Names: _____

Mr. Croft ~ Biology

Breeding Bunnies

50 Points

In this activity, you will examine natural selection in a small population of wild rabbits. Evolution, on a genetic level, is a change in the frequency of alleles in a population over a period of time. Breeders of rabbits have long been familiar with a variety of genetic traits that affect the survivability of rabbits in the wild, as well as in breeding populations. One such trait is the trait for furless rabbits (naked bunnies). This trait was first discovered in England by W.E. Castle in 1933. The furless rabbit is rarely found in the wild because the cold English winters are a definite selective force against it.

Note: In this lab, the dominant allele for normal fur is represented by F and the recessive allele for no fur is represented by f. Bunnies that inherit two F alleles or one F and one f allele have fur, while bunnies that inherit two fs have no fur.

Procedure:

1. Fill in the **hypothesis** section of the data form and specific **predictions** based on that hypothesis.
2. The red beans represent the allele for fur, and the white beans represent the allele for no fur. The paper bag represents the English Countryside, where the rabbits randomly mate.
3. You need four labeled cups: FF, Ff, ff, and RIP.
4. Place the 50 red and 50 white beans (alleles) in the bag and shake up (mate) the rabbits. (Please note that these frequencies have been chosen arbitrarily for this activity.)
5. Without looking at the beans, select two at a time, and place the "rabbits" into the appropriate cup: FF, Ff, or ff. Continue drawing pairs of beans until all of the beans are gone.
6. Record the total number of rabbits with each genotype on the data form (Generation 1). **Please note that the total number of individuals will be half the total number of beans because each rabbit requires two alleles.**
7. The ff bunnies are born furless. The cold weather kills them before they reach reproductive age, so they can't pass on their genes. Place the beans from the ff container in the RIP cup before beginning the next round.
8. Place the alleles of the surviving rabbits – FF & Ff (which have grown, survived and reached reproductive age) back into the bag and mate them again to get the next generation.
9. Repeat the procedure to obtain generations two through ten. Make sure everyone in your group has a chance to either select the beans or record the results.
10. Use the formulas to calculate the data needed for the rest of the data table. Express results in decimal form. The sum of the frequency of F and f should equal one for each generation.
11. Post required data on the board for comparison with the rest of the class.

Formulas:

#F Alleles = 50

#f Alleles = #Ff

Total # of Alleles = #F + #f

$$\text{Gene Frequency F} = \frac{\#\text{F Alleles}}{\text{Total \# of Alleles}}$$

$$\text{Gene Frequency f} = \frac{\#\text{f Alleles}}{\text{Total \# of Alleles}}$$

Graph: Graph your gene frequencies for F **and** f. Prepare a line graph with the horizontal axis as the time (generations) and the vertical axis as the gene frequency (%).

Conclusion (summary of the experiment, analysis of data, discussion of error):

Questions:

1. Compare the frequencies of the dominant allele to the frequencies of the recessive allele over ten generations.

2. How do your results compare with the class data? If significantly different, why are they different?

3. Assume you are running another simulation in which the furless rabbits did not die and the five Hardy-Weinberg conditions were met. The initial gene frequencies of F and f are each 0.5. What does the Hardy-Weinberg equation predict for the gene frequencies of F and f after 10 generations?

4. Which of the five Hardy-Weinberg Equilibrium rules were violated in this experiment (there may be more than one)? Explain.

5. In a real rabbit habitat new animals often come into the habitat (immigrate), and others leave the area (emigrate).
   a. How would emigration and immigration affect the gene frequency of F and f in this population of rabbits?

   b. How could you simulate this effect if you were to repeat this activity?

6. In a **large** population, would it be possible to completely eliminate a deleterious recessive allele (such as the allele for no fur)? Explain.

7. What is the importance of heterozygotes in maintaining genetic variation in populations?

evolution

Breeding Bunnies: Gene Frequency Data

How does natural selection affect gene frequency over several generations?

Clearly state your hypothesis (a tentative explanation or solution to the problem).

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State what you would predict (if your hypothesis is true) about the frequency of *F* alleles and *f* alleles in the population of rabbits after 10 generations, where *ff* bunnies are selected against (do not survive).

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Generation	Number of *FF* Individuals	Number of *Ff* Individuals	Number of *ff* Individuals	Number of *F* Alleles	Number of *f* Alleles	Total Number of Alleles	Gene Frequency of *F*	Gene Frequency of *f*
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

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