

Population Genetics

1. Genetic _____ that influences the characteristics of organisms provide the raw material for natural selection.
2. Darwin never used the term “evolution” – he used the term “descent _____.”
3. Jean-Baptiste Lamarck proposed that evolution occurred by the _____.
4. Natural populations contain considerable amounts of genetic variation in all organisms including humans. Such variation cannot be fully accounted by _____ alone.
5. A _____ locus exhibits more variation than is expected by mutation.
6. Migration and hybridization between individuals of adjacent populations causes gene _____.
7. Random changes in the _____ of alleles at a given locus is known as genetic drift.
8. In order to study evolution we must study the properties of genes first within individuals and then within _____.
9. Genotypes are said to be in _____ - _____ equilibrium if there is random mating and no other forces tend to alter the proportions of alleles from one generation to the next.
10. The key point in Darwin's proposal is that the _____ imposes the conditions that determine the results of selection and thus the direction of selection.
11. The early theory, later disproved, that suggested offspring were always intermediate types relative to their parents, is the theory of _____.
12. Selection cannot alter a trait with little or no genetic variation and will not eliminate _____ alleles.
13. Natural selection as a mechanism of evolution that acts on variants within populations and ultimately leads to the evolution of different species was proposed by
 - A. Mendel
 - B. Lyell
 - C. Malthus
 - D. Darwin
 - E. Founder
14. Features that increase the likelihood of survival and reproduction by an organism in a particular environment are called
 - A. genes
 - B. alleles
 - C. mutations
 - D. adaptations
 - E. selection

15. The gene pool includes
- A. all of the fitness within a population
 - B. all of the individuals within a population
 - C. all of the mutations within a population
 - D. all of the adaptations within a population
 - E. all of the alleles of genes within a population
16. The founder principle explains how rare alleles and a combination of alleles may be enhanced in new
- A. populations
 - B. clines
 - C. bottleneck areas
 - D. migratory areas
 - E. genomes
17. A restriction in genetic variability caused by a drastic reduction in population size is called a
- A. founder effect
 - B. Hardy-Weinberg effect
 - C. bottleneck effect
 - D. polymorphic effect
 - E. adaptive effect
18. The genetic contribution of an individual to succeeding generations, compared with that of other individuals in the population, is known as
- A. variation
 - B. microevolution
 - C. macroevolution
 - D. fitness
 - E. adaptive makeup
19. Darwin proposed that natural selection occurs in an environment by
- A. favoring heritable features that make the organism better suited to survive and reproduce
 - B. producing a constant number of offspring while in that environment
 - C. surviving for a fixed amount of time
 - D. resisting the environment and keeping the environment from changing
 - E. all of the above

20. The Hardy-Weinberg equations only hold true, that is, a population is only in equilibrium
- A. when immigration in and out of the area are held constant
 - B. when changes only take place over long periods of time
 - C. when it includes episodes of extinction
 - D. when the population is designed to survive in new habitats
 - E. when all of the Hardy-Weinberg assumptions are correct
21. In the Hardy-Weinberg equations the frequencies of 2 alleles in a population (where there are only 2 alleles to consider) can be designated as
- A. a and b
 - B. p and q
 - C. p^2 and q^2
 - D. $2pq$
 - E. all of the above
22. “The inheritance of acquired characteristics” proposal was put forward by
- A. Darwin
 - B. Lamarck
 - C. Wallace
 - D. Founder
 - E. Hardy-Weinberg
23. The frequency of a particular allele within a population can be changed, over time, by
- A. genetic outflow
 - B. gene expression
 - C. selection
 - D. steroid interaction
 - E. random mating
24. The genetic preservation of the features that increase the likelihood of survival and reproduction of some individuals within a population is called the process of
- A. natural selection
 - B. creation of new species
 - C. genetic drift
 - D. outcrossing
 - E. increasing evolutionary resistance

25. Which of the following describes Darwin's explanations for evolution?
- A. new species formation is through adaptational changes; populations are independent of environment; learned experiences pass on to the next generation
 - B. adaptational changes accumulate; natural selection is responsible for changes within a population
 - C. new species formation is spontaneous; populations are independent of environment; learned experiences pass on to the next generation
 - D. all of the above
 - E. a and b
26. Biologists examined the question of variation in different genes through studies on
- A. blood groups
 - B. enzymes
 - C. pigments
 - D. a, b, c
 - E. a and b only
27. Enzyme loci of a typical human being are heterozygous to about
- A. 1%
 - B. 5%
 - C. 10%
 - D. 50%
 - E. 100%
28. A locus with more variation than can be explained by mutation is referred to as
- A. polyzygous
 - B. polynomial
 - C. polymorphic
 - D. polyloci
 - E. polyvariant
29. Hardy-Weinberg pointed out that the original proportions of the genotypes in a population will remain constant from generation to generation if certain assumptions are met. These are
- A. the population is very large and random mating is occurring
 - B. no gene mutation and migration takes place
 - C. no selection occurs
 - D. a, b, and c
 - E. a and b only

