SYLLABUS: BIMM 110 MOLECULAR BASIS OF HUMAN DISEASE

Instructor:	*John Tat, Ph.D.*
Lecture time:	*Mon-Thurs: 6:30-7:50 PM on Zoom: (recurring Zoom link: https://uchealth.zoom.us/j/87843404686)*
Instructor's Office hours:	*Mon-Wed: after class until 8:30 PM*
Midterm exam:	*Due by 11:59 PM PST on Monday, August 21, 2023 on Canvas*
Final exam:	*Due by 10:59 AM PST on Saturday, September 9, 2023 on Canvas*

Graduate IA	**Email**
Hongxin (Max) Cai	hocai@ucsd.edu

Max's section time	**Recurring section Zoom link**
A01: 9 AM-10:50 AM PST	https://ucsd.zoom.us/j/96284544181
A02: 11 AM-12:50 PM PST	https://ucsd.zoom.us/j/94278934365
A03: 1 PM-2:50 PM PST	https://ucsd.zoom.us/j/94609991215

Max's office hour	**Recurring office hour Zoom link**
Frid: 8-9 PM PST on Zoom	https://ucsd.zoom.us/j/92305608587

Specific aim. We will examine the molecular bases and clinical aspects of selected human diseases. My aim is that by the end of this course, students will have gained the theoretical background and critical thinking and teamwork skills that will prepare them for higher education in the health professions, research, or join the biopharmaceutical industry. Using a backward design, I set up three learning outcomes to achieve my aim:

1. Students will learn about selected human diseases; the genetic, molecular, biochemical, cellular, and physiological approaches used to study the molecular basis of these diseases; and how these techniques have been leveraged to develop successful and potential preventative, diagnostic, and therapeutic strategies to address these diseases.

2. Students will learn critical thinking by examining quantitative and qualitative data, and using scientific evidence to formulate conclusions.

3. Students will learn how to communicate and work with each other, especially to complete major assignments, i.e., homework and exams.

I will deliver curriculum through a combination of direct instructions and heuristic approaches. I can modify the curriculum at any time to deliver

the best learning experience. This syllabus is not legally binding.

Integrated nature of the course. BIMM 110's prerequisites are BICD 100 Genetics, BIBC 100/102 Biochemistry, and BIMM 100 Molecular Biology, or their equivalence. Many BIMM 110 students will also have completed their general chemistry, organic chemistry, calculus, physics, and writing series. I will use this background to provide a more complex presentation of human diseases. While they are not expected to be experts in the said arenas, students should not be strangers to them when they appear in BIMM 110. BIMM 110 students will also need to take the initiative to learn on their own and/or apply what they know on many occasions. Taken together, these two features will add to the difficulty of BIMM 110.

Videocasting. Lectures and discussion sections will be recorded. They are accessible at podcast.ucsd.edu.

Trigger warning. Health topics are sensitive, personal, and sometimes even political. Discussions about health topics can feel offensive, especially when these topics are coupled with disparities caused by biological, socioeconomic, gender, language, and other factors. Please know these offenses are unintentional, and I ask for your forgiveness and grace.

Reading materials. We will not use a textbook, but instead rely on primary literature. I will post all reading materials on Canvas.

Optional attendance. The effectiveness of mandatory class attendance is still under debate. However, a meta-analysis using data covering ~100 years and ~28,000 student learning outcomes found attendance to be the most important predictor of high grades (Crede et al. *Review of Educ Res*, 2016, *80*(2), 272-295). Similarly, IA-led discussion sections help to clarify and reiterate information, give additional tutelage, and provide me with information about a student's work ethics. Extra efforts showcasing scholarly commitment may sometimes be used to justify rounding up a student's grade when it is within 0.5%. However, BIMM 110 students should decide for themselves whether attendance is necessary for their education. Therefore, lecture and discussion section attendance are optional.

