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Integrative Biology 200A "PRINCIPLES OF PHYLOGENETICS: SYSTEMATICS" Spring 2010

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 (but write clearly and large enough to see!); outlines and pictures are fine. Word-processed answers are OK, as long as they are the equivalent length. **The Quiz is due at 3:30 sharp**, either in room 3083 VLSB, or by email to: BMishler@berkeley.edu. Relative point value is given -- 100 points total.

1. (10 points) The dedicated dispersalist P.J. Darlington wrote in his book on "zoogeography" (1963) that "*All the main continents (except Antarctica) are connected or nearly so, or are linked by archipelagos so that, as Wallace says, it would probably be possible to travel over the whole system of continents without ever being out of sight of land.*" Given this, PJD explained all current distributions as the result of dispersal (or lack of dispersal) and response to climate. How is vicariance biogeography a response to this sort of dispersalist biogeography and what vicariance biogeography assumptions would PJD, or other dispersalists, find most problematic?

2. (10 points) A researcher collects a specimen of some organism on a remote island and declares that he/she will get the species' "DNA barcode" to identify it. This person is clearly very excited at the prospect, and has asked you to help. What advice can you offer him/her? Specifically explain what it takes to have a good DNA identification tool for a group of organisms and compare/contrast ideas about "DNA barcoding", "DNA taxonomy" and the effort/costs required and efficiency of various identification tools he/she might use?

3. (20 points) If species are just another arbitrary rank imposed on the tree of life as Prof. Mishler argues, address these two commonly-made distinctions:

(a) what is the difference (if any) between “micro-” and “macroevolution”?

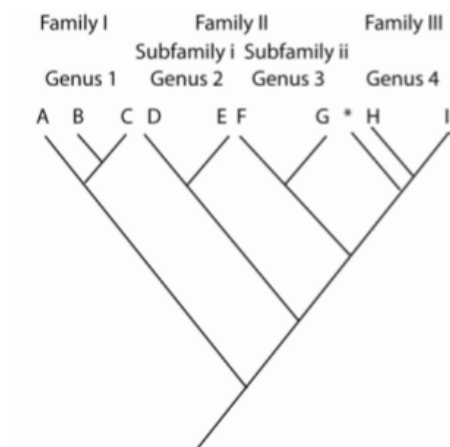
(b) what is the difference (if any) between phylogeography and regular phylogenetic biogeography?

4. (20 points) You need to estimate the age of divergence of two sister taxa. How are you going to do this? Give a short list of the steps you will perform to complete this task and the appropriate caveats that you will need to consider at each. What tests would you perform and how would you proceed given different outcomes of these tests. Are there any assumptions that go along with your decision?

4 (continue if needed)

5. (20 points) You have just completed an analysis that suggests the presence of an undescribed taxon (* in the figure at right). How would you formally name this new taxon using:

(a) Traditional Linnaean protocol (ICZN or ICBN):



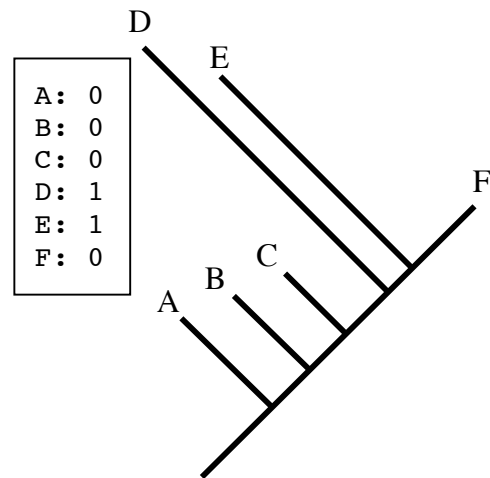
(b) Phylocode protocol:

6. (10 points) One way to estimate the biogeographic history of a clade is to classify each OTU into a single area, and then infer the locations of ancestral nodes using parsimony. Explain:

(a) How do DIVA and Lagrange differ from the above simple parsimony analysis?

(b) For DIVA and Lagrange, give a strength and weakness of each method.

7. (10 points) Consider the phylogenetic tree at right, where branch lengths are scaled to reflect expected amount of evolutionary change. Now consider the binary character shown in the box:



(a) show the two ways it can be mapped onto the tree using parsimony.

(b) what are these two different ways of mapping characters (under equal parsimony) called in general?

(c) what do these two different ways imply about evolution?

(d) what is the consistency index for this character? (show calculation with labeled numerator and denominator)

(e) explain in general terms how maximum likelihood would map this character on the tree?