

**PLB 449 Plant Systematics and Evolution
Fall Semester, 2005**

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Office Hours: I will meet with you individually by appointment.

Lectures: Monday & Wednesday, 1 - 1:50, Rm. 450 LS II

Discussions: Friday 1 - 1:50, Rm. 450 LS II. The assigned reading or readings are listed on your syllabus. Photocopies or reprints of papers not included in the Soltis et al. book will be placed in the Plant Biology library (Rm. 460). You may either read them in the library or copy them for your own use. Please do not remove them from this room unless making copies.

Textbook: Soltis, D., P. Soltis, and J. Doyle. 1998. Molecular Systematics of Plants II: DNA Sequencing. Kluwer Academic Publishers, Boston, MA.

Web Page: <http://www.science.siu.edu/Plant-Biology/PLB449/index.html>

Course Grading: Your grade for this course will be based upon your performance on lecture exams, Discussion participation (see above), and a term paper. The format for the lecture exams will be short answer and essay. The relative percentages for each are:

Exam 1	20%	
Exam 2	20%	
Final (comprehensive)		20%
Discussion participation	20%	
Term paper	<u>20%</u>	
Total	100%	

Discussion Participation: To ensure that everyone 1) reads the assigned papers and 2) participates in the Friday Discussion part of the course, I will be giving points for this part of the course. Each week I will ask one student to begin the Discussion by providing a brief (5-10 minute) introduction to the main concepts of the paper. Because I will not announce which student will be responsible prior to class time, all students should come prepared to give the introduction. Your grade for this part of the course will be determined by 1) whether you read the paper, 2) participation in discussing the paper, and 3) your degree of understanding following the discussion.

Term Paper: A list of potential topics for your term paper will be distributed early in the semester as well as instructions on format, length, style, etc. The term paper will be due on Friday Dec. 9, 2005.

PLB 449 - Syllabus Fall 2005

Date	Topics and Readings
Aug. 22	Introduction - What is systematics? Significance of phylogenetic information.
Aug. 24	Classification systems
Aug. 26	Discussion
	Reading: The Science of Plant Systematics, Chapter 1 (pp. 1-11) in Judd et al. (2002).
	Reading: Kruckeberg, A. R. 1997. Essay: Whither plant taxonomy in the 21 st century. Syst. Bot. 22: 181-182.
	Reading: Landrum, L. R. 2001. What has happened to descriptive systematics? What would make it thrive? Syst. Bot. 26: 438-442.
Aug. 29	Cladistics: analysis of morphological data
Aug. 31	Cladistics: manual method (WGPDM)
Sept. 2	Discussion
	Reading: Methods and Principles of Biological Systematics, Chapter 2 (pp. 13-39) in Judd et al. (2002).
Sept. 5	Labor Day Holiday, no class
Sept. 7	Cladistics: Homology. Discussion
	Reading: Crisci and Stuessy, 1980, Determining primitive character states for phylogenetic reconstruction. Syst. Bot. 5:112-135.
Sept. 12	Cladistics: anatomy of parsimony
Sept. 14	Homology: gene trees, species trees, orthology, paralogy. Discussion
	Reading: Soltis et al. Chapter 4, p. 101. Homology in Molecular Phylogenetics: A Parsimony Perspective. Jeff J. Doyle and Jerrold I. Davis
Sept. 19	Molecular evolution: nucleotide substitution models
Sept. 21	Molecular evolution: nucleotide substitution models. Review session for first exam
Sept. 26	Exam I
Sept. 28	Maximum likelihood. Reading: Soltis et al. Chapter 5, p. 132. Maximum Likelihood as an Alternative to Parsimony for Inferring Phylogeny Using Nucleotide Sequence Data. Paul O. Lewis
Oct. 3	Molecular evolution: molecular clocks, relative rates
Oct. 5	Molecular evolution, cont. Discussion. Reading: Soltis et al. Chapter 9, p. 242. Estimating Rate and Time in Molecular Phylogenies: Beyond the Molecular Clock? Michael J. Sanderson.
Oct. 10	Choosing a gene for phylogenetic analysis; overview plastid genome
Oct. 12	Chloroplast genes: "high level" relationships. Discussion. Reading: Soltis Chapter 1, p. 1. Choosing an Approach and an Appropriate Gene for Phylogenetic Analysis. Douglas E. Soltis and Pamela S. Soltis
Oct. 17	Chloroplast genes: "medium level" relationships

Oct. 19 Chloroplast genes: “low level” relationships. Discussion. Reading: Soltis Chapter 17, p. 488 A Perspective on the Contribution of Plastid rbcL DNA sequences to Angiosperm Phylogenetics. Mark W. Chase and Victor A. Albert.

Oct. 24 The evolutionary origin of the chloroplast

Oct. 26 Evolution of plastid genomes. Discussion and review for exam. Reading: Soltis Chapter 13, p. 375. The Origin and Evolution of Plastids and Their Genomes. Jeffrey D. Palmer and Charles F. Delwiche.

Oct. 31 Exam 2

Nov. 2 Phylogenetics of plants: nuclear genes. Discussion. Reading: Soltis Chapter 7, p. 188. Molecular Evolution of 18S rDNA in Angiosperms: Implications for Character Weighting in Phylogenetic Analysis. Pamela S. Soltis and Douglas E. Soltis.

Nov. 7 Phylogenetics of plants: nuclear genes

Nov. 9 Phylogenetics of plants: mitochondrial genes. Discussion. Reading: Duff and Nickrent (1999; Amer. J. Bot. 86:372-386).

Nov. 14 Phylogenetics of plants: mitochondrial genes.

