JF Notes: 2020 02 11  
  
**1) We already see cost occurs in constant environments. Two models tested are pleiotropy and mutation accumulation. A negative correlation between environments supports pleiotropy. There is also a prediction that AP should cause breadth in fitness to be more narrow when selection in constant environment. We don't have good reaction norms for evolved lines, but we will.**

* Pleiotropy vs. Mutation accumulation
  + Negative correlation between fitness in no stress vs. high stress environment supports pleiotropy.
    - TEST: cor.test with current fitness data.
    - TEST: JF Phenotyping data.
  + Antagonistic pleiotropy should cause fitness breath to be more narrow for constant lines than fluctuating lines.
    - TEST: requires JF phenotyping data (10? Environments), VF fitness assays too coarse (no stress, low, high, very high).

**2) In fluctuating environments, is response due to increase in mean or decrease in environmental variance in fitness. The long-term fitness of a genotype in a heterogeneous environment is best described by its geometrical mean fitness across environments (Gillespie, 1973) which is approximately w - 1/2 sigma^2 (Bulmer, 1994). This in turn implies that the kinds of adaptations that evolve should be specific to the scale of environmental variation (Bradshaw, 1965). So, lets calculate the increase in mean and decrease in env. variance in fitness for each of our lines. There is comparatively little data on the response of the environmental variance to natural selection. With you current data we only have crude measures of environmental variance in fitness. But we will soon have much better data.**

* Flux: increase in mean fitness vs. decrease in variance for fitness
  + Calculate mean fitness across environments (expect to increase).
    - QUANTIFY: mean fitness across no stress and high stress environments for each treatment with VF data.
    - QUANTIFY: mean fitness across environments with JF phenotyping data.
  + Calculate variance in fitness across environments (expect to decrease).
    - QUANTIFY: variance in fitness across no stress and high stress environments for each treatment with VF data.
    - QUANTIFY: variance in fitness across environments with JF phenotyping data.

**3) Is there a cost to generalist strategy. This can be tested by connecting performance of specialists in each environment.**

* Cost of generalist (flux treatment) relative to both benign specialist (lower stress treatment) and stress specialist (higher stress specialist)
  + TEST: ?

**4) Is evolution of generalist slower than specialist? Prior results say yes, I suspect we will find the same. This is probably just a matter of measuring vector length of adaptation in 2d fitness.**

* Generalist evolution slower than specialist?
  + TEST: ?

**5) Does fluctuating cause increase in diversity, sympatric specialists? We've looked and so far we see none. But hard to say we have good power here. I'm not sure if the genomics data would help or not.**

* Does fluctuating select for increased diversity in phenotype/strategy (i.e., sympatric specialists?)
  + TEST: use pair data to do a cor.test for barcodes from the same well. Is fitness increase the same or different direction in no stress? High stress?

So, in conclusion I think we need to examine each of these issues and determine whether we can do a simple test with our existing data that would test these ideas. The main barrier right off is whether we can get a measure of environmental variance in fitness. I think this can be done even if just fitness measured in two environments.