and horizontal

E. father to daughter inheritance

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #8

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

9. Sickle cell anaemia is a recessive trait in humans. The gene that causes this disease is not located on the sex chromosomes. In a cross between a father who has sickle cell anaemia and a mother who is heterozygous for the gene, what is the probability that their first three children will have the normal phenotype?

A. 1/4
B. 1/2
C. none
D. 1/8
E. 1/16 will be albino

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #9
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

10. A dominant trait, Huntington disease, causes severe neural/brain damage at approximately age 40. The gene that causes this disease is not located on the sex chromosomes. A female whose mother has Huntington disease marries a male whose parents are normal. It is not known if the female has the disease. Assuming the female's mother was a heterozygote, and her father was normal, what is the probability that their firstborn will inherit the gene that causes Huntington disease?

A. 25%
B. 50%
C. 75%
D. 100%
E. 0%

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #10
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

11. In a monohybrid cross *AA* × *aa*, what proportion of homozygotes is expected among the F_2 offspring?

A. 1/4

B. 1/2

C. 3/4

D. All are homozygotes.

E. None are homozygotes.

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #11

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

12. An allele that expresses its phenotype even when heterozygous with a recessive allele is termed

A. recessive.

B. recombinant.

C. dominant.

D. D)parental.

E. independent.

Accessibility: Keyboard Navigation

Blooms: Remember

Hartwell - Chapter 02 #12

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

13. Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a black guinea pig with a homozygous brown guinea pig, what proportion of the progeny will be homozygous?

A. none
B. 1/4
C. 1/2
D. 3/4
E. all

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #13
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

14. In the dihybrid cross *AaBb* × *aabb*, what proportion of individuals are expected to be homozygotic for both genes in the F_1 generation?

A. 1/4
B. 1/2
C. 3/4
D. All are homozygotes.
E. None are homozygotes.

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #14
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

15. _____ is/are a cross(es) between parents that differ in only one trait.

A. Self-fertilization
B. Cross fertilization
C. Monohybrid crosses
D. Artificial selection
E. Reciprocal crosses

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #15
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

16. Assuming independent assortment, which of the crosses below will produce a 1:1 phenotypic ratio among the F_1 progeny?

A. *AABB* × *aabb*
B. *AaBb* × *AaBb*
C. *AaBb* × *aabb*
D. *AaBB* × *aaBB*
E. *AAbb* × *aaBB*

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #16
Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

17. The actual alleles present in an individual make up the individual's

A. recombinant types.

B. zygote.

C. dominant allele.

D. allele.

E. genotype.

Accessibility: Keyboard Navigation

Blooms: Remember

Hartwell - Chapter 02 #17

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

18. In a dihybrid cross *AAbb* × *aaBB*, what proportion of the F_2 offspring is expected to be homozygotic for at least one gene?

A. 1/4

B. 1/2

C. 3/4

D. All are homozygotes.

E. None are homozygotes.

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #18

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

19. A phenotype reflecting a new combination of genes occurring during gamete formation is called

A. a recombinant type.
B. an independent assortment.
C. heterozygous.
D. homozygous.
E. a multihybrid cross.

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #19
Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

20. Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a homozygous black guinea pig with a heterozygous brown guinea pig, what proportion of the progeny will be black?

A. none
B. 1/4
C. 1/2
D. 3/4
E. all

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #20
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

21. The diploid cell formed by the fertilization of the egg by the sperm during sexual reproduction is a

A. reciprocal.

B. zygote.

C. dihybrid.

D. gamete.

E. monohybrid.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #21

Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

22. In a dihybrid cross for which the parental cross is *AABB* × *aabb*, what proportion of F_2 offspring will be heterozygous for both genes? Assume independent assortment.

A. 1/4

B. 1/2

C. 3/4

D. All are heterozygotes.

E. None are heterozygotes.

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #22

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

23. An alternative form of a single gene is known as

A. parental.
B. dihybrid.
C. reciprocal.
D. allele.
E. recessive.

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #23
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

24. Assume that in guinea pigs, dark brown fur (*B*) is dominant to black fur (*b*). If you mate a homozygous black guinea pig with a homozygous brown guinea pig, what proportion of the progeny will be heterozygous?

A. none
B. 1/4
C. 1/2
D. 3/4
E. all

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #24
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

25. Which of the crosses listed below will give a 1:1:1:1 genotypic ratio in the F_1 generation? Assume independent assortment.

A. *AABB* × *aabb*

B. *AaBb* × *AaBb*

C. *AaBb* × *aabb*

D. *AaBB* × *aaBB*

E. *AAbb* × *aaBB*

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #25

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

26. For the cross *AaBb* × *aabb*, what proportion of F_1 offspring will be heterozygous for both gene pairs? Assume independent assortment.

A. 1/4

B. 1/2

C. 3/4

D. All are heterozygotes.

E. None are heterozygotes.

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #26

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

27. The purposeful control over mating by choice of parents for the next generation is called

A. artificial selection
B. natural selection
C. mutation
D. evolution
E. random selection

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #27
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

28. When both egg and pollen from the same plant produce a zygote, the process is called

A. cross-pollination
B. outcrossing
C. self-fertilization
D. recombination
E. trans-pollination

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #28
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

29. Which of the following was not involved in the rediscovery of Mendel's work?

A. Correns

B. de Vries

C. Tschermak

D. Morgan

E. Watson

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #29

Learning Objective: 02-03 Explain Mendels law of segragation.

30. What does a vertical pattern of inheritance in a pedigree likely indicate?

A. rare recessive trait

B. rare dominant trait

C. mulitgenic inheritance

D. environmental impact

E. common recessive trait

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #30

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

31. Calculate the probability of either all-dominant or all-recessive genotypes for the alleles A, B, E, and F in the following cross: *AaBbccddEeFf* × *AaBbCcddEeFf*

A. 1/32

B. 1/16

C. 1/64

D. 1/128

E. 1/256

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #31

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

32. In some plants, a purple pigment is synthesized from a colourless precursor. In a cross between two plants, one purple and the other colourless, an F_1 generation was produced that was all-purple. The F_2 produced from the F_1 had 775 purple, 200 red, and 65 colourless. What is the genotype of the parents?

