Plant Diversity and Evolution

Formerly known as Plant Environmental Physiology

Professor
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Location
Lecture: 50 min, M W F 8:00 – 8:50 am, **Boyd 236**
Lab: 2 hrs. 45 min, Th 2:00 – 4:45 pm, **Boyd 121**
Office hours: W & F 4:00 – 5:00 pm, **Boyd 226**

Course Objectives: In this advanced botany course, students traverse plant systematics and the major concepts and skill sets relevant to modern studies of plant diversification patterns and evolutionary processes. The course of study includes the formulation and use taxonomic keys, phylogenetic and network methods, phytogeography, cytology, statistical methods for characterizing morphological variation, and the use of natural history specimens for scientific research.

Registration information
Pre-requisites: BI 1110, BI 1120, and Junior/Senior standing, *or* permission from Dr. Jolles
Course number: TBA
Credits earned: 4

Textbook: The required textbook for this course is Michael Simpson's Plant Systematics, available free of charge as an eBook through Lamson Library. If you want to own a hard copy of the text:

> Simpson, M.G. (2006) Plant Systematics. Amsterdam: Academic Press.
> ISBN: 9780126444605

In addition to assigned readings from Simpson, supplemental readings from the following text will be provided to you:

Baum, D.A., and Smith, S.D. 2013. Tree Thinking: An Introduction to Phylogenetic Biology. Greenwood Village, Colo.: Roberts and Company Publishers, Inc.

Required Tools: A few tools a required for this course—these include a 10× magnification hand lens, an unlined sketchbook, pencil and eraser, and… an open mind!

Online course manager: This course has a dedicated Moodle website used to record evaluation scores (assignments, tests, etc.) and to organize course material for the lecture and lab. Assigned exercises, readings, and course materials must be accessed through Moodle.

ASSIGNMENTS AND EVALUATION

Lecture

- Reading — Students must complete all assigned readings on time to keep up!
- Article reviews— Students will read and discuss peer-reviewed articles to supplement the textbook readings. To prepare for discussion, students will write article reviews comparing and contrasting arguments, methodologies, and perspectives.
- Paper discussions— Pairs of students will take the lead on one or two of the peer-reviewed papers we'll be reading this semester. Students should prepare a 5-minute summary of the paper, pose questions to the group, and moderate class discussion. A sign-up list will be circulated on the first day of class.
- Tests— short, quarterly tests will be used to evaluate comprehensive understanding of the lecture material, including readings, lectures, and paper discussions. Tests will typically be open-notes and include a mix of short answer and problem-solving questions.

Lab

- Lab notebooks— students are required to make drawings and notes in their lab sketchbooks each week. Drawing is an extremely effective way of observing, learning, and engaging with the material. The semester will begin with a short tutorial on scientific illustration. Sketchbooks will be evaluated for symbolic accuracy and completeness.
- Lab reports— Two formal lab reports will be assigned over the course of the semester following lab experiments. Reports may be completed individually or in groups of two students. Students will gain experience with peer-review of lab reports, but reports will ultimately be evaluated by Dr. Jolles using the lab report rubric available on Moodle.
- Independent projects— Students are encouraged to pursue their personal interests when designing and conducting an independent project, working individually or as pairs. *In lieu of a final exam, a formal lab report and 15-minute lab presentation will be due during finals week.*
- Tests— Quarterly tests are used to evaluate comprehensive knowledge gained in lab. Tests will use approximately 60 minutes of lab time, followed/preceded by normal lab activities.

Grading Rubrics

Grading rubrics used to evaluate mini-reviews, paper discussions, lab notebooks, and lab reports will be available on the course website at the start of the semester and will serve, in part, as general guidelines for formatting assignments.

Grading Scheme

Assignment	Points (each)	Number	% of Total Grade
Article reviews	10	7	15
Paper discussion lead	10	1	2
Lecture tests	25	4	21
Lab notebook	10	9	19
Lab reports	25	2	11
Independent project	100	1	21
Lab tests	25	2	11
Total			**100**

A 95–100%; **A-** 90–94.99%; **B+** 85–89.99%; **B** 80–84.99%; **B-** 75–79.99%; **C+** 70–74.99%; **C** 65–69.99%; **C-** 60–64.99%; **D+** 55–59.99%; **D** 50–54.99%; **D-** 45–49.99%; **F** 0–44.99%

Grades: Assignments turned in after scheduled deadlines will be docked one letter grade per day. For example, an A+ paper that is one day late will receive an A grade, a B- paper that is two days late will receive a C grade. For all other matters, PSU's fair grading policy applies: <https://www.plymouth.edu/undergraduate/files/2010/11/Fair-Grading-Policy.pdf>

