

COURSE INFORMATION

Course Title	Course Code Number	Credit Value
Applied Plant Breeding	APBI 318	3

CONTACTS

Course Instructor	Contact Details	Office Location	Office Hours
Andrew Riseman	andrew.riseman@ubc.ca	Macmillan 323	By appointment

COURSE STRUCTURE

This course uses a flipped format where students are required to watch pre-recorded mini-lectures ahead of synchronous meetings and come prepared to discuss the topics covered in the recordings.

Synchronous meetings are held Tuesdays and Thursdays at 9:30-11:00 am Vancouver Time

This course will give students working knowledge of small-scale classical (e.g., non-biotechnological) plant breeding and associated issues (e.g., plant reproductive biology, genetics). It will use an application-oriented approach to enhance student understanding of the techniques and procedures involved in reproductive biology (i.e., anatomy, morphology, fertilization, genetics), in implementing a simple plant breeding program, and in evaluating the impact of selection on breeding populations and desired outcomes.

The course will include video recorded mini-lectures, synchronous discussions (recorded and posted), writing assignments, computer simulation, term project, and at-home laboratories.

This course has been [pre-approved by the BC Institute of Agrologists \(BCIA\) for those applying as registrants](#). For more information about the Practice of Agrology, [how to apply as a registrant](#), or the [full list of approved courses](#), consult the [BCIA website](#). If you wish to become a student member, please check the [student member program](#) and complete an application.

SCHEDULE OF TOPICS

Week	Date	Discussion Topic	Mini-lectures to Watch Before Synchronous Discussion
1	Sept 2	Imagine Day (No Class)	
	Sept 4	Course Introduction Student introductions, goals, and favorite plant	• Course Logistics
2	Sept 9	Impacts of domestication and plant breeding	• Introduction to Plant Breeding • Important Historical Events
	Sept 11	Flowers and the female gametophyte	• Flower Structure • Megasporogenesis
3	Sept 16	The male gametophyte and the cool world of pollen	• Microsporogenesis • Pollen Overview • Microspore Embryogenesis
	Sept 18	Sex, fertilization, and the consequences.... Discuss your perfect plants	• Fertilization • Seeds
4	Sept 23	Fruit diversity and breeding	• Fruit Types • Seed Dispersal •
	Sept 25	Seeds and early growth	• Seed Physiology • Seed Testing
5	Sept 30	Practical seed cleaning	• Tomato seed fermentation video • My Seed Diary Part I
	Oct 2	Class discussion Breeding Projects	
6	Oct 7	Breeders work with natural breeding systems, until they don't....	• Natural Breeding Systems • Self Incompatibility Overview • Self Incompatibility Morph and Dev Mech
	Oct 9	Breeders work with natural breeding systems, until they don't.... (con't)	• Self Incompatibility Genetic Mech • Variants in the Reproductive Process
7	Oct 14	Mendel and his genetics	• Introduction to Qualitative Inheritance • Mendelian Genetics • Chi Square Analysis • Linkage and Recombination • Three Point Test Cross
	Oct 16	When things don't work out, linkage? Introduction to Greengenes	• Detecting Linkage • Altered Ratios Epistasis • Practice word problems

			• Greengenes Document Mastering Mendel's Magic
8	Oct 21	Class discussion Breeding Projects	
	Oct 23	Dissecting complex traits, the quantitative way...	• Introduction to Quantitative Inheritance • History of Quantitative Inheritance • Quantitative Distributions • Variance review
9	Oct 28	Populations are made up of individuals that breeders select.... And... The royals come to plants...	• Genotypic Variance • Heritability and Selection Pressure • Inbreeding Depression • Heterosis and Hybrid Vigour
	Oct 30	Catch up day	
10	Nov 4	Breeding strategies for Self-Pollinated Crops	• Breeding Schemes Overview • Breeding Schemes Mass Selection
	Nov 6	Breeding strategies for Self-Pollinated Crops (continued)	• Breeding Schemes Pure Line • Breeding Schemes Bulk Method
11	Nov 11	No Class- Winter Break	
	Nov 13	Breeding strategies for Cross Pollinated Crops	• Breeding Schemes Pedigree Selection • Breeding Schemes Single Seed Descent • Breeding Schemes Backcross Breeding • Combining Ability • Recurrent Selection
12	Nov 18	Doing the actual work in the field	• Field Plot Technique • Experimental Design
	Nov 20	Example breeding scenario: Breeding for Disease Resistance	• Introduction: Breeding for Disease Resistance • Disease Development • Vertical and Horizontal Resistance • Disease Resistance Mechanisms
13	Nov 25	Example breeding scenario: Breeding for Disease Resistance (continued)	• Sources of Resistance • Screening Techniques
	Nov 27	Breeding Project Checkins	
14	Dec 2	Sharing day	
	Dec 4	Sharing and wrap-up	

