UNIVERSITY OF ROCHESTER

SCHOOL OF MEDICINE AND DENTISTRY

GRADUATE STUDIES HANDBOOK

for the

DEGREE PROGRAMS

in

BIOCHEMISTRY

REVISED 8/16

J. Munger, Director of Graduate Studies
M. Vera, Graduate Studies Coordinator

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 both the Handbook and the "Regulations and University Policies Concerning Graduate Studies"

http://www.rochester.edu/GradBulletin/PDFbulletin/Regulations14-16.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.

TABLE OF CONTENTS

Page

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, Eric Phizicky and Yi-Tao Yu).

B. Courses

A total of 120 credit hours are required for the Ph.D. This number reflects credit obtained for course work (a minimum of 24 hours, not counting 1-credit courses), 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	5 credits
IND 409	Cell Biology	4
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 410	Molecular Biology & Genomics	4
BCH 502	Biochemistry Seminar	1
BCH 595	Ph.D. Research (Research Rotation)	6
Total		16 credits

2. Courses Required Each Semester

BCH 501 or 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 2 additional specific or elective courses, totaling 6 credits or more (but not counting 1-credit courses). Remaining course credits may be satisfied with courses selected by the student reflecting the 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 a program director.

Fall Semester 2016

BCH 515 (1)	Critical Thinking in Research Science
BCH 517 (1)	Topics in Cellular, Biochemical and Molecular Sciences
BIO 422 (4)	Biology of Aging
BIO 426 (4)	Developmental Biology
CHM 411(4)	Inorganic Chemistry I
CHM 415 (2)	Group Theory
CHM 423(2)	NMR Spectroscopy
MBI 473 (3)	Immunology
PHP 403 (4)	Human Cell Physiology
BST 463 (4)	Introduction to Biostatistics
BST 464 (4)	Applied Linear Regression

Spring Semester 2017

BIO 415 (4)	Molecular Biology of Cell Signaling
BIO 453 (4)	Computational Biology
BPH 411 (5)	Methods in Structural Biology (even numbered years)
BPH 509 (5)	Molecular Biophysics (odd numbered years)
CHM 402 (4)	Bio-Physical Chemistry I (even numbered years)
CHM 414 (4)	Biological Inorganic Chemistry
CHM 416 (2)	X-Ray Crystallography
CHM 440 (4)	Bio Organic Chemistry (even numbered years)
CHM 458(2)	Molecular Spectroscopy
CHM 460 (2)	Chemical Kinetics
GEN 507(4)	Advanced Genetics
IND 443 (4)	Eukaryotic Gene Regulations
IND 447 (4)	Signal Transduction
MBI 456 (4)	General Virology (odd numbered years)
MBI 421(3)	Microbial Genetics
PTH 507 (3)	Cancer Biology
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 or not 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 the first year. At the beginning of the academic year, faculty members will present short (20 – 30 minute) informal lectures to the incoming students describing their research activities. The goals of this series are to acquaint students with ongoing research in the Program and to alert them to opportunities for their laboratory rotations and future Ph.D. research. **Attendance at these lectures is critical for selection of laboratory rotations. Students should also consult laboratory web pages, publications, and interview current students and P.I.s to facilitate laboratory rotation choices.**

Students sign up for laboratory rotations by submitting a list of their choices to the Graduate Studies Coordinator. The list must be discussed with the student's assigned 1st year advisor and signed by the advisor. The student should bring the BLANK rotation sign-off sheet to the scheduled meeting with their 1st year advisor for sign-off. Every effort will be made to accommodate the students' wishes. Students are expected to complete 3 projects in 3 different laboratories representing more than one area of interest before requesting assignment to a laboratory in which their Ph.D. research project will be completed. If advisable, a student will complete an additional rotation before requesting assignment. Occasionally students arrange a rotation during the summer before the first year. In this event, the student must still complete three rotations during the fall and spring semesters.

Rotation Report

A rotation report is due at the end of each rotation period. The primary purposes of the report are to help the student think more clearly about their rotation project as it relates to the overall field

of interest, and to develop their scientific writing skills. The report is written by the student, in consultation with the faculty rotation mentor. The format of the report should consist of a 6-8 page double-spaced write up including the following sections: Introduction (~2 pages), Materials and Methods (~2 pages), Results (~2 pages) and Discussion (~2 pages). Use Arial Font 11. All figures (with figure legends), tables and references should be placed in an appendix that does not count towards the page limits. In addition, include a cover page and an abstract of no more than 200 words. The faculty mentor will critically review the report, providing annotated feedback, and will comment on the quality of the write up in the rotation evaluation. The student will submit an e-copy of the final revised report to the BMB Program Director and to the Graduate Studies Coordinator.

