

Population Genetics Homework 1: due Monday, 14 March

1. In a population you find that the frequencies of A and a are 0.95 and 0.05, respectively. Assume that the population is at equilibrium.

Determine parameter combinations that could lead to this observation on the basis of heterozygote advantage. In other words, find values for the genotype fitnesses, w_{AA} , w_{Aa} , and w_{aa} , that would give these frequencies at equilibrium. (You can set one of them, *e.g.* w_{AA} , equal to 1, then choose a possible value for one of the others, and then solve for the third.)

[Keep your work on this problem; the next homework assignment will build on it.]

2. Although the frequency of dominant alleles causing industrial melanism reached a very high level relatively quickly in England, the frequency of recessive alleles causing the light forms typically did not drop below 10%. What do you know about the dynamics of selection (not depending on frequency-dependent selection) that could explain this observation?
3. Using the software of your choice (*e.g.* Excel), program a simulation of the simple selection model presented in class, *i.e.* of equations (3) and (2) from the lecture notes (though you may want to use the 1 , $1-hs$, $1-s$ parameterization of the fitnesses). Output should include graphs of p_t vs. time and Δp vs. p_t .
 - (a) Email me your simulation program, including enough annotation that I can understand it.
 - (b) Use your program to explore the effects of the strength of selection (differences in fitnesses, *e.g.* the value of s) on the evolutionary response to selection, for a case of partial dominance ($w_{aa} < w_{Aa} < w_{AA}$; *e.g.* $0 < h < 1$); submit a few graphs illustrating what you find.