BOT6935/ZOO6927 – Phylogenomics

Catalog Description

An advanced course in phylogenetic methods and theory, focusing on coalescent methods, their statistical background, and techniques for analyzing datasets of many taxa and loci.

Credit Hours

3 credits

Pre-requisites and Co-requisites

A course in phylogenetics or molecular systematics.

Course Objectives

By the end of the course, the student will be able to do the following:

- Explain maximum likelihood and Bayesian inference statistical approaches, and how they are used in phylogenetics/phylogenomics.
- Understand and explain the coalescent process and how it is used in phylogenomic analyses.
- Learn when and why to implement each one of the most recent software programs to perform phylogenomic analyses (ASTRAL, BUCKy, BPP, SVD-quartets, among others). Thus, we would like our students to learn to filter scientific arguments through the sieve of statistical argumentation.
- Learn the basics of using the UF high-performance computing cluster, HiPerGator, to perform these analyses.

Instructor Information

Name: Emily Sessa
Office location: Bartram 521A
Telephone: 392-1098
E-mail address: emilysessa@ufl.edu
Web site: http://sessalab.biology.ufl.edu
Office hours: By appointment

Name: José Miguel Ponciano
Office location: Carr 309
Telephone: 392-2784
E-mail address: josemi@ufl.edu
Web site: http://people.clas.ufl.edu/josemi/
Office hours: By appointment

Course Meeting Times and Location

MWF, periods 8–10 (3:00-5:10 pm)
Bartram 211

Course Website

Course materials and related information will be posted on the course E-Learning (Sakai) website at http://lss.at.ufl.edu. You are responsible for all announcements made in class and/or posted on the course website for this course.

Readings

Required: Required readings will be posted on Canvas.

Recommended: We strongly recommend that you purchase the book: Felsenstein, J. 2003. *Inferring Phylogenies*, 2nd Edition. Published by Sinauer.

Attendance Policy and Expected Conduct in Class

- Students are expected to be on time for class, and attendance in all class periods is mandatory. Please contact the instructor at least a week in advance if you must be absent. The policies for allowable absences and make-up work follow the university attendance policies: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx
- Only approved electronic devices may be used in class. Approved electronic devices are laptop computers (when used to take notes or otherwise participate in classroom activities) and voice recording devices. Unapproved electronic devices include cell phones, MP3 players, etc.The policies for allowable absences and make-up work follow the university attendance policies: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. The student will remain responsible for scheduling any make-up work with the instructor.

Grading

- Homeworks: 60% of final grade
- Presentations: 25% of final grade
- Class Participation: 15% of final grade

Grading Scale & Policies

Point Range (%)	Letter Grade		Point Range (%)	Letter Grade
≥ 90.00	A		70.0 – 73.2	C
86.7 – 89.9	A-		66.7 – 69.9	C-
83.3 – 86.6	B+		63.3 – 66.6	D+
80.0 – 83.2	B		60.0 –63.2	D
76.7 – 79.9	B-		56.7 – 59.9	D-
73.3 – 76.6	C+		< 56.7	E

Note that a "C-" will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html

UF Counseling Services

- Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
  - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
  - Career Resource Center, Reitz Union, 392-1601, career and job search services.

- Many students experience test anxiety and other stress related problems. "A Self Help Guide for Students" is available through the Counseling Center (301 Peabody Hall, 392-1575) and at their web site: http://www.counsel.ufl.edu/.

Honesty Policy

- All students registered at the University of Florida have agreed to comply with the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University."
- In addition, on all work submitted for credit the following pledge is either required or implied: "*On my honor I have neither given nor received unauthorized aid in doing this assignment*."
- If you witness any instances of academic dishonesty in this class, please notify the instructor or contact the Student Honor Court (392-1631) or Cheating Hotline (392-6999). For additional information on Academic Honesty, please refer to the University of Florida Academic Honesty Guidelines at: http://www.dso.ufl.edu/judicial/procedures/academicguide.html.

