Molecular Genetics (PCB 4522 + MCB 6937)

Fall 2025 Syllabus

Course summary: All known organisms use genetic instructions encoded in DNA. But DNA alone is not enough – an instruction book by itself is useless without a way to read and implement the instructions within. In this course, we will explore the molecular structure of DNA, how genes and genomes are arranged, how DNA is mutated and repaired, and the machinery that is used to transcribe and translate DNA across different major branches of the tree of life, including both eukaryotic and prokaryotic systems.

Course goals: the main goal of this course is to endow students with a foundational understanding of the molecules involved with the transmission, utilization, and evolution of genetic information. Achieving this goal should empower students to think critically about how molecular genetic processes are connected to and interact with macro-scale processes in other areas of research and everyday life. As this pertains to each module, students should be able to:

- Understand nucleic acid biochemistry and apply this understanding to predict and evaluate hypothetical experimental outcomes (Module I)

- Analyze hypothetical outcomes of mutations on the cell cycle, replication, and gene expression (Module II)

- Evaluate hypothetical genetic circuits to predict what functional outcomes they would yield (Module III)

- Apply an understanding of gene regulation to create a simplified genome that will yield a hypothetical morphology (Module IV)

- Apply knowledge of public databases and modern tools to analyze a gene, protein, or cell type (Module V)

Prerequisites: A grade of C or better in Integrated Principles of Biology (BSC 2010) and its accompanying lab course (2010L), or equivalent.

Instructor contact: Dr. Tyler Square, email: square.t@ufl.edu, office: Microbiology and Cell Science (building 0981, main campus) room 1001.

Course Canvas Website: https://ufl.instructure.com/courses/541376

Class Schedule: This class is asynchronous and can be taken 100% online via Canvas. It is designed to follow a Tuesday-Thursday type schedule throughout the semester. The lectures are pre-recorded and uploaded to Canvas. Dates of lectures in the syllabus correspond to the intended Tues/Thurs distribution; students are encouraged but not required to follow along at this pace. The quizzes and exams are timed and will only be available during the windows indicated below.

<u>Textbook:</u> Lewin's Genes XII (Authors: Krebs, Goldstein, and Kilpatrick) ISBN 1284104494. Recommended but not required.

<u>Office hours:</u> Thursday period 9 (4:05-4:55p) in Weil 0270, and by request.

<u>Course Structure:</u> The course consists of five modules, each corresponding to an exam. The first four modules comprise five lectures and two quizzes each. The last module has only three lectures and one quiz.

Lecture # (suggested date)	Subject material	Suggested reading	Due dates for exams, quizzes, and homework
Module I: meet the molecules (nucleic acids, genomes, and methods)			
Lecture 1 (~08/21)	Course intro, the origin of life, DNA biochemistry	1.1-1.10	Quiz 1 on lectures 1-3 due 11:59p 08/29
Lecture 2 (~08/26)	RNA biochemistry, gene structure, mutations	1.11-1.27, 3.1-3.11, 23.1-23.3	Honorlock test quiz due 11:59p 09/03
Lecture 3 (~08/28)	Genome structure and contents	4.1-4.9	MCB6937 lit. reflection #1 due 11:59p 09/04
Lecture 4 (~09/02)	Comparative genomics and evolution	5.1-5.23	Quiz 2 on lectures 4 and 5 due 11:59p 09/05
Lecture 5 (~09/04)	Methods in molecular biology	2.1-2.12	**Exam I starts 8a 09/08 ends 8p 09/10**
Module II: the meaning of life (DNA replication, cell division, repair, incursions)			
Lecture 6 (~09/11)	DNA replication and cell division in prokaryotes	9.1-9.8, 10.1-10.7, 11.1-11.12, 11.15	BLAST and NCBI homework due 11:59p 9/15
Lecture 7 (~09/16)	DNA replication and mitosis in eukaryotes	9.9-9.11, 10.8-10.11, 11.13	Quiz 3 on lectures 6, 7, 8 due 11:59p 09/19
Lecture 8 (~09/18)	Meiosis and life cycles	13.1-13.5; Wikipedia life cyc	MCB6937 lit. reflection #2 due 11:59p 09/25
Lecture 9 (~09/23)	DNA repair	14.1-14.13, 11.14	Quiz 4 on lectures 9 and 10 due 11:59p 09/26
Lecture 10 (~09/25)	Transposable elements and viruses	15.1-15.18	**Exam II starts 8a 09/29 ends 8p 10/01**
Module III: Putting up some walls (transcription and translation)			
Lecture 11 (~10/02)	Transcription in prokaryotes	17.1-17.17	Poster homework due 11:59p 10/07
Lecture 12 (~10/07)	Transcription in eukaryotes	18.1-18.12	Quiz 5 on lectures 11, 12, 13 due 11:59p 10/10
Lecture 13 (~10/09)	RNA processing	19.1-19.16, 21.1-21.4	MCB6937 lit. reflection #3 due 11:59p 10/15
Lecture 14 (~10/14)	RNA localization and stability	20.1-20.11	Quiz 6 on lectures 14 and 15 due 11:59p **10/16**
Lecture 15 (~10/16)	Translation	22.1-22.22, 23.9	**Exam III starts 8a 10/20 ends 8p 10/22**
Module IV: Work smarter, not harder (gene regulation and cell differentiation)			
Lecture 16 (~10/23)	Gene regulation in prokaryotes	24.1-24.16	Quiz 7 on lectures 16, 17, 18 due 11:59p 10/31
Lecture 17 (~10/28)	Gene regulation eukaryotes	26.1-26.14	PCB 4522 + MCB 6937 lit. reflection homework due 11:59p 10/30
Lecture 18 (~10/30)	Epigenetics	27.1-27.6, 28.1-28.5	MCB 6937 lit. reflection #4 due 11:59p 11/06
Lecture 19 (~11/04)	Intro to developmental biology	Wikipedia dev. biol. page	Quiz 8 on lectures 19 and 20 due 11:59p 11/08
Lecture 20 (~11/06)	Genetic compensation	none (lit. reflection HW)	**Exam IV starts 8a 11/10 ends 8p 11/13**
Module V: The Frontier Awaits (modern tools, applications, and approaches)			
Lecture 21 (~11/14)	CRISPR and gene editing	Review paper link	
Lecture 22 (~11/19)	Modern genetic tools	Gal4/UAS, AAVs, Brainbow	Sequence design homework due 11:59p 11/19
Lecture 23 (~11/21)	Sequencing approaches	Illumina, PacBio, Nanopore, scRNAseq	Quiz 9 on lectures 21, 22, 23 due 11:59p 11/21
~~Lecture 24~~ (~12/03)	None – hurricane buffer/extra review		**Exam V during finals week (date TBD)**

Lectures: There are 23 content lectures in this class, five for each of the first four modules, and only three lectures for Module V. Most lectures are about one hour long, but some are as short as ~35 min, and others are as long as ~75 minutes. For some, the longer formats may be difficult to get through in a single sitting, so please feel free to press pause and break them up into shorter watching sessions if you feel you would ingest the information better in smaller doses.

Grading: Grades in this class will be determined by five exams, ten quizzes, and four* homework assignments. The ten quizzes include nine on course subject material (numbered 1-9) and an additional Honorlock/camera setup "quiz." No items in this class are dropped, and there is a single 1% extra credit opportunity, to be announced midway through the class. Grades are determined as follows:

Graded items	% of grade
Exam I	10
Exam II	15
Exam III	15
Exam IV	15
Exam V	10
Quizzes (10x)	15
Homework (4x*)	20

Percentage	Letter grade
93% to 100%	A
90% to 92.9%	A-
87% to 89.9%	B+
83% to 86.9%	B
80% to 82.9%	B-
77% to 79.9%	C+
73% to 76.9%	C
70% to 72.9%	C-
67% to 69.9%	D+
60% to 66.9%	D
0% to 59.9%	F

*Graduate level sections have 4 additional literature reflection homework assignments that fall into the homework category; the category is still weighted 20%

Exam and Proctoring Information: For the exams, you must use the Chrome browser with the Honorlock extension. You are also required to procure and use an external camera with at least a 110° viewing window (I recommend this camera). Your screen and immediate surroundings will be monitored for suspicious activity and reported if anything is detected. Someone from the teaching team will review your Honorlock video for each exam. Canvas also records a log of test taker network and screen activity during the exam. **If the teaching team determines you were using any outside resources, like your phone, during the exam, you will receive a 0 and be referred to the Dean of Students Office for an Honor Code violation.**

For each exam, there is a 2.5 day window in which you can complete it. The exam windows will open at 8:00 AM EST and close at 8:00 PM EST 2.5 days later. These exams are designed to take ~40 minutes to complete, but I make them universally accessible from a timing perspective by giving all students 2 hours to complete each exam. Thus all students benefit from a 3x time increase, assuming you begin the exam prior to 6 PM on the last day. If you live in a different time zone, please take this into account: Canvas will lock your exam responses at 8 PM Eastern Standard Time. You can complete your exam with Honorlock proctoring at any time during the

exam window. You do not need to schedule an appointment to use Honorlock. The exams are closed book with a lockdown browser. You may use one sheet of **blank** scratch paper during the exam (you must show it to the camera before and after the exam). To learn more about Honorlock, go to the student page of Honorlock and watch their quick video at: https://honorlock.com/students/

Note: If you have privacy concerns regarding Honorlock's access to your computer activity outside of the times it is required for class, the Honorlock extension can be easily removed from your browser immediately after each exam or the test quiz (you'll need to add it again for the next exam). To remove it, go to Chrome -> preferences -> settings -> extensions and select remove Honorlock.

When you start the onboarding process for Honorlock you will be asked to take a picture of your face and your photo ID. You may need to do this using your laptop camera if your external camera cannot focus on your ID. To familiarize you with Honorlock and the external camera, we will do a proctored test quiz. This way, we can work out any bugs well before the proctoring system is needed for an exam. This quiz is due on Wednesday, September 3rd by 11:59 PM and a score of 100% is required to access the exams. You can take the quiz as many times as you want to score 100%. If you are experiencing technical issues that Honorlock support cannot fix, please contact your TA.

Quizzes: There will be nine quizzes on class material. Each quiz covers 2-3 lectures worth of material, they happen each week that there is not an exam. The quizzes are open for one week, usually due on Fridays at 11:59 PM (one exception: Quiz 6 is due on Thursday 10/16), see the schedule table above for quiz due dates. You have three attempts to submit your quiz, your highest score will be kept. For quizzes with a free response question, only your final free response will be graded. The quizzes are open book – please feel free to use outside resources and collaborate with your classmates to complete them. However, I do encourage you to *actually* quiz yourself on at least the first attempt in order to identify which areas of the material you may need to review. I have structured the quiz questions to be similar in difficulty and scope to exam questions, so these should be thought of as a tool for you to hone your knowledge of the material on which you will be tested.

Homework: PCB 4522 will have four homework assignments: 1) BLAST tutorial, 2) science poster, 3) literature reflection, and 4) sequence and cloning design. MCB 6937 will have four *additional* homework assignments, all of which are literature reflections. Note that in the course content table above, the 4th column indicating the due dates does not necessarily align with the lecture dates in the first column. See the canvas page "Homework Assignments" for more information and links to assignment prompts and rubrics. You may correspond with your classmates about their content and use outside resources, but each student is expected to turn in their own unique work which will be subject to plagiarism and AI checks. You may not plagiarize or use an AI text generator to complete your homework. **AI-generated text is painfully obvious in most cases; if we determine that you used an AI text generator to complete any of your homework assignments, you will receive a 0 and be referred to the Dean of Students Office for an honor code violation.**

Teaching Assistants: We have graduate TAs and undergraduate TAs on our teaching team. Please use them as the knowledgeable resources that they are. All TAs have either taken my class or served as a TA previously. Each student is designated one TA. In most cases, they should be your first point of contact if you have any questions about the content of this course. See the Canvas page "Teaching Assistants" for TA bios and a link to the TA designations.

Late policy: "The due dates are the due dates." I only accept quiz, homework, and exam submissions made before the due date, unless you have a documented extenuating circumstance that is verified by requesting a letter from the UF Dean of Students Office (DSO) declaring you were sick or otherwise experiencing an extenuating circumstance on the due date. They require documentation, so plan accordingly. https://care.dso.ufl.edu/instructor-notifications/

Discord: The teaching team moderates a Discord page where you can ask and answer questions about genetics! Someone from the teaching team will try to always respond within a few hours between 8 AM and 8 PM most days. This means that if you are scrambling to finish a quiz at 11:30 PM, you may not get answers from myself or a TA until it is too late, though your fellow classmates might be able to point you in the right direction. Please read the rules for the page and be respectful.

Appealing grades: The teaching team is always happy to discuss why answers you submitted did or did not receive full credit -- helping you understand genetics is our job! However, in the case of the essay questions in this course, we will not regrade questions until the end of the course, and only if it could make the difference between letter grades. So feel free to bring questions to office hours or email your TA to clarify why your answer did not receive full credit, but we will not reconsider the score you were given unless it matters for your letter grade at the end of the class.

Technical and digital literacy skills: As with most online classes, this class requires students to interact with various technologies. These include:
- Using Canvas
- Using email with attachments
- Creating and submitting files in commonly used word processing program formats
- Downloading and installing software
- Using spreadsheet programs
- Using presentation and graphics programs like Power Point
- Using apps in digital devices like Discord
- Using web conferencing tools and software like Zoom
- Using online libraries and databases to locate and gather appropriate information
- Using computer networks to locate and store files or data
- Using online search tools for specific academic purposes, including the ability to use search criteria, keywords, and filters
- Analyzing digital information for credibility, currency, and bias (e.g., disinformation, misinformation)
- Properly citing information sources
- Preparing a presentation of research findings

Students requiring accommodations: Students impacted by learning barriers who would like to

request academic accommodations should connect with the Disability Resource Center (https://disability.ufl.edu/get-started/).

Academic integrity: UF students are bound by The Honor Pledge, which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students 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." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies several behaviors that are in violation of this code and possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructors in this class.

Students are encouraged to discuss course-related materials with each other from the course, help each other understand concepts, study together, and discuss quiz questions and homework assignments with each other. However, the following is considered academic dishonesty, and the instructors expect that no student will ever do any of the following:

- Have another person complete a quiz or test in this course
- Copy another student's exam answers in this course
- Collaborate with anyone during an exam in this course
- Discuss the questions and answers of an exam with other students while the exam window is still open.
- Manipulate and/or distribute any materials provided in this course for any dishonest purpose (including course lecture slides).
- Use any materials provided by a previous student taking the course.

For more information on UF Academic Policies & Resources, please visit: https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/