About the Cover

Jennifer Gehret McCarthy, Ph.D. (Biological Chemistry 2012)

The marine environment, full of bioactive natural products, is largely untapped. Natural products, including those found in the marine environment, exhibit an impressive array of chemical diversity and often potent bioactivity, which can be harnessed for therapeutics. Many unusual enzymes reside in natural product assembly-line pathways, and create the diverse collection of chemical functional groups found in natural products. The study of enzymes in natural product biosynthetic pathways can reveal new modes of catalysis, unique chemical transformations, and novel biosynthetic tools. The antimitotic natural product curacin A is a perfect example of interesting chemistry found in the marine environment.

Curacin A (center), produced by the marine cyanobacterium *Moorea producens* (background), contains many interesting chemical groups including cyclopropane and thiazoline rings, an internal cis double bond and a terminal alkene. Equally interesting are the structural details of the biosynthetic pathway that produces curacin A (arrows), giving insight into how each unique chemical group is made. Shown are the published structures from the curacin A biosynthetic pathway (starting from the top left and moving counter clockwise): a dehydratase that produces a trans double bond\(^1\), a dehydratase that produces a cis double bond\(^1\), an acyl carrier protein involved in cyclopropane biosynthesis\(^2\), a loading enzyme with dual decarboxylase and acetyltransferase activities\(^3\), an Fe\(^{2+}/\alpha\)-ketoglutarate dependent halogenase involved in cyclopropane biosynthesis\(^4\), a decarboxylase that establishes regiochemistry for cyclopropane formation\(^5\), a dehydratase that produces a trans double bond\(^1\), and a \(\beta\)-sulfate specific thioesterase that produces a terminal alkene\(^6\).

CONTENTS

I. Program Overview 4

II. Program Administration 4

III. Admission and Application 4

IV. Academic Program 5
    PhD Program Requirements 5
    Laboratory Rotations 7
    Academic Performance 8
    Masters Degree 8
    Selection of thesis/dissertation advisor 8
    Preliminary Exam 8
    Advancement to Candidacy 9
    Formation of Thesis Advisory Committee 9
    Dissertation Defense and Final Oral Examination 10
    Biological Chemistry Seminar Series 10
    Work Hours and Vacation Guidelines 10

V. Departmental Events 10

VI. Web Resources 12

Addendum: Mentoring Plans 14

Addendum: Preliminary Examination Guidelines and Timeline 16
I. PROGRAM OVERVIEW
The Department of Biological Chemistry at the University of Michigan offers a Ph.D. degree through the Rackham School of Graduate Studies. The Ph.D. program includes formal course work, seminars, individual study and original research. Current areas of research include structural biology, protein biochemistry, enzyme reaction mechanisms, molecular genetics, signal transduction, neurobiology, and cell and developmental biology. The common theme is an interest in understanding biological phenomena at the molecular and mechanistic level.

II. PROGRAM ADMINISTRATION
Graduate Program Director      Dr. Anne Vojtek    avojtek@umich.edu
Graduate Program Manager       Ms. Beth Goodwin   egoodwin@umich.edu

Academic Advisors:      Dr. Anne Vojtek    avojtek@umich.edu
                        Dr. Mike Uhler     muhler@umich.edu

III. ADMISSION AND APPLICATION TO THE PROGRAM
The Program in Biomedical Sciences (PIBS) is the gateway for biomedical science graduate study at the University of Michigan. PIBS was created to provide flexibility to students in their choice of dissertation mentor and graduate program. PIBS coordinates the first year graduate studies for 14 Ph.D. programs at the University of Michigan. These programs are: Biological Chemistry, Bioinformatics, Biophysics, Cancer Biology, Cell and Developmental Biology, Cellular and Molecular Biology, Human Genetics, Immunology, Microbiology and Immunology, Molecular, Cellular, and Developmental Biology, Molecular and Cellular Pathology, Molecular and Integrative Physiology, Neuroscience, and Pharmacology. When applying to PIBS, students will be asked to specify the two departmental programs they are most interested in, although there are no restrictions to those programs when choosing rotation laboratories (see page 7 for additional information). Students seeking a Ph.D. in Biological Chemistry should apply directly to PIBS at the University of Michigan for admission, and designate Biological Chemistry as their primary department of interest on the application form.

Online applications are accepted from September through December 1 and are available from PIBS. See http://medicine.umich.edu/medschool/education/phd-programs/phd-admissions for instructions and applications.
IV. ACADEMIC PROGRAM

Ph.D. Program Requirements
Graduate work in the Department of Biological Chemistry combines the rigor of advanced study with the flexibility for students to design their own optimum curriculum. Coursework consists of both required and elective components. Elective coursework must be didactic, graded, relevant graduate-level course work. Short courses and seminar courses are not counted towards elective credit. A minimum of 4 biological chemistry advanced elective credits (2 courses) is required. To best match each student's individual interests and needs, students choose elective coursework in consultation with their research mentor. Elective coursework outside the Biological Chemistry Department requires approval by Biological Chemistry academic advisors.