A. *AABB* × *AABB*

B. *AABB* × *aabb*

C. *aabb* × *aabb*

D. *aaBB* × *aabb*

E. *AAbb* × *aabb*

Accessibility: Keyboard Navigation

Blooms: Evaluate

Hartwell - Chapter 02 #32

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

33. Lines that produce offspring carrying specific parental traits that remain constant from generation to generation are called

A. maternal
B. indeterminate
C. heterozygous
D. pure-breeding
E. wild-type

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #33
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

34. After a cross between two corn plants, the F_1 plants all had a dwarfed phenotype. The F_2 consisted of 1,207 dwarf plants and 401 tall plants. Identify the phenotypes and genotypes of the two parents.

A. *DD* (dwarf), *dd* (tall)
B. *DD* (tall), *dd* (dwarf)
C. *dd* (dwarf), *dd* (tall)
D. *DD* (dwarf), *DD* (tall)
E. *dd* (dwarf), *Dd* (tall)

Accessibility: Keyboard Navigation
Blooms: Evaluate
Hartwell - Chapter 02 #34
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

35. Rosy coloured eyes and forked bristles are unlinked, recessive traits in Drosophila. A rosy-eyed Drosophila with wild-type bristles was crossed with a forked Drosophila with wild-type eyes. All of the F_1 were phenotypically wild-type for both traits, whereas the F_2 consisted of 306 wild-type, 94 rosy-eyed, 102 fork-bristled, and 33 forked-bristled and rosy-eyed flies. Infer the genotypes of the parents.

A. *rrff*, *RRFF*

B. *Rrff*, *rrFf*

C. *RRFF*, *RRFF*

D. *rrff*, *rrff*

E. *RRff*, *rrFF*

Accessibility: Keyboard Navigation

Blooms: Evaluate

Hartwell - Chapter 02 #35

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

36. Which of the following is not a phenotypic description of allele interactions affecting the expression of traits?

A. incomplete dominance

B. codominance

C. polymorphic

D. multifactorial

E. pleiotropic

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #36

Learning Objective: 02-08 Describe pleiotropy and how it arises.

37. An interaction between non-allelic genes that results in the masking of expression of a phenotype is

A. epistasis.
B. epigenetic.
C. dominance.
D. codominance.
E. incomplete dominance.

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #37
Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

38. Which of the following diseases show pleiotropism?

A. albinism
B. muscular dystrophy
C. colour blindness
D. sickle cell anaemia
E. male pattern baldness

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #38
Learning Objective: 02-08 Describe pleiotropy and how it arises.

39. A deviation from normal Mendelian ratios, which may be resolved by counting and/or controlled crosses, is seen in which of the following terms?

A. pleiotropy
B. codominance
C. incomplete dominance
D. complete dominance
E. penetrance and expressivity

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #39
Learning Objective: 02-11 Distinguish between penetrance and expressivity.

40. Which of the following phenotypic ratios show incomplete dominance?

A. 2:1
B. 3:1
C. 1:2:1
D. 1:1
E. 4:1

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #40
Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

41. Which of the following ratios show codominance?

A. 2:1

B. 3:1

C. 1:2:1

D. 1:1

E. 4:1

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #41

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

42. Which of the following ratios indicates a lethal gene?

A. 2:1

B. 3:1

C. 1:2:1

D. 1:1

E. 4:1

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #42

Learning Objective: 02-08 Describe pleiotropy and how it arises.

43. A person who has type O blood has

A. anti-A antibodies.

B. anti-B antibodies.

C. anti-AB antibodies.

D. both anti-A and -B antibodies.

E. no surface antigens.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #43

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

44. If two or more forms of the same gene exist, the different forms are called

A. incomplete dominance.

B. penetrance and expressivity.

C. pleiotropic.

D. alleles.

E. dihybrid.

Accessibility: Keyboard Navigation

Blooms: Remember

Hartwell - Chapter 02 #44

Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

45. The blood groups A, B, and O are different types of

A. incomplete dominance.
B. penetrance and expressivity.
C. pleiotropy.
D. alleles.
E. heterozygotes.

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #45
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.
Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

46. The blood groups A, B, and O show

A. complete dominance.
B. recessiveness.
C. codominance.
D. complete dominance, recessiveness, and codominance.
E. None of the choices are correct.

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #46
Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

47. Which of the following monohybrid ratios can describe incomplete dominance and codominance?

A. 2:1

B. 3:1

C. 1:3

D. 1:2:1

E. 4:1

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #47

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

48. Which of the following ratios demonstrate gene interaction?

A. 2:1

B. 3:1

C. 1:2:1

D. 9:3:4

E. 1:3

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #48

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

49. A _____ results whenever the nucleotide sequence is changed.

A. phenotype

B. genotype

C. mutation

D. trait

E. character

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #49

Learning Objective: 02-07 Explain the terms wild-type allele; mutant allele; monomorphic; and polymorphic.

50. When the same gene is related to respiratory problems and sterility, it can be described as

A. pleiotropy.

B. codominance.

C. incomplete dominance.

D. complete dominance.

E. penetrance and expressivity.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #50

Learning Objective: 02-08 Describe pleiotropy and how it arises.

51. Another name for a normal gene is

A. wild-type.

B. pleiotropy.

C. dominant.

D. codominant.

E. recessive.

Accessibility: Keyboard Navigation

Blooms: Remember

Hartwell - Chapter 02 #51

Learning Objective: 02-07 Explain the terms wild-type allele; mutant allele; monomorphic; and polymorphic.

52. The phenotypic ratio 1:2:1 may indicate

A. complete dominance.

B. codominance.

C. epistasis.

D. recessive lethal.

E. codominance and epistasis.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #52

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

53. The phenotypic ratio 3:1 may indicate

A. complete dominance.

B. codominance.

C. epistasis.

D. incomplete dominance.

E. codominance and epistasis.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #53

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

54. The phenotypic ratio 2:1 may indicate

A. complete dominance.

B. codominance.

C. epistasis.

D. recessive lethal.

E. codominance and epistasis.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #54

Learning Objective: 02-08 Describe pleiotropy and how it arises.

55. The phenotypic ratio 9:7 may indicate

A. complete dominance.

B. codominance.

C. epistasis.

D. recessive lethal.

E. complementary gene action.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #55

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

56. The phenotypic ratio 9:3:4 may indicate

A. complete dominance.

B. codominance.

C. epistasis.

D. recessive lethal.

E. codominance and epistasis.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #56

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

57. Which of the following phenotypic ratios show independent assortment?

A. 9:3:3:1

B. 9:7

C. 9:3:4

D. 13:3

E. All of the choices are correct.

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #57

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

58. Temperature sensitive (*ts*) alleles of the Drosophila *shibire* gene were isolated by David Suzuki. Under permissive conditions, what is the phenotype of flies homozygous for the *ts* alleles?

