

***THE UNIVERSITY OF CHICAGO***

***BIOCHEMISTRY & MOLECULAR BIOPHYSICS GRADUATE  
PROGRAM***

***STUDENT HANDBOOK***

2020 – 2021

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## **INTRODUCTION TO THE BIOCHEMISTRY AND MOLECULAR BIOPHYSICS GRADUATE PROGRAM**

Welcome to the Department of Biochemistry and Molecular Biology at the University of Chicago. Our Department offers training for careers in biochemistry and molecular biophysics. Research encompasses all areas of modern biochemistry, including but not limited to the following topics: protein engineering, protein and RNA folding and misfolding, RNA catalysis, error biology, microbiology, DNA recombination, molecular endocrinology and immunology, cytoskeleton, ion channels, and membrane protein structure, function, and insertion. In addition to more traditional biochemical approaches, techniques employed in the department include but are not limited to NMR spectroscopy, X-ray crystallography, cryo-electron microscopy, single-molecule techniques, computational approaches, display technology, electron paramagnetic resonance, and small angle X-ray scattering. Our Department is distinguished by its intellectual rigor and collaborative style. The interdisciplinary nature of the Department is further accentuated by the Institute for Biophysical Dynamics, which brings together biological and physical scientists to pursue common research goals and through NIH sponsored training programs in Molecular and Cellular Biology and Chemical Biology.

This handbook is to help you become familiar with our graduate program. We hope that it will help you get started. Good luck!

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## **MISSION AND GOALS OF OUR PROGRAM**

The Biochemistry and Molecular Biophysics graduate program seeks to recruit highly motivated students and equip them with the skills that will be needed to recognize and solve the major problems in biomedical science in the coming decades. A major goal in our research enterprise aims to understand the molecular, structural, and energetic principles that govern function and behavior at the organismal level. Major advances in analytical biochemistry in the past decade have led to an explosion of information regarding the parts that comprise cells, underscoring the richness and complexity of living systems. We seek to deliver a generation of scientists equipped with the skill set to unravel this complexity at the mechanistic level. Our program therefore aims to instill a conceptual framework for how life works from a molecular perspective and to facilitate acquisition of a solid understanding of the principles that govern the structure, function, and energetics of biological macromolecules together with an appreciation of the methods and analytical tools used to address biological questions at a variety of scales. To that end, our program serves to train an important cadre of students whose interests bridge the physical and biological sciences. To realize these goals, the Department of Biochemistry and Molecular Biology has built a faculty and created courses and workshops that span a broad research agenda and bring to bear capabilities that encompass a wide range of biophysical and biochemical systems and techniques. In addition, our research and training program is powerfully enriched by our interactions with an array of cross-divisional institutes and programs (Institute for Biophysical Dynamics, The Chemistry and Biology Interface Training Program, and the Biophysics Training Program). Modular workshops comprise another unique feature of our program. These currently include X-ray crystallography, NMR spectroscopy, Molecular Dynamics Simulation, and Proposal Writing.

## REQUIREMENTS AND POLICIES FOR STUDENTS IN THE BIOCHEMISTRY AND MOLECULAR BIOPHYSICS GRADUATE PROGRAM

Most students in the Department of Biochemistry and Molecular Biology enter the graduate program to earn the Ph.D. Degree, although a Master's degree is also offered. The Ph.D. program requires generally 4 to 6 years of study. The first year is dedicated to completing course work and engaging in small research projects in several laboratories (research rotations) as a mechanism to become acquainted with research in the department. During the first year there are also many opportunities to attend the Graduate Student Seminar Series and departmental seminars and participate in the visits of invited speakers. After the Preliminary Examination at the end of the first year, students choose a research advisor in whose laboratory they will carry out their Ph.D. research, culminating in a written dissertation, oral defense, and a public presentation. Throughout your graduate career, your research advisor, the department chair, your academic advisor, and the student program administrator are ready to help you achieve your goals and complete your degree in a timely manner.

Each student is required to complete the BMB core curriculum. The core curriculum includes two research rotations (Winter and Spring Quarter), seven didactic courses, and additional requirements listed below. Among the seven didactic courses, Protein Fundamentals (30400), Biophysical Properties of Biomolecules (32200), Cell Biology (31600) and one of two of the following courses: Molecular Biology I (31200) and Nucleic Acid Structure and Function (30600) are required (see course descriptions below; 31600 may be substituted with another course in Cell Biology). Two additional courses (BCMB 31900 – Introduction to Faculty Research, called “Faculty All Stars” and BCMB 31800 – Current Seminar Topics in Biochemistry and Molecular Biology) are required. BCMB 31900 is not for credit; however, BCMB 31800 is for ½ a credit. Additionally, BMB students are required to participate in two workshops associated with the curriculum. The first is the Data Science with R Bootcamp that takes place in the fall and winter quarter and is associated with BCMB 30400. The second is a Proposal Writing Workshop that takes place at the end of Spring Quarter/beginning of Summer Quarter and is associated with the Preliminary Examination process. Each student is required to serve as a Teaching Assistant for a total of two quarters, but this *requirement is fulfilled AFTER second year of training*.

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**1. Full-time Residence** – Students must enroll in courses totaling 300 units of credit during each of the first three quarters subsequent to matriculation at UChicago. Both first-year and more senior students receive the official holidays of the University and up to four weeks of vacation per year. Time off during interim period is counted as vacation. If more time off is required students must petition the Curriculum Committee for a leave of absence.

**2. Course Requirements** – Students must complete the BMB core curriculum [Protein Fundamentals (BCMB 30400) and the associated Data Science with R Bootcamp, Biophysical Properties of Biomolecules (BCMB 32200), Cell Biology (BCMB 31600), and one of the following two courses: Molecular Biology (BCMB 31200) or Nucleic Acid Structure and Function (30600)]. To fulfill full-time residence requirements, students complete two research rotations (see below) and elective courses from among many offered by BMB and other departments. In making these choices, students are welcome to consult their academic advisor or Curriculum Chair.

**3. Submission of a Research Manuscript** – Students must submit to a peer-reviewed journal a minimum of one primary research manuscript on which they are listed as first author. This is in addition to completing a significant body of research approved by all members of the Thesis Committee.

**4. Research Rotations** – Students are required to complete two research rotations with at least two faculty members (one of whom must be a faculty member of BMB). Rotations are performed during the first academic year – one each in winter and spring quarter. Each rotation lasts ten weeks, coinciding with the academic quarter. A third rotation in the summer quarter is an option but requires approval from the Curriculum Committee Chair.

**5. Grade Requirements** – Students must receive the letter grade A, B, or C, or the equivalent in all courses completed while a student at the University and must maintain a cumulative B average (3 on a 4 point system) at all times. Students who do not maintain a B average will not be considered a student in “good standing” and will be placed on academic probation. Any grade recorded as “I” (incomplete) must be replaced by a standard letter grade by the close of the next academic quarter.

**6. Academic Standing** – To be designated as being in “good standing”, students must maintain a B average and complete all departmental requirements on schedule. A student not in good standing may be placed on academic probation, may be restricted from registering for subsequent quarters of study, or may be asked to leave the program. Students that have been placed on academic probation a second time may, at the Curriculum Committee’s discretion, be asked to leave the program.

**7. Deadlines** – Students who fail to meet the deadlines set for their Preliminary Exam Proposal, Thesis Proposal (Qualifying Exam), and Fifth Year Review materials may be placed on academic probation.

**8. BMB Seminars** – Students are strongly encouraged to attend all scheduled BMB seminars throughout their entire stay in graduate school; attendance at other seminars is encouraged.

**9. Ethics-** All first year students are required to take a course entitled “Scientific Integrity and the Ethical Conduct of Research” for academic credit. Students enroll in this course in the Winter quarter of their first year. Students who are still registered 4 years after completing the initial ethics training must enroll in a second ethics course prior to graduation. This course is given in the Spring quarter.

**9. Teaching Assistantships** – Students are required (by rules of the Biological Sciences Division) to serve twice as a Teaching Assistant. Students are not eligible to start their teaching assistant requirement until their third and fourth year of residence unless the Curriculum Committee is petitioned for a waiver. Students are also encouraged to enroll in the TA Training Course (BSDG 50000, completion of which currently takes the place of one of the two teaching assistantship requirements). Multiple teaching opportunities exist for more senior graduate students to participate (with extra remuneration) in teaching programs once the teaching assistant requirement has been met. Students must have the approval of the Graduate Student Advisor (prior to choosing a laboratory for thesis research) or their thesis advisor (after choosing a research laboratory) before they agree to serve as a teaching assistant in any course.

**10. Requirements for the Transitional Master of Science Degree** – Students may apply for a transitional degree of Master of Science. The transitional Master’s will only be awarded to candidates who have been matriculated for three quarters or more, successfully completed all course requirements for the Ph.D. and met the requirement for a B average, successfully completed the Preliminary Examination and are otherwise in good standing at the time of application. To request the transitional Master’s degree, students must contact the Graduate Program Administrator and must submit their degree application online.

**11. Preliminary Examination – At the beginning of June, students will begin the Preliminary Examination process.** The Preliminary Examination in BMB consists of a written research proposal that is prepared and submitted during the summer quarter of the first year (the fourth quarter in residence). Students (including MSTP students interested in joining BMB) will be permitted to take the Preliminary Examination only after all course and grade requirements have been met. The exam consists of a concise written research proposal and an oral defense of the proposal. Students are expected to demonstrate their ability to 1) identify a scientific problem, 2) propose experiments to address the problem, 3) interpret potential outcomes from the experiments, and 4) frame the question and results in a broader scientific context. In addition, students are evaluated on their ability to convey their ideas clearly in the written proposal and to defend the proposal orally. The chairperson of each exam committee will then contact the student regarding the outcome of their exam and provide written feedback. Two outcomes are possible: Pass or Revisions Needed. If revisions are required, the student will have the opportunity to respond to the committee's concerns and either revise portions of the proposal or re-write the entire proposal as indicated by the committee. In these cases, students will need to write a cover letter addressing the concerns of the committee and the changes that have been made. In addition, students may be required to re-defend the revisions orally with part or all of the exam committee. If a student is asked to re-write and re-defend the entire proposal, an additional faculty member will be added to the exam committee. Inadequate performance on a second exam is grounds for dismissal from the program. For continuation in the program, students must successfully pass the Preliminary Examination by the end of the fifth quarter of full-time residence as a graduate student in Biochemistry and Molecular Biology.

**12. Choosing a Thesis Advisor and Research Laboratory –** Students are expected to choose a thesis advisor and research laboratory within one month after passing their Preliminary Examination; they are required to do so by the end of the fifth quarter of full-time residence in the program. It should be understood that choosing a thesis advisor and research laboratory involves the consent of both parties, and that all such arrangements must be approved by the Curriculum Committee. Thesis advisors must agree to support graduate students performing satisfactory thesis research (by payment of stipend and tuition) should training grant funds not be available or after training grant funds have been applied to the student's pre-doctoral research training.

**13. Thesis Committee and First Thesis Committee Meeting (Qualifying Examination) –** Students (with the advice of their thesis advisor and the approval of the Chair of the Curriculum Committee) must name a Thesis Advisory Committee by the last week of November of their second year and hold their first thesis committee meeting by the end of Winter quarter of their second year. It is the student's responsibility to obtain the agreement of faculty members to serve on the committee before submitting the list for approval. The Thesis Advisory Committee must have a total of four members (including the thesis advisor), at least two of which are members of BMB. The written thesis proposal should be submitted by the fourth week of the Winter quarter of the second year. The oral presentation (Qualifying Examination) will be scheduled at that time and should be completed by the last week of the Winter quarter of his/her second year. A Chair of the Committee who is a member of BMB and who is someone other than the thesis advisor must be chosen by the agreement of committee members at the time of the first meeting.

For each committee meeting the student should give an oral presentation designed to last a maximum of 45 minutes that highlights the written report and covers the essentials of the proposal—the background and significance, scientific aims, experimental design, project status and a time-line for the remainder of the experiments. The first committee meeting should set the stage for the thesis project. Much of the time should be given to developing the background and significance, scientific aims,

experimental design and time-line. The committee will critically evaluate the merits and feasibility of the research project at this time.

The **background and significance** section should address several questions. What broad area of science does the research address and why is it important? What are the major unanswered questions in the field of study and why are they important? Where is the field now and how will the proposed research impact it? The **experimental design** should include the limitations of the proposed approach and what plans are given to address them. In addition, potential hurdles should be noted. The **conclusion** should include a discussion on how the proposed research will further the field in particular and science in general, assuming a successful outcome.