Course schedule. This curriculum follows five internal medicine subspecialties (except for Unit 1). This format mirrors many medical, pharmacy, and biomedical PhD curricula. Each unit starts with the anatomical and physiological overview of a system and then followed by lectures on diseases specific to that system. Teaching tidbits for each disease will normally follow this pattern: (1) general information, (2) epidemiology, (3) pathophysiology, (4) risk factors, (5) signs/symptoms, (6) diagnostic tools, and (7) current and/or potential treatments. There is a heavy emphasis on biological mechanisms. Studying the teaching tidbits in this pattern will help students form the conceptual framework of molecular medicine. This framework will help students to understand how small details come together to build the big pictures, and to master the course materials.

Schedule ***Required readings are testable as homework or exam questions***

Unit 1: Philosophical foundations

- Mon, 8/7 Prologue 1. J.L. Scully. What is a disease? Disease, disability & their definitions. *EMBO Rep* 2004
  F. Gannon. Molecular medicine: trendy title or new reality? *EMBO Rep* 2003

Unit 2: Pulmonology

- Tues, 8/8 Respiratory system 2. Harkema et al. Respiratory System. *Fundamentals of Toxicologic Pathology*, 2018, pp 351-361
- Wed, 8/9 Asthma 3. Johnson & Theurer. A stepwise approach…*American Family Physician*. 2014. 89(5):359-366
- Thurs, 8/10 Cystic fibrosis 4. Willis et al. Failure to thrive in a 14-month old child. *LabMed*. 2003;7(34)

Discussion sections meet at scheduled time on Friday, August 11, 2023
Homework #1 due by 10:59 PM PST on Friday, August 11, 2023 on Canvas

Unit 3: Global Health & Infectious Diseases

- Mon, 8/14 Infectious diseases 5. No reading
- Wed, 8/15 Tuberculosis 6. Mondal et al. In-vivo studies on Transitmycin...*PLoS ONE*. 2023;Mar 3;18(3):e0282454.
- Tues, 8/16 Malaria 7. O'Neill et al. A tetraoxane-based antimalarial drug candidate... *Nat Commun*. 2017. 24(8):15159
- Thurs, 8/17 Viral hepatitis 8. Song and Kim. Diagnosis of hepatitis B. *Ann Transl Med*. 2016;4(18):338

Discussion sections meet at scheduled time on Friday, August 18, 2023
Homework #2 due by 10:59 PM PST on Friday, August 18, 2022 on Canvas

- Mon, 8/21 Midterm (no class) Exam released at 6:30 PM PST and due on Canvas at 10:59 PM PST on Monday, August 21, 2023

Unit 4: Endocrinology and metabolism

- Tues, 8/22 Endocrine system 9. Watamura. Endocrine system. Encyclopedia of Infant & Early Childhood Dev, 2008; 450-459
- Wed, 8/23 Newborn screening 10. Ney et al. Glycomacropeptide supports growth and reduces [Phe]. J Nutr. 2008; 138(2):316-22
- Thurs, 8/24 Diabetes type II 11. Goyal and Jialal (StatPearls, 2021) Diabetes mellitus type 2

NO HOMEWORK THIS WEEK SO IA CAN GRADE MIDTERM EXAM

Unit 5: Gastroenterology

- Mon, 8/28 Digestive system 12. https://www.niddk.nih.gov/health-information/digestive-diseases/digestive-system-how-it-works

- Tues, 8/29 Peptic ulcers 13. Abdel-Baki et al. Irigenin...for management of H. pylori infection. *Sci Rep*. 2022 Jul 6;12(1):11457
- Wed, 8/30 GERD 14. Clarett and Hachem. Gastroesophageal reflux disease (GERD). *Missouri Medicine*. 2018
- Thurs, 8/31 Celiac disease 15. Trasciatti et al. Effect of oral cholecalciferol...: *J Steroid Biochem Mol Biol.* 2022 Mar 4;220:106083

Discussion sections meet at scheduled time on Friday, September 1, 2023
Homework #3 due by 10:59 PM PST on Friday, September 1, 2023 on Canvas