A. lethal

B. conditional on other factors

C. indistinguishablefrom wild-type

D. continuously variable

E. co-dominant

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #58

Learning Objective: 02-11 Distinguish between penetrance and expressivity.

59. People may inherit a specific genotype that predisposes them to cancer. However, not everyone with this genotype develops cancer; the occurrence of cancer in these individuals is dependent on environment. This is an example of:

A. epistasis
B. incomplete penetrance
C. variable expressivity
D. incomplete dominance
E. complementation

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #59
Learning Objective: 02-11 Distinguish between penetrance and expressivity.

60. Which of these is not an example of a continuous trait?

A. age at death
B. occurrence of phenylketonuria (PKU)
C. human skin colour
D. birth weight of mice
E. plant height

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #60
Learning Objective: 02-12 Explain the inheritance of continuous traits.

61. Which of the following statements about continuous traits is not true?

A. they do not obey Mendel's laws

B. they are called complex traits

C. they are also called quantitative traits

D. they are relevant to medicine

E. they are relevant to agriculture

Accessibility: Keyboard Navigation

Blooms: Apply

Hartwell - Chapter 02 #61

Learning Objective: 02-12 Explain the inheritance of continuous traits.

62. Several alleles at several different loci all contribute additively to the same trait. Therefore, for this trait:

A. homozygotes cannot exist

B. heterozygotes cannot exist

C. only one phenotypic class is possible

D. only two phenotypic classes are possible

E. continuous variation may be observed

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #62

Learning Objective: 02-12 Explain the inheritance of continuous traits.

63. How does penetrance differ from expressivity?

A. expressivity is dependent on environment; penetrance is not

B. expressivity is qualitative (presence or absence); penetrance is quantitative

C. penetrance involves multiple genes; expressivity involves a single gene

D. penetrance is qualitative (presence or absence); expressivity is quantitative

E. penetrance is dependent on environment; expressivity is not

Accessibility: Keyboard Navigation

Blooms: Understand

Hartwell - Chapter 02 #63

Learning Objective: 02-11 Distinguish between penetrance and expressivity.

64. Wild-type pea flowers are purple. You find spontaneous, white-flowered mutants growing nearby in five different locations (numbered a-e). You establish pure breeding lines of each and perform crosses between them, and record the F_1 phenotype in the table below. Based on the data in the table, how many different genes in the pathway for purple flowers have been identified by mutation?

	a	b	c	d	e
a	white	purple	purple	white	purple
b	purple	white	purple	purple	purple
c	purple	purple	white	purple	white
d	white	purple	purple	white	purple
e	purple	purple	white	purple	white

A. 1

B. 2

C. 3

D. 4

E. 5

Blooms: Evaluate

Hartwell - Chapter 02 #64

Learning Objective: 02-10 Evaluate the significance of the complementation test as a tool for genetic analysis.

65. Which of the following is not useful in a complementation test?

A. recessive alleles
B. sexual reproduction
C. pure breeding lines
D. F_1 progeny
E. alleles dominant to wild-type

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #65
Learning Objective: 02-10 Evaluate the significance of the complementation test as a tool for genetic analysis.

66. If two homozygous recessive mutants show the same phenotype, but are caused by mutations at different loci, what will be the phenotype ratio among their F_1 progeny?

A. 1 wild-type : 0 mutant
B. 1 wild-type : 2 mutant
C. 1 wild-type : 1 mutant
D. 2 wild-type : 1 mutant
E. 0 wild-type : 1 mutant

Accessibility: Keyboard Navigation
Blooms: Analyze
Hartwell - Chapter 02 #66
Learning Objective: 02-10 Evaluate the significance of the complementation test as a tool for genetic analysis.

67. *AA* and *Aa* make red flowers, and *aa* makes white flowers. *BB* and *Bb* make tall plants, and *bb* makes short plants. What would be the expected ratios of phenotypes among the offspring of the cross of *AaBb* x *aaBb*? Note the genotypes in the cross carefully. Assume independent assortment of each gene.

A. 9 (red & tall): 3 (red & short): 3 (white & tall): 1 (white & short)
B. 3 (red & tall): 1 (white & tall)
C. 3 (red & tall): 1 (red & short): 3 (white & tall): 1 (white & short)
D. all (red & tall)
E. 1 (red & tall): 1 (red & short): 1 (white & tall): 1 (white & short)

Accessibility: Keyboard Navigation
Blooms: Evaluate
Hartwell - Chapter 02 #67
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

68. Seeds of some lentils are speckled. A true breeding strain with small speckles is crossed with a true breeding strain with large speckles. All of the F1 progeny have both large and small speckles. Which of the following is true?

A. The trait is controlled by two genes and the alleles are co-dominant
B. The trait is controlled by one gene and the alleles are co-dominant
C. The trait is controlled by two genes and the alleles are incompletely dominant
D. The trait is controlled by one gene and the alleles are incompletely dominant
E. The trait is controlled by one gene and both alleles are dominant

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #68
Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

69. The mating of parents with antagonistic traits produces hybrids.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #69
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

70. Mendel's law of segregation states that two alleles for each trait unite in a specific, predictable manner during gamete formation.

FALSE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #70
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

71. Dihybrid crosses helped reveal the law of independent assortment.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #71
Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

72. The Punnett square was introduced in 1906 by Reginald Punnett and provides a simple and convenient method of tracking possible combinations of gametes that might be produced in a given cross.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #72
Learning Objective: 02-03 Explain Mendels law of segragation.

73. Using the product rule, one would calculate the probability of parents having six children who are all boys as $(½)^6$.

TRUE

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #73
Learning Objective: 02-03 Explain Mendels law of segragation.

74. The sum rule states that the probability of both of two mutually exclusive events occurring is the sum of their individual probabilities.

FALSE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #74
Learning Objective: 02-03 Explain Mendels law of segragation.

75. If you know the phenotype and the dominance relation of the alleles you can predict the genotype.

FALSE

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #75
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

76. An individual can be a heterozygote for one trait and a homozygote for another.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #76
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

77. A testcross is a cross between two heterozygotes.

FALSE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #77
Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

78. At fertilization, in the mating of dihybrids, four different kinds of eggs can combine with four different kinds of pollen, producing a total of sixteen different genotypes.

FALSE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #78
Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

79. During gamete formation, different pairs of alleles on different chromosomes segregate independently of each other.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #79
Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

80. If yellow and round phenotypes in peas are dominant, and pea shape and colour are each controlled by a single gene, you know the genotype of all peas that are green and wrinkled.

TRUE

Accessibility: Keyboard Navigation
Blooms: Apply
Hartwell - Chapter 02 #80
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

81. Several single-gene disorders are more common in some populations of people than in others.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #81
Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

82. A lethal disorder does not include the inheritance of traits that cause death in adulthood.

FALSE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #82
Learning Objective: 02-08 Describe pleiotropy and how it arises.

83. Cross-fertilization is the same as reciprocal cross.

FALSE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #83
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

84. A zygote is a fertilized egg.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #84
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

85. A *YY* or *yy* genotype is called heterozygous.

FALSE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #85
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

86. The progeny of the F_1 generation is also known as the second filial generation

FALSE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #86
Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

87. The law of segregation is a Mendelian law that states that both alleles must separate during gamete formation.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #87
Learning Objective: 02-03 Explain Mendels law of segragation.

88. Multifactorial inheritance is when a phenotype arises as a result of multiple genes interacting with each other and/or the environment.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #88
Learning Objective: 02-08 Describe pleiotropy and how it arises.
Learning Objective: 02-12 Explain the inheritance of continuous traits.

89. The flower colours white, pink, and red indicate codominant inheritance.

FALSE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #89
Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

90. When a late blooming pea and an early blooming pea are crossed and an intermediate phenotype occurs, this result would suggest incomplete dominant inheritance.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #90
Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

91. In codominance, F_1 hybrids show the traits of both parents.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #91
Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

92. Different alleles indicate unique genes.

FALSE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #92
Learning Objective: 02-02 Distinguish between the terms gene and allele and contrast dominant alleles with recessive alleles.

93. Mutations are the source of new alleles.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #93
Learning Objective: 02-07 Explain the terms wild-type allele; mutant allele; monomorphic; and polymorphic.

94. A wild-type allele is any allele whose frequency is closest to 100%.

FALSE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #94
Learning Objective: 02-07 Explain the terms wild-type allele; mutant allele; monomorphic; and polymorphic.

95. A mutant allele has a rare occurrence in a population.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #95
Learning Objective: 02-07 Explain the terms wild-type allele; mutant allele; monomorphic; and polymorphic.

96. Genes with more than one wild-type allele are termed polymorphic.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #96
Learning Objective: 02-07 Explain the terms wild-type allele; mutant allele; monomorphic; and polymorphic.

97. The mouse *agouti* gene has one wild-type allele and several mutant alleles.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #97
Learning Objective: 02-07 Explain the terms wild-type allele; mutant allele; monomorphic; and polymorphic.

98. The phenomenon of a single gene determining a number of distinct and seemingly unrelated characteristics is known as pleiotropy.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #98
Learning Objective: 02-08 Describe pleiotropy and how it arises.

99. In epistasis, one gene's alleles mask the effects of another gene's alleles.

TRUE

Accessibility: Keyboard Navigation
Blooms: Remember
Hartwell - Chapter 02 #99
Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

100. In complementary gene action, dominant alleles of two or more genes are required to generate a particular trait.

TRUE

Accessibility: Keyboard Navigation
Blooms: Understand
Hartwell - Chapter 02 #100
Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

101. You are a judge in a civil trial where a young man is attempting to prove that he is the illegitimate child of a very wealthy man who has recently died. He wishes to be included in the distribution of the wealth. After considering all the testimony about how this person was conceived, the key evidence seems to come down to two main facts. The wealthy man and the mother of the young man are both deaf but the young man is not. Therefore the lawyer of the family suggests that the wealthy man is not the father. The mother, wealthy man, and young man all have O, MM, and Rh Blood Type at the phenotypic level but a genotyping screen indicates that the wealthy man is actually I^AI^A *hh* blood type. How do you interpret the evidence presented and how does it influence your decision in this case?

The fact that the young man can hear is not evidence against his being the son of the wealthy man. Two deaf individuals can, via complementation, give rise to hearing offspring if the mutation they carry is on different genes (hearing is a polygenic trait.) The blood type evidence is definitive in favour of the wealthy man not being the father of the young man. Although both putative parents and the son in question have O blood type, the wealthy man is genetically type A and phenotypically type O because of recessive homozygosity of the *h* allele which leads to Bombay phenotype; the protein to which the A sugar attaches is missing thereby making the wealthy man phenotypically type O. Any son of his would be highly likely to have A-antigen, as the *h* allele is very rare in humans, making homozygous recessive offspring extremely unlikely except in consanguineous matings.

Blooms: Evaluate

Hartwell - Chapter 02 #101

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

102. Calculate the probability of the production of a homozygous recessive genotype for the following cross: *AaBbccddEeFf* × *AaBbCcddEeFf*

¼ × ¼ × ½ × 1 × ¼ × ¼ = 1/512

Blooms: Apply

Hartwell - Chapter 02 #102

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

103. In *Drosophila,* forked (*fk*) bristles are recessive to normal (fk^+) and glassy eyes (*gls*) are recessive to normal (gls^+). If an F_1 heterozygous female is backcrossed to the homozygous wild-type male parent, predict the genotypes and phenotypes of the offspring.

Genotype	Phenotype
$fk^+fk^+gls^+gls^+$	Wild type
$fk^+fk^+gls^+gls$	Wild type
$fk^+fk\ gls^+gls^+$	Wild type
$fk^+fk\ gls^+gls$	Wild type

Blooms: Evaluate

Hartwell - Chapter 02 #103

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

104. A science teacher is attempting to convince her class that alcoholism, which has long been known to be a disease of polygenic inheritance, really is partially genetically determined. You are asked to assist in the design of an experiment that will help show eighth graders genetic transmission of differences in alcohol drinking. You have been given outbred rats as your experimental model. Set up a quantitative experiment that would test the hypothesis that alcoholism, as determined by amount of alcohol drunk, is a quantitative trait.

