

SYLLABUS BIBC 151, SPRING 2021

CHEMISTRY OF BIOLOGICAL INTERACTIONS LABORATORY

TIME: Lecture: Asynchronous in advance of laboratory meetings

Laboratory: MANDATORY SYNCHRONOUS MEETINGS, 12:30-2:30 PM, Wednesdays and Fridays

INSTRUCTORS: Alisa Huffaker, Eric Schmelz

INSTRUCTIONAL ASSISTANTS: Helen Khuu, Winnie Gong

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COURSE OVERVIEW: Complex interactions between organisms ranging from immunity to mate attraction have a chemical basis. Moreover, an evolutionary arms race in chemical biosynthesis is widely appreciated to have driven much of the planet's biological diversity. Plants and microorganisms are the dominant life forms on earth and a major source of natural product chemicals for the discovery of new pharmaceuticals. Interactions between photosynthetic and non-photosynthetic organisms range from antagonistic to mutualistic. This laboratory will explore the chemical basis of plant-microbial interactions and explore both specialized trace signaling molecules and highly abundant multifunctional natural products. Striking conceptual overlap and relevance to roles in humans will be emphasized. In this context, the course will enable the opportunity to explore biomolecules and organism interactions in a collaborative and multi-disciplinary environment. We will learn about how to extract, quantify and test activity of plant and microbial biochemicals of ecological and medicinal significance and pursue cutting edge methods for discovery of new chemicals of interest as antimicrobials or pharmaceuticals.

COURSE LEARNING OBJECTIVES: You will learn essential concepts of chemistry-mediated biological interactions, practice fundamentals of the research process, and develop experience with a variety of practical methods related to small molecule discovery, extraction and analysis.

CONCEPTS:

- Mechanisms by which chemistry mediates complex biological processes and interactions between organisms
- Strategies for discovery of new pharmaceuticals (antibiotics) from plants and microbes
- How measurable chemical phenotypes can be rapidly linked to genotype

RESEARCH SKILLS:

- Reading and understanding scientific literature
- Identifying scientific questions, forming hypotheses and proposing methodology to test hypotheses
- Oral presentation of a research proposal

METHODS:

- Extraction processes for small molecule purification
- Fundamentals of chromatography and analysis by mass spectrometry
- Basic summarization and statistical analysis of mass spectrometry data
- Analysis of small molecule function through a variety of assays
- Analysis of metagenome data to identify novel biosynthetic clusters for antibiotic discovery
- Use of association mapping to identify biosynthetic pathways for plant antimicrobials of interest

SCHEDULE

Week	Dates	Topic	Points
Week 1	March 31, April 2	Course Introduction	n/a
Week 2	April 7 & 9	Module 1: Salicylates: multifunctional molecules, from plant hormones to blockbuster drugs	110
Week 3	April 14 & 16		
Week 4	April 21 & 23	Module 2: Plant natural products: ecological roles and pharmaceutical applications	110
Week 5	April 28 & 30		
Week 6	May 5 & 7	Module 3: Microbial natural products: metabolic engineering and next-generation antibiotics	110
Week 7	May 12 & 14		
Week 8	May 19 & 21	Module 4: Integrating genetics & chemistry: discovery of metabolic markers and biosynthetic pathways	110
Week 9	May 26 & 28		
Week 10	June 2 & 4	Final Presentations	60

COURSE INFORMATION SPECIFIC TO SPRING 2021 REMOTE TEACHING

LECTURES AND LABS: For synchronous laboratory sessions, 12:30 – 2:30 PM Wednesday and Friday, ATTENDANCE IS MANDATORY. Lectures will be recorded in advance and posted as Zoom recordings posted to Canvas. Lectures are to be viewed prior to attending laboratory for the week.

OFFICE HOURS: Interactive office hours will be conducted weekly through Zoom by both Drs. Huffaker and Schmelz and the Instructional Assistants. Times will be announced on Canvas shortly. We will aim to ensure that all students are able to attend at least one scheduled office hour session.

