# Introductory Biology -- Population Genetics Problem Set

1. Suppose that you study the genetics of a locus that controls flower color (C). There is no dominance and homozygous $C^R$ give red flowers, homozygous $C^W$ give white flowers and the heterozygotes are pink. You go out and write down the phenotypes of a number of plants and get the following:

red = 70
pink = 120
white = 110

(a) What are the allele frequencies in the study population?
(b) Is this population at Hardy-Weinberg Equilibrium?

2. Suppose that the following frequencies are observed for blood type alleles in a human population:

$I^A = 0.40$

$I^B = 0.05$

$i = 0.55$

(a) Write and expand an equation to predict the frequency of each genotype at Hardy-Weinberg equilibrium.

(b) If the population is at Hardy-Weinberg equilibrium, give the frequency of each of the following:

(i) type "O" individuals
(ii) A blood types who are homozygotes
(iii) total proportion who have type A blood
(iv) frequency of type AB

(c) What will the frequencies be of alleles $I^A$, $I^B$ , and i in the next generation? How about type O? What will be the frequency of each allele and type O in three more generations?

3. Suppose that you know a population is at or very close to H-W equilibrium with respect to a certain locus. Furthermore, assume that this locus, called A, shows complete dominance with only two alleles present (the dominant and recessive). Suppose that you count individuals with the two different phenotypes and find:

| | |
|---|---|
| Phenotype A | 125 |
| Phenotype a | 375 |

(a) What are the frequencies of the two phenotypes?
(b) What genotypes make up each phenotype?

(c) Assuming that the freq. (A) = p and freq. (a) = q, give the expressions from the H-W equation used to calculate the frequencies of each genotype.
(d) Calculate the frequencies of each allele. Note -- you will not be able to use the equation we learned in class that works for situations where there is lack of dominance. Why? Hint: Look at your answer to part (c) and see if any of H-W terms for genotypes corresponds to a group that we did actually measure.
(e) Find the frequencies of each homozygote and the heterozygotes.
(f) Would this technique work if the pop was not at H-W equilibrium?
(g) If a pop. is at H-W equilibrium for one locus, must it also be for others? Explain.
(h) If a population is at H-W equilibrium for a number of generations and suddenly there is selection for one of the homozygotes over the other phenotypes, what will happen to the other phenotypes and to the allele frequencies? (give a qualitative answer)