Rotation Schedule 2016 – 17

Faculty research presentations	Sept 1 – Sept 19
Meetings with 1st year advisors	Sept 19 – Sept 21
Submit rotation choices	September 22
Receive rotation assignment	September 27
Begin rotation	September 28
Rotation period ends	December 16
Meet with advisor	December 6 – 9
Submit rotation choices	December 12
Receive rotation assignment	December 16
Begin rotation	January 3
Rotation period ends	March 10
Meet with advisor	March 1 – 3
Submit rotation choices	March 6
Receive rotation assignment	March 10
Begin rotation	March 13
Rotation ends	May 31
Choose permanent advisor*	mid-May
Begin work in permanent lab	June 1 or when approved

*Some students may request an additional rotation.

PLEASE NOTE: Graduate students are expected to be in residence, working in laboratory rotations, for the entirety of these periods. This includes semester, fall and spring "breaks" listed on the University (undergraduate) academic calendar. Please follow the School of Medicine Graduate School calendar included at the end of this booklet.

Students will be evaluated at the end of each rotation period. The written evaluations will be kept on file and a copy will be sent to the Graduate Studies Office. The evaluations will also be used to fulfill the progress report requirement in the first year.

2. Choosing a Research Advisor

At the end of the first academic year, students should discuss permanent assignment with chosen faculty and submit choices to the Graduate Studies Coordinator. Permanent assignment will be reviewed by the program director and department chair. The student will be notified when assignment has been made. Note that no agreement to join a particular laboratory may be made with an advisor before the completion of the final rotation period in May. The student will then follow the curriculum, procedures, rules and regulations of the Biochemistry Ph.D. program or other selected Ph.D. program.

- If a student chooses a research advisor with an appointment (primary or secondary) in the Department of Biochemistry and Biophysics, or who is a member of the BMB program, the student is automatically approved to enter the Biochemistry Ph.D. Program.
- Students choosing research advisors who do not have departmental affiliation or Program affiliation should apply to a program with which the advisor is affiliated.
- In the unlikely event that a student has not found an advisor by the beginning of their second year (September 1), he or she may be asked to leave the program.

3. Radiation Certificate

All students are to pass Health Physics Radiation Safety tests 1 and 2 by December 1 of their first year such that they qualify as an Authorized User of Radioisotopes. Radiation certification does not count toward the 30 hours of course credit necessary for the Ph.D.

4. First Year Assessment

At the conclusion of the first year, the Biochemistry Advisory Committee will assess the performance of students in the following areas: course work, rotation performance, and attendance at seminars/ meetings (see Rubric in Appendix). Students whose performance has been deemed unsatisfactory will meet with the Program Director to discuss the program's concerns and potential barriers to success. Subsequent action will largely depend on the specific situation, but could include tutoring, counseling, or dismissal from the program.

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.

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 second 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, he/she 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 June 1 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 committee members, the student, the Senior Associate Dean, SMD Registrar, SMDGradEval@urmc.rochester.edu, the Program Director, and the Graduate Studies Coordinator (Melissa Vera).

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.

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)

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 (with the exception of the advisor/advisors) 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, two primary members of the Department of Biochemistry and Biophysics (this may include the advisor), one faculty member from outside the Department and one additional faculty member. 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.

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. 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 1 of the second 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 Masters 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 4 weeks prior to the exam.
2. At least 4 weeks prior to the exam, inform the program administrator of date/time of the exam, confirm committee members and schedule a room. Submit title and abstract (250 words, maximum) online at this time. 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. The abstract should not be longer than 30 lines of text. The format and length of the proposal is similar to 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 the means by which 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 as a whole will discuss with the student the strengths and weaknesses of the qualifying exam performance, and will inform the student of whether or not 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.

In the event that 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 several months before the defense, at which a Thesis Approval Form (see appendix) will be signed by all committee members to indicate their approval to begin writing the thesis. The Chair Nomination 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.