FACILITATING INTERACTION WITH INSTRUCTORS: While we are all disappointed not to be able to spend the quarter together at the bench, we're working very hard with the aim of ensuring you leave the class with the same general knowledge and opportunity for interpersonal interactions. One of our favorite things about this course is getting to know our students as individuals, and we will be working hard to interact with you both through Zoom during class and office hours. We'd like to hear about what you're interested in, what you'd like to do when you graduate and anything else you'd like to talk about! We're looking forward to working with you this quarter and helping you do your best!

GRADING

POSSIBLE EARNED POINTS FOR THE QUARTER:

140 points	Active participation (14)
80 points	Lecture Questions (16)
80 points	Module Exercises (8)
120 points	Module Presentations (4)
40 points	Literature synopses (4)
40 points	Final Presentation

500 points Total

GRADING SCALE:

≥ 450 points (90%)	A
≥ 435 points (87%)	A-
≥ 420 points (84%)	B+
≥ 400 points (80%)	B
≥ 385 points (77%)	B-
≥ 370 points (74%)	C+
≥ 350 points (70%)	C
≥ 335 points (67%)	C- (PASS)
≥ 300 points (60%)	D

Grades will be assigned based on points earned using the scale listed on the right.

ASSESSMENT

ACTIVE CLASS PARTICIPATION (140 POINTS): Modern scientific research is both detail-oriented and a highly collaborative process. Reflecting this, we will work in teams to analyze research data, discuss relevant literature, and prepare presentations discussing your work. As fellow student collaborators, you are relying on one another as a team. To obtain full points for participation, you need to (a) be actively engaged in data analysis and research team discussions during the class meetings, (b) work constructively with your research team, and (c) share work equitably among your group. You will begin earning 10 points each week beginning in week 2 (April 7 and 9th). You will earn 10 points for each of 14 classes.

LECTURE QUESTIONS (80 POINTS): Lectures will be posted to Canvas as Zoom videos prior to class meetings. To reinforce the learning objectives for each lecture, you will complete 3 to 4 short-answer questions that cover the primary concepts covered. These will be posted as assignments on Canvas. You may work collaboratively but should send individual answers. Answer keys will be posted on Canvas after class. **You are required to view the lectures and submit your lecture question assignment before attending laboratory sessions for the week.** We will complete 16 problem sets worth 5 points each.

MODULE EXERCISES (80 POINTS): Each module will have two exercises covering a variety of topics such as analysis of small molecule function, extraction processes for small molecule purification, fundamentals of chromatography and analysis by mass spectrometry, basic summarization and statistical analysis of mass spectrometry data, analysis of metagenome data to identify novel antibiotic biosynthetic clusters, and use of association mapping to identify biosynthetic pathways for plant antimicrobials of interest. These exercises will be diverse, and may involve making observations, performing calculations, internet research or other activities, and submitting the information you generate. You will work collaboratively to complete these exercises and discuss their meaning in teams during laboratory meetings, but each individual should post their own files. A total of 8 exercises will be worth 10 points each.

MODULE PRESENTATIONS (120 POINTS): To develop analytical and presentation skills, you will prepare a 15-minute presentation for each module with your group. Presentations should include (1) a concise introduction including background and questions/hypotheses being examined, (2) a brief description of experimental procedure, and (3) discussion of your results; namely, whether they upheld your hypothesis, what you learned, and how your results fit with our other knowledge about the topic. Slides will be created cumulatively with your team during each class meeting, as you analyze/discuss data, share information and ideas with other students in your team. Reports will be presented to professors and instructional assistants the final Friday of each module and will be worth 30 points.

SCIENTIFIC LITERATURE SYNOPSES (40 POINTS): To develop familiarity with reading scientific literature and learn in more detail about course topics, we will read and discuss one paper per module. For the first Friday of each module, you will (1) read the posted paper and write a brief synopsis, and (2) search for a paper related to the module topic to bring to class. Two posted papers will be reviews of the field, whereas two will be research manuscripts. For review papers, please summarize the main premises. For research manuscripts, please summarize (1) the research question, (2) the experimental approach and (3) conclusions. The synopsis should be no more than one page (one clear and detailed paragraph is sufficient). You will discuss both the assigned paper and the one you identified in class with your group, focusing on how they inform the research exercises performed. Although discussion is as a group, each person will post their own synopsis. There will be a total of 4 synopses due, with each worth 10 points.

