Molecular Endocrinology MCB 135A UC Berkeley, Fall 2020
MCB 135A, 3 units
Monday, Wednesday, Friday, 9-9:59
AM Remote lectures

Course webpage: bcourses site

Instructor Information

Faculty Instructor: **Gary Firestone** (Dept. MCB)
Office Hours: Tuesdays 10:30-11:30 remote meetings via Zoom (another weekly office hour will likely be added based on student input) I'm always accessible by email

Graduate Student Instructors: Maggie Chang and Nicholas Yiv
Discussion Sections: Mondays (GSI, Nicholas Yiv):
DIS 101: 10-10:59 AM (Remote meetings by Zoom),
DIS 102: 11-11:59 AM (Remote meetings by Zoom)

Wednesdays (GSI, Maggie Chang):
DIS 103: Noon-12:59 (Remote meetings by Zoom)
DIS 104: 1:00-1:59 (Remote meetings by Zoom)

Discussion Sections start the week of August 31st^{h}.

(There will be no discussion sections during the Week of Sept. 7th because of the Labor Day holiday).

Course Description

Prerequisites: MCB 100A or MCB 102 (biochemistry) or an equivalent class. Please contact me if you have not previously taken or are not concurrently enrolled in either course. At a minimum you should be familiar with (or at least heard of) concepts in biochemistry and cell biology, such as biochemical fractionation of proteins, DNA binding of transcription factors, gene expression, phosphorylation of proteins, Membrane-associated versus cytoplasmic-associated proteins, and protein-protein interactions. In past years, students have mentioned that Bio1A provided an adequate background to understand the key topics of the course. If you have taken Bio1A (or an equivalent introductory biology class) without MCB102 or MCB100A, this should provide enough background for the class depending on your confidence level with biochemistry, molecular biology and cell biology. In general, I will be teaching the key fundamental concepts needed to understand the more advanced course material.

Overview of Course: MCB135A is a research-based course that focuses on experimental approaches to understanding hormone action at the molecular level. This course is not about memorizing facts, structures and/or figures. Rather the emphasis is on problem solving,

conceptual understanding, and critical thinking. While the content for this course is based on in-depth examination of a limited number of topics in molecular endocrinology, the approaches to studying these topics can be applied to other areas of biology such as cell biology, neurobiology, immunology, developmental biology, genetics, tumor biology and physiology.

Methods of Instruction: Using a combination of lecture material and student participation, each class session will focus on learning the fundamentals of molecular hormone action, developing tools to design experiments and interpret results, and creating new models of hormone receptor signal transduction. All of this can be accomplished remotely, and I encourage you to participate in the classroom and office hours discussions, ask questions and share your insights. The course material will be presented using a chalkboard-like format.

What You Will Learn in This Course: You will learn how to design valid and reliable experiments, incorporate the appropriate positive and negative controls into your experimental design, interpret the resulting data, draw appropriate conclusions, and develop new directions for future research. All of these concepts will allow you to read and critique scientific papers in primary research journals, distinguish good from poor research studies, and conduct a review of the literature in a particular area of interest.

Readings: There is no required textbook. In past years, I designed a course reader that provided course notes, experimental strategies, outcomes of the experiments and study questions. However, because of teaching the class remotely this semester, sections of this reader will be uploaded into bcourses throughout the semester (denoted as "Lecture Workbook sets") so that you can download the material as desired. The Lecture Workbook sets are designed to complement the lecture material.

Course Requirements: Undergraduate Students

Exams: There will be two midterms (70 points each) and one final exam (140 points). All exams will be open note. The questions on the exams will involve some aspect of interpreting theoretical data from which you will be asked to design a model and then experimentally test your proposed model. Sample questions will be discussed in class and in the lecture workbook sets. The tentative dates of the midterms are Friday Oct 2nd and Friday Oct 30th. Both midterms will be given asynchronously over a defined time frame through Gradescope. Details will be discussed later in the semester.

