Hardy Weinberg Equilibrium Worksheet
BIOL 01104 Spring 2020, Dr. Spielman

Scenario 1

Wing coloration in the scarlet tiger moth is governed by a single gene with two alleles, A and a, where each genotype has the given phenotype.

- Genotype **AA** individuals have white spots.
- Genotype **Aa** have intermediate-colored spots.
- Genotype **aa** have no spots at all.

This phenotype-genotype relationship provides an example of a *phenotypic incomplete dominance*, under *balancing* natural selection. Researchers studying a population of these moths found the following numbers of individuals for each phenotype (genotype): white-spotted (AA) = 1470, intermediate spots (Aa) = 140, and no spots (aa) = 10.

1. Calculate the values for p (frequency of allele "F") and q (frequency of allele "f") . Confirm you are correct by checking that $p+q=1$.

2. Calculate the ***expected NUMBER*** of individuals for each genotype if the population were in HWE using the formula $p^2 + 2pq + q^2$. (Hint: this formula will give you the expected frequencies of genotypes. You must multiply by the total number of individuals to get the expected number.)

3. Compare the observed numbers to the expected: Do you believe this population is in HWE?

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Scenario 2

You are studying an elusive population of blast-ended skrewts (Harry Potter anyone? Please???), who show heritable variation in their attack phenotypes - some preferentially shoot fire at and some preferentially sting their prey. You have further determined that this trait is controlled by a single gene, F/f (for fire!), such that:

- Genotype **FF and Ff** individuals shoot fire.
- Genotype **ff** individuals sting.

With a brave crew of research volunteers, you journey into the Forbidden Forest and take a small sample (very carefully!) from their tails to determine their genotypes. In the end, you found 250 skrewts with the following genotypes: 119 FF, 107 Ff, and 24 ff.

1. Calculate the values for p (frequency of allele "F") and q (frequency of allele "f") . Confirm you are correct by checking that $p+q=1$.

2. Calculate the expected NUMBER of individuals for each genotype if the population were under HWE, using the formula $p^2 + 2pq + q^2$.

3. You return the next generation and you find there are 200 FF individuals, 18 Ff individuals, and 32 ff individuals. Does this finding provide evidence that the population is more likely in HWE, or more likely evolving?

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Scenario 3

You are studying a population of invasive cane toads in Australia. These toads can squirt a toxin from glands around their face when threatened. Are are studying a gene which controls the level of toxicity, where toxin form TT individuals is 100% deadly, Tt toxin is 75% lethal, and tt toxin in 60% lethal.

You observe in one generation that, of 500 cane toads, 100 are TT, 300 are Tt, and 100 are tt. Assume the population then undergoes a generation of random mating and enters HWE. What will its genotype frequencies be at that time?