"Preparing Your Thesis: A Manual for Graduate Students" is available on-line

http://www.rochester.edu/Theses/ThesesManual.pdf

In addition, the "Guidelines for the Content of a Basic Science Ph.D. Thesis" is included in the Appendix and appears online

https://www.urmc.rochester.edu/education/graduate/trainee-handbook/academic-resources/documents/smd-bs-thesis-guide-supplement.pdf

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 in order 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

[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

approval/paperwork process starts at least 6 months before registration with the following steps:

1. 6 months prior to the thesis defense, the student must obtain written approval from his/her committee members to start working on their thesis. All members of the committee must sign the Thesis Approval form that can be obtained from the Graduate Studies Coordinator.
2. At least 4 months in advance of scheduling the defense, the student must turn in the completed Chair Nomination form along with a thesis title page and abstract to the Graduate Studies Coordinator. From there, the Senior Associate Dean of Graduate Education will select a Chair for the defense. The chair, student, PI and Graduate Studies Coordinator will be notified via email when a chair has been selected.
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 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.
6. At least 17 business days prior to the defense, the student will need to meet with the Graduate Studies Coordinator to complete the online registration progress via Sharepoint.
7. 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 SharePoint site (link provided in email sent from UnivGradStudies@UR.Rochester.edu).
8. At least 10 full business days must elapse between the registration date and the actual date of defense.
9. The school allows 30 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 30 days. Please consult the academic calendar for these deadline dates.

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

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 completed 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 will cease. The student should discuss this with his/her advisor and share this information with the Graduate Studies Coordinator.

VIII. 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.

CURRICULUM

1) All of the following courses are required:

BCH 412 (5)	Advanced Topics in Biological Macromolecules	Spring

IND 410 (4)	Molecular Biology and Genomics	Spring
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

IND 409 (4)	Cell Biology	Spring

Or

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 REQUIREMENTS

No Teaching Assistantship is required.

The Qualifying Examination is required at the end of the second year of Ph.D. studies.

Thesis preparation and defense.

IX. 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 (5 credits)	Advanced Biochemistry
IND 409 (4)	Cell Biology
IND 410 (4)	Molecular Biology and Genomics
IND 501 (1)	Ethics in Research
BCH 412 (5)	Advanced Topics in Biological Macromolecules

M.S. candidates are also expected to attend the Biochemistry Student Seminars (BCH 501-502). Up to 6 hours of seminar and/or research credit can be counted toward the 30 hours required for the Degree. 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.

X. GENERAL POLICY

A. 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: Graduate students are supported by fellowships or research grants from a variety of sources, both internal and external, and each agency has slightly different regulations regarding vacations. In general, most state that fellows and trainees are expected to engage in full-time study and are entitled only to official University Holidays (New Year's Day, Memorial Day, 4th of July, Labor Day, Thanksgiving Day and the Friday Following Thanksgiving Day,

[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.

Christmas Day). The School of Medicine allows a 2 week vacation period per year in addition to these holidays. **Semester breaks are not to be considered holidays** (see the SMD Academic Calendar) and any absence during those times must be approved in advance. The Department must submit monthly time reports on all graduate students and these are subject to close scrutiny by auditors from both the governmental accounting office and the University. **Thus, every student should inform his or her advisor of *any* absence, including planned vacation times. Any additional absences must be approved by both the advisor and the Graduate Studies Coordinator (Melissa Vera) at least one month in advance. In addition, international students must follow procedures set by the International Student's Office. Students will not receive stipends if absent without authorization.**

C. 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.

D. Switching Labs: On rare occasion, students may wish to discontinue research with a chosen permanent research advisor and begin thesis research anew in a second laboratory. Such a change is to be considered only as a last resort as significant additional time toward finishing the Ph.D. is often required in such situations. Nevertheless, if a student finds a situation untenable and wants to switch labs, the change must be approved by the Graduate Advisory Committee, the Department Chair and the Senior Associate Dean. If approved, the student may rotate in one or more labs for up to 3 months to find a permanent advisor. If, at the end of this time, an advisor is not identified, the case will be reviewed by the Graduate Advisory Committee and the student may be asked to leave the program.

APPENDIX

2016-17 School of Medicine and Dentistry Academic Calendar

Department of Biochemistry and Biophysics Faculty

BMB Faculty Advisors

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

PLEASE NOTE: Your street address should be kept current in HRMS, the Student Registrar System and the Department system.

