

Breeding Bunnies

Summary

In this activity, students will examine natural selection in a small population of wild rabbits.

Time Frame

1 class periods of 45 minutes each

Group Size

Small Groups

Materials

- [student worksheet](#)

(attached)

Per group:

50 white beans and 50 red beans (about 500 of each)

paper bag or deep container

3 dishes (about 30)

Background for Teachers

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.

Student Prior Knowledge

Students should understand basic Mendelian genetic terms like homozygous, heterozygous, dominant, recessive, gene, and allele. They also must understand the roll of natural selection in evolution.

Instructional Procedures

Move students into small groups and pass out the student handout "Breeding Bunnies" Hand out materials to each group 1 deep container, 3 dishes, 50 red beans, and 50 white beans.

The red beans represent the allele for fur (F), and the white beans represent the allele for no fur (f). The container represents the English countryside, where the rabbits randomly mate.

Label one dish FF for the homozygous dominant genotype. Label a second dish Ff for the heterozygous condition. Label the third dish ff for those rabbits with the homozygous recessive genotype.

Place the 50 red and 50 white beans (alleles) in the container and shake up (mate) the rabbits. (Please note that these frequencies have been chosen arbitrarily for this activity.)

Without looking at the beans, select two at a time, and record the results on the data form next to "Generation 1." For instance, if you draw one red and one white bean, place a tally mark in the chart under "Number of Ff individuals." Continue drawing pairs of beans and recording the results in your chart until all beans have been selected and sorted. Place the "rabbits" into the appropriate dish: FF, Ff, or ff. (Please note that the total number of individuals will be half the

total number of beans because each rabbit requires two alleles.)

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 aside before beginning the next round.

Count the F and f alleles (beans) that were placed in each of the "furred rabbit" dishes in the first round and record the number in the chart in the columns labeled "Number of F Alleles" and "Number of f Alleles." (This time you are really counting each bean, but don't count the alleles of the ff bunnies because they are dead.) Total the number of F alleles and f alleles for the first generation and record this number in the column labeled "Total Number of Alleles."

Place the alleles of the surviving rabbits (which have grown, survived and reached reproductive age) back into the container and mate them again to get the next generation.

Repeat steps five through nine to obtain generations two through ten. If working as a team, make sure everyone in your group has a chance to either select the beans or record the results.

Determine the gene frequency of F and f for each generation and record them in the chart in the columns labeled "Gene Frequency F" and "Gene Frequency f." To find the gene frequency of F, divide the number of F by the total, and to find the gene frequency of f, divide the number of f by the total. Express results in decimal form. The sum of the frequency of F and f should equal one for each generation.

Have members of the group record your group's frequencies on the board so your classmates can see them.

Complete the Discussion Questions form with your group.

Extensions

Adding multi color beans representing multiple alleles for the hair traits in bunnies

Adding in the idea of tree mapping to see changes of the alleles over time

Adding competition or predation and different climate changes by rolling a die to explore affects of biotic factors affecting abiotic factors (for earth systems teachers)

Adding environmental mutagens to see how it changes populations

Assessment Plan

Scoring Guide:

1. Students properly fill in introduction section (2 points for hypothesis).....4 pts

2. Students properly fill in data table.....10 pts

3. Students correctly answer analysis questions (2 points each).....12 pts

Based on your lab data, do you need to change your hypothesis? Explain. -- This questions could have various answers, however to receive full points it should answer the questions if they needed to change their hypothesis and explained clearly why.

How did the number of alleles for the dominant characteristic compare to number of alleles for the recessive characteristic? How did those numbers change over time? -- For the first few generations the numbers may vary, however over time, we would expect an increase in dominant alleles and a decrease in recessive alleles.

How do the frequencies of the dominant allele compare to the frequencies of the recessive allele over time? -- The answer should explain that because the number of dominant alleles is increasing the frequency is also increasing and as the number of recessive alleles is decreasing the frequency is also decreasing.

In a real rabbit habitat new animals often come into the habitat (immigrate), and others leave the area (emigrate). How might emigration and immigration affect the gene frequency of F and f in this population of rabbits? How might you simulate this effect if you were to repeat this activity? -

- The first part of this question should mention that the hairless bunnies may emigrate to warmer climates and survive better. They could also discuss how predators or other herbivores may immigrate and change the ecosystem by causing predation or competition. The second part of the question answers may vary and depend on student's ideas.

How do your results compare with the class data? If significantly different, why are they different? -- Answers may vary but must be complete for full points.

How are the results of this simulation an example of evolution? -- Answers may vary, but overall idea of the answer should demonstrate an understanding of the part of genetic traits and mutations in natural selection.

4. Students write thoughtful conclusion.....4 pts

Bibliography

Lesson Design by Jordan School District Teachers and Staff.

Authors

[Utah LessonPlans](#)