

Problem Set 6, Bio 4181: Due Nov. 10, 2009

1. The fruit fly *Drosophila melanogaster* uses the enzyme alcohol dehydrogenase (Adh) to detoxify the effects of alcohol in the rotting fruits in which they feed as larvae. Natural populations have two common alleles (F and S) at the autosomal *Adh* locus that codes for this enzyme. An experiment was done in which flies with the three genotypes were allowed to lay eggs on a food medium with a high alcohol content, and the mean number of adult offspring produced by the three genotypes in this experiment was as follows:

Genotype	Mean Number of Offspring
FF	120
FS	60
SS	30

- Assuming that egg-to-adult viability is the only fitness component, what are the relative fitnesses of the three genotypes using the convention that the fitness of FF is 1?
- Now assume in addition that FF and FS have the same fecundity, but that SS is five times as fecund as the other genotypes. Combine this information with that in part a) to give the relative fitnesses of the three genotypes, setting the fitness of FF to 1.
- Given a random mating population with a frequency of F of 0.4 in the initial gene pool and the fitness information given in parts a) and b), what are the adult genotype frequencies?
- What is the frequency of the F allele in the next generation given the information in parts a), b), and c)?
- What is the change in average viability in going from the generation described in part c) to the next generation that you calculated in part d)?
- Does the change in average viability violate Fisher's Fundamental Theorem of Natural Selection? Explain your answer.

2. Two chromosomal inversions are commonly found in populations of *Drosophila pseudoobscura*: Standard (ST) and Arrowhead (AR). When tested with the insecticide DDT, the genotypes for these inversions exhibit overdominance, with the following fitnesses:

Genotype	Fitness
ST/ST	0.47
ST/AR	1
AR/AR	0.62

What will the frequencies of ST and AR be after equilibrium has been reached in a randomly mating population?