Graduate Education – www.rochester.edu/its/acs/oge_address_form.html

Department office – send an email to LaSarah Reynolds or Zachary Mendes with the change

International students also must change their address with the ISO and the Federal Government.

ISO/Government – http://www.iso.rochester.edu/study/enrolled/address.html

Glacier Records

Graduate Program Academic Calendar 2016-17

Fall 2016

August

- 31st - Fall 2016 semester begins

September

- 5th - The University is closed in observance of Labor Day
- 13th - Full tuition refund deadline - 100% refunded for dropped courses up to this date
- 14th, 4:00pm - **Last day to submit final copy of PhD dissertation to ProQuest to fulfil requirements for October 2016 degree conferral**
- 14th - **Last day to submit final results for MA/MPH/MS degrees to fulfil requirements for October 2016 degree conferral**
- 28th - Add/drop/audit deadline. Classes added after this date will require a petition to the Dean and *will be assessed a $150 late registration fee. Classes **dropped** after this date will be reflected on the official transcript as withdrawn and with a **W** grade.*

October

- 3rd - **Last day to hold qualifying examination for biomedical science students in their 5th semester of study**
- **7th - October 2016 degree conferral date (PhD, MA, MPH, MS).**
- 11th - Partial tuition refund deadline - 50% refunded for dropped courses up to this date. ***No refund given after this date.***

November

- 1st - Course registration opens for matriculated students for the Spring 2017 semester
- 23, 4:00pm - **Last day to submit final corrected PhD dissertation to ProQuest to fulfil requirements for December 2016 degree conferral**
- 24-25th - The University is closed in observance of the Thanksgiving holiday.
- 30th - Course registration deadline for matriculated students for the Spring 2017 semester. *Registration submitted after this date will be assessed a $150 late registration fee.*

December

- 1st - Course withdrawal deadline. *Withdrawal requests after this date will receive a failing grade (**E**).*
- 1st - Course registration opens for new matriculated students and non-matriculated students for the Spring 2017 semester.
- 13th - Last day of classes for the Fall 2016 semester.
- 16th - **Last day to complete thesis defense registration for defenses scheduled the week of January 3-6, 2017.**
- 17-22nd - Final examinations
- 19th-Jan 2nd - **Blackout Period – *no defenses may be registered and no defenses may be held during this period. Defenses to be held during the week of January 3-6, 2017 must be registered with University Graduate Studies by December 16, 2016.***
- 26th - The University is closed in observance of the Christmas holiday
- 30th - Faculty grading deadline for the Fall 2016 semester
- 30th - **Last day to submit final results for MA/MPH/MS degrees to fulfil requirements for March 2017 degree conferral *without registering for the Spring 2017 semester***
- 31st - **December 2016 degree conferral date (PhD)**

Spring 2017

January

- 2nd - The University is closed in observance of New Year's Day.
- 6th - Registration deadline for new matriculated students and non-matriculated students for the Spring 2017 semester. *Registration submitted after this date will be assessed a $150 late registration fee.*
- 13th - **Last day to submit final PhD thesis to ProQuest to fulfil requirements for March 2017 degree conferral *without registering for the Spring 2017 semester***
- 18th - Spring 2017 semester begins.

February

- 1st - Full tuition refund deadline - 100% refunded for dropped courses up to this date.
- 16th - **Last day to submit final PhD thesis to ProQuest to fulfil requirements for March 2017 degree conferral.**
- 16th - **Last day to submit results of qualifying exams and terminal MA/MPH/MS degrees to fulfil requirements for March 2017 degree conferral.**
- 14th - Add/drop/audit deadline. Classes added after this date will require a petition to the Dean and *will be assessed a $150 late registration fee. Classes **dropped** after this date will be reflected on the official transcript as withdrawn and with a **W** grade.*
- 22nd - Partial tuition refund deadline - 50% refunded for dropped courses up to this date. ***No refund given after this date.***

March

- 13-17th - No classes. ***THIS IS NOT A SEMESTER BREAK FOR SMD PHD STUDENTS***
- 17th - **March 2017 degree conferral date**

