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Ecology & Evolutionary Biology
Exam 4
19 December 2001

1. Describe 3 differences between *Homo habilis* and *Paranthropus robustus*. (6 points)

2. Describe an example of character convergence. (4 points)

3. Describe the theory of endosymbiosis. (4 points)

4. Use the following data matrix to answer questions a. through f. below.

Taxa	Characters										
	1	2	3	4	5	6	7	8	9	10	11
<i>Antus corus</i>	0	1	0	1	1	1	1	1	1	0	0
<i>Antus berus</i>	1	1	1	0	1	0	1	1	1	0	1
<i>Antus fagus</i>	0	1	1	0	0	1	0	1	0	1	1
(Outgroup) <i>Gadium larum</i>	0	0	0	0	0	0	0	0	0	0	0

a. Draw all of the different possible dichotomous sets of relationships among the three ingroup taxa provided in the data matrix above. (3 points)

b. Map the character data provided in the data matrix above onto each of your tree topologies. (6 points).

c. Based on the character data provided in the matrix above, which tree topology is most strongly supported by these data? (i.e., circle the most parsimonious tree above). (4 points)

d. Identify a synapomorphy for the group *A. corus* + *A. berus* + *A. fagus*. (3 points)

e. Identify an ingroup taxon that possesses the plesiomorphic condition of character 5. (2 points)

f. Identify an ingroup taxon that possesses the apomorphic condition of character 4. (2 points)

5. a. Describe one advantage of molecular data, relative to morphological data, as a source of characters for reconstructing phylogenetic relationships. (3 points)

b. Describe one disadvantage of molecular data, relative to morphological data, as a source of characters for reconstructing phylogenetic relationships. (3 points)

6. What is the relationship between the continental shelf and continental islands? (4 points)

7. What category of classification is most commonly used to address questions of quantitative change over geological time? Why is this the preferred category? (4 points)

8. Use the following tree of the phylogenetic relationships among 12 species of mayflies to answer questions a. through f. below.

a. Identify a paraphyletic group on this tree. (3 points)

b. What is the sister taxon to the group C + L. (3 points)

c. Identify a character that is synapomorphic for the group G + E + I + C + L. (2 points)

d. Identify a character that is sympleisiomorphic for the group I + C + L. (3 points)

e. Identify a character that is homoplasious on this tree. (2 points)

f. What type of homoplasy is illustrated by the character you have selected in part e. above? (2 points)

9. Answer questions a. and b. below using the following symbolic, ancestral developmental sequence and time line. Note: onset of sexual maturity is indicated with an asterisk.

a. Illustrate the developmental sequence of a descendant that is paedomorphic relative to the above ancestor. (Note: pay close attention to the time line and don't forget to indicate onset of sexual maturity with an asterisk!) (5 points)

b. What type of paedomorphosis have you illustrated in part a. above? (3 points)

10. Can the phylogenetic relationships among a group of taxa be determined from the fossil record alone? Explain your answer. (4 points)

11. Use the following map to answer questions a. through d. below.

- a. Illustrate, using shading on the map provided above, the distribution of a taxon that is disjunct and endemic to the Palearctic biogeographic realm. (4 points)

- b. Illustrate, using stripes on the map provided above, the distribution of a taxon that is endemic to an oceanic island. (3 points)

- c. Place Xs on the map to identify 4 biogeographic realms that were once part of the supercontinent of Gondwana. (Note: feel free to make additions to the map if you desire) (4 points)

- d. Approximately how old would a taxon distributed as you have indicated in 7b. need to be in order for its current distribution to be explained by the breakup of Gondwana? (circle one) (3 points)
 - i. 100,000 years
 - ii. 10 million years
 - iii. 100 million years
 - iv. 500 million years

12. Distinguish between cladogenesis and anagenesis using simple illustrations. (4 points)
13. What evidence exists to support an extra-terrestrial phenomenon as the cause of the mass extinction that occurred at the end of the Cretaceous Period? (4 points)
14. Identify three different sources of molecular sequence data that can be utilized in examining the phylogenetic relationships among plant taxa. (3 points)

