The Hardy-Weinberg Equilibrium Lab – A Simulation

Objective
Students will learn how changes in allele frequency affect population changes.

Time
This lesson was designed for one or two 50-minute class periods.

Materials
(based on a class size of 30)
- One large aquarium or wading pool to serve as "gene pool"
- 60 index cards with "A" alleles
- 60 index cards with "a" alleles
- Hardy-Weinberg Equilibrium data collection handout

1. Have each student select an "A" allele and an "a" allele from the gene pool.
2. Determine the genotype of each student (first generation) and record the data on the board and on the Hardy-Weinberg equlibrium data record.
3. Calculate the frequency of the "A" allele and the "a" allele (first generation) and record the data.
4. Have each student randomly choose another student in the class to create offspring.
5. Have students face each other with both allele index cards behind their backs. Together, count to three and then reveal one allele. The two alleles (one from each student) represent the first offspring. Record results.
6. Repeat step 5 to produce a second offspring. Record results.
7. The first generation now dies out and one student assumes the genotype of one offspring, while the other student in each pair assumes the genotype of the second offspring. (Index cards represent genes. Students may need to return to the gene pool to select index cards that represent the genes of the new generation.
8. Have students return to their seats.
9. Count the number of each of the possible genotypes (AA, Aa, and aa) that occurred in the second generation and determine the frequency of each of the alleles (A and a).
10. Repeat steps 4-9 until you have the data recorded for at least five generations.

Population Two (Selection)
Follow the same procedure as in population one, but conditions are altered so that any offspring that are homozygous recessive "aa" will not survive and must be replaced (another mating must replace the "aa" offspring). Only "AA" and "Aa" individuals will occur in generation two and higher. Repeat steps four through nine until data is recorded for at least five generations.

Population Three (Heterozygote Advantage)
In this population, "aa" will continue to die out, but "Aa" has been found to survive at a higher rate than "AA." Therefore, if the offspring that is produced is "AA" flip a coin to determine if individuals with this genotype will survive. Heads means "AA" will survive; tails means "AA" will die. Repeat steps four through nine until data is recorded for at least 10 generations.

Population Four (Genetic Drift)
Divide the class into three small isolated populations, following the same procedure as Population One. Mating may only occur within the same group. Repeat steps four through nine until data is recorded for at least five generations.

Adapted with permission from Marilyn Havlik