Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block: \_\_\_\_\_\_\_\_

**DIHYBRID CROSSES**

Crosses that involve two traits, such as pod color and pod shape, are called dihybrid crosses. Predicting the outcome of dihybrid crosses requires basically the same procedure as that for crosses involving one trait. Keep in mind that in dihybrid crosses the genes controlling the two different traits are located on nonhomologous chromosomes. During meiosis, nonhomologous chromosomes assort independently. This means that each of the chromosomes of any pair of homologous chromosomes has an equal probability of ending up in a gamete with either chromosome from any other pair of homologous chromosomes. The genes that are located on nonhomologous chromosomes also assort independently, as you can see in the following diagram.



Because of independent assortment, a plant that is heterozygous for two traits (genotype *AaBb*) will produce equal numbers of four types of gametes—*AB*, *Ab*, *aB*, and *ab*.

In the example that follows, we will predict the results of a cross between two plants that are heterozygous for both pod color and pod shape.

**Sample Problem**

What are the genotypic and phenotypic ratios in the offspring resulting from a cross between two pea plants that are heterozygous for pod color and pod shape? What is the phenotype of the parents in this cross?

**Step I Choose letters to represent the genes in the cross.**

Let’s use the letters we used in the monohybrid crosses—*G* for green., *g* for yellow, *N* for smooth, and *n* for constricted.

**Step 2 Write the genotypes of the parents.**

Since the parents are heterozygous for both traits, their genotype must be *GgNn*. The cross can be written as *GgNn* x *GgNn*.

**Step 3 Determine the possible gametes that the parents can produce.**

Each parent produces four types of gametes—*GN*, *Gn*, *gN*, and *gn*.

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

**Step 5 Complete the Punnett square by writing the alleles from the gametes in the appropriate boxes.**

The alleles from the gamete above the box and the alleles from the gamete to the side of the box are combined inside each of the boxes. Write the capital letter first for each pair of alleles. The letters inside each box represent the probable genotypes of the offspring resulting from the cross.

|  |
| --- |
|  *GN Gn gN Gn* |
| *GN* *Gn**gN**gn* | *GGNN* | *GGNn* | *GgNN* | *GGNn* |
| *GGNn* | *GGnn* | *GgNn* | *GGnn* |
| *GgNN* | *GgNn* | *ggNN* | *GgNn* |
| *GgNn* | *Ggnn* | *ggNn* | *Ggnn* |

**Step 6 Determine the phenotypes of the offspring.**

In this example, 9/16 have green smooth pods, 3/16 have yellow smooth pods, 3/16 have green constricted pods, and 1/16 have yellow constricted pods.

**Step 7 Using the results of Steps 5 and 6, answer the problem.**

Note that in this example, as in many of the genetics problems you will encounter, you are asked for more than just the ratios resulting from the cross. This is one reason why it is important to read genetics problems carefully. In this example, the genotypic ratio is 1/16:2/16:1/16:2/16:4/16:2/16:1/16:2/16:1/16 = 1:2:1:2:4:2:1:2:1.The phenotypic ratio is 9/16:3/16:3/16:1/16 = 9:3:3:1. The phenotype of the parent is green smooth pods.

**Practice Problems**

In mice, the ability to run normally is a dominant trait. Mice with this trait are called running mice (*R*). The recessive trait causes mice to run in circles only. Mice with this trait are called waltzing mice (*r*). Hair color is also inherited in mice. Black hair (*B*) is dominant over brown hair (*b*). For each of the following problems, draw a Punnett square in the space provided and fill in the information on the indicated lines.

1. Cross a heterozygous running, heterozygous black mouse with a homozygous running, homozygous black mouse.

Parental genotypes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Cross a homozygous running, homozygous black mouse with a heterozygous running, brown mouse.

Parental genotypes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Cross a waltzing brown mouse with a waltzing brown mouse.

Parental genotypes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Cross a homozygous running, heterozygous black mouse with a waltzing brown mouse.

Parental genotypes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Cross a heterozygous running, brown mouse with a heterozygous running, homozygous black mouse.

Parental genotypes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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