

HARDY-WEINBERG Problems

Modified from <http://www.k-state.edu/parasitology/biology198/hardwein.html>

The Hardy-Weinberg Law basically states that if no evolution is occurring, then an equilibrium of allele frequencies will remain in effect in each succeeding generation of sexually reproducing individuals. In order for equilibrium to remain in effect (i.e. that no evolution is occurring) then the following five conditions must be met:

1. No mutations must occur so that new alleles do not enter the population.
2. No gene flow can occur (i.e. no migration of individuals into, or out of, the population).
3. Random mating must occur (i.e. individuals must pair by chance)
4. The population must be large so that no genetic drift (random chance) can cause the allele frequencies to change.
5. No selection can occur so that certain alleles are not selected for, or against.

$$p^2 + 2pq + q^2 = 1 \text{ and } p + q = 1$$

p = frequency of the dominant allele in the population
 q = frequency of the recessive allele in the population

p^2 = percentage of homozygous dominant individuals
 q^2 = percentage of homozygous recessive individuals
 $2pq$ = percentage of heterozygous individuals

1. You have sampled a population in which you know that the percentage of the homozygous recessive genotype (aa) is 36%. Using that 36%, calculate the following:
 - a. The frequency of the " aa " genotype.
 - b. The frequency of the " a " allele.
 - c. The frequency of the " A " allele.
 - d. The frequencies of the genotypes " AA " and " Aa ."
 - e. The frequencies of the two possible phenotypes if " A " is completely dominant over " a ."
2. There are 100 students in a class. Ninety-six did well in the course whereas four blew it totally and received a grade of F. Sorry. In the highly unlikely event that these traits are genetic rather than environmental, if these traits involve dominant and recessive alleles, and if the four (4%) represent the frequency of the homozygous recessive condition, please calculate the following:
 - a. The frequency of the recessive allele.
 - b. The frequency of the dominant allele.
 - c. The frequency of heterozygous individuals.
3. Within a population of butterflies, the color brown (B) is dominant over the color white (b). And, 40% of all butterflies are white. Given this simple information, which is something that is very likely to be on an exam, calculate the following:
 - a. The percentage of butterflies in the population that is heterozygous.
 - b. The frequency of homozygous dominant individuals.

