BIO 113: Evolution and speciation in flowering plants

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Office Hours: M/F 9:00-10:30 (or by appointment)
Office: HMB 211D or SQU 20

Class Hours: T/Th 3:00-4:15
Class Room: SQU 325

Course Description

A survey of the important tools and mechanisms used to study speciation in plants. Topics include the molecular basis of evolutionary change, intraspecific genetic variation at both the local and landscape levels, theory regarding mechanisms of speciation, and the importance of polyploidy. Readings will be from both a text and from the primary literature, and will include in-depth discussions of historical and modern studies in plant evolution. Lecture three hours.

Materials

- Required text
  - none
- Supplemental reading
  - Coyne & Orr. 2004. Speciation. Sinauer Associates: Sunderland MA
  - Journal articles will be used for case studies. I will make these available to you through Canvas

Prerequisites

BIO 1 and BIO 2 or equivalent.

Course Objectives

By the end of the course you should:

1. Be familiar with basic plant structure and function
2. Understand the inheritance and variation in genetic material of plants
3. Understand the genetic basis of phenotypes, and phenotypic plasticity
4. Understand the mechanisms that prevent inbreeding
5. Be familiar with the extraordinary variation in plant breeding systems, and their evolution
6. Understand the ecological factors that influence plant evolution
7. Be familiar with the species concepts commonly used by biologists
8. Understand the mechanisms responsible for speciation in plants
9. Know how to determine the important factors influencing speciation
10. Understand the importance of hybridization in evolution
11. Comprehend the tremendous role that polyploidy plays in plant evolution
12. Understand the genetic and morphological changes evident in polyploids
13. Be able to effectively lead a discussion on topics related to plant speciation
14. Be able to discuss scientific papers and theories related to speciation in plants

Course Structure

Welcome to Evolution and Speciation in Flowering Plants! In this course, we will be discussing some of the major concepts related to evolutionary biology in plants, focusing on factors leading to speciation. The format of this course will include both lecture and group discussions.

Assessments

Your grade in this course will be based on exam performance, participation and attendance, and up to five case studies. Exams will consist of a combination of multiple choice, short answer, and essay questions. I expect that your responses to exam questions will integrate reading assignments, lecture material and case studies. For the case studies, you will be working in groups to analyze scientific papers in the context of the course material. In preparation for team activities, you will be required to complete a pre-assignment that will be worth 10 points. The case studies will draw from the papers for discussion and material presented in lectures. We will discuss the guidelines for these assignments as the time comes closer. Although I may not take attendance every day, I expect you to be here. This is the only way that you will benefit from the lecture material and insights that arise from classroom interactions. In fact, 5% of your grade is based on attendance and participation. If you come to class prepared and participate in daily activities,

you should expect to receive full credit for participation and attendance. However, if you miss more than one class, come to class without having prepared, or do not participate, I reserve the right to deduct points based on your participation. Remember that this is enough to change your grade by one half of a letter grade, so please take it seriously.

Grading Policy

Grading in this course will be based on exams, team activities, participation and attendance. I reserve the right to curve the scale dependent on overall class scores at the end of the semester. Any curve will only ever make it easier to obtain a certain letter grade. The grade will count the assessments using the following proportions:

	Points
3 Exams @ 100 pts each	300
5 Case Studies @ 25 pts each (Team Activities)	125
Pre-assignments for case studies (5 @ 10 pts each)	50
Attendance and participation	25
Point total	**500**

Grade assignments will be on a standard 90-80-70... scale.

How to succeed in this course:

- Attend lectures and take notes. Attendance is mandatory (that's what you're here for, after all). Even though I may not take attendance every day, it is important that you are in class. If I notice that you are absent frequently, or come to class unprepared, I will begin to make notes and deduct points from your participation grade. Furthermore, come to class prepared. I expect that you will have read the relevant material prior to coming to each lecture. You will be responsible for all of this material on the exams. Also remember that your notes will be an important part of your success in this course. I will make presentations available to you, but these provide only an outline of the lecture topics. Printing and studying these in lieu of coming to class will not provide you with all of the important material from lecture.
- Spend enough time studying. We are covering a lot of material in this course. It is important to review lecture material regularly in order to succeed on exams. In order to receive an A or B in this course, expect to spend about two hours studying for every hour you spend in class (6 hours reading and reviewing lecture notes...). It is very easy to fall behind. If you stay on top of readings and assignments, you are likely to do much better on exams.
- Ask questions. My job is to present information to you, encourage your exploration of the subject, and help you master it. Please let me know if you don't understand something. Don't be shy about asking questions during lecture because if you don't understand something, chances are there are other students that don't understand.
- Please take advantage of my office hours to come by and ask questions.

