**How Does Natural Selection Affect Allelic Frequencies?**

**I. Introduction**

In this exploration, you will investigate a simulated model of natural selection of an organism in different environments. The simulation represents the effect of predation on natural selection. The predator finds certain phenotypes of the prey more easily in those environments where they do not blend in. By placing pressure on specific phenotypes, a change in the frequency of the alleles that produce these phenotypes will occur. Natural selection can significantly alter the genetic equilibrium of a population’s gene pool over time. Evolution can be described as the change in allelic frequencies of a gene pool over time. This can lead to the evolution of a new species.

You will assume that the organisms’ survival depends upon a single gene with two alleles, **A** and **a**, that show incomplete dominance. These alleles combine to form three genotypes : **AA**, **Aa**, and **aa**. All three genotypes are phenotypically expressed as varying traits of the organism. Individuals carrying the genotype **AA** display “yellow” scales. Individuals heterozygous for the allele **A** and **a** have mostly “brown” scales. Individuals of the homozygous genotype **aa**, have “grey” scales.

Each variation of a trait may increase or decrease the organism’s survival in an environment. Note that not all phenotypic traits are visible. For instance, a plant may be drought resistant and this trait would only be detectable in a dry environment.

**II. Procedure**

1. Start the activity by going to the following website :

<http://glencoe.mheducation.com/sites/dl/free/0078802849/383939/BL_12.html> .

2. Select the “Initial Allelic Frequencies” of **A** and **a** and an “Environment”. The number of

organisms of each genotype will be displayed on the screen.

3. Click the “Natural Selection” button to show the number of organisms of each genotype that

survive after natural selection has taken place. The display will also show how natural

selection has affected allelic frequencies.

4. Click a “Generation” button, in order, from G1 through G5, to display 100 organisms in the

proportions representing the new allelic frequencies after natural selection occurred in the

previous generation.

5. Collect and record data on allelic frequency changes due to natural selection in the population

over five generations.

6. Use the “Reset” button to collect data with different initial allele frequencies or different

environments.

**III. Data**

1. Record your data in the Table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Allelic Frequencies In Different Environments** | | | | |
|  | **A = 0.2**  **A = 0.8** | **A = 0.4**  **A = 0.6** | **A = 0.5**  **A = 0.5** | **A = 0.6**  **A = 0.4** |
| Generation 1 |  |  |  |  |
| Generation 2 |  |  |  |  |
| Generation 3 |  |  |  |  |
| Generation 4 |  |  |  |  |
| Generation 5 |  |  |  |  |

**IV. Analysis & Conclusions**

**1. Did either allele A or a disappear from the population you studied? Why or why not?**

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**2. Did the effect of natural selection vary with different starting allele frequencies in**

**identical environments? Why or why not?**

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**3. A population in which the frequency of alleles remains the same over generations is said**

**to be in genetic equilibrium. Describe one mechanism by which a populations' genetic**

**equilibrium can be disrupted and result in the process of evolution.**

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**4. In which of the simulated environments do individuals of the genotype Aa survive best?**

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**5. In which of the simulated environments do individuals of the genotype aa survive best?**

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**6. Which set of data represents a type of natural selection that stabilizes the allele**

**frequencies of the population?**

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