

MCB 153: Molecular Therapeutics
UC Berkeley Department of Molecular and Cell Biology
MWF 9:10-10 am (3 hours/week), weekly discussion section, 4 Units
Syllabus for Fall 2021

Guest Lecturers: Fyodor Urnov (IGI/UCB), Anders Naar (UCB), Mark Charbonneau (Synlogic, Inc), Heinz Moser (Novartis), John Bilello (Gilead), Art Reingold (UCB/SPH), Jan Vilcek (NYU/Vilcek Foundation), Michael Dupage (UCB), Alan Korman (Vir), Joe Goldstein (UTSW), Dan Nomura (UCB), John Marshall (UCB) and Jim Allison (MD Anderson).

Prerequisites: Bio1A and MCB102 or MCBC100A or Chem 135

Course Description: The overarching goal of MCB153 is to convey to students the scientific and regulatory process by which therapeutic drugs are developed and created. After completing this course, students will have a firm understanding on the mechanism of action of several therapies used to fight disease. The course will cover areas such as the discovery and refinement of antibiotics, anti-virals, cancer therapies and CRISPR-based therapies. Furthermore, MCB153 will delve into disease areas not covered in other courses, such as autoimmune diseases, cardiovascular diseases and neurological diseases. Lastly, MCB153 will implement a “case study” for each topic displaying real world challenges and solutions to treating complex diseases.

Course Learning Objectives & Intent

- 1) to learn and apply concepts of basic biology and chemistry to the science of the discovery of therapeutics and vaccines
- 2) to acquire factual knowledge about the history of the development of important and/or innovative therapeutics currently used in the clinic
- 3) to build a background in therapeutic sciences that can help a student prepare for a future career in industry.

These objectives will be met through lectures, discussion sections, reading, and examinations.

The course is intended for:

- 1) undergraduate upper level MCB and other biological sciences majors with an interest in careers in medicine, infectious diseases, biotech and the development of novel therapeutics.
- 3) graduate students who are interested in exploring possible careers in the science of therapeutics and translational science, whether in academia or industry.

Course Format: Three 50 minute lectures per week; one 50-minute discussion section per week.

Lecture	Date		Lecture Topic
1	8/25/21	Introduction	Introduction to the course
2	8/27/21	Small Molecules	Target engagement
3	8/30/21	Biologics	Peptides
4	9/1/21		CRISPR
5	9/3/21		Case Study CRISPR
	9/6/21	<i>Labor Day No Class</i>	
6	9/8/21		ASOs
7	9/10/21		Case study
8	9/13/21		Antibody
9	9/15/21		Case Study Antibody
10	9/17/21		Cytokines
11	9/20/21		Case Study Cytokines

12	9/22/21		Midterm #1
13	9/24/21	Antimicrobials	Overview of Medical Microbiology
14	9/27/21		The history and current state of antibiotics
15	9/29/21		Antibiotic/antiviral discovery; screening and target identification
16	10/1/21		cont'd
17	10/4/21		Case Study
18	10/6/21		HIV and COVID-19
19	10/8/21		cont'd
20	10/11/21		Case study: Remdesivir
21	10/13/21	Immune mediated diseases and	Immunology overview
22	10/15/21		cont'd
23	10/18/21		cont'd
24	10/20/21		Vaccines
25	10/22/21		Case study Vaccine
26	10/25/21		Sepsis
27	10/27/21		Midterm #2
28	10/29/21		Overview of Autoimmunity and Asthma
29	11/1/21		Therapeutic interventions in autoimmunity and asthma
30	11/3/21		contd
31	11/5/21		Case Study - Type I diabetes
32	11/8/21	Cancer	Overview of cancer biology
33	11/10/21		Small molecules/chemotherapy
34	11/12/21		Immunology of cancer/CAR T/checkpoint inhibitors
35	11/15/21		contd
36	11/17/21		Case Study
37	11/19/21	Heart Disease and Alzheimers	Heart Disease
38	11/22/21		contd
	11/24/21	<i>Thanksgiving Holiday No Class</i>	
	11/26/21	<i>Thanksgiving Holiday No Class</i>	
39	11/29/21	Other	Case study/Statis
40	12/1/21		Alzheimers
41	12/3/21		Using Human Genetic Databases to identify new targets of disease (UK
42	12/6/21		Lessons from Myriad genetics
43	12/8/21		Preclinical academia transition to clinic
44	12/10/21		Review

Course Grading

Basis for Grading:

Discussion/participation/quizzes	15%
Midterm #1 over 11 lectures	25%
Midterm #2 over 11 lectures	25%
<u>Final exam (comprehensive)</u>	<u>35%</u>
TOTAL	100%

Points for Discussion/participation/quizzes will be determined by the GSIs for their sessions. A quiz will be administered every other week during discussion section to prepare students for the midterm and final exams (please see below).

The final exam will be given during the normal scheduled exam time for this course.