Nov. 16 Combining data and congruence measures. Reading: Soltis Chapter 10, p. 265. Phylogenetic Incongruence: Window into Genome History and Molecular Evolution. Jonathan F. Wendel and Jeff J. Doyle

Nov. 19-27 Thanksgiving Vacation

Nov. 28 Phylogeny and biogeography

Nov. 30 Phylogeny and biogeography, cont. Discussion. Reading: Soltis Chapter 14, p. 410. Molecular Phylogenetic Insights on the Origin and Evolution of Oceanic Island Plants. Bruce G. Baldwin, Daniel J. Crawford, Javier Francisco-Ortega, Seung-Chul Kim, Tao Sang, and Tod F. Stuessy

Dec. 5 Parasitic plants: overview

Dec. 7 Parasitic plants: challenges for molecular evolution and phylogeny. Discussion. Reading: Soltis Chapter 8, p. 211. Molecular Phylogenetic and Evolutionary Studies of Parasitic Plants. Daniel L. Nickrent, R. Joel Duff, Alison E. Colwell, Andrea D. Wolfe, Nelson D. Young, Kim E. Steiner, and Claude W. dePamphilis

Final Exam Thu., Dec 15, 10:10 a.m.-12:10 p.m.

Useful References

Molecular Evolution & Molecular Systematics

- Avise, J. C. 2000. Molecular markers, natural history and evolution, 4th. edition. Kluwer Academic Publishers. 511 pp.
- Avise, J. C. 2000. Phylogeography: The history and formation of species. Harvard University Press, Cambridge, MA. 447 pp.
- Crawford, D. J. 1990. Plant Molecular Systematics, Macromolecular Approaches. John Wiley & Sons, New York. 388 pp.
- Gillespie, J. H. 1991. The Causes of Molecular Evolution. Oxford University Press, New York, N.Y. 352 pp.
- Graur, D., and W.-H. Li. 2000. Fundamentals of Molecular Evolution. Sinauer Associates, Inc., Sunderland, MA.
- Harvey, P. H. and M. D. Pagel. 1991. The Comparative Method in Evolutionary Biology. Oxford University Press, New York, N.Y. 248 pp.
- Hillis, D. M., C. Moritz & B. Mable. 1996. Molecular systematics, Second edition. Sinauer Assoc., Inc. Sunderland, MA 655 pp.
- Hollingsworth, P. M., R. M. Bateman, and R. J. Gornall. 1999. Molecular Systematics and Plant Evolution. Taylor and Francis, New York.
- Li, W.-H. & D. Graur. 1990. Fundamentals of Molecular Evolution. Sinauer Assoc., Sunderland, Mass.
- Li, W.-H. 1997. Molecular Evolution. Sinauer Associates, Inc., Sunderland, MA. 487 pp.
- Miyamoto, M. and J. Cracraft (eds). 1991. Phylogenetic Analysis of DNA Sequences. Oxford Univ. Press, N.Y. 358 pp.
- Page, R. D. M., and E. C. Holmes. 1998. Molecular Evolution - A Phylogenetic Approach. Blackwell Science, Oxford, UK. 346 pp.
- Patterson, C. (ed.). 1987. Molecules and Morphology in Evolution: Conflict or Compromise? Cambridge Univ. Press, Cambridge. 229 pp.
- Soltis, D., P. Soltis, and J. Doyle. 1998. Molecular Systematics of Plants II: DNA Sequencing. Kluwer Academic Publishers, Boston, MA. 574 pp.
- Soltis, P. S., D. E. Soltis & J. J. Doyle, eds. 1992. Molecular Systematics of Plants. Chapman and Hall, New York. 434 pp.

Plant Taxonomy & Biosystematics

- Briggs, D. & S. M. Walters. 1997. Plant Variation and Evolution, 3rd. edition. Cambridge University Press, Cambridge, UK.
- Cronquist, A. 1988. The Evolution and Classification of Flowering Plants, 2nd. Ed. New York Botanical Garden. 555 pp.
- Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia Univ. Press, N.Y.
- Davis, P. H. & V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, New York. A classic text used by previous generations of plant systematists.
- Grant, V. 1985. The Evolutionary Process: A critical Review of Evolutionary Theory. Columbia Univ. Press, New York, NY.
- Judd, W. S., C. S. Campbell, E. A. Kellogg, and P. F. Stevens. 2002. Plant Systematics: A Phylogenetic Approach, Second Edition. Sinauer Associates, Inc., Sunderland, MA. 576 pp. + CD. Used here at SIUC for PLB 304, also has basics of molecular systematics.
- Lincoln, R. J., G. A. Boxshall and P. F. Clark. 1982. A dictionary of ecology, evolution and systematics. Cambridge University Press, New York. 298 pp.

- Mabberley, D. J. 1997. *The Plant Book. A Portable Dictionary of the Higher Plants.* Second Edition. Cambridge Univ. Press, Cambridge. 858 pp.
- Radford, A. E. 1986. *Fundamentals of Plant Systematics.* Harper & Row, New York, NY.
- Radford, A. E., W. C. Dickison, J. R. Massey & C. R. Bell. 1981. *Vascular Plant Systematics.* Harper and Row, New York. 891 pp.
- Sivarajan, V. V. 1991. *Introduction to the principles of plant taxonomy.* Cambridge University Press, New York.
- Stace, C. A. 1989. *Plant Taxonomy and Biosystematics,* 2nd. Ed. Edward Arnold Publ. 288 pp.
- Stuessy, T. F. 1990. *Plant Taxonomy; The Systematic Evaluation of Comparative Data.* Columbia University Press, New York. 514 pp.
- Takhtajan, A. 1997. *Diversity and classification of flowering plants.* Columbia University Press, New York.
- Walters, D. R. and D. J. Keil. 1996. *Vascular Plant Taxonomy,* 4th. Ed. Kendall/Hunt Publ. Co., Dubuque, Iowa. 608+ pp.