17. Mechanisms of diversification

"If we cannot end our differences at least we can make the world safe for diversity." --JFK

MAJOR THEMES
- Origins of body plans
- Protein products and mutations
- Homeobox genes
- Differential growth
- Allometry and isometry
- D'arcy Thompson's "method of transformations"
- Mollusc shell growth: simple rules?
- Navigating morphospaces

Recap: Patterns of diversity

OUTLINE

Mechanisms of diversification

- What is the role of major regulatory genes in phylum level-body plan diversity?
- How does differential growth contribute to diversity at finer taxonomic levels?

GOALS

After studying from lecture notes and the associated reading, you should be able to:

- Describe some hypotheses for what led to the appearance of the extant phyla by the end of the Cambrian and why no new phyla have appeared since
- Explain the roles of Homeobox-type genes in animal development
- Describe some examples of homeotic mutations in *Drosophila*
- Explain what is meant by a Homeobox gene complex, and describe why and how these complexes vary among phyla and classes
- Explain the significance of linear gene order within Homeobox gene complexes, and how this order relates to patterns of expression within an animal's body plan
- Explain the significance of the "homeobox" region of such a gene
- Define "allometry" and "isometry," and describe examples of "allometric growth"
- Explain D'arcy Thompson's "method of transformation" as a simple way of describing allometric growth
- Explain how the diversity of mollusc shells can be produced by simple rules for how shells coil during growth
- Explain what a morphospace is, and speculate on why large parts of the mollusc shell "morphospace" are vacant

REFERENCES

Arthur, W (1997). *The Origin of Animal Body Plans*. Cambridge University Press.

de Rosa et al. (1999). Hox genes in brachiopods and priapulids and protostome evolution. Nature 399:772-776.

Erwin D, J Valentine and D Jablonski (1997). The origin of animal body plans. American Scientist 85:126-137.

McGinnis W and M Kuziora (1994). The molecular architects of body design. Scientific American, Feb 1994, pp. 58-66.

Raup, DM (1966). Geometric analysis of shell coiling: general problems. Journal of Paleontology 40:1178-1190.

Thompson, D (1961, orig. 1917). On Growth and Form. Cambridge University Press.