Questions for examinations will include essay, multiple-choice, matching, and short answer. Students will have the opportunity to review the grading of each exam and point out possible errors in the grading. However, once the final grade has been assigned, the grade will NOT be changed.

bCourses website:

To access the course website, go to bCourses at bcourses.berkeley.edu. Here you will find links to required and optional readings, the syllabus, assignment descriptions and additional course resources. Any changes will be reflected in the assignment section of the site. Students are encouraged to routinely scores and quiz scores to ensure all assignments are accounted for.

Required Reading Materials

1) Cancer: The emperor of all maladies for lectures:

32	11/8/21	Cancer	Overview of cancer biology
33	11/10/21		Small molecules/chemotherapy
34	11/12/21		Immunology of cancer/CAR T/checkpoint inhibitors
35	11/15/21		contd
36	11/17/21		Case Study

2) Bliss, Michael (2014). *The Discovery of Insulin*. For lectures:

31	11/5/21		Case Study - Type I diabetes
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3) Gray N, Wenzel M, Multitarget Approaches against Multi-resistant Superbugs, *ACS Infect. Dis.* 2020, 6, 6, 1346–1365 for lectures:

13	9/24/21	Antimicrobials	Overview of Medical Microbiology
14	9/27/21		The history and current state of antibiotics
15	9/29/21		Antibiotic/antiviral discovery; screening and target identification
16	10/1/21		cont'd
17	10/4/21		Case Study

4) Janeway's Immunobiology, Chapter 1: Basic Concepts in Immunology. For lectures:

21	10/13/21	Immune mediated diseases and	Immunology overview
22	10/15/21		cont'd
23	10/18/21		cont'd
24	10/20/21		Vaccines
25	10/22/21		Case study Vaccine
26	10/25/21		Sepsis
27	10/27/21		Midterm #2
28	10/29/21		Overview of Autoimmunity and Asthma
29	11/1/21		Therapeutic interventions in autoimmunity and asthma
30	11/3/21		contd

5) Wei SC, Duffy CR, Allison JP. *Cancer Discov.* Fundamental Mechanisms of Immune Checkpoint Blockade. 2018 Sep;8(9):1069-1086. For lectures:

21	10/13/21	Immune mediated diseases and	Immunology overview
22	10/15/21		cont'd
23	10/18/21		cont'd
24	10/20/21		Vaccines
25	10/22/21		Case study Vaccine
26	10/25/21		Sepsis
27	10/27/21		Midterm #2

28	10/29/21	Overview of Autoimmunity and Asthma
29	11/1/21	Therapeutic interventions in autoimmunity and asthma
30	11/3/21	contd

6) Janeway's Immunobiology, Chapter 15, Autoimmunity; Chapter 16 manipulation of the immune response. For lectures:

8	9/13/21	Antibody
9	9/15/21	Case Study Antibody
10	9/17/21	Cytokines
11	9/20/21	Case Study Cytokines

Optional Reading Material

Course Requirements

All graded and evaluated materials will be returned to students no longer than 2 weeks after they have been turned in.

Lecture Slides

The draft *lecture slides* or *outlines* for each session will be posted by 8AM, so that they will be available to students before class at 9 AM. Following each lecture, a final version of the lecture slides may be posted. Students are responsible for all material included in the final (labelled) version of each lecture.

Discussion Sections

Discussion sections will begin on ---. You must attend the discussion section for which you are enrolled. We won't be able to move students around and cannot accommodate section hopping, so please be sure you can attend your enrolled section. Dates and times of the discussion sections are listed in the present syllabus.

Participation

In order to foster a learning environment that closely parallels that of in-person courses, we encourage students to engage during all of the lectures and discussion sections. Students are expected to participate during lecture using iclicker polling function and are highly encouraged to ask questions during lecture. In discussion section, students are expected to ask questions, participate in class discussions, and work collaboratively in small paired/group activities.

- The polling will be used primarily to foster interest and discussion, and monitor students' understanding of course material.

Final Exam

The final exam is comprehensive and will include a subset of questions sampled from each lecture covered in the course. **The final exam will be administered during the campus scheduled time for this course day and time, which is ---**

Course Communication

As we move through the course materials, we want to hear how the course is going for you, your questions as well as how your personal and professional experiences add to our conversation. You can learn a lot from discussing the material in this course with each other and we encourage you to take advantage of the interactive components of the course to learn from each other (these are to take place on the bCourse website discussion threads).

Announcements

Course updates will be posted on the bCourse website, and students are responsible to regularly check the bCourse website.

Course mail

Course announcements will also be sent out through Canvas' notification system. The default is to receive announcements via the Course Mail system, so make sure to check your Course Mailbox or berkeley.edu email address for messages or wherever you receive notifications.

Policies

Attendance

Students are encouraged to attend both lecture and discussion section to succeed in the course.

Classroom Policies and Exam Procedures

In general, makeup exams will not be given in this course. The only acceptable reason for missing an exam is a medical or family emergency. For missed midterm exams due to legitimate extenuating circumstances, the final grade will be assigned based on the average of their two completed midterm exams. Exceptions may be made for students with disabilities or to accommodate religious creed. If you have a conflict with either of the midterm exams or the final examination, please notify one of the course instructors by the end of the second week in writing.

