Integrative Biology 200B Spring 2013

"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, please confine the answers to the space provided on the front of the page (but write clearly and large enough to see!); outlines and drawings are fine. You may handwrite or type your answers. You can hand in hardcopy to me at my office (4164 VLSB) until **7:00 pm**, or email to bmishler@calmail.berkeley.edu by **9:00 pm**, this evening, April 2.

1. [20 pts.] There are good a priori reasons to believe that laterally symmetric flowers (zygomorphy) may promote lineage diversification, compared to radially symmetric flowers. Three data sets are provided to you to address this question: 1) the diversity (number of named species) of flowering plant 'families' (assume for this study that they are all properly monophyletic), 2) a description of whether floral symmetry in each family is 100% bilateral, 100% radial, or mixed, and 3) a phylogenetic backbone tree showing relationships among families. How would you use this information to set up a comparative test of the hypothesis? What is expected under the null hypothesis? In general terms, what kind of statistical test could you use to test your data against this null hypothesis?

2. [20 pts.] Community assembly studies compare the species of local communities (at a particular scale) to a regional species pool. In rain forest studies, plants within local plots (1 ha scale) are more closely related to each than expected by chance, compared to a regional species pool spanning a range of habitats (Swenson). The plants of Hawai'i are also more closely related than by chance, if compared to a large regional species pool from the surrounding continents of the Pacific region. Given the different spatial scales of these data sets, do you believe that similar or different processes might contribute to these patterns? What other data (phylogenetic, biogeographic, ecological) could you collect to distinguish the role of alternative processes?

3. [20 pts.] Organisms are never wholly paedomorphic or peramorphic, but rather combinations of different heterochronic processes. Given that your organism is a developmental mosaic, how would you go about determining which developmental pathways are 'slowing down' and which have been "sped up"?

4. [4 pts each] Define the following terms and give a short example of how they apply to comparative phylogenetic studies:

a. shoehorning

b. shape coordinates

c. ghost lineages

d. subfunctionalization in gene-family evolution

e. adaptive radiation

5. [4 pts each] What is the conceptual difference between the following pairs of terms, and how can you tell the difference in practice?

a. diversity vs. disparity

b. adaptation vs. exaptation

c. parsimony vs. maximum likelihood reconstruction of ancestral character states

d. high phylogenetic signal vs. low phylogenetic signal

e. ultrametric vs. non-ultrametric trees