



program in  
**chemical biology**

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UNIVERSITY OF MICHIGAN

# MS Student Handbook

Fall 2016 Edition

[www.chembio.umich.edu](http://www.chembio.umich.edu)

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## **ABOUT THE PROGRAM**

One of the most exciting developments of modern biology is our growing ability to study the molecular details of biological macromolecules using techniques developed by chemists, biochemists and structural biologists. These molecular details provide fundamental insights into the functional properties of biological molecules and suggest routes by which they can be manipulated. The discipline of chemical biology is premised on the view that understanding the molecular mechanisms of biological processes provides an opportunity to manipulate them in a defined and predictable fashion.

At virtually every major university in the United States, research in chemical biology is dispersed among several departments (e.g., biology, chemistry and biochemistry) and schools (e.g., literature & science colleges and medical schools). This dispersion often results in graduate training that is fragmented or inadequate. In addition, no single department or graduate program by itself has large numbers of faculty working in chemical biology. Therefore, choices for thesis research in any given department or program can be limited.

The University of Michigan is a recognized leader in the application of chemical approaches to biological problems and has been for many years. To better serve the needs of today's students, the Chemical Biology Program was developed.

Starting in 2012, Chemical Biology began offering a one-year didactic Master of Science in Cancer Chemical Biology degree program. A unique feature of the program is the offering of a coursework sequence tailored to a student's past experience and future goals. Additionally, the program includes one-on-one mentoring to assist students in transitioning to post-graduate employment, or long-term educational goals, such as medical school, pharmacy school, or graduate school.

## **MASTER DEGREE PROGRAM**

This section provides information on the requirements for the degree of Masters of Science in Cancer Chemical Biology. The requirements stated here include those set by the Program and those set by the Rackham School of Graduate Studies. Students are also encouraged to consult the Rackham Graduate Student Handbook (<http://www.rackham.umich.edu/currentstudents/policies/academic-policies>).

Program requirements for the M.S. degree are administered by the Operating Committee, which consists of the Program Director, Associate Director and several Program faculty. The Program Director, in consultation with this Committee, has the authority to set and interpret rules and requirements and, when circumstances warrant, grant exceptions upon formal appeal. Throughout the tenure of the Program, students are encouraged and welcomed to consult with the Program Director, Operating Committee and Dissertation Committee for additional advice and guidance. If questions, concerns or conflict arise at any point in the Program, students should contact the Program Director or their designate.

Course elections for each term must be approved either by the Operating Committee or the Program Director. Each student's status is reviewed by the Operating Committee after each term and an appropriate report is provided to the student when needed. NOTE: Failure to follow the

approved registration can jeopardize a student's standing in the M.S. program. Students should not make unapproved changes to their schedules.

### **Academic Schedule – <http://www.ro.umich.edu/calendar/>**

The academic year at the University of Michigan consists of three full terms: Fall, Winter and Spring/Summer. The Fall term begins in September and ends in December; the Winter term runs from January through April. Each Fall and Winter semester has a mid-term break in which classes do not meet and a final exam period at the end of the term. The Spring/Summer term spans May through August. Two short terms, Spring and Summer, run concurrently with the Spring/Summer term. Spring classes meet May through June and Summer term courses meet July through August. Most didactic courses of interest to graduate students are offered only in the Fall and Winter terms.

Class periods begin ten minutes after the hour (or half-hour), although classes are listed as beginning on the hour or half-hour. Note: The words “semester” and “term” possess identical meanings at UM and are used interchangeably.

### **Requirements for the M.S. Degree**

A student is expected to remain in good standing during his/her term of study by complying with the rules, regulations, and requirements set forth by the Rackham Graduate School and the Program in Chemical Biology.

### **Graduate School Requirements**

The basic requirements for the degree of Master of Science set by the Graduate School and the Program include:

- Minimum residence and fee requirements.
- A “B” (3.0 on a 4.0 scale) average for all courses in the graduate student's record.
- At least 24 credit hours of graduate coursework registered as a Rackham student while in residence on the Ann Arbor campus.

### **Credits and Rackham Requirements**

Students enrolled in the full-time Chemical Biology course of study must register for consecutive Fall and Winter terms to complete 24 credits and all degree requirements within one year. A student is considered full-time with registration of eight credit hours per term, however it is important to keep in mind that 24 credits hours over one year is still the requirement.

