

"PRINCIPLES OF PHYLOGENETICS: ECOLOGY AND EVOLUTION"

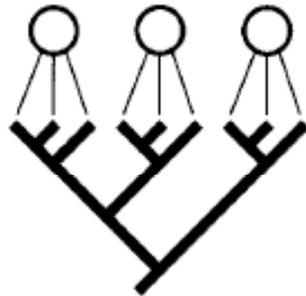
Quiz 2

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 pictures are fine.

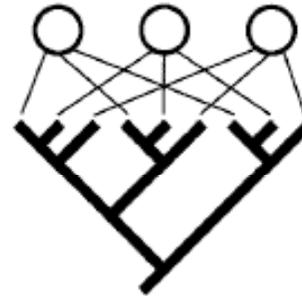
1. Ecological filtering refers to a process whereby species co-occurring within communities tend to be phenotypically similar to each other. Filtering can lead to either phylogenetic clustering or phylogenetic overdispersion (see diagrams below). Explain a scenario leading to each outcome.

Communities
or Niches

Phylogeny



Phylogenetic clustering



Phylogenetic overdispersion

2. The branching patterns of a phylogeny of leaf cutter ants and a phylogeny of their associated fungal symbionts match exactly. However, node dates derived from one fossil for each group do not match up. Does this falsify the hypothesis of cospeciation? If they did in fact cospeciate, how could you test for an association between node dates? In general, what is the role of branch length information in such comparisons? Does it matter if the branches are in relative time units, or if they are calibrated against absolute time?

3. Explain two roles of phylogenetics in establishing conservation priorities? In each case, what is the conservation objective (implicit or explicit) and how can phylogenetic information help to accomplish that objective?

4. What is meant by the age of a 'species'? How about the age of a higher taxon (i.e., that includes two or more 'species')? When we compare 'species' within a flora, can we say that some species are part of older taxa than others? Is there a better way to make comparisons without taxa?

5. One of the examples for selection operating above the species level is the positive correlation between geographic range and geologic duration of gastropod molluscs. Give another possible example of selection operating at or above the species level. Be sure to indicate what you mean by "selection operating at the species level".

6. What aspects of paleobiology enrich biogeographical and ecological studies of living taxa?

7. *Drosophila melanogaster* and *D. simulans* each have one copy of a gene which appear as sisters in a phylogeny of the entire genomes of both taxa. These genes may be orthologs in which case their divergence is explained by a coalescent process. On the other hand these genes could in fact be paralogs.

a) Would you expect the divergence of these two gene sequences to be older under the coalescent or the paralog hypothesis? Would both of these divergences occur before the speciation event?

b) What form would the ancestors of these two genes take in the ancestral population before divergence?

Under coalescent:

Under paralogy:

c) What happened after the populations diverged?

Under coalescent:

Under paralogy:

8. Compare and contrast two (2) of the following three (3) terms:

1. Center of origin vs. a generalized track
2. Vicariance biogeography vs. panbiogeography
3. Cosmopolitan taxa vs. endemic taxa

9 & 10. What sort of comparative method or approach would you apply to the following evolutionary questions (e.g., what assumptions would you make, what kind of data would you require, how would you generate a null hypothesis, how would you judge statistical significance?):

9. Periodic reticulation (interbreeding) has occurred among lineages of the oak clade throughout its history.

10. In the breakup of Gondwana, which two present-day continents were connected the longest?