

Course Number and Title: PCB4553/6685 Population Genetics

Catalog Description: This course provides a comprehensive introduction to the mathematical theory of allele and genotype frequency dynamics within and between populations and will serve as a springboard to more advanced topics in evolutionary biology. Topics covered include deterministic and stochastic processes in evolution and an introduction to classical quantitative genetics theory.

Credit Hours

4 credit hours

Pre-requisites and Co-requisites

Consent of instructor; there are no formal prerequisites. The course assumes familiarity with basic transmission genetics ("Mendelian genetics") and mastery of basic algebra. Some knowledge of linear algebra, calculus and elementary probability theory is useful but not assumed.

Course Objectives

By the end of the course the student will have a basic working knowledge of the fundamental mechanisms of evolution, including:

- Mutation
- Recombination
- Random genetic drift
- Natural selection
- Components of phenotypic variance

Instructor Information

Name: Juannan Zhou

Office location: 122 Bartram Hall

E-mail address: juannanzhou@ufl.edu

Office hours: By appointment

Teaching Assistant Information (if applicable):

N/A

Course Meeting Time(s) T/Th P3-4 (9:35-11:30)

Course Meeting Location(s) CRR (Carr Hall) 0521

Course Website

Course # on Canvas. **You are responsible for all announcements made in class and/or posted on the course website for this course.**

Fees: NONE

Required Materials Textbook or Other Readings

Graham Coop. Population and Quantitative Genetics. Online. 3rd Release. PDF link: [minicoop.pdf](#)

Software

NA

Other Materials (e.g., clickers, instruments, etc.)

NA

Recommended Materials

NA

Course schedule (topics covered by week or by class period)

Lecture	Week	Date		Topic	Book chapter
1	1	1/14/2025	Intro	Introduction to course	MC1 Intro, Appendix
2	1	1/16/2025	Math background	Mathematical background	MC Appendix
3	2	1/21/2025	Descriptive statistics	Allele and Genotype Frequencies	MC2
4	2	1/23/2025	Neutral theory	Loss of heterozygosity due to drift	MC4.1
5	3	1/28/2025	Neutral theory	The Coalescent and patterns of neutral diversity	MC4.2
6	3	1/30/2025	Neutral theory	The coalescent process of a sample of alleles; Diffusion Approximation	MC4.3
7	4	2/4/2025	Neutral theory	Diffusion Approximation	JHG Diffusion approximation
8	4	2/6/2025	Molecular evolution	The Population Genetics of Divergence and Molecular Substitution	MC5
9	5	2/11/2025	Population structure	Population Structure and Correlations Among Loci	MC3
10	5	2/13/2025	Population structure	Neutral Diversity and Population Structure.	MC6
11	6	2/18/2025	Selection	Selection in infinite population	MC10
12	6	2/20/2025	Selection	Selection with mutation and migration	MC11
13	7	2/25/2025	Selection	Selection in finite populations	MC12
14	7	2/27/2025	Selection	Effects of linked selection	MC13
15	8	3/4/2025	Selection	Natural selection and sex: Interaction of Multiple Selected Loci.	MC14
16	8	3/6/2025	Quantitative genetics	Phenotypic variation and the resemblance between relatives	MC7
17	9	3/11/2025	Quantitative genetics	Response of single trait to phenotypic selection	MC8
18	9	3/13/2025	Quantitative genetics	Response of multiple traits to phenotypic selection	MC9

	10	3/18/2025	Springbreak		
	10	3/20/2025	Springbreak		
19	11	3/25/2025	Quantitative genetics	Genetic architecture: dominance and epistasis	JHG6.4
20	11	3/27/2025	Paper discussion		TBD
21	12	4/1/2025	Paper discussion		TBD
22	12	4/1/2025	Paper discussion		TBD
23	13	4/3/2025	Paper discussion		TBD
24	13	4/8/2025	Paper discussion		TBD
25	14	4/10/2025	Paper discussion		TBD
26	14	4/15/2025	Paper discussion		TBD
27	15	4/17/2025	Project Presentations		TBD
28	15	4/22/2025	Project Presentations		

Attendance Policy

In-person attendance are required

Conduct in Class

- Please be courteous and do not talk during lecture. This can be distracting to other students and the instructor.
- 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, video recorders, digital cameras and MP3 players.

Grading

Midterm Exam (100 points, 50% of final grade): The midterm is a weekend-long take-home exam. I will post it on the afternoon of Friday, 3/3; it will be due at the beginning of class on Tuesday, 3/7. Open book/notes/Internet. You may NOT discuss any aspect of the midterm exam with any other individual human.

Class Participation (20 points, 10% of final grade): Each student will be responsible for leading an in-class discussion on one of the assigned readings.

Final Project (80 points, 40% of final grade).

PCB4553: The final project is a presentation on the subsequent influence (i.e., the "paper trail") of the paper you presented in class.

PCB6685: Graduate students in the class are required to identify a research topic and complete a course project where they apply certain population genetic analyses taught in the course to their own datasets. In cases where a student has yet to generate their own experimental data, publicly available datasets can also be used (e.g. from NCBI). The final project will be an in-class presentation of the findings.

Grading Scale

Point Range (%)	Letter Grade	GPA equivalent
≥ 90.00	A	4.0
86.7 – 89.9	A-	3.67
83.3 – 86.6	B+	3.33
80.0 – 83.2	B	3.0
76.7 – 79.9	B-	2.67
73.3 – 76.6	C+	2.33
70.0 – 73.2	C	2.0
66.7 – 69.9	C-	1.67
63.3 – 66.6	D+	1.33
60.0 – 63.2	D	1.0
56.7 – 59.9	D-	0.67
< 56.7	E	0

Grade Curve Policy

The grades shown in the table are guarantees, e.g., if you make AT LEAST a 73.3% you are GUARANTEED a C+. I reserve the right to curve downward, i.e., to be more generous.

Make-up Exam Policy

Make-up exams will be administered on a case-by-case basis. Valid excuses include (but are not necessarily limited to) personal illness or injury or the illness, injury, or death of a family member. If you know you will need to miss class (e.g., for a job interview), please notify me in advance.

UF Counseling Services

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