April

- 1st - Course registration opens for matriculated students and non-matriculated students for the Summer 2017 semester
- 18th - **Last day to submit final results for qualifying exams and terminal MA/MPH/MS degrees to fulfil requirements for May 2017 degree conferral**
- 18th - **Last day to submit final PhD thesis to ProQuest to fulfil requirements for May 2017 degree conferral**
- 22nd - Course withdrawal deadline. *Withdrawal requests after this date will receive a failing grade (E)*

May

- 2nd - Registration deadline for matriculated and non-matriculated students for the Summer 2017 semester. *Registration submitted after this date will be assessed a $150 late registration fee*
- 3rd - Last day of classes for Spring 2017 semester
- 4-12th - Final examinations
- 15th - Faculty grading deadline for the Spring 2017 semester
- 19th - SMD Doctoral Commencement Dinner and Awards Ceremony
- 20th - **May 2017 degree conferral date**
- 20th - University Doctoral Degree Commencement
- 20th - SMD/AS&E Master's Degree Commencement

Summer 2017

May

- 22nd - Summer semester begins
- 22 – Aug 11th - Institutional refund policy applied for all dropped courses
- 29th - The University is closed in observance of Memorial Day

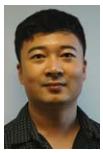
July

- 4th - The University is closed in observance of Independence Day
- 5th - Registration opens for matriculated graduate students for the Fall 2017 semester
- 31st - Registration deadline for matriculated students for the Fall 2017 semester. *Registration submitted after this date will be assessed a $150 late registration fee.*

August

- 1st - Registration opens for non-matriculated students for the Fall 2017 semester
- 11th - **Last day to submit final results for terminal MA/MPH/MS degrees to fulfil requirements for October 2017 degree conferral*without registering for the Fall 2017 semester***
- 11th - Summer sessions end
- 18th - Faculty grading deadline for the Summer 2017 semester.
- TBA - International Student Orientation Program
- TBA - Orientation Program for new graduate students
- TBA - Registration deadline for new graduate students admitted for the Fall 2017 semester. *Registration submitted after this date will be assessed a $150 late registration fee*
- TBA - **Last day to submit the final copy of the PhD dissertation to ProQuest for the August 2017 degree conferral *without registering for the Fall 2017 semester***
- TBA - Registration deadline for non-matriculated students for the Fall 2017 semester. *Registration submitted after this date will be assessed a $150 late registration fee*
- 31st - **August 2017 degree conferral date (PhD)**

Department of Biochemistry and Biophysics – Primary Faculty

Faculty	Interests
 Mark Dumont, Ph.D.	Signal transduction; membrane protein structure, yeast molecular biology
 Dmitri Ermolenko, Ph.D.	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.
 Barry Goldstein, M.D., Ph.D.	Crystallography and structural chemistry of enzyme-ligand interactions.
 Elizabeth Grayhack, Ph.D.	Role of the genetic code in regulating protein synthesis and mRNA metabolism in *Saccharomyces cerevisiae*.
 Alan Grossfield, Ph.D.	Investigating membranes and membrane proteins via computer simulation
 Jeffrey Hayes, Ph.D. (Chair)	DNA structure; chromatin; protein-DNA interactions
 Clara Kielkopf, Ph.D.	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.
 Xin Li, Ph.D.	Small non-coding RNA regulation in germ cells; paternal aging; transgenerational inheritance.

Faculty	Interests
 Lynne Maquat, Ph.D.	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.	Computational biology of RNA, including structure prediction, molecular dynamics, and genomics.
 Joshua Munger, Ph.D.	Mechanisms of metabolic network manipulation induced by viral infection and oncogenic mutation.
 Eric Phizicky, Ph.D.	tRNA biogenesis, function and quality control; intellectual disability due to deficiencies in tRNA modifications.
 Harold Smith, Ph.D.	RNA regulation of innate immune modulators and small molecule inhibitors of HIV RNA-binding proteins.
 Joseph Wedekind, Ph.D.	Structure and function analysis of gene regulation by riboswitches and microRNAs as a basis for therapeutic development.
 Yi-Tao Yu, Ph.D.	RNA modification; pre-mRNA splicing; snRNP biogenesis; telomerase RNA modification and aging; nonsense-disease therapeutics.