FINAL PRESENTATION (40 POINTS): To synthesize concepts and approaches learned over the course of the quarter, you will prepare an oral presentation of proposed research for a topic you find interesting in collaboration with fellow students in groups of four. Your topic may be an extension of a study we performed in class, or you may select an entirely different question focused on chemistry-mediated interactions in aquatic organisms, biomedicine, etc. A select library of manuscripts related to potential topics will be posted on Canvas for consideration in designing your proposal. Presentations will be made through Zoom on the final day of class (June 4th) and should be 10 minutes in length, with an additional 5 minutes allocated for questions and discussion. Presentations should include: (1) a brief introduction to the background of the research area you've selected, (2) a clear statement of your research question and hypothesis and (3) an experimental outline of methods you would use to address this question and test your hypothesis. You will be required to prepare and use powerpoint slides in support of your presentation, and all partners are expected to share equally in development and presentation of your proposal. Two weeks prior to your presentation, you will be required to briefly discuss an outline of your research question with the instructors. The final day of class before presentations will be dedicated to helping you finalize your proposal presentation with input from the instructors.

COURSE POLICIES

ATTENDANCE POLICY: For synchronous laboratory sessions, 12:30 – 2:30 PM Wednesday and Friday, ATTENDANCE IS MANDATORY. All lectures will be delivered asynchronously.

POLICY ON LATE ASSIGNMENTS: Assignments are due on the assigned date. Please talk to us if emergency or illness precludes you from submitting on time.

ADD/DROP DEADLINES: Add/Drop deadlines are different for lab courses than lecture courses. Students who drop a Biology lab class after the end of the second scheduled class will be assigned a "W." Additional details: <http://biology.ucsd.edu/go/ug-labs>.

ADMINISTRATIVE QUESTIONS: To drop/add a class or with other similar questions/issues, please go to the Biology Undergraduate Student Affairs Office Website.

UCSD POLICY ON ACADEMIC INTEGRITY: Cheating or academic dishonesty will not be tolerated and all academic work will be completed by the student to whom it is assigned without assistance. As defined by UCSD policy, academic dishonesty includes copying another student's work or allowing another student to copy your work. Any student caught or suspected of cheating will be reported to the UCSD Academic Integrity Coordinator and the Dean of the student's college. Confirmed cases of cheating will result in the student receiving an automatic F as their final grade as well as other disciplinary actions determined appropriate by the Academic Integrity Coordinator.

LETTERS OF RECOMMENDATION: Generally, we will write letters only for students who (a) receive an A in this course and (b) actively participate and engage with us. For a letter of recommendation to be meaningful, we must be able to observe your thought processes, ideas and enthusiasm for learning. Some ways you can demonstrate these qualities are to actively participate in class discussions and ask questions, offer your own ideas and interpretations of your results, and bring interesting papers or facts that are relevant to the material we are studying.