Set up a selective breeding experiment. Provide rats with water and with a solution of water and alcohol in a low concentration. Measure the consumption of the alcohol-containing solution per day for all rats. Breed the high-drinking male rats with the high-drinking females, and the low-drinking males with low-drinking females. Test the offspring for alcohol solution consumption, and do the same in subsequent generations. If the rats bred for high drinking continue to increase their drinking levels from generation to generation, and the low drinkers decrease their drinking levels in the same way, this is evidence that alcohol consumption is genetically determined. Your data will also show that the individual rats differ in amount of consumption, and when plotted together the data will show a continuous distribution, indicating a quantitative trait (interactions of more than one gene and interactions with the environment contribute to the alcohol drinking trait).

Blooms: Create

Hartwell - Chapter 02 #104

Learning Objective: 02-12 Explain the inheritance of continuous traits.

105. In corn, liguleless (*l*) is recessive to ligules (*L*) and a green leaf (*G*) is dominant to the normal non-green (*g*). If a testcross is performed with a plant that is a dihybrid for both of these genes, what would be the phenotypes and genotypes of the progeny? Assume independent assortment.

Genotype	Phenotype
LlGg	Ligules/Green
Llgg	Ligules/Non-green
llGg	Liguleless/Green
llgg	Liguleless/Non-green

Blooms: Evaluate

Hartwell - Chapter 02 #105

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

106. Short hair in rabbits is produced by a dominant allele (l^+) and long hair by its recessive allele (l). Black hair results from the action of a dominant allele (b^+) and brown hair from its recessive allele (b). Determine the genotypic and the corresponding phenotypic ratios of the F_2 offspring, beginning with a parental cross of a rabbit with brown, short hair to a rabbit with long, black hair. Assume that the parent with short hair is homozygous for that allele, and that the parent with black hair is homozygous for that allele. Assume independent assortment.

#	Genotype	Phenotype
1	$l^+l^+\ b^+b^+$	Short Black
2	$l^+l\ b^+b^+$	Short Black
2	$l^+l^+\ b^+b$	Short Black
4	$l^+l\ b^+b$	Short Black
1	$l^+l^+\ bb$	Short Brown
2	$l^+l\ bb$	Short Brown
1	$ll\ b^+b^+$	Long Black
2	$ll\ b^+b$	Long Black
1	$llbb$	Long Brown

Blooms: Evaluate

Hartwell - Chapter 02 #106

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

107. What does a diamond symbol ◊ in a pedigree indicate?

Sex unspecified

Blooms: Remember

Hartwell - Chapter 02 #107

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

108. You wish to know the genotype of some carrot plants that you have grown in your garden so that you might grow more of them. They have reddish orange flesh, are sweet in taste, long in root, and short in leaf. Using classical genetic techniques how would you determine the genotype?

You need to determine the dominant/recessive nature of each trait. Set up crosses between reddish orange, sweet tasting, long in root, and short in leaf carrot plants and true orange, plain tasting, short in root, and long in leaf carrot plants to determine each dominant trait. Then create a "tester plant" that is recessive for all four traits. Cross your favourite carrot plants with the tester and observe the offspring. The traits shown in the offspring are indicative of the genotype of your original carrot plant.

Blooms: Create

Hartwell - Chapter 02 #108

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

109. In *Drosophila,* forked (*fk*) bristles are recessive to normal (fk^+) and glassy eyes (*gls*) are recessive to normal (gls^+). If a homozygous wild-type male is mated to a forked-bristled, glassy-eyed female, predict the genotypes and phenotypes of the F_2. Assume independent assortment.

# Genotype	Phenotype
1 fk^+fk^+ gls^+gls^+	Wild type
2 fk^+fk^+ gls^+gls	Wild type
2 fk^+fk gls^+gls^+	Wild type
4 fk^+fk gls^+gls	Wild type
1 fk^+fk^+ *gls gls*	Glassy eyes
2 fk^+fk *gls gls*	Glassy eyes
1 *fk fk* gls^+gls^+	Forked bristles
2 *fk fk* gls^+gls	Forked bristles
1 *fk fk gls gls*	Forked bristles and glassy eyes

Blooms: Evaluate

Hartwell - Chapter 02 #109

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

110. In *Drosophila,* forked (*fk*) bristles are recessive to normal (fk^+) and glassy eyes (*gls*) are recessive to normal (gls^+). If a homozygous wild-type male is mated to a forked-bristle, glassy-eye female, predict the genotypes and phenotypes of the F_1.

Genotype	Phenotype
fk^+fk gls^+gls	Wild type

Blooms: Evaluate

Hartwell - Chapter 02 #110

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

111. Short hair in rabbits is produced by a dominant allele (l^+) and long hair by its recessive allele (l). Black hair results from the action of a dominant allele (b^+) and brown hair from its recessive allele (b). Determine the genotypic and the corresponding phenotypic ratios of the F_1 offspring, beginning with a parental cross of a rabbit with brown, short hair to a rabbit with long, black hair. Assume that the parent with short hair is homozygous for that allele, and that the parent with black hair is homozygous for that allele. Assume independent assortment.

Genotype	Phenotype
$l^+l\ b^+b$	short, black

Blooms: Evaluate

Hartwell - Chapter 02 #111

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

112. Stem colour of tomato plants is known to be under the genetic control of at least one pair of alleles such that *A*_ results in the production of anthocyanin pigment (purple stem). The recessive genotype *aa* lacks this pigment and hence is green. The production of two locules (seed chambers) in the tomato fruit is controlled by the dominant allele *M*, and multiple locules is determined by *mm*. Determine the genotypic and phenotypic ratios of the F_1 from a cross between an inbred tomato plant with a purple stem and fruit with two locules crossed to a tomato plant with a green stem and fruit with multiple locules.

Genotype	Phenotype
AaMm	purple, 2 locules

Blooms: Evaluate

Hartwell - Chapter 02 #112

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

113. In corn liguleless, (*l*) is recessive to ligules (*L*) and a green leaf (*G*) is dominant to the normal non-green (*g*). If a plant homozygous for liguleless and green leaves is crossed to one homozygous for non-green with ligules, predict the phenotypes and genotypes of the F_1. Assume independent assortment.

Genotype	Phenotype
LlGg	Ligules/Green

Blooms: Evaluate

Hartwell - Chapter 02 #113

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

114. A cross in which the traits carried by the male parent and the female parent are reversed.

Reciprocal cross

Blooms: Understand

Hartwell - Chapter 02 #114

Learning Objective: 02-01 Explain how monohybrid crosses led Mendel to infer the law of segregation.

