"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 pictures are fine.

1. In flowering plants, the seed contains an embryo and a nutritive tissue called the endosperm; endosperm provides the energy for early seedling growth. Endosperm has evolved once, about 200-250 Ma and is now found in all ~250,000 species of flowering plants. Does endosperm exhibit high phylogenetic signal? If so, in what context? Can it be considered an adaptation? If needed, explain what additional information you would need to be able to give an unambiguous answer to these questions.

2. Given data on two traits, x and y, for a group of species you can calculate either the conventional interspecific correlation (Rs) based on the trait values of the species or the independent contrasts correlation, using the contrasts calculated on a phylogeny (Rc). For each one, you can then obtain the significance (P-value) based on the appropriate degrees of freedom (let's call them Ps and Pc). Describe any assumptions that are invoked to calculate Rs and Rc. How about Ps and Pc. Strong proponents of comparative methods will argue that the values of Rs and Ps are 'wrong'. What is meant by that?

3. Imagine you are a graduate student (imagine!) who has been asked by your tyrannical advisor to develop a test that will determine if a clade 'is an adaptive radiation'. Pick one of the following responses, and defend your answer: 1) There is no 'one' test for AR and it's silly to try and devise one (explain why). or 2) Yes, my chance at fame, I'm going to solve this problem! What would the elements of your test involve?

4. The fossil record contains more species (and therefore more morphologies) than currently occur on the planet. However, few transitionary examples exist, especially amongst invertebrate groups. Why might this be the case aside from the usual 'fragmentary nature of the fossil record" arguments?

5. Rigorous geometric morphometric studies require the correspondence of homologous landmarks on the specimens being compared. However in practice, determining a homologous point between taxa, and sometimes even between individuals of the same cohort, is problematic. Give an example of this potential problem from your favorite taxon.

6. Bats are one of the most diverse orders of mammals. Unlike all other mammals, they can fly. Has the rate of diversification in the bat clade increased as a consequence of their ability to fly?

a) Describe two problems with testing this hypothesis.

b) Make the hypothesis more general such that it resolves these problems.

7. What is the difference between paedomorphosis and peramorphosis.? How can you tell in practice?

8. What is the difference between allometry and isometry? How can you tell in practice?

9. What is the difference between adaptation and exaptation? How can you tell in practice?

10. What is the difference between clades and lineages? How can you tell in practice?