DETAILED COURSE SCHEDULE WITH DUE DATES

Week	Dates	Assignments	Time Due	Points
Week 1	March 31, April 2	Course Introduction	n/a	n/a
Module 1: Salicylates: multifunctional molecules, from plant hormones to blockbuster drugs				Total 110
Week 2	Wednesday, April 7	Lecture 1 Questions	Before Class	5
		Lecture 2 Questions	Before Class	5
		Active Participation	During Class	10
		Module 1 Exercise 1	After Class	10
	Friday, April 9	Active Participation	During Class	10
		Literature Synopsis	After Class	10
Week 3	Wednesday, April 14	Lecture 3 Questions	Before Class	5
		Lecture 4 Questions	Before Class	5
		Active Participation	During Class	10
		Module 1 Exercise 2	After Class	10
	Friday, April 16	Module Presentation	During Class	30
Module 2: Plant natural products: ecological roles and pharmaceutical applications				Total 110
Week 4	Wednesday, April 21	Lecture 5 Questions	Before Class	5
		Lecture 6 Questions	Before Class	5
		Active Participation	During Class	10
		Module 2 Exercise 1	After Class	10
	Friday, April 23	Active Participation	During Class	10
		Literature Synopsis	After Class	10
Week 5	Wednesday, April 28	Lecture 7 Questions	Before Class	5
		Lecture 8 Questions	Before Class	5
		Active Participation	During Class	10
		Module 2 Exercise 2	After Class	10
Friday, April 30	Module Presentation	During Class	30	
Module 3: Microbial natural products: metabolic engineering and next-generation antibiotics				Total 110
Week 6	Wed, May 5	Lecture 9 Questions	Before Class	5
		Lecture 10 Questions	Before Class	5
		Active Participation	During Class	10
		Module 3 Exercise 1	After Class	10
	Friday, May 7	Active Participation	During Class	10
		Literature Synopsis	After Class	10
Week 7	Wed, May 12	Lecture 11 Questions	Before Class	5
		Lecture 12 Questions	Before Class	5
		Active Participation	During Class	10
		Module 3 Exercise 2	After Class	10
Friday, May 14	Module Presentation	During Class	30	
Module 4: Integrating genetics & chemistry: discovery of metabolic markers and biosynthetic pathways				Total 110
Week 8	Wed, May 19	Lecture 13 Questions	Before Class	5
		Lecture 14 Questions	Before Class	5
		Active Participation	During Class	10
		Module 4 Exercise 1	After Class	10
	Friday, May 21	Active Participation	During Class	10
		Literature Synopsis	After Class	10
Week 9	Wed, May 26	Lecture 15 Questions	Before Class	5
		Lecture 16 Questions	Before Class	5
		Active Participation	During Class	10
		Module 4 Exercise 2	After Class	10
Friday, May 28	Module Presentation	During Class	30	
Final Presentations				Total 60
Week 10	Wed, June 2	Active Participation	During Class	10
	Friday, June 4	Active Participation	During Class	10
		Presentations	During Class	40

ADDITIONAL UCSD STUDENT RESOURCES (not specific to this course)

UCSD COVID19-SPECIFIC INFORMATION AND RESOURCES FOR STUDENTS:

STUDENT AFFAIRS COVID19 INFORMATION: A broad website with links to resources for supporting students during these challenging circumstances, including (but not limited to) resources for: Student Retention and Success, Remote Student Employment, Preparing for Remote Learning, Academic Support, Internet and Technology Access, Remote Library Resources, Accommodations for Students with Disabilities, Student Health and Mental Wellness Services, and Information for International Students, <https://vcsa.ucsd.edu/news/covid-19-info.html>

UCSD COVID19 GENERAL INFORMATION: <https://coronavirus.ucsd.edu/>

ASSISTANCE COPING WITH STRESS: If you are experiencing heightened feelings of anxiety, please contact Counseling and Psychological Services (CAPS), <https://wellness.ucsd.edu/CAPS/Pages/default.aspx>. Also see this helpful article from thisweek@ucsandiego with coping strategies and resources available from both UCSD and more generally:

https://ucsdnews.ucsd.edu/feature/coping-with-coronavirus-stress?utm_source=This+Week+Subscriber+List&utm_campaign=c2382a82da-THIS_WEEK_2020_03_26&utm_medium=email&utm_term=0_db568fca07-c2382a82da-92196685

ACADEMIC SUPPORT RESOURCES:

- Teaching and Learning Commons at UCSD: <http://commons.ucsd.edu/students/index.html>
- Supplemental Instruction: Scheduled sessions to support students in classes that many UCSD students find challenging. A list of supported classes and schedules may be found at: <https://commons.ucsd.edu/students/supplemental-instruction/index.html>
- Triton Achievement Partners: Drop-in tutoring for lower division math and chemistry courses. <https://commons.ucsd.edu/students/math-science%20tutoring/index.html#Math-and-Chemistry-Tutoring>
- Writing and Critical Expression Hub: See <http://commons.ucsd.edu/students/writing/index.html>. Writing mentors on staff (including some biology expertise and training in science writing) work with students to improve their writing skills while working on class writing assignments (e.g. lab reports!) and other writing projects. See their drop-in hours, and options for appointments.
- OASIS: Office of Academic Support and Instructional Services also offers tutoring, writing and mentoring support – see <https://students.ucsd.edu/sponsor/oasis/> Each year, OASIS serves 3,000 students in language, math, science, study skills, and writing as well as peer counseling and peer mentoring. Located on the third floor of Center Hall, (858) 534-3760, oasis@ucsd.edu.

