Name Period Date

SECTION 6.3 | MENDEL AND HEREDITY

Reinforcement

KEY CONCEPT Mendel's research showed that traits are inherited as discrete units.

Traits are inherited characteristics, and **genetics** is the study of the biological inheritance of traits and variation. Gregor Mendel, an Austrian monk, first recognized that traits are inherited as discrete units. We call these units genes. Mendel conducted his experiments with pea plants, which were an excellent choice because they are easily manipulated, produce large numbers of offspring, and have a short life cycle. Mendel made three important decisions that helped him to see patterns in the resulting offspring.

- Use of purebred plants: Mendel used pea plants that had self-pollinated for so long that they had become genetically uniform, or **purebred.** This meant that the offspring looked like the parent plant. Because of this characteristic, Mendel knew that any differences he observed in the offspring were the result of his experiments.
- Control over breeding: At the start of his experiments, Mendel removed the male flower parts from the pea plants. He then pollinated the female flower part with pollen from a plant of his choosing, which produced offspring referred to as the F_1 generation.
- Observation of "either-or" traits: Mendel studied seven traits that appeared in only two forms. For example, flowers were white or purple; peas were wrinkled or round.

Mendel observed that when he mated, or **crossed,** a purple-flowered plant with a white-flowered plant, for example, all of the F_1 offspring had purple flowers. Mendel next allowed the F_1 offspring to self-pollinate; that is, the plant mated with itself. In the resulting offspring, the F_2 generation, approximately three-fourths of the flowers were purple and one-fourth were white. Mendel continued to find this 3:1 ratio for each of his crosses, regardless of the specific trait he was examining.

Based on his results, Mendel concluded that traits are inherited as discrete units. He also developed what is known as Mendel's first law, or the **law of segregation.** This law states the following:

- Organisms inherit two copies of each unit (gene), one from each parent.
- The two copies separate, or segregate, during gamete formation. As a result, organisms donate only one copy of each unit (gene) in their gametes.

1. In which generation of offspring did Mendel observe a 3:1 ratio in the appearance of the offspring?

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2. What is segregating in the law of segregation? When does this segregation occur?

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Name Period Date

SECTION 6.4 | TRAITS, GENES, AND ALLELES

Reinforcement

KEY CONCEPT Genes encode proteins that produce a diverse range of traits.

A **gene** is a segment of DNA that tells the cell how to make a particular polypeptide. The location of a gene on a chromosome is called a locus. A gene has the same locus on both chromosomes in a pair of homologous chromosomes. In genetics, scientists often focus on a single gene or set of genes. **Genotype** typically refers to the genetic makeup of a particular set of genes. **Phenotype** refers to the physical characteristics resulting from those genes.

An alternative form of a gene is an **allele.** The pea plants that Mendel worked with had two alleles for each gene. For example, there was an allele for round peas and an allele for wrinkled peas. Genes are not limited to two alleles, however. Some genes are found in many different forms throughout a population.

Your cells have two alleles for each gene regardless of how many alleles are present in a population. Suppose there were 64 alleles of a hair color gene present in the human population. Your cells would only have two of those alleles, one from your mother and one from your father. If the two alleles are the same, they are **homozygous.** If the two alleles are different, they are **heterozygous.**

Some alleles are dominant over others.

- A **dominant** allele is expressed when two different alleles or two dominant alleles are present. Therefore, both homozygous dominant and heterozygous genotypes can produce the dominant phenotype.
- A **recessive** allele is expressed only when both alleles are recessive. Therefore, only the homozygous recessive genotype can produce the recessive phenotype.

Alleles may be represented using letters. Uppercase letters represent dominant alleles. Lowercase letters represent recessive alleles.

1. If you were to make an analogy and say that genotype is like blueprints, how would you complete the analogy to describe phenotype?

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2. Use the letters B and b to represent the following genotypes: heterozygous, homozygous recessive, homozygous dominant.

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