Competition and Natural Selection

If you remember only one thing from this class, that should be evolution by natural selection. This theory forms the basis for much of this class and for much of modern biology. Natural selection incorporates ideas of population growth into our understanding of why a population changes through time. That is, not every individual will survive to reproduce, so birth rates and death rates of different phenotypes will influence what a population will look like at some point in the future.

With that being said, the first idea you needed to understand is "fitness", which is a measure of reproductive success. Next, there is the idea of "relative fitness." This is compares the fitness of one organisms with the reproductive success of all organisms within a population. If all individuals have the same relative fitness, will a population evolve? Think about it.

In addition to reproduction, there are three conditions that must be met in order for a population to evolve via natural selection.

1) There must be variable **phenotypes** within a population
[note: quite often when we introduce this idea we just focus on a single phenotypic trait (e.g., size), but in reality, many traits will be acted on by selection]

2) The **phenotypic trait** of interest must have a genetic basis, at least in part. That is, it can be passed on to the offspring.

3) Some **phenotypes** have a higher probability of surviving and reproducing than other phenotypes--that is, there is differential reproductive success.

For all of the conditions listed above, note that we are focused on the phenotype. The is because it is the phenotype that is interacting with the environment and with other organisms, and so natural selection acts on the phenotype.

In lab you were using the mustard plant, *Brassica*, in your study of natural selection. You had two phenotypes grown under different conditions of competition, and you were trying to see if competition was affecting the reproductive success of the mustard, and ultimately would natural selection favor one phenotype over another.

Before we can see if natural selection can act on the *Brassica*, we need to see if all of the conditions of natural selection were met.
Was there phenotypic variation? Yes--there were green plants and yellow-green plants. Was there a genetic basis for this color? Yes--the Y allele produced a green plant, and the yellow-green plants were homozygous for the y allele (yy). Was there differential reproductive success? This is what you were testing, and so the answer depends on your results.

Recall there were three treatments--plants grown alone, intramorph competition, and intermorph competition. Again, going back to the big question you were exploring, is competition affecting the reproductive success of the green morph or yellow-green morph under different competition regimes? To answer this you chose components of fitness to measure (or proxies of reproductive success--why did you chose proxies and not measure fitness directly?), you pooled your data with the class, and then decided if there was an effect of competition.

In this lab we asked you to analyze your data using a t-test, which is one of a myriad of statistical tests available--when you take statistics you'll understand why we used a t-test--don't worry about it for this class. One thing we do want you to think about is why are we using statistics. Try to think of it as another tool in science to help you analyze a data set. The t-test for this lab helps us determine if the average number of flowers, for example, was truly different between the green morph and the yellow-green morph, thus a difference in reproductive success, or there was no true difference in the number of flowers, thus no difference in reproductive success. Again, the t-test was a tool to help make this determination by taking into consideration the sample size and how variable the data were. Whether or not you found a difference was dependent on the data you collected. So did you find a difference in reproductive success? If so what do you think the implications are for your Brassica population?