

CHAPTER 2: HEREDITY AND EVOLUTION

Questions included in web quizzing are marked in bold

Multiple Choice Questions

1. Gregor Mendel is known for which of the following?
 - a. He developed theories of evolutionary change.
 - b. He discovered the structure of the DNA molecule.
 - c. He studied characteristics that are influenced by several genetic loci.
 - d. He discovered the fundamental principles of how traits are inherited.
 - e. He developed the theory of inheritance of acquired characteristics.

ANS: d REF: p. 74 SOURCE: PICKUP

2. How do the basic principles of inheritance, identified by Mendel in plants, differ from those in humans?
 - a. They are simpler.
 - b. Plants don't have alleles.
 - c. There are no differences since the basic principles are the same.
 - d. There are no Mendelian traits in humans.
 - e. The number of chromosomes is different; therefore the genetic principles are different.

ANS: c REF: p. 74 SOURCE: PICKUP

3. When Mendel crossed true breeding tall and short parental plants, what was produced?
 - a. All the offspring were tall.
 - b. Half the offspring were tall, the other half were short.
 - c. All the offspring were short.
 - d. The offspring were intermediate in height relative to the two parent plants.
 - e. About 90 percent were tall, but the rest were short.

ANS: a REF: p. 74 SOURCE: PICKUP

4. In Mendel's experiments, what was the ratio of tall to short plants in the F₂ generation?
 - a. 15 to 1
 - b. 3 to 1
 - c. ½ tall, ½ short
 - d. 4 to 1
 - e. 5 to 1

ANS: b REF: p. 75 SOURCE: PICKUP

5. Which statement concerning the F₁ plants in Mendel's experiments is *false*?
 - a. They were hybrids.
 - b. They were heterozygous for the traits in question.
 - c. Their parents were homozygous for the traits in question.
 - d. All F₁s displayed the dominant trait in their phenotype.
 - e. All F₁s displayed the recessive trait in their phenotype.

ANS: e REF: p. 77 SOURCE: NEW

6. A person who is homozygous recessive at a locus has which of the following?
- two copies of the recessive allele
 - two copies of the dominant allele
 - an autosomal trisomy
 - a recessive allele on the X chromosome only
 - a recessive allele on the Y chromosome only

ANS: a REF: p. 76 SOURCE: PICKUP

7. What is the term for the condition of two copies of the same allele being present in the genotype?
- dominant
 - codominant
 - recessive
 - homozygous
 - segregated

ANS: d REF: p. 76 SOURCE: PICKUP

8. In Mendel's experiments, the tall parental (P) plants
- were homozygous for the allele for tallness
 - were heterozygous at the locus controlling height
 - could NOT be crossed with short plants
 - were homozygous for the allele for shortness
 - were heterozygous for the allele for shortness

ANS: a REF: p. 76 SOURCE: NEW

9. What is an individual's actual genetic make-up called?
- phenotype
 - homozygosity
 - recessiveness
 - phenotypic ratio
 - genotype

ANS: e REF: p. 77 SOURCE: PICKUP

10. According to the principle of independent assortment there is a _____ chance that any tall pea plant will produce either yellow or green peas.
- 0 percent
 - 25 percent
 - 50 percent
 - 75 percent
 - 100 percent

ANS: c REF: p. 78 SOURCE: PICKUP

11. What is the term used to refer to the observable, physical expression of genotypes?
- genotype
 - phenotype
 - phenotypic ratio

- d. **genotypic ratio**
- e. **independent assortment**

ANS: b REF: p. 78 SOURCE: NEW

12. Mendelian traits

- a. **are governed by more than one genetic locus**
- b. **occur only in some people**
- c. **are always dominant**
- d. **are governed by one genetic locus**
- e. **are always recessive**