### **Course Requirements**

The Program is concerned that the student has an adequate undergraduate background in chemistry, biology and mathematics and that the Program’s core courses adequately prepare students to branch into more specialized fields in chemical biology.

During their studies, students complete four core courses in Chemical Biology: CHEMBIO 501, 601, 502 and 602. Additionally, students are required to complete PIBS 503 (research responsibility and ethics). Students will also be required to complete other graduate level elective courses (minimum of 2 credits) to meet the minimum 24 credits for graduation.

Courses taken in fulfillment of Rackham degree requirements must be approved for Rackham graduate credit. Courses at the 300 level or below may not be used for graduate credit. Courses at the 400 level are open to both undergraduates and graduate students but must be approved by the Registrar to carry graduate credit. 400-level courses usually require additional work for graduate students. Approved courses are listed by graduate program in Rackham's Programs of Study section.

Courses not approved for Rackham graduate credit appear on the transcript with the notation NFC or NDC. The course grade will appear but will not be averaged into the cumulative grade point average or the total credits required for the program (CTP) total.

Students should periodically discuss their academic progress with their advisors to learn whether they are performing satisfactorily and making sufficient progress toward the degree. A student whose cumulative GPA falls below a "B" (3.0 on a 4.0 scale) in a given term or half term will be placed on academic probation for the following term or half term of enrollment. A student may be given an opportunity to correct the scholastic and/or academic deficiency under the supervision of the Director.

### **Applying for Graduation and Deadlines**

To receive your master's degree or certificate, you must apply for graduation through Wolverine Access. Please see the Rackham Website, <http://www.rackham.umich.edu/current-students/graduation/masters-degree-diploma-application-deadlines>, for master's deadlines.

Students who have applied for degree by the master's deadline will have their names printed in the commencement program. Applications for graduation will be accepted until the last day of classes of the term in which you wish to receive your degree/diploma; however, your name will not appear in the commencement program. It is your responsibility to see that all requirements are met and recorded by the last day of classes in the term you have applied for degree/diploma.

### **Chronology of the M.S. Degree**

This section displays the typical academic progression through the M.S. degree. Students are expected to complete the Program within 1 year, with a minimum of 24 credits.

#### **Fall Term (September - December)**

- CHEMBIO 501 (macromolecular structure and function; 3 credits)
- CHEMBIO 601 002 (critical analysis of the current literature, 2 credits)
- PIBS 503 (research responsibilities and ethics, 1 credit)
- Up to 8 credits of elective course(s) in biology, chemistry, biological chemistry, medicinal chemistry, biophysics or other course in consultation with the Program advisor (2-4 credits each)

Winter Term (January - April)

- CHEMBIO 502 (protein translation, signal transduction and combinatorial methods, 3 credits)
- CHEMBIO 602 002 (critical analysis of the current literature, 2 credits)
- Up to 8 credits of elective course(s) in biology, chemistry, biological chemistry, medicinal chemistry, biophysics or other course in consultation with the Program advisor (2-4 credits each)

### **Chemical Biology Course Descriptions**

CHEMBIO 501 - Chemical Biology I. This course will provide a high-level overview on the structure, function and chemistry of biological macromolecules including proteins, nucleic acids and carbohydrates. Topics include protein and nucleic acid folding, energetics of macromolecular interactions (kinetics and thermodynamics) and mechanistic enzymology. Using specific examples from the current literature, each topic will stress how chemists have used molecular level tools and probes to help understand the specific systems under study. The overarching theme in this course will be that structure and function are intimately linked. Offered in Fall; 3 credits.

CHEMBIO 502 - Chemical Biology II. This course is a continuation of ChemBio 501. The basic concepts obtained in ChemBio 501 will be applied to and demonstrated in three broad areas of interest to both chemists and biologists. The first topic will discuss combinatorial methods including SELEX and gene shuffling, combinatorial organic synthesis, high throughput screening and chemical genetics. The second topic will focus on signal transduction, emphasizing general concepts (at the molecular level) and how small molecules have been used to probe and modulate signal transduction pathways. The final topic will cover protein translation, stressing mechanistic aspects of protein synthesis and folding in vivo. Offered in Winter; 3 credits.

CHEMBIO 599 - Chemical Biology Research Rotation. This course consists of practical hands-on experience in a faculty member's lab. Students receive training in research methods and techniques necessary for the successful conduct of dissertation research. This course is available to M.S. Chemical Biology students only after consultation with the Program Director and proposed research advisor. Offered each term; 2-4 credits.

CHEMBIO 601 - Critical Analysis in Chemical Biology I. In this course, students will read and dissect papers from the current literature. The specific papers will be selected by the instructor; however, the topics to be emphasized in the papers will loosely parallel and complement the topics covered in ChemBio 501. This course is available to Chemical Biology students only. Please note that M.S. Chemical Biology students are required to take the 2 credit hour section of this class (002), which has an increased focus on cancer biology. Offered in Fall; Section 002 should be selected for MS students; 2 credits.

CHEMBIO 602 - Critical Analysis in Chemical Biology II. In this course, students will read and dissect papers from the current literature. The specific papers will be selected by the instructor; however, the topics to be emphasized in the papers will loosely parallel and complement the topics covered in ChemBio 502. This course is available to Chemical Biology students only. Offered in Winter; Section 002 should be selected for MS students; 2 credits.

## **Elective Courses**

The following is a list of potential elective courses; however, this list is meant to serve only as a guide; these courses may or may not be available in a given term. Please consult the time schedule of classes on Wolverine Access (<http://wolverineaccess.umich.edu>) for current availability.

### Bioinformatics

- 527 Introduction to Bioinformatics & Computational Biology
- 545 Data Analysis in Molecular Biology
- 551 Proteome Informatics

### Biological Chemistry

- 530 Structural Biology in Solutions: Structure, Dynamics, and Interaction
- 640 Post-transcriptional Gene Regulation
- 650 Mechanism of Eukaryotic Gene Expression
- 673 Kinetics & Mechanism of Enzymes

### Biophysics

- 520 Biophysical Chemistry I
- 521 Biophysical Chemistry II

### Biostatistics

- 646 Data Analysis in Molecular Biology

### Cancer Biology

- 553 Cancer Biology

### Cell and Developmental Biology

- 530 Cell Biology
- 580 Developmental Biology

### Chemistry

- 507 Inorganic Chemistry
- 515 Organometallic Chemistry
- 540 Organic Principles
- 541 Advanced Organic Chemistry
- 542 Applications of Physical Methods to Organic Chemistry
- 538 Organic Chemistry of Macromolecules
- 543 Organic Mechanisms
- 616 Advanced Inorganic Chemistry
- 673 Kinetics & Mechanism of Enzymes

### Environmental Health Sciences

- 612 Biochemical and Molecular Toxicology

### Epidemiology

- 560 Mechanisms of Bacterial Pathogenesis

### Human Genetics

541 Gene Structure & Regulation

### Medicinal Chemistry

532 Bioorganic Principles of Medicinal Chemistry

### Microbiology and Immunology

615 Molecular and Cellular Determinants of Viral Pathogenesis I

640 Molecular and Cellular Immunology I

### Molecular, Cellular, and Developmental Biology

680 Organogenesis of Complex Tissues

### Neuroscience

601 Principles of Neuroscience I

### Pathology

643 Immunopathologic Mechanism of Disease

### Pharmaceutical Science

734 Pharmacogenomics and Drug Discovery

### Pharmacology

601 Basic Quantitative Principles of Pharmacology

611 Principles of Pharmacology

612 Seminar in Antimicrobial and Cancer Pharmacology

615 Molecular Neuropharmacology

616 Seminar in Cardiovascular Pharmacology

619 Structural Basis for Drug Action

621 Translational Pharmacology

759 Autonomic Nervous System Drugs

760 Central Nervous System Drugs

### Physics

511 Quantum Theory and Atomic Structure I



## **FINANCIAL INFORMATION**

### **Tuition**

Payment of resident or non-resident tuition fees is determined by residency regulations given in detail on the Registrar's Office website: <http://ro.umich.edu/>. Students are expected to self-fund the costs associated with this program, including tuition, health insurance, and registration and student fees.

### **Loans**

Loan funds administered through the Office of Financial Aid (2011 SAB) are available to meet the needs of any educational expense for students while enrolled in the University. The extent of this financial need must be clearly established by providing a complete statement of the applicant's financial resources and expenses for the academic year. Loans are NOT available for any non-educational expense which is normally financed by a commercial lending institution, nor are they available for the repayment of previously incurred indebtedness. For more information, please see <http://www.finaid.umich.edu/>.

