

CHAPTER

8

DIRECTED READING

Mendel and Heredity

► Section 8-1: The Origins of Genetics

Mendel and Others Studied Garden-Pea Traits

Read each question, and write your answer in the space provided.

1. What did T. A. Knight discover?

2. How did Mendel's scientific work differ from the work of T. A. Knight?

3. What are three reasons the garden pea is a good subject for studying heredity?

Mendel Observed that Traits Are Expressed as Simple Ratios

Mark each statement below T if it is true or F if it is false.

- _____ 4. A monohybrid cross is a mating that considers one pair of contrasting traits.
- _____ 5. Cross-pollination assures that each variety of garden pea is true-breeding.
- _____ 6. The P generation consists of the first two individuals that are crossed in a breeding experiment.
- _____ 7. In Mendel's experiment in which he cross-pollinated two P generation plants that had contrasting forms of a trait, the F₁ generation showed both forms of the trait.
- _____ 8. The F₂ generation in Mendel's experiment was obtained by cross-pollinating the F₁ generation.
- _____ 9. The F₂ generation in Mendel's experiment showed both forms of the trait in a ratio of 1:1.

► Section 8-2: Mendel's Theory

Mendel's Work Became a Theory of Heredity

In the space provided, write the letter of the description that best matches the term or phrase.

- | | |
|-----------------------|------------------------------------------------------------------------------------------------------------------|
| _____ 1. alleles | a. when two different alleles are present, the allele that is completely expressed |
| _____ 2. dominant | b. when two alleles of a particular gene are the same |
| _____ 3. recessive | c. when two alleles of a particular gene are different |
| _____ 4. homozygous | d. an organism's physical appearance |
| _____ 5. heterozygous | e. the set of alleles that an organism has |
| _____ 6. genotype | f. different versions of a gene |
| _____ 7. phenotype | g. when two different alleles are present, the allele that has no observable effect on the organism's appearance |

Complete each statement by writing the correct term or phrase in the space provided.

8. If the allele for yellow peas is Y, the allele for the contrasting trait, green peas, is _____ .
9. If Tt is the genotype of a plant, where T stands for tall and the recessive allele stands for short, its phenotype is _____ .
10. If tt is the genotype of a plant, where T stands for tall and the recessive allele stands for short, its phenotype is _____ .

Mendel's Ideas Gave Rise to the Laws of Heredity

Read each question, and write your answer in the space provided.

11. What is the law of segregation?

12. What is the law of independent assortment?

► Section 8-3: Studying Heredity

Punnett Squares Can Predict the Expected Results in Crosses

Complete each statement by writing the correct term or phrase in the space provided.

1. The Punnett square in Figure 8-9 shows that _____ the offspring will be heterozygous.
2. The Punnett square in Figure 8-10 shows that _____ of the offspring will have yellow seeds.
3. In a test cross to determine if an individual with a dominant phenotype is heterozygous or homozygous for the trait, you always cross the individual with a homozygous _____ individual.
4. If the offspring of a test cross all have the dominant trait, then the genotype of the individual being tested is _____ .
5. If some of the offspring of a test cross have the recessive trait, then the genotype of the individual being tested is _____ .

Probabilities Can Also Predict the Expected Results of Crosses

Complete each statement by writing the correct term or phrase in the space provided.

6. The probability that a gamete from a plant with a Tt genotype will carry a t allele is _____ .
7. The probability of homozygous recessive offspring resulting from a cross between two homozygous dominant individuals is _____ .
8. The probability of heterozygous offspring resulting from a cross between two heterozygous individuals is _____ .

Family Pedigrees Can Be Used to Study How Traits Are Inherited

Read each question, and write your answer in the space provided.

9. When studying a pedigree, how do scientists determine if a trait is sex-linked or autosomal?

10. When studying a pedigree, how do scientists determine if a trait is dominant or recessive?

► Section 8-4: Patterns of Heredity Can Be Complex

Most Traits Are Not Controlled by Simple Dominant-Recessive Alleles

In the space provided, explain how the terms in each pair differ in meaning.

1. polygenic trait, multiple alleles

2. incomplete dominance, codominance

Mark each statement below T if it is true or F if it is false.

- _____ 3. The genes for a trait are always located at a single place on a chromosome.
- _____ 4. Different combinations of three alleles result in four different blood types.
- _____ 5. If a horse with white hair mates with a horse with red hair, the offspring will have both red hairs and white hairs.
- _____ 6. The color of hydrangea flowers is influenced by the amount of acid in the soil.

Some Traits Are Caused by Mutations

Complete each statement by writing the correct term or phrase in the space provided.

7. Sometimes genes are damaged or are copied incorrectly, resulting in faulty

_____ .

8. _____ is a genetic disorder caused by a defective chloride-ion transport protein.

Read each question, and write your answer in the space provided.

9. Who should go for genetic counseling prior to having children?

10. What is gene therapy?

11. after
12. a belt of proteins

CHAPTER 7

Meiosis and Sexual Reproduction

SECTION 7-1

1. Meiosis is a process that occurs during cell division that produces reproductive cells, such as gametes and spores. Meiosis involves two divisions of the nucleus, which halves the chromosome number of the cells.
2. Meiosis I involves the separation of pairs of homologous chromosomes. Meiosis II involves the separation of the two chromatids that make up each chromosome.
3. prophase I, metaphase I, anaphase I, telophase I, prophase II, metaphase II, anaphase II, and telophase II
4. Crossing-over is the exchange of reciprocal portions of DNA between two homologous chromosomes at the beginning of meiosis.
5. anaphase II
6. anaphase I
7. prophase I
8. prophase II
9. metaphase II
10. telophase II
11. telophase I
12. metaphase I
13. T
14. F
15. F
16. F
17. T
18. F
19. T
20. Spermatogenesis is the process by which sperm are produced in males. Oogenesis is the process by which eggs are produced in females.
21. Undifferentiated sperm cells are produced by meiosis. These cells become sperm by changing in form and developing tails.
22. In males, the cytoplasm divides equally following meiosis I and meiosis II to form four cells of the same size. In females, the cytoplasm divides unequally after meiosis I and meiosis II to produce one large egg and three smaller polar bodies.

SECTION 7-2

1. In asexual reproduction, a single parent passes copies of all its genes to its offspring and there is no fusion of gametes. In sexual reproduction, two parents each form gametes, which fuse to form offspring.
2. A clone is an offspring that is genetically identical to its parent. Asexual reproduction is the type of reproduction that produces clones.

3. Binary fission is the type of asexual reproduction that occurs in prokaryotes. Budding is a type of asexual reproduction in which new individuals split off from existing ones.
4. In budding, a new individual forms from another and may or may not break away from its parent. In fragmentation, a multicellular individual breaks into several pieces that may later develop into complete individuals by growing their missing parts.
5. T
6. T
7. F
8. T
9. F
10. F
11. T
12. F
13. T
14. F
15. T

CHAPTER 8

Mendel and Heredity

SECTION 8-1

1. Knight discovered that the purple-flowered offspring of a cross between garden peas with purple flowers and garden peas with white flowers produce some offspring with purple flowers and some with white flowers.
2. Mendel carefully counted the number of each kind of offspring, analyzed the data, and discovered that the numbers formed simple ratios.
3. Garden peas have many traits with two clearly different forms; it is easy to control matings in garden peas; and garden peas are small, mature quickly, and produce numerous offspring.
4. T
5. F
6. T
7. F
8. F
9. F

SECTION 8-2

1. f
2. a
3. g
4. b
5. c
6. e
7. d
8. y
9. tall
10. short
11. The law of segregation states that the two alleles for a trait segregate when gametes are formed during meiosis.

12. The law of independent assortment states that the pairs of alleles for different traits separate independently of one another during meiosis.

SECTION 8-3

1. all
2. $\frac{3}{4}$
3. recessive
4. homozygous
5. heterozygous
6. $\frac{1}{2}$
7. 0
8. $\frac{1}{2}$
9. If a trait is autosomal, it will appear equally in both sexes.
10. If an autosomal trait is dominant, every individual with the trait will have a parent with the trait. If a trait is recessive, an individual with the trait may have one, two, or no parents with the trait.

SECTION 8-4

1. A polygenic trait is a trait that is influenced by several genes. A trait determined by multiple alleles is controlled by a gene that has three or more alleles.
2. Incomplete dominance occurs when offspring display a form of a trait that is intermediate between the forms of the trait displayed by the parents. Codominance occurs when two alleles for a characteristic are expressed at the same time.
3. F
4. T
5. T
6. T
7. proteins
8. Cystic fibrosis
9. people with a family history of genetic disorders
10. Gene therapy is a procedure that attempts to replace defective genes by inserting copies of healthy genes into an individual.

CHAPTER 9

DNA: The Genetic Material

SECTION 9-1

1. Griffith was trying to prepare a vaccine against the pneumonia-causing bacteria.
2. The S bacteria were protected from the body's defense systems by a capsule of polysaccharides.
3. They were unable to reproduce.
4. The live R bacteria acquired a capsule and became live, virulent S bacteria.
5. transformation—the change in phenotype that occurs when bacteria take up genetic material from foreign cells

6. He showed that protein-destroying enzymes do not prevent transformation while DNA-destroying enzymes do.

7. bacteriophages
8. protein coat
9. protein coat
10. protein
11. DNA
12. phage
13. bacteria
14. blender
15. centrifuge
16. DNA

SECTION 9-2

1. h
2. d
3. a
4. g
5. b
6. c
7. f
8. e
9. The base-pairing rules refer to the fact that between two DNA strands, adenine always pairs with thymine and guanine always pairs with cytosine. The two strands in DNA are complementary, which means that the sequence of bases in one strand determines the sequence of bases in the other.
10. Adenine and thymine are two of the four nitrogen bases found in DNA nucleotides, and they pair with each other.
11. Cytosine and guanine are two of the four nitrogen bases, and they pair with each other.
12. Chargaff observed that for each organism he studied, the amount of adenine always equaled the amount of thymine, and the amount of guanine always equaled the amount of cytosine.
13. They suggested to Watson and Crick that DNA resembled a tightly coiled helix made of two or three chains of nucleotides.
14. A DNA molecule consists of two strands of nucleotides twisted around a central axis.

SECTION 9-3

1. b
2. d
3. c
4. a
5. e
6. Scientists were able to predict that the complementarity would enable exact copies of DNA to be made each time a cell divides. Watson and Crick proposed that one strand serves as a template for completing the other.
7. Additional proteins attach to the strands and prevent the strands from reattaching to one another.