chapter 13 Genetics and Biotechnology

section 1 Applied Genetics

Before You Read

Imagine that you could design the perfect dog. What color would it be? Would it be big or small? On the lines below, describe the traits your dog would have. In this section, you will learn how selective breeding produces certain traits.

MAIN Idea

Selective breeding is used to create animals or plants with certain traits.

What You'll Learn

- how inbreeding differs from hybridization
- how to use test crosses and a Punnett square to find the genotypes of organisms

Read to Learn

Selective Breeding

For thousands of years, people have been breeding animals and plants to have certain traits. For instance, some dogs, such as huskies, have been bred to be strong runners. Other dogs, such as Saint Bernards, have been bred to have a good sense of smell.

People have also bred plants, such as tomatoes, apples, and roses, to taste better, resist disease, or produce fragrant flowers. **Selective breeding** is the process used to breed animals and plants to have desired traits. As a result of selective breeding, desired traits become more common.

What is hybridization?

A hybrid is an organism whose parents each have different forms of a trait. For instance, a disease-resistant tomato plant can be crossed with a fast-growing tomato plant. The offspring of the cross would be a tomato plant that has both traits. The hybrid is disease resistant and grows quickly.

Hybridization is the process of making a hybrid organism. Hybridization is expensive and takes a long time, but it is a good way to breed animals and plants with the right combination of traits.

Study Coach

Create a Quiz After you read this section, create a five-question quiz from what you have learned. Then, exchange quizzes with another student. After taking the quizzes, review your answers together.

Reading Check

1. **Name** an advantage of hybridization.

How is inbreeding used?

Inbreeding is another example of selective breeding. **Inbreeding** occurs when two closely related organisms that both display the desired trait are bred. Inbreeding can be used to ensure that the desired trait is passed on. Inbreeding can also eliminate traits that are not desired.

Purebred animals are created by inbreeding. Clydesdale horses are an example of a purebred animal. Clydesdale horses were first bred in Scotland hundreds of years ago. They were bred for use as farm horses that could pull heavy loads. All Clydesdales have the traits of strength, agility, and obedience.

A disadvantage of inbreeding is that harmful traits can be passed on. Harmful traits are usually carried on recessive genes. Both parents must pass on the recessive genes for the harmful traits to appear in the offspring. Inbreeding increases the chance that both parents carry the harmful traits.

Test Cross

Breeders need a way to determine the genotype of the organisms they want to cross before creating a hybrid. They use test crosses to find out the genotype of an organism. In a **test cross**, an organism whose genotype for a desired trait is unknown is crossed with an organism that has two recessive genes for the trait.

Reading Check

2. Explain What is the purpose of a test cross?

When are test crosses performed?

An orchard owner might use a test cross to find out the genotype of a white-grapefruit tree. In grapefruits, white color is a dominant trait and red color is a recessive trait. A red-grapefruit tree has two recessive genes (*ww*). A white-grapefruit tree might have two dominant genes (*WW*), or it might have one dominant gene and one recessive gene (*Ww*).

Picture This

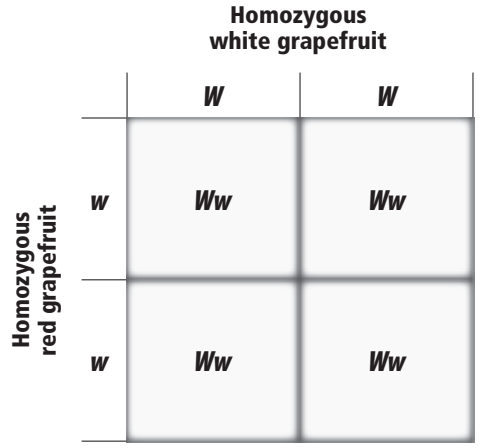
3. Label Fill in the phenotype with the word *white* or *red* for each genotype.

Genotype	Phenotype
Homozygous dominant (*WW*)	
Homozygous recessive (*ww*)	
Heterozygous (*Ww*)	

How does a test cross reveal the genotype?

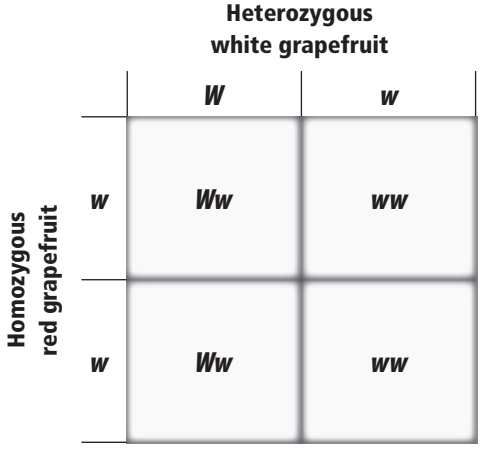
The orchard owner decides to do a test cross to find out the genotype of a white grapefruit tree. The white grapefruit tree is crossed with a red grapefruit tree. The orchard owner uses a Punnett square to understand the results of the cross.

The figure below shows a Punnett square for the test cross if the white grapefruit tree is homozygous, meaning it has two dominant genes (*WW*) for white fruit. All the offspring from the test cross will be heterozygous, meaning they will have one dominant and one recessive gene (*Ww*). All the offspring of the test cross are white grapefruit trees.



What if the test cross involved a heterozygous tree?

The figure below shows a Punnett square for the test cross if the white grapefruit tree is heterozygous (*Ww*). Half the offspring from the test cross will be white (*Ww*). Half the offspring from the test cross will be red (*ww*).



Picture This

4. Evaluate If you planted 100 seeds from this test cross, about how many would be white? How many would be red?

_____

_____

Picture This

5. Calculate If you planted 100 seeds from this test cross, about what percentage would be white? What percentage would be red?

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