ANS: d REF: p. 78 SOURCE: PICKUP

13. Gregor Mendel

- a. **published his results and won the Nobel Prize for his discoveries**
- b. **was trained as a geneticist**
- c. **did not know about chromosomes**
- d. **was a professor at the University of Vienna**
- e. **never published his work**

ANS: c REF: p. 78 SOURCE: PICKUP

14. The ABO blood type system consists of _____ alleles.

- a. 6
- b. 4
- c. 3
- d. 2
- e. 5

ANS: c REF: p. 80 SOURCE: PICKUP

15. Which of the following is *not* a polygenic trait?

- a. stature
- b. skin color
- c. eye color
- d. ABO blood type
- e. hair color

ANS: d REF: p. 82 SOURCE: PICKUP

16. What is it called when a person possesses two different alleles at the same locus, and both alleles are expressed in the phenotype?

- a. recessiveness
- b. codominance
- c. dominance
- d. homozygosity
- e. X-linkage

ANS: b REF: p. 80 SOURCE: PICKUP

17. What is type AB blood an example of?

- a. codominance
- b. blending
- c. recessiveness
- d. dominance
- e. polygenic inheritance

ANS: a

REF: p. 80

SOURCE: PICKUP

18. How many ABO phenotypes (blood types) are there?

- a. 4
- b. 2
- c. 3
- d. 6
- e. 1

ANS: a

REF: p. 80

SOURCE: PICKUP

19. Mendelian traits are described as discrete, or discontinuous because

- a. Their phenotypic expressions overlap
- b. Their phenotypic expressions do not fall into clearly defined categories
- c. Their genotypic expression overlap
- d. Their genotypic expressions do not fall into clearly defined categories
- e. Their phenotypic expressions do not overlap

ANS: e

REF: p. 81

SOURCE: NEW

20. In a hypothetical situation, B is the allele that causes brachydactyly. If a man who has normal fingers (bb) and a woman with brachydactyly (Bb) have children, what proportion of these children would you expect to have normal fingers? (Hint: Use a Punnett square).

- a. None
- b. All
- c. 1/4
- d. 3/4
- e. 1/2

ANS: e

REF: p.77

SOURCE: PICKUP

21. At a hypothetical locus, a man's genotype is Aa. What proportion of his gametes would be expected to receive the A allele?

- a. All
- b. $\frac{1}{2}$
- c. $\frac{3}{4}$
- d. $\frac{1}{4}$
- e. None

ANS: b

REF: p.77

SOURCE: PICKUP

22. Two people (*both* heterozygotes) are able to taste a chemical substance called PTC. The ability to taste PTC is caused by a dominant allele (T). The inability to taste PTC is caused by a recessive allele (t). What proportion of their children would be expected to have the ability to taste PTC?

- a. $3/4$
- b. $1/2$
- c. All
- d. $1/4$
- e. $2/3$

ANS: a REF: p.77 SOURCE: PICKUP

23. Two people (*both* heterozygotes) are able to taste a chemical substance called PTC. The ability to taste PTC is caused by a dominant allele (T). The inability to taste PTC is caused by a recessive allele (t). What proportion of their children would be expected *not* to be able to taste PTC?

- a. $3/4$
- b. All
- c. $1/4$
- d. $2/3$
- e. none

ANS: c REF: p.77 SOURCE: PICKUP

24. Two people (*both* heterozygotes) are able to taste a chemical substance called PTC. The ability to taste PTC is caused by a dominant allele (T). The inability to taste PTC is caused by a recessive allele (t). What proportion of their offspring would be expected to be heterozygous?

- a. $3/4$
- b. $1/2$
- c. All
- d. $1/4$
- e. $2/3$

ANS: b REF: p.77 SOURCE: PICKUP

25. Which of the following is *not* inherited in a Mendelian fashion?

- a. Huntington Disease
- b. albinism
- c. cleft chin
- d. Tay-Sachs disease
- e. skin color

ANS: e REF: p. 79 SOURCE: PICKUP

26. Which of the following types of traits are governed by more than one genetic locus?

- a. polygenic
- b. dominant
- c. Mendelian
- d. recessive
- e. pleiotropic

ANS: a REF: p. 81 SOURCE: PICKUP

27. Which statement concerning polygenic traits is *not* true?

- a. They are governed by more than one genetic locus.