Attendance policy: Attendance is mandatory. PSU's attendance policy explains excused absences, but keep in mind that a missed lab cannot ever be 'made up' exactly. Labs are nuanced and highly coordinated—as such, make-up labs provided students with excused absences cannot possibly provide a comparable experience and should be avoided. Likewise, there are no true 'make-ups' for lecture discussions. Students who miss all or part of a class will be docked credit toward their final grade in the course. For a planned absence, please discuss with Dr. Jolles well in advance. <https://www.plymouth.edu/undergraduate/files/2010/11/Class-Attendance-Policy.pdf>

Academic integrity: Cheating and plagiarism in this course is absolutely prohibited. If a student is suspected of academic dishonesty (claiming someone else's work as your own without giving proper credit, doing another student's work for them, falsifying data, etc.), a failing grade will be given for the assignment in question. If a student's academic integrity is called into question a second time, this will result in a failing grade for the course. For PSU's academic integrity policies, see <https://www.plymouth.edu/undergraduate/files/2010/11/Academic-Integrity-Policy.pdf>

Academic accommodations: Students with documented disabilities have equal access to all university programs and facilities. Students with disabilities requiring accommodations should immediately contact the Disability Services Office (DSO) in the Center for Student Success in Mary Lyon (535-3065) to determine their eligibility for such accommodations. Academic accommodations will only be considered for students who have registered with DSO. Students with a Letter of Accommodation for this course from DSO need to provide Dr. Jolles with that information privately to further review and plan for accommodations.

Course etiquette: The university setting provides scholars with unique opportunities to exchange ideas and challenge each other intellectually. As such, diverse opinions that are relevant to the course of study will not be censored— Dr. Jolles encourages open discussion and debate surrounding controversial issues. However, the use of hate speech as form of rhetoric is strongly discouraged—students should spend time thinking about how to best articulate their ideas and opinions in a way that will stimulate discussion rather than shutting it down.

Mutual respect and *scholarship* are key to the success of this course—students are expected to make contributions in class and be respectful of their colleagues. Dr. Jolles will facilitate open communication and assist students in finding a voice. If students have questions or concerns about the course at any time throughout the semester, they are encouraged to speak with Dr. Jolles as soon as possible.

Cell phones and other electronic devices are not permitted in class. Students must silence cell phones before lecture begins. If using a laptop in class, students are asked to turn off the wireless internet access to avoid distraction.

SPRING 2017 LECTURE SCHEDULE & DUE DATES

Wk.	Date	Day	Subject	**Text** page ranges
1	1/30	M	Plant morphology & anatomy	**S** 347:463 (skim)
	2/1	W	Intro. to systematics & nomenclature	**S** 3:16, 495:516
			Lab 1. Botanical terminology, methods	**S** 535:544 (skim)
	2/3	F	Plant molecular systematics	**TT** 1:30, **S** 477:491
2	2/6	M	Plant collection & preservation	**S** 517:534
	2/8	W	'Protist plants': Algae	**S** 51:58, **TT** 107:133 (skim)
			Lab 2. Field trip, specimen preparation	
	2/10	F	Evolution of photoreceptors	Li & Mathews, 2016
3	2/13	M	Molecular systematic methods	**TT** 35:99, **S** 17:44
	2/15	W	No classes—Winter carnival	none
			Lab 3. Lab quiz, algae, systematic methods	
	2/17	F	Land plants: adaptation to life in air	**S** 54:77
4	2/20	M	Lycopodiophyta	**S** 77:82
	2/22	W	Paleobotany	Boyce & DiMichele, 2016
			Lab 4. Lycopodiophyta, life cycles	**S** 53:58
	2/24	F	TEST 1	none
5	2/27	M	Monilophyta	**S** 82:92
	3/1	W	Physical geography	Bliss, 1963
			Lab 5. Monilophyta & physical geography	
	3/3	F	Phylogeography	Li *et al.*, 2014
6	3/6	M	Spermatophyta	**S** 97:114
	3/8	W	Evolutionary development	Chanderbali *et al.*, 2010
			Lab 6. Field trip, Gymnospermae, biogeography	
	3/10	F	Angiospermae	**S** 121:141
7	3/13	M	Insect-plant symbioses	Jolles *et al.* (ms in prep)
	3/15	W	Population genetics	Call *et al.*, 2015
			Lab 7. Lab test, Magnoliids, evo-devo & paleoecology	
	3/17	F	TEST 2	none
8	3/20	M	SPRING BREAK— Go somewhere! Do something interesting!	
	3/22	W		
	3/24	F		

