

POPULATION GENETICS PROBLEM #2

Theodosius Dobzhansky (*Genetics* 32:142–160; 1947) investigated fitness differences among inversion types of *Drosophila pseudoobscura*. In one of his population cages he compared the fitnesses of individuals in an experimental population polymorphic for the Standard, *ST*, and the Chiricahua, *CH*, arrangements. He collected the following data:

	Inversion genotype		
	<i>ST/ST</i>	<i>ST/CH</i>	<i>CH/CH</i>
Larvae	41	82	27
Adults	57	169	29

Using these data answer the following questions:

1. Are the genotypes in larvae and adults in Hardy-Weinberg proportions?
2. Is the frequency of *ST* in larvae the same as it is in adults?
3. What is the fitness of the *ST/ST* homozygote relative to the *ST/CH* heterozygote?
4. What is the fitness of the *CH/CH* homozygote relative to the *ST/CH* heterozygote?
5. What is the expected frequency of the *ST* chromosome at equilibrium?
6. Are the chromosome frequencies in the experimental population are consistent with the equilibrium expectation?

Hints

- Don't specify genotype frequencies as a function of allele frequencies and an inbreeding coefficient. Rather, treat the genotypes as a multinomial sample, use priors like these

```

for (i in 1:3) {
  a.larvae[i] ~ dexp(1)
  x.larvae[i] <- a.larvae[i]/a.larvae.sum
}
a.larvae.sum <- sum(a.larvae[])

```

and calculate the allele frequencies and inbreeding coefficient from the genotype frequencies.

- If you use the following fitnesses for each of the genotypes

Genotype	<i>ST/ST</i>	<i>ST/CH</i>	<i>CH/CH</i>
Fitness	$w_{11} = 1 - s_1$	1	$w_{22} = 1 - s_2$

then the frequency of the *ST* chromosome at equilibrium is $p = s_2/(s_1 + s_2)$. To make sure you don't run into numerical problems when calculating this in WinBUGS, use this code:¹

```
p.poly <- step(s.1)*step(s.2)*(s.2/(s.1+s.2))
```

- See if you can figure out how to get the data into WinBUGS on your own. If more than one or two of you can't, I'll post that part of the code on the web site.

¹I'll explain what this code does in class.