

Syllabus - Advanced Genetics - PCB 5065 - Fall 2016

Section 2191; 4 credits; 2318 Fifield Hall; MTWR 5th Period

www.hos.ufl.edu/courses/PCB5065

Genetic analysis is explored with a team of instructors who use genetic approaches in their research programs. The objective of PCB 5065 is to strengthen students' comprehension of genetic concepts, so that they can read and interpret classical and current literature in the field of genetics and apply genetic analysis to their own research problems. PCB 5065 is designed to establish a strong foundation for advanced specialty courses in genetics and to complement advanced courses in molecular biology.

Prerequisite: Undergraduate general genetics. We assume students are familiar with basic Mendelian genetics and that they understand the nature and functions of DNA, RNA and proteins.

Reading: There is no required text for the course. No one book covers everything we will discuss in class. Required reading in the form of review and research articles from the primary literature will be provided in electronic format. Each section of the course concludes with a discussion paper from the current literature and/or a computer exercise. Discussion papers, along with questions for class discussion, will be provided one week prior to the scheduled discussion. Students are expected to read the paper and discussion questions in advance and to actively participate in the class discussions.

Optional books that students *might* find helpful for the beginning sections of the course:

Title: ADVANCED GENETIC ANALYSIS: GENES, GENOMES AND NETWORKS IN EUKARYOTES

Author: Philip Meneely

ISBN: 0199219826

Publisher: Oxford University Press, USA

Cover: paperback book

or

Title: ADVANCED GENETIC ANALYSIS: FINDING MEANING IN A GENOME

Author: R Scott Hawley and Michelle Y Walker ISBN: 1405103361

Publisher: John Wiley & Sons

Cover: paperback book Edition: 1

Optional books that students *might* find helpful for the final section of the course:

Title: PRINCIPLES OF POPULATION GENETICS

Author: Daniel L Hartl, Andrew G Clark

ISBN: 0878933085

Publisher: Sinauer Associates, Inc

Cover: hardback book Edition: 4

or

Title: INTRODUCTION TO QUANTITATIVE GENETICS

Author: David S Falconer and Trudy Mackay ISBN: 0582243025

Publisher: Prentice Hall

Cover: paperback book Edition: 4

Exams: The course is divided into five sections with an exam following the completion of each section (see schedule). Exams are scheduled for evening periods 11 and E1 (6:15-8:10 PM) to allow adequate time for solution of problem-based questions. **Exams are closed book and closed notes.** If you have another exam scheduled **at the same time** as a PCB 5065 exam, or if a PCB 5065 exam falls on a religious holiday that you traditionally observe, an alternate time will be arranged for your exam.

Please notify the instructor of these conflicts well in advance of the exam! Students who cannot take a scheduled exam due to illness or last-minute emergencies should contact the instructor prior to the exam if at all possible!

Grades: Final grades will be based upon the sum of 5 exam scores, but the scores will be weighted for the number of classes covered by each exam. Exams 1-3 are effectively worth 85 points each, exam 4 is worth 105 points and exam 5 is worth 140 points. The grading scale is: <325 points = C+ or lower; 325-374 = B; 375-424 = B+; 425-500 = A. Class attendance and participation will be considered in assigning grades to students with exam averages falling near a cut-off point. Information on current UF grading policies for undergraduate and graduate students can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

<http://gradcatalog.ufl.edu/content.php?catoid=2&navoid=762#grades>

Absences and Make-Up Work: Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Instructors: Contact information for all course instructors is provided below; Instructors are available to assist students on an individual basis by appointment.

