ENRICHMENT ACTIVITY
Genetics Problem Solving

CHAPTER 25

Crosses Involving Incomplete Dominance

In the traits considered previously, an organism heterozygous for a trait has been indistinguishable from a homozygous dominant individual. This is because a dominant allele prevents the expression of a recessive allele. Thus Mendel's peas were either tall or short. If a pea plant had one tall allele and one short allele, it was as tall as a pea having two tall alleles.

There are some genes for which this is not true. For example, in Japanese four-o'clocks, the gene controlling flower color has alleles that are neither dominant nor recessive. Plants that have two red alleles (RR) have red flowers. Plants with two white alleles (WW) have white flowers. However, plants with one red allele and one white allele, (RW), are pink. This condition is called incomplete dominance.

The outcome of crosses involving traits that show incomplete dominance are determined in the same way as those involving dominant traits. However, keep in mind that each allele of a gene showing incomplete dominance is represented by its own capital letter. Also, with incomplete dominance, the heterozygote has a phenotype different from that of either homozygote.

SAMPLE PROBLEM

In Japanese four-o'clocks, predict the outcome of a cross between a red-flowered plant and a pink-flowered plant.

Step 1 Determine the genotypes of the parents.
The red flowered plant is homozygous RR; The pink plant is heterozygous RW
RR × RW

Step 2 Determine the gamete genotypes produced by each parent.
RR → R
RW → R,W

Step 3 Set up a Punnett square using the gamete genotypes.

	R	W
R		

Step 4 Combine the gamete genotypes of one parent with those of the other parent to show all possible offspring genotypes.

	R	W
R	**RR**	**RW**

Step 5 State the genotype and phenotype ratios of the offspring.
1 RR: 1 RW = ½ RR, ½ RW
1 red: 1 pink = ½ red, ½ pink

EXERCISES

In each exercise draw a Punnett square, and write the phenotype ratio in the space provided.

1. In Japanese four-o'clocks, predict the phenotype ratio of a cross between

   a. a red plant and a white plant _____

   b. a white plant and a pink plant _____

   c. a red plant and a pink plant _____

   d. two pink plants _____

2. In some cats the gene for tail length shows incomplete dominance. Cats with long tails and those with no tails are homozygous for the respective alleles. Cats with one long-tail allele and one no-tail allele have short tails. Predict the phenotype ratio of a cross between

   a. a long-tail cat and a cat with no tail _____

   b. a long-tail cat and a short-tail cat _____

   c. a short-tail cat and a cat with no tail _____

   d. two short-tail cats _____