Accommodation for Students with Disabilities

- Students who will require a classroom accommodation for a disability must contact the Dean of Students Office of Disability Resources, in Peabody 202 (phone: 352-392-1261). Please see the University of Florida Disability Resources website for more information at: http://www.dso.ufl.edu/drp/services/.
- It is the policy of the University of Florida that the student, not the instructor, is responsible for arranging accommodations when needed. Once notification is complete, the Dean of Students Office of Disability Resources will work with the instructor to accommodate the student.

Software Use

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

U Matter, We Care

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Course Calendar * HyperGator intro TBD (45 mins)

Week	Date	Topic	Reading
1	Mon, 1/8	Introduction; Probability models, simple binomial, intro to ML	Taper & Ponciano, 2016
	Weds, 1/10	Questions based on reading	
	Fri, 1/12 *JM gone!	Discussion of student background & interests	
2	Mon, 1/15	HOLIDAY – MLK DAY	Swofford et al., ch. 11 Felsenstein, ch. 10
	Weds, 1/17	Simple multinomial, simple phylogenetic multinomial	
	Fri, 1/19	Example of ML estimation using Multinomial and intro to simple Bayesian inference	
3	Mon, 1/22	Wright Fisher, part 1	JMP lecture notes
	Weds, 1/24	Questions/problems based on lecture	
	Fri, 1/26	Wright Fisher, part 2	
4	Mon, 1/29	Coalescent, part 1	Felsenstein, ch. 26 JMP lecture notes
	Weds, 1/31 *Emily gone!	Coalescent, part 2	
	Fri, 2/2	Questions/problems based on lecture	
5	Mon, 2/5	Coalescent, part 3	Simmons & Gatesy, 2015 Felsenstein, ch. 17 (optional but rec)
	Weds, 2/7	Coalescent, part 4	
	Fri, 2/9	Tajima's D, Watterson's theta & properties	
6	Mon, 2/12 *Emily gone!	ML for the coalescent	Felsenstein, ch. 16
	Weds, 2/14 *Emily gone!	ML through ESF and the infinite alleles model & sufficiency	
	Fri, 2/16	ML estimation: software usage (RAxML)	
7	Mon, 2/19 *Emily gone!	ML estimation II: Parametric Bootstrap, nodal support	Felsenstein, ch. 18 Nascimento et al., 2017
	Weds, 2/21 *JM gone!	Bayesian Inference (BI) and MCMC	
	Fri, 2/23 *JM gone!	BI: software usage (MrBayes), and ML with MrB	
8	Mon, 2/26	Gene tree/species tree reconciliation	
	Weds, 2/28	Gene tree/species tree reconciliation, cont.	
	Fri, 3/2	Mito DNA MCMC dataset intro	
SB	3/5-3/9	SPRING BREAK	JMP homework/notes
9	Mon, 3/12	Mito DNA MCMC dataset	ASTRAL paper

	Weds, 3/14	Lab: software – ASTRAL, SVD	SVD paper BUCKy paper
	Fri, 3/16	Lab: software – BUCKy	
10	Mon, 3/19	Species delimitation	BPP paper ABC paper
	Weds, 3/21	Species delimitation, cont.	
	Fri, 3/23	Lab: software for species delim – BPP, ABC	
11	Mon, 3/26	Comparative methods I	
	Weds, 3/28	Comparative methods II	
	Fri, 3/30	Lab: comp methods	
12	Mon, 4/2	Comparative methods III	
	Weds, 4/4	Comparative methods IV	
	Fri, 4/6	Lab: comp methods, cont.	
13	Mon, 4/9	Paper discussion	Discussion papers
	Weds, 4/11	Paper discussion	
	Fri, 4/13 *Emily gone!	Paper discussion	
14	Mon, 4/16	Work on projects in class	No readings
	Weds, 4/18	Work on projects in class	
	Fri, 4/20	Presentations	
15	Mon, 4/23	Presentations	No readings
	Weds, 4/25	Presentations	