

# SYLLABUS BIBC 151, SPRING 2020

## CHEMISTRY OF BIOLOGICAL INTERACTIONS

**CLASSROOM AND TIME:** All coursework will occur remotely through Canvas and zoom using virtual lectures and meetings, Zoom office hours for all Instructors will be announced shortly

**INSTRUCTORS:** Alisa Huffaker, Eric Schmelz

**INSTRUCTIONAL ASSISTANTS:** Ahmed Khalil, Tobin Groth

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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

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Week	Dates	Topic	Module Due Date	Points
Week 1	April 1 & 3	Course Introduction	n/a	n/a
Week 2	April 8 & 10	Module 1: Salicylates: multifunctional molecules, from plant hormones to blockbuster drugs	Midnight, Sunday 04/19	110
Week 3	April 15 & 17			
Week 4	April 22 & 24	Module 2: Plant natural products: ecological roles and pharmaceutical applications	Midnight, Sunday 05/03	110
Week 5	April 29, May 1			
Week 6	May 6 & 8	Module 3: Microbial natural products: metabolic engineering and next-generation antibiotics	Midnight, Sunday 05/17	110
Week 7	May 13 & 15			
Week 8	May 20 & 22	Module 4: Integrating genetics & chemistry: discovery of metabolic markers, and biosynthetic pathways	Midnight, Sunday 05/31	110
Week 9	May 27 & 29			
Week 10	June 3 & 5	Final Presentations	Presentations on June 5	40

## COURSE INFORMATION SPECIFIC TO SPRING 2020 COVID19 SITUATION

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**LECTURES:** Lectures will be asynchronous, meaning that they are recorded in advance. All lectures will be available as Zoom recordings posted to Canvas. As per UCSD policy for this quarter, prerecording of lectures is to accommodate students that have moved to different time zones or students with family or other responsibilities that do not allow for class attendance at a specific time.

**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. If you are working with a particularly challenging schedule, please contact Dr. Huffaker to make arrangements.

**ZOOM TRAINING:** We will all be using Zoom a lot this quarter. For students that are new to this (like us), and could use assistance understanding how to connect to and use Zoom, here are some helpful sites:  
<https://aah.ucsd.edu/content-tutoring/zoom.html>  
<https://support.zoom.us/hc/en-us/categories/200101697-Getting-Started>

**GRADING:** We understand this is a difficult time and that you may have challenges with accessing the course material, adapting to online-only learning, and completing online assignments. Our goals are to teach you the course material, fairly assess your knowledge of this material, and grade you accordingly, while keeping these challenges in mind. Grading for BIBC 151 for Spring 2020 can be Pass/No Pass. Because we are all learning as we go how to keep thriving during new and challenging circumstances, there is more flexibility this quarter with regard to taking courses and P/NP or S/U. For more information, please see: <https://aps.ucsd.edu/facdev/covid-19/faq.html#Spring-2020-Grading-Policies>

**FACILITATING INTERACTION WITH INSTRUCTORS:** While we're all disappointed not to be able to spend the quarter together at the bench in our lab, we're working very hard with the aim of ensuring you leave the class with the same general knowledge and opportunity for interpersonal interactions. Although lectures will be pre-recorded to accommodate students in different time zones, or managing additional responsibilities, we are still committed to in-person 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 weekly Zoom office hours and through individual Zoom virtual coffee chats with each student. 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!

### 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](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)

## GRADING

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### POSSIBLE EARNED POINTS FOR THE QUARTER:

80 points	Lecture Questions (16)
160 points	Module Exercises (8)
120 points	Module reports (4)
80 points	Literature synopses (4)
40 points	Final Presentation
<b>480 points</b>	<b>Total</b>

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

### GRADING SCALE:

≥ 432 points (90%)	A
≥ 417 points (87%)	A-
≥ 403 points (84%)	B+
≥ 384 points (80%)	B
≥ 369 points (77%)	B-
≥ 355 points (74%)	C+
≥ 336 points (70%)	C
≥ 321 points (67%)	C- (PASS)
≥ 300 points (60%)	D

## ASSESSMENT

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**LECTURE QUESTIONS (80 POINTS):** To reinforce the learning objectives for the day, each lecture will include 3 to 4 short-answer questions that cover the primary concepts covered. You may work collaboratively, but should send individual answers. Answer keys will be posted on TED after class. We will complete 16 problem sets worth 5 points each.

**MODULE EXERCISES (160 POINTS):** Each module will have two scientific exercises to provide knowledge and experience with a variety of topics, including 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 biosynthetic clusters for antibiotic discovery, 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. Each exercise will be guided with instructions, and template files for you to fill out and submit will be provided. You may work collaboratively, but each individual should send their own files. A total of 8 exercises will be worth 20 points each.

**MODULE REPORTS (160 POINTS):** To develop analytical and writing skills, you will write up a brief report for each module (approximately 3 pages), including (1) a brief overview of the question being examined and hypothesis you formulated, (2) a concise description of experimental procedure, and (3) a 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. While discussion and sharing of information and ideas with other students in the class is encouraged, and data to be discussed will reflect the work of others in addition to your own, the reports themselves must be your own work. The course is organized into four learning modules, and you will be responsible for submitting a report for each module. Each report will be worth 30 points.

**SCIENTIFIC LITERATURE SYNOPSES (80 POINTS):** To develop familiarity with reading scientific literature and to learn more detail about course topics, we will read and discuss four papers this quarter. For each paper, you will write a brief synopsis of the paper to hand in in class on the day it is discussed. Two papers we discuss will be reviews of the field, whereas two will be manuscripts describing original work. For review papers, please summarize the main premises laid out by the paper. For original manuscripts, please summarize (1) the research question, (2) the experimental approach and (3) conclusions. The synopsis should be no more than one page (a clear and detailed paragraph is sufficient). To receive credit, all students must bring a print copy of their synopsis to class to hand in for grading at the end the discussion. There will be a total of 4 synopses due, with each worth 20 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 your lab partner. 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 TED for your consideration in designing your proposal. Presentations will be made through Zoom on the final day of class (June 8<sup>th</sup>) 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 both 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**

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**ATTENDANCE POLICY:** None, all lectures will be delivered asynchronously. Live office hours will be offered through Zoom, as will one on one meetings, but these are not mandatory.

**POLICY ON LATE ASSIGNMENTS:** Modules 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.

## **ADDITIONAL UCSD STUDENT RESOURCES (not specific to this course)**

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### **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](mailto:oasis@ucsd.edu).

## HEALTH AND COMMUNITY RESOURCES (IN ALPHABETICAL ORDER):

- 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/>
- 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 violence (e.g. sexual assault, dating violence, domestic violence, and 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](mailto: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!