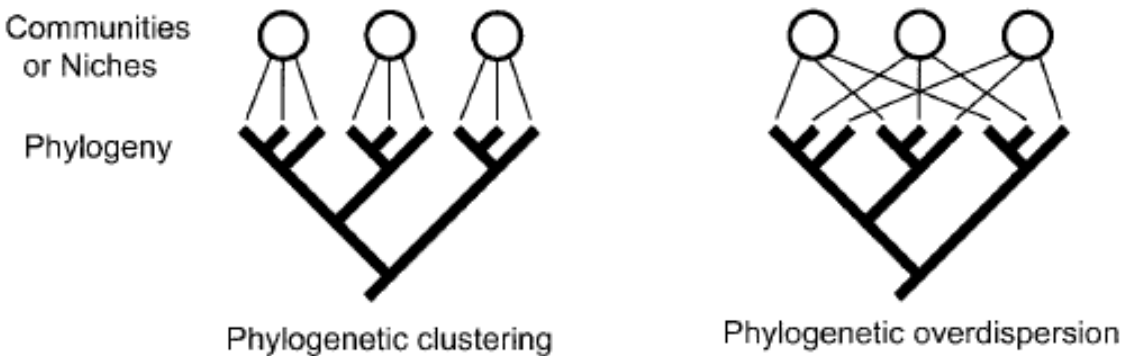


"PRINCIPLES OF PHYLOGENETICS "

Quiz 2

You may use any books, notes, or references, but you must work independently of other people. To help keep the amount of writing under control, outlines, bullet points, and drawings are fine. Please email to bmishler@berkeley.edu by **Midnight** Friday, 4/29.

1. [10 pts.] Ecological filtering refers to a process whereby species co-occurring within communities tend to be phenotypically similar to each other. Filtering can lead to either phylogenetic clustering or phylogenetic overdispersion (see diagrams below). Explain a scenario leading to each outcome.



2. [20 pts.] How can one test the hypothesis that the net diversification rate (speciation – extinction) is higher in one clade than another, if (1) the two clades are sister taxa; (2) you know the stem ages of the two clades (which are not necessarily the same) but not their internal phylogenies; (3) you have fully resolved and dated phylogenies for the two clades (again, not necessarily sister taxa or the same age).

3. [20 pts., 10 for each part] As we discussed in class, (1) biogeographic analysis of areas, (2) study of gene family evolution among genomes, and (3) studies of host-parasite coevolution often involve comparisons of different phylogenies, with tests for similarity in topology and/or timing.

A) Identify important ways in which these three types of studies are similar and different.

B) Then describe a comparative method that is used in *each* field, and evaluate whether it is appropriate to use it for the others. If not, why not?

4. [10 pts] You complete your study of a group of organisms using multiple sources of data and based on very highly supported clades in the phylogeny, it is clear that some existing taxa must be changed to reflect monophyly in the classification. However, a colleague feels strongly that

the existing classification should be maintained since it is a widespread, common and well-known group with an extensive literature in scientific and popular publications.

Do one of the following: If you agree with your colleague explain and justify your position. Or, if you disagree, then write a convincing argument to change your colleague's mind.

5. [20 pts., 10 for each part] Over the semester we've seen many models of discrete character evolution that are continuous-time Markov chains (CTMCs), and they underpin all likelihood and Bayesian phylogenetic methods.

A) Briefly explain what a CTMC model is, and describe the parameterization of a specific example (besides the DEC) that you used in lab.

B) The dispersal-extinction-cladogenesis (DEC) model is a CTMC, but it additionally includes an extra set of probabilities that other CTMC models of discrete character evolution do not. Explain what events these additional probabilities model. Why are these extra probabilities necessary for modeling geographic range evolution?

6. [20 pts., 10 for each part]

You have been awarded a grant to evaluate five valleys in a mountain range from a biodiversity standpoint and decide which two have the highest priority to preserve permanently as parks as a mitigation measure (the remaining three are likely to be developed for hydroelectric power). Consider your decision two ways, and give your criteria and the methods you would use: (A) using species diversity & species endemism measures, and (B) using phylogenetic diversity & phylogenetic endemism measures.