HEALTH AND COMMUNITY RESOURCES (IN ALPHABETICAL ORDER):

- Asian Pacific Islander Middle Eastern Desi American (APIMEDA) Programs and Services: APIMEDA Programs and Services encourages community development, enhances coalition building with and within the APIMEDA students, staff and faculty, fosters greater visibility for the diversity within the APIMEDA community, and helps students gain skills for success in their future careers. <https://apimeda.ucsd.edu/index.html>

- Black Resource Center: a campus community center that serves everyone at UC San Diego while emphasizing the Black experience. Promotes scholarship, fosters leadership, and cultivates community through the committed, collaborative effort and support of faculty, staff, and the broader UC San Diego community. <http://brc.ucsd.edu/>
- Counseling and Psychological Services: (CAPS) provides FREE, confidential, psychological counseling and crisis services for registered UCSD students. CAPS also provides a variety of groups, workshops, and drop-in forums. See <http://caps.ucsd.edu/> and/or call (858) 534-3755.
- Cross-Cultural Center: strives for meaningful dialogues and context across all cultures, particularly those of underrepresented or underprivileged backgrounds. Offers supportive and educational services through art, social and educational programs, workshops, and outreach. Welcomes creative venues for enhancing social consciousness and equity. <http://ccc.ucsd.edu/>
- Intertribal Resource Center (ITRC): focused on supporting Native American students and promoting educational access in our tribal communities. <https://itrc.ucsd.edu/index.html>
- LGBT Resource Center: provides a visible presence on campus and enhances a sense of connection and community among LGBT faculty, staff, students, alumni and the UC San Diego Community. <http://lgbt.ucsd.edu/>
- Office for the Prevention of Harassment & Discrimination (OPHD): provides assistance to students with concerns about bias, harassment, and discrimination. UCSD is committed to upholding policies regarding nondiscrimination, sexual violence and sexual harassment. Students have options for reporting incidents of sexual assault, dating violence, domestic violence, stalking and sexual harassment. Information about reporting options may be obtained at OPHD at (858) 534-8298, ophd@ucsd.edu, or <http://ophd.ucsd.edu>. Students may also receive confidential assistance at the Sexual Assault Resource Center at (858) 534-5793, sarc@ucsd.edu or <http://care.ucsd.edu>.
- Office for Students with Disabilities (OSD): works with students who have documented disabilities to provide reasonable accommodations. See <https://disabilities.ucsd.edu/about/index.html> or call 858.534.4382 and/or email osd@ucsd.edu. Students in need of disability accommodations for a UCSD course must provide their instructor with a current Authorization for Accommodation (AFA) letter issued by OSD. If you have an AFA, please arrange to meet privately with us during the first week of the quarter so we can discuss your accommodation. If you have any questions or concerns about a disability, please discuss with us!
- Raza Resource Centro: a lively space where students study, meet, write, get tutoring, and most importantly are in community. It is a space where Latina/Chicano organizations hold meetings, events and where culture, art, and academics interconnect. <http://raza.ucsd.edu/>
- Student Veterans Resource Center (SVRC): supports military-affiliated students in making the transition to campus life and facilitating their progress toward degree completion. The Center also provides opportunities for peer-to-peer support, mentoring and social networking. See <https://students.ucsd.edu/sponsor/veterans/>
- Women's Center: serves as a resource for the entire campus community while placing the experiences of diverse women at the center through resources provided, programming and learning opportunities facilitated, and dynamic community space. <https://women.ucsd.edu/>

There are many other resources available to you on campus. If you want to know more about where you can go for support, please let us know and we'll work together to identify useful resources!