Entomology and Genetics 606
Wildlife and Fisheries Sciences 646
Quantitative Phylogenetics
Spring 2014

Course Syllabus

Instructors:

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Office Hours at 320B Old Herman Heep Bldg. (HLB) by appointment.

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Office Hours at 305 Heep Center (HCPT) by appointment.

Purpose:

To provide students with hands-on experience in the inference of phylogenetic relationships using current computer applications.

Course information:

Class meets:

- Lecture on Monday and Wednesday, 12:40–1:30 pm, 210 Heep Center (HPCT)
- Lab on Fri 1:50–4:40 pm at 311 Old Herman Heep (Main Campus). We may occasionally meet at 302 Nagle Hall; but we will provide prior notice.

Course Description:

This course provides the theory and tools that are used to infer phylogenetic relationships using morphological characters, and DNA and protein sequences. The course emphasizes a hands-on approach to molecular phylogenetics and combines lecture presentations with computer exercises, discussion of original scientific literature and peer review exercises.

Course credit:

3 semester hours, based on 2 one-hour lectures per week and one three-hour laboratory session per week.

Prerequisite:

A basic course in principles of systematic and comparative biology. Entomology 601 at Texas A&M University provides the necessary background, but equivalent courses are fine with the consent of the instructors.

Textbook (Optional):

-Lemey, Salemi and Vandamme (2009), *The Phylogenetic Handbook, Second Edition*, Cambridge University Press, 723 pp.

Course Web Site for Content: https://insects.tamu.edu/entocourses/ento606/
Course Web Site for grades: ecampus.tamu.edu

Communication with Instructors:
Please use our tamu email addresses for electronic communications (do not use eCampus for this). In the subject line, include ENTO 606, GENE 606, or WFSC 646.

Grading:

Grades will be based on:
Final project proposal (5%)
Preliminary data set for final project (5%)
First draft of Final project (15%)
Written reviews of peers' first drafts (10%)
Final Paper (25%)
Homework/lab assignments (30%).
Class participation (includes leading paper discussions) (10%)

[91–100% = A; 81–90% = B; 71–80%= C; 61–70 = D; ≤60 = F]

Attendance:

Attendance to lectures and labs is compulsory. You should inform one of us as soon as possible if you plan to miss (or have missed) a lecture or lab/discussion due to a university-excused reason. Assignments will be given during lectures. Students are responsible for assignments even if they did not attend lecture during which the assignment was given, unless other arrangements have been made with the instructor. Each student will be responsible for leading the discussion of several papers throughout the semester, which will be assigned by us.

Discussion participation:

You will be expected to hand in via email or hardcopy at least three discussion points/questions regarding each paper to be discussed, prior to the discussion session. Questions that just reflect ignorance of the topic will not be accepted. However, part of the discussion session can be used to clarify concepts.

Course outline (Subject to Change):

Week 1		**Introduction (JBW)**
	Mon Jan 13	Introduction to Phylogenetics **Reading**: Goldman and Yang 2008
	Wed Jan 15	Homology and sequence alignment
	Fri Jan 17	Demonstration: Data file formats, tree file formats, data editing and file conversion tools (meet in Nagle 302)
Week 2		**Homology (JBW)**
	Mon Jan 20	No class; MLK holiday
	Wed Jan 22	Approaches to sequence alignment
	Fri Jan 24	**Lab 1:** BLAST, sequence alignment
Week 3		**Parsimony Analysis (JBW)**
	Mon Jan. 27	Basic parsimony analysis.
	Wed Jan 29	Character optimization and models of character state change
	Fri Jan 31	**Lab 2:** Parsimony analysis, character optimization
Week 4		**Advanced Parsimony Analysis (JBW)**
	Mon Feb 3	Strategies and algorithms for heuristic parsimony analysis **Reading:** Goloboff 1999 **One-page proposal for Final project due** (please submit by email to both of us)
	Wed Feb 5	Resampling methods, Bremer Support **Reading:** Soltis and Soltis 2003
	Fri Feb 7	**Lab 3:** Advanced parsimony analysis
Week 5		**Distance-Based Methods (JBW)**
	Mon Feb 10	Measures of molecular distance.
	Wed Feb 12	Clustering algorithms.
	Fri Feb 14	**Lab 4:** Phenetic analysis of molecular data, MEGA/PAUP*
Week 6		**Model-Based Methods: Maximum Likelihood Methods (MM)**
	Mon Feb 17	Substitution rate matrices, nucleotide frequencies, other model parameters.
	Wed Feb 19	Model Selection
	Fri Feb 21	**Lab 5:** ModelTest **Preliminary, aligned data for final project due**
Week 7		**Model-Based Methods: Maximum Likelihood Methods continued (MM)**
	Mon Feb. 24	Implementing a Maximum Likelihood analysis
	Wed Feb 26	Different algorithms and ML programs
	Fri Feb 28	**Lab 6:** Implementing a Maximum Likelihood analysis (Paup, PhyML, RAxML and GARLI)
Week 8		**Model-Based Methods: Bayesian Analysis (MM)**
	Mon Mar 3	Bayesian inference methods in phylogenetics.
	Wed Mar 5	Analytical issues, convergence of chains