Dr. Christine Chase (Course Coordinator), Professor - Horticultural Sciences, Graduate Program in Plant Molecular and Cellular Biology (PMCB Program), Graduate Program in Genetics and Genomics Ph.D. in Biology/Genetics, University of Virginia

Office: 2215 Fifield Hall, (352) 273-4862

e-mail: cdchase@ufl.edu

<http://hos.ufl.edu/faculty/cdchase>

Research interests: Plant mitochondrial biogenesis and function; development and application of molecular markers

Dr. Dean Gabriel, Professor - Plant Pathology & PMCB Program

Ph.D. in Genetics/Botany/Plant Pathology, Michigan State University

Office: 2559 Fifield Hall, (352) 392-7239

e-mail: dgabr@ufl.edu

<http://plantpath.ifas.ufl.edu/faculty/dean-gabriel/profile/#d.en.311865>

Research interests: The genetics of host/parasite interactions

Dr. Curt Hannah, Professor - Horticultural Sciences, PMCB Program

Ph.D. in Genetics, University of Wisconsin

Office: Building 710 (Plant Physiology building -- east of Fifield Hall across the parking lot), (352) 392-6957

e-mail: lchannah@ufl.edu

<http://hos.ufl.edu/faculty/lchannah>

Research interests: The molecular-genetics of starch biosynthesis in higher plants; the effects of introns and transposons on gene expression

Dr. Matias Kirst, Associate Professor, Forest Resources & Conservation, PMCB Program, Graduate Program in Genetics & Genomics

Ph.D. in Genetics and Functional Genomics, North Carolina State University

Office: 367 Newins-Ziegler Hall, (352) 846-0900

e-mail: mkirst@ufl.edu

<http://sfrc.ufl.edu/people/faculty/kirst/>

Research interests: Fundamental and applied genomic research; Technology and genomic tool development

Dr. Don McCarty, Professor - Horticultural Sciences, PMCB Program, Graduate Program in Genetics & Genomics

Ph.D. in Biochemistry, University of Wisconsin

Office: 2237 Fifield Hall, (392) 273-4846

e-mail: drm@ufl.edu

<http://hos.ufl.edu/faculty/drmccarty>

Research interests: Physiological and molecular aspects of development in seeds

Dr. Márcio F R Resende - Interim Chief Executive Officer, [RAPiD Genomics](#)

Ph.D. University of Florida Genetics and Genomics

Office: Florida Innovation Hub, 747 SW 2nd Avenue, Suite 354, (352) 273-2196

Email: mresende@rapid-genomics.com

Research Interests: Quantitative Genetics; Genomics; Molecular Breeding

Online Course Evaluation Process: Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at: <https://evaluations.ufl.edu> Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at: <https://evaluations.ufl.edu/results>

Academic Honesty: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not

be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

Software Use: All faculty, staff and students 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.

Services for Students with Disabilities: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation. 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc

Campus Helping Resources: Students experiencing crises or personal problems that interfere with their general well - being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

University Counseling and Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/ The center offers counseling services, groups and workshops, outreach and consultation, a self help library, training programs, and a community provider database.

Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Schedule – Advanced Genetics, PCB 5065, Fall 2016
 Section 2191, MTWR 5th Period, 2318 Fifield Hall

Date	Instructor	Topic
Mon Aug 22	All	Course introduction
Tues Aug 23	Hannah	The gene in molecular terms
Wed Aug 24	Hannah	The gene pre-Mendel to Mendel
Thurs Aug 25	Hannah	The gene as a unit of function
Mon Aug 29	Hannah	The gene as a unit of mutation
Tues Aug 30	Hannah	The operon
Wed Aug 31	Hannah	Allelic interactions – cistrons and operons; Genic interactions - epistasis
Thurs Sept 1	Hannah	Transposable elements – molecular and genetic properties
Mon Sept 5	NO CLASS	LABOR DAY HOLIDAY
Tues Sept 6	Hannah	Transposable elements as tools of forward and reverse genetics
Wed Sept 7	Hannah	Additional reverse genetics approaches – T-DNA, TILLING, RNAi
Thurs Sept 8	Chase/Hannah	Discussion paper - genes, mutations & genetic interactions
Mon Sept 12	Gabriel	Meiosis - segregation, assortment, chromosome mechanics, nondisjunction
Tues Sept 13	Gabriel	Genes & chromosomes
Tues Sept 13	6:15-8:10 PM	Exam 1 – genes, mutations & genetic interactions
Wed Sept 14	Gabriel	Linkage - gene order, linearity, crossing-over & recombination
Thurs Sept 15	Gabriel	Tetrad analysis & sister-strand exchange
Mon Sept 19	Gabriel	Recombination mechanisms I – gene conversion & Holiday structures
Tues Sept 20	Gabriel	Recombination mechanisms II – DSB, SDSA & early decision models
Wed Sept 21	Gabriel	Parasexuality & mitotic recombination
Thurs Sept 22	Gabriel	Recombination & genome editing I
Mon Sept 26	Gabriel	Recombination & genome editing II
Tues Sept 27	Chase	Discussion paper – CRISPR/Cas9 genome editing
Wed Sept 28	Resende	Chromosome variation – polyploidy, aneuploidy
Thurs Sept 29	Resende	Genome features - implications for markers, mapping & gene identification
Thurs Sept 29	6:15-8:10 PM	Exam 2 – recombination
Mon Oct 3	Resende	Molecular markers and genotype by sequencing
Tues Oct 4	Resende	Multipoint linkage mapping
Wed Oct 5	Resende	Linkage software demonstration
Thurs Oct 6	Resende	Pedigrees and LOD scores
Mon Oct 10	Resende	Map-based applications – QTL mapping
Tues Oct 11	Resende	Map-based applications – positional cloning
Wed Oct 12	Resende	From genotype to phenotype and back: tomato fruit size example
Thurs Oct 13	Chase	Discussion paper - homozygosity mapping in human pedigrees
Mon Oct 17	Chase	Transmission bias I – life cycles, organelles
Tues Oct 18	Chase	Transmission bias II – organelles, meiotic drive & gametophytic effects
Tues Oct 18	6:15-8:10 PM	Exam 3 – genomes, chromosomes, markers and mapping