LEARNING OUTCOMES

Upon successful completion of this course, the students should be able to:

- Design and implement a simple plant breeding program
- Predict the potential for successful plant improvement for a particular breeding objective, given the nature of the plant species and the genetic inheritance of the trait
- Create and manage plant populations in terms of specific genetic composition
- Develop genetic hypotheses and apply the appropriate statistical methods for their evaluation
- Process seed for either seed saving or part of a breeding project

LEARNING ACTIVITIES

Learning activities include creative writing assignment, topical word problems, computer simulation-Greengenes, at home laboratories, 2-minute Presentation, group discussion, and a term project.

LEARNING MATERIALS

All learning materials will be provided through Canvas and include mini lecture recordings, assignment instructions, grading rubrics, and resource materials.

ASSESSMENTS OF LEARNING

Students will be evaluated based on their comprehension of course material, participation, and their ability to apply this information in addressing relevant problems in plant breeding and crop improvement.

Creative writing and topical word problem Assignments	
(1x written and 3x word problems @ 5% each)	20%
Computer simulation-GreenGenes	20%
Laboratory Reports (2@2.5% each)	5%
2-min Presentations	15%
Term Project	40%
Crossword Puzzle (Bonus)	up to +5%

Assignment policies:

Late submissions will be accepted up to three days after due date with a 5% deduction per day.

Resubmissions will be accepted up to one week after return with the opportunity to earn back up to 50% of lost marks.

ASSIGNMENTS

All assignments have complete descriptions with instructions in Canvas. All assignments are to be submitted through Canvas.

Assignment 1: Critical Thinking Assignments

Assignment 1 (written): Topic: My perfect plant.

In under 1000 words, describe your perfect plant, its attributes, phenotypes, capabilities, and uses. Knowing there are genetic engineering tools that allow trans-species genetic exchange, you are free to dream big. If you have seen a particular trait in some other biological organism, it can be included. However, please note 1) it must maintain the essence of a plant (e.g., no walking plants with legs) and 2) you are bound by all laws of nature (e.g., no anti-gravity potatoes 🤪). Citations should be in the APA format. See the Creative Writing Rubric in the Canvas assignment page for specific assessment criteria.

Assignments 2, 3 and 4: Topical Word Problems

Complete the assigned genetic word problems using the genetic nomenclature used in class. Complete each component in sufficient detail to allow me to understand how you answered the problem. Show all calculations, summaries, hypotheses, statistics, and conclusions.

Computer Breeding Simulation-Greengenes:

Each student will receive a unique web-based breeding problem designed to emulate an actual breeding program but without the time required to grow populations. You will select parents, make crosses, and produce progeny from those crosses. You will be asked to determine the genetic control of simply inherited traits, identification of interactions between genes (epistasis) and calculation of co-segregation (linkage) if present. Additional information including the grading rubric, is available on Canvas.

Laboratory Reports:

My Seed Diary Parts I and II are at home laboratories where you will acquire a mature fruit, describe the plant species' biology and reproduction, develop seed cleaning procedures for that species, and test for seed viability. See the assignment page on Canvas for specific assessment criteria.

2 min Presentation:

Each student will pre-record and post a presentation of no more than 2 minutes on a topic to be determined in class. Students are encouraged to be creative in presenting the topic and may include text, images, animations, poetry, dance, etc. See the assignment page on Canvas for specific assessment criteria.

Term Project Description

Each student will select a crop (that is or could be grown at in SW British Columbia) and write a paper that details the development of a breeding program for it. We will brainstorm ideas as a group but plan to have your choice of crop and breeding objective ready by mid-October. The term project will describe in detail the history and importance of your crop, current breeding efforts, reproductive biology, breeding objectives, techniques, breeding strategies, selection criteria, and year-to-year activities. See the assignment page on Canvas for specific assessment criteria.

COMMUNICATION POLICY

I will primarily use Canvas announcements to communicate with you. Please turn on Canvas Alerts so you will be notified when I post a new announcement. If you have any questions that can not be answered during or after class, feel free to email me and I will reply within 24 hrs.

