

## **Molecular Genetics (PCB 4522 + MCB 6937)**

### **Fall 2024 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](mailto:square.t@ufl.edu), office: Microbiology and Cell Science room 1001.

Course Canvas Website:

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 approximately this pace. The quizzes and exams are timed and will only be available during the windows indicated below.

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

Office hours: Thursday period 9 (4:05-5:05p) in McCarty C 0100, and by request.

Course Structure: 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 four lectures and one quiz.

Lecture # (suggested date)	Subject material	Suggested reading	Due dates for exams, quizzes, and homework
<b>Module I: meet the molecules (nucleic acids, genomes, and methods)</b>			
Lecture 1 (~08/22)	Course intro, the origin of life, DNA biochemistry	1.1-1.10	Quiz 1 on lectures 1-3 due 11:59p 08/30
Lecture 2 (~08/27)	RNA biochemistry, gene structure, mutations	1.11-1.27, 3.1-3.11, 23.1-23.3	Honorlock test quiz due 11:59p 09/04
Lecture 3 (~08/29)	Genome structure and contents	4.1-4.9	MCB6937 lit. reflection #1 due 11:59p 09/05
Lecture 4 (~09/03)	Comparative genomics and evolution	5.1-5.23	Quiz 2 on lectures 4 and 5 due 11:59p 09/06
Lecture 5 (~09/05)	Methods in molecular biology	2.1-2.12	<b>Exam I starts 8a 09/09 ends 8p 09/11</b>
<b>Module II: the meaning of life (DNA replication, cell division, repair, incursions)</b>			
Lecture 6 (~09/12)	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 9/13
Lecture 7 (~09/17)	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 09/20
Lecture 8 (~09/19)	Meiosis and life cycles	13.1-13.5; <a href="#">Wikipedia life cyc</a>	MCB6937 lit. reflection #2 due 11:59p 09/24
Lecture 9 (~09/24)	DNA repair	14.1-14.13, 11.14	Quiz 4 on lectures 9 and 10 due 11:59p 09/27
Lecture 10 (~09/26)	Transposable elements and viruses	15.1-15.18	<b>Exam II starts 8a 09/30 ends 8p 10/02</b>
<b>Module III: Putting up some walls (transcription and translation)</b>			
Lecture 11 (~10/03)	Transcription in prokaryotes	17.1-17.17	Poster homework due 11:59p 10/07
Lecture 12 (~10/08)	Transcription in eukaryotes	18.1-18.12	Quiz 5 on lectures 11, 12, 13 due 11:59p 10/11
Lecture 13 (~10/10)	RNA processing	19.1-19.16, 21.1-21.4	MCB6937 lit. reflection #3 due 11:59p 10/15
Lecture 14 (~10/15)	RNA localization and stability	20.1-20.11	Quiz 6 on lectures 14 and 15 due 11:59p 10/18
Lecture 15 (~10/17)	Translation	22.1-22.22, 23.9	<b>Exam III starts 8a 10/21 ends 8p 10/23</b>
<b>Module IV: Work smarter, not harder (gene regulation and cell differentiation)</b>			
Lecture 16 (~10/24)	Gene regulation in prokaryotes	24.1-24.16	Quiz 7 on lectures 16, 17, 18 due 11:59p 11/01 PCB 4522 + MCB 6937 lit. reflection homework due 11:59p 11/1
Lecture 17 (~10/29)	Gene regulation eukaryotes	26.1-26.14	MCB 6937 lit. reflection #4 due 11:59p 11/05
Lecture 18 (~10/31)	Epigenetics	27.1-27.6, 28.1-28.5	MCB 6937 lit. reflection #4 due 11:59p 11/05
Lecture 19 (~11/05)	Intro to developmental biology	<a href="#">Wikipedia dev. biol. page</a>	Quiz 8 on lectures 19 and 20 due 11:59p 11/08
Lecture 20 (~11/07)	Genetic compensation	none (lit. reflection HW)	<b>Exam IV starts 8a 11/12 ends 8p 11/14</b>
<b>Module V: The Frontier Awaits (modern tools, applications, and approaches)</b>			
Lecture 21 (~11/14)	CRISPR and gene editing	<a href="#">Review paper link</a>	
Lecture 22 (~11/19)	Modern genetic tools	<a href="#">Gal4/UAS</a> , <a href="#">AAVs</a> , <a href="#">Brainbow</a> <a href="#">Illumina</a> , <a href="#">PacBio</a> , <a href="#">Nanopore</a> , <a href="#">scRNAseq</a>	Sequence design homework due 11:59p 11/20
Lecture 23 (~11/21)	Sequencing approaches		Quiz 9 on lectures 21, 22, 23 due 11:59p 11/22
Lecture 24 (~12/03)	TBD		<b>Exam V during finals week (date TBD)</b>

**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 no extra credit. 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. A human proctor will review flagged incidents and send a report to the instructor. The instructor always has access to the full recordings of the test taker and the screen recording. Canvas also records a log of test taker activity during the exam.

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. You have 2 hours to complete the exam, assuming you begin the exam prior to 6pm 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. Again: you may not use any outside resources. 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 or phone 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 4th 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, due on Fridays at 11:59pm, see the schedule table above for quiz due dates. You have three attempts to submit your quiz, your highest score will be kept. 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) sequence manipulation, and 4) literature reflection. MCB 6937 will have four *additional* homework assignments, all of which are literature reflections. Note that in the course content table above, the 4<sup>th</sup> 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. 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.

Teaching Assistants: We have graduate TAs and undergraduate TAs on our teaching team. Please use them as the knowledgeable resources that they are. 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.

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/>). It is important for students to share their accommodation letter with their instructor and discuss their access needs as early as possible in the semester.

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 a number of 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.