Date	Instructor	Topic	
Wed	Oct 19	Chase	Expression bias – early development & maternal effect genes
Thurs	Oct 20	Chase	Expression bias – epigenetics I
Mon	Oct 24	Chase	Expression bias – epigenetics II
Tues	Oct 25	McCarty	Developmental genetics overview
Wed	Oct 26	McCarty	Developmental genetics – drosophila
Thurs	Oct 27	McCarty	Developmental genetics – drosophila
Mon	Oct 31	McCarty	Developmental genetics – drosophila / plants
Tues	Nov 1	McCarty	Developmental genetics – plants
Wed	Nov 2	McCarty	Developmental genetics – plants
Thurs	Nov 3	Chase	Discussion paper – chromosomal-non-chromosomal interactions
Mon	Nov 7	Kirst	Hardy-Weinberg Equilibrium and Introduction to Population Genetics
Tues	Nov 8	Kirst	Population genetics – segregation, recombination & linkage disequilibrium
Tues	Nov 8	Chase/McCarty	Exam 4 – Non-Mendelian and developmental genetics
Wed	Nov 9		Population genetics – Evolutionary forces that contribute to linkage disequilibrium
Thurs	Nov 10	Kirst	Forces that change gene frequencies: Mutation
Mon	Nov 14	Kirst	Forces that change gene frequencies: Random genetic drift
Tues	Nov 15	Kirst	Forces that change gene frequencies: Natural selection
Wed	Nov 16	Kirst	Population genetic structure, genetic distance & effective population size
Thurs	Nov 17	Kirst	Exercise on Population Genetic Structure
Mon	Nov 21	Kirst	Introduction to Quantitative Genetics (Quantitative Genetic Models)
Tues	Nov 22	Kirst	Introduction to Quantitative Genetics (Genetic variance and Heritability)
Wed	Nov 25	NO CLASS	Thanksgiving Holiday
Thurs	Nov 26	NO CLASS	Thanksgiving Holiday
Mon	Nov 28	Kirst	Genomic dissection of quantitative variation – genome-wide association studies
Tues	Nov 29	Kirst	Genomic dissection of quantitative variation – genomic prediction
Wed	Nov 30	NO CLASS	Florida Genetics 2016 Symposium
Thurs	Dec 1	NO CLASS	Florida Genetics 2016 Symposium
Mon	Dec 5	Kirst	Genomic dissection of quantitative variation – integrating GWAS & genomic prediction with multiple layers of genomic data
Tues	Dec 6	Kirst	Paper discussion
Wed	Dec 7	Kirst	Review / question-answer session
Wed	Dec 7	6:15-8:10 PM	Exam 5 – Population & quantitative genetics