30. For a gene with two alternative alleles, A (frequency p) and a (frequency q), the term in the algebraic form of the Hardy-Weinberg equilibrium for the heterozygote genotype frequency is
- A. p^2
 - B. q^2
 - C. $2pq$
 - D. $(p+q)^2$
 - E. $2Aa$
31. Which one of the following is not an agent of natural evolutionary change?
- A. mutation
 - B. migration
 - C. genetic drift
 - D. non-random mating
 - E. artificial selection
32. The phenomenon in which rare alleles become more common in new populations is called
- A. founder effect
 - B. gene flow
 - C. genetic drift
 - D. assortative mating
 - E. mutation
33. In small populations, frequencies of certain alleles may change by chance alone. Such random change in the frequency of alleles is called
- A. mutation
 - B. migration
 - C. genetic drift
 - D. nonrandom mating
 - E. selection
34. The type of non-random mating that causes the frequencies of particular genotypes to differ greatly from those predicted by the Hardy-Weinberg equilibrium is called
- A. mutation
 - B. migration
 - C. genetic drift
 - D. assortative mating
 - E. selection

35. Sometimes a restriction in genetic variability is imposed on populations by natural catastrophes such as flooding, earthquake, etc. The surviving individuals reflect only a small, random genetic sample of the population affected. This process is termed
- A. mutation
 - B. migration
 - C. genetic drift
 - D. assortative mating
 - E. bottleneck effect
36. Gene flow, defined as the movement of genes from one population to another, can take place by migration, as well as
- A. mating with certain trait-containing individuals
 - B. mating with dominant phenotypes
 - C. hybridization between individuals of adjacent populations
 - D. removing the barriers between the populations
 - E. physical movement of genes within an individual by transposons
37. In some populations the drive is to mate with individuals that are phenotypically different at a variety of loci. This leads to large numbers of heterozygotes and is called
- A. neutral theory
 - B. disassortative mating
 - C. shifting balance theory
 - D. bottleneck effect
 - E. founder effect
38. There are 5 agents of evolutionary change
- A. mutation, point mutation, transposition, deletion, crossing over
 - B. mutation, gene flow, nonrandom mating, genetic drift, selection
 - C. founder principle, bottleneck effect, genome effect, gene flow, selection pressure
 - D. gene flow, Hardy-Weinberg effect, p^2 , q^2 , mutation
 - E. there are more than 5 agents, all of the above cause evolution change
39. Populations of humans are known to have founder effects. For instance there are small populations in the US that frequently show
- A. 6 fingers
 - B. 4 fingers
 - C. complete hairlessness
 - D. blue hair
 - E. no human populations are known to have founder effects

40. In order for natural selection to occur within a population, three conditions must be met. These include
- A. phenotypic differences resulting from environmental conditions
 - B. frequent mutations that are inherited
 - C. low rates of immigration
 - D. phenotypic variations that are genetic
 - E. all of the above
41. About 80% of present-day thoroughbred horses can be dated back to 31 known ancestors from the late eighteenth century. This means
- A. the phenotypic differences are very low
 - B. the proto-allelic differences are very low
 - C. the genotypic differences are very low
 - D. the hybridization rates are very low
 - E. the allelopathy rates are very high
42. When selection acts to eliminate one extreme from an array of phenotypes it is called
- A. natural selection
 - B. stabilizing selection
 - C. disruptive selection
 - D. directional selection
 - E. artificial selection
43. The total of all of alleles in the entire population can be thought of as
- A. an allele mixture
 - B. a gene pool
 - C. a genetic melting pot
 - D. a genome
 - E. variant genes
44. Certain small towns in the western United States have remained isolated and inbred since their settlement many years ago. Some alleles are more common in these communities as compared to the rest of the population. This effect is known as
- A. artificial selection
 - B. directional selection
 - C. disrupting selection
 - D. Hardy-Weinberg principle
 - E. founder principle

45. Cheetahs have been through a genetic bottleneck; evidence for this is that
- A. little natural selection occurs in this species
 - B. the body is long, thin, and graceful
 - C. there is very little genetic variability
 - D. these cats are members of an endangered species
 - E. they originally came from small areas of Africa
46. Compared with Hardy-Weinberg predictions, populations that have practiced assortative mating have
- A. fewer homozygotes
 - B. less natural selection
 - C. more heterozygotes
 - D. more homozygotes
 - E. more mutations
47. Which of the following characteristics are found in a species?
- A. members are generally similar genotypically
 - B. members mate with other members
 - C. members do not usually mate outside the species
 - D. sterile offspring usually result from mating outside the species
 - E. all of the above