115. What are the four general themes that have arisen from Mendel's work?

Variation, as expressed in alternative forms of a trait, is widespread in nature. Observable variation is essential for following inheritance of traits. Variation is not distributed by chance alone but is inherited according to the genetic tenet that "like begets like." Mendel's laws apply to all sexually reproducing organisms.

Blooms: Understand

Hartwell - Chapter 02 #115

116. You are out on a nature walk up in the mountains and you find a pretty wildflower in the lower altitude that is short and bushy with small, fragrant, bright purple flowers. In the higher altitude you find what seems to be the same plant, yet it is tall and sparse with larger flowers of the same colour and fragrance. A) Set up an experiment to test the hypothesis that the plants are different due to genetic but not environmental influences. B) Is it possible to tell if both genetic and environmental effects occur?

A) Assuming these are not endangered plants and you are not in a protected area, obtain several specimens from each location. Plant seeds of both types of plants in both low- and high-altitude locations. Observe the offspring. If the offspring look the same as their parental stock, then the differences are simply genetic in nature. If the offspring look short and bushy with small fragrant, bright purple flowers in the lower altitude, but tall and sparse with larger flowers of the same colour and fragrance in the higher altitude, then the differences are due to environmental influences. B) Yes, a combination of the traits would indicate that both environmental and genetic influences play a role in the differences you have identified.

Blooms: Create

Hartwell - Chapter 02 #116

Learning Objective: 02-11 Distinguish between penetrance and expressivity.

117. In corn liguleless, (*l*) is recessive to ligules (*L*) and a green leaf (*G*) is dominant to the normal non-green (*g*). If a plant homozygous for liguleless and green leaves is crossed to one homozygous for non-green with ligules, predict the phenotypes and genotypes of the F_2.

# Genotype	Phenotype
1 *LLGG*	Ligules/Green
2 *LLGg*	Ligules/Green
2 *LlGG*	Ligules/Green
4 *LlGg*	Ligules/Green
1 *LLgg*	Ligules/Non-green
2 *Llgg*	Ligules/Non-green
1 *llGG*	Liguleless/Green
2 *llGg*	Liguleless/Green
1 *llgg*	Liguleless/Non-green

Blooms: Evaluate

Hartwell - Chapter 02 #117

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

118. Stem colour of tomato plants is known to be under the genetic control of at least one pair of alleles such that *A*_ results in the production of anthocyanin pigment (purple stem). The recessive genotype *aa* lacks this pigment and hence is green. The production of two locules (seed chambers) in the tomato fruit is controlled by the dominant allele M, and multiple locules is determined by mm. Determine the genotypic and phenotypic ratios of the F_2 offspring beginning with a parental cross between an inbred tomato plant that has a purple stem and fruit with two locules, and a tomato plant that has a green stem and fruit with multiple locules. Assume independent assortment.

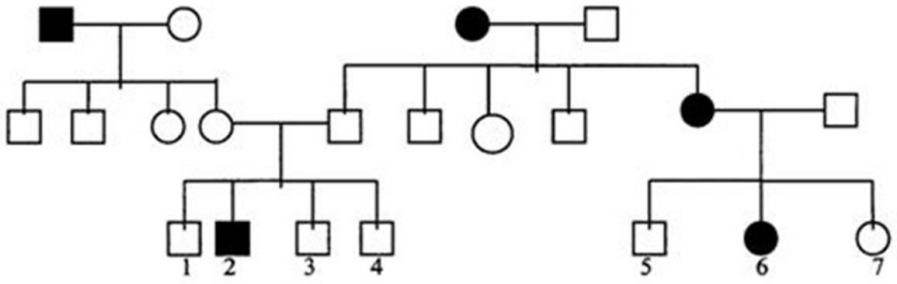
#	Genotype	Phenotype
1	*AAMM*	Purple, 2 locules
2	*AaMM*	Purple, 2 locules
2	*AAMm*	Purple, 2 locules
4	*AaMm*	Purple, 2 locules
1	*aaMM*	Green, 2 locules
2	*aaMm*	Green, 2 locules
1	*AAmm*	Purple, Multi locules
2	*AAMm*	Purple, Multi locules
1	*aamm*	Green, Multi locules

Blooms: Evaluate

Hartwell - Chapter 02 #118

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

119. Below is a pedigree for a human trait. Shaded symbols are for individuals exhibiting the trait. Identify the mode of inheritance of the trait and apply the laws of probability to calculate the probability that individual #4 is a heterozygous carrier of the trait.



Mode of inheritance is recessive. The probability that #4 is a carrier is 1/4, since both of his parents are carriers, and since he does not have the trait himself (i.e. 3 Aa: 1 AA).

Blooms: Evaluate

Hartwell - Chapter 02 #119

Learning Objective: 02-04 Differentiate between the terms homozygous; heterozygous; genotype; and phenotype.

120. In corn, three dominant genes are necessary for aleurone colour. The genotype *B_D_R_* is coloured. Any homozygous recessive for one gene is colourless. Predict the genotypes and phenotypes of the offspring of the cross *BbDdRr* × *BbDdRr*

Phenotype: 27 coloured; 37 colourless

Ratio of Genotypes	
1	*BBDDrr*
2	*BBDdrr*
2	*BbDDrr*
4	*BbDdrr*
1	*BBddrr*
2	*Bbddrr*
1	*bbDDrr*
2	*bbDdrr*
1	*bbddrr*
2	*BBDDRr*
4	*BBDdRr*
4	*BbDDRr*
8	*BbDdRr*
2	*BBddRr*
4	*BbddRr*
2	*bbDDRr*
4	*bbDdRr*
2	*bbddRr*
1	*BBDDRR*
2	*BbDDRR*
2	*BBDdRR*
4	*BbDdRR*
1	*bbDDRR*
2	*bbDdRR*
1	*BBddRR*
2	*bbDdRR*
1	*bbddRR*

Blooms: Evaluate

Hartwell - Chapter 02 #120

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

121. In corn, three dominant genes are necessary for aleurone colour. The genotype *B_D_R_* is coloured. Any homozygous recessive for one gene is colourless. Predict the genotypes and phenotypes of the offspring of the cross *BbDdRR × BbDdRR*

Phenotype: 9 colour; 7 colourless

Ratio of Genotypes	
1	*BBDDRR*
2	*BbDDRR*
2	*BBDdRR*
4	*BbDdRR*
1	*bbDDRR*
2	*bbDdRR*
1	*BBddRR*
2	*bbDdRR*
1	*bbddRR*