Biological Chemistry PhD Graduate Curriculum

A. Biological Chemistry Required Course:
   BIOLCHEM 660 Molecules of Life: Protein Structure, Function & Dynamics (2 Cr, F)
Or, alternately,
   BIOLCHEM 501 Chemical Biology (3 Cr, F)

B. Biological Chemistry Advanced Electives (4 Credits/2 courses minimum):
   Fall
   BIOLCHEM 650 Eukaryotic Gene Transcription (2 Cr, F)
   BIOLCHEM 690 Biochemical Regulatory Mechanisms (2 Cr, F)
   BIOLCHEM 713 Emerging Areas of Biochemistry (1 Cr, F)
   Winter
   BIOLCHEM 640 Regulatory RNA and Control of Gene Expression (2 Cr, W)
   BIOLCHEM 528 Biology and Chemistry of Enzymes (2 Cr, W)
   BIOLCHEM 673 Enzyme Kinetics (3 Cr, W)
   BIOLCHEM 602 Protein Crystallography (3 Cr, W)

C. Additional required courses:
   BIOLCHEM 597 Critical Analysis (2 Cr, W)
   BIOLCHEM 712 Biological Chemistry Seminar Series (2 Cr, F/W)
   Register F/W every year
   BIOLCHEM 711 Graduate Seminar (2 Cr, F/W)
   Register F/W Year 2 & 3
   PHRMACOL 502 Introduction to Scientific Communication (2 Cr, F)
   Register Fall Semester Year 2
   PIBS 503 Research Responsibility & Ethics (1 Cr, F)
   Register in Year 1 & Year 5

D. Electives*** (3 Cr minimum):
   Fall
   BIOINF 527 Introduction to Bioinformatics and Computational Biology (4 Cr, F)
   BIOINF 528 Advanced Applications of Bioinformatics (3 Cr, F)
   BIOPHYS 520 Techniques in Biophysical Chemistry (3 Cr, F)
   BIOSTAT 501 Introduction to Biostatistics (4 Cr, F)
BIOSTAT 521 Applied Biostatics (4 Cr, F) [calculus prerequisite]
CDB 530 Cell Biology (3 Cr, F)
CDB 581 Developmental Genetics (3 Cr, F)
MICRBIOL 612 Microbial Informatics (3 Cr, F)
HUMGEN 541 Molecular Genetics (3 Cr, F)
PHYSIOL 510 Principles of Systems and Integrative Physiology (4 Cr, F)

Winter
BIOLCHEM 625 Foundations in Bioinformatics and Systems Biology
(3 modules, 1 Cr each, W)
BIOPHYS 521 Theory and Methods of Biophysical Chemistry (3 Cr, W)
CDB 582 Stem cells: Organogenesis to Regenerative Biology (3 Cr, W)
CHEMBIO 502 Chemical Biology II (3 Cr, W)
MICRBIOL 504 Cellular Biotechnology (3 Cr, W)
PATH 581 Tissue, Cellular and Molecular Basis of Disease (4 Cr, W)

***This is a partial list. Consult your research mentor and academic advisor if you would like to take an elective course not listed above.

E. Research:
PIBS 600 Biomedical Science Independent Study (F/W, Year 1)
BIOLCHEM 990 Dissertation – Precandidate Research
BIOLCHEM 995 Dissertation – Candidate Research

In addition to coursework and conducting research, the Biological Chemistry PhD has the following additional requirements:

• Students are required to attend the Biological Chemistry Departmental Seminars, and attendance at 75% of the Biological Chemistry Departmental seminars per semester is mandatory.

• Students gain valuable teaching experiencing by serving as a teaching assistant in Biological Chemistry for one semester.

• Successful completion of the Preliminary/Qualifying Examination is necessary to advance to Ph.D. candidacy. This examination, taken in the fall semester of the second year, involves writing a detailed research proposal and defending it orally before a faculty committee.

• Progress to degree is monitored by the student’s thesis advisory committee. Meetings are required annually, beginning winter semester of year 2, or more often if required by the thesis committee.

• Students present a research seminar to the department in year 4.

Program requirements are reviewed periodically to assess the quality of graduate education in the Department and may be subject to change upon review. At the discretion of the Department, changes may be applied retroactively to students already enrolled in the Biological Chemistry Graduate Program.
Course Requirements for Students Entering with a Masters Degree

Graduate credits cannot be transferred from another institution to a Rackham doctoral program. The Biological Chemistry program will work closely with the student to devise an optimal educational program that builds on and complements the student’s prior training.

Course Requirements for the Medical Scientist Training Program (MSTP)

MSTP students who join the Biological Chemistry PhD program will devise an individual coursework plan in consultation with the MSTP program and the Biological Chemistry PhD program.

Biological Chemistry 711 Enrollment Requirements for Students Appointed to Training Grants

Biological Chemistry PhD students are required to take two years (4 terms) of Biolchem 711. If a training grant offers a similar course, the student may request a waiver for one year of the two-year requirement for 711.

<table>
<thead>
<tr>
<th>TRAINING GRANT</th>
<th>REQUIRED 711 ENROLLMENT</th>
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<tbody>
<tr>
<td>Cancer Biology Training Program</td>
<td>2 Years (4 terms)</td>
</tr>
<tr>
<td>Cell Biotechnology Training Program (CBTP)</td>
<td>2 Years (4 terms)</td>
</tr>
<tr>
<td>Chem/Biology Interface (CBI)</td>
<td>2 Years (4 terms)</td>
</tr>
<tr>
<td>Genetics Training Program <em>(Enroll one year of Biochem 711 and two years Gen 631)</em></td>
<td>1 Year (2 terms)</td>
</tr>
<tr>
<td>Immunology</td>
<td>2 Years (4 terms)</td>
</tr>
<tr>
<td>Institute of Gerontology (IOG NIA TG)</td>
<td>2 Years (4 terms)</td>
</tr>
<tr>
<td>Molecular Biophysics <em>(Enroll one year of Biochem 711 and Biophys 801 Seminar Course)</em></td>
<td>1 Year (2 terms)</td>
</tr>
<tr>
<td>Pharmacological Sciences Training Program <em>(Enroll in one year of Biochem 711 and Med Chem 740)</em></td>
<td>1 Year (2 terms)</td>
</tr>
<tr>
<td>Proteome Informatics of Cancer Training Program (PICTP) <em>(Enroll in one year Biochem 711 and Bioinf 602 as specified by PICTP)</em></td>
<td>1 Year (2 terms)</td>
</tr>
<tr>
<td>Reproductive Sciences Training Program</td>
<td>2 Years (4 terms)</td>
</tr>
<tr>
<td>Vision Training Grant</td>
<td>2 Years (4 terms)</td>
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*Additional terms of seminars may be required by the training grant

Laboratory Rotations

PIBS students engage in research rotations, choosing one rotation during Fall and Winter term, with the option to perform half-semester rotations with the approval of the research mentor. PIBS students also have the option to start in the summer, engaging full time in a research rotation. Upon completion of the PIBS year, the students elect a mentor and degree granting program.

Before choosing a laboratory for a rotation, students review faculty research interests through the departmental or PIBS websites and attend formal and informal networking
sessions with faculty, including the Biological Chemistry Annual Retreat. Appointments with potential research mentors should be arranged to discuss potential projects available in a given term.

**Academic Performance**
The Rackham Graduate School requires students to maintain a grade point average of B (3.0 on a 4.0 scale) and the Department of Biological Chemistry requires all students to receive grades no lower than a B- in required courses. A student whose cumulative GPA falls below a B, who is not making satisfactory progress toward the degree in coursework and/or in research, or who is failing to demonstrate an ability to succeed in his or her plan of studies, may be denied permission to register, required to withdraw, or dismissed from the program. Students who receive a grade lower than a B- in a required course who are otherwise in good standing in the program may be asked to repeat the class or undertake additional coursework. Failure to successfully remediate the coursework may result in dismissal from the program. Students are encouraged to be proactive and seek assistance when in difficulty as the department has resources available to assist the students when academic difficulties occur.

**Masters Degree**
Biological Chemistry Ph.D. students who have completed a minimum of 24 credit hours may apply for a master’s degree. It is possible to meet the Biological Chemistry Ph.D. coursework requirements but not have the required number of credits for receipt of a master’s degree, as some coursework (including 990, 995 and audited courses) cannot be counted towards this degree. The degree is not automatically awarded; you must submit a request that the Graduate School award it to you. Contact Beth Goodwin and an academic advisor upon entry into the Biological Chemistry Ph.D. program for additional information.

**Selection of Thesis/Dissertation Advisor**
The design of the PIBS program allows students to perform rotations with any of the faculty associated with PIBS Ph.D. programs. However, once a mentor is chosen the student is expected to join the Ph.D. program with which the mentor is associated. The only exceptions to this policy would be cases in which there is a clear and extensive collaboration occurring between a primary mentor in another program and a co-mentor in Biological Chemistry. In instances like this a very significant amount of the experimental work would be expected to occur in the laboratory of the Biological Chemistry faculty mentor. Approval for a co-mentorship arrangement is granted by the Graduate Program Director in consultation with the faculty Advisory Committee. Most PIBS students select thesis advisors and begin full-time laboratory research by the beginning of the summer following the first year of graduate study. Once your thesis advisor has been selected, he or she will provide guidance in selecting a dissertation research problem, in selecting a Dissertation Committee, and in other aspects of your graduate career and professional development.

**Preliminary/Qualifying Examination**
During the fall of the second year (or in the case of MSTP students, in the first-year), students in Biological Chemistry write and defend orally an in-depth original research proposal. The written and oral components of the exam assess the student’s mastery of
the required course content for the department and the student’s ability to reason analytically and to independently develop ideas and experimental approaches. Both components of the exam must be passed in order to advance to candidacy. Following the exam, the Chair of the Preliminary Committee will meet with the student to indicate the outcome and to discuss with the student the strengths and weaknesses of his/her performance. If the student fails either or both of the exam components, the Committee will make a recommendation to the Graduate Chair whether the student can re-write the written component and/or re-defend the oral component one time, or recommend that the student be dismissed from the program. To be eligible to retake the preliminary exam, the student must be in good standing in research. The academic record of the student will also be taken into consideration in making the decision to allow a retake of the exam. The Committee may also recommend additional coursework. The Preliminary/Qulifying Examination Guidelines and Timeline are attached as an addendum to this handbook.

