



USC University of Southern California

MICB560: Recent Advances in Microbiology
Special Topic: Emerging applications of metabolomics
(Literature presentation + Critique)

Credit: 1 unit

Term: Spring 2025

Time: Wednesdays — 12:00 - 12:50pm

Location: MCH 156

Instructor: Hyungjin Eoh DVM, PhD

Office: ZNI 537

Office Hours: Wednesdays 4:00-5:00 pm or by appointment

Contact Info: heoh@usc.edu or 323-442-6048

Course Background

Medicine is evolving quickly, thanks to the rapid advancement of various systems biological technologies at the DNA, RNA, protein, and metabolite levels. In addition to genomics, transcriptomics and proteomics, metabolomics is the newest of the systems-level disciplines. It seeks to reveal the physiological state of a given biological system through the global and unbiased study of its small-molecule metabolites. It represents a powerful approach because metabolites and their concentrations, unlike other “omics” measures, directly reflect the underlying biochemical activity and state of a cell or tissue. Thus, metabolomics best represents the molecular phenotype.

Metabolomics holds great promise for advancing our understanding of the functioning of various biological systems. It affords detailed characterization of metabolic phenotypes and can enable precision medicine at a number of levels, including the characterization of metabolic derangements that underlie disease, discovery of new therapeutic targets, and discovery of biomarkers that may be used to either diagnose disease or monitor activity of therapeutics.

For students in the biomedical sciences, it is imperative to become familiar with key concepts and applications of metabolomics. It will serve them in all areas of contemporary biomedical and clinical research settings and will provide them with a competitive edge.

Course Description

The main purpose of this course is to expose students to the diversity of research topics associated with metabolomics. This will be achieved through a “journal club” style course format, where students learn how to read, interpret, present and critically evaluate the relevant literature in this field.

After an introductory lecture by the course director, the subsequent sessions will be led by individual students, who will present recently published primary research articles for evaluation and discussion by the class. Depending upon the class size, students will have 2–3 opportunities to select and present articles.

Relevant topics are categorized in the following areas:

1. Advances of mass spectrometry in metabolomics research
2. Identification of diagnostic biomarkers of diseases
3. Elucidation of the pathological mechanisms of diseases
4. Discovery of novel drug targets
5. Prediction of drug responses
6. Interpretation of mechanistic bases of drug action
7. Precision treatment of patients
8. Drug development using synthetic biology

This course is strongly recommended to all MMI master’s students and is open to all graduate students on campus.

Learning Objectives

By the end of this course, students will be able to:

- critically evaluate the scientific literature in the field of metabolomics;
- describe how metabolomics can help to identify pathophysiology and drug development for various infectious diseases, cancer, and neurodegenerative diseases;
- present succinct summaries of the scientific literature;
- critically discuss the scientific literature;
- write a critical evaluation of a published scientific paper.

Course Materials

During the first class session, each student will be assigned a presentation topic. Readings will be selected each week by the student presenter with the guidance of the instructor. All course materials will be posted on Brightspace. Students are responsible to regularly (at the minimum: once per week) check Brightspace for updates.

Prerequisites

None. If possible, students will bring their own laptop computers.

Student Presentations and Activities

Metabolomics topics include, but are not limited to: infectious agents, cancer, neurodegenerative diseases, environmental hazards, toxicology, aquatic pathogens, airborne pathogens, vaccines, agricultural exposures, and global health.

Tasks expected of student presenters:

- Ten days before the scheduled presentation date, the presenting student sends a proposed article in pdf format to the course instructor for approval (except for the very first presenting student). The first presenting student will be decided in the first class and the article will be decided by the course instructor. Upon approval of the article, the instructor will distribute it to the class (via BrightSpace).
- Presentation day: The student presents a primary research article and leads the discussion regarding the article as follows:
 - 1) PowerPoint summary of scientific background (5 mins)
 - 2) PowerPoint summary of the scientific paper (20-30 mins)
 - 3) Discussion with specific questions (10-15 mins)

Non-presenting students will select 1 topic among the topics described in the course schedule, prepare a 1-page review form (see last page of this document), and turn it in at the beginning of class. The next presenter prepares a 1-page review form for this week's topic and turns it in the class.

Should a student miss class, the instructor will ask the student to present a 2-page, double-spaced review of the paper/manuscript in the following format:

- 1) Manuscript summary (1 page)
- 2) Major criticism (1/2 page)
- 3) Minor criticism (1/2 page)

Course Requirements/Evaluation/Grading

When students present more than 1 time, their presentation scores will be averaged. Students will be evaluated by an average numeric grade of their understanding of the topic/publication, oral presentation, use of visual aids (PowerPoint summary slides), and discussion leadership (40%); an average numeric score of their weekly submitted written critiques (40%); and their class participation (20%).

Students who do their readings in advance of class, participate in discussions, and attend every session will earn an A for the class participation portion of the overall grade.

Grading Breakdown

Assignment	% of Grade
In-Class Participation	20
Presentation	40
Critiques	40
Total	100

Late Policy

Late assignments will have a 5% deduction for each day late, unless other arrangements have been made ahead of the due date with the instructor.

Attendance

Students are expected to complete all reading and writing assignments and to come to class prepared for discussion and debate. Attendance is required.