During Class

During class, please be respectful of me and of your fellow students. In particular, I have a few expectations of everyone during class meetings:

1. Please don't talk while I'm talking. This is distracting not only to me, but to other students.
2. Try to arrive on time. I know that sometimes arriving late (or leaving early) is unavoidable, but please do your best to be quiet if this happens.
3. Please turn the sound off on cell phones and pagers during class. If you need to take a call, please leave the room before answering the phone. Answering phones during class is distracting to me and other students.
4. During exams, I expect phones to be turned off.
5. Eating and drinking are fine, as long as you are not disruptive to other students in the class.

Cheating

I urge everyone to review the University policy on academic dishonesty (https://www.csus.edu/umanual/student/stu-0100.htm). In addition to the actions listed in this document, receiving phone calls during an exam, having papers other than exam forms on your desk, and talking to another student will be considered cheating. Any student caught cheating on an exam will receive a score of zero on that assignment. Any student suspected of cheating or plagerism will be reported to the Dean of Students. Keep in mind that cheating can result in complete dismissal from CSUS.

Late Assignments

Late assignments will be accepted for no penalty if a valid excuse is communicated to the instructor before the deadline. After the deadline, assignments will be accepted for a 50% deduction to the score up to 2 days after the deadline. After this any assignments handed in will be given 0.

Accommodations for Disabilities

If you have a disability and require accommodations, please provide disability documentation to SSWD (Lassen Hall 1008, 916-278-6955). Please discuss your accommodation needs with me after class or during my office hours early in the semester.

Schedule and weekly learning goals

The schedule is tentative and subject to change.

Week 01, 08/27 - 08/31: How to build a plant

- Course introductions
- Structure and function of plant cells and tissues

Week 02, 09/03 - 09/07: How to build a plant

- Fundamental differences between plants and animals
- Seeds and seedlings

Week 03, 09/10 - 09/14: How to build a plant

- Stem and Root structure, function, and variation
- Leaf structure, function, and variation

Week 04, 09/17 - 09/21: Evolution of the Angiosperms

- Evolutionary history and key synapomorphies of Angiosperms
- Refresher on evolutionary mechanisms

Week 05, 09/24 - 09/28: Evolution and variation in flowering plants

- Historical perspective on evolution
- Major variation across Angiosperms
- Intraspecific and interspecific variation in plants

Week 06, 10/01 - 10/05: **Exam 1**

- Exam 1 review/catch up
- **Exam 1 (4Oct)**

Week 07, 10/08 - 10/12: Plant/Animal interactions

- Defense, carnivory, pigmentation, etc
- Case study 1 - Plant defense jigsaw

Week 08, 10/15 - 10/19: Plant breeding systems

- Structural basis, and evolutionary impact of selfing vs outcrossing
- Evolution of heterostyly

Week 09, 10/22 - 10/26: Breeding systems cont.

- Case study 2 - Breeding systems
- Close Encounters of the Floral Kind

Week 10, 10/29 - 11/02: Pollination

- Pollination strategies, abiotic vs biotic
- Case study 3 - Pollination syndromes

Week 11, 11/05 - 11/09: **Exam 2**

- Review for exam 2 / Catch up
- **Exam 2 8Nov**

Week 12, 11/12 - 11/16: Population level processes

- Population structuring
- Genetics of populations
- Reproductive isolation
- Experimental considerations

Week 13, 11/19 - 11/23: Thanksgiving

- Case study 4 - population differentiation
- No Class 22Nov18

Week 14, 11/26 - 11/30: Plant genomics

- Nuclear, plastid, mitochondrial genomics
- Polyploidy
- systematics and phylogenomics

Week 15, 12/03 - 12/07: Species and Speciation

- Species as a biologically relevant rank
- Species concepts in plants - are they useful?
- Case Study 5 - Speciation

Week 16, 12/10 - 12/14: **Final Exam**