

1. What types of gametes are produced by individuals that are XxZz, if X and Z are on one homolog, x and z are on the other homolog, and crossing over takes place during 20% of the meiotic events?

30% X Z; 30% x z ; 20% X z; 20% x Z

40% X Z; 40% x z; 10% X z; 10% x Z

*45% X Z; 45% x z; 5% X z; 5% x Z

80 % Xx Zz; 20% xx zz

80% Xx Zz; 10% XX ZZ; 10% xx zz

none of the above

2. In Drosophila, the allele dp+ determines long wings and the recessive dp determines short ("dumpy") wings. At a separate locus e+ determines tan body and the recessive e determines ebony body. Both loci are autosomal. The following crosses were made, starting with pure-breeding parents: long ebony male x dumpy tan female; F1 long tan female test-crossed to dumpy ebony male; F2: 54 long ebony; 47 long, tan; 52 dumpy, tan; 47 dumpy ebony. Use a Chi square test to determine if these loci are linked.

Chi-squared = 0; df = 3; P>0.90; loci are not linked

Chi-squared = 0.76; df = 3; 0.50<P<0.90; loci are linked

*Chi-squared = 0.76; df = 3; P>0.90; loci are not linked

Chi-squared = 38; df = 3; P<0.001; loci are linked

Chi-squared = 38; df = 3; P<0.001; loci are not linked

none of the above

ct, y, v	54
ct, y, +	349
ct, +, v	4
ct, +, +	93
+, y, v	97
+, y, +	6
+, +, v	331
+, +, +	66

3. In Drosophila, the genes ct (cut wing margin), y (yellow body), and v (vermillion eye color) are X-linked. Females heterozygous for all three markers were mated with wildtype males, and the male progeny were obtained in the numbers shown in the table above. As is conventional in genetics, the wild type allele of each gene is designated by a + sign in the appropriate column. Each homologous chromosome is symbolized by /. What is the linkage phase of the heterozygous female parent, and what is the order of the genes?

+ + + // ct y v

+ + v // ct y +

+ + + // y ct v

*+ + v // y ct +

+ ct + // y + v

ct + + // + y v

none of the above

4. For the three-point cross above, calculate the map distance between genes and the interference.

0.2 mu; 0.13 mu; I=0.38

*0.2 mu; 0.13 mu; I=0.62

2 mu; 1.3 mu; I=0.38

2 mu; 1.3 mu; I=0.62

20 mu; 13 mu; I=0.38

20 mu; 13 mu; I=0.62

none of the above

5. Cystic fibrosis is a recessive disorder that is lethal without medical attention.

If the mutation rate to the cystic fibrosis allele is 1×10^{-5} , what is the expected equilibrium allele frequency, and what is the expected proportion of individuals who are heterozygotes for the cystic fibrosis allele?

0.00001, 0.00002

0.0001, 0.006

0.001, 0.00002

*0.003, 0.006

0.05, 0.00002

none of the above

6. Based on the information given above, what is the expected frequency of individuals born with cystic fibrosis in a population in Hardy-Weinberg equilibrium? Would this frequency be higher or lower in a population that undergoes inbreeding?

*0.00001, higher

0.0001, lower

0.001, lower

0.003, higher

0.05, lower

none of the above

7. In areas where malaria is endemic, the allele causing sickle-cell anemia is in high frequency. In a certain population, the fitness of homozygotes for the normal allele is 0.8, the fitness of homozygotes for the sickle-cell allele is 0.0, and the fitness of heterozygotes is 1.0. This form of selection is called

Directional selection

Frequency-dependent selection

*Heterozygote advantage

Mutation-selection balance

Under-dominance

None of the above

8. In the problem above, predict the equilibrium frequency of the sickle-cell allele:

0.00
0.12
*0.17
0.20
0.83
none of the above

9. Which evolutionary process causes deviations from Hardy-Weinberg genotype proportions, but does not change allele frequencies? What evolutionary process tends to equalize allele frequencies among subpopulations?

Inbreeding; genetic drift
*Inbreeding; migration
Migration; selection
Migration; selection
Mutation; migration
Selection; genetic drift
None of the above

10. Which evolutionary process causes adaptive evolution and which causes changes in allele frequencies due to sampling variation?

Inbreeding; genetic drift
Inbreeding; migration
Migration; selection
Migration; selection
Mutation; migration
*Selection; genetic drift
None of the above

11. The decline in fitness that accompanies inbreeding is due to

*increased proportion of homozygotes for deleterious alleles
increased proportion of heterozygotes for deleterious alleles
increased proportion of homozygotes for beneficial alleles
increased proportion of heterozygotes for beneficial alleles
increased proportion of homozygotes for dominant alleles
none of the above

12. A mouse geneticist wants to create a completely inbred strain of mice for use in cancer research. Beginning with a single unrelated male and female, she propagates the mice through 10 generations of brother-sister mating. What will be the heterozygosity of the resulting inbred line, relative to the heterozygosity in the non-inbred progenitor line?

0%
0.0001%
0.10%
*6%
60%

none of the above

13. Assume that a cross is made between tall and dwarf tobacco plants. The F1 generation showed intermediate height while the F2 generation showed a distribution of height ranging from tall to dwarf, like the original parents, and many heights between the extremes. These data are consistent with the following mode of inheritance.

Alteration of generations

Hemizyosity

Incomplete dominance

*Multi-gene inheritance

codomiannce

14. A strain of laboratory mice used in cancer research is completely inbred. That is, all individuals in the strain are homozygous at every locus (heterozygosity=0) and all individuals have the same allele at every locus in the genome. Predict the narrow-sense heritability of susceptibility to lymphoma in this strain.

*0

0.33

0.5

0,67

1.0

Cannot tell without further information

15. A fisheries scientist wants to increase the average length of one-year old trout produced by the hatchery. Broad-sense heritability is 0.65 and narrow-sense heritability is 0.48. The current trout population has an average length of 16.5 inches at one year of age. If trout that averaged 20.5 inches at one year of age are selectively bred, what would the expected average length of trout be after one round of selection?

13.9 inches

14.6 inches

16.5 inches

*18.4 inches

19.1 inches

none of the above

	shank length	neck length	Body mass index
Environmental variance	250	300	60
Additive genetic variance	80	100	40
Dominance genetic variance	15	250	15

16. In a large herd of cattle, three continuously distributed traits were measured and variances for these traits are given below in the table above. What is the phenotypic variance for body mass index?

0

0.35

15

40

60

100

*none of the above

17. What are the broad-sense and narrow-sense heritabilities of shank length, respectively?

0,0

0.23, 0.28

*0.28, 0.23

0.32, 0.38

0.38, 0.32

none of the above

18. Which trait should respond most quickly to artificial or natural selection?

Shank length

Neck length

*Body Mass Index

All about the same

None of the above