Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_
**Natural Selection Activity**

**Background Information**

A population is a group of organisms, all of the same species, living together in a specific area. A healthy population typically grows and dies at a relatively constant or steady rate until factors in the environment, such as water, food, space, disease, or predators, change. After making observations of populations over long periods of time or many generations, scientists have realized that diversity or variations between individuals can increase. **Variations** are differences in genetic traits between individuals. When variations are an advantage to the survival of the species they are called adaptations. Sometimes, when variations become more significant, a new species may arise that can be traced back to the original population. The occurrence of new biological species due to the process of evolution is called **speciation**.

The idea that populations of organisms can change over time is central to our understanding of evolution. Charles Darwin (1809-1882) first developed the idea of **natural selection** after a five year journey, which included the Galapagos Islands. After observing the diversity of animals present on the islands, he determined that variation exists among individuals within a population. Those individuals most adapted to the environment were most likely to survive, reproduce, and pass the genes for successful adaptations to their offspring. Over long periods of time, the changes in the original population could lead to the existence of new species. (Biggs, Hagins, Kapicka & et al, 2003).





In this activity, different types of beans will be used to represent the individuals of a population and a bowl will represent the environment. Holes in the bowl will represent pressures from the environment. The model will demonstrate how natural selection results in populations that are different from the original population. A living population of organisms would include many more individuals, but you will work with much smaller numbers.

**Biggs, A., Hagins, W. C., Kapicka, C., & et al, C. (2003).*Biology dynamics of life*. New York: McGraw-Hill/Glencoe.**

**Hypothesis:**

Write a hypothesis predicting how the population might change over many generations. Use your EDR to make sure your hypothesis is complete.

**Materials:**

Bowl with six holes, plastic cup of beans, bowl without holes

**Procedure:**

1. Obtain the materials for your lab group. To create the initial population, select **5 of each type of bean**. Place this population of 25 in the bowl.
2. Place the bowl *without holes* on the table. Above the bowl *without holes*, shake the bowl containing the beans for 5 seconds. You will get the best results if you shake the bowl from side to side just as you do before you throw dice. Note which beans fall through the holes and which beans remain in the original bowl.
3. A group recorder must keep accurate records of the numbers of beans that remain in the bowl after the shaking. The beans that fall through the holes are considered dead. The beans remaining in the bowl have survived and are considered the first generation. They are the parents for the next generation. Record the number of each type of bean representing the first generation in the data table.
4. Only beans that survive can reproduce. For each of the beans remaining in the bowl, add another one of the same type to indicate that the organism reproduced. Count the total number of each type of bean in the bowl and record your results in the data table as Generation 2, Starting number.
5. Repeat steps 2-4 with the population of Generation 2. Gently, shake the bowl for 5 seconds. Count and record the number of each type of bean remaining in the bowl. Record these numbers as Generation 2 survived. Again, duplicate the beans remaining in the bowl. Record the numbers for Generation 3, Starting number.

**Data: Population of Each Type of Bean for 5 Generations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Bean type*** | **Lentil** | **Split pea** | **Pinto** | **Kidney** | **Black** |
| **starting population** | **5** | **5** | **5** | **5** | **5** |
| Generation 1Number “survived” |  |  |  |  |  |
| Generation 2**starting population** |  |  |  |  |  |
| Generation 2Number “survived” |  |  |  |  |  |
| Generation 3**starting population** |  |  |  |  |  |
| Generation 3Number “survived” |  |  |  |  |  |
| Generation 4**starting population** |  |  |  |  |  |
| Generation 4Number “survived” |  |  |  |  |  |
| Generation 5**starting population** |  |  |  |  |  |
| Generation 5Number “survived” |  |  |  |  |  |

**Graph:**

Make a line graph with a line showing the **starting population** of each bean type over 5 generations. Use your EDR to make sure you have included all components of a good graph.

**Analysis**

1. Describe how the numbers of the different types of beans changed over 5 generations. Include numbers from your data.
2. Which types of beans were most likely to survive and which types were least likely to survive? Support your answer with numbers.
3. List at least 2 characteristics or traits of the beans that impacted the chances for survival.
4. Describe how these characteristics varied between the types of beans that were more successful (more likely to survive) and the types of beans that were less successful (less likely to survive).
5. Think about the pictures of the finches. What might have happened to the finch population if it didn't evolve into many different species?
6. How are the beans a good model of what happens to populations over time?
7. How are the beans a poor model of a living population?
8. Do you think that environmental changes are always bad for a species or do you think such changes can actually help certain species? Explain your answer using an example.
9. Do you think that extinction can occur because of environmental changes? Explain your answer.