**\*\***Once a thesis committee has been established, its composition can be changed only by petitioning the Curriculum Committee. Such changes may be necessitated by circumstances, including a shift in experimental focus of the candidate or unavailability of a faculty member.

**14. Second and Subsequent Thesis Committee Meetings** – Thesis Committee meetings must be held every six months and not more than nine months apart. Once a student receives notification that he/she is due to have a Thesis Committee Meeting, he/she will have 30 days from the date of notification to arrange the meeting. If the graduate program administrator has not been notified of the date within the 30 days, the graduate program administrator will schedule the meeting for the student.

**One week** prior to a student's thesis committee meeting he/she is expected to provide a written 2 page outline of his/her progress, goals, and directions. In addition to the outline the student must also outline his/her plans for manuscript submission. The student will be asked to address questions like the following: *Please list your major accomplishments to date, including publications and presentations? What are the plans for publication of your ongoing work? What is your timeline for completion of your thesis and graduation? What are your post-graduation career plans? What steps have you taken to explore these possibilities?* The exact nature of these questions will change depending upon his/her year in the program. The student will develop answers to these questions in collaboration with his/her Ph.D. advisor.

Changes in the project should be presented and justified. At the penultimate committee meeting members will reach a consensus that the research has satisfactorily addressed the specific aims of the project. At this point, the student can begin writing their thesis. In between the formal meetings the committee members will be available as a resource for the student.

**15. Penultimate Meeting with the Thesis Committee** – After completing a significant body of experimental work, the student should seek permission from the thesis committee to write and defend his/her dissertation. **One week** prior to this meeting, the student is expected to submit an outline of his/her proposed dissertation to the committee members, including a list of ongoing experiments to be completed before the defense. All committee members must be present for this meeting. Immediately before the start of the meeting, the mentor will review for the Thesis Committee the student's overall progress in the program. The student is not present for this review. The student then summarizes finished or published work and provides details of any ongoing experiments to be completed for the dissertation. If the committee concurs that the student is ready to write and defend his/her thesis, the Chairperson will write a recommendation approving this action. The recommendation may include specific guidelines for unfinished experiments as well as for the structure and content of the dissertation. Approval to write and defend the dissertation does not constitute its acceptance.



**16. Reports of Thesis Committee Meetings** – At the close of each Thesis Committee meeting, the Chair of the Committee must meet with the student to apprise him or her of the view of the Committee and of any problems or difficulties that might have become apparent. The Chair of the Committee must also write and submit a brief report of the Committee attesting to performance, committee recommendations, and so forth. **This report must be submitted to Graduate Program Administrator, all members of the committee, and the student within one week of the meeting so that there will be no disagreement as to the conclusion of the meeting.** This report will become part of the student's permanent file, which the student is welcome to view at any time. In the event that unsatisfactory performance is identified, students may be asked by the Committee to undertake remedial activities to improve their standing.

**17. Annual Training Progress Reports** – Students will be asked to prepare brief annual progress reports of their activities that are necessary to ensure compliance with Training Grant guidelines for performance during the years of pre-doctoral research training.

**18. Individual Development Plan (IDP)** – The Individual Development Plan is designed to foster communication in a variety of ways, primarily to ensure that the student and advisor are discussing short- and long-term training goals, and also that the student is receiving comprehensive guidance on how to best achieve these goals while making efficient progress toward earning his or her degree. Both research and training goals should be discussed, as well as the level of effort and commitment necessary to meet these goals. Training goals are expected to evolve over time.

While we encourage you to complete your IDP with your advisor you may choose to do it with another individual if you prefer. Alternative IDP mentors include your thesis committee chair, program/curriculum chair, training grant directors or BSD Career Advisor.

In the fall quarter of the second year, each student should complete the Individual Development Plan (IDP) with his or her advisor. Thereafter, we recommend you complete your IDP at the time of your committee meeting. The deadline for submitting proof that you completed your IDP is at the end of August of each year; if you are unable to submit your IDP by the deadline, you must petition the curriculum committee for an extension.

**19. Thesis Submission and Thesis Examination** – The examination will involve a comprehensive evaluation of the thesis and related topics. The examination will occur in two parts (Private Defense and Public Seminar) that will take place on separate days. Students must submit well-formatted, complete copies of their thesis to members of their Thesis Committee a **minimum of two weeks** prior to the date of the meeting. Failure to submit the thesis in a timely fashion will require rescheduling of the closed session meeting.

**Part 1 (Private Defense)** is a thesis evaluation conducted by the Thesis Committee and involves a closed session thesis committee meeting. All thesis committee members will have read the thesis before this meeting. During the meeting the student will summarize the major findings of their graduate research and update the committee on experiments completed since the penultimate committee meeting. Thesis committee members should be prepared to provide recommendations for revision of the thesis. In certain cases, it may be necessary to postpone the public seminar until the dissertation is considered satisfactory.

**Part 2 (Public Seminar)** is a high-quality seminar delivered by the student. The public seminar should take place within 10-30 days after the thesis evaluation but not before or after that time frame. All thesis committee members are expected to attend the public seminar.

**\*\*Both parts of the exam must be completed to the satisfaction of the thesis committee in order for the student to pass the examination.**

Students must ensure that their thesis meets the guidelines and requirements of the University Office of Academic Publications (<http://www.libl.uchicago.edu/e/phd/>).

**20. Term of Graduate Research Training** – While there is no maximal or minimal term specified for completion of thesis research leading to the Ph.D. in BMB, students who have not had their penultimate meeting by the beginning of Autumn Quarter of their fifth year are required to undergo a review to assess research progress and potential for fulfilling degree requirements in a timely fashion. For the review, the student must provide the following information.

- A cover letter that includes a proposed timeline for graduation
- Curriculum vitae
- Detailed summary of graduate research and accomplishments including reprints of published papers, preprints of submitted papers, or drafts of manuscripts in preparation
- Outline of proposed dissertation
- List of ongoing experiments to be completed before graduation
- Signature of the thesis advisor

The review materials will be considered incomplete if any of the above is not provided. To ensure an accurate view of research progress, the Curriculum Committee will meet with students as part of the review process.