USE OF GENERATIVE AI TOOLS

Students are permitted to use artificial intelligence tools, including various generative AI products, to gather information, review concepts or to help produce deliverables relevant to this course. However, students are ultimately accountable for the work they submit, and any content generated or supported by an artificial intelligence tool must be cited appropriately. I welcome your use of these tools and want to learn with you about them. If used, please detail how they were engaged (i.e., prompt series) and how their outputs were used (i.e., 1st drafts, idea suggestions, etc.). Please visit CTLT for more information on AI tools and their use (<https://ai.ctlt.ubc.ca>).

ACADEMIC HONESTY

Academic honesty is a core value of scholarship. Cheating and plagiarism (including both presenting the work of others as your own and self-plagiarism), are serious academic offences that are taken very seriously in Land & Food Systems. By registering for courses at UBC, students have initiated a contract with the university that they will abide by the rules of the institution. It is the student's responsibility to inform themselves of the University regulations. Definitions of Academic Misconduct can be found on the following website: <https://academicintegrity.ubc.ca/regulation-process/academic-misconduct/#:~:text=Academic%20misconduct%20includes%20any%20conduct,to%20gain%2C%20an%20unfair%20academic>

UNIVERSITY POLICIES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access, including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here: <https://senate.ubc.ca/policiesresources-support-student-success>.

ACADEMIC ACCOMMODATION The University accommodates students with disabilities who have registered with the Centre for Accessibility (<http://students.ubc.ca/about/access>). Please let me know in advance, preferably within the first 2 weeks of class, if you require any accommodation on these grounds.

ACADEMIC CONCESSION During your time in this course, if you encounter medical, emotional, or personal problems that affect your attendance or performance, please notify me. You may be able to obtain academic concession from the Dean of your Faculty. For further information on academic concession, please consult Policies and Regulations in the UBC Calendar (<http://www.calendar.ubc.ca/vancouver/index.cfm>).

LEARNING RESOURCES Learning Commons (<http://learningcommons.ubc.ca>) is an online resource designed to provide UBC students with learning and study support. It is an interactive website that provides access to information on exam preparation, tutoring, on-campus learning workshops, study groups, and technical tools. The University of Northern British Columbia (UNBC) also has a number of useful learning resources available for students online. They can be found at: <http://www.unbc.ca/lsc/index.html>.

HEALTH & WELLNESS RESOURCES

BC Crisis Center: Non-profit, volunteer-driven organization that provides emotional support to youth, adults, and seniors in crisis in BC. Crisis line available 24/7. Website: www.crisiscentre.bc.ca | Phone: 604-872-3311

Centre for Accessibility: The Centre for Accessibility provides accommodations for UBC students living with physical or mental disabilities. Website: www.students.ubc.ca/about/access | Phone: 604-822-5844

Counselling Services at UBC: Counselling offers a variety of resources to help you maintain your mental health while in school. You may see a counsellor on an individual basis, attend group counselling, or document an illness. Website: www.students.ubc.ca/livewell/services/counselling-services | Phone: 604-822-3811

Distress Line: If you are in distress or are worried about someone in distress who may hurt themselves, call 1-800-SUICIDE 24 hours a day to connect to a BC crisis line, without a wait or busy signal.

Kaleidoscope: A confidential peer-run mental health support group that takes place on campus at least once a week. You may attend the group if you are experiencing any kind of mental health related challenges, or if you're just feeling stressed about school in general. Website: www.the-kaleidoscope.com

Mental Health Awareness Club: A club that offers opportunities to speak about mental health with others and strives to promote mental health awareness at UBC. Website: www.ubcmhac.sites.olt.ubc.ca

Student Health Services at UBC: Student health provides students with a variety of healthcare related services to help you maintain your health while studying. Access to doctors and registered nurses. Website: www.students.ubc.ca/livewell/services/student-health-service | Phone: 604- 822-7011

Wellness Centre at UBC: Speak with other UBC students about tips for managing stress, keeping healthy sleep and eating patterns, concerns about safe sex, etc. Website: www.students.ubc.ca/health/wellness-centre

LEARNING ANALYTICS

Learning analytics includes the collection and analysis of data about learners to improve teaching and learning. This course will be using Canvas so that data about your activities are captured and provided to improve the quality of my teaching and learning. In this course, I plan to use analytics data to:

- View overall class progress
- Review statistics on course content being accessed to support improvements in the course
- Track participation in discussion forums
- Assess your participation in the course

COPYRIGHT

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