

Evolution and Gene Frequencies: A Game of Survival and Reproductive Success

Introduction:

In this population of Bengal tigers, alleles exist as either dominant or recessive. Bengal tigers live high in the mountains of India where the temperature is very cold. The presence of fur is dominant to the absence of fur, which is recessive. Because of this, the homozygous recessive trait is lethal.

Purpose:

To determine the effect of random mating in a population of tigers possessing a recessive gene.

Materials:

- * 50 red M & M candies
- * 50 green M & M candies
- * 1 paper bag
- * 3 Petri dishes

Before continuing state a hypothesis to predict what will happen to the lethal recessive gene after 10 generations in a closed population.

Procedure:

1. Let 50 M & M's represent the allele for fur and 50 M & M's represent the allele for no fur in a Bengal tiger population.
2. Let the paper bag represent the deep dark jungles of India where random mating occurs unwitnessed by biology students.
3. Label one Petri dish 'HH' for the homozygous dominant allele. Label a second Petri dish 'Hh' for the heterozygous allele. Label the third Petri dish 'RIP' for the homozygous recessive allele or those who were not naturally selected to survive the cold environment.
4. Place the 50 red and 50 green alleles (M & M's) in the dark jungle bag and shake up (mate) the tigers. DON'T LOOK!

5. Select two alleles at a time and record in your chart next to generation #1 each individual (combination of alleles or genotype) tiger produced. Sort the dominant and recessive alleles resulting from HH and Hh genotypes into Petri dishes #1 and #2. All homozygous recessive tiger cubs unfortunately get placed in dish #3 — the RIP Graveyard. Continue this procedure until all alleles have been counted and sorted.

*** Once in the RIP Graveyard these alleles are no longer able to be passed on to the next generation and become available to the sweet-toothed Homo sapiens. ENJOY!!

6. Count and record the 'H' and 'h' alleles obtained and place in the chart. Total the number of 'H' and 'h' for the first generation and record this number also.

7. Place the alleles of the surviving tigers (which have grown, survived and reached reproductive age) back into the dark jungle and mate them again to get the F2 generation.

8. Repeat steps 5,6, and 7 to obtain generations 2 through 10.

***Remember: all 'hh' individuals become part of the RIP Graveyard and therefore cannot reproduce.

9. Determine the gene frequency of 'H' and 'h' for each generation and record in the chart.

To determine the gene frequency take:

o # of 'H'/Total = Gene frequency of 'H'

o # of 'h'/Total = Gene frequency of 'h'

o The frequency of 'H' and 'h' = 1 (all the alleles for fur in the population)

10. Plot your frequency of 'H' and 'h' on one graph using a solid line for 'H' and a dotted line for 'h'. Plot the class data on the same graph using the same symbols but a different color. Graph paper will be on the cart in the lab.

Laboratory Questions

Student _____

Section _____

Date _____

1. Do your results support your hypothesis? If not, explain why.

2. What happened to the number of the dominant gene from one generation to the next?

What happened to its frequency?

Account for any change.

3. What happened to the number of the recessive gene from one generation to the next?

What happened to its frequency?

Account for any changes from generation to generation.

4. What would happen to the gene frequency of the recessive allele if it became extinct?

5. How would emigration and immigration affect the gene frequency of 'H' and 'h' in this population of tigers?

6. Compare your data with the class data which will be recorded on the blackboard. How does your data differ?

7. Define evolution. Are the results of this game/simulation an example of evolution?

Explain your answer.