	Fri Mar 7	**Lab 7:** Implementing a Bayesian analysis; MrBayes.
Spring Break	**Mar 10-14**	**Spring Break (NO CLASSES)**
Week 9		**Data Partitions (JBW)**
	Mon Mar 17	Strategies for analysis of heterogeneous data sets
	Wed Mar 19	Partitioned Bremer Support, tests for data congruence **Reading**: Lambkin 2004
	Fri Mar 21	**Ecological Integration Symposium (no lab)**
Week 10		**Gene Trees vs. Species Tree (MM)**
	Mon Mar 24	Gene trees vs. species trees, deep coalescence and lineage sorting, the "anomaly zone" **Reading:** Degnan et al. 2009
	Wed Mar 26	Analytical approaches to gene tree discordance
	Fri Mar 28	**Lab 8: Species tree analyses (BEST, *Beast, BUCKy)**
Week 11		**Testing Hypotheses: Topology Comparisons (MM)**
	Mon Mar 31	Topology Comparisons: AU test and (SOWH test)
	Wed Apr 2	Parametric Bootstrap
	Fri Apr 4	**Lab 9:** topology comparisons
Week 12		**Rate heterogeneity and the molecular clock (MM)**
	Mon Apr 7	Tests of Molecular Clock **First draft of final paper due (submit electronically)**
	Wed Apr 9	Calibration and relaxed clocks
	Fri Apr 11	**Lab 10:** Identifying Rate Heterogeneity among lineages, BEAST and Multidivtime
Week 13		**Testing Hypotheses: comparative analyses (JBW)**
	Mon Apr 14	Use of phylogenetic frameworks for hypothesis testing **Written reviews of peer's papers due**
	Wed Apr 16	Independent Contrasts. **Reading**: Garland et al. 2005
	Fri Apr 18	**Reading day: no classes.** We will not schedule a lab exercise this week, but we will be in the laboratory to help you with any issues with the analyses for your projects.
Week 14		**Open: unfinished topics or suggestions for additional topics (MM)**
	Mon Apr 21	**To be determined**. Some options: detection of recombination, ancestral trait reconstruction, model averaging, next generation sequencing and phylogenomics, etc.
	Wed Apr 23	TBD
	Fri Apr 25	**Open Lab**: we will be in the laboratory to help you with any final issues with the analyses for your projects, construction of figures, etc.
Week 15		
	Mon Apr 28	**Prep Day, classes meet**: Course Evaluations. Open discussion, critique of course, suggestions, problems encountered during course, etc. Last meeting of class.

	Tue Apr 29	**Redefined by TAMU as Friday**. No formal class, but instructors will be available in lab, upon request, for consultation on final projects. (If you would like to work with us, please send us an email to confirm so we will be sure to be there)
	Fri May 2	**Final Paper due.**

Class Participation.

We believe that participation in class is essential for graduate students to develop critical thinking and oral communication skills. It also allows us to gauge the level of understanding of covered topics, and the degree to which our teaching of various topics has been successful, or not. To obtain 100% in class participation, you should excel in all four of the following:

1- Participate with questions or comments during lectures.
2- You should lead discussions assigned to you. Come to class prepared to address major issues or questions with the paper.
3- Turn in your discussion points for each paper discussed in class, prior to class.
4- Participate actively in paper discussions, even if you are not the discussion leader.

Homework Assignments.

Weekly homework assignments provide practice with manipulating data and use of particular computer software relevant to each week's topics. In grading each assignment, we will use the following criteria:

1- Is each part of the assignment completed, and is an appropriate amount of output from programs, written discussion, or charts or figures provided so that we can determine that you have addressed all of the questions? When including computer output, be very selective in providing only what we ask for, or only what is essential to answer a question or address a particular point (60% of grade).

2- Are questions that require interpretation, analysis of results, or synthesis of results answered in sufficient detail, and in your own words (40% of grade)?

Americans with Disabilities Act (ADA) Policy Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Cain Hall or call 845-1637.

Academic Integrity Statement

"An Aggie does not lie, cheat, or steal or tolerate those who do."
Refer to the Honor Council Rules and Procedures on the web http://www.tamu.edu/aggiehonor.

Teaching Laboratory Safety

The Departments of Entomology and Wildlife and Fisheries Sciences are committed to the safety of all students and employees participating in teaching laboratories. To ensure that a safe environment is maintained in our teaching laboratories, it is expected that all students will adhere to general safety guidelines and emergency procedures, as well as course-specific and activity-specific safety instructions provided by faculty and teaching assistants. Laboratory safety and emergency procedures will be reviewed during the first class period and you will be asked to sign your acknowledgement of these instructions before attending further classes in this course.