The final exam is currently scheduled for Thursday, December 17th 2020 from 7 pm-10 pm. However, similar to the midterms, the final will be given asynchronously over a **defined** time frame through Gradescope.

Discussion Section Assignments: There will be approximately six discussion section assignments worth between 3 points to 5 points for a total of 20 points. The assignments will be to answer experimental problem-solving questions, and at least one of the assignments will involve writing a short critique of a primary research paper. The paper topics will focus on steroid receptors and/or plasma membrane receptors. Details about selecting research journal articles and writing the short critiques will be discussed in class and in the discussion sections.

Course Requirements: Graduate Students

Exams and Discussion Section Assignments: There will be two open note midterm exams and the Final (may be somewhat different than the undergraduate exam). 70 points each midterm and 140 points for the final. The questions on the exam will provide theoretical data from which you will be asked to design a model and then experimentally test your proposed model. Sample questions will be discussed in class. The midterms and final will be given at the same time as the one for the undergraduates in the class. Participation in the discussion sections and completion of the discussion section assignments are optional for graduate students.

Grant proposal: Graduate students will be asked to write a modified version of a postdoctoral fellowship application on a molecular endocrinology-related topic. Your application will include a critical review of the literature and proposed experiments. Information about writing the grant proposal and the precise due date of the grant proposal will be provided later in the semester. Graduate student grant proposal: 20 points.

Grading Policies

Your grade in this course will be based on a total of 300 points. Undergraduate and graduate students will be graded differently and independently of each other. Note: All assignments and exams must be completed to pass this class or receive a letter grade.

Undergraduate Students

Course components will be weighted as follows:

Total midterms:	140 points (midterm #1: 70 points; midterm #2: 70 points)
Discussion section:	20 points
Final Exam:	**140 points**

Graduate Students

Course components will be weighted as follows:

Midterms:	140 points (midterm #1: 70 points; midterm #2: 70 points)
Grant proposal:	20 points
Final Exam:	**140 points**

If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let one of the instructors and/or your GSI know as early as possible. Attend Faculty and GSI office hours; bring your questions and think about those from other students.

Course Policies

Safe, Supportive, and Inclusive Environment:

Whenever a faculty member, staff member, post-doc, or GSI is responsible for the supervision of a student, a personal relationship between them of a romantic or sexual nature, even if consensual, is against university policy. Any such relationship jeopardizes the integrity of the educational process.

Although faculty and staff can act as excellent resources for students, you should be aware that they are required to report any violations of this campus policy. If you wish to have a confidential discussion on matters related to this policy, you may contact the Confidential Care Advocates on campus for support related to counseling or sensitive issues. Appointments can be made by calling (510) 642-1988.

The classroom, lab, and workplace should be safe and inclusive environments for everyone. The Office for the Prevention of Harassment and Discrimination (OPHD) is responsible for ensuring the University provides an environment for faculty, staff and students that is free from discrimination and harassment on the basis of categories including race, color, national origin, age, sex, gender, gender identity, and sexual orientation. Questions or concerns? Call (510) 643- 7985, email ask_ophd@berkeley.edu, or go to http://survivorsupport.berkeley.edu/.

Statement on Accommodation:

If you need accommodations for any physical, psychological, or learning disability, or if you want me to have emergency medical information, please speak to Gary Firestone privately, either by requesting a zoom meeting or during my office hours. For DSP students needing accommodations for the exams, please contact Gary Firestone at least two weeks prior to the midterms and/or final so that we can work out acceptable accommodations.

If there are any conflicts with the due dates of the exams or assignments for religious reasons, travel for campus sponsored extracurricular activities, travel for family issues, medical and graduate school interviews, or for other reasons, please directly contact Gary Firestone.

Academic Honesty:

I expect you to do your own work and to uphold the standards of intellectual integrity. If you are having trouble with an assignment or studying for an exam, or if you are uncertain about permissible and impermissible conduct or collaboration, please come see me with your questions. UC Berkeley's cheating policy (http://bulletin.berkeley.edu/academic- policies/#studentconductappealstext) will be followed.