## **STAYING INFORMED**

### **Student Handbook**

This Handbook is to be used as a guide to the University, Graduate School and Program rules and regulations that govern the Program in Chemical Biology. Students should familiarize themselves with requirements of the Program and the Graduate School. Throughout the Handbook, references are made to Graduate School rules and regulations; these may be found in their entirety in Rackham Graduate Student Handbook, which is located at <http://www.rackham.umich.edu/current-students/policies/academic-policies>.

### **E-mail**

Each student is provided with an e-mail account. Messages and information are sent frequently to the student group (PCBCancerMSstudents@umich.edu) and to individual students. It is important that students read their UM e-mail on a daily basis.

### **Mailboxes**

All mail will be directed to the program office and placed in a pickup box located in Room 4222 of the Life Sciences Institute.

### **Administration**

The Program Office is located in 4008 Life Sciences Institute. This office can provide assistance in all matters of the Program, including graduate records and admissions, professional development, room reservations and seminar postings.

## FACULTY

<b>Faculty Member</b>	<b>Department</b>	<b>E-mail</b>	<b>Phone</b>
Bailey, Ryan	Chemistry	ryancb@umich.edu	TBD
Banerjee, Ruma	Biological Chemistry	rbanerje@umich.edu	734.615.5238
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Brooks III, Charles	Chemistry	brookscl@umich.edu	734.647.6682
Cho, Uhn-Soo	Biological Chemistry	uhnsoo@umich.edu	734.764.6765
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Garcia, George	Medicinal Chemistry	gagarcia@umich.edu	734.764.2202
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Iniguez-Lluhi, Jorge	Pharmacology	iniguez@umich.edu	734.615.6565
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Kerppola, Tom	Biological Chemistry	kerppola@umich.edu	734.764.3554
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Mapp, Anna (Program Director)	Chemistry	amapp@umich.edu	734.615.6862
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Narayan, Allison	Chemistry	arhardin@umich.edu	734.615.5505
Nikolovska-Coleska, Zaneta	Pharmacology	zanetan@med.umich.edu	734.615.9202
O'Brien, Patrick	Biological Chemistry	pjobrien@umich.edu	734.647.5821
Palfey, Bruce (Associate Director)	Biological Chemistry	brupalf@umich.edu	734.615.2452
Pecoraro, Vincent	Chemistry, Biophysics	vlpec@umich.edu	734.763.1519
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Saper, Mark	Biophysics; Biological Chemistry	saper@umich.edu	734.764.3353
Schindler, Corinna	Chemistry	corinnas@umich.edu	734.763.6853
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Skiniotis, Georgios	Biological Chemistry	skinioti@umich.edu	734.647.1532
Smith, Janet	Biological Chemistry	janetsmi@umich.edu	734.615.9564
Soellner, Matthew	Medicinal Chemistry	soellner@umich.edu	734.615.2767
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Tesmer, John	Pharmacology	tesmerjj@umich.edu	734.615.9544
Triebel, Raymond	Biological Chemistry	rtriebel@umich.edu	734.647.0889
Veatch, Sarah	Biophysics	sveatch@umich.edu	734.615.2099
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Wang, Shaomeng	Pharmacology; Med Chem	shaomeng@umich.edu	734.615.0362
Weisman, Lois	Cell and Developmental Biology	lweisman@umich.edu	734.647.2539
Woodard, Ronald	Medicinal Chemistry	rww@umich.edu	734.764.7366
Xu, Zhaohui	Biological Chemistry	zhaohui@umich.edu	734.615.2077
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## **SAFETY and EMERGENCY PRECAUTIONS and PROCEDURES**

It is critical that students follow proper laboratory safety procedures. The research interests of the faculty of the Chemical Biology program are very diverse, making it impossible to create a single set of guidelines that are applicable to all laboratory situations open to students. It is vitally important that students become trained in the safety procedures that are relevant to their lab. For more information on general safety information, please see <http://www.oseh.umich.edu/>, the University of Michigan's Occupational Safety & Environmental Health organization.

### **Emergency and Safety Regulations/Emergency Telephone Numbers**

In case of an emergency in a campus building, occupants are to use a campus-only phone to dial 911 to provide a description and location of the emergency. The Department of Public Safety (DPS) may also be reached by dialing 3-1131.