Unit 6: Oncology

- Mon, 9/4 **No class** **Labor Day**
- Tues, 9/5 Cancer biology 16. Hanahan and Weinberg. Hallmarks of cancer: the next generation. *Cell*. 2011 Mar 4;144(5):646-74
- Wed, 9/6 Breast cancer 17. Kim et al. The antiasthma med…suppresses breast cancer stem cells. *Molecules. 2020.* 25:6028
- Thurs, 9/7 Epilogue No reading

Extra credit: SET due by 8 AM on Friday, September 8, 2023
Discussion sections meet at scheduled time on Friday, September 8, 2023
Final examination released at 11 PM PST on Friday, September 8, 2023, due by 11 AM PST on Saturday, September 9, 2023 on Canvas

Grading system and its rationale. Many professors evaluate students on test scores alone. While efficient, this method makes an "A" almost unobtainable for students who might have good work ethics but are poor test-takers. It also disadvantages students who may have good work ethics and are good test-takers but may have had a subpar testing day. In short, grading by exam alone neither acknowledges nor rewards the fact that good scholarship requires both wit and grit. In the short run, this method makes taking any class risky. In the long run, this method does not professionally prepare our graduates. To address this issue, I designed my grading system to reward both wit (~75%) and grit (~25%).

Type	***Points***	***Notes***
Weekly homework	~25 points each (x3)	~75 points total
Midterm exam	~60 points	
Final exam	~120 points	
Extra credits/efforts (can boost grade by ~3.5%)		
SET	1-5 points	1 pt. iff ≥90% of students fills out SET form; 5 pts iff 100% evaluations
Midterm exam survey	2 points	
Final exam survey	2 points	

Lecture attendance	Unlimited	Given out randomly (see below)
Possible	+264/ ~255 points	

Grade distribution. The course is not curved since one student's success should not depend on another student's misfortune. Your letter grade is based on point accumulation. So, collaborations are highly recommended since everyone could potentially earn an "A." My teaching experiences show a positive correlation between a student's willingness to work with others and their letter grade.

Mastery/Excellent		***Proficiency/Good***		***Developing/Fair***		***Poor***		***Fail***	
96-100+%	A+	84-87.9%	B+	72-75.9%	C+	>63.9%	D	>53.9	F
92-95.9%	A	80-83.9%	B	68-71.9%	C				
88-91.9%	A-	76-79.9%	B-	64-67.9%	C-				

Ungraded in-class quizzes. In-class quizzes are a type of formative assessment (i.e., ongoing evaluations enabling students to monitor their own learning) conducted to gauge students' understanding and provide feedback on my pedagogy. In-class quizzes are set up in the format of easy, moderate, and advanced questions (described below) to help students prepare for their exams.

Group work option. On all assignments, students may submit as individuals or in groups of up to five students from the same section. This is another active learning activity designed to promote collaboration and inclusivity. If you chose the group option, you need to compose your group *only* from the people in your section. Students from different sections cannot co-author assignments to avoid statistical anomalies when assigning letter grades. If a submission was co-authored by students from different sections, then that assignment without exception will receive zero points. Students may change groups for each assignment. As long as every member reports their name, PID, and justification (see below) on the submission, they will be credited. The IA and I will not regulate your groups.

***Credit justification on group work*.** For everyone to receive the same full mark on a submission, co-authors must write a paragraph on the assignment's cover page justifying why every team member deserves equal credit. If the justification is missing for a group member, that member automatically loses 20% from whatever the full mark may be. Also, if your team feels a member should not receive full credit, decide as a team what percentage of the total points that person should receive and justify why. Below is an example justification:

> "John Smith and Jane Doe handled all the easy questions and significantly helped with the moderate and advanced questions. Al Batross and An Chovy were assigned moderate and advanced questions. However, Al Batross and An Chovy responded slowly and did not ask for help in a timely manner. Their answers also did not address the prompts. We were forced into a time crunch and did not have enough time to review the test before submitting. Therefore, we agreed, and demonstrate so through our signatures, that while John Smith and Jane Doe

should receive full credit, Al Batross and An Chovy would only get 75% of the credit."

Rationale for the group work option. Group work will alleviate some stress stemming from the summer session's rapid pace. Also, collaboration and sharing credit are common features in the research community, where a publication may have several co-authors, with each author's contributions explicitly stated (Casadevall et al. *J Clin Invest*. 2019;129(6):2167-2168). Therefore, the group option teaches science the way science is practiced professionally.

Homework is another formative assessment. It will have easy, moderate, and advanced questions to prepare students for their exams. While students may submit as individuals, they are highly encouraged to submit as groups of up to five students from the same section.

Examinations are summative assessments enabling me to assess students' mastery of BIMM 110. My philosophy on making testing effective, equitable, and fair is as follows. First, since we will cover many biomedical topics, memorizing a copious amount of information will be very burdensome. Second, to replicate the scientific research setting, this course emphasizes critical thinking and communication clarity, and not information regurgitation. Third, real-world problems are usually accompanied by (nearly) infinite resources that may be used to formulate a solution. Fourth, closed-access examinations can engender dishonesty. These four characteristics justify my examinations being open-book, open-note, and open-Internet. In fact, since I began teaching in 2013, all my exams have been open-resource as this approach has not been shown to inflate test scores if an exam was well designed (Brightwell et al., *BEE-j* 2004; my unpublished data).

At the appointed time, a Word Document will appear on Canvas. Although the midterm can be completed in 1.5 h and the final exam in 3 h, all students will have at least twice the amount of time needed to complete each exam.

My *evaluation ladder* has three levels of difficulty, adapted from the 2001 revision of Bloom's taxonomy on the hierarchy of learning.

Easy Assess students' comprehension through recalling information; these are multiple-choice or true-false questions.

Moderate Assess students' analysis of the course materials through synthesizing and applying information to derive the correct answer. These questions may be multiple-choices, true-false, or short answers with multiple parts. They may require students to make scientific justifications.

Advanced Assess students' application of current knowledge and/or creation of new knowledge through evaluating, interpreting, synthesizing, and applying course materials and peer-reviewed data to formulate and/or predict scientific conclusions. These questions are short answers with multiple parts and can be hypothetical in nature.

Turnitin. All assignments will be submitted on Canvas where they will be checked by Turnitin for academic integrity. If submitting as a group, only the group's spokesperson has to submit. As long as everyone's names, PID's, and justification are there, you will receive credit.

Extra credit opportunities. I believe students learn better when they have ownership in the direction of the course. Thus, I give out extra credits to encourage and reward active learning through inclusive participation.

Lecture participation. I will give out extra credit for participating in class. The amount is unlimited.

SET is designed to help UCSD improve its educational system. SET survey results are only meaningful if there is a sizable sample. If and only if 100% of the class completed SET, then each person will receive 5 additional points on top of the 255 possible points.

Academic integrity. The course is designed so that cheating and plagiarism have no clear advantage. Having said that, I reserve the right to determine what is academically (dis)honest. All cases of dishonesty will be brought before the Office of Academic Integrity for arbitration.

Special accommodations. Students needing accommodations must provide me with a current Authorization for Accommodation letter issued by the Office for Students with Disabilities (OSD), located in University Center 202, by August 11, 2023. Your education is very important to me. Please do this ASAP so reasonable accommodation may be found early to facilitate your success.

Contact the Professor or IA. *Please only contact us using the course via Canvas to so we know that the message is coming from BIMM 110 students.* Please be considerate when sending email inquiries. Check if the question has already been answered in the syllabus, or if a question can be better answered in office hours.

Final thoughts. You always need to act professionally. If you harmed the learning experience of other students, I will ask you to leave the class. Along this line, no trolling is allowed. Also, sometimes even when unprompted, students will share with the class their personal experiences with human diseases. Please be sensitive and respectful if this happens.

All submissions must be typed, Arial size 11 or Times New Roman size 12, black ink. Submission not in this format will be rejected.

Please work with me to promote and perpetuate diversity, equity, and inclusivity. Everyone deserves a high-quality education. Plus, we all benefit when we can learn from each other.