Molecular Evolution & Phylogenetics (BIOS 659: Advanced Studies in Genetics)

Assignment III – 19 Oct 2004

You'll need to use PAUP* for the following problems. PAUP is installed on iNquiry (http://inquiry.egg.isu.edu). Data required for the following problem may obtained from the course website but you may also use your own data. The problem requires the generation of some data – you will also provide a brief interpretation (1-2 paragraphs) of the final results. **The assignment is due on Tuesday, October 26.**

The Strepsiptera Problem.

From Tree of Life: Strepsiptera are obligate parasites of insects, with hosts ranging across 7 orders and 34 families. The name of the group is derived from the Greek words for twisted (streptos) and wing (pteron) and refers to the peculiar twisted wing of the male's hind-wings while in flight. Strepsiptera exhibit extreme sexual dimorphism. Strepsipteran males emerge from the host after endoparasitic pupation in the host. Adult males are free-living, and their sole mission is to find and fertilize a female. They have reduced forewings and fan-shaped hind wings, branched antennae, and raspberry-like eyes; the latter are very unusual among living insects and form a modern counterpart to the structural plan proposed for eyes of trilobites. Females of the strepsipteran family Stylopidae are neotenic (i.e., they retain juvenile features even in adulthood) and totally endoparasitic in their hosts. They are highly modified morphologically, lacking adult external characteristics such as eyes, antennae, legs, wings and external genitalia. In contrast, males and females in the strepsipteran family Mengenillidae leave the host at the end of the last larval instar to pupate externally. After eclosion, the females are free-living, with the presence of all other adult characteristics such as eyes, mouthparts, antennae, legs and a ventral genital opening, but with the absence of wings. Strepsiptera are a monophyletic group (the group contains all of its descendants) but **the position of Strepsiptera among Insecta is still not solved**.

1. Given the 18S genes of insects, consisting of 13 taxa and 770bp, use ModelTest to identify the best, unbiased estimate of substitution rates for the given data set.
    a) What is the model?

2. Set your distance model according to the parameters found by ModelTest. Find the NJ tree.
    a) Determine the distance score (ME) for the tree.
    b) Determine the parsimony score for the tree.
    c) Print a copy of the tree with branch lengths.

3. Use the Branch & Bound method to find the maximum parsimony (MP) tree(s).
    a) How many MP trees are there?
    b) Determine the parsimony scores for the MP trees.
    c) Determine the distance scores for the MP trees. Be sure the distance measure is set the same as in #2 above. Use "dscores /sorttrees;" to see the scores reported in ascending order.
    d) Calculate MP branch lengths (use "describe trees brlens=yes;")
    e) Determine the majority rule consensus tree (use "ConTree MajRule=yes").
    f) Print a copy of the consensus tree.

4. Discuss how the MP tree(s) differs from the NJ tree – compare topology and relative branch length estimates. What do the two trees tell you about the position of Strepsiptera among the insects?