Correspondence

Email contact information is listed for all faculty and GSI's. Students can expect a 48-hour response time, however if you do not hear from the faculty or GSI you are trying to reach, please kindly re-send your email. For all email correspondence, please put MCB153/253 in the subject heading. We will try to answer your query within 48 hours during the week. If you send an email on Friday after 5:00 PM you will get a reply the following Monday.

MCB Course Policies:

Descriptions of and relevant campus links to MCB school wide course policies on Disability Support Services, Accommodation of Religions Creed, Course Evaluations, Academic Integrity can be found at:

Promoting Academic Honesty

Being able to perform academically without using cheating as a crutch is something to be proud of and builds self-confidence that one succeeds best in the world by being honest. Academic honesty is promoted in this course by the following measures:

1. All midterms will be given only at the scheduled time and place unless accommodations for disabilities or religious creed are arranged in advance with the professor.

2. Cheating on exams or plagiarism on reports is against University regulations. The following is excerpted from a memo to all Berkeley professors:

“The instructor certainly has the right to give an F on a single exercise produced by cheating without determining whether the cheater has a passing knowledge of the relevant factual material. That is an appropriate academic evaluation, given not on the basis of race, sex or politics, but for a failure to understand or to abide by the basic rules of academic study and inquiry. By extension, such an F, if given for the entire course, is not ruled out under A207. It must be understood that any student who knowingly aids in plagiarism or other cheating, e.g., allowing another student to copy a paper or examination answer, carries guilt equally with the other student.”

3. Fortunately, most students have a clear idea of what cheating is and do not cheat. The following is a partial list of practices we consider to be cheating:
 - a. copying answers from other students' examinations or providing answers to other students during an examination;
 - b. writing “crib (cheat) notes” on cards, backpacks, clothing, skin, pens, fingernails, etc. or programming into accessible electronic devices;
 - c. obtaining exam questions before the exam by theft or some other means;
 - d. asking to leave the exam room to go to the bathroom, then looking at “crib” notes there;
 - e. plagiarizing a news report from another student or having another student write these reports for you; stealing reports from other students;
 - f. changing examination answers after the exam is handed back, then going to the instructor and claiming the answer was graded incorrectly;
 - g. stealing the books for this course on reserve in the library;
 - h. faking illness or death in the family to get excused from an examination.
4. Why do students cheat?
 - a. pressure to get good grades;
 - b. procrastination of studying until just before midterms.
 - c. uncertainty about what constitutes academic dishonesty

Students with Disabilities

Accommodations will be made for students with disabilities. Please see: <http://www.dsp.berkeley.edu/> for details. **Please provide your written request to the instructor(s) and your GSI within the first 2 weeks of the course.**

Additional Student Resources

If you are experiencing stress, anxiety, or other forms of distress during the semester, we hope to be a resource for you. Please reach out to a GSI or Professor for support. There are also many resources available to you.

All registered Berkeley students are eligible to use Counseling Psychological Services. You do not have to purchase the Student Health Insurance Plan to use these services. The first five counseling sessions are free for registered Berkeley students. Counselors can provide support in academic success, life management, career and life planning, and personal growth and development.

UC Berkeley, Counseling and Psychological Services:

- Please call (510) 642-9494 or stop by the office on the 3rd floor of the Tang Center to make an appointment with a counselor.
- **Drop-in counseling for emergencies:** Monday - Friday, 10:00AM - 5:00PM
- **After hours counseling:** In the case of emergencies at night or on weekends, call [\(855\) 817-5667](tel:8558175667) for free assistance and referrals. Request to speak with a counselor.
- For emergency support: Call UCPD 911 or (510) 642-3333

24-Hour Crisis Hotlines

- Alameda County Crisis Line: (offers confidentiality, TDD services for deaf and hearing impaired callers and translation in 140 languages) Call 1-800-309-2131
- National Crisis Help Line: Call 1-800-273-TALK
- Crisis Text Line: Text HOME to 741741
- National HopeLine Network: Call 1-800-SUICIDE

We also ask that you look out for your fellow peers. If you see any of the signs below that may indicate your classmate may need assistance, please use the resources above or reach out to any of the GSIs or Professors.

- Withdrawing from other people
- Changes in weight or eating patterns
- Changes in sleeping patterns
- Fatigue or lack of energy
- Increased anxiety or irritability
- Feeling worthless or hopeless

Other Campus Resources:

- Let's Talk: Informal Drop-In Counseling <https://uhs.berkeley.edu/counseling/lets-talk>
- Self-Help Resources <https://uhs.berkeley.edu/counseling/self-help>
- Be Well at Cal <https://uhs.berkeley.edu/bewell>

For help in time management and handling the stress/anxiety of taking tests, etc.:
<http://uhs.berkeley.edu/students/counseling/cps.shtml>; 510-642-9494 (Tang Counseling Services).