**21. Leave of Absence** – Under unusual circumstances (usually involving personal difficulties), students may request a leave of absence from their graduate studies. Petitions for leave of absence must be submitted in writing to the Curriculum Committee for consideration. Such petitions must describe the relevant circumstances, the importance of the leave to the student, and a plan for returning to full time study and completion of requirements. Leave of absence petitions are generally approved for students in good standing who express sound reasons for choosing to enter out-of-residence status. Nevertheless, the Curriculum Committee may set certain limitations on a leave of absence and may identify a maximal term for the leave. In any case, a leave of absence can be approved for a period of no longer than 12 months. Students who will be out of residence for a longer period must petition the Committee annually for an extension of their leave. Students on an extended leave of absence may be required to fulfill additional course requirements. It should be understood that a leave of absence will not be approved indefinitely and that a leave may alter the ability of students to resume their research and financial support upon their return to academic residence.

**22. Vacation Policy** – As graduate students who are fully registered and receiving a full stipend for four academic quarters, all students are required to be on campus, in residence, and engaged in study or research during all four quarters, including summer quarter. During the first year in the graduate program, vacations generally coincide with the university's academic calendar. Prior to joining a laboratory, first year students who wish to take a vacation at other times, including during summer quarter, must obtain the approval of the Curriculum committee Chair. After joining a laboratory, the amount and the timing of vacation must be agreed by a student and his/her advisor.

**23. Tuition payments for students in their 7<sup>th</sup> year** – Tuition support is available for students through their sixth year of residence. Students are expected to pay their own tuition after the 6<sup>th</sup> year unless they have petitioned the curriculum committee for an exception. Research advisors and the thesis committees must make every effort to help students complete their dissertation research within six years.

**24. Waiving Requirements** – The Department expects that its pre-doctoral students will follow the guidelines set forth in this handbook and meet the requirements of the program in a timely fashion. Under extenuating circumstances, students may petition the Curriculum Committee for a waiver of a requirement or for extension of a deadline. Such petitions must be in writing, must state the related background, and must explain why the request is being made. Petitions may be accepted (with a detailed schedule possibly being set for completion of responsibilities), or may be denied. The timely submission of a petition for waiver of a requirement, or for extension of a deadline, remains the student's responsibility.

**25. Problems or difficulties** – At various times during their stay in graduate school; students might experience a problem that concerns an academic or personal matter. The faculty and staff of the Department are here to help. On the one hand, a student's first contact in seeking help might be his or her thesis advisor or the graduate student advisor. On the other hand, a student might wish instead to contact the Chair of the Department, the Chair of the Thesis Committee, or any other faculty member. If the matter is sensitive, students should say so and should request confidentiality in related discussions. At the same time, students should not hesitate to ask for assistance (be it advice or intervention) whenever they need it.

**26. Grievances** – The BMB graduate program follows the Biological Sciences Division policies on resolving graduate students' concerns about academic matters. Academic matters include but are not limited to such matters as course grades, teaching assignments, publication rights, timely feedback on academic work, timeliness of letters of recommendation, and application of policies and practices.

Briefly, students who encounter problems with their research project, their advisor, or the responses of their thesis committee to their work should approach the chair of their thesis committee to discuss how to handle and resolve the situation. If they feel uncomfortable approaching the chair, then they should contact the chair of the Curriculum Committee and/or the chair of the graduate program for advice – such conversations will always be regarded as confidential. If a student disagrees with the report on their committee meeting, they should immediately contact the chair of the Curriculum Committee. Students should always feel free to contact the CMB Curriculum Committee to discuss any difficulties, scientific or personal; such communications are always confidential. Similarly, the Dean in the BSD Office of Graduate Affairs is available to help resolve academic problems, and can help direct students to appropriate academic and non-academic support services provided by the Division and University.

The text below is taken from the Statement of BSD policy on “Procedures to Resolve BSD Graduate Students Concerns about Academic Matters”. The full document and other relevant information can be found at: <https://biosciences.uchicago.edu/current-students/policies> (access requires Cnet ID and password).

#### **Questions about academic matters**

Students with a question about a grade received in a course should consult with the instructor first. Other questions about academic matters may be brought to the academic advisor, the procedural chair of the student's thesis committee, the chair of the student's graduate program, the head of the

program's curriculum committee, or the dean for graduate students. These people will also be able to help guide students in determining who can best answer their question.

### **Grievance resolution process**

Students with a grievance should bring the grievance to the attention of an appropriate faculty member, who may be the academic advisor, the procedural chair of the student's thesis committee, the chair of the student's graduate program, the head of the program's curriculum committee, the department chair of the faculty mentor, or in rare cases where none of these individuals are appropriate, the dean for graduate students. In cases where there is a perceived ethical issue, rather than, or in addition to, an academic issue, students should bring their grievance direct to the dean for graduate students. The person to whom the student brings their grievance will act as the facilitator of the resolution process, or alternatively will assist the student in finding a more appropriate facilitator. Grievances should be described in a concise and formal written document and brought forward as soon as possible, at the latest within one quarter.

Should the matter remain unresolved, the student may bring the grievance to the attention of the dean for graduate students. The student should submit their grievance, the written response to the grievance, and an articulation of why the matter is still unresolved in writing to the dean for graduate students. The dean for graduate students will review the written materials, may ask the student for clarification, may consult with the facilitator, and together with the BSD standing faculty grievance committee will make a final determination. The dean for graduate students will discuss the outcome of the review in person with the student and follow up in writing.

Students with questions about any of these procedures may contact the dean for graduate students. Students may also avail themselves of the Office of the Student Ombudsperson (<http://ombudsperson.uchicago.edu/>) to assist in providing impartial advice and assistance with navigating the grievance procedures or related matters. The Ombudsperson can also help where the existing channels of communication or dispute resolution have proven unsatisfactory.

### **Other Complaints**

Complaints about sexual harassment or discrimination and harassment on the basis of race, color, religion, sex, sexual orientation, gender identity, national or ethnic origin, age, disability, veteran status, genetic information, or other protected classes under the law are addressed under the University's unlawful discrimination and harassment policy. For more information, please see <http://studentmanual.uchicago.edu/university/index.shtml#unlawful>.

Complaints about student conduct involving possible violation of University policies and regulations and other breaches of standards of expected behavior of University students should be brought promptly to the attention of the Dean of Students of the academic area of the student in question."