Blooms: Evaluate

Hartwell - Chapter 02 #121

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

122. In corn, three dominant genes are necessary for aleurone colour. The genotype *B_D_R_* is coloured. Any homozygous recessive for one gene is colourless. Predict the genotypes and phenotypes of the offspring of the cross *BbDdRR* × *BbDdrr*

Phenotype: 9 colour; 7 colourless

Ratio of Genotypes	
1	*BBDDRr*
2	*BBDdRr*
2	*BbDDRr*
4	*BbDdRr*
1	*BBddRr*
2	*BbddRr*
1	*bbDDRr*
2	*bbDdRr*
1	*bbddRr*

Blooms: Evaluate

Hartwell - Chapter 02 #122

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

123. In rats, the gene for the pigment (*P*) is dominant to no pigment (*p*). The gene for black (*B*) is dominant to the gene for cream (*b*). If a pigment gene (*P*) is absent, genes *B* and *b* are inoperative. Predict the genotypes and phenotypes of the F_1 of a cross between a homozygous black rat and an albino homozygous for cream.

Genotype	Phenotype
PpBb	Black

Blooms: Apply

Hartwell - Chapter 02 #123

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

124. In rats, the gene for the pigment (*P*) is dominant to no pigment (*p*). The gene for black (*B*) is dominant to the gene for cream (*b*). If a pigment gene (*P*) is absent, genes *B* and *b* are inoperative. Predict the genotypes and phenotypes of the F_2 of a parental cross between a homozygous black rat and an albino homozygous for cream.

9 Black; 3 cream; 4 colourless

	Genotype	Phenotype
1	*PPBB*	Black
2	*PPBb*	Black
2	*PpBB*	Black
4	*PpBb*	Black
1	*ppBB*	colourless
2	*ppBb*	colourless
1	*PPbb*	cream
2	*Ppbb*	cream
1	*ppbb*	colourless

Blooms: Analyze

Hartwell - Chapter 02 #124

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

125. In the common daisy, the genes *A* and *a* and *B* and *b* represent two pairs of alleles acting on flower colour. *A* and *B* are required for colour. The alleles of these two genes show recessive epistasis. The two gene pairs together thus show duplicate recessive epistasis. Predict the genotypes and phenotypes of the F_1 of a cross between two colourless plants, one homozygous for *A* and the other homozygous for *B*.

Genotype	Phenotype
AaBb	Colour

Blooms: Apply

126. In the common daisy, the genes *A* and *a* and *B* and *b* represent two pairs of alleles acting on flower colour. *A* and *B* are required for colour. The alleles of these two genes show recessive epistasis. The two gene pairs together thus show duplicate recessive epistasis. Predict the genotypes and phenotypes of the F_2 of a cross between two colourless plants, one homozygous for *A* and the other homozygous for *B*.

9 Black; 7 colourless

	Genotype	Phenotype
1	*AABB*	Colour
2	*AABb*	Colour
2	*AaBB*	Colour
4	*AaBb*	Colour
1	*aaBB*	Colourless
2	*aaBb*	Colourless
1	*AAbb*	Colourless
2	*Aabb*	Colourless
1	*aabb*	Colourless

Blooms: Apply

Hartwell - Chapter 02 #126

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

127. In poultry, if a Black Longshank male with feathered shanks is crossed with a Buff Rock female with unfeathered shanks the F_1 are all feathered and the F_2 show 90 feathered to 6 unfeathered. Infer the genotypes of the parents.

AABB × *aabb*; The ratio is a 15:1 which is a dihybrid ratio; therefore the parents are homozygous and produce a heterozygous F_1.

Blooms: Evaluate
Hartwell - Chapter 02 #127
Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

128. In a certain breed of plants, dark green is determined by the dominant gene *G* and light green is determined by the recessive gene *g*. The heterozygote shows 75% penetrance for the dominant phenotype. If the parental cross is *GG* × *gg,* what phenotype distribution would be expected in a population of 400 F_2 plants?

250 dark green (*GG* + 75% *Gg*); 150 light green (*gg* + 25% *Gg*)

Blooms: Apply
Hartwell - Chapter 02 #128
Learning Objective: 02-11 Distinguish between penetrance and expressivity.

129. A man with blood type A whose father was blood type O married a woman of blood type B whose mother was blood type O. What are the possible blood types of their offspring?

Blood types A, B, AB, and O are possible.

Blooms: Apply
Hartwell - Chapter 02 #129

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

130. What phenotypes and genotypes would you expect from the following cross of blood-related genotypes?

$I^B\ i\ rh^+\ rh^+ \times I^A i\ rh^+\ rh$

$I^BI^Arh^+rh$	AB positive
$I^BI^Arh^+rh^+$	AB positive
I^Birh^+rh	B positive
$I^Birh^+rh^+$	B positive
I^Airh^+rh	A positive
$I^Airh^+rh^+$	A positive
$ii\ rh^+rh$	O positive
$ii\ rh^+rh^+$	O positive

Blooms: Evaluate

Hartwell - Chapter 02 #130

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

131. Coat colour in a certain species of rabbit is governed by multiple alleles. The dominance series for these alleles is as follows: coloured (c^+), chinchilla, (c^{ch}), himalayan (c^h) and albino (c). Give the phenotypes and ratios from the following crosses: (A) $c^+c \times c^h\ c^h$ (B) $c^+c^+ \times c^h\ c^{ch}$ (C) $c^+\ c \times c^hc$ (D) $c\ c \times c^hc^{ch}$ (E) $c^+\ c^h \times c^h\ c^{ch}$ (F) $c^+\ c^{ch} \times c^hc^{ch}$ (G) $c\ c \times c^+c^{ch}$.

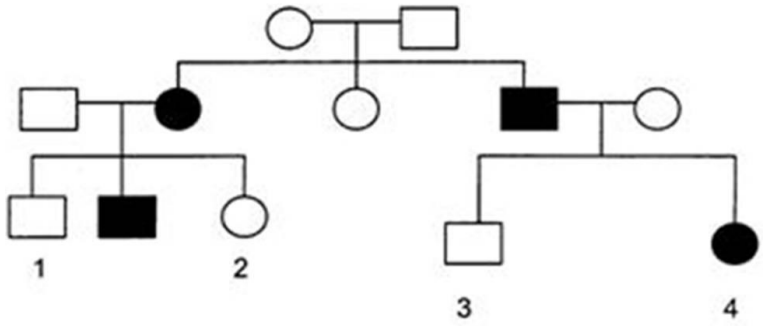
(A) 2 coloured : 2 himalayan (B) all coloured (C) 2 coloured : 1 himalayan : 1 albino (D) 2 himalayan : 2 chinchilla (E) 2 coloured : 1 himalayan : 1 chinchilla (F) 2 coloured : 2 chinchilla (G) 2 coloured : 2 chinchilla.

Blooms: Evaluate

Hartwell - Chapter 02 #131

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

132. Affected individuals in the following pedigree are homozygous for the allele that causes the trait. What are the possible genotypes of persons 1, 2, 3 and 4?



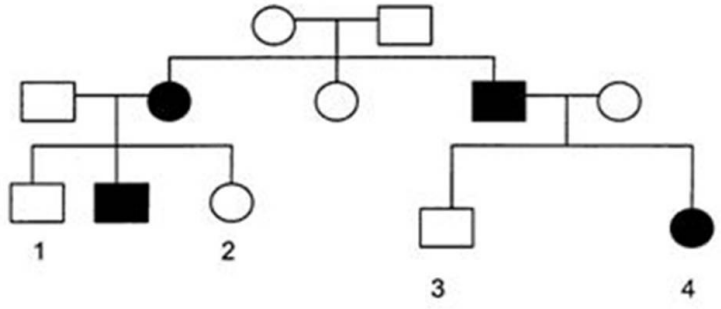
Persons 1, 2, 3 are Aa. Person 4 is AA.

Blooms: Apply

Hartwell - Chapter 02 #132

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

133. The pedigree shown is for a human genetic disease in which solid colour indicates affected individuals. Affected individuals in the pedigree are homozygous for the allele that causes the trait. Apply the laws of probability and calculate the probability, the offspring of the cousin marriage (individual 2 × individual 3) will exhibit the disease.



The trait is a recessive trait. Individual #2 and individual #3 are both carriers, therefore, there is a ¼ chance their offspring will be homozygous for the recessive allele.

Blooms: Analyze

Hartwell - Chapter 02 #133

Learning Objective: 02-05 Analyze Mendels law of independent assortment; and explain how Mendel proposed the law from dihybrid crosses.

134. The following five mothers, (a) through (e), with phenotypes given, each produced one child whose phenotype is described as to blood group (A, B, O), M or N antigens, and Rh factor. For each child, select as the father, one of the five males whose genotypes are given. For some children, more than one male may be a possible father.
(*ii* = Type O blood, *rr* = rh & **R** = rh$^+$]

	Maternal Phenotype	Child Phenotype	Genotype of Male
(a)	A M R	O M R	1. I^Ai MN rr
(b)	B N r	O N r	2. I^Bi MN RR
(c)	O M r	A MN R	3. iiNNrr
(d)	A N R	AB MN R	4. iiMMrr
(e)	AB MN r	A MN r	5. I^AI^AMNRR

For the child of mother (a), the father could be 1 or 4. For the child of mother (b), the father could be 1 or 3. For the child of mother (c), the father could be 5. For the child of mother (d), the father could be 2. For the child of mother (e), the father could be 1 or 3 or 4.

Blooms: Evaluate

Hartwell - Chapter 02 #134

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

135. You have obtained an interesting flower for your garden from your neighbour. The neighbour has given you two pure lines of the plant, one with red flowers and one with yellow flowers. You decide to cross them and find that you obtain all orange flowers. The curious molecular geneticist in you decides to test two independent hypotheses: Hypothesis 1: Incomplete dominance; Hypothesis 2: Recessive epistasis. The first step in your test is to self the F_1 orange plants, which you complete only to find that the results do not statistically distinguish the two hypotheses. a) What ratio of yellow, orange, and red would you expect in the F_2 population for each hypothesis and b) what crosses would you complete next to definitively test your two hypotheses?

a) The expected phenotypic ratio for recessive epistasis is 9:3:4, and for incomplete dominance, 1:2:1. b) Cross the yellow F_2 flowers with true breeding red flowers. If the hypothesis for incomplete dominance is correct, the yellow colour will be determined by a single gene and all F_2 yellow flowers will be homozygous recessive and give rise to only orange flowers in the F_3 population [*aa* × *AA* = *Aa*]. However, if the hypothesis for recessive epistasis is correct, a cross of F_2 yellow and true breeding red flowers will give rise to some red and some orange flowers [*Yyrr* × *yyRR* = either *yyRr* or *YyRr*].

Blooms: Create

Hartwell - Chapter 02 #135

Learning Objective: 02-06 Compare and contrast complete dominance; incomplete dominance; and codominance relationships; and demonstrate how a dominance series can be established.

136. Genes *A* and *B* are required for colour. If *A* or *B* is absent (that is, *aa* or *bb*) the result is colourless. Give the genotypes and phenotypes for each F_1 and F_2 progeny of the cross *AAbb* × *aabb*

F_1 = *Aabb*/All colourless; F_2 = 1*AAbb*: 2*Aabb*: 1*aabb*/All colourless

Blooms: Evaluate

Hartwell - Chapter 02 #136

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

137. Genes *A* and *B* are required for colour. If *A* or *B* is absent (that is, *aa* or *bb*) the result is colourless. Give the genotypes and phenotypes for each F_1 and F_2 progeny of the cross *aaBB* × *aabb*

F_1 = *aaBb*/All colourless; F_2 = 1*aaBB*: 2*aaBb*: 1*aabb*/All colourless

Blooms: Evaluate

Hartwell - Chapter 02 #137

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

138. Genes *A* and *B* are required for colour. If *A* or *B* is absent (that is, *aa* or *bb*) the result is colourless. Give the genotypes and phenotypes for each F_1 and F_2 progeny of the cross *AAbb* × *aaBB*

F_1 = *AaBb* coloured; F_2 = 9 coloured; 7 colourless

Genotype	Phenotype
For F_1:	
AaBb	Coloured
For F_2:	
1*AABB*	Coloured
2*AABb*	Coloured
2*AaBB*	Coloured
4*AaBb*	Coloured
1*aaBB*	Colourless
1*AAbb*	Colourless
2 *aaBb*	Colourless
2*Aabb*	Colourless
1*aabb*	Colourless

Blooms: Evaluate

Learning Objective: 02-09 Compare and contrast complementary gene action; recessive epistasis; and dominant epistasis.

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