Wk.	Date	Day	Subject	Reading (**page range**) est. reading time
9	3/27	M	Reproductive biology & diversification	Fowler, 2016
	3/29	W	Monocotyledonous plants	**S** 153:221
			Lab 8. Monocots & reproductive biology	
	3/31	F	Comparative physiology	**S** 153:221
10	4/3	M	Lower Eudicots	**S** 228:237
	4/5	W	Transcriptomics	Hao & Xiao, 2015
			Lab 9. Lower Eudicots, evo-devo & statistical methods	
	4/7	F	Drugs	Verma *et al.*, 2016
11	4/10	M	Core Eudicots	**S** 238:252
	4/12	W	Evaluating statistical methods	Chartier *et al.*, 2014
			Lab 10. Core Eudicots & statistical methods	
	4/14	**F**	TEST 3	none
12	4/17	M	Phylogenetic methods	**TT** 173:207
	4/19	W	Rosids I	**S** 252:275
			Lab 11. Core Eudicots: Rosids & phylogenetic methods	
	4/21	F	Rosids II	**S** 278:289
13	4/24	M	Asterids I	**S** 289:319
			Lab 12. Core Eudicots: Rosids, Asterids & phylogenetic methods	
	4/26	W	Asterids I	**S** 319:339
	4/28	F	Evolutionary parameterization of models	TT 217:231, Fisher *et al.*, 2015
14	5/1	M	Phylogenomics	TBA
	5/3	W	Careers in botany	http://www.botany.org/bsa/careers/why.php
			Lab 13. Core Eudicots: Asterids & phylogenomics	
	5/5	**F**	TEST 4	none
15	5/8	M	Ethnobotany	Ross, 2011
	5/10	W	Botanical diversity & conservation	Cogbill *et al.*, 2002
			Lab 14. Optional, finish independent projects	
	5/12	F	Emerging agricultural technologies	none
16	5/15	M	Finals week = lab presentations	
	5/17	W		
	5/19	F		

Scientific papers (links on Moodle):

Bliss, L.C. 1963. Alpine plants of the presidential range, New Hampshire. *Ecology* 44(4): 678–697.

Boyce, C.K., and DiMichele, W.A. 2016. Arborescent lycopsid productivity and lifespan: Constraining the possibilities. *Review of Palaeobotany and Palynology* 227: 97-110.

Call, A., et al. 2015. Genetic structure and post-glacial expansion of *Cornus florida* L.(Cornaceae): integrative evidence from phylogeography, population demographic history, and species distribution modeling. *Journal of Systematics and Evolution* 54: 136-151.

Chanderbali, A.S., *et al.* 2010. Conservation and canalization of gene expression during angiosperm diversification accompany the origin and evolution of the flower. *Proceedings of the National Academy of Sciences* 107(52): 22570-22575.

Chartier, M., et al. 2014. The floral morphospace–a modern comparative approach to study angiosperm evolution. *New Phytologist* 204(4): 841-853.

Cogbill, C.V., Burk, J., and Motzkin, G. 2002. The forests of presettlement New England, USA: spatial and compositional patterns based on town proprietor surveys. *Journal of Biogeography* 29(10-11): 1279-1304.

Fisher, A.E., *et al.* 2015. Evolutionary history of *Blepharis* (Acanthaceae) and the origin of C4 photosynthesis in section Acanthodium. *International Journal of Plant Sciences* 176(8): 770-790.

Fowler, J. 2016. Specialist Bees of the Northeast: Host Plants and Habitat Conservation. *Northeastern Naturalist* 23(2): 305-320.

Hao, D., and Xiao, P. 2015. Genomics and evolution in traditional medicinal plants: road to a healthier life. *Evolutionary bioinformatics online* 11: 197-212.

Li, F., and Mathews, S. 2016. Evolutionary aspects of plant photoreceptors. *Journal of plant research* 129(2): 115-122.

Li, Y. *et al*. 2014. Paleobiogeography of the lotus plant (Nelumbonaceae: Nelumbo) and its bearing on the paleoclimatic changes. *Palaeogeography, Palaeoclimatology, Palaeoecology* 399: 284-293.

Ross, N.J. 2011. Modern tree species composition reflects ancient Maya “forest gardens” in northwest Belize. *Ecological Applications* 21(1): 75-84.

Verma, N., et al. 2016. Genetic diversity, population structure and marker trait associations for alkaloid content and licit opium yield in India-wide collection of poppy (*Papaver somniferum* L.). *Plant Gene* 7: 26-41.