Biochemistry and Molecular Biology (BMB) Faculty

Faculty	Interests
 Xin Bi, Ph.D. Associate Professor, Biology	Chromatin-mediated regulation of gene expression in eukaryotes.
 Dirk Bohmann, Ph.D. Professor, Biomedical Genetics	The biochemistry, molecular biology and genetics of signal-transducing transcription factors and their role in development, aging and disease
 Paul Brookes, Ph.D. Associate Professor, Anesthesiology	Mitochondria and free radicals in cardiac ischemia-reperfusion
 Michael Bulger, Ph.D. Associate Professor, Pediatrics	Chromatin domains and long-range activation by enhancers
 J. Butler, Ph.D. Associate Professor, Microbiology & Immunology	Regulation of Gene Expression by Targeted Degradation of RNA
 Gloria Culver, Ph.D. Professor, Biology Dean of the School of Arts and Sciences	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
 Dmitri Ermolenko, Ph.D. Assistant 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.

Faculty	Interests
 Sina Ghaemmaghami, Ph.D. Assistant Professor, Biology	Molecular mechanisms of prion propagation and pathogenesis
 David Goldfarb, Ph.D. Professor, Biology	Molecular mechanisms that control the exchange of molecules and information between the nucleus and cytoplasm
 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
 Jeffrey Hayes, Ph.D. Professor & Chair, Biochemistry & Biophysics	DNA structure; chromatin; protein-DNA interactions
 Clara Kielkopf, Ph.D. Associate 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
 Xin Li, Ph.D. Assistant Professor, Biochemistry & Biophysics	Small non-coding RNA regulation in germ cells; paternal aging; transgenerational inheritance.

Faculty	Interests
 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. Associate Professor, Biochemistry & Biophysics	Computational biology of RNA, including structure prediction, molecular dynamics, and genomics.
 Margot Mayer-Pröschel, Ph.D. Associate Professor, Biomedical Genetics	Stem Cells in the mammalian CNS / Gestational insults and embryonic CNS development / Astrocyte dysfunction
 Benjamin Miller, Ph.D. Professor, Dermatology	Carbohydrate and protein recognition, molecular design, and biomolecular sensing
 Joshua Munger, Ph.D. Associate Professor, Biochemistry & Biophysics	Mechanisms of metabolic network manipulation induced by viral infection and oncogenic mutation.
 Archibald Perkins, M.D., Ph.D. Professor, Pathology & Laboratory Medicine	Genes that impact the development of leukemias and other human malignancies
 Eric Phizicky, Ph.D. Professor, Biochemistry & Biophysics	tRNA biogenesis, function and quality control; intellectual disability due to deficiencies in tRNA modifications.
 Elaine Sia, Ph.D. Associate Professor, Biology	Mutagenesis and repair of the mitochondrial genome.
 Harold Smith, Ph.D. Professor, Biochemistry & Biophysics	RNA regulation of innate immune modulators and small molecule inhibitors of HIV RNA-binding proteins.

	Faculty	Interests
	Laurie Steiner, M.D. Assistant Professor, Pediatrics Medicine	Pediatric Biomedical Research
	Douglas Turner, Ph.D. Professor, Chemistry	Biophysical chemistry of RNA folding/stacking using NMR; RNA-targeted therapeutics
	Joseph Wedekind, Ph.D. Professor, Biochemistry & Biophysics	Structure and function analysis of gene regulation by riboswitches and microRNAs as a basis for therapeutic development.
	Yi-Tao Yu, Ph.D. Professor, Biochemistry & Biophysics	RNA modification; pre-mRNA splicing; snRNP biogenesis; telomerase RNA modification and aging; nonsense-disease therapeutics.
	Jiyong Zhao, Ph.D. Associate Professor, Biomedical Genetics	Signal transduction and development of therapeutic agents in B-lymphomas; Cell cycle regulation
	Jian Zhu, Ph.D. Assistant Professor, Microbiology & Immunology	Host-virus interactions, particularly for HIV and herpes viruses

BMB Elective Courses

Fall 2016

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.

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.)

CHM 423 NMR SPECTROSCOPY (2)

(Formerly CHM 422) - An introduction to NMR spectroscopy. Collection, processing, and interpretation of homonuclear and heteronuclear 1D and multidimensional spectra will be covered. Topics to be discussed include chemical shifts, relaxation, and exchange phenomena. Examples from organic, inorganic, and biological chemistry will be used. (Fall, 1st half of semester).

MBI 473 IMMUNOLOGY (3)

Innate and adaptive immunity; structure and genetics of immunoglobulins and T cell receptors; lymphocyte development, immune regulation, immunological diseases, tumor immunity. Three Exams.

PHP 403 HUMAN CELL PHYSIOLOGY (4)

This course is aimed at providing an introduction to the fundamental principles of modern cell physiology; the implications of cellular and molecular principles for the integrated physiological responses of intact organs and tissues, in both healthy and diseased states, will be discussed. The material will include basic concepts, principal research questions, and common methodologies - emphasis will be on a quantitative approach wherever possible. Course content will particularly focus on basic cellular physiology, including excitable cell physiology, and will emphasize intercellular interactions and responses to their tissue and organ environment. Recent literature relevant to the material will be reviewed and analyzed during the course.

BST 463 INTRO TO BIOSTATISTICS (4)

Introduction to statistical techniques with emphasis on applications in the health sciences. Summarizing and displaying data; introduction to probability; Bayes' theorem and its application in diagnostic testing; binomial, Poisson, and normal distributions; sampling distributions; estimation, confidence intervals, and hypothesis testing involving means and proportions; simple correlation and regression; contingency tables; use of statistical software.

BST 464 APPLIED LINEAR REGRESSIONS (4)

One-way and two-way analysis of variance; multiple comparisons involving means; fixed and random effects; simple and multiple linear regression; analysis of covariance; interactions; correlation and partial correlation; multicollinearity; model selection; model checking.

Spring 2017

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 (5)

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 every other year (Even # years).

BPH 509 MOLECULAR PHYSICS (5)

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 every other year (Odd # years).

CHM 402 BIOPHYSICAL CHEMISTRY I (4)

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. Paper and presentation. (even years)

CHM 414 BIOLOGICAL INORGANIC CHEMISTRY (4)

Discussion of the role of metal ions in biological systems, especially enzymes. Uptake and regulation of metals, common spectroscopic techniques used for studying metals, and mechanisms through which they react. Other topics include metal ion toxicity, metal-based drugs, and interaction of metals with nucleic acids. Problem sets and proposal.

CHM 416 X-RAY CRYSTALLOGRAPHY (2)

Students will learn the basic principles of X-ray diffraction, symmetry, and space groups. Students will also experience the single crystal diffraction experiment, which includes crystal mounting, data collection, structure solution and refinement, and the reporting of crystallographic data. Weekly assignments: problem sets, simple lab work, or computer work.

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.

CHM 458 MOLECULAR SPECTROSCOPY (2)

This 2 credit course covers the basic theory and experimental practice of spectroscopy in molecules and condensed matter. A general review of electromagnetic waves is followed by time dependent perturbation theory and a density matrix treatment of two-level systems. The basic principles are applied electronic, vibrational and rotational spectroscopy. The course draws heavily on literature studies that exemplify the material.

CHM 460 CHEMICAL KINETICS (2)

Within the broad area of chemical kinetics, this course will focus on basic concepts of kinetics, photochemistry and electron-transfer (eT). In addition to studying bulk reaction rates, we will discuss Marcus's theory of eT, intramolecular vibrational energy redistribution (IVR) and vibrational cooling, and the fates of photoexcited species (radiative and non-radiative decay channels). We will address the experimental quantification of these kinetics using time-resolved spectroscopy and analysis of kinetic data. The course material will be somewhat continuous with that of CHM 458, Molecular Spectroscopy. (Spring, 2nd half of semester.)

GEN 507 ADVANCED GENETICS (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 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. It has become clear that cells have multiple mechanisms for sensing the environment and converting the external signals into intracellular responses. The goal of this course will be for students to learn modern concepts in signal transduction. The lectures will cover a spectrum of topics ranging from basic principles and mechanisms of signal transduction to contemporary techniques for doing research in this area.

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.

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).

PTH 507 CANCER BIOLOGY (3)

The lectures will provide historical perspectives of cancer incidence, treatment, and early scientific inquiry as a foundation for understanding the current state of cancer research. Leading basic and translational scientists will discuss the genetic basis of cancer in both familial cancer syndromes and acquired somatic mutations. Research on the normal cellular functions such as cell cycle control, apoptosis, and signal transduction that become aberrant in cancer progression will also be discussed. Additionally, the mechanism of chemical and viral induction of cancer will also be explored.

The second half of the course will focus on clinical identification and treatment of cancer as well as the 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.

