Name: _____

CASE

Activity 7.1.4 Odd Couples

Purpose

The principles of dominant and recessive genes sound pretty straightforward. However, because of genetic variations among species there are exceptions to the law of dominance.

In some animals, both characteristics of a heterozygous genotype are expressed. This results in each trait being partially expressed in the phenotype. In a trait such as color, an even mixture of two hair colors produces a color pattern referred to as roan. The expression of both traits for a gene is called codominance.

A second variation within dominance is incomplete dominance. Incomplete dominance occurs when the phenotype of offspring is in between that of the parents. The best example is in plants where red flowers crossed with white flowers produce pink flowers. The phenotype is a blend as neither allele is completely dominant.

In other animals, sex-linked traits are common. For example in felines, the calico pattern of orange, black, and white patches of the hair coat is found only in female cats. In chickens, the feather characteristic known as barred will be expressed in male offspring and present, but not expressed in female offspring.

Can you predict what will occur in codominance, incomplete dominance, and sex-linked pairings?

Materials

Per pair of students:

- 16oz plastic cup
- 20 dry red beans
- 20 dry white beans
- Computer station with Drosophila Genetics software

Per student:

- Pencil
- *Agriscience Notebook*

Procedure

Part One – Codominance in Shorthorns

Shorthorn cattle come in three colors, red, white, or roan. This is because they express codominance in heterogeneous crosses. In Part One, you and your partner will be testing predictions for two heterogeneous crosses to determine the percentage of offspring that will be red, white, or roan.

1. Use a Punnett Square and make a prediction for a cross between two roan parents. Because neither color is dominant or recessive, the gametes are represented by "*RW*".

	R	W
R		
W		

Table 1. *Prediction*

Hair Coat Color	Prediction (Percentage)
Red	
White	
Roan	

2. Place 20 red beans and 20 white beans in the plastic cup. These will represent gametes for twenty crosses of the pairing made in Step 1.

3. Shake up the beans and pull out two beans at a time. Your partner will record the pairings in Table 2. For a pairing of two red beans you will place a mark in the red column, for a white pairing mark in the white column, and one red and one white bean pairing will be marked in the roan column.

4. Continue pulling pairs of beans out of the cup until you have removed all of the beans.

5. Because statistical predictions are more accurate with several repetitions of an experiment, repeat Steps 2-4 four more times so you have completed 100 pairings.

Table 2. *Shorthorn Cross Trial Data*

Trial	Red Pairings	White Pairings	Roan Pairings
1			
2			
3			
4			
5			
Total of All Trials			
Percentage			

6. Compare your results for Table 2 with your prediction in Table 1.

7. Report your trial results to you teacher. Your teacher will assist the class with determining a classroom average. By including everyone's data points, statistical error may be further eliminated.

Part Two – Sex-Linked Crosses

You and your partner will once again use the Drosophila Genetics simulation software. This time you will investigate a cross between parents with sex-linked characteristics.

1. Your teacher will provide you with two experiments.

2. Conduct *Experiment 6 – White-Eyed Male* first and complete the worksheet.

3. When you have finished Experiment 6, conduct *Experiment 7 – White-Eyed Female* and complete the corresponding worksheet.

4. Your teacher will lead the class in a short discussion of the findings for these exercises. After the discussion, submit both worksheets for grading.

Conclusion

1. How can you improve your prediction using the Punnett Square method?

2. Explain what sex-linked traits are and how they can influence an animal breeding program.

3. Determine your prediction for a shorthorn cross between a red male and a roan female.

Prediction	
Hair Coat Color	**Prediction (Percentage)**
Red	
White	
Roan	