- b. Their expression is often influenced by genetic/environmental interactions.
- c. The alleles have an additive effect on the phenotype.
- d. They are continuous traits
- e. The most frequently discussed are skin, hair and eye color.

ANS: c REF: p. 81 SOURCE: NEW

28. Polygenic traits

- a. are discrete
- b. have a continuous range of expression
- c. are controlled by only one genetic locus
- d. include the ABO blood type system and cystic fibrosis
- e. are also called Mendelian traits

ANS: b REF: p. 81-83 SOURCE: PICKUP

29. What does each mitochondrion contain?

- a. nuclear DNA
- b. 46 chromosomes
- c. an X but never a Y chromosome
- d. several copies of a ring-shaped DNA molecule, or chromosome
- e. A Y but never an X chromosome

ANS: d REF: p. 84 SOURCE: PICKUP

30. Evolution can be described as a two-stage process that includes which of the following?

- a. genetic drift followed by migration
- b. natural selection followed by migration
- c. recombination followed by mutation
- d. production of variation followed by natural selection acting on this variation
- e. production and distribution of variation

ANS: d REF: p. 85 SOURCE: NEW

31. Evolution can be most succinctly defined as

- a. the appearance of new species
- b. the change from one species to another in one generation
- c. the change in allele frequency from one generation to the next
- d. any type of genetic mutation
- e. genetic drift

ANS: c REF: p. 85 SOURCE: PICKUP

32. What is the only source of new genetic material in any population?

- a. mutation
- b. genetic drift
- c. founder effect
- d. migration
- e. natural selection

ANS: a REF: 86 SOURCE: PICKUP

33. What produces new alleles at a locus?

- a. natural selection
- b. recombination
- c. mutation
- d. migration
- e. genetic drift

ANS: c

REF: 86

SOURCE: PICKUP

34. In order for a mutation to be passed on to offspring, the mutation must

- a. occur in a gamete
- b. be beneficial
- c. occur in a somatic cell
- d. result in additional chromosomes
- e. have negative evolutionary consequences

ANS: a

REF: p. 86

SOURCE: NEW

35. What is gene flow defined as?

- a. production of new alleles
- b. production of new genetic material
- c. chance loss of alleles in a population
- d. exchange of genes between populations
- e. differential reproductive success of individuals

ANS: d

REF: p. 86

SOURCE: PICKUP

36. Genetic drift is

- a. the change in allele frequencies produced by random factors
- b. the result of large populations
- c. the opposite of founder effect
- d. not evolutionary change
- e. the change in allele frequencies produced by nonrandom factors

ANS: a

REF: p. 87

SOURCE: NEW

37. Which of the statements below is *false* regarding the relationship between malaria and the Hb^S allele?

- a. There is no geographic correlation between the distribution of the Hb^S allele and malaria.
- b. Heterozygotes have greater resistance to malaria than homozygous individuals.
- c. The malarial parasite does not reproduce very well in the red blood cells of heterozygotes.
- d. Malaria is caused by the *Plasmodium* parasite.
- e. Most people are homozygous for the Hb^A allele.

ANS: a

REF: 90

SOURCE: NEW

38. The Hb^S allele increased in frequency in West African populations due to which of the following?

- a. sickle-cell anemia
- b. genetic drift
- c. migration

- d. increased mutation rates
- e. natural selection

ANS: e REF: p. 91 SOURCE: PICKUP

True/False Questions

1. All human genetic disorders are inherited as recessive traits.

ANS: False REF: p. 79 SOURCE: PICKUP

2. Recessive conditions are usually associated with the lack of production of an enzyme.

ANS: True REF: p. 80 SOURCE: PICKUP

3. Dominance and recessiveness are all-or-nothing situations because the recessive allele has no phenotypic effects in heterozygotes.

ANS: False REF: p. 80 SOURCE: PICKUP

4. Melanin production is the result of interactions between several different loci.

ANS: True REF: p. 81 SOURCE: NEW

5. Polygenic traits account for few, if any, of the readily observable phenotypic variation seen in humans.

ANS: False REF: p. 81 SOURCE: PICKUP

6. The genotype sets limits and potentials for development and interacts with the environment to produce the phenotype.

ANS: True REF: p. 83 SOURCE: PICKUP

7. Mitochondrial DNA (mtDNA) is extremely useful for studying genetic change over time.

ANS: True REF: p. 84 SOURCE: NEW

8. New alleles are the results of mutations.

ANS: True REF: p. 86 SOURCE: PICKUP

9. Genetic drift is the random factor in evolution.

ANS: True REF: p. 87 SOURCE: PICKUP

10. The relationship between malaria and the Hb^S allele is an example of natural selection as a factor that can cause directional change in allele frequencies.

ANS: True REF: p. 90 SOURCE: NEW

11. A manifestation of sickle-cell anemia is the abnormal hemoglobin S reduces the ability of red blood cells to transport oxygen throughout the body.

ANS: True REF: p. 90 SOURCE: NEW

12. In regions where malaria is present, it acts as a selective agent that favors the heterozygous phenotype, because people with sickle-cell trait produce more offspring than those with only normal hemoglobin, who may die of malaria.

ANS: True REF: p. 90 SOURCE: NEW

Short Answer Questions

1. Explain Mendel's principle of segregation.

ANS: Will vary REF: p. 74-75 SOURCE: PICKUP

2. Explain Mendel's principle of independent assortment.

ANS: Will vary REF: p. 78 SOURCE: PICKUP

3. What are the typical Mendelian phenotypic and genotypic ratios in the F_2 generation for a cross of purebred tall and short plants? Why are these ratios typical?

ANS: Will vary REF: p. 77 SOURCE: PICKUP

4. Explain the concepts of dominance, co-dominance, and recessiveness as used in modern genetics.

ANS: Will vary REF: p. 78-81 SOURCE: PICKUP

5. Explain why a woman with type O blood and a man with type A blood could potentially have children with either type A or O blood.

ANS: Will vary REF: p. 80 SOURCE: PICKUP

6. Explain how two parents who do NOT express a particular trait in their phenotype can nevertheless produce children who express the trait. Give an example of a specific trait or disease where this could occur.

ANS: Will vary REF: p. 81-83 SOURCE: PICKUP

7. Define genetic drift. How are founder effect and genetic drift related?

ANS: Will vary REF: p. 87-89 SOURCE: PICKUP

8. What is the effect of genetic bottlenecks on human and nonhuman species?

ANS: Will vary REF: p. 88-89 SOURCE: PICKUP

9. What is meant by the statement, "natural selection is the one factor that can cause directional change in allele frequency relative to specific environmental factors"?

ANS: Will vary REF: p. 90 SOURCE: PICKUP

Essay Questions

1. Why is mutation an important element in accounting for the variation in mtDNA? What are the factors that redistribute genetic variation?

ANS: Will vary REF: p. 84; 86-89 SOURCE: NEW

2. Using the Hb^S allele to illustrate, describe why fitness levels are a function of the environment.

ANS: Will vary REF: 90-93 SOURCE: PICKUP

3. Discuss the differences between Mendelian and polygenic modes of inheritance. Provide an example of a Mendelian and a polygenic trait.

ANS: Will vary REF: 78-83 SOURCE: PICKUP

4. Allele frequencies are indicators of the genetic makeup of a population. Use the example of ABO blood types to show how allele frequencies change.

ANS: Will vary REF: p. 85 SOURCE: NEW