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.

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER MEDICAL CENTER

Annual PhD Student Evaluation / Progress Report

Student Name		Program Name	Select Program
Entering Year		Today's Date	
Evaluation Period Start Date		Evaluation Period End Date	

Title of Research Project

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, the Senior Associate Dean for Graduate Education and to Graduate Education and Postdoctoral Affairs.*
- *Upon receipt of the email, the Dean's 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.

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

3. Papers Published

4.a. Predoctoral Fellowships: Applications

4.b. Predoctoral Fellowships: Awarded

4.c. Predoctoral Fellowships: Planned

5. Honors / Awards Received

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

1. Teaching

2. University or Department Committees

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

4. Clinical / Translational Experiences

5. Other Professional Activities Not Identified Above

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

C. COURSEWORK

1. Remaining Required Courses

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

3. Courses to be Taken Next Year

D. RESEARCH PROGRESS

1. Overall objective of research efforts.

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

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

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*).

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

F. CAREER GOALS

1. Current Career Goals

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

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?

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

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.

H. ADDITIONAL STUDENT COMMENTS

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

I. COMMITTEE MEETING INFORMATION

Committee Meeting Date

If no meeting occurred, please explain why.

Advisor's Name

Committee Member 1 Name

Committee Member 2 Name

Committee Member 3 Name

Committee Member 4 Name

Committee Member 5 Name

J. COMMITTEE REPORT

Is the student making satisfactory progress?

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.

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.

Should the student meet with the committee at 6 months instead of 1 year?

Anticipated month/year of PhD defense:

Please rate the student's progress for the period covered by this report:

Instructions for Evaluation Submission to the Senior Associate Dean's 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- Senior Associate Dean, Edith M. Lord edith_lord@urmc.rochester.edu
  2- SMDGradEval@urmc.rochester.edu
  3- All Committee Members
  4- Student
- Upon receipt of the email, the Dean's 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.

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER MEDICAL CENTER

Rotation Evaluation Form (Student)

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

Student Name

Mentor Name

Program Name Select Program

MD/PhD Student?

Evaluation Date

Rotation Start Date

Rotation End Date

My attendance (in the lab or otherwise) was:

Have you been assigned background readings?

Can you perform (execute) your own experiments?

How much have you learned technically?

Contact with mentor:

Did your mentor keep commitments, appointments, etc.?

Who did the bulk of the training?

Did you get along with your mentor?

Was your mentor a good rotation advisor?

Did your rotation advisor discuss your rotation evaluation with you?

Overall rating of rotation:

Did this rotation meet your expectations?

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.

Briefly describe the research project assigned for this rotation.

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

Describe what you accomplished.

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 Senior Associate Dean's 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:
  - Senior Associate Dean, Edith M. Lord edith_lord@urmc.rochester.edu
  - SMDGradEval@urmc.rochester.edu

- Upon receipt of the email, the Dean's 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 Senior Associate Dean 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

Revised 07/15

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		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		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:		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:		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:		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)		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 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.
- 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.

THESIS COMMITTEE APPOINTMENT FORM

Student Name: _____ Date:

Program of Study: Select One _____

Advisor: _____

The following faculty members have agreed to serve on the Ph.D. Advisory Committee

Primary members of the Department of Biochemistry and Biophysics

_____

_____

Additional faculty (at least one must have a primary appointment in a department other than Biochemistry and Biophysics)

_____

_____

_____

Four committee members (including the advisor) are required. A student may have additional members.

Approval

Advisor _____ Date _____

Program Director _____ Date _____

Notes (For Office Use Only):

SCHOOL OF MEDICINE & DENTISTRY
UNIVERSITY of ROCHESTER MEDICAL CENTER

Request for PhD Defense Chairperson

Name of Candidate _____ UR ID# _____

Department _____

For the Degree In _____

Name of Advisor _____

Committee Members: _____ _____

_____ _____

_____ _____

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

1st Chair Nominee	Dept. of Primary Appointment/Faculty Rank	
2nd Chair Nominee	Dept. of Primary Appointment/Faculty Rank	
3rd Chair Nominee	Dept. of Primary Appointment/Faculty Rank	

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

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 one faculty member is approved to chair the defense exam.

This form must be submitted to the Senior Associate Dean for Graduate Education 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: 03/15

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.