Incomplete Policy:

Under emergency/special circumstances, students may petition Gary Firestone to receive an incomplete grade. Please clearly state your reasoning in your comments to me.

Letters of Recommendation:

I am quite willing to provide letters of recommendation as needed for any of your applications (such as medical and graduate school and/or job opportunities). In addition to participating in the classroom discussions, please be sure to attend several of the course office hours. Also, ask your discussion section GSI to send to me (Gary Firestone) a brief note about your participation and performance in your discussion section. After the end of the course (even years later), feel free to communicate with me about your letter and I'll let you know what is needed for me to complete the letter (such as a copy of your unofficial transcript, your resume and your personal statement. I'm very familiar with Interfolio, which many of you will likely be using for your applications.

Additional Course Policies

- Be sure to pay close attention to deadlines.
- If you have a conflict with the midterm or due dates of assignments, please contact me in advance.
- For unexpected emergencies, please email Gary Firestone.
- You may discuss the general features of your discussion section assignments with other students, but the assignment that you submit must be completed on your own.

Key Dates

Tentative Midterm Dates: Midterm #1 **Friday, October 2nd** Midterm #2 **Friday, October 30th** (Note: depending on the progress with the lectures, there could be changes in the dates of the midterms) The midterms will be given asynchronously using Gradescope and the exam times and conditions will be will be communicated with you well before each exam.

Due Date for grant proposal (Graduate Students Only)	**TBD**
Final Exam	**Thursday, Dec. 17th 2020.** The final will be given asynchronously using Gradescope.

Resources

All key resources needed for the class will be provided remotely and the files will be uploaded into bcourses.

Evaluation of the Course

Please let me know how things are going during the course. When the campus opens up again, and you see me around campus (or at any sports events or other activities), feel free to introduce yourself and let me know how everything went with the class and/or ask any career-related questions.

Course Topics

The topics below will be discussed in order though the amount of time devoted to each topic will vary. If new research is published relevant to course topics, the information will be discussed in class during the semester.

a. Experimental approaches to examine properties of steroid ligand binding to receptors, hormone agonists/antagonists and medical uses (focus on estrogen and androgen receptors), activation of nuclear receptors, and receptor localization
b. Genetic, biochemical and molecular analysis of structural and functional domains within steroid receptors
c. DNA binding properties of steroid receptors, analysis of receptor mutations
d. Sequence-specific high affinity DNA binding sites; functional and mutagenic analysis of receptor DNA binding sites, receptor specificity of DNA binding sites, role of spacing and orientation
e. Molecular genetic analysis of co-regulator interactions with steroid receptors, Androgen insensitivity syndrome and receptor structure/function.
f. Identification of primary steroid receptor target genes, steroid regulated expression of individual genes and populations of endogenous genes in steroid responsive cells
g. GREs in primary response genes; steroid receptor-transcription factor interactions.
h. Transcriptional co-regulators and role in steroid receptor function.
i. Role of chromatin structure in steroid receptor mediated gene expression.
j. Formation of protein complexes and protein-protein interactions involving nuclear receptors
k. Overview of cell surface receptor structures, receptor dimerization, clustering and interactions with membrane components
l. Mechanism of tyrosine kinase receptor action: Insulin receptor signaling and EGF receptor signaling; molecular genetic analysis of the receptor structural domains, receptor binding proteins, SH2/SH3 domains and protein-protein interactions
m. Down-stream tyrosine kinase receptor signaling events-serine/threonine protein kinase cascades, Ras-activation of MAPK, alterations in cancer cell receptor signaling
n. Transcriptional regulation by protein hormone receptor signaling
o. TGF-beta receptor signaling through SMAD proteins; Interleukin/prolactin signaling through JAK-STAT pathway
q. Activation and inhibition of adenylate cyclase, GTP-binding regulatory components, secondary messengers (cAMP), and control of gene transcription
r. Cross talk between steroid and protein hormone pathways

Fine Print: The course deadlines, assignments, exam times and material (and anything else related to the class) are subject to change at the whim of the professor.