

HARDY – WEINBERG LAB

I. Objectives:

II. Materials & Procedure:

III. Class Data:

	EE	Ee	ee
Generation 1			
Generation 2			
Generation 3	(big grp)/(small grp)	/	/
Generation 4	/	/	/

IV. Data Analysis: Calculate and fill out chart below
 Graph p and q vs. time. Interpret results.
 Sample calculations of p, q, p², q², 2pq for one generation

When calculating these values, remember you are not in complete H-W equilibrium, so the values may change depending on your starting point. So, start with your value of: P², then move your way to P, then Q, etc....

Class H-W Values:

	P	Q	P ²	Q ²	2pq
Generation 1					
Generation 2					
Generation 3	/	/	/	/	/
Generation 4	/	/	/	/	/

Conclusion Questions-

- A. What is H-W equilibrium?
- B. In case #1, are we in equilibrium? Why or why not?
- C. What does p represent? q? p²? q²? 2pq?
- D. What does the H-W equation predict for p and q?
- E. Do the results you obtained (the actual class data) agree with the H-W predictions? If not, why?
- F. In the isolated group, how do the frequencies of p and q compare to the frequencies in the larger group?
- G. What major H-W assumptions were not followed during Case #2?
- H. If you continued another 5 generations, predict the trend in p and q values.
- I. In a large population would it be possible to eliminate a deleterious recessive allele? Explain.
- J. How might geographic isolation influence the allele frequencies? Explain.
- K. Give one application of this lab to the environment.

The **Hardy–Weinberg principle** states that both allele and [genotype](#) frequencies in a population remain constant—that is, they are in equilibrium—from generation to generation unless specific disturbing influences are introduced. Those disturbing influences include *non-random mating*, *mutations*, *selection*, *limited population size*, "overlapping generations", [random genetic drift](#) and [gene flow](#). It is important to understand that outside the lab, one or more of these "disturbing influences" are always in effect. That is, Hardy–Weinberg equilibrium is impossible in nature. Genetic equilibrium is an ideal state that provides a baseline to measure genetic change against.

Static allele frequencies in a population across generations assume: random mating, no mutation (the alleles don't change), no migration or emigration (no exchange of alleles between populations), infinitely large population size, and no selective pressure for or against any traits.

In the simplest case of a single locus with two [alleles](#): the dominant allele is denoted **A** and the recessive **a** and their frequencies are denoted by p and q ; $\text{freq}(\mathbf{A}) = p$; $\text{freq}(\mathbf{a}) = q$; $p + q = 1$. If the population is in equilibrium, then we will have $\text{freq}(\mathbf{AA}) = p^2$ for the **AA** [homozygotes](#) in the population, $\text{freq}(\mathbf{aa}) = q^2$ for the **aa** homozygotes, and $\text{freq}(\mathbf{Aa}) = 2pq$ for the [heterozygotes](#).

Based on these equations, we can determine useful but difficult-to-measure facts about a population. For example, a patient's child is a carrier of a recessive mutation that causes [cystic fibrosis](#) in homozygous recessive children. The parent wants to know the probability of her grandchildren inheriting the disease. In order to answer this question, the genetic counselor must know the chance that the child will reproduce with a carrier of the recessive mutation. This fact may not be known, but disease frequency is known. We know that the disease is caused by the homozygous recessive genotype; we can use the Hardy–Weinberg principle to work backward from disease occurrence to the frequency of heterozygous recessive individuals.