BZ / BSPM 520 ADVANCED SYSTEMATICS

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Objectives:

Students will be able to conduct a phylogenetic analysis using both morphological and molecular characters. Students will be able to select appropriate loci for the desired level of phylogenetic analysis, align sequences, code the characters, obtain the most parsimonious tree(s) and branch-support values, and infer the evolutionary patterns of characters and taxa using the trees. Students will be able to critically evaluate the methods used and the support for conclusions reached in the phylogenetic literature.

Grading:

Exam #1:	20%
Exam #2:	20%
Cumulative final:	25%
Individual project:	35%

Reference books:

Felsenstein, J. 2004. Inferring phylogenies. Sunderland, Mass., Sinauer Associates, Inc.

Hall, B. G. 2011. Phylogenetic trees made easy: a how-to manual (4th edition). Sunderland: Sinauer Associates.

Hillis, D. M., C. Moritz and B. K. Mable, eds. 1996. Molecular systematics. Sunderland, Mass.: Sinauer Associates.

Kitching, I. J., P. L. Forey, C. J. Humphries and D. M. Williams. 1998. Cladistics: the theory and practice of parsimony analysis. Oxford: Oxford University Press.

Li, W.-H. 1997. Molecular evolution. Sunderland, Mass.: Sinauer Associates.

Schuh, R. T. 2000. Biological systematics. Comstock Publishing Associates, Ithaca.

Soltis, P. S., D. E. Soltis and J. J. Doyle, eds. 1992. Molecular systematics of plants. New York: Chapman and Hall.

Soltis, D. E., P. S. Soltis and J. J. Doyle, eds. 1998. Molecular systematics of plants II DNA sequencing. Boston: Kluwer Academic Publishers.

Williams, D. M. and M. C. Ebach. 2008. Foundations of systematics and biogeography. New York, Springer.

Yang, Z. 2006. Computational molecular evolution. Oxford, Oxford University Press.

WEEK 1:

The scope of systematics:

History of taxonomy (Mayr, E and P. D. Ashlock. 1991. *Principles of Systematic Zoology*, 2nd Ed., McGraw-Hill).

The three schools of Systematics: Phenetics, Cladistics, Evolutionary Classifications.

(Duncan, T. and T. F. Stuessy (eds.). 1984. *Cladistics.* Columbia University Press); Sneath, P. H. A. 1995. *Thirty Years of Numerical Taxonomy*. Syst. Biol. 44: 281-298; Quick, D. L. J. 1993. *Principles and Techniques of Contemporary Taxonomy*. Blackie Academic and Professional, London).

WEEK 2:

Taxonomic Monographs: Strategy of Publishing

Review of selected sources for nomenclature and systematics; review of publications in systematic zoology and botany.

WEEK 3:
Evolution of the theory of Nomenclature.
    International Code of Zoological Nomenclature. 1999. (4th edition)

WEEK 4:
– Museums and Collections
– (Proposal Presentations) Species Concepts
– *Discuss species concepts papers*

WEEK 5:
– Characters and fundamental concepts
– (Boris)
– Hypothesis Testing

WEEK 6:
– (Literature Review) Trees, Rooting, and Optimality
- Homology
– FIRST IN-CLASS EXAM

WEEK 7:
– Morphological character coding, polymorphism, missing data

 – Sequence alignment
– *Discuss readings (announced on Canvas)*

WEEK 8:
– Heuristic solutions and statistical approaches
– Optimality criteria - distance
– *Discuss readings (announced on Canvas)*

Spring Recess

WEEK 9:
– Optimality criteria – parsimony
– Optimality criteria – likelihood
– Optimality criteria - parsimony
WEEK 10:
– Comparing optimality criteria
– Tree-searching
- *Discuss readings (announced on Canvas)*

WEEK 11:
– Support – re-sampling
 – Support – optimality-based
- SECOND IN-CLASS EXAM

WEEK 12:
 – (Support) Organellar and nuclear genomes
– Simultaneous analysis
- *Discuss readings (announced on Canvas)*

WEEK 13:
– Introgression, gene trees/species trees

– Consensus, congruence, supertrees

- *Discuss readings (announced on Canvas)*

WEEK 14:
– (Conclusions) Phylogenetics online

– Clocks and rates
– Guest lecture, TBD

WEEK 15:
– Guest lecture, TBD
– Applied systematics
– Coalescent methods

FINAL EXAM: