UNIVERSITY OF ROCHESTER

SCHOOL OF MEDICINE AND DENTISTRY

GRADUATE STUDIES HANDBOOK

for the

DEGREE PROGRAMS

in

BIOCHEMISTRY

REVISED 10/24

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PREFACE

This handbook is intended to summarize the major features and policies of the program leading to the Ph.D. in Biochemistry. Students and advisors will need to consult:

1. The BMB Handbook policies set forth below
2. Regulations and University Policies Concerning Graduate Studies: [https://www.rochester.edu/graduate-education/wp-content/uploads/2024/10/FINAL_Regulations_September_2024.pdf]
3. University of Rochester Official Bulletin Graduate Education [https://www.rochester.edu/graduate-education/wp-content/uploads/2023/09/GradBulletin_WebFINAL.pdf]

Policy, of course, continues to evolve in response to the changing needs of the graduate programs and the students in them. Thus, it is wise to verify any crucial decisions with the Program Directors and the Graduate Studies Coordinator.

Although the Ph.D. in Biochemistry is primarily a research degree, it also encompasses a certain breadth of training in areas that are not directly related to the thesis research project. This breadth is best attained by formal courses, attendance at and participation in various seminar programs, teaching, and research activities including publication.

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I. Ph.D. in BIOCHEMISTRY – PROGRAM REQUIREMENTS

A. *General Information*

The Ph.D. in Biochemistry is administered through the Department of Biochemistry and Biophysics in the School of Medicine and Dentistry by the **Graduate Advisory Committee** (current members: Drs. Mark Dumont, Dmitri Ermolenko, Jeffrey Hayes, Lynne Maquat, Joshua Munger, Mitchell O'Connell, Eric Wagner and Yi-Tao Yu).

B. Courses

A total of 96 credit hours are required for the Ph.D. This number reflects credit obtained for course work (a minimum of 24 hours), attendance and participation in topical seminars, and credit hours awarded for satisfactory research work relating to the thesis project. Program course requirements are meant to be sufficiently flexible to accommodate students with diverse backgrounds and career goals. Students should consult with their assigned advisors or the Biochemistry Program Director (Joshua Munger) for curriculum advice. Certain courses or their equivalent constitute a Core Curriculum for the Ph.D. in Biochemistry and are specifically required in the first year: Continuous registration for 16 credits per semester is required. Course descriptions may be found in the Appendix.

1. Required Courses (taken in the first year of study)

Fall Semester

IND 408	Advanced Biochemistry	4 credits
IND 431	Foundations in Modern Biology I	5
IND 501	Ethics & Professional Integrity in Research	1
BCH 501	Biochemistry Seminar	1
BCH 595	Ph.D. Research (Research Rotation)	5
	Total	16 credits

Spring Semester

BCH 412	Advanced Topics in Biological Macromolecules	5 credits
IND 432	Foundations in Modern Biology II	5
BCH 502	Biochemistry Seminar	1
BCH 595	Ph.D. Research (Research Rotation)	5
Total		16 credits

2. Courses Required Each Semester

BCH 501 & BCH 502	Biochemistry Seminar	1 credit
BCH 595	Ph.D. Research	15 credits (unless an elective is chosen)

3. Elective Courses

The program requires a minimum of 4 additional credits. This additional credit requirement can be satisfied in the following ways: 1) A 4-credit course; 2) A 3-credit course plus a 1-credit course; 3) Two 2-credit courses. These courses can be selected by the student based on their specific research interests. A wide variety of courses is available. It should be noted that course offerings change constantly, and the student should consult the online course schedule.

Suggested elective courses
Other courses from other departments can be substituted, subject to the approval of the advisor and the program director.

Fall Semester 2024

BCH 515 (1)	Critical Thinking in Research Science
BCH 517 (1)	Topics in Cellular, Biochemical and Molecular Sciences
BCH 521 (4)	Bioinformatics for Life Scientists
BCH 570 (1)	BCH 570-01 - Multilayered Control of Gene Expression
BIO 422 (4)	Biology of Aging
BIO 426 (4)	Developmental Biology
BST 463 (3)	Introduction to Biostatistics
BST 464 (4)	Applied Linear Regression
CHM 411(4)	Inorganic Chemistry I
CHM 415 (2)	Group Theory
CHM 423(2)	NMR Spectroscopy
GEN 507(4)	Advanced Genetics & Genomics
MBI 473 (3)	Immunology
PHP 403 (4)	Human Cell Physiology
PTH 507 (3)	Cancer Biology

Spring Semester 2025

BIO 415 (4)	Molecular Biology of Cell Signaling
BIO 453 (4)	Computational Biology
BPH 411 (2)	Methods in Structural Biology
BPH 509 (2)	Molecular Biophysics
CHM 440 (4)	Bio Organic Chemistry
IND 419 (3)	Introduction to Quantitative Biology
IND 443 (4)	Eukaryotic Gene Regulations
IND 447 (4)	Signal Transduction
MBI 456 (4)	General Virology
MBI 421(3)	Microbial Genetics & Physiology
PHP 404 (4)	Principles of Pharmacology

4. Exemptions from Course Work Requirements

All entering students concerned with exemptions from core courses may appeal to a Biochemistry Program Director to determine whether an exemption is appropriate. The student will also be asked to meet with the Course Director to determine whether the exemption is warranted. Exemptions must be approved by the Dean for Graduate Studies.

5. Policy Regarding Grades

If a student in the program receives one grade of "C" or below, he/she will be reviewed by the Graduate Advisory Committee and a recommendation made to the dean that may include termination from the program. If the student is allowed to remain in the program, the course or an appropriate substitute course (approved by a Biochemistry Program Director), must be re-taken successfully with a final grade of B- or higher.

6. Policy Regarding Plagiarism

Plagiarism is an extremely serious ethical and moral offense. Any suspected instances will be reviewed by the Graduate Advisory Committee, the Department Chair, the Senior Associate Dean for Graduate Studies and appropriate University officials. This review can lead to suspension or expulsion from the University. According to University policy, academic transcripts issued during periods of suspension or expulsion will be accompanied by a letter from the registrar indicating that the student is currently suspended or expelled from the University for disciplinary reasons. Ignorance of the policy regarding plagiarism will not be considered as an excuse for violations.

From the Medical Student Handbook

Students are sometimes uncertain about what constitutes misuse of another person's expressed ideas. This statement is designed to explain the limits normally used to define plagiarism.

1. *Plagiarism is literary theft, intentional or unintentional. It is the use of a unique idea or phrase which does not originate with the user, without proper acknowledgment of the source.*

2. *In written papers, due credit to the original source of major or unique ideas (i.e., ideas which you could not and did not arrive at by yourself) must be given in the form of footnotes or clear allusions at the proper places in the paper itself. These precise indications of source must be given whether the material is paraphrased or quoted directly. An appended bibliography [only] is insufficient acknowledgment.*

3. *Quotation marks must enclose all direct quotations even though the quoted material is no more than occasional phrases interspersed with original observations.*

C. Seminar Requirement

All students will register for the **Department of Biochemistry and Biophysics Student Seminar Series**: BCH 501 (Fall) and BCH 502 (Spring), each semester in residence. Credit will be awarded for first year students' attendance at a minimum of 75% of the seminars in each semester. In subsequent years, students must attend a minimum of 75% of the seminars in each semester and present in the series each year. If a student fails to attend 75% of the student seminars in a given semester, he/she will need to write a 750 word paper for every seminar below attendance.

PLEASE NOTE: The Department of Biochemistry and Biophysics sponsors a seminar series that typically features leading scientists from other institutions. While not considered a formal course for which credit is granted, these seminars constitute an important part of the graduate experience. Every effort should be made to attend the **Department of Biochemistry and Biophysics Seminar Series**, currently scheduled every Wednesday at 2:00 pm during the fall and spring semesters. Students are encouraged to attend seminars offered by other departments that may be of interest.

D. Additional Requirements – First Year

1. **Laboratory Rotations**

All first-year students are required to complete three laboratory rotations during their first year. To assist in selecting rotations, faculty members will give short (20–30 minute) informal presentations at the beginning of the academic year to describe their research. These presentations help students identify suitable labs for rotations and potential future Ph.D. research.

Students should consult faculty web pages, publications, and speak with current students and PIs to make informed rotation choices.

- **Rotation Sign-Up:** Submit a list of preferred rotations to the Graduate Studies Coordinator after discussing and obtaining approval from your assigned 1st-year advisor.
- **Rotation Requirement**: Complete three projects in three different labs across multiple areas of interest before requesting a permanent lab assignment. In some cases, students may be asked to complete an additional rotation.
- **Summer Rotations**: If a student completes a summer rotation, they are still required to complete three more rotations during the academic year.

2**. Rotation Evaluations and Reports**

After each rotation, students must submit rotation report to the BMB Program Director and Graduate Studies Coordinator. The report helps develop both scientific thinking and writing skills. Reports should follow this format:

- Length: 6–8 pages, double-spaced, using Arial Font 11.
- Sections: Introduction (~2 pages), Materials and Methods (~2 pages), Results (~2 pages), and Discussion (~2 pages).
- Appendix: Include figures, tables, and references in an appendix (not included in the page limit).
- Abstract: A cover page with an abstract of no more than 200 words.

Faculty mentors will review and provide feedback on these reports.

After submitting the rotation report, both the faculty mentor and the student must complete and submit rotation evaluations to the Graduate Studies Coordinator, who will forward them to the Senior Associate Dean for Graduate Education and Postdoctoral Affairs. These evaluations should be submitted within five days after the end of each rotation. Visit the SMD Handbook regarding finding your lab, research advisors and mentors to download evaluation forms. [https://www.urmc.rochester.edu/education/graduate/phd/translational-biomedical-science/handbook/laboratory-rotations.aspx]

3. Rotation Schedule 2024–2025

First Rotation

- Faculty Research Presentations: Sept 4 – Sept 18
- Meet with 1st-Year Advisors for Approval: By Sept 20
- Submit Rotation Requests: By Sept 20
- Receive Rotation Assignment: By Sept 27
- Begin Rotation: Oct 1 (Confirm with PI)
- End of Rotation: Dec 15
- Reports, Evaluations (faculty & student) due 5 – 10 days after first rotation ends

Second Rotation

- Meet with Advisor to Discuss Preferences: Nov 29 – Dec 18
- Submit Preferences: By Dec 18
- Receive Assignment: By Dec 23
- Begin Rotation: Jan 1 (Confirm with PI)
- End of Rotation: Mar 15
- Reports, Evaluations (faculty & student) due 5 – 10 days after second rotation ends

Third Rotation

- Meet with Advisor to Discuss Preferences: Feb 27 – Mar 3
- Submit Preferences: By Mar 3
- Receive Assignment: By Mar 7
- Begin Rotation: Mar 16 (Confirm with PI)
- End of Rotation: May 31
- Reports, Evaluations (faculty & student) due 5 – 10 days after third rotation ends

Permanent Lab Selection

- Choose Advisor: Mid-May
- Begin Work in Permanent Lab: June 1 (or upon approval)

Note: Students are expected to be in residence during these periods, including university breaks. Follow the School of Medicine Graduate School calendar.

4. Choosing a Research Advisor

At the end of the first year, students will finalize their choice of a research advisor. Once approved, the assignment will be reviewed by the Program Director and Department Chair, and the student will be notified.

- No agreements with any advisor should be made before the final rotation period ends in May.
- If the advisor is affiliated with the Biochemistry and Biophysics Department or is a member of the BMB Program, the student is automatically approved for the Biochemistry Ph.D. Program.

- If the advisor is not affiliated with the department or program, the student must apply to a relevant Ph.D. program.
- If a student has not secured an advisor by the beginning of their second year (Sept 1), they may be asked to leave the program.

5. First-Year Assessment
At the conclusion of the first year, the Biochemistry Advisory Committee will evaluate student performance based on:

- Coursework
- Rotation performance
- Required assignments
- Seminar/meeting attendance

Unsatisfactory performance may result in dismissal from the program following a review by the committee.

E. Additional Requirements - Second Year

1. **Teaching Assistantship -** Each student will be required to act as a teaching assistant for one semester. Usually, this will be during the second year of studies. However, for those students for whom English is a second language, the teaching assistantship can be delayed until the third or fourth year. Students are welcome to request specific teaching assignments, and every effort will be made to accommodate such requests. Assignments will be made by the Biochemistry Program Director. All TAs will be given a written evaluation by the course director. This evaluation will be included in the student's file.
2. Choose **Thesis Advisory Committee** by September 30 of the second year (see details on page 9).
3. Present first **Student Seminar** (Spring semester), followed by a thesis committee meeting and complete Research Review form.
4. Continue Ph.D. research and preparation of **Qualifying Examination** proposal. **The qualifying exam must be completed by October 1 of the third year of graduate study.** A written Qualifying Examination proposal must be submitted at least 10 business days before the Qualifying Examination (copies for each member of the student's Advisory Committee and a copy for the department file).

F. Additional Requirements - Third and Succeeding Years

1. Ph.D. research and thesis preparation.
2. Yearly student seminar.
3. Yearly committee meeting and research review.

G. Final Examination (see VII)

II. STUDENT RESEARCH SEMINARS

Experience in organizing research data, interpretation of data, synthesis of information from diverse sources, and presentation to an audience of scientific colleagues

represents valuable preparation for a career in science, whether in an academic or industrial setting. Therefore, students will be required to present a yearly seminar in the student series beginning in their second year of studies. Thesis committee members should be advised of the scheduled student seminar as soon as the schedule is published (August). **The yearly committee meeting should be scheduled at the time of the seminar or within two weeks following the seminar.** Prior to this meeting, the student should provide the committee with a brief, written summary of progress, including aims, results, and immediate and longer-term plans.

All students will register for this seminar series each semester: BCH 501 (Fall) and BCH 502 (Spring). Credit will be awarded for presentation of a seminar in the series (once a year, beginning in the second year) and for attendance at 75% of the seminars in each semester (every year). If a student fails to attend 75% of the student seminars in a given semester, they will need to write a 750-word paper for every seminar below attendance

III. YEARLY PROGRESS REPORT AND RESEARCH REVIEW

A yearly progress report (Research Review form) must be submitted to the Senior Associate Dean for Graduate Studies by May 31 of each academic year. Students should plan to meet with their thesis advisory committee and file a Graduate Student Research Review form (see appendix) in the Education office during each academic year. In the first year of studies, the laboratory rotation evaluations will be used to fulfill this requirement (see D.1.).

The required yearly Research Review form must be completed by the student, and submitted to the committee members, at least two days before the annual student committee meeting (pages 1-3). The form will be sent to the student in an electronic format that will allow it to be typed and saved. The last (Section J, page 4, Committee Report) page of the form will be completed at the meeting. The entire completed form will then be approved by the committee members and the student and forwarded by the advisor to all of the committee members, the student and the Graduate Studies Coordinator (Marianne Arcoraci). The Graduate Studies Coordinator will then forward it to Graduate Education and the Program Director.

This annual meeting with the thesis advisory committee should normally be scheduled on the same day as the student's seminar. It is the students' responsibility to schedule committee meetings. Note that the student seminar schedule is published in August for the entire academic year and committee meetings should be scheduled at that time.

At the end of the annual thesis committee advisory meeting, the thesis advisor, and any non-voting committee members including, e.g., family members of the advisor, will leave the room to give the student an opportunity to meet privately with the remaining members of the thesis committee. This will give the student the opportunity to obtain mentoring from his or her committee in the absence of the advisor. The thesis committee members will be responsible for following up on any concerns raised by the student during this time. The graduate program director and the Chair of Biochemistry &

Biophysics will help to resolve concerns, and if needed, the University Intercessor will be called in to help.

A. Guidelines for Annual Student Committee Meeting and Research Review

1. The Annual Research Review form should be sent to student's committee members at least two days before annual student committee meeting (in electronic form). Visit the SMD Forms and Tools Website / Academic Support Section to download Annual Evaluation Form. [https://www.urmc.rochester.edu/education/graduate/current-students/forms.aspx - RegistrarForms]

2. The student committee meeting should be arranged in advance by the student (complete with a reserved room) and should ideally take place within two weeks after the date of the student seminar. Committee meetings often require up to 2 hours.

3. At the committee meeting, the student should be prepared to:

   a. summarize the thesis aims and the progress toward those aims

   b. discuss and expand on important points of the seminar, as needed

   c. discuss results on other aspects of your thesis work

   d. discuss, as necessary, the impact of research in other labs on the ongoing work

   e. present and discuss experiments planned in the next year in the context of the overall thesis plan

4. Committee meetings will be limited to faculty attendance only.

IV. THESIS ADVISORY COMMITTEE

Following selection of the research advisor, the student's thesis advisory committee is selected by September 30 of the second year. The thesis advisory committee performs several functions. It may help the student choose specific elective courses in preparation for the chosen field of research. It provides advisory input during the development of the thesis research project with respect to scientific merit, techniques and methodology, relevant literature, etc. It gives final approval of the specific program presented for the thesis topic to be developed and participates in the Qualifying Examination. Finally, it, along with a representative appointed by the Dean's Office, is the examining committee for the thesis defense. Committee members may also provide more complete guidance in the selection of final courses in preparation for research and assist the thesis advisor. By September 30 of the second year, the student and the research advisor must submit a list of

suggested committee members to the Graduate Studies Coordinator. The proposed thesis committee must be approved by the Program Director.

The thesis advisory committee must consist of the research advisor, one faculty member in the Biochemistry & Molecular Biology (BMB) program, one faculty member who belongs to the BMB program as well as the Department of Biochemistry and Biophysics (one of these faculty members may include the advisor), one faculty member from outside the BMB program AND Department and one additional faculty member who can be inside or outside. Joint appointees who have primary appointments in another department are considered outside members. An advisor who is not a primary member of the Department may not count as the outside member (he or she must be considered the 4th member of the committee). At least one member of the advisory committee should have trained a graduate student through completion of the Ph.D. Additional committee members may be included from either within or outside the University if it is considered useful or necessary. Thus, the minimum size of the committee will be four members, but five (or more) is quite possible. In the case of joint co-advisors, a minimum of five members may be required. Changes to the thesis committee must be pre-approved by the Program Director. To prevent potential conflicts of interests, spouses or immediate family of research advisors who are on the thesis advisory committee are non-voting members of the committee. In this case the thesis advisory committee should have an additional member.

V. QUALIFYING EXAMINATION

The purpose of the Qualifying Examination is to determine whether the student is qualified and competent to continue work toward a Ph.D. in Biochemistry. It is primarily a means of determining the potential of the student for independent thought, experimental acumen, comprehension of the general field, and potential for exploiting a relevant problem in a scientifically sound manner. Research productivity and potential is also a factor in passing the examination.

The examination will be administered by the student's thesis advisory committee, excluding the advisor and including one or more faculty assigned by the Graduate Advisory Committee or Program Director. The advisor may be present during the examination but will not be a voting member of the committee and will not participate in the exam unless consulted by the committee. Non-voting members of the committee may participate in the exam, but do not vote on the exam's outcome. A report written by the Graduate Advisory Committee representative will be submitted to the student and included in the file.

The examining procedure involves preparation by the student of a written Ph.D. thesis research proposal. Because a career in science will undoubtedly involve submission and defense of research projects (whether in an academic or industrial setting) we recommend using a modified NIH proposal outline as described below. **The qualifying exam must be completed by October 15 of the third year of graduate study.**

Students must have completed a minimum of 24 hours of course work credit, as outlined above, at the time of the Qualifying Exam. The Plan B Master's Degree will be awarded upon successful completion of this examination. If the examination is not passed, the exam committee may allow the student to take a second exam. The second exam must be taken after 5 months but no later than 6 months following the first exam.

Procedure:

1. Schedule Qualifying Examination with committee members and the faculty member appointed to the exam committee a minimum of 6 weeks prior to the exam.
2. At least 6 weeks prior to the exam, inform the program Coordinator of date/time of the exam, confirm committee members and schedule a room. At least 25 business days prior to the exam, submit title and abstract (30 lines of text maximum) online currently. The Graduate Studies Coordinator will complete paperwork and submit to the Registrar.
3. Submit a copy of the proposal a minimum of 10 business days before the exam to each committee member and the Graduate Studies Coordinator.
4. The annual Research Review form may be completed at the time of the Qualifying Exam. The form is available in the department office. Please return to Graduate Studies Coordinator.

A. Suggested Outline for Qualifying Examination Research Proposal

The proposal should not exceed 14 double spaced pages (type font set at Arial 11 with margins set to 0.5 inches on all sides). Page lengths are based on standard double-spaced pages. Include page numbers for sections 1-4 indicated (see below). A title and abstract page is required at the time of registration and does not count towards the page limit. A face page should be included with the title of your proposal, your name, the date of the oral exam, exam location (or Zoom link), and your Ph.D. advisor's name. The abstract should not be longer than 30 lines of text. The format and length of the proposal is like a pre-doctoral fellowship application, which you will be strongly encouraged to apply for.

The proposal should be the student's own work and should be in the student's own words; however, the student may consult with their advisor and colleagues for advice. Refreshments should not be provided by the student for the examination.

1. **Specific Aims:** State concisely and realistically what the research described in the proposal is intended to accomplish and/or what hypothesis is to be tested. Do not exceed two pages.

2. **Significance:** Briefly sketch the background to the proposal and critically evaluate existing knowledge. State concisely the importance of the research described in the proposal by relating the specific aims to longer term objectives. This section should be approximately 2-3 pages long.

3. **Preliminary Studies:** This section should summarize the work that has been done by the student and others to indicate that the proposal is realistic and significant in scope. Graphs, diagrams, tables, and charts relevant to this section can be included as "Appendix" material. Make sure to properly cite figures with legends, text or appendix material. This section should be approximately 2-3 pages long.

4. **Proposed Experiments:** Discuss in detail the experimental design and the procedures to be used to accomplish the specific aims of the work described in the proposal. Describe the protocols to be used and a tentative timetable for the investigation. Include how the data will be analyzed and interpreted. Describe new methodology and its advantage over existing methodology. Discuss the potential difficulties and limitations of the proposed procedures and alternative approaches to achieve the aims. Include information about species of animals to be used. There is no page limitation for this section but make every attempt to be concise. This section should be approximately 6-8 pages long.

5. **References:** Use a standard journal format (with titles, and a full list of authors, up to 10 authors). Note: The Reference section is not included in the page limit.

6. **Appendix:** Graphs, diagrams, tables, and charts, all with proper citations and legends, supporting the proposal should be included in this section. Note: The Appendix is not counted in the 14-page limit.

B. Qualifying Examination Format

The student is expected to present an overview of the thesis research proposal for the first 15-20 minutes using blackboard, slides or overhead projector. The committee will then examine the student orally. A typical examination will take between two and three hours. The candidate is judged on the written and oral presentation; a grasp of the fundamental issues; the ability to apply the background from formal course work to problems related to the proposal; and a demonstration of critical assessment of results. It is important to recognize that while the written proposal serves as a focus for the oral examination, questions about distantly related areas will be raised.

C. Results of Qualifying Exam

The Chair of the examining committee or the committee will discuss with the student the strengths and weaknesses of the qualifying exam performance and will inform the student of whether s/he has passed the examination. The Chair will also report whether the students has passed or failed to the Senior Associate Sean for Graduate

Studies of the Medical School and to the Graduate Studies Coordinator, who will inform the Director of Graduate Studies.

If the student passes pending modifications to the thesis proposal, s/he will be given 14 calendar days after the exam to make the necessary revisions.

If the student fails the examination, the student's performance will be reviewed for the BMB faculty, and a recommendation will be made to the Senior Associate Dean of Graduate Studies. The recommendation may be that the student must retake the qualifying examination or that s/he must leave the program.

VI. THESIS PREPARATION AND REGISTRATION

The student's thesis advisory committee must approve writing of the Ph.D. thesis at a formal committee meeting 4-6 months prior to the defense, at which time a Thesis Approval Form (see appendix) will be signed by all committee members to indicate their approval to begin writing the thesis.

The Chairperson Nomination for a PhD Defense form must be completed by the Principal Investigator and the student four months prior to the exam. The Principal Investigator must contact chair choices prior to submitting the form to the Graduate Studies Coordinator to assure the potential chair is willing and able to serve as chair. The Chairperson Nomination Form is available at the following link.
https://rochester.box.com/s/5ptqfw9rq6y8gyvq20mp2xe9rn1u9fw6 

The SMD Training Handbook Thesis Defense Page is a comprehensive guide, written specifically for SMD graduate students. The guide covers everything from before the defense, to the defense itself, to after the defense, providing information about the process, outlining requirements and offering useful tips and is available online at:
https://www.urmc.rochester.edu/education/graduate/trainee-handbook/academic-resources/thesis-defense.aspx]

In addition, the "*Guidelines for the Content of a Basic Science Ph.D. Thesis*" written by Dirk Bohmann and Eric Phizicky is available online at:
https://www.urmc.rochester.edu/medialibraries/urmcmedia/education/graduate/trainee-handbook/academic-resources/documents/smd-bs-thesis-guide-supplement.pdfs

It is the responsibility of the student to see that style, format, margins, paper, binding, etc. are in accordance with University regulations. The student should be aware that the Dean of Graduate Studies has a deadline each year by which time a thesis must be registered to allow graduation at the next Commencement. It will usually take at least three months to prepare the thesis after all experimental work is complete and the most common mistake is not allowing adequate time for preparation of illustrations, typing, review by the advisor and thesis advisory committee and for registration in the Graduate Dean's Office.

Registration with the office of the Dean of Graduate Studies must take place at least 10 business days before the final exam.[1] In preparation for registration, the student should begin the process by meeting with the Graduate Studies Coordinator when first discussing a defense date with the Ph.D. advisor and thesis advisory committee. The approval/paperwork process starts at least 6 months before registration with the following steps:

1. 4-6 months prior to the thesis defense, the student must obtain written approval from his/her committee members to start working on their thesis. The thesis defense approval form must be signed by all members of the committee at a committee meeting 4-6 months prior to a planned defense date and a research review form must be completed for this meeting. The thesis approval form and research review form can be obtained from the Graduate Studies Coordinator.
2. At least **4 to 6 months** before scheduling the defense, students must submit their **Committee Chairperson Nomination Form**, along with a **thesis title page** and **abstract**, to the **Graduate Studies Coordinator**.
3. Once a chair has been selected and approved, the student can move forward with selecting the date and time for his/her defense. Once a date/time is selected, they should immediately contact the Graduate Studies Coordinator so that room reservations can be secured, and a detailed email will be sent to the student to convey pertinent information. This must be at least 2 months prior to the defense to allow sufficient time to meet all deadlines as well as time to write and prepare for their defense. [2]
4. At least 2 months prior to the defense date the student should poll the thesis committee and defense chair to determine their preference for thesis format (hard copy or pdf).
5. At least 30 full business days prior to the defense, the student will need to provide the Graduate Studies Coordinator with the necessary information needed to create the SharePoint record.
6. At least 25 full business days prior to the defense, the student must provide the thesis to his/her thesis committee and defense chair to review in their preferred format. The version given at this time MUST be the same version given to the entire thesis committee and defense chair; no revisions can be made until after the thesis defense. The student will also need to meet with the Graduate Studies Coordinator to approve the SharePoint information and provide them with the required documentation.
7. At least 20 business days prior to the defense, the Graduate Studies Coordinator approves the SharePoint record, and the SharePoint approval emails are sent to the thesis committee.
8. At least 15 full business days prior to the defense the thesis committee and Program Director must approve of the thesis submitted for defense via the

[1] Registration deadlines vary. Please check in the Department Office for a schedule of dates for the academic year. Final exams may not be scheduled during specific blackout periods

[2] If the examination takes place during Fall or Spring semester, avoid scheduling the examination on a Tuesday, Wednesday or Friday afternoon.

SharePoint site (link provided in email sent from UnivGradStudies@UR.Rochester.edu).

9. At least 10 full business days must elapse between the registration date and the actual date of defense.
10. The school allows 60 calendar days after the defense date for submission of the final copy of the thesis via ProQuest. However, defenses schedules later in the semester will be subject to a deadline date that may be shorter than 60 days. Please consult the academic calendar for these deadline dates.

Please note that a "Summary or Conclusion" section must be included in the thesis. The information is in the "Preparation of a Thesis" manual.

VII. FINAL EXAMINATION AND TERMINATION

The format of the Final Examination for the Ph.D. is as follows. The first hour of the exam is a formal seminar open to the public. The student's presentation should last 50 minutes, and 10 minutes are allowed at the conclusion for questions from the audience. Notes, slides, charts, and the usual visual aids for a seminar are permitted. Students must bring a copy of the thesis to the examination. The student and the Examining Committee will then adjourn to a private session where the second part of the exam will be conducted. Using oral interrogation, the committee will scrutinize the student's comprehension, execution, description and interpretation of the research described in the thesis. The student is encouraged to bring a copy of their thesis to the defense for their own reference.

After successful completion of the Final Examination and after making any required corrections in the thesis, the student must electronically submit a corrected copy of the thesis via SharePoint. The student is also expected to complete the UR Research Authorization form, provide the Graduate Studies Coordinator with an updated post defense Curriculum Vitae (C.V.), one tape bound copy of the final thesis needs to be submitted to the Department office and an electronic version of the Department Termination Form must be emailed to the Graduate Studies Coordinator. Students are required to turn in their lab key(s) and student ID on their termination date to the Department office.

The termination date will determine when the stipend payment ceases. The student should discuss this with his/her advisor and share this information with the Graduate Studies Coordinator.

VIII. CONCENTRATIONS

Students in the PhD program in Biochemistry can elect for the **Cancer Biology** or **Bioinformatics** concentration. These concentrations reflect areas of strong interest for our faculty and students, and areas where enhanced skills and expertise will serve our students in their future career paths.

The **Cancer Biology** concentration will add coursework in clinical and translational cancer biology to our existing course on the molecular and cell biology of cancer. Students will also participate in an ongoing seminar series for exposure to the most cutting-edge scientific advances.

The **Bioinformatics** concentration will focus on biology and medically related informatics work most appropriate to trainees in various aspects of Biochemistry. As with the Cancer Biology concentration, the concentration in Bioinformatics will require students to take to course covering the analysis of biomedical "big data" as well as a seminar series focused on recent advances in the field. One of these courses will involve computational approaches to large data sets, whereas the second will involve statistical analysis. As indicated in the curriculum, there will be some leeway in the courses allowed to enable students to tailor the course selection to the types of statistical problems and computational approaches most applicable to their research projects.

Students interested in concentrations should meet with the Graduate Studies Coordinator to assure that the appropriate courses are being taken.

CONCENTRATION CURRICULUM

Existing Concentration: Biochemistry & Molecular Biology		**Proposed Concentration in Cancer Biology**		**Proposed Concentration in Bioinformatics**	
First Year	**Credits**		**Credits**		**Credits**
BCH412 Advanced Topics in Biological Macromolecules	5	Same for Biochemistry & Molecular Biology		Same for Biochemistry & Molecular Biology	
BCH501 Biochemistry Fall Seminar	1				
BCH502 Biochemistry Spring Seminar	1				
IND408 Advanced Biochemistry	4				
IND431 Foundations in Modern Biology I, Modules 1-5	5				
IND432 Foundations in Modern Biology II, Modules 1-5	5				
IND501 Ethics in Research	1				
Second Year					
Choice of 1-2 electives made in consultation with thesis mentor and program director	4	PTH507 Cancer Biology	3	Choose 1 of the following: BCH521 Bioinformatics for Life Scientists, IND419, Introduction to Quantitative Biology, or BIO457 Applied genomics	3-4 credits depending on class
BCH501 Biochemistry Fall Seminar	1	IND517 Clinical and Translational Oncology	2	Choose 1 of the following: DSC462 Computational Introduction to statistics, BST457 Applied Statistics in the Biomedical Sciences, BST 432 High Dimensional Data Analysis, BST 434 Genomic Data Analysis,	3-4 credits depending on class
BCH502 Biochemistry Spring Seminar	1	IND507 Cancer Biology Seminar	4	IND484 Current Topics in Bioinformatics	4
BCH595 PhD Research	68+		68+		68+
Total:	**96 credit hours or more in total**				

IX. M.D./Ph.D. PROGRAM IN BIOCHEMISTRY

M.D./Ph.D. program students usually enter the Ph.D. portion of their combined degree work after the basic science years of the M.D. curriculum. During the second year of the M.D. program students should discuss the Ph.D. Program with prospective faculty advisors and the Biochemistry Program Director. It is optimal for the student to complete two research rotations before choosing a permanent advisor.

M.D./Ph. D CURRICULUM

1) All of the following courses are required:

BCH 412 (5)	Advanced Topics in Biological Macromolecules	Spring
IND 408 (4)	Advanced Biochemistry	Fall
IND 501 (1)	Ethics in Research	Fall
BCH 501, 502 (1)	Biochemistry Seminar*	(each semester)
BCH 595	Ph.D. Research	(each semester)

*Includes yearly presentation

2) Additional requirement

An (advisor and program director) approved alternative elective

NOTE: M.D. Ph.D. students are granted 30 credits toward the 90-credit hour requirement for the Ph.D. on the basis of their basic sciences curriculum.

OTHER M.D./Ph.D. REQUIREMENTS

No Teaching Assistantship is required.

The Qualifying Examination is required at the end of the second year of Ph.D. studies, to be completed by October 1 of the third year of graduate study.

Thesis preparation and defense.

X. M.S. (Plan "A") PROGRAM IN BIOCHEMISTRY

A "Plan A" (terminal) M.S. degree is offered by the Biochemistry Program, subject to approval by the Graduate Studies Director.

No financial resources are provided by the Biochemistry M.S. Program for either tuition or stipend costs, so that these obligations must be borne by the candidate, alone or in conjunction with funds provided at the discretion of the advisor from the sponsoring

advisor's budget. Any monetary compensation to M.S. candidates from the sponsoring advisor will be limited to the current stipend for Ph.D. candidates.

Admission to the M.S. program will not be approved unless a letter from the faculty research sponsor is included with the University application forms. This letter must indicate the nature of the research project or area agreed upon and should state that the faculty member is intending to provide the required advisory input as well as laboratory space, supplies, and equipment necessary to pursue the project.

At least one year (two semesters) of full-time enrollment or 2 years (four semesters) of part-time enrollment is required (the equivalent of two years of full-time study is usual).[3] In the first year, course work requirements are fulfilled (30 hours) with initiation of the research project. The second year is spent in research activity leading to submission of the M.S. Thesis.

Five courses are specifically required:

IND 408 (4 credits)	Advanced Biochemistry
IND 431 (5)	Foundations in Modern Biology I
IND 432 (5)	Foundations in Modern Biology II
IND 501 (1)	Ethics in Research
BCH 412 (5)	Advanced Topics in Biological Macromolecules

The program requires a minimum of 1 additional specific or elective course, totaling 3 credits or more. M.S. candidates are expected to attend the Biochemistry Student Seminars (BCH 501-502). The remaining credits required to meet the 30 credit hours needed for the M.S. degree will consist of credits from student seminar and research credit. Up to 10 hours of course work may be taken prior to formal admission (matriculation) into the program.

In the "Plan A" M.S. program, a research thesis must be developed from an independent research project accomplished under the supervision of a faculty member in the Department of Biochemistry. Format and preparation should follow guidelines set forth in the "The Preparation of Doctoral Theses" booklet available in the Department Office.

A Thesis Advisory committee is required for M.S. candidates as described in Section V. The Committee serves a similar purpose to that described for Ph.D. candidates.

The Final Examination is administered by the Thesis Advisory Committee following presentation of the completed thesis. For M.S. candidates, the chairman of the Examining Committee is appointed by the Graduate Studies Director.

[3] Please note that although the Graduate Studies Official Bulletin stipulates one year of full-time enrollment, special requests for part-time study will be considered.

XI. GRADUATE STUDENT EXPECTATIONS

PhD students are responsible for working toward completion of their degree programs in a timely manner and are responsible for the following aspects of their programmatic training.

- **Academics:** To learn the existing theories, practices, and research methods of Biochemistry & Molecular Biology and to apply these in your research and teaching.
- **Thesis:** To discover and pursue a unique topic of research in order to construct new knowledge and to substantially contribute to your field of study.
- **Communication:** To communicate regularly with faculty advisor and thesis advisory committee members, providing them with updates on your progress within the program and on results of research activities. You should always adhere to the highest professional standards in communication with colleagues and co-workers.
- **Integrity and ethics:** To assume the highest integrity and maintain ethical standards in all aspects of your work, especially in the tasks of collecting, analyzing, and presenting research data. Special care should be taken to follow guidelines established by the University's independent review boards for research, such as the Institutional Biosafety Committee, (IBC) and the University Committee on Animal Resources (UCAR)
- **Laboratory notebooks:** To maintain detailed, organized, and accurate laboratory notebooks and records, including electronic records. Please note that when a student leaves a lab, the notebook, electronic records, and all research data remain the property of the University and are a valuable resource for the laboratory, and so must be organized and accessible.
- **Teaching:** To diligently participate in teaching as required for the degree, and as an opportunity to enhance your effectiveness as an instructor and to further the educational goals of the students being taught.
- **Scientific Community:** To contribute, wherever possible, to the scholarly discourse of the discipline through presentations, publications, and professional engagement and service. The student should attend and participate in appropriate meetings, colloquia, seminars, and group discussions that are part of the educational program, and the student should submit all relevant research results that are ready for publication in a timely manner.
- **Work environment:** To help maintain a clean and safe work environment, including but not limited to office space, laboratory spaces, and common spaces.
- **Mentors:** To actively seek out a range of faculty, professional, and peer mentors who can help prepare you for professional and career roles and responsibilities, and to serve as a mentor to others when appropriate.
- **Collegiality:** To promote collegiality and a welcoming environment in the classroom and laboratories and in all aspects of your academic program, ensuring that all students, faculty, and staff are treated with respect.
- **Familiarity with policies:** To take responsibility for keeping informed of, and complying with, regulations and policies, including those stated in the BMB Program Handbook, and to complete all required paperwork and other degree obligations in a timely fashion.
- **Effort:** To devote full time and effort toward completing degree requirements. The New York State Education Department (NYSED) requires 3 hours of research/instruction/

assignments per credit hour per week, equating to 45 hours per week for a typical 15 credit hour load.

X. GENERAL POLICY

A. **Office Space**: The Department of Biochemistry and Biophysics provides office space for students with computer access. Once a research advisor has been chosen, the student will usually be given a desk in the advisor's laboratory

B. **Vacations / Holidays**

Graduate students are supported by fellowships or research grants from various internal and external sources, each with specific regulations regarding vacations. Generally, fellows and trainees are expected to engage in full-time study and are entitled to the following official University Holidays:

- New Year's Day
- Memorial Day
- July 4th
- Labor Day
- Thanksgiving Day and the Friday after
- Christmas Day

The School of Medicine also allows for a **2-week vacation period** per year, in addition to these holidays. **Semester breaks are not considered holidays**, and any absences during these periods require prior approval.

All absences, including vacations, must be communicated to your advisor and approved by both the advisor and the Graduate Studies Coordinator (Marianne Arcoraci) at least one month in advance.

C. **International students** must adhere to the policies of the International Student's Office. **Stipends will not be paid** for unauthorized absences.

D. **Dismissal Procedure**: In the event of chronic poor performance, behavior, and/or attendance, a student may be subject to dismissal from the laboratory by his/her advisor, subject to the approval of the Program Directors and the Chair of the Department of Biochemistry and Biophysics. The Advisory Committee, in consultation with the student's committee and Department of Biochemistry and Biophysics Chair, will then determine if the student will be allowed to remain in the program. In that case, the student may rotate in one or more labs for up to 3 months to find a permanent advisor.

E. **Switching Labs**:

- On rare occasions, students may wish to discontinue their research with a chosen permanent advisor and begin thesis research in a different laboratory. Such a change should be considered only as a last resort, as it often results in a significant extension of time needed to complete the Ph.D. However, if a student finds the situation untenable and wishes to switch labs, the following steps must be taken:

- The change must be approved by the **Graduate Advisory Committee**, the **Department Chair**, and the **Senior Associate Dean**.
- Once approved, the student may rotate in one or more labs for up to **three months** to identify a new permanent advisor.
- If a new advisor is not identified by the end of this period, the case will be reviewed by the **Graduate Advisory Committee**, and the student may be asked to leave the program.

F. **Emergency or Temporary Closings and Other Changes in Class Schedules and University Operations:** The University plans to commence and conclude classes on the dates indicated in the academic calendars. But unforeseen circumstances or events may occur that require the University to temporarily close or otherwise adjust its student life, residential housing, class schedules and format, method and location of instruction, educational activities, and operations because of reasons beyond the University's control. For example, such circumstances or events may include but are not limited to inclement weather, the onset of public health crises, being subject to government order(s), significant safety or security concerns, faculty illness, strikes, labor disturbances, sabotage, terrorism, war, riot, civil unrest, fire, flood, earthquake, acts of God, malfunction of University equipment (including computers), cyberattacks, unavailability of particular University facilities occasioned by damage to the premises, repairs or other causes, as well as disruption/unavailability of utilities, labor, energy, materials, transportation, electricity, security, or the internet. If any of these or other unforeseen circumstances or events outside of the University's control occur, the University will respond as necessary and appropriate, and it assumes no liability for any interruption or adjustments made to student life, residential housing, class schedules and format, method and location of instruction, educational activities, and operations caused by these or other unforeseen circumstances or events. And the University shall not be responsible for the refund of any tuition or fees in the event of any such unforeseen circumstances or events, except as may otherwise be expressly provided in the University's Leave of Absence and Withdrawal Policy or its published tuition refund schedule available online at: [https://www.rochester.edu/adminfinance/bursar/payments-and-refunds/payments-and-refunds/]

G. **Change of Address:** Be sure to report any changes in address as they occur in:
   - UR Student / Workday: https://tech.rochester.edu/wp-content/uploads/QRC-How-to-Update-an-Address-in-UR-Student-Final.pdf
   - SMD Office of Graduate Education and Postdoctoral Affairs (GEPA) Address Change Form: https://uidp-prod.its.rochester.edu/idp/profile/SAML2/Redirect/SSO?execution=e1s2

- Department of Biochemistry & Biophysics: send email with updates to the graduate coordinator Marianne Arcoraci (marianne_arcoraci@URMC.rochester.edu)
- International students should contact the International Services Office (ISO) and the Federal Government with address changes. Visit International Services Office Website for more information: https://www.rochester.edu/iso/ /.

APPENDIX

2024-25 School of Medicine and Dentistry Academic Calendar

Department of Biochemistry and Biophysics Faculty

BMB Electives Course Descriptions

Forms:

- Research Rotation Evaluation
- Annual Ph.D. Student Evaluation Report
- Rubric
- Thesis Approval Form
- Chair Nomination Form

Guidelines for the Content of a Basic Science Ph.D. Thesis

University of Rochester

2024-2025 Academic Calendar

(School of Medicine and Dentistry – Graduate Programs)

Fall 2024	
August 26 (Monday)	Classes Begin
September 2	Labor Day (No Classes)
September 9	Last day to add/drop courses in *without* permission from course director
September 23	Last day to add/drop courses with permission from the course director and last day to request courses be changed to an audit status
September 24	First day to Withdraw ("W") from a course
October 14 - 15	University Fall Break (**NOT** a break for Graduate Students)
November 11	Last day to Withdraw ("W") from a course
November 27 - December 1	Thanksgiving Recess
December 2	Classes Resume
December 9	Last Day of Class
December 10 - 12	Reading Days
December 13 - 18	Final Exams
December 27	Final Grades Due
Spring 2025	
January 21 (Tuesday)	Classes Begin
January 24 (Friday)	Rochester "Monday" – all students attend Monday classes
February 3	Last day to add/drop courses in *without* permission from course director
February 17	Last day to add/drop courses with permission from the course director and last day to request courses be changed to an audit status
February 18	First day to "W" from a course
April 14	Last day to Withdraw ("W") from a course
March 8 - 16	University Spring Break (**NOT** a break for Graduate Students)
May 2	Last Day of Class
May 3 - 5	Reading Days
May 6 - 11	Final Exams
May 15 (Thursday)	Final Grades Due
May 16 - 18	Commencement Weekend
Summer 2025	
May 19 – August 1	Full Summer Session
May 26 (Monday)	Memorial Day Observed (No Classes)
June 19 (Thursday)	Juneteenth Observed (No Classes)
July 4 (Friday)	Independence Day Observed (No Classes)

Created: March 2024

Biochemistry and Molecular Biology (BMB) Affiliated Faculty

	Faculty	Interests
	**Brian Altman, Ph.D.** Assistant Professor, Biomedical Genetics	Role of circadian rhythm in gene regulation and cancer cell biology and metabolism
	**Douglas Anderson, PhD.** Assistant Professor, Department of Medicine, Aab Cardiovascular Research Institute	LncRNA control of heart development and disease; Discovery and function of micropeptides encoded by putative lncRNAs; Genome-editing by RNA-guided nucleases.
	**Xin Bi, Ph.D.** Professor, Biology	Chromatin-mediated regulation of gene expression in eukaryotes
	**Paul Boutz, Ph.D.** Assistant Professor, Biochemistry & Biophysics	Regulation of pre-mRNA splicing and polyadenylation in healthy and diseased states; the contribution of RNA processing to cancer biology; effects of small molecule drugs on RNA processing and gene expression.
	**Paul Brookes, Ph.D.** Professor, Anesthesiology	Cardioprotection against ischemia-reperfusion (IR) injury. Role of Mitochondria and metabolism in ischemic preconditioning and anesthetic preconditioning
	**Michael Bulger, Ph.D.** Associate Professor, Pediatrics	Chromatin domains and long-range activation by enhancers
	**Gloria Culver, Ph.D.** Professor, Biology	Assembly of the *E. coli* 30S ribosomal subunit, which is essential for cellular growth, so as to understand how infections might be controlled through selective inhibition of specific assembly control points
	**Ian Dickerson, Ph.D.** Associate Professor, Neuroscience	Molecular mechanisms of neuropeptide signal transduction
	**Mark Dumont, Ph.D.** Professor, Biochemistry & Biophysics	Signal transduction; membrane protein structure, yeast molecular biology

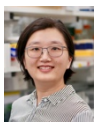
Biochemistry and Molecular Biology (BMB) Affiliated Faculty

	Faculty	Interests
	**Dmitri Ermolenko, Ph.D.** Professor, Biochemistry & Biophysics	Structural dynamics of the ribosome and ribosomal ligands during proteins synthesis, regulation of protein synthesis by mRNA structure in normal and diseased cells, and mechanisms of antibiotic action
	**Sina Ghaemmaghami, Ph.D.** Professor, Biology	Molecular mechanisms of prion propagation and pathogenesis
	**Vera Gorbunova, Ph.D.** Professor, Biology	Mechanisms of aging and the role of DNA repair and genomic instability in the aging process
	**Elizabeth Grayhack, Ph.D.** Associate Professor, Biochemistry & Biophysics	Role of the genetic code in regulating protein synthesis and mRNA metabolism in *Saccharomyces cerevisiae*
	**Alan Grossfield, Ph.D.** Associate Professor, Biochemistry & Biophysics	Investigating membranes and membrane proteins via computer simulation
	**Isaac Harris, Ph.D.** Assistant Professor, Biomedical Genetics	Understanding the roles of antioxidants in cancer
	**Jeffrey Hayes, Ph.D.** Professor & Chair, Biochemistry & Biophysics	Regulation of transcription, nuclear processes, related to chromatin structure and function
	**Clara Kielkopf, Ph.D.** Professor, Biochemistry & Biophysics	Splicing defects in hematologic malignancies; roles of human pre-mRNA splicing factors in HIV-1 infectivity; development of engineered splicing factors for correction of splicing defects; splice sites and their associated proteins as therapeutic targets
	**Hartmut Land, Ph.D.** Professor & Chair, Biomedical Genetics	Molecular mechanisms of carcinogenesis. Signaling and Cancer Cell Metabolism

Biochemistry and Molecular Biology (BMB) Affiliated Faculty

	Faculty	Interests
	**John Lueck, Ph.D.** Associate Professor, Pharmacology & Physiology	Determining the therapeutic promise of engineered tRNAs for treatment of nonsense associated diseases and investigating the pathomechanisms of skeletal muscle weakness and wasting in myotonic dystrophy
	**Lynne Maquat, Ph.D.** Professor, Biochemistry & Biophysics	RNA metabolism in human cells (nonsense-mediated mRNA decay/mRNA surveillance); influence of pre-mRNA splicing on mRNA translation; Staufen-mediated mRNA decay and Staufen-regulated RNA metabolism; post-transcriptional gene control via lncRNAs and SINEs; miRNA metabolism; Fragile X Mental Retardation Syndrome/Autism; therapeutics of nonsense diseases
	**David Mathews, M.D., Ph.D.** Professor, Biochemistry & Biophysics	Computational biology of RNA, including structure prediction, molecular dynamics, and genomics
	**Margot Mayer-Pröschel, Ph.D.** Professor, Biomedical Genetics	Identification of different stem and precursor cell pools in CNS that may be critical for cell replacement therapies or are targets of insults that lead to developmental pathologies
	**Stephano Mello, Ph.D.** Assistant Professor, Biomedical Genetics	Understanding how nuclear proteins and non-coding RNAs (ncRNAs) regulate gene transcription in pancreatic preneoplastic lesions, gaining knowledge of the process of cellular transformation and tumor initiation
	**Anne Meyer, Ph.D.** Associate Professor, Biology	Bacterial stress response; 3D Printing of Bacteria; Biomaterials
	**Benjamin Miller, Ph.D.** Professor, Dermatology	Carbohydrate and protein recognition, molecular design, and biomolecular sensing
	**Joshua Munger, Ph.D.** Professor, Biochemistry & Biophysics	Mechanisms of metabolic network manipulation induced by viral infection and oncogenic mutation.
	**Mitchell O'Connell, Ph.D.** Associate Professor, Biochemistry & Biophysics	Biochemical mechanisms of RNA-mediated gene regulation; RNA-targeting CRISPR tool development

Biochemistry and Molecular Biology (BMB) Affiliated Faculty

	Faculty	Interests
	**Eric Phizicky, Ph.D.** Professor, Biochemistry & Biophysics	tRNA biogenesis, function and quality control; intellectual disability due to deficiencies in tRNA modifications
	**Marlies Rossmann, M.D., Ph.D.** Assistant Professor, Biomedical Genetics	The role of metabolism in lineage differentiation
	**Elaine Sia, Ph.D.** Professor, Biology & Associate Dean of Academic Affairs	Mutagenesis and repair of the mitochondrial genome.
	**Laurie Steiner, M.D.** Professor, Pediatrics Medicine	Utilizes genomics techniques to study the molecular mechanisms underlying erythroid maturation and development in both normal and disease states
	**Paula Vertino, Ph.D.** Professor, Biomedical Genetics	Cancer epigenetics: the role of DNA methylation and chromatin in driving cancer phenotypes and as a target for therapeutic intervention
	**Eric Wagner, Ph.D.** Professor, Biochemistry & Biophysics	Mechanism and physiological importance of alternative polyadenylation; Integrator Complex and transcriptional control, development and application of next-generation sequencing technologies
	**Ning Wang, Ph.D.** Assistant Professor, Biology	Cell biology, biochemistry, and molecular genetics; Organelle biogenesis; Organelle degradation through selective autophagy; Organelle aging and neurodegeneration; Cellular stress response
	**Joseph Wedekind, Ph.D.** Professor, Biochemistry & Biophysics	Structure and function analysis of gene regulation by non-protein-coding (nc)RNAs as a basis for therapeutic development
	**Peng Yao, Ph.D.** Associate Professor, Medicine	Pathophysiological function and molecular mechanism of new non-coding RNAs (and RBPs) and new modes of gene regulation in cardiac system and cardiovascular disease
	**Yi-Tao Yu, Ph.D.** Professor, Biochemistry & Biophysics	RNA modification; pre-mRNA splicing; snRNP biogenesis; telomerase RNA modification and aging; nonsense-disease therapeutics.

BMB Elective Courses

Fall 2024

BCH 515 CRITICAL THINKING IN RESEARCH SCIENCE (1)

Students present a history of experimental work leading to their research project. This includes a selection of published and unpublished work from their advisor's lab and other labs in the same field, providing a rationale for the project. Students conclude with a report of their published and preliminary data. Focus will be on interpreting experimental data and engaging student interactions.

BCH 517 TOPICS IN CELLULAR, BIOCHEMICAL AND MOLECULAR SCIENCE (1)

Students attend presentations in the Department of Biochemistry and Biophysics Seminar Series. Instructors and students select speakers and read 2-3 publications (suggested by the speaker) in depth. Students present these papers to the class, instructors and the speaker's faculty host in a journal club setting prior to the speaker's arrival. Finally, students attend a post-seminar class with the selected speaker.

BCH 521 BIOINFORMATICS FOR LIFE SCIENTISTS (4)

This course will teach scripting in Python and also algorithm design for bioinformatics. It expects no prior knowledge in programming. The class will meet twice a week – once for a traditional lecture and once for a laboratory session.

BCH 570 MULTILAYERED CONTROL OF GENE EXPRESSION

We will meet once per week (1.5 hours/session) for this literature-based course meeting, where students read and discuss research papers describing how, in higher eukaryotes, gene expression is shaped by multiple and often interconnected layers of regulation. The instructor has selected recent research papers that illustrate how given regulators may influence different steps of gene expression and how these steps cooperate to robustly control gene expression. The purpose of this course is to familiarize students with current models of gene expression and with contemporary research methodologies through student-led discussions of publications in the field.

This is an advanced biochemistry course intended for senior undergraduate and graduate students. Students are expected to read the papers before class and participate in the classroom discussion

BIO 422 BIOLOGY OF AGING (4)

This course focuses on molecular mechanisms of aging. We will discuss popular theories of aging, model organisms used in aging research, evolution of aging, relation between aging and cancer, human progeroid syndromes, and interventions to slow aging.

BIO 426 DEVELOPMENTAL BIOLOGY (4)

This course deals with the cellular and molecular aspects of animal development, with emphasis on processes and underlying mechanisms. Topics include embryonic cleavage, gastrulation, early

development of model vertebrates and invertebrates, patterning of cell fates along embryonic axes of Drosophila and vertebrates, organogenesis and stem cells.

CHM 411 INORGANIC CHEMISTRY I (4)

This course covers bonding in inorganic molecules, molecular symmetry, an introduction to solid-state chemistry, coordination chemistry and the properties of transition metal complexes. Two 75 minute lectures per week, 7 workshops, 6 problem sets, three midterm examinations and a final examination.

CHM 415 GROUP THEORY (2)

Development of symmetry and group theory concepts and scope of applications to chemical problems. Applications include molecular orbital theory, ligand field theory and spectroscopy. (Fall, 1st half of semester.)

mechanism of therapeutic action in prevention of carcinogenesis. Lectures from leading clinician-scientists will provide insight for cancer treatment with goals of understanding the human impact of the disease and identifying common themes, as well as distinctive characteristics of cancer.

Spring 2025

BIO 415 MOLECULAR BIOLOGY OF CELL SIGNALLING (4)

This course offers an introduction to cell signaling. We will explore basic molecular mechanisms of signal transduction, and study how these mechanisms are used in different contexts to direct cell fate during development, physiology and disease. The course will draw heavily on experiments from the classic and most recent primary literature.

BIO 453 COMPUTATIONAL BIOLOGY (4)

An introduction to the history, theory, and practice of using computers to conduct biological research. Topics include the fundamentals of Linux-based computing and perl programming, accessing and storing biological data, alignment of molecular sequences, and computer-based analysis of data.

BPH 411 METHODS IN STRUCTURAL BIOLOGY (2)

An introduction to the theory and practical application of several major techniques used in the structural characterization of biological macromolecules. These methods include: X-ray crystallography, Small Angle X-ray Scattering, Spectroscopic and Calorimetric Techniques, NMR and Comparative Modeling. The goal is to enable non-specialists to become conversant in the language and principles of the field, as well as to understand the strengths and limitations of various techniques. This course is a prerequisite to the literature-based course BPH592, “Advanced Topics in Biomolecular Diffraction and Scattering”. Non-majors should also consider BCH 412 “Advanced Topics in Biological Macromolecules”. Offered for the first half of the Spring semester.

BPH 509 MOLECULAR PHYSICS (2)

This course is designed to show how physical concepts and techniques are used to explore and understand biological phenomena. A major portion of the term focuses on thermo- dynamics of biological molecules and systems; the remainder covers the structure and physical properties of biological membranes and transport. Students are expected to have had basic courses in physics, chemistry, and biology, with an in-depth background in at least one of these areas. Offered for the second half of the Spring semester.

CHM 440 BIO ORGANIC CHEMISTRY (4)

(Formerly CHM 437) An introduction to bioorganic chemistry and chemical biology. The course will present a survey of how the principles of organic chemistry have been applied to understand and exploit biological phenomena and address fundamental questions in life sciences. The course is primarily based upon the primary literature. Covered topics include the design and mechanism of enzyme mimics and

small molecule catalysts (organocatalysts), synthesis and chemical modification of biomolecules (oligonucleotides, proteins, and oligosaccharides), design and application of oligonucleotide and peptide mimetics, and chemical approaches to proteomic and genetic analyses. Not open to freshmen and sophomores.

GEN 507 ADVANCED GENETICS AND GENOMICS (4)

This course offers in-depth discussions of theoretical concepts and experimental strategies in genetics and genomics. Lectures will cover genetically tractable model organisms, including yeast, Drosophila, Caenorhabditis elegans (a nematode), mouse, and human and their analyses from gene to genome and systems level. Examples of the particular questions that can be addressed with advantage in each genetic model will be presented, and the special genetic approaches feasible in these respective systems will be emphasized. The course builds upon a strong prior background in Mendelian and molecular genetics. Topics covered include the genetic basis of pattern formation, cell-fate determination, control of cell function, structure-function relationships in macromolecules, and searching for genes important in human health. Additional topics incorporated recently into the course include genome structure & evolution, small RNAs & mobile genetic elements, epigenetics and genomics, proteomics, and other studies at the whole genome level.

IND 419 Introduction to Quantitative Biology (3)

This is a graduate-level survey course that introduces concepts for the analysis of high volume biological data in the context of important current biological questions. No previous computational experience is required. Course Aims and Objectives: At the end of this course, students should have a deeper understanding of the computational tools involved in the analysis of high volume biological data, focusing on web-based resources but also introducing core approaches in bioinformatics. As an advanced-level course, we will emphasize critical thinking and reading of the primary literature to understand original experiments, rather than abstract facts and memorization. Students' knowledge, understanding and ability to formulate new ideas will be evaluated through homework and discussions.

IND 443 EUKARYOTIC GENE REGULATIONS (4)

This advanced course examines mechanisms of chromatin-mediated regulation of gene expression, relating molecular structures, dynamic interactions, nuclear processes, 3-D nuclear organization to biological functions. Topics include DNA structures, packaging and higher order chromatin organization in the nucleus, the transcription machinery, eukaryotic chromosome structure and its modifications, epigenetics and functional genomics, dynamics of nuclear processes, nuclear reprogramming, development and applications of genome manipulation technology. Lectures and readings draw heavily on primary literature both classic and most recent.

IND 447 SIGNAL TRANSDUCTION (4)

Cellular signal transduction is one of the most widely studied topics in the biomedical sciences. Cells have multiple mechanisms for sensing the environment and converting the external signals into intracellular responses that are important for regulation of human physiology. Dysregulation of these processes can result in disease and manipulations of these pathways are the basis for many therapeutics.

MBI 421 MICROBIAL GENETICS (3)

This course provides an in-depth examination of representative genetic systems in bacteria and bacterial viruses. Emphasis is placed on the methods of genetic analysis used to study biological function. The material covered includes: the nature of bacterial variation, processes affecting gene synthesis and integrity, the nature of gene transfer in bacteria, the regulation of gene expression in prokaryotes and genomic approaches to the study of microbial genetics. (Graduate students register for MBI 521 Seminar).

MBI 456 GENERAL VIROLOGY (4)

Provides an introduction to animal virology, with emphasis on human disease. Topics covered include the following: general properties of viruses, methods in viral research, virus structure, biochemistry of virus replication, virus- host cell interactions, pathogenesis, HIV/AIDS, emerging infections, vaccines, antivirals, and viral vectors and gene therapy. Three exams.

PHP 404 PRINCIPLES OF PHARMACOLOGY (4)

Pharmacology is one of the vital disciplines in biomedical sciences. It employs the multidisciplinary knowledge in biochemistry, cell biology, chemistry, genetics, neuroscience, pathology, physiology, toxicology, and clinical medicine, to elucidate the mechanisms of action of drugs in treating human diseases. This course represents a collective endeavor of our faculty to the teaching of graduate and senior undergraduate students in UR. It focuses on the fundamental principles of pharmacology, neuropharmacology, cardiovascular pharmacology, and contemporary approaches to drug discovery and design.

Rotation Evaluation Form (Faculty)

Please complete this form ***electronically*** and submit to the office of Graduate Education and Postdoctoral Affairs by the due date at the end of the form.

Student Name: Enter text. URID: Enter text.

Mentor Name: Enter text.

Program Name: Choose program MD/PhD Student? Choose an item.

Evaluation Date: MM/DD/YYYY Rotation Start Date: MM/DD/YYYY Rotation End Date: MM/DD/YYYY

Extent of your personal involvement in training: Choose an item. Recommended Grade: Choose an item.

Did the student meet rotation research report requirements via oral or written presentation? Choose an item.

Evaluation	Unacceptable	Needs Improvement	Meets Expectations	Exceeds Expectation
Ability to design experiments	☐	☐	☐	☐
Bench work (may not apply)	☐	☐	☐	☐
Analytical skills	☐	☐	☐	☐
Work ethic	☐	☐	☐	☐
Lab/research meeting participation	☐	☐	☐	☐
Background knowledge	☐	☐	☐	☐
Notebook	☐	☐	☐	☐
Attendance (in the lab or otherwise)	☐	☐	☐	☐
Attitude and intellectual involvement	☐	☐	☐	☐
Grasp of new concepts/self-sufficiency	☐	☐	☐	☐
Overall evaluation	☐	☐	☐	☐

Project Title/Description:

Enter text.

Faculty evaluation of student's strengths and weaknesses:

Comment on the student's strengths and weaknesses. In addition, comment on the quality of the student's written report (if one was required):

Enter text.

I have *HONESTLY* discussed with the student his/her performance during this rotation and provided constructive criticism. Choose an item.

Instructions for Evaluation Submission to the Graduate Education and Postdoctoral Affairs Office

The Lab Mentor completes the evaluation and emails the final document to the Graduate Program Coordinator and the Graduate Program Director by the appropriate due date below. The Graduate Program Coordinator will forward the document via email to:

- SMDGradEval@urmc.rochester.edu
- Student

Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that all pertinent parties are in agreement. Thus, the email represents each party's signature and will be kept with the evaluation in the student file.

The form is due to the Graduate Education and Postdoctoral Affairs office on one of the following dates:

Rotation Begins	**Rotation Ends**	**Evaluation DUE**
October 1	December 15	December 20
January 1	March 15	April 1
March 16	May 31	June 15
July 1	August 31	September 15

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER

Rotation Evaluation Form (Student)

Please complete this form **electronically** and submit by the due date at the end of the form.

Student Name:	Enter text.	URID:	Enter text.
Mentor Name:	Enter text.		
Program Name:	Choose program	MD/PhD Student?	Choose an item.

Evaluation Date:	MM/DD/YYYY	Rotation Start Date:	MM/DD/YYYY	Rotation End Date:	MM/DD/YYYY

My attendance (in the lab or otherwise) was:	Choose an item.
Have you been assigned background readings?	Choose an item.
Can you perform (execute) your own experiments?	Choose an item.
How much have you learned technically?	Choose an item.
Contact with mentor:	Choose an item.
Did your mentor keep commitments, appointments, etc.?	Choose an item.
Who did the bulk of the training?	Choose an item.
Did you get along with your mentor?	Choose an item.
Was your mentor a good rotation advisor?	Choose an item.
Did you rotation advisor discuss your rotation evaluation with you?	Choose an item.
Overall rating of rotation:	Choose an item.
Did this rotation meet your expectations?	Choose an item.

Please give a detailed description of your expectations for this rotation. Include any ways that your experience may have fallen short of, met, or exceeded these expectations.

Enter text.

Briefly describe the research project assigned for this rotation.

Enter text.

Describe what you believe the goals and duties were for this rotation.

Enter text.

Describe what you accomplished.

Enter text.

This form is confidential – it will not be shown to the faculty member unless you agree to disclosure.

☐ Yes, the contents of this form can be disclosed.

☐ No, the contents of this form should remain confidential in the Graduate Education and Department files.

Instructions for Evaluation Submission to the Graduate Education and Postdoctoral Affairs Office

- The student completes the evaluation and emails the final document to the Graduate Program Coordinator and the Graduate Program Director by the appropriate due date below. The Graduate Program Coordinator will forward the document via email to the following:
  - SMDGradEval@urmc.rochester.edu
- Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that all pertinent parties are in agreement. Thus, the email represents each party's signature and will be kept with the evaluation in the student file.

This form is due to the Graduate Education and Postdoctoral Affairs office on one of the following dates:

Rotation Begins	**Rotation Ends**	**Evaluation DUE**
October 1	December 15	December 20
January 1	March 15	April 1
March 16	May 31	June 15
July 1	August 31	September 15

Annual PhD Student Evaluation/Progress Report

Student Name	Enter text.	Program Name	Choose program
ORCID iD	Enter text.	eRA Commons Username	Enter text.
URID	Enter text.	Entering Year YYYY	Today's Date MM/DD/YYYY
Evaluation Period Start Date	MM/DD/YYYY	Evaluation Period End Date	MM/DD/YYYY

Title of Research Project

Enter text.

INSTRUCTIONS FOR FORM COMPLETION

This form should be completed electronically. *Please provide information requested from the time you began the graduate program.*

Student Responsibilities:

- *Inform your program coordinator of your committee meeting date.*
- *Complete the top portion of this form and sections A-I.*
- *E-mail the completed form to your committee prior to the meeting.*

Advisor/Committee Responsibilities:

- *Complete section J of this form,* ***electronically****.*
- *Come to a consensus and finalize the document between the advisor, the committee members and the student.*
- *Within 1 week of the committee meeting, the Advisor emails the* ***complete and final*** *document to the Graduate Program Coordinator and Graduate Program Director. The Graduate Program Coordinator will forward the document via email to the student, all committee members, and to Graduate Education and Postdoctoral Affairs.*
- *Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that the advisor, the committee members, and the student agree on the document's contents.*

The Advisor is ultimately responsible for the completion and submission of this form on an annual basis.

A. RESEARCH ACCOMPLISHMENTS (*from the time you began the graduate program, in chronological order)*

1. Meetings Attended: Provide names, dates and locations. Please indicate if there was a presentation. If so, provide the title and indicate if it was a poster or oral presentation.

Enter text.

2. Other Seminars/Presentations (include in-house)

Enter text.

3. Papers Published

Enter text.

4.a. Predoctoral Fellowships: Applications

Enter text.

4.b. Predoctoral Fellowships: Awarded

Enter text.

4.c. Predoctoral Fellowships: Planned

Enter text.

5. Honors/Awards Received

Enter text.

B. SERVICE AND OTHER ACTIVITIES (from the time you began the graduate program, in chronological order)

1. Teaching

Enter text.

2. University or Departmental Committees

Enter text.

3. Student Activities/Organizations (indicate if you held an office)

Enter text.

4. Clinical/Translational Experiences

Enter text.

5. Other Professional Activities Not Identified Above

Enter text.

6. Other Activities (community, etc.) With Professional Relevance

Enter text.

C. COURSEWORK

1. Remaining Required Courses

Enter text.

2. Courses Taken/Workshops Attended (*from the time you began the graduate program, in chronological order)*

Enter text.

3. Courses to be Taken Next Year

Enter text.

D. RESEARCH PROGRESS

1. Overall Objective of Research Efforts

Enter text.

2. Have the aims of your thesis proposal changed since your last progress report? If so, how?

Enter text.

3. Provide a brief summary of accomplishments prior to the current review period.

Enter text.

4. Provide a report of your research progress for the period covered by this report. Address the aims in your proposal as well as the goals stated in your last report (*1 page maximum*).

Enter text.

E. GOALS FOR THE NEXT PERIOD (define whether it is a 4-, 6-, or 12-month period and why)

Enter text.

F. CAREER GOALS

1. Current Career Goals

Enter text.

2. Have you started to search for a job/postdoctoral position? If no, when do you anticipate starting this search?

Enter text.

G. INDIVIDUAL DEVELOPMENT PLAN (IDP) EXPECTATION

It is expected that all SMD PhD students will create and maintain an IDP. IDPs should be revised and modified on a regular basis, no less than annually. There are many IDP tools available. Students may choose the type of IDP that works best for their needs.
Do you have an up-to-date IDP in place?

Choose an item.

If no, why not? When do you expect to create/update your IDP?

Enter text.

Have you discussed your IDP with your advisor and/or another trusted mentor? You are **strongly encouraged** to share your goals with your advisors and to communicate openly.

Choose an item.

H. ADDITIONAL STUDENT COMMENTS

Are there any additional concerns/issues that you would like to discuss with the committee?

Enter text.

I. COMMITTEE MEETING INFORMATION

Committee Meeting Date: MM/DD/YYYY

If no meeting occurred, please explain why.

Enter text.

Advisor's Name:	Enter text.
Committee Member 1 Name:	Enter text.
Committee Member 2 Name:	Enter text.
Committee Member 3 Name:	Enter text.
Committee Member 4 Name:	Enter text.
Committee Member 5 Name:	Enter text.

J. COMMITTEE REPORT

Is the student making satisfactory progress? Choose an item.

Please provide feedback on the student's progress, strengths and accomplishments. Aspects to address include research efforts and progress, intellectual growth, professional development, quality of the presentation and coursework requirements or suggestions.

Enter text.

Committee recommendations including future plans for research, research goals, suggested changes in the project, specific experimental suggestions, areas in need of improvement, career goals, etc.

Enter text.

Should the student meet with the committee at 6 months instead of 1 year?	Choose an item.
Anticipated month/year of PhD defense:	MM/YYYY
Please rate the student's progress for the period covered by this report:	Choose an item.

Instructions for Evaluation Submission to the Graduate Education and Postdoctoral Affairs Office:

- Come to a consensus and finalize document between the advisor, the committee members and the student.
- Within 1 week of the committee meeting, the Advisor emails the **complete and final** document to the Graduate Program Coordinator and the Graduate Program Director. The Graduate Program Coordinator will forward the document via email to:
    1. SMDGradEval@urmc.rochester.edu
    2. All Committee Members
    3. Student
- Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that the advisor, the committee members and the student agree on the document's contents. Thus, the email represents each party's signature and will be kept with the evaluation in the student file.

Biochemistry and Molecular Biology End of First year evaluation: Rubric

Student: _____

Outcome/Assessment	Score	"Scoring" is based on the following system				
		Outstanding 4	**Very Good 3**	**Acceptable 2**	**Marginal 1**	**Not Achieved 0**
Fall semester grades	Grade:	Avg of 3.8 and above	Avg of 3.5-3.79	Avg of 3.0-3.49	Avg of 2.33-2.99, or one grade of C	Avg <2.33, or two grades of C
Spring semester grades	Grade:	Avg of 3.8 and above	Avg of 3.5-3.79	Avg of 3.0-3.49	Avg 2.33-2.99, or one C grade of C	Avg <2.33, or two grades of C
Rotation 1 Evaluation Mentor:	Score:	Mixture of "Meets Expectations" and "Exceeds Expectations"	All "Meets Expectations"	Mostly "Meets Expectations" but one "Requires More Effort" * & not balanced by "exceeds expectations"	≤ 2 "Requires More Effort" *	At least one "Unacceptable" or the majority of metrics ranked as "Requires More Effort" *
Rotation 2 Evaluation Mentor:	Score:	Mixture of "Meets Expectations" and "Exceeds Expectations"	All "Meets Expectations"	Mostly "Meets Expectations" but one "Requires More Effort" * & not balanced by "exceeds expectations"	≤ 2 "Requires More Effort" *	At least one "Unacceptable" or the majority of metrics ranked as "Requires More Effort" *
Rotation 3 Evaluation Mentor:	Score:	Mixture of "Meets Expectations" and "Exceeds Expectations"	All "Meets Expectations"	Mostly "Meets Expectations" but one "Requires More Effort" * & not balanced by "exceeds expectations"	≤ 2 "Requires More Effort" *	At least one "Unacceptable" or the majority of metrics ranked as "Requires More Effort" *
Involvement in activities (e.g., lunch with speakers, attend monthly student meetings, attend seminars)	Score:	Regularly	Often	Sometimes	Infrequently	Never *
Comments:						
Lab joined or to be joined:						

**Is there evidence that the faculty mentor communicated this with the student? In writing, orally, or both?*

If yes, see below. If no, then the Program Director will speak first with the faculty mentor for the rotation and request that they communicate concerns directly to the student, preferably in writing or both orally and in writing.

Follow up after first year student evaluations:

Students who receive a 0 for coursework will be immediately dismissed from the program.

For students who receive a 1 or 0 (in any other category except grades), the following may happen:

- They will meet with the Program Director immediately (may not wait for end of the year) to discuss barriers to success and concerns. Actions that follow will depend on the situation, and may include setting up tutoring or counseling, meeting with faculty mentor(s), and possibly the Senior Associate Dean for Graduate Education.
- They will be put on academic probation
- They will be dismissed from the program if none of the mentors with whom they rotated is willing to have the student join his/her laboratory
- They may not be eligible for support on the training grant for at least one year

For students who receive a 1 in course work in either semester, and 1s in at least one rotation, the following will happen:

- They will meet with the Program Director immediately (may not wait for end of the year) to discuss barriers to success and concerns. Actions that follow will depend on the situation, and may include setting up tutoring or counseling, meeting with faculty mentor(s), and possibly the Senior Associate Dean for Graduate Education.
- With a faculty mentor or mentoring committee, they will outline strategic goals for improving performance. Ideally, the primary mentor should be the faculty member in whose laboratory the student will be conducting dissertation research (however, if this is necessary during the first year, the Program Director may serve in this role). Other faculty mentors will be assigned based on the situation, and may include the Program Director or someone recommended by the Senior Associate Dean for Graduate Education. Follow-up with the student's progress will occur monthly, and taper to quarterly as performance improves.
- They may be put on academic probation
- They may not be eligible for support on the Biochemistry Training Grant for at least one year
- They may be dismissed from the program if none of the mentors with whom they rotated is willing to have the student join his/her laboratory

For students who receive 3s and higher, no remedial action will be taken unless they are unable to find a lab to join.

BIOCHEMISTRY Ph.D. PROGRAM
Thesis Defense Approval Form

Student's Name _____

Date _____

Advisor _____

The following committee members have agreed and approve the above mentioned student to start writing his/her thesis.

Name (please print)	Signature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

NOTE: The thesis defense approval form must be completed at a committee meeting 4-6 months prior to a planned defense date.

Please return to the Biochemistry Office.

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER

Request for PhD Defense Chairperson

Name of Candidate:	Enter text.	URID:	Enter text.
Department:	Choose an item.		
For the Degree In:	Choose an item.		
Name of Advisor:	Enter text.		
Committee Members:	Enter text.	Enter text.	
	Enter text.	Enter text.	
	Enter text.	Enter text.	

The following ranked full-time faculty from **outside** the candidate's PhD department/program are **suggested to serve as chair** of the oral exam.

SMD Grad Dean Indicate Selection

Enter text. (1st Chair Nominee)	Enter text. (Dept. of Primary Appointment/Faculty Rank)	☐
Enter text. (2nd Chair Nominee)	Enter text. (Dept. of Primary Appointment/Faculty Rank)	☐
Enter text. (3rd Chair Nominee)	Enter text. (Dept. of Primary Appointment/Faculty Rank)	☐

Thesis Title: (***please note: an abstract of thesis work and program of study must also accompany this form)***

Enter text.

At the University of Rochester, a chairperson is appointed for each PhD oral defense exam to monitor and promote fairness and rigor in the conduct of the defense. The chair's status as *a nonmember* of the advisor's and student's department or program enables distance from previously established judgments on the candidate's work and prevents the chairperson from exerting administrative authority over other members or being subject to such authority. In the graduate programs within the School of Medicine and Dentistry, the program director (with input from the advisor/student when appropriate) nominates three faculty members to serve as chair. The nominations are reviewed by the Senior Associate Dean for Graduate Education and Postdoctoral Affairs and one faculty member is approved to chair the defense exam.

This form must be submitted to the Senior Associate Dean for Graduate Education and Postdoctoral Affairs to initiate the appointment of a doctoral defense chairperson
at least 4 months prior to scheduling a defense date. When scheduling for the defense, the approved chair is included in the student's planning for specific dates.

Program Director Signature Date

Senior Associate Dean Signature Date

Revised 12/2018

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER MEDICAL CENTER

Guidelines for the Content of a Basic Science PhD Thesis

prepared by Dirk Bohmann and Eric Phizicky

1. Purpose of this document:

This document provides a summary of the expectations for the written content of a thesis; that is, it provides a guide for how a thesis should be structured for writing, and for the content that comprises a well written thesis.

This document is meant to be a supplement to the general guidelines of the University of Rochester for preparation of a thesis (THE PREPARATION OF DOCTORAL THESES: A MANUAL FOR GRADUATE STUDENTS), which can be found at the website: http://www.rochester.edu/Theses/ThesesManual.pdf, and which governs all theses at this university. Rather, the guidelines described here are meant to be a guide for the written content of the thesis.

2. Overview of thesis contents

A thesis is a description and interpretation of the research conducted by the candidate that qualifies him/her for the degree of PhD.

It is written for non-specialized scientists (not for the mentor!). Specifically, every member of the thesis examination committee, including faculty from other science departments, have to be able to read and understand everything that is included in the text without consulting secondary sources. Specialist terms need to be explained or avoided. Non-standard techniques have to be explained.

It is written in English with correct spelling and grammar. It is not the job of the committee to proof-read the text. Having the text of the thesis corrected and edited for clarity by a second person (mentor or otherwise) is acceptable and highly recommended. A committee member can refuse to accept a thesis with excessive grammatical or graphical errors.

There is no formal minimum or maximum length. The thesis has to give an in depth account of the background and scientific question addressed, as well as a detailed description of the conducted experiments, that is typically more specific than the published literature on the same work. Independent and original thought is welcome. An alliteration of published fact(oid)s with tangential relevance to the research topic (just to fill up pages) should be avoided.

3. Sections of the thesis

Title page

Abstract
-- Must be a maximum of 350 words.
-- Should contain no references, and no undefined non-standard abbreviations.

Acknowledgements
My boss rocks….. but I am glad to be out of here.. and I love my mother

Foreword
Although the thesis document can contain experimental data not generated by the candidate (for example those supplied by a collaborator or technician, if they are critical for the scientific argument), all such contributions must be specified in the foreword.

Glossary
A table explaining non-standard abbreviations and terms. For generally accepted abbreviations see the website at the Journal of Biological Chemistry (http://www.jbc.org/site/misc/abbrev.xhtml)

Biographical Sketch
Short academic history and list of papers published by the candidate. Date of birth and dates of earlier degrees are no longer included.

4. Organization of the Thesis

Introductory chapter

The introduction outlines the background of the field, and should set the stage for formulating the scientific question/problem addressed in the experimental part of the thesis. The introduction should tell a story with the candidate's own thoughts, to frame the question to be addressed in the thesis, and should not summarize all the papers that the candidate has read.

The last paragraphs of the introduction should explicitly state the questions to be addressed in the thesis, or the set of experimental aims, and the organization of the thesis.

Results chapters

Results chapters are most conveniently organized as papers or manuscripts, complete with abstract (250 word limit), introduction, materials and methods, results, figures and tables, discussion, and references. If there are several chapters with similar materials and methods the candidate is encouraged to organize all of the materials and methods into a single chapter. This eliminates unnecessary redundancy.

It is not necessary to include all of a published paper in a chapter, if for instance the candidate's contribution was a limited part. Additional data not included in the paper can also be added to a chapter.

One or more final chapters may include a collection of experiments that are not yet organized as manuscripts. These chapters should also have a title, an abstract, and a discussion that contains more in-depth interpretations and/or a general perspective on the overall set of results.

The paper format is encouraged as it is expected that every candidate will have one or more first author papers by the time of the thesis defense. However, the alternate format of having the thesis organized as separate chapters containing the Materials and Methods, Results, and Discussion is also acceptable.

Perspectives chapter

Each thesis should also include a final chapter (which could be entitled "Final Perspectives", "Perspectives", "Overall Conclusions", or some similar title) in which the candidate tries to tie up his thesis and add any overall perspectives. For example, the candidate might recapitulate the state of the field at the outset of the thesis, summarize the major results of the thesis, explain the status of the field as a result of the thesis work, explain current gaps in our knowledge of the field, raise questions that arise as a result of the thesis, or speculate on likely future directions of the field.

5. Description of the specific contents of each section of a chapter:

Title and Abstract: Each chapter should have its own title page, and an abstract page (abstract limited to 250 words)

Introduction: The introduction of each results chapter (manuscript, paper or results chapter) should outline the relevant background of the field without getting too expansive or detailed, and should frame the question(s) being addressed in the chapter in the context of the background. Often the last part of the introduction includes a very brief statement of the results and their significance.

Results sections:
Each experiment/group of experiments in the result section should include:

a statement of the purpose of the experiment
a description of the experiments and the results, with figures, tables, etc
a brief explanation or interpretation of the results.

Discussion sections:

The discussion section of results chapters should include a BRIEF summary of the major findings and discoveries, without regurgitation of the results section. This section of the chapter might also address questions such as: What does it mean? Why is it relevant? How does it add to/extend existing knowledge? What general conclusions and principles (beyond the immediate field of study) may arise from this research? What were the experimental problems, ambiguities, alternative explanations? What next?

Materials and Methods

This is the most important, and most read part of the thesis for your colleagues and lab mates (and your future self). Use the opportunity to carefully document techniques that you have worked out during your PhD research in a way that others can use it as a protocol book. If the results chapters come from published papers, the materials and methods may be removed from those chapters and grouped into a single chapter. This is generally recommended as it makes the thesis easier to read and a better source for techniques.

Figures and Legends

Each figure should be clear and self-explanatory. It should be possible to gain at least a superficial understanding of the displayed experiments without reading the text or figure legends.

Each legend should have a title that conveys the conclusion of the presented experiments or data. If there are multiple panels (A, B, etc), each of these should also have a title. The body of each legend should explain all items included in the figure.

Figures can be placed on separate pages, or can be embedded in the text as text boxes.

References

All references in the thesis should be modeled on a journal (such as Cell) and should include a full set of authors (for ten or less authors), the complete title of the work, and the volume, and page numbers (and editor and publishers as necessary). If using reference management software, the references should be checked manually for completeness and accuracy.

Supplements, appendices

This part of the thesis is not a requirement, but can be highly useful for including data that does not easily fit within the main part of the thesis. Examples include movies, genomic data sets, PCR primer sets, and crystallographic coordinates or even supporting preliminary data.

Rotation Evaluation Form (Faculty)

Please complete this form ***electronically*** and submit to the office of Graduate Education and Postdoctoral Affairs by the due date at the end of the form.

Student Name: Enter text. URID: Enter text.

Mentor Name: Enter text.

Program Name: Choose program MD/PhD Student? Choose an item.

Evaluation Date: MM/DD/YYYY Rotation Start Date: MM/DD/YYYY Rotation End Date: MM/DD/YYYY

Extent of your personal involvement in training: Choose an item. Recommended Grade: Choose an item.

Did the student meet rotation research report requirements via oral or written presentation? Choose an item.

Evaluation	Unacceptable	Needs Improvement	Meets Expectations	Exceeds Expectation
Ability to design experiments	☐	☐	☐	☐
Bench work (may not apply)	☐	☐	☐	☐
Analytical skills	☐	☐	☐	☐
Work ethic	☐	☐	☐	☐
Lab/research meeting participation	☐	☐	☐	☐
Background knowledge	☐	☐	☐	☐
Notebook	☐	☐	☐	☐
Attendance (in the lab or otherwise)	☐	☐	☐	☐
Attitude and intellectual involvement	☐	☐	☐	☐
Grasp of new concepts/self-sufficiency	☐	☐	☐	☐
Overall evaluation	☐	☐	☐	☐

Project Title/Description:

Enter text.

Faculty evaluation of student's strengths and weaknesses:

Comment on the student's strengths and weaknesses. In addition, comment on the quality of the student's written report (if one was required):

Enter text.

I have *HONESTLY* discussed with the student his/her performance during this rotation and provided constructive criticism. Choose an item.

Instructions for Evaluation Submission to the Graduate Education and Postdoctoral Affairs Office

The Lab Mentor completes the evaluation and emails the final document to the Graduate Program Coordinator and the Graduate Program Director by the appropriate due date below. The Graduate Program Coordinator will forward the document via email to:

- SMDGradEval@urmc.rochester.edu
- Student

Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that all pertinent parties are in agreement. Thus, the email represents each party's signature and will be kept with the evaluation in the student file.

The form is due to the Graduate Education and Postdoctoral Affairs office on one of the following dates:

Rotation Begins	**Rotation Ends**	**Evaluation DUE**
October 1	December 15	December 20
January 1	March 15	April 1
March 16	May 31	June 15
July 1	August 31	September 15

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER

Rotation Evaluation Form (Student)

Please complete this form **electronically** and submit by the due date at the end of the form.

Student Name:	Enter text.	URID:	Enter text.
Mentor Name:	Enter text.		
Program Name:	Choose program	MD/PhD Student?	Choose an item.

Evaluation Date:	MM/DD/YYYY	Rotation Start Date:	MM/DD/YYYY	Rotation End Date:	MM/DD/YYYY

My attendance (in the lab or otherwise) was:	Choose an item.
Have you been assigned background readings?	Choose an item.
Can you perform (execute) your own experiments?	Choose an item.
How much have you learned technically?	Choose an item.
Contact with mentor:	Choose an item.
Did your mentor keep commitments, appointments, etc.?	Choose an item.
Who did the bulk of the training?	Choose an item.
Did you get along with your mentor?	Choose an item.
Was your mentor a good rotation advisor?	Choose an item.
Did you rotation advisor discuss your rotation evaluation with you?	Choose an item.
Overall rating of rotation:	Choose an item.
Did this rotation meet your expectations?	Choose an item.

Please give a detailed description of your expectations for this rotation. Include any ways that your experience may have fallen short of, met, or exceeded these expectations.

Enter text.

Briefly describe the research project assigned for this rotation.

Enter text.

Describe what you believe the goals and duties were for this rotation.

Enter text.

Describe what you accomplished.

Enter text.

This form is confidential – it will not be shown to the faculty member unless you agree to disclosure.

☐ Yes, the contents of this form can be disclosed.

☐ No, the contents of this form should remain confidential in the Graduate Education and Department files.

Instructions for Evaluation Submission to the Graduate Education and Postdoctoral Affairs Office

- The student completes the evaluation and emails the final document to the Graduate Program Coordinator and the Graduate Program Director by the appropriate due date below. The Graduate Program Coordinator will forward the document via email to the following:
  - SMDGradEval@urmc.rochester.edu
- Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that all pertinent parties are in agreement. Thus, the email represents each party's signature and will be kept with the evaluation in the student file.

This form is due to the Graduate Education and Postdoctoral Affairs office on one of the following dates:

Rotation Begins	**Rotation Ends**	**Evaluation DUE**
October 1	December 15	December 20
January 1	March 15	April 1
March 16	May 31	June 15
July 1	August 31	September 15

Annual PhD Student Evaluation/Progress Report

Student Name	Enter text.	Program Name	Choose program
ORCID iD	Enter text.	eRA Commons Username	Enter text.
URID	Enter text.	Entering Year YYYY	Today's Date MM/DD/YYYY
Evaluation Period Start Date	MM/DD/YYYY	Evaluation Period End Date	MM/DD/YYYY

Title of Research Project

Enter text.

INSTRUCTIONS FOR FORM COMPLETION

This form should be completed electronically. *Please provide information requested from the time you began the graduate program.*

Student Responsibilities:

- *Inform your program coordinator of your committee meeting date.*
- *Complete the top portion of this form and sections A-I.*
- *E-mail the completed form to your committee prior to the meeting.*

Advisor/Committee Responsibilities:

- *Complete section J of this form,* ***electronically****.*
- *Come to a consensus and finalize the document between the advisor, the committee members and the student.*
- *Within 1 week of the committee meeting, the Advisor emails the* ***complete and final*** *document to the Graduate Program Coordinator and Graduate Program Director. The Graduate Program Coordinator will forward the document via email to the student, all committee members, and to Graduate Education and Postdoctoral Affairs.*
- *Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that the advisor, the committee members, and the student agree on the document's contents.*

The Advisor is ultimately responsible for the completion and submission of this form on an annual basis.

A. RESEARCH ACCOMPLISHMENTS (*from the time you began the graduate program, in chronological order)*

1. Meetings Attended: Provide names, dates and locations. Please indicate if there was a presentation. If so, provide the title and indicate if it was a poster or oral presentation.

Enter text.

2. Other Seminars/Presentations (include in-house)

Enter text.

3. Papers Published

Enter text.

4.a. Predoctoral Fellowships: Applications

Enter text.

4.b. Predoctoral Fellowships: Awarded

Enter text.

4.c. Predoctoral Fellowships: Planned

Enter text.

5. Honors/Awards Received

Enter text.

B. SERVICE AND OTHER ACTIVITIES (from the time you began the graduate program, in chronological order)

1. Teaching

Enter text.

2. University or Departmental Committees

Enter text.

3. Student Activities/Organizations (indicate if you held an office)

Enter text.

4. Clinical/Translational Experiences

Enter text.

5. Other Professional Activities Not Identified Above

Enter text.

6. Other Activities (community, etc.) With Professional Relevance

Enter text.

C. COURSEWORK

1. Remaining Required Courses

Enter text.

2. Courses Taken/Workshops Attended (*from the time you began the graduate program, in chronological order)*

Enter text.

3. Courses to be Taken Next Year

Enter text.

D. RESEARCH PROGRESS

1. Overall Objective of Research Efforts

Enter text.

2. Have the aims of your thesis proposal changed since your last progress report? If so, how?

Enter text.

3. Provide a brief summary of accomplishments prior to the current review period.

Enter text.

4. Provide a report of your research progress for the period covered by this report. Address the aims in your proposal as well as the goals stated in your last report (*1 page maximum*).

Enter text.

E. GOALS FOR THE NEXT PERIOD (define whether it is a 4-, 6-, or 12-month period and why)

Enter text.

F. CAREER GOALS

1. Current Career Goals

Enter text.

2. Have you started to search for a job/postdoctoral position? If no, when do you anticipate starting this search?

Enter text.

G. INDIVIDUAL DEVELOPMENT PLAN (IDP) EXPECTATION

It is expected that all SMD PhD students will create and maintain an IDP. IDPs should be revised and modified on a regular basis, no less than annually. There are many IDP tools available. Students may choose the type of IDP that works best for their needs.
Do you have an up-to-date IDP in place?

Choose an item.

If no, why not? When do you expect to create/update your IDP?

Enter text.

Have you discussed your IDP with your advisor and/or another trusted mentor? You are **strongly encouraged** to share your goals with your advisors and to communicate openly.

Choose an item.

H. ADDITIONAL STUDENT COMMENTS

Are there any additional concerns/issues that you would like to discuss with the committee?

Enter text.

I. COMMITTEE MEETING INFORMATION

Committee Meeting Date: MM/DD/YYYY

If no meeting occurred, please explain why.

Enter text.

Advisor's Name:	Enter text.
Committee Member 1 Name:	Enter text.
Committee Member 2 Name:	Enter text.
Committee Member 3 Name:	Enter text.
Committee Member 4 Name:	Enter text.
Committee Member 5 Name:	Enter text.

J. COMMITTEE REPORT

Is the student making satisfactory progress? Choose an item.

Please provide feedback on the student's progress, strengths and accomplishments. Aspects to address include research efforts and progress, intellectual growth, professional development, quality of the presentation and coursework requirements or suggestions.

Enter text.

Committee recommendations including future plans for research, research goals, suggested changes in the project, specific experimental suggestions, areas in need of improvement, career goals, etc.

Enter text.

Should the student meet with the committee at 6 months instead of 1 year?	Choose an item.
Anticipated month/year of PhD defense:	MM/YYYY
Please rate the student's progress for the period covered by this report:	Choose an item.

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    1. SMDGradEval@urmc.rochester.edu
    2. All Committee Members
    3. Student
- Upon receipt of the email, the Graduate Education and Postdoctoral Affairs office assumes that this is the final evaluation and that the advisor, the committee members and the student agree on the document's contents. Thus, the email represents each party's signature and will be kept with the evaluation in the student file.

Biochemistry and Molecular Biology End of First year evaluation: Rubric

Student: _____

Outcome/Assessment	Score	"Scoring" is based on the following system				
		Outstanding 4	**Very Good 3**	**Acceptable 2**	**Marginal 1**	**Not Achieved 0**
Fall semester grades	Grade:	Avg of 3.8 and above	Avg of 3.5-3.79	Avg of 3.0-3.49	Avg of 2.33-2.99, or one grade of C	Avg <2.33, or two grades of C
Spring semester grades	Grade:	Avg of 3.8 and above	Avg of 3.5-3.79	Avg of 3.0-3.49	Avg 2.33-2.99, or one C grade of C	Avg <2.33, or two grades of C
Rotation 1 Evaluation Mentor:	Score:	Mixture of "Meets Expectations" and "Exceeds Expectations"	All "Meets Expectations"	Mostly "Meets Expectations" but one "Requires More Effort" * & not balanced by "exceeds expectations"	≤ 2 "Requires More Effort" *	At least one "Unacceptable" or the majority of metrics ranked as "Requires More Effort" *
Rotation 2 Evaluation Mentor:	Score:	Mixture of "Meets Expectations" and "Exceeds Expectations"	All "Meets Expectations"	Mostly "Meets Expectations" but one "Requires More Effort" * & not balanced by "exceeds expectations"	≤ 2 "Requires More Effort" *	At least one "Unacceptable" or the majority of metrics ranked as "Requires More Effort" *
Rotation 3 Evaluation Mentor:	Score:	Mixture of "Meets Expectations" and "Exceeds Expectations"	All "Meets Expectations"	Mostly "Meets Expectations" but one "Requires More Effort" * & not balanced by "exceeds expectations"	≤ 2 "Requires More Effort" *	At least one "Unacceptable" or the majority of metrics ranked as "Requires More Effort" *
Involvement in activities (e.g., lunch with speakers, attend monthly student meetings, attend seminars)	Score:	Regularly	Often	Sometimes	Infrequently	Never *
Comments:						
Lab joined or to be joined:						

**Is there evidence that the faculty mentor communicated this with the student? In writing, orally, or both?*

If yes, see below. If no, then the Program Director will speak first with the faculty mentor for the rotation and request that they communicate concerns directly to the student, preferably in writing or both orally and in writing.

Follow up after first year student evaluations:

Students who receive a 0 for coursework will be immediately dismissed from the program.

For students who receive a 1 or 0 (in any other category except grades), the following may happen:

- They will meet with the Program Director immediately (may not wait for end of the year) to discuss barriers to success and concerns. Actions that follow will depend on the situation, and may include setting up tutoring or counseling, meeting with faculty mentor(s), and possibly the Senior Associate Dean for Graduate Education.
- They will be put on academic probation
- They will be dismissed from the program if none of the mentors with whom they rotated is willing to have the student join his/her laboratory
- They may not be eligible for support on the training grant for at least one year

For students who receive a 1 in course work in either semester, and 1s in at least one rotation, the following will happen:

- They will meet with the Program Director immediately (may not wait for end of the year) to discuss barriers to success and concerns. Actions that follow will depend on the situation, and may include setting up tutoring or counseling, meeting with faculty mentor(s), and possibly the Senior Associate Dean for Graduate Education.
- With a faculty mentor or mentoring committee, they will outline strategic goals for improving performance. Ideally, the primary mentor should be the faculty member in whose laboratory the student will be conducting dissertation research (however, if this is necessary during the first year, the Program Director may serve in this role). Other faculty mentors will be assigned based on the situation, and may include the Program Director or someone recommended by the Senior Associate Dean for Graduate Education. Follow-up with the student's progress will occur monthly, and taper to quarterly as performance improves.
- They may be put on academic probation
- They may not be eligible for support on the Biochemistry Training Grant for at least one year
- They may be dismissed from the program if none of the mentors with whom they rotated is willing to have the student join his/her laboratory

For students who receive 3s and higher, no remedial action will be taken unless they are unable to find a lab to join.

BIOCHEMISTRY Ph.D. PROGRAM
Thesis Defense Approval Form

Student's Name _____

Date _____

Advisor _____

The following committee members have agreed and approve the above mentioned student to start writing his/her thesis.

Name (please print)	Signature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

NOTE: The thesis defense approval form must be completed at a committee meeting 4-6 months prior to a planned defense date.

Please return to the Biochemistry Office.

Chairperson Nomination for PhD Defense

Candidate Name _____

UR ID: _____

Department: _____

Degree program: _____

Name of PI Advisor _____

Committee Members:

Member Name	Department

The following ranked full-time faculty members from outside the candidate's PhD department/program are suggested to serve as chair of the oral examination:

Chair Name	Department

Signatures:

Candidate: X _____

PI Advisor: X _____

Program Director X _____

Please ensure that all suggestions for the chairperson align with the University of Rochester's Regulations & Policies Concerning Graduate Studies,(page 11) *which specify that the chair should be external to the candidate's program and without significant scholarly relationships with the candidate or committee members.*

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER MEDICAL CENTER

Guidelines for the Content of a Basic Science PhD Thesis

prepared by Dirk Bohmann and Eric Phizicky

1. Purpose of this document:

This document provides a summary of the expectations for the written content of a thesis; that is, it provides a guide for how a thesis should be structured for writing, and for the content that comprises a well written thesis.

This document is meant to be a supplement to the general guidelines of the University of Rochester for preparation of a thesis (THE PREPARATION OF DOCTORAL THESES: A MANUAL FOR GRADUATE STUDENTS), which can be found at the website: http://www.rochester.edu/Theses/ThesesManual.pdf, and which governs all theses at this university. Rather, the guidelines described here are meant to be a guide for the written content of the thesis.

2. Overview of thesis contents

A thesis is a description and interpretation of the research conducted by the candidate that qualifies him/her for the degree of PhD.

It is written for non-specialized scientists (not for the mentor!). Specifically, every member of the thesis examination committee, including faculty from other science departments, have to be able to read and understand everything that is included in the text without consulting secondary sources. Specialist terms need to be explained or avoided. Non-standard techniques have to be explained.

It is written in English with correct spelling and grammar. It is not the job of the committee to proof-read the text. Having the text of the thesis corrected and edited for clarity by a second person (mentor or otherwise) is acceptable and highly recommended. A committee member can refuse to accept a thesis with excessive grammatical or graphical errors.

There is no formal minimum or maximum length. The thesis has to give an in depth account of the background and scientific question addressed, as well as a detailed description of the conducted experiments, that is typically more specific than the published literature on the same work. Independent and original thought is welcome. An alliteration of published fact(oid)s with tangential relevance to the research topic (just to fill up pages) should be avoided.

3. Sections of the thesis

Title page

Abstract
-- Must be a maximum of 350 words.
-- Should contain no references, and no undefined non-standard abbreviations.

Acknowledgements
My boss rocks….. but I am glad to be out of here.. and I love my mother

Foreword
Although the thesis document can contain experimental data not generated by the candidate (for example those supplied by a collaborator or technician, if they are critical for the scientific argument), all such contributions must be specified in the foreword.

Glossary
A table explaining non-standard abbreviations and terms. For generally accepted abbreviations see the website at the Journal of Biological Chemistry (http://www.jbc.org/site/misc/abbrev.xhtml)

Biographical Sketch
Short academic history and list of papers published by the candidate. Date of birth and dates of earlier degrees are no longer included.

4. Organization of the Thesis

Introductory chapter

The introduction outlines the background of the field, and should set the stage for formulating the scientific question/problem addressed in the experimental part of the thesis. The introduction should tell a story with the candidate's own thoughts, to frame the question to be addressed in the thesis, and should not summarize all the papers that the candidate has read.

The last paragraphs of the introduction should explicitly state the questions to be addressed in the thesis, or the set of experimental aims, and the organization of the thesis.

Results chapters

Results chapters are most conveniently organized as papers or manuscripts, complete with abstract (250 word limit), introduction, materials and methods, results, figures and tables, discussion, and references. If there are several chapters with similar materials and methods the candidate is encouraged to organize all of the materials and methods into a single chapter. This eliminates unnecessary redundancy.

It is not necessary to include all of a published paper in a chapter, if for instance the candidate's contribution was a limited part. Additional data not included in the paper can also be added to a chapter.

One or more final chapters may include a collection of experiments that are not yet organized as manuscripts. These chapters should also have a title, an abstract, and a discussion that contains more in-depth interpretations and/or a general perspective on the overall set of results.

The paper format is encouraged as it is expected that every candidate will have one or more first author papers by the time of the thesis defense. However, the alternate format of having the thesis organized as separate chapters containing the Materials and Methods, Results, and Discussion is also acceptable.

Perspectives chapter

Each thesis should also include a final chapter (which could be entitled "Final Perspectives", "Perspectives", "Overall Conclusions", or some similar title) in which the candidate tries to tie up his thesis and add any overall perspectives. For example, the candidate might recapitulate the state of the field at the outset of the thesis, summarize the major results of the thesis, explain the status of the field as a result of the thesis work, explain current gaps in our knowledge of the field, raise questions that arise as a result of the thesis, or speculate on likely future directions of the field.

5. Description of the specific contents of each section of a chapter:

Title and Abstract: Each chapter should have its own title page, and an abstract page (abstract limited to 250 words)

Introduction: The introduction of each results chapter (manuscript, paper or results chapter) should outline the relevant background of the field without getting too expansive or detailed, and should frame the question(s) being addressed in the chapter in the context of the background. Often the last part of the introduction includes a very brief statement of the results and their significance.

Results sections:
Each experiment/group of experiments in the result section should include:

a statement of the purpose of the experiment
a description of the experiments and the results, with figures, tables, etc
a brief explanation or interpretation of the results.

Discussion sections:

The discussion section of results chapters should include a BRIEF summary of the major findings and discoveries, without regurgitation of the results section. This section of the chapter might also address questions such as: What does it mean? Why is it relevant? How does it add to/extend existing knowledge? What general conclusions and principles (beyond the immediate field of study) may arise from this research? What were the experimental problems, ambiguities, alternative explanations? What next?

Materials and Methods

This is the most important, and most read part of the thesis for your colleagues and lab mates (and your future self). Use the opportunity to carefully document techniques that you have worked out during your PhD research in a way that others can use it as a protocol book. If the results chapters come from published papers, the materials and methods may be removed from those chapters and grouped into a single chapter. This is generally recommended as it makes the thesis easier to read and a better source for techniques.

Figures and Legends

Each figure should be clear and self-explanatory. It should be possible to gain at least a superficial understanding of the displayed experiments without reading the text or figure legends.

Each legend should have a title that conveys the conclusion of the presented experiments or data. If there are multiple panels (A, B, etc), each of these should also have a title. The body of each legend should explain all items included in the figure.

Figures can be placed on separate pages, or can be embedded in the text as text boxes.

References

All references in the thesis should be modeled on a journal (such as Cell) and should include a full set of authors (for ten or less authors), the complete title of the work, and the volume, and page numbers (and editor and publishers as necessary). If using reference management software, the references should be checked manually for completeness and accuracy.

Supplements, appendices

This part of the thesis is not a requirement, but can be highly useful for including data that does not easily fit within the main part of the thesis. Examples include movies, genomic data sets, PCR primer sets, and crystallographic coordinates or even supporting preliminary data.