Assignment 1: BIO 434

1. Prove that Hardy-Weinberg frequencies are obtained after one generation, when all of the assumptions are met, with random mating of diploid individuals. (We did this briefly in class; expand the algebra.)

2. Levy and Levin (1975) used electrophoresis to study the gene for phosphoglucose isomerase-2 in the evening primrose *Oenothera biennis*. They observed two alleles affecting electrophoretic mobility of the enzyme, and among 57 strains they found 35 PGI-2^a/ PGI-2^a, 19 PGI-2^a/ PGI-2^A, and 3 PGI-2^A/PGI-2^A genotypes.

a. Calculate the allele frequencies of PGI-2^a and PGI-2^A.
b. What numbers of the genotypes would be expected with random mating?

3. Phenylketonuria is an autosomal recessive form of severe mental retardation. About 1 in 10,000 newborn Caucasians are affected (i.e., show the phenotype of the disease). Assuming random mating, what is the frequency of heterozygous carriers?

4. Consider an autosomal gene with four alleles A1, A2, A3, and A4 with respective frequencies 0.1, 0.2, 0.3, and 0.4. Calculate the expected genotype frequencies for a diploid population with random mating.

5. A cross of Ab/aB with ab/ab produced 60 nonrecombinant and 40 recombinant offspring. Is there evidence of linkage?

6. For two genes, one with alleles A1 and A2 at frequencies p_1 and p_2 respectively and another gene has alleles B1, B2, and B3 at frequencies q_1, q_2, and q_3, what are the expected frequencies of gametes with linkage equilibrium, assuming that p_1 = 0.3, q_1 = 0.2, and q_2 = 0.3? What is the expected genotype frequency of A1 A1 B1 B3 at Hardy Weinberg equilibrium?