Integrative Biology 200B   Spring 2011
"PRINCIPLES OF PHYLOGENETICS: ECOLOGY AND EVOLUTION"

Quiz 1
          You may use any books, notes, or references, but you must work independently of other people. To keep the amount of writing under control, <u>please confine the answers to the space provided on the front of the page</u> (but write clearly and large enough to see!); outlines and pictures are fine. You may go elsewhere to work on this, but either email it to <u>bmishler@calmail.berkeley.edu</u> or turn it in hard copy to room 3083 by **3:30**.

1. [10 pts.] The term 'diversity' often means different things to different life scientists. Compare and contrast these meanings as they relate to 'ecological diversity,' 'morphological diversity,' and 'evolutionary diversity.'

2. [10 pts.] You want to do a morphometric analysis of your taxa, but anticipate problems in assigning homologous points across the entire group. Somewhere you heard about using geometric homologous points, but are unsure on whether or not you should mix these two different kinds of landmarks.
          A. How are these two forms of landmarks different?
          B. Do you combine them in your analysis?

3. [10 pts.] Which evo-devo approach would be most appropriate for your group and why? Keep in mind the state-of-genomics and culturing\husbandry in your group.
     A. Forward genetic studies
     B. Reverse genetic studies

4. [10 pts.] What are the two fundamental steps in the process of putting time onto a node or a branch of a tree? Outline the recommended methods for carrying out these steps.

     1.

     2.

5. [10 pts.] What are the strengths and weaknesses of the Brownian motion model when it is used as a model for the evolution of a quantitative trait?

6. [10 pts.] There are several potential sources of incongruence between different 'gene trees' (and between a 'gene tree' and a containing 'species tree'). For the two listed below, provide a brief description of the process and describe the biological situations in which it is most likely to be common.

a. Lateral gene transfer

b. Incomplete lineage sorting

7. [10 pts.] Statistical thinking: Imagine that you have trait data and you have mapped it onto a known phylogenetic tree. These data are your observations. Describe a simple test you could do to check if your observed data show 'phylogenetic signal' -- i.e., do they correlate with the phylogeny more than would be expected by chance?

8. [10 pts.] Angiosperms are the most diverse group of land plants. Unlike all other organisms, they have flowers. Many have hypothesized that the rate of diversification in the angiosperms increased as a consequence of coevolution with insects enabled by the flower.

      a) Can the flower be considered a key innovation that led to an adaptive radiation?

      b) Describe problems with testing this hypothesis.

9. [20 pts.] What is the conceptual difference between the following pairs of terms, and how can you tell the difference in practice?

paedomorphosis vs. peramorphosis?

adaptation vs. exaptation?

paralogs vs. orthologs

replicator vs. interactor