**Advancement to Candidacy**
The minimal requirements for Candidacy are: (a) a Bachelor’s degree or equivalent awarded by an accredited university; (b) a minimum of 18 credits of graded coursework in residence; (c) graduate didactic coursework in biochemistry and related fields, including Biolchem 660 (or 501) and Biolchem 597 (see IV. Academic Program, PhD Program Requirements above for more detailed information on required coursework and electives); (d) two semesters of Biolchem 711 and two semesters of PIBS 600; (e) 4 credit hours of cognate coursework with a B- or better; (f) a cumulative grade point average of B (3.0 or better on 4.0 scale) AND a minimum grade of B- in required courses; (g) passing the preliminary examination, scheduled in winter term, year 2; and, (h) satisfactory progress in research (Biolchem 990).

**Formation of Thesis Advisory Committee**
Following advancement to candidacy you will be asked to form your dissertation committee. Biological Chemistry requires that your committee consist of (at least) five members, including your research mentor who chairs the committee. (You may appoint a co-chair if you wish.) At least three of the members of your dissertation committee will be members of Biological Chemistry. At least one other member of your committee will be chosen from outside of the department (and will not hold any fraction of an appointment in Biological Chemistry) and designated as your cognate member. Should the composition of your dissertation committee change during the course of your thesis research be sure to update the Graduate Program Office. After approval by your mentor, the names of the members of your committee are submitted to Beth Goodwin in the Biological Chemistry Graduate Program Office. Following approval by the Biological Chemistry Graduate Program Director, your committee will be officially submitted to the Rackham Graduate School.

You are required to meet with your committee during the term after you advance to candidacy (winter term, year 2) and at regular intervals (determined by your dissertation committee, but no less than once per year) to maintain your academic standing in the program. You are also required to submit reports of your progress to your committee and the Biological Chemistry Graduate Program Office. Students usually complete the program within 5-6 years.
Dissertation Defense and Final Oral Examination
The Department requires that all five (or more) members of a dissertation committee read and approve the dissertation and all members should be present at the defense. However, in special cases in which a student has undue difficulty in scheduling all five members for the actual final oral defense, the student can request that the defense proceed with only four members present. This must include the Chair and the Cognate member. To get approval to hold the defense with only four members present, the student must receive approval from all five members. This request can be made by email; all committee members must respond to the student and to either the Graduate Program Director or Beth Goodwin.

Biological Chemistry Seminar Series
The Department of Biological Chemistry sponsors a weekly seminar program during the Fall and Winter terms that attracts outside speakers of international reputation. The seminars are held each Tuesday at Noon and all biochemistry students are required to attend. Students are invited and encouraged to meet with the seminar speakers. In addition to the weekly seminar program, the Department sponsors an annual Distinguished Alumni Lecture and four endowed lectureships: the Irwin Goldstein Lectureship in Glycobiology, the G. Robert Greenberg Lectureship in Biological Chemistry, the William E.M. Lands Lectureship in the Biochemical Basis for the Physiology of Essential Nutrients, and the Martha L. Ludwig Lectureship in Structural Biology. Attendance at 75% of weekly seminars and biochemistry sponsored lectureships is required each semester during graduate school. Exceptions are made on a case-by-case basis and include overlapping required coursework and off-site internships.

Work Hours and Vacation Guidelines
Students should consult with their mentors regarding specific laboratory policies on research hours, vacations, and planned absences. Request for time off from research must be done in advance and in consultation with the student’s mentor. First year PIBS students may take time off on official university holidays and season days, plus two weeks of the student’s choice, in consultation with the student’s mentor.

V. DEPARTMENT EVENTS

Annual Departmental Retreat
The student-organized Biological Chemistry retreat, held before the beginning of the Fall semester at Kellogg Biological Station on Gull Lake in Western Michigan, provides students, postdoctoral fellows and faculty an opportunity to present and discuss research in a relaxed and informal setting.

Student chalk talks
Students in the Department of Biological Chemistry meet approximately twice each month for lunch, conversation, and an informal research talk. This gathering provides an opportunity for students to keep in touch with their colleagues and to share scientific expertise and advice. The chalk talk schedule can be found on our website.
**Monthly Happy Hour**
Once a month members of the department are invited to gather together at a local establishment in Ann Arbor to enjoy conversation and appetizers.

**Poster Session for PIBS Rotation Students**
PIBS students rotating with Biological Chemistry faculty have the opportunity to present their research at informal poster sessions held at the conclusion of the Fall and Winter terms.

**Annual Student Awards**
Students in the Department of Biological Chemistry are eligible for nomination for the following awards. Each award, which carries with it a cash prize, is presented by the Chair of the Department at a special ceremony held annually, usually in May.

The **Halvor N. and Mary M. Christensen Award** is presented to a 2nd year student on the basis of the student’s academic record. The recipient receives a cash award of $1,000 and his/her mentor receives $15,000 to support the recipient’s research expenses.

The **Adam A. and Mary J. Christman Award** is presented to a 3rd year student who is judged to be the most outstanding in that class. The recipient receives a cash award of $1,000 and his/her mentor receives $15,000 to support the recipient’s research expenses.

The **Anthony and Lillian Lu Award** is presented to a student on the basis of academic background, achievement in the graduate program, and potential as a scientist. Preference will be given to a student who is not a resident of the United States. There is no restriction with respect to time in the Program. The recipient receives a cash award of $1,000.

The **Lee Murphy Memorial Prize** is awarded to the student who embodies the highest ideals of scientific integrity and who has published a paper, or a series or papers, judged most significant. The recipient receives a cash award of $1,000.

The **Minor J. and Mary Lou Coon Award** is presented to the student who best exhibits excellence in research, teaching, and service to the Department. The recipient receives a cash award of $1,000 and his/her mentor receives $15,000 to support the recipient’s research expenses.

The **Dziewiatkowski Award** is dedicated to the memory of the late faculty member, Dominic D. (Jay) Dziewiatkowski, and is offered to the student who has submitted the most outstanding Ph.D. dissertation during the last academic year. The recipient receives a cash award of $1,000.
VI. WEB RESOURCES

Laboratory Safety and Training EHS – Environmental Health and Safety
http://ehs.umich.edu/

WELCOME MATERIALS FOR NEW GRADUATE STUDENTS
http://www.rackham.umich.edu/current-students/life-at-michigan/after-you-arrive-on-campus/welcome-materials

RESOURCES FOR GRADUATE STUDENTS
http://www.rackham.umich.edu/current-students

WRITING SUPPORT
http://www.lsa.umich.edu/sweetland/

RACKHAM ACADEMIC POLICIES
http://www.rackham.umich.edu/policies/gsh/

INTEGRITY IN SCHOLARSHIP
http://www.rackham.umich.edu/current-students/policies/academic-policies/section11

PROFESSIONAL DEVELOPMENT

A. Rackham
http://www.rackham.umich.edu/current-students/graduate-student-success/pd

B. UM Alumni Association
http://alumni.umich.edu/students/career-resources

C. University of Michigan Medical School

UM Office of Graduate & Postdoctoral Studies
https://medicine.umich.edu/medschool/office-graduate-postdoctoral-studies

Office of Graduate & Postdoctoral Studies Career and Professional Development Team

Shoba Subramanian, PhD
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Margery (Maggie) Evans, PhD
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HOW TO GET THE MENTORING YOU WANT
PARENTAL ACCOMMODATION POLICY
http://www.rackham.umich.edu/current-students/policies/parental-accommodation-policy

HEALTH AND WELLNESS RESOURCES
http://www.rackham.umich.edu/current-students/life-at-michigan/health-wellness

FINANCIAL ASSISTANCE

   Emergency Funds
   http://www.rackham.umich.edu/prospective-students/funding/student-application/graduate-student-emergency-funds

   Fellowships, grants and scholarships
   http://www.rackham.umich.edu/prospective-students/funding

   Rackham Student Research Grant
   http://www.rackham.umich.edu/prospective-students/funding/student-application/graduate-student-research-grant

   Rackham Conference Travel Grant
   http://www.rackham.umich.edu/prospective-students/funding/student-application/rackham-conference-travel-grant
Mentoring Plan
UM-Biochemistry Graduate Student Commitments

• I acknowledge that I have the primary responsibility for the successful completion of my degree. I will be committed to my graduate education and will demonstrate this by my efforts in the classroom and the research laboratory. I will maintain a high level of professionalism, self-motivation, engagement, scientific curiosity, and ethical standards.

• I will meet regulatory with my thesis advisor and provide him/her with updates on the progress and results of my activities and experiments.

• I will work with my thesis advisor to develop a thesis project. This will include establishing a timeline for each phase of my work. I will strive to meet the established deadlines.

• I will work with my thesis advisor to select a thesis committee and commit to meeting with this committee, according to my graduate program guidelines. I will be responsive to the advice of and constructive criticisms from my committee.

• I will be knowledgeable of the policies and requirements of my graduate program, Rackham Graduate School and the University of Michigan. I will commit to meeting these requirements, including teaching responsibilities.

• I will attend and participate in laboratory meetings, seminars and journal clubs that are part of my educational program.

• I will comply with all UMMS and Rackham Graduate School policies, including academic program milestones. I will comply with both the letter and the spirit of all institutional safety laboratory practices and animal use and human-research policies at my institution.

• I will participate in the UM Responsible Conduct of Research Training Program (PIBS 503) and practice those guidelines in conducting my thesis research.

• I will be a good laboratory citizen. I will agree to take part in shared laboratory responsibilities and will use laboratory resources carefully and frugally. I will maintain a safe and a clean laboratory space. I will be respectful of, tolerant of, and work collegially with all laboratory personnel.

• I will maintain a detailed, organized, and accurate laboratory notebook. I am aware that my original notebooks and all tangible research data are property of my institution but that I am able to take a copy of my notebooks with me after I complete my thesis.

• I will discuss policies on work hours, sick leave and vacation with my thesis advisor. I will consult with my advisor and notify fellow lab members in advance of any planned absences.

• I will discuss policies on authorship with my research advisor. I will work with my advisor to submit all relevant research results that are ready for publication in a timely manner prior to my graduation.

• I acknowledge that it is primarily my responsibility to develop my career following the completion of my degree. I will seek guidance from my research advisor, dissertation committee, other mentors and any other resources available for advice on career plans.

Adapted from the Association of American Medical Colleges and UM-PIBS.
Mentoring Plan
UM-Biochemistry Research Advisor Commitments

- I will be committed to mentoring the graduate student. I will be committed to the education and training of the graduate student as a future member of the scholarly community.

- I will be committed to the research project of the graduate student. I will help to plan and direct the graduate student’s project, set reasonable and attainable goals, and establish a timeline for completion of the project. I recognize the possibility of conflicts between the interests of my own larger research program and the particular research goals of the graduate student, and will not let my larger goals interfere with the student’s pursuit of his/her thesis/dissertation research.

- I will be committed to meeting with the student on a regular basis.

- I will be committed to providing resources for the graduate student as appropriate or according to my institution’s guidelines, in order for him/her to conduct thesis/dissertation research.

- I will be knowledgeable of, and guide the graduate student through, the requirements and deadlines of his/her graduate program as well as those of the institution, including teaching requirements and human resources guidelines.

- I will help the graduate student select a thesis/dissertation committee. I will help assure that this committee meets at least annually (or more frequently, according to program guidelines) to review the graduate student’s progress.

- I will lead by example and facilitate the training of the graduate student in complementary skills needed to be a successful researcher; these may include oral and written communication skills, grant writing, lab management, animal and human research policies, the ethical conduct of research, and scientific professionalism. I will encourage the student to seek additional opportunities in career development training.

- I will expect the graduate student to share common research responsibilities in my research group and to utilize resources carefully and frugally.

- I will discuss authorship policies regarding papers with the graduate student. I will acknowledge the graduate student’s contributions to projects beyond his or her own, and I will work with the graduate student to publish his/her work in a timely manner.

- I will discuss intellectual policy issues with the student with regard to disclosure, patent rights and publishing research discoveries, when they are appropriate.

- I will encourage the graduate student to attend professional meetings and make an effort to help him/her secure funding for such activities.

- I will provide career advice and honest letters of recommendation for his/her next phase of professional development. I will also be accessible to give advice and feedback on career goals.

- I will try to provide for every graduate student under my supervision an environment that is intellectually stimulating, emotionally supportive, safe, and free of harassment.

- Throughout the graduate student’s time in graduate school, I will be supportive, equitable, accessible, encouraging, and respectful. I will foster the graduate student’s professional confidence and encourage critical thinking, skepticism and creativity.

Adapted from the Rackham/Dean’s Office “Michigan Graduate Student Mentoring Plans”
PRELIMINARY EXAMINATION. The Biological Chemistry Preliminary Examination (Prelim) requires that each beginning 2nd year student write an original research proposal and present it before a committee of Biological Chemistry faculty members in an oral defense of that proposal. The written and oral components of the preliminary examination must each be passed before a student achieves Candidacy for the Ph.D. degree. The following guidelines have been determined by the departmental Preliminary Examination Committee in order to give the student more guidance for the Fall 2017 Prelim exams. The Prelims are meant to be an examination of the students’ ability to carry out independent research, but are also meant to illustrate the importance of learning from your colleagues. These two principles can at time seem to oppose each other, so the guidelines presented here are meant to balance the teaching and testing components of the Prelim.

1. Purpose

The Prelim tests for the student's ability to reason analytically and to independently develop ideas and experimental approaches. The exam gives the student an opportunity to demonstrate creativity, critical thought and knowledge of an area of current research. Upon completion of the Prelim, the student’s Prelim examination committee should be convinced that the student has mastered the required course content for the department, has demonstrated the ability to think independently about complex research problems and can test a reasonable hypothesis using a set of appropriately designed experiments. The prelim also offers an opportunity for the student to get constructive criticism about writing style and the clarity of idea presentation.

2. The role of the thesis mentor in the Prelim

A critical resource for the student in the Prelims and beyond will be their thesis advisor. Whether or not the student chooses a topic related to their thesis project, the thesis advisor should advise the student with respect to important papers to read when investigating their research topic as well as local faculty with expertise in a particular methodology or model system. Thesis advisors can guide the student in general issues regarding the formulation of the hypothesis, but should not actually write the hypothesis or specific aims. Thesis advisors and other faculty should not proofread the proposal, but other graduate students may proofread the document.

3. Choosing a Topic

The selection of the Prelim project must be done in consultation with the student’s thesis advisor. In particular, the thesis advisor should give input as to whether the topic chosen has sufficient significance and feasibility for a proposal.

The specific project for the Prelim proposal may be related to the thesis advisor’s research area, but should not be a currently active project in the laboratory. The specific project can be based on the lab’s research, but the research proposed should largely represent original ideas of the student. The scope should be appropriate for one individual (e.g., a grad student) to accomplish in 3-4 years with an outcome of publishing approximately two first-author papers based on the
research. After approval of the topic by the thesis advisor, the student will consult with the Prelim Coordinator as to whether a topic is appropriate before investing significant effort in researching and writing the Specific Aims. The project proposed is expected to be of sufficient quality to potentially develop into a thesis project, but it is **not required** that the Prelim Project develops into the student’s thesis project.

4. Specific Aims

The student submits to their Prelim Coordinator a one-page document describing the proposed topic. This page should include how the project evolves from the previous studies (the background and rationale), the hypothesis to be tested, the specific aims to address the hypothesis, the general experimental approach used to test the hypothesis and the significance of the project. This page will serve as the “Specific Aims” page (per an NIH research grant application), and becomes the first page of the prelim proposal. This page can be revised from that approved by the Prelim Coordinator as the student writes the full proposal.

5. Departmental Preliminary Examination Committee

a. Members

The student submits the names of two Biological Chemistry faculty members who **have agreed to serve** on the examining committee at the time that the Specific Aims page is submitted. The student's thesis advisor may not serve as a member of this committee, but can advise the student on selection of faculty for the committee. The Prelim Coordinator appoints two additional members and appoints one prelim committee member to serve as committee chair. It is estimated that composing the committee will be completed within one week. The thesis advisors of students currently taking the preliminary examination are expected to participate in the examinations of other students (faculty members should expect to serve on two committees for each of their students taking the Prelim).

b. Arranging the Examination Committee Meeting

Once the examination committee has been determined, the coordinator will notify the student. As soon as possible, the student is responsible for arranging a day and time during the designated prelim exam period that all of the committee members can attend the oral exam. Beth Goodwin in the departmental office can assist the student in reserving a room and obtaining appropriate audiovisual aids for that day and time.

The student is responsible for seeing that each examination committee member receives a copy of the Specific Aims page describing the research problem. The committee members will review these Specific Aims to determine ultimate feasibility and acceptability of the outlined project. The Examination Committee Chair will communicate to the student (YES or NO) within **ONE WEEK** whether the Specific Aims are appropriate. If the Specific Aims are deemed **NOT appropriate**, the Committee Chair will explain the problems with the proposed project and the student will have one opportunity to revise and resubmit the Specific Aim page to the committee within one week.
c. Role of Prelim Coordinator

The Department Prelim Exam Committee members (Prelim Coordinators) serve as representatives of the Departmental Advisory Committee. Each student will be assigned to work with one of the Prelim Coordinators. It is the responsibility of the student to contact that Prelim Coordinator in accordance with the timeline.

A primary role of the Prelim Coordinator is to ensure that the timeline of the Prelim exam is followed. The Prelim Coordinator will discuss the prelim topic with the student after the student has discussed an appropriate topic(s) with the thesis advisor. The Prelim Coordinator will receive the written Specific Aims page after thesis advisor approval, to use as a guide for composing the prelim exam committee. The Prelim Coordinator will finalize the prelim committee by adding two Biological Chemistry faculty as committee members in addition to the two identified by the student. The Coordinator will also identify a Prelim Committee Chair among each student’s committee members.

The Prelim Coordinators will compose the prelim committees as soon as possible after receiving the student’s faculty selections, with a target date for completion within a week of receiving the Specific Aims page.

d. Role of Prelim Examination Committee Chair

The Prelim Examination Committee Chair represents the Prelim Examination Committee and is responsible for giving feedback to the student on behalf of the Examination Committee, within one week following submission of the Specific Aims. In addition, the Prelim Examination Committee Chair coordinates the oral exam and is responsible for summarizing and communicating the outcome of the prelim exam to the student and the Departmental Prelim Committee Program.

6. Written Proposal

a. Format

The written proposal must contain background information and a brief summary of an original experimental approach to a scientific problem of current interest in cellular and molecular biology. The student must write a proposal (PDF format) up to 7 single spaced pages in length (including figures with Arial 11 point font size and 0.5 inch margins), using the NIH research grant format: i.e., 1 page Specific Aims (see “Specific Aims” description above) and 6 pages of Research Strategy. The research strategy should have sections (a) significance (1-2 pages), (b) innovation (0.5 to 1 page), and (c) Approach (3-4.5 pages). Literature cited should also be included but is not subject to the page limits. A preliminary data section is not usually included.

The student is ultimately responsible for independently deciding on the problem and devising logical and convincing experimental approaches. When writing the proposal and preparing an oral presentation, students can ask peers and faculty for advice on execution of specific techniques or specific interpretation of published work. Faculty can suggest reading materials, but should avoid taking active part in specific experimental design. Fellow students
(but not faculty) can proofread the proposal. When in doubt about appropriate boundaries of advice from others, the student is expected to consult with the Chair of his/her Preliminary Exam Committee. Students preparing for the exam can look over copies of previous student proposals that were considered excellent, which are kept on file by Beth Goodwin.

The student submits to the four members of the Examination Committee a written proposal of not more than seven typewritten pages (single spaced), counting figures but not counting references. The deadline for submission of the proposal will follow the designated timeline (See Item B below). It is recommended that the written proposal be hand-delivered to each member of the examining committee or that acknowledgements of electronic receipt be obtained by the students. A copy should also be submitted to Beth Goodwin in the Biological Chemistry office.

**The student will not approach Prelim Committee members to discuss the written proposal prior to the oral exam.**

**b. Timeline**

All prelim exams will take place in a limited (about two weeks) timeframe specified for each academic year before the end of Winter Term. The following timeline will be implemented for 2017-2018 academic year, with final deadlines on or before:

- **Tuesday August 22, 2017 (10 am to noon)** – Initial meeting with Departmental Prelim Committee.
- **Tuesday September 19, 2017** – Student submits prelim specific aims and name of two committee members.
- **Tuesday September 26, 2017** – Student committees and chairs assigned by Departmental Prelim Committee. Prelim specific aims page is approved or suggestions are provided to the student.
- **Tuesday October 3, 2017** – Student submits original or revised abstract to Individual Prelim Committee chair.
- **Thursday October 12, 2017** – Student’s Prelim chair responds concerning acceptability of specific aims and student schedules Prelim examination date and time.
- **Tuesday November 14, 2017** – Student distributes copy of proposal to their committee members.
- **November 27-December 8, 2017** – Prelim Exam Period. All oral defenses scheduled are during this interval and all prelim evaluation forms are submitted to Departmental Prelim Committee by December 8th.
7. Oral Exam

a. Focus

The oral exam tests the student's ability to reason analytically and to develop ideas and defend them in front of other scientists. Thus, the emphasis is on hypothesis testing and experimental design. The student should be familiar, however, with the key past experiments performed that led to the hypothesis and the important basic concepts of the approaches to be used (i.e., if studying a membrane receptor, the student must know aspects of that receptor binding, whether the cell type is appropriate for studying that receptor, whether antibodies or vectors have been made to that receptor, etc.). The committee members will expect students to be familiar enough with each technique proposed so as to understand its theoretical basis, as well as its appropriateness and limitations in addressing the hypothesis being tested. However, detailed knowledge of such things as buffer ingredients and incubation times are less important, unless they are vital to the interpretation of the results. For example, if one proposes to use PCR, one should know how PCR works, whether the necessary starting materials are available, whether PCR is the best approach to address the question being asked, and the limitations of using PCR. One does not need to know the exact ions needed for the PCR reaction to take place, nor the incubation time of the steps. In contrast, if one were studying ion channels, one might be expected to know the ion concentrations in the buffers to be used to measure ion transport.

b. Format of the oral examination

Each student’s file is provided to the Examination Committee Chair by Beth Goodwin prior to the exam. The student should not bring refreshments to the prelim exam. At the start of the examination the student will be asked to leave the room for a few minutes while the examining committee has a chance to discuss the student's record, issues related to the proposal and organization of the examination. The student will then be asked to give a 15-20 minute oral presentation. This presentation should start with a very short introduction to the background, statement of the hypothesis to be tested, the specific aims, and a few sentences pertaining to the significance. However, the major emphasis of the meeting should be on the experimental design and methods to be taken to test the hypothesis. The members of the committee might wait until the presentation is over, or might ask questions as points are presented. At the end of the presentation, committee members will then ask questions for the remainder of the examination (usually lasting approximately 2 hours).

It is expected that the students should have a fairly deep understanding of any experiments proposed and how to interpret them, as well as a solid grasp of the key literature in the field of inquiry. Furthermore, the curriculum for all students is based on a solid foundation in biochemistry, and students should demonstrate a breadth of knowledge. At least some of the questions from the committee should address the extent to which the student can think independently of the proposal using their knowledge in these areas.

c. Evaluation

When all committee members have had the opportunity to ask all the questions they wish, the student will be asked to leave the room. The committee will then discuss whether the student has displayed sufficient depth and breadth of scientific knowledge, insight into experimental design,
and ability to think critically, analytically and quantitatively, to predict a high likelihood of success in pursuit of a Ph.D. thesis.

For the outcome of the prelim, the written and oral exams will be evaluated separately by the Committee. A student will either pass or fail each component (Written and Oral). If a student fails either or both exams – the Committee will decide whether the student can rewrite/re-present the exams one time, or recommend to the Graduate Chair that the student should be dismissed from the Graduate Program. It is not unusual for students to be asked to rewrite part, or all, of the written proposal, or occasionally to retake the exam with the same problem, or with a different problem.

Immediately following the examination, the Prelim Committee Chair should indicate the outcome and discuss with the student the strengths and weaknesses of his/her performance on the prelim. Then the chair writes a summary of the examination on the form provided by the department office. All of the committee members sign the form, which is returned promptly (within one week) to Beth Goodwin in the department office. The report and outcome of the Preliminary Exam comprise a recommendation to the Graduate Chair as part of the consideration of the student for advancement to candidacy for the Ph.D.