Use the following scenario to answer Questions 48-52

After a coastal storm 3 deermice (*Peromyscus*), huddled on a tree trunk, are carried several miles out to sea and wash ashore on a small island that has no mice, but can certainly support them. Deermice eat seeds, primarily. The island has one side covered with decomposed black lava and ash, and black sands from an ancient volcano; the rest of the island has typical desert vegetation and white sandy beaches. The entire island has lots of plants and places for mice to live. There are small groundnesting birds, hawks, and a variety of lizards living on the island. Two of the mice are female, and they both mate with the male.

48. The major limiting factor for the future population of island deermice is
- A. the phenotype of the male
 - B. the genotype of the male
 - C. the phenotypes of the two females
 - D. the genotypes of the two females
 - E. none of the above

49. Many thousands of years pass. Someone coming to the island might find
- A. a population of very dark mice
 - B. a population of very light mice
 - C. two populations of mice, one light and one dark, that seldom interbreed
 - D. a population of mice that interbreeds but has a lot of phenotypic variation in coat color
 - E. a population of mice that are mottled light and dark
50. The reason that there are changes in coat color of the deermice is
- A. competition
 - B. genetic drift
 - C. the hawks
 - D. founder effect
 - E. bottleneck effect
51. Although it was a rare trait in the mainland population, one of the original female mice is homozygous for very large ears. This will lead to a population with a higher incidence of big ears than the mainland population because of
- A. bottleneck effect
 - B. founder effect
 - C. mutation
 - D. genetic drift
 - E. selection pressure
52. At least some of the requirements for a Hardy-Weinberg equilibrium would be in effect on the island. For instance there is probably
- A. high rates of immigration
 - B. very large population size
 - C. no immigration
 - D. no mutation
 - E. none of the above
53. In negative frequency-dependent selection, such as in the study done on the water boatman insect
- A. the incidence of predation leads to extinction of a rare genotype
 - B. the incidence of predation leads to even distribution of genotype frequencies
 - C. the incidence of predation leads to an increase in a rare genotype
 - D. the level of predation on the rarest allele causes an increase in that homozygous phenotype
 - E. both c and d

54. In some instances environmental change causes a situation where one phenotype is favored for a period of time, and then a different phenotype is favored. This oscillating selection causes
- A. the maintenance of genetic variation in the population
 - B. extinction of the rarer genotypes because of uneven selection
 - C. an increase in point mutations
 - D. high population increase to maintain phenotypic variation
 - E. both b and d

55. The text discusses sickle-cell anemia, which is a classic example of
- founder effect
 - genetic bottleneck
 - point mutation
 - heterozygote advantage
 - none of the above
56. In disruptive selection, over time
- a population goes extinct
 - the most extreme outliers of a population are eliminated (e.g., the largest beaks and smallest beaks are eliminated)
 - the population is strongly selected for in one direction (e.g., larger beak size)
 - the population is strongly selected for in two directions (e.g., larger beak size and smaller beak size)
 - a population increases its variation (e.g., a wide selection of all beak sizes)
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58. Match each of the following.
- | | |
|--|---|
| _____ A. both extremes of an array of phenotypes are favored | 1. directional selection |
| _____ B. one extreme of an array of phenotypes is favored | 2. stabilizing selection |
| _____ C. small, drab, early reproduction is favored | 3. disruptive selection |
| _____ D. the midrange of an array of phenotypes is favored | 4. guppies with pike cichlids and killifish |
| _____ E. large, colorful, later reproduction is favored | 5. guppies with killifish |

Answer Key

No. on Test	Correct Answer
1	variation
2	with modification
3	inheritance of acquired characteristics
4	mutation
5	polymorphic
6	flow
7	frequency
8	populations
9	Hardy-Weinberg
10	environment
11	blended inheritance
12	recessive
13	D
14	D
15	E
16	A
17	C
18	D
19	A
20	E
21	B
22	B
23	C
24	A
25	B
26	E
27	B
28	C
29	D
30	C
31	E
32	A
33	C

34	D
35	E
36	C
37	B
38	B
39	A
40	D
41	C
42	D
43	B
44	E
45	C
46	D
47	E
48	B
49	C
50	C
51	B
52	C
53	E
54	A
55	D
56	D
57	C
58	1-B, 2-D, 3-A, 4-C, 5-E