Students who anticipate they will miss a class must contact the instructor before class; students who have an emergency absence must contact the instructor as soon as possible. Two unapproved absences will result in a grade decrease, and more than two unapproved absences may result in a final grade of C, D, or F.

Course Correspondence

All correspondence between instructor and students will be made using email. All materials will be posted on Brightspace. The Brightspace web site may be entered at <https://brightspace.usc.edu/d2l/home>. The lecturer will make every effort to upload the lecture slides to Brightspace prior to class. Only students who are registered for the course will have access to Brightspace. If you cannot access the web site, contact the course director right away.

Course evaluation

Student feedback is welcome. Students will have an opportunity to submit comments on the mid-term evaluation and the standard USC course evaluation survey at the end of the semester.

Course policies

As per USC policies, recordings of lecture material require the express permission of the instructor and announcement to the entire class, and can only be used for individual or group study.

(see next page for Course Schedule)

Course Schedule (Spring 2025)

Week 1	Jan. 15	Introduction: How to read a paper and prepare it for presentation
Week 2	Jan. 22	Metabolomics: definition and significance in Systems Biology
Week 3	Jan. 29	Advances of mass spectrometry
Week 4	Feb. 05	Pathological mechanisms of diseases I
Week 5	Feb. 12	Pathological mechanisms of diseases II
Week 6	Feb. 19	Pathological mechanisms of diseases III
Week 7	Feb. 26	Diagnostic biomarker elucidation I
Week 8	Mar. 05	Diagnostic biomarker elucidation II- by Dr. Weiming Yuan
Week 9	Mar. 12	Discovery of novel drug targets I
—	Mar. 19	No class: Spring Recess
Week 10	Mar. 26	Discovery of novel drug targets II – by Dr. Brian Luna
Week 11	Apr. 02	Mechanistic bases of drug action and drug responses I
Week 12	Apr. 09	Mechanistic bases of drug action and drug responses II – by Dr. Peter Mullen
Week 13	Apr. 16	Precision treatment of patients I
Week 14	Apr. 23	Precision treatment of patients II
Week 15	Apr. 30	Synthetic biology using metabolomics I
Week 16	May 07	Synthetic biology using metabolomics II

SUPPORT FOR STUDENT NEEDS AND WELL-BEING

Special Needs

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to the Course Director as early in the semester as possible. DSP is located in GFS-120 (University Park Campus) and is open 8:30 a.m. – 4:30 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776. Their website is <http://dsp.usc.edu>.

Stress Management

Students are under a lot of pressure. If you start to feel overwhelmed, it is important that you reach out for help. A good place to start is the Eric Cohen Student Health Center on this campus (the Health Sciences Campus, HSC). The phone number is (323) 442-5631 and the website is <http://ecohenshc.usc.edu>. The service is confidential, and there is no charge.

Student Counseling Services

(213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

<https://engemannshc.usc.edu/counseling/>

National Suicide Prevention Lifeline

Tel: 1-800-273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. <http://www.suicidepreventionlifeline.org/>

Beyond Academic Challenges

Balancing course work, midterms, finals, and laboratory research presents a challenge and at times can feel overwhelming. On top of that, many students are far away from home and family, perhaps even their country and their native language, which can feel quite depressing. Sometimes, relationship problems come up and make life miserable. But no matter the problem, USC offers resources to help students deal with depression, anxiety, and other types of distress. USC's services are not only geared toward helping students with academic challenges, but also with personal problems. Students in need should not hesitate to take advantage of the services that are listed above (and on the next page); there is no need to feel embarrassed or ashamed. USC is offering these services and resources so that students are in the best position to meet their academic and personal goals.

ACADEMIC STANDARDS, CONDUCT, AND ACADEMIC SUPPORT

Academic Integrity Standards

The University prides itself in maintaining high academic integrity standards. The entire academic community benefits from the adherence to such standards. An academic integrity overview, including descriptions of dishonest acts and consequences for students found responsible, is available online at: <https://sjacs.usc.edu/students/academic-integrity/>.

Further information, including a number of tutorials for students, can be found online at: <https://libraries.usc.edu/research/reference-tutorials>. This website has tutorials such as: how to avoid plagiarism, how to prevent academic dishonesty, how to manage your research, and other useful how-to tools and tutorials.

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in Section 11 of the *SCampus* publication (online at: <https://policy.usc.edu/student/scampus>). Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, Harassment, Assault

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu/> or to the *Department of Public Safety* <http://dps.usc.edu/>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Relationship and Sexual Violence Prevention (RSVP) Services at <https://engemannshc.usc.edu/rsvp/> provide 24/7 confidential support, and the Sexual Assault Resource Center webpage <https://sarc.usc.edu/> describes reporting options and other resources.

Other Support Systems

A number of USC schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of Brightspace, teleconferencing, and other technology.

Journal Club Article Critique Form MICB-560

→ Use font size Arial 11 for all text

Student's Name:

Date:

Article/manuscript (Title, Journal name, year, issue, page, and first author)

1) Rationale for the study (1 – 2 sentences):

2) Hypothesis (1 sentence):

3) Study design:

4) Conclusion (2 – 4 sentences):

5) Strengths (2 – 4 sentences):

6) Weakness (2 – 4 sentences):

7) Other comments: