Seeds, Leaves, and Fingers

Assessment: Students measure and make observations of seeds, leaves, and their own index fingers to document and quantify variation in individuals of the same species.

Educational Delivery:
Time: 1 class period

Materials:
Per class: jars or large test tubes, 8
Per lab group (2 students): metric ruler**;** pinto bean seeds or other dried bean seeds, 10**;** graph paper, 3 pieces**;** leaves, 10 from the same tree species

Procedures:
Part A
Working in pairs, students measure the length of each of their seeds in millimeters and then sort the seeds according to length. Provide 8 to 10 jars or large test tubes of uniform size, labeled in millimeter intervals corresponding to the range of distribution in size you might find among the seeds. Students add their seeds to the appropriate jars and then measure the height of the seeds in each jar in centimeters. Write these measurements on the chalkboard. A continuous normal curve of distribution results. Students then plot on graph paper the height of the beans in each jar (vertical axis) as a function of size of the seeds (horizontal axis). If the seeds are kept dry, they can be saved from year to year for this activity.
Part B
Working in pairs, students measure the length of each of the 10 tree leaves from the end of the petiole to the tip of the leaf (in centimeters). Record the measurements on the chalkboard, organized by the number of leaves that measure within a given range of values. Students then draw a graph and plot the data as before.
Part C
Each student measures his or her index finger from the base of the finger to the tip. Record their measurements on the board and have them graph the data as before in Parts A and B.

Concept Summary:
A basic component of Darwin's theory of natural selection is that populations that reproduce sexually show great variation in phenotype (the physical expression of the genes of the organism). The occurrence of variations within the members of a species is a basic requirement for the mechanism of natural selection. In some cases, a variation in a species will cause some members to survive and reproduce better than others. Over time the variation will become the norm as those members of the species with the variation survive in greater numbers than do those members without the variation. However, most of the time, as in the example of length of index fingers, simple phenotypic variations within a species do not confer any special reproductive advantage for the members that express them.

If a given sample population is large enough and the environment for that organism is stable, the statistics for a given variation will reveal that the mode = mean = median. Under such stable conditions, most variations from the norm, arising through mutation or recombination of existing alleles of genes, are likely to be harmful. The organisms most likely to reproduce successfully are those with a phenotype that is close to the average for the population. The variants are less likely to reproduce and so are at a selective disadvantage compared to the norm. This is stabilizing selection; variants at the extremes of the range are eliminated.

Variations:
Students could extend this activity by comparing the degree of variation of several species of plant leaves. Students could calculate mode, mean, and range of variation for each species to determine if any generalizations can be made based on plant type, age, or location. Is there a difference between native species and imported ones?

Name _____ Date _____ Period _____

Seeds, Leaves, and Fingers

Think ahead: Why do species show variation in traits? Why is this so important?

Overview:

It is said that no two snowflakes are exactly alike. Can the same be said for living things? How can you determine and show the amount of variation within individuals of the same species? Is variation good for a species? In this activity you will examine variation in seeds and leaves and among students' index fingers. A basic component of Darwin's theory of natural selection is that populations that reproduce sexually show great variation in the physical expression of the genes of the organism. In terms of adapting to the environment, is one variation better than another? How would you decide the answer to such a question?

Procedures:

Part A

1. Measure the length of 10 seeds in millimeters. Sort the seeds according to length and record the length below.

Seed 1	Seed 2	Seed 3	Seed 4	Seed 5	Seed 6	Seed 7	Seed 8	Seed 9	Seed 10

2. Place the seeds in the labeled class jars corresponding to the length of the seeds. Label the axes of the graph below and plot the number of seeds of each length.

Part B

1. Measure the length in centimeters of each of 10 leaf blades of the same species. Record your data below:

Leaf 1	Leaf 2	Leaf 3	Leaf 4	Leaf 5	Leaf 6	Leaf 7	Leaf 8	Leaf 9	Leaf 10

2. Compile and record the class data, then draw a graph and plot the data.

Part C

1. Measure the length of your index finger from the base to the tip. Use the side inside your hand and don't include your fingernail.

   My index finger is _____ mm. Add your results to the class data on the board.

2. When the class totals have been placed on the chalkboard, draw a graph and plot the data.

Questions:

1. What is the range of measurements for the bean seeds?

2. What is the range of measurements for the leaf blades?

3. What is the range of measurements for index fingers?

4. The mode is the most frequently occurring value. What is the mode for Parts A-C?

   seeds _____ leaf blades _____ index fingers _____

5. Describe the shapes of each of your graphs.

   Seeds:

   Leaves:

   Fingers:

6. What does this tell you about variations within a species?

7. What do you think would happen to your graph after 10 generations if large seeds in nature are more easily found and eaten by other species? Explain your answer.

8. What do you think would happen to your graph after 10 generation if the large seeds contained more water and nutrients, causing a larger number of their offspring to survive? Explain your answer?

9. What factors in nature may be present that would select for leaf size?

10. What factors in nature may be present that would select for index finger size?