## 2020 MOLECULAR BIOSCIENCES CURRICULUM

**Requirements for students registered in the five units will be as follows:**

**Biochemistry & Molecular Biophysics:** Four required courses: Protein Fundamentals (Autumn), Biophysical Properties of Biomolecules (Spring), one course in Cell Biology, and one of the following: Nucleic Acids Structure and Function OR a course Molecular Biology, **and** Current Seminar Topics in Biochemistry and Molecular Biology, **and** Workshop on Proposal Writing (beginning of Summer Quarter). Additional recommended courses: Membrane Proteins, Evolution of Biological Macromolecules, Computation in Biophysics, Data Science in Biochemistry and Biophysics, plus three electives.

**Development, Regeneration, and Stem Cell Biology:** One course in Cell Biology, one course in Genetics, one course in Molecular Biology. Plus four electives, three of which must be in the field of Developmental Biology.

**Genetics, Genomics & Systems Biology: EMPIRICAL TRACK:** Four required courses: Genetics Analysis of Model Organisms, Genomics & Systems Biology, Molecular Biology (I or II), and one of the following courses: Fundamentals of Molecular Evolution, **OR** Principles of Population Genetics I **OR** Evolutionary Genomics **OR** Human Variation & Disease

**COMPUTATIONAL TRACK:** Three required courses: Statistical Theory and Methods, Fundamentals of Computational Biology: Models and Inference, Fundamentals of Computational Biology: Algorithms and Applications; **AND**

Three of the following core elective courses required: Human Genetics I, Genetic Analysis of Model Organisms, Introductory Statistical Genetics, Principles of Population Genetics I, Evolution of Biological Molecules, Biophysics of Biomolecules, Human Variation and Disease, Genomics and Systems Biology, Quantitative Analysis of Biological Dynamics

**Human Genetics:**

**EMPIRICAL TRACK:**

Two required courses: Human Genetics I **and** Human Variation & Disease

**AND**

Two of the following required core elective courses: Intro Statistical Genetics **OR** Evolution of Biological Molecules **OR** Fundamentals of Computational Biology: Models and Inference **OR** Principles of Population Genetics I **OR** Genomics and Systems Biology **OR** Molecular Biology II **OR** Genetic Analysis of Model Organisms **OR** Developmental Mechanisms

**COMPUTATIONAL TRACK:**

Three required courses: Statistical Theory and Methods, Fundamentals of Computational Biology: Models and Inference, Fundamentals of Computational Biology: Algorithms and Applications; **AND** Three of the following core elective courses required: Human Genetics I, Genetic Analysis of Model Organisms, Introductory Statistical Genetics, Principles of Population Genetics I, Evolution of Biological Molecules, Biophysics of Biomolecules, Human Variation and Disease, Genomics and

Systems Biology, Quantitative Analysis of Biological Dynamics

**Cell and Molecular Biology:** One course in Cell Biology, one course in Genetics, one course in Molecular Biology, and an additional course in one of these areas.

**\*Students who are undecided about which of the five units they would like to join are advised to take the following courses during their first two quarters to facilitate their transition from one unit to another:**

FALL QUARTER

Cell Biology  
Genetic Analysis  
Protein Fundamentals  
Human Genetics I

WINTER QUARTER

Molecular Biology I

## BIOCHEMISTRY & MOLECULAR BIOPHYSICS COURSES 20-21

### ***AUTUMN QUARTER COURSES***

**BCMB 30400 – Protein Fundamentals:** The course covers the physical-chemical phenomena that define protein structure and function. Topics include: the principles of protein folding, molecular motion and molecular recognition; protein evolution, design and engineering; enzyme catalysis; regulation of protein function and molecular machines; proteomics and systems biology.

*Özkan, Araç, Piccirilli*

**BCMB 30600 – Nucleic Acid Structure and Function:** This course focuses on the biology, biochemistry and biophysics of nucleic acids. Topics include nucleic acid structure, folding, chemistry and interactions with proteins, the mechanisms of CRISPRs and other biotech tools, non-coding RNAs, and the enzymology of key processes such as DNA replication, repair and recombination. Emphasis is placed on primary literature and methodology. Prerequisite: Courses in Biochemistry, molecular biology and organic chemistry. *Rice, Fei*

**BCMB 31400 – Genetic Analysis of Model Organisms (=MGCB 31400):** Fundamental principles of genetics discussed in the context of current approaches to mapping and functional characterization of genes. The relative strengths and weaknesses of leading model organisms are emphasized via problem-solving and critical reading of original literature. *Bishop, Moskowitz, Ferguson, Lee*

**BCMB 31600 – Cell Biology (=MGCB 31600):** Eukaryotic protein traffic and related topics, including molecular motors and cytoskeletal dynamics, organelle architecture and biogenesis, protein translocation and sorting, compartmentalization in the secretory pathway, endocytosis and exocytosis, and mechanisms and regulation of membrane fusion. *Turkewitz, Glick*

**BCMB 31800 – Current Seminar Topics in Biochemistry and Molecular Biology:** This course will expose students to current research topics in biochemistry and molecular biology by highlighting a selection of

speakers from the weekly seminar series. Prior to each highlighted seminar, we will discuss relevant papers and subsequently, we will review the seminar. **This is a required ½ credit course for all BMB first year students and will be graded as Pass/Fail.** *Kossiakoff/Moffat*

**BCMB 31900 – Introduction to Faculty Research:** Lectures on current research by departmental faculty and other invited speakers. This is a required course for all first-year graduate students. *Staff*

**BCMB 39800 – Selected Reading Topics in Biochemistry and Molecular Biology:** Subject matter for individual tutorial-based study is selected through prior consultation and is given under the guidance of a faculty member. The student and faculty member must indicate at time of registration whether the course will be taken on a letter grade or pass/fail basis. Prerequisite: Consent of Department and Instructor. *Staff*

**BCMB 40100 – Research in Biochemistry and Molecular Biology:** The student conducts original investigation under the direction of a faculty member. The research is presented and defended as a dissertation in candidacy for the degree of Doctor of Philosophy. Prerequisite: Completion of course requirements and Preliminary Examination at the Ph.D. level and approval of Chairman of the Department. *Staff*

