Project for Quantitative Physiology Winter 2021. Geometric morphometrics.

In order to quantitatively probe the developmental biology of morphological and shape variation, researchers need a way to describe that variation in a way that is amenable to statistical analysis. Geometric morphometrics is a widely used tool for describing and analyzing morphological variation, but studies that merge it with a mechanistic developmental biology approach are rare.

In the paper we read, Matomoro-Vidal et al. used geometric morphometrics to track the emergence of differences between genotypes in wing shape during *Drosophila* development.

Choose one of two tasks:

a) Find a paper (not on fly wings) that analyzes the developmental biology of the shape of a body part but would be improved if the authors used geometric morphometrics to better describe the shape. The goal can't be simply to describe the shape better. Justify your choice by pointing to questions that were left unresolved, unexplored, or that were not well supported in the original analysis that would be clarified or made possible by integrating morphometrics into the approach. Describe what landmarks you would use and why, what comparisons you would do (i.e. between strains, genotypes, species, etc.), and speculate on what you think the results would be, and what you think you would learn that couldn't be learned by someone only doing developmental biology or morphometrics.

b) Find a paper (not on fly wings) that uses geometric morphometrics to quantitatively analyze shape variation but that would be improved if the authors incorporated mechanistic developmental biology experiments to explain where the variation comes from. As in (a) justify your choice by pointing to questions that were left unresolved, unexplored, or that were not well supported in the original analysis that would be clarified or made possible by integrating developmental biology into the approach. Describe what kinds of experiments you would do, how you would integrate these results with the morphometric results, and what you think you would learn that couldn't be learned by someone only doing developmental biology or morphometrics.

If you want to read more about geometric morphometrics, here are some textbooks, all of which are available in electronic versions in the library (and some in hard copy as well) in addition to a key clearinghouse website for this field.

- Zelditch et al. Geometric Morphometrics for Biologists: a primer
  (the source of most of the diagrams in my presentation)
- Bookstein. A Course in Morphometrics for Biologists (Bookstein is one of the major innovators in the field, but his books are a bit impenetrable)
- Claude. Morphometrics with R
- Dryden and Mardia. Statistical Shape Analysis with Applications in R
- http://life.bio.sunysb.edu/morph/