

CHAPTER 9

*Introduction to Genetics**Section 9-2*

SKILL ACTIVITY

*Applying Formulas**Using Punnett Squares to Predict
the Outcomes of Crosses*

The possible gene combinations in the offspring that result from a genetic cross can be determined by drawing a diagram known as a Punnett square. A Punnett square shows the genes (represented by letters) in the parents' gametes along the top and left-hand side of a square and the possible gene combinations in the offspring within the square.

A completed Punnett square gives the probable outcome of a given cross. However, actual results may vary from the probable results, especially if only a few organisms are considered.

ONE-FACTOR CROSSES

Crosses that involve one trait, such as seed coat color, are called one-factor crosses. For the one-factor crosses in this activity, we will use some of the traits Mendel observed in pea plants. The expressions of the dominant and recessive alleles for the genes controlling these traits are described in the following chart. The chart also assigns letters to represent the different alleles.

Trait	Dominant Allele	Recessive Allele
Pod shape	Smooth (S)	Constricted (s)
Pod color	Green (G)	Yellow (g)
Flower position	Axial (A)	Terminal (a)
Plant height	Tall (T)	Short (t)

In the example that follows, we will predict the results of a cross between a plant that is heterozygous for green pods and a plant that has yellow pods.

Sample Problem

A plant that is heterozygous for green pods is crossed with a plant that has yellow pods. What are the probable genotypic and phenotypic ratios in the offspring resulting from this cross?

Step 1: Choose a letter to represent the alleles in the cross.

In this case, the letters have already been selected—G for the dominant green allele and g for the recessive yellow allele.

Step 2: Write the genotypes of the parents.

Since the plant with the green pods is heterozygous for the trait, its genotype must be Gg. The problem does not state whether the plant with yellow pods is homozygous or heterozygous. But we know that yellow pods are a recessive character, and that recessive characters are expressed only in a homozygous recessive individual. Thus the genotype of this plant must be gg. The cross, therefore, is Gg X gg.

Step 3: Determine the possible gametes (reproductive cells) that the parents can produce.

The two alleles of any gene are segregated during the formation of gametes. Thus the green-pod parent (Gg) will produce two kinds of gametes—G and g. The yellow-pod parent (gg) will produce a gamete.

Step 4: Enter the possible gametes at the top and side of the Punnett square.

At this point, the Punnett square for this problem would look like this: