

Biomedical Research Capstone



MEDS5030/5031 Biomedical Research Capstone

2025–26 Syllabus

This two-semester sequence provides students in the Medical Sciences major with a rigorous senior-year capstone experience in original biomedical research. The course is designed to give a highly personalized laboratory research experience to students who are interested in careers in biomedical research, medicine, and other health professions by matching them with some of the best and most accomplished scientists in the College of Medicine and Cincinnati Children's Hospital Medical Center. Students gain a critical appreciation of the research process from inception to completion and communication of the study.

Biomedical Research Capstone 1

At the start of the semester, students work closely with their faculty research mentor to identify a scientific question or clinical problem, research the literature, and articulate the impetus for the study. The student then develops a hypothesis and research plan. The student receives required laboratory safety and compliance training, and training or refreshing in the laboratory techniques needed for the project. In the first semester, emphasis is placed on study design, training, troubleshooting in the laboratory, and the collection, recording, and analysis of data.

The student's efforts in the library and the laboratory are complemented by programmatic elements throughout the semester. Class meetings comprise student presentations (research proposals), and workshops on varied topics including research funding (e.g. funding agencies, and the essential elements of grant and fellowship applications), bibliographical software, and the responsible conduct of research (e.g. image manipulation).

MEDS5030 Upon completion, the student will be able to do the following:

Course Objectives

1. Study the literature, identify a scientific question or clinical problem, and articulate the impetus for the study
2. Formulate a hypothesis
3. Analyze the literature to determine the best approaches to testing the hypothesis
4. Develop a detailed research plan that includes experimental design and plans for statistical analyses
5. Write a research proposal
6. Collect, analyze, and interpret experimental data accurately
7. Communicate the study objectives and work in progress in oral presentations

Prerequisites In order to enroll in MEDS5030, the student must have Senior class standing, be majoring in Medical Sciences, and have earned C or better in MEDS3023C Statistics & Experimental Design for the Biomedical Sciences.

Biomedical Research Capstone 2

The student will normally have been placed with a faculty research mentor in the first semester and given responsibility for a project that they will continue into the second semester. In the second semester, emphasis is placed on the collection and analysis of data; troubleshooting and, if necessary, redesign of the study or revision of the objectives; interpretation of the study findings; and communication of the study results in written and oral reports. Whereas no research study is guaranteed success, the expectation is that the student's final written report will be of such a quality that it can serve as a draft of a modest manuscript for which the student will be first author or that it can contribute to a larger study that may be submitted for publication in a biomedical or clinical journal with the student as a co-author.

The student's efforts in the library and the laboratory are complemented by programmatic elements throughout the semester. Class meetings comprise student presentations (work in progress), and workshops on varied topics such as responsible conduct of research (e.g. authorship, plagiarism), scientific writing, publication and the peer-review process, and the effective presentation of scientific data in reports, manuscripts, and poster or oral presentations.

MEDS5031 Upon completion, the student will be able to do the following:

Course Objectives

1. Collect, analyze, and interpret experimental data accurately
2. Troubleshoot technical issues in experimentation and weaknesses in the experimental design, redefining the study objectives or research plan if necessary
3. Communicate findings in work-in-progress oral presentations
4. Write a final written report, carefully reporting the results and outcomes of the study
5. Present the results and outcomes in a capstone poster presentation

Prerequisites In order to enroll in MEDS5031, the student must have earned C or better in MEDS5030 Biomedical Research Capstone 1.

Course Director Bryan Mackenzie, PhD (Email: bryan.mackenzie@uc.edu)
Tel: (513)558-3627 | Office: MSB 4257A | Office hours: By appointment

Registration	Course #	Section	Class Number	Credit Hours ^a	Class Schedule	Location
	MEDS5030 Fall 2025	001	19645	3–6	M 4:00 – 4:55 pm and flexibly scheduled lab time	Uptown Campus East (Medical) MSB 4051
	MEDS5031 Spring 2026	001	—	3–6	M 4:00 – 4:55 pm and flexibly scheduled lab time	Uptown Campus East (Medical) MSB 4051

Course Delivery and Attendance The course will be delivered via a hybrid in-person and online approach. In-person attendance is required in the lab (by arrangement with the faculty research mentor). Some lab tasks may be performed remotely (e.g. data analysis, computational research approaches). Attendance is required at course events. **^aYou are expected to work in the lab (or remotely on lab tasks, e.g. data analysis) 4 hours per week per credit hour enrolled.** (Your mentor may assign reading that you may be expected to complete outside of lab time.)

Canvas & Email Policy Announcements and messages sent via Canvas or via UC email will be considered sufficient notice. It is your responsibility to check notification settings in your Canvas account to ensure that announcements are forwarded to your email address. You should not communicate with instructors from a non-UC email account—any such communication will be ignored.

Textbook There is no required textbook for this course. The laboratory faculty mentor may recommend that the student refer to a textbook as appropriate; however, the student will primarily refer to the primary literature. The student is expected to search and read relevant published journal articles relating to the topic of the student's project.

Auditing No auditing option

Assessment and Grading Assessment is based on participation in laboratory research, attendance at required class sessions, and completion of the required assignments. At the end of the semester, the faculty research mentor will provide a written assessment of the student's aptitude and progress—both experimental and intellectual—in the laboratory and will recommend to the Course Director a letter grade. The Course Director will consider the faculty mentor's recommendation together with the student's performance in required components and assign a final grade.

The following grades will be awarded to students on the completion of each course (MEDS5030 and MEDS5031) independently:

Outstanding	A	Good	B	Satisfactory	C	Poor, but passing, quality	D
Excellent	A–		B–		C–	Minimum passing quality	D–
	B+		C+		D+	Fail (with full attendance)	F

A grade of **SP** (In Progress—Satisfactory Progress) will be assigned to any student who has made satisfactory progress but who has been unable to complete one or more required components (e.g. oral presentation of project) due to illness or excused absence. An excused absence is an absence for a legitimate reason (e.g. attendance at a research conference, schedule conflict with an exam) that has been communicated to, and approved by, the Course Director in advance of the absence.

A grade of **SP** must be remediated by completing the required component(s) in a subsequent semester or by otherwise making arrangements with the Course Director to complete an equivalent exercise, after which the Course Director will assign a final grade. A grade of **SP** that has not been remediated within one year will convert automatically to an **I/F** (Incomplete/Fail) grade (which carries 0.00 quality points).

Compliance/ Safety Training Safety in the laboratory is of paramount importance. Prior to starting work in the laboratory, all students must complete EH&S training online by visiting <http://ehs.uc.edu/itc/compliance.asp>. If this is your first time, you must complete all of the following training modules:

1. Lab Safety Orientation (<https://ehs.uc.edu/webtrain/login.asp?shell=orientation>)
2. Hazard Communication (<https://ehs.uc.edu/webtrain/login.asp?shell=compliance>)
3. Bloodborne Pathogens (<https://ehs.uc.edu/webtrain/login.asp?shell=compliance>)
4. Hazardous Waste (<https://ehs.uc.edu/webtrain/login.asp?shell=compliance>)
5. Visit Advanced Laboratory Safety Training (<https://ehs.uc.edu/itc/labsafety.aspx>) and complete any modules relevant to your work, e.g. if you run DNA/RNA gels with ethidium bromide, complete the Ethidium Bromide module.

If you are a returning student, check your transcript at <http://ehs.uc.edu/itc/transcript.asp> to ensure that you are up to date with your safety training. A refresher for modules 2–4 above must be completed annually by the date indicated.

Depending on the specific project you will undertake, you may be required to complete additional compliance/safety training, e.g. radiation safety, IACUC (animals) orientation and species-specific training, HIPAA. Discuss with your faculty research mentor what additional training you will need.

Emergency Closing Policy When the university announces a campus closure such as due to weather emergency, undergraduate and graduate classes at the college of medicine will be canceled. Undergraduate students enrolled in MEDS5030/5031 should not attend their lab during a campus closure, or should leave the lab by the time the university is to close as indicated in the announcement. If the student has been given responsibility for certain critical tasks that must be done during a campus closure (e.g. animal care), the student should notify their faculty research mentor or lab mentor (via email or otherwise) so that such tasks can be reassigned.

Academic Integrity Policy	The University Rules, including the Student Code of Conduct, and other documented policies of the department, college, and university related to academic integrity will be enforced. Any violation of these regulations, including acts of plagiarism or cheating, will be dealt with on an individual basis according to the severity of the misconduct.
Artificial Intelligence Policy	The use of generative artificial intelligence (AI) tools or AI-assisted tools in study design, generation of the conclusions, preparation of figures, or in any written work is expressly prohibited. All written work submitted must be primarily authored by the student. Your faculty research mentor and colleagues in the lab may provide limited portions (e.g. standard methods in the lab) and offer suggestions for edits. The use of AI-assisted tools in the research study (e.g. collection of data) may be considered permissible and only when the student and research mentor contact the course director to describe the type of use and obtain prior permission. The use of AI-assisted tools in this manner must be described in the Methods. The AI policy excludes tools that are used solely to improve grammar or spelling (e.g. Grammarly, Wordtune) or reference managers (e.g. EndNote, RefWorks), the use of which is always permissible.
Special Needs Policy	If you have any special needs related to your participation in this course, including identified visual impairment, hearing impairment, physical impairment, communication disorder, and/or specific learning disability that may influence your performance in this course, you should meet with the instructor to arrange for reasonable provisions to ensure an equitable opportunity to meet all the requirements of this course. At the discretion of the instructor, some accommodations may require prior approval by Disability Services.
Student Religious Accommodations	Ohio law and the university's Student Religious Accommodations for Courses Policy 1.3.7 permits a student, upon request, to be absent for reasons of faith or religious or spiritual belief system or to participate in organized activities conducted under the auspices of a religious denomination, church, or other religious or spiritual organization and/or to receive alternative accommodations with regard to examinations and other course requirements due to an absence permitted for the reasons described above. Not later than fourteen days after the first day of instruction in the course, the student should provide the course director with written or email notice of the specific dates for which the student requests alternative accommodations. For additional information about this policy, please contact the Executive Director of the Office of Equal Opportunity and Access at (513) 556-5503 or oeohelp@ucmail.uc.edu .
Counseling Services	Students have access to counseling and mental health care through the University Health Services (UHS), which can provide both psychotherapy and psychiatric services. In addition, Counseling and Psychological Services (CAPS) can provide professional counseling upon request; students may receive five free counseling sessions through CAPS without insurance. Students are encouraged to seek assistance for anxiety, depression, trauma/assault, adjustment to college life, interpersonal or relational difficulty, sexuality, family conflict, grief and loss, disordered eating and body image, alcohol and substance abuse, anger management, identity development and issues related to diversity, concerns associated with sexual orientation and spirituality concerns, as well as any other issue of concerns. After hours, students may call UHS at (513) 556 2564 or CAPS Cares at (513) 556 0648. For urgent physician consultation after hours, students may call (513) 584 7777.
Title IX	Title IX is a federal civil rights law that prohibits discrimination on the basis of your actual or perceived sex, gender, gender identity, gender expression, or sexual orientation. Title IX also covers sexual violence, dating or domestic violence, and stalking. If you disclose a Title IX issue to me, the course director, I am required to forward that information to the Title IX Office. They will follow up with you about how the University can take steps to address the impact on you and the community and make you aware of your rights and resources. Their priority is to make sure you are safe and successful here. You are not required to talk with the Title IX Office. If you would like to make a report of sex or gender-based discrimination, harassment or violence, or if you would like to know more about your rights and resources on campus, you can consult the website www.uc.edu/titleix or contact the office at (513) 556 3349.

Biomedical Research Capstone 1 | Fall Semester 2025 Schedule

Fall	Date	Topic/Event	Location	Time
Week 1	August 25, 2025	Orientation Start group assignment	MSB 4051	4:00 pm
Week 2	September 1	Class does not meet today (Labor Day Holiday)		
Week 3	September 8	ORCID and PubMed	MSB 4051	4:00 pm
Week 4	September 15	EndNote (Citation and Reference Manager)	MSB 4051	4:00 pm
Week 5	September 22	Hypothesis Development	MSB 4051	4:00 pm
Week 6	September 29	How is Research Funded?	MSB 4051	4:00 pm
Week 7	October 6	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 8	October 13	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 9	October 20	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 10	October 27	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 11	November 3	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 12	November 10	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 13	November 17	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 14	November 24	Goals & Approaches Presentations	MSB 4051	4:00 pm
Week 15	December 1	Responsible Conduct of Research—Image Manipulation	MSB 4051	4:00 pm
Week 16	December 8	Class does not meet today (Exam week)		

Note: Class does not meet each week; however, you must keep each weekly meeting time (Mondays 4:00 – 4:55 pm) free unless noted “Class does not meet today” as the schedule may change to better accommodate the schedules of invited speakers, faculty, and students, and to make up for snow days etc.

Biomedical Research Capstone 2 | Spring Semester 2026 Schedule

Spring	Date	Topic/Event	Location	Time
Week 1	January 12, 2026	Class does not meet today		
Week 2	January 19	Class does not meet today (Dr Martin Luther King Jr Birthday Holiday)		
Week 3	January 26	Class does not meet today		
Week 4	February 2	Responsible Conduct of Research— Authorship	MSB 2351	4:00 pm
Week 5	February 9	Scientific Writing	MSB 2351	4:00 pm
Week 6	February 16	Work-in-Progress Presentations	MSB 2351	4:00 pm
Week 7	February 23	Work-in-Progress Presentations	MSB 2351	4:00 pm
Week 8	March 2	Work-in-Progress Presentations	MSB 2351	4:00 pm
Week 9	March 9	Work-in-Progress Presentations	MSB 2351	4:00 pm
Week 10	March 16	Spring Break		
Week 11	March 23	Work-in-Progress Presentations	MSB 2351	4:00 pm
Week 12	March 30	Work-in-Progress Presentations	MSB 2351	4:00 pm
Week 13	April 6	Work-in-Progress Presentations	MSB 2351	4:00 pm
Week 14	April 13	Publishing and the Review Process	MSB 2351	4:00 pm
Week 15	April 20	Class does not meet today		
	April 22	Medical Sciences Poster Fair	CARE/Crawley Atrium	2:00 – 5:00 pm
Week 16	April 27	Class does not meet today (Exam week)		

Note: Class does not meet each week; however, you must keep each weekly meeting time (Mondays 4:00 – 4:55 pm) free unless noted “Class does not meet today” as the schedule may change to better accommodate the schedules of invited speakers, faculty, and students and to make up for snow days etc.

Biomedical Research Capstone | Learning Modules

Fall 2025		Spring 2026	
Module 1	Laboratory Safety/Compliance Training	Module 1	Personal Goals
Module 2	Personal Goals	Module 2	Progress Report <i>Due January 30</i>
Module 3	ORCID Record PubMed Literature Search	Module 3	Responsible Conduct of Research— Authorship
Module 4	EndNote (Citation and Reference Manager)	Module 4	Scientific Writing
Module 5	Hypothesis Development	Module 5	Work-in-Progress Presentation <i>Mondays beginning February 16</i>
Module 6	Written Research Proposal <i>Due September 26</i>	Module 6	Publication and the Peer-Review Process
Module 7	How is Research Funded?	Module 7	Written Report <i>Due April 17</i>
Module 8	Goals & Approaches Oral Presentation <i>Mondays beginning October 6</i>		
Module 9	Post-Review Revised Research Proposal <i>Due October 30</i>	Module 8	Poster Presentation 6th Annual Medical Sciences Poster Fair <i>Wednesday, April 22, 2026</i>
Module 10	Responsible Conduct of Research—Image Manipulation	Module 9	Peer Review
Module 11	Reflection on Personal Goals	Module 10	Post-Review Revised Written Report <i>Due April 27</i>