### ***WINTER QUARTER COURSES***

**Molecular Dynamics Workshop:** This 3 week workshop covers the fundamental physical elements and numerical algorithms underlying molecular dynamics simulations, and provides the practical information needed to utilize the programs VMD and NAMD. Each week, there will be a one-hour formal lecture plus a one-hour practical session. The workshop will take place during a period of three weeks during mid-winter quarter. *Roux*

**BCMB 31100 – Evolution of Biological Molecules:** The course connects evolutionary changes imprinted in genes and genomes with the structure, function and behavior of the encoded protein and RNA molecules. Central themes are the mechanisms and dynamics by which molecular structure and function evolve, how protein/ RNA architecture shapes evolutionary trajectories, and how patterns in present-day sequence can be interpreted to reveal the interplay data of evolutionary history and molecular properties. Core concepts in macromolecule biochemistry (folding and stability of proteins and RNA, structure-function relationships, kinetics, catalysis) and molecular evolution (selection, mutation, drift, epistasis, effective population size, phylogenetics) will be taught, and the interplay between them explored. *Drummond, Thornton*

**BCMB 31200 – Molecular Biology I (=MGCB 31200):** Nucleic acid structure and DNA topology; methodology; nucleic-acid protein interactions; mechanisms and regulation of transcription, replication and genome stability and dynamics. *Rothman-Denes, Bishop*

**BCMB 31358 – Simulation, Modeling, and Computation in Biophysics:** This course will develop skills for modeling biomolecular systems, proteins, membranes, ion channels. Fundamental knowledge will cover basic statistical mechanics, free energy, and kinetic concepts. Tools will include molecular

dynamics and Monte Carlo simulations, random walk and diffusion equations, and methods to generate random Gaussian and Poisson distributions. A term project will involve writing a small program that simulates a process. Familiarity with a programming language or Math lab would be valuable. Prerequisite: BIOS 20200 or consent of instructor. *Roux*

**BCMB 32300 – Structure and Function of Membrane Proteins:** This course will be an in depth assessment of the structure and function of biological membranes. In addition to lectures, directed discussions of papers from the literature will be used. The main topics of the course are: (1) Energetic and thermodynamic principles associated with membrane formation, stability and solute transport (2) membrane protein structure, (3) lipid-protein interactions, (4) bioenergetics and transmembrane transport mechanisms, and (5) specific examples of membrane protein systems and their function (channels, transporters, pumps, receptors). Emphasis will be placed on biophysical approaches in these areas. The primary literature will be the main source of reading. Students will be responsible for presentation of each assigned paper and discussions of the significance of the papers. *Perozo*

**BCMB 32800 – Introduction to Data Science in Biochemistry and Biophysics:** This course will introduce students to exploratory computational data analysis in biochemistry. We will begin with exploration of example datasets in the R programming language for statistics. We will cover approaches to wrangle data into shape for analysis, to develop models that explain trends in data sets, and finally to refining our graphical presentation and preparing analysis reports and figures for publication. A middle segment will cover best practices with tooling and workflows, including navigating the shell in Linux/Unix/BSD systems. Finally, we will introduce students to the Julia programming language, which is useful for more complex problems where expressiveness and performance matter. The course will follow a lecture format, with live, in class exercises.

**BCMB 39800 – Selected Topics in Biochemistry and Molecular Biology:** Subject matter for individual tutorial-based study is selected through prior consultation and is given under the guidance of a faculty member. The student and faculty member must indicate at time of registration whether the course will be taken on a letter grade or pass/fail basis. Prerequisite: Consent of Department and Instructor. *Staff*

**BSDG 40100 – Non-Thesis Research:** The student participates in one of the research programs of the Department. Prerequisite: Consent of Department Chairman and individual faculty member. *Staff*

**BCMB 40100 – Research in Biochemistry and Molecular Biology:** The student conducts original investigation under the direction of a faculty member. The research is presented and defended as a dissertation in candidacy for the degree of Doctor of Philosophy. Prerequisite: Completion of course requirements and Preliminary Examination at the Ph.D. level and approval of Chairman of the Department. *Staff*

### **SPRING QUARTER COURSES**

**BCMB 31300 – Molecular Biology II (=MGCB 31300):** The content of this course will cover the



mechanisms and regulation of eukaryotic gene expression at the transcriptional and post-transcriptional levels. Our goal is to explore with you research frontiers and evolving methodologies. Rather than focusing on the elemental aspects of a topic, the lectures and discussions will focus on the most significant recent developments, their implications and future directions. Enrollment requires the equivalent of an undergraduate molecular biology course or consent from the instructors. *Staley, Ruthenburg*

**BCMB 32200 – Biophysical Properties of Biomolecules:** The course will cover the properties of proteins, RNA, DNA and their interactions. Particular emphasis will be on interplay between structure, thermodynamics, folding and function at the molecular level. Topics will include cooperativity, linked equilibrium, hydrogen exchange, electrostatics diffusion and binding. *Sosnick*

**BCMB 32600 – Methods in Structural Biology:** This course aims to provide students with the theoretical and applied knowledge on the use of modern structural biology methods, namely x-ray crystallography, cryo-electron microscopy and nuclear magnetic resonance spectroscopy. Basic knowledge of protein chemistry (as provided in BCMB 30400) strongly recommended. *Ozkan, Zhao, Meredith, Sachleben*

**BCMB 39800 – Selected Topics in Biochemistry and Molecular Biology:** Subject matter for individual tutorial-based study is selected through prior consultation and is given under the guidance of a faculty member. The student and faculty member must indicate at time of registration whether the course will be taken on a letter grade or pass/fail basis. Prerequisite: Consent of Department and Instructor. *Staff*

**BSDG 40100 – Non-Thesis Research – Introduction to Research:** The student participates in one of the research programs of the Department. Prerequisite: Consent of Department Chairman and individual faculty member. *Staff*

**BCMB 40100 – Research in Biochemistry and Molecular Biology:** The student conducts original investigation under the direction of a faculty member. The research is presented and defended as a dissertation in candidacy for the degree of Doctor of Philosophy. Prerequisite: Completion of course requirements and Preliminary Examination at the Ph.D. level and approval of Chairman of the Department. *Staff*

### ***SUMMER QUARTER***

**Proposal Writing Workshop:** The main objective of this workshop is to learn the aspects of writing a proposal, coming up with ideas, creating a draft and writing a proposal. The workshop involves morphing original ideas from individual students into proposal forms through verbal discussions in class for proposals in NIH 6-page format. The workshop will take place during early summer quarter. **BMB students complete this workshop in conjunction with the Preliminary Examination process.** *Pan*

**BCMB 39800 – Selected Topics in Biochemistry and Molecular Biology:** Subject matter for individual tutorial-based study is selected through prior consultation and is given under the guidance of a faculty member. The student and faculty member must indicate at time of registration whether the course will be taken on a letter grade or pass/fail basis. Prerequisite: Consent of Department and Instructor. *Staff*

**BCMB 39900 – Introduction to Research:** The student participates in one of the research programs of the Department. Prerequisite: Consent of Department Chairman and individual faculty member. *Staff*

**BCMB 40100 – Research in Biochemistry and Molecular Biology:** The student conducts original investigation under the direction of a faculty member. The research is presented and defended as a dissertation in candidacy for the degree of Doctor of Philosophy. Prerequisite: Completion of course requirements and Preliminary Examination at the Ph.D. level and approval of Chairman of the Department. *Staff*

## **PRELIMINARY EXAMINATION-STUDENT GUIDLINES**

The Preliminary Exam provides an opportunity to evaluate a students' potential for conducting independent research by preparing and defending a research proposal. In addition, the process provides an opportunity for the students to develop proposal/grant writing skills and receive feedback from faculty. Students initiate the process by participating in a Proposal Writing Workshop that begins in early June.

The exam consists of a concise written research proposal and an oral defense of the proposal. Students are expected to demonstrate their ability to 1) identify a scientific problem, 2) propose experiments to address the problem 3) interpret potential outcomes from the experiments and 4) frame the question and results in a broader scientific context. In addition, students are evaluated on their ability to convey their ideas clearly in the written proposal and to defend the proposal orally.

Students in good academic standing are eligible to take the Preliminary Examination after they have completed their required coursework and have met all other requirements of the department. For most students, the Preliminary Examination is scheduled during the summer quarter corresponding to the fourth quarter of full time residence in our graduate program. The Curriculum Committee and its chairperson are responsible for determining eligibility and for scheduling the examination.

### **Timeline for the exam process**

#### **1. Choose a topic**

The topic of the proposal should be from an area of contemporary biochemistry, biophysics or molecular biology that interests the student. It should be within the focus of the department and should integrate information from coursework, seminars and reading. The question addressed in the proposal should be distinct from the student's projected thesis research, other research the student has conducted as an undergraduate or during a rotation, and other proposals the student has generated for courses (at U of C or elsewhere). Any questions about the appropriateness of a topic should be addressed to the Curriculum Committee chairperson.

#### **2. Submit preliminary title and specific aims**

The preliminary title and specific aims will be due in mid-June. The Curriculum Committee chairperson will approve all topics and assign an examination committee based on the submitted research subject. The Graduate Program Administrator will schedule the exam to take place in late July.

This document should be no longer than 1 page and should include the title, a paragraph that sets the stage for the experiments being proposed, and the specific aims (see specific aims section for more details). The feasibility of the aims should be well thought out and the document clearly written. This document should serve to guide the student in writing the full proposal.

While the detailed content of the aims is likely to change as the research proposal is developed, the general topic should remain the same. Students who wish to change the topic of their research proposal after submission of the specific aims page should contact the chairperson of the Curriculum Committee.

#### **3. Prepare written proposal – due mid-July**

This research proposal is analogous to a NIH R21 application or a thesis proposal. In other words, it should clearly and concisely detail experiments that could complete in 4 person years (2 persons x 2 years). The proposal should include the following sections: (a) Title Page, (b) Specific Aims Page (1 page), (c) Background and Significance (1-2 pages), (d) Innovation (0.5 page), (e) Experimental Design/Methods (2-3 pages), (f) Figures, and (g) References. The heart of the proposal (sections b-f) should be no longer than 6 single-spaced pages.

(a) The **Title Page** is important, as it keys the reader to the goal of the project. Include your title, your name, the statement "Preliminary examination – Department of Biochemistry" and the date of submission.

(b) The **Specific Aims Page** is the cornerstone of the proposal. Set the stage with a paragraph in which you define the area of investigation, identify important gaps in knowledge and articulate the long-term goal or question and its significance. Then clearly delineate each of the specific aims followed by a few sentences explaining the experimental approach proposed to accomplish the aim. Provide enough detail that the reader will understand what will be done. Most proposals have 2-4 specific aims.

*Keep in mind: The long-term goal is one that will not be accomplished by the experiments in this proposal. The specific aims are the short-term goals that will be addressed by the proposed experiments and should be problem/hypothesis/question oriented. There should be a logical flow to the aims; however they should not be so dependent on each other that if aim 1 fails to work the others cannot be carried out.*

(c) The goal of the **Background and Significance** is not to review an entire field, but give the reader what is necessary to understand the context of proposed experiments. Convey that you understand the literature in the field, the outstanding questions or controversies, and how your project fits into ongoing research. You will not be able to review the entire field or cite every paper. Be selective. Review and cite what is most relevant to your project. Make sure you communicate the significance of the proposed research: Why is your question interesting? Why is it important to answer it? What will we learn from the answers? How does this relate to a fundamental biological question?

(d) The **Innovation** section describes the importance of your proposal in the context of the field. Highlight what is unique about your proposed research, and how it will move the field forward. Avoid ideas that simply replicate everything already published with a new macromolecule.

(e) The **Experimental Design and Methods** should elaborate each of the specific aims and detail the experiments and analysis proposed to accomplish them. Use the specific aims as section headings and present the experiments in each section as they are outlined in the aims.

For each aim you should consider (a) experimental design—how data will be collected, analyzed, and interpreted; (b) important controls, both positive and negative and (c) expected results, how they will be interpreted, and how they might lead to further experimentation. Choose your methods carefully remembering that every method has its caveats. What method is best suited to answer the question at hand? (d) Potential pitfalls and alternative approaches: Point out potential difficulties, limitations or drawbacks to the proposed approach. Give alternative approaches that could confirm results or be used if the first approach fails and explain the benefit of the alternate approach. Make clear what you expect to get from each experiment, and how each experiment fits into your overall goal of finding out how things really work.

It may be helpful to start with a “Rationale” section for each aim to justify the approach you have chosen. Then present an “Experimental Detail” section in which you provide the experimental design. While there is not enough space to include every experimental detail, consider and describe the details that are critical to the success of the project. Provide enough detail so that it is clear you understand the experiments you propose.

(e) Effective **Figures** are an essential component of the proposal. Visual representations are an efficient, reader-friendly way to convey an experimental scheme, a complicated model or expected/hypothetical results. Use them wherever they will help you make a point. Figures should be accompanied by a title and legend that describes the major features of the illustration. Embed the figures in the text where appropriate, not at the end of the document. Be sure to give citations for figures or tables that are taken or adapted from the work of others. *Keep in mind: figures are only effective if they are readable and contain relevant information.* Remake/adapt figures from other sources if the details are too small or if incorporation of additional material would be helpful.

(g) The **References** section contains all of the literature references cited throughout the proposal. The style used for citing references in the text and listing references in this section should be similar to *Biochemistry*, *Biophysical Journal*, *Cell* or which use either citation number or author(s) and year to identify references in the text, and which include the full title of the citation in the reference list. The

use of a citation manager such as EndNote is highly recommended. While there is no limit, most proposals generally include 25-40 citations.

By the time you turn in your preliminary title and aims, you should have a rough outline of your proposal. Develop the ideas in your outline throughout the summer. Often students find as they get into the details, what they initially proposed is not feasible, or that another approach is superior. Give yourself enough time that you can develop your ideas, identify the problem areas in your experimental plan, and revise the direction of your proposal if necessary. The written proposal is due one week before the oral exam.

#### **4. The oral exam - mid-July**

During the first portion of the meeting, the student will be asked to wait outside the room while the faculty briefly reviews the student's academic record. In the second portion of the exam, the student will present an overview of the proposal. The student should give appropriate background and frame the questions to be addressed before presenting each aim in detail. *The importance of clear figures in the presentation cannot be over-emphasized.* The figures serve to guide the student and the audience through the material to be covered. Throughout the presentation, the exam committee will ask questions to gauge the student's depth of knowledge and to clarify or extend points that were made in the written proposal. The student is expected to know their proposal in more detail than is presented in the written document and to be able to expand on their ideas. While many questions will be focused on the area of biochemistry and molecular biology represented by the proposal, others may be directed towards connecting areas with which the student should be familiar. The oral examination should last no longer than two hours.

#### **5. Outcomes**

After all students have defended their proposals, members of the exam committees and the Curriculum Committee will meet to discuss each student's proposal and exam and to discuss the outcomes of all the exams. The chairperson of each exam committee will then contact the student regarding the outcome of their exam and provide written feedback. Two outcomes are possible: Pass or Revisions Needed. If revisions are required, the student will have the opportunity to respond to the committee's concerns and either revise portions of the proposal or re-write the entire proposal as indicated by the committee. In these cases, students will need to write a cover letter addressing the concerns of the committee and the changes that have been made. In addition, students may be required to orally re-defend the revisions with part or all of the exam committee. If a student is asked to re-write and re-defend the entire proposal, an additional faculty member will be added to the exam committee. Inadequate performance on a second exam is grounds for dismissal from the program. For continuation in the program, students must successfully pass the Preliminary Examination by the end of the sixth quarter of full-time residence as a graduate student in Biochemistry and Molecular Biology.

#### **6. Tips for preparation for the Preliminary Examination**

It is critical that you talk to your exam committee as you are preparing your proposal. You must meet with your committee chairperson at least once (more is preferred) and it is recommended that you meet with your other committee members as well. It is recommended that you meet with your chairperson early in the process and discuss the scope of your proposal. Often students prepare overambitious proposals and your committee can help you focus your aims. As you develop the proposal, bring an outline to your committee to make sure they feel your approach is reasonable. You may also want to discuss with them which kinds of experimental details will be most important to address in your written proposal. Your committee members are not intended to generate the ideas or

serve as editors. Instead, they may ask questions to help you identify weaknesses in your proposal, or point out literature you should be familiar with. Your committee members are meant to guide you in the process.

In addition, help may be sought from other parties under the guideline that you ask for feedback on your ideas, but not for the ideas themselves. Leverage the resources you have around you. Discuss your proposal ideas with other students and postdocs. Ask for their feedback; what are the weaknesses in your plan; what are the strengths? Scientists do not work in a vacuum and good ideas are made better by dialogue.

Start early enough that you have time to develop your ideas and to address unexpected problems that are guaranteed to come up.

*Effective communication, written and oral, is critical to your success as a scientist.* The proposal **MUST** be clear and well written. Many proposals are rejected for funding because they are poorly written, sloppy or do not clearly convey the ideas. Clear writing demonstrates that your ideas are well thought out.

- Follow the “General tips on writing well” document available from the Graduate Student Administrator. “The Science of Scientific Writing” is another very helpful document and is available at <http://www.amstat.org/publications/jcgs/sci.pdf>.

## **PRELIMINARY EXAMINATION FACULTY EXPECTATIONS AND RESPONSIBILITIES**

### **Before the exam:**

All members of the exam committee should meet with the student at least once to talk through the student’s ideas. The chairperson is responsible for meeting with the student 2-3 times before the oral exam. The purpose of these meetings is to guide the students and teach them how to develop and prepare a research proposal. In the initial meeting, it is appropriate to review the preliminary specific aims with the student to assess if the scope of the proposal is reasonable. Later students may bring more detailed outlines to discuss. Ask questions to get the student thinking. You should not be telling

the student what to propose, but rather making sure the student is on the right track. You might suggest literature and/or point out glaring holes in their experimental plan; however you are not expected to read drafts or serve as a copy editor.

After the proposal is turned in, the chair should solicit comments from the other committee members a few days before the exam. This will allow for some preliminary discussion regarding the strengths and weaknesses of the proposal.

**After the exam:**

The exam committee should fill out the student evaluation form and recommendation an outcome to the Curriculum Committee. *Please do NOT indicate the outcome to the student immediately after the exam.* In addition, the chairperson of each exam committee should prepare a written assessment of the student's performance discussing the strengths and weaknesses of the proposal. This written feedback will be given to all students after the outcomes are decided, similar to comment sheets from grant applications. The evaluation form, copies of the proposal with written comments, and the written assessment should be brought to the Graduate Student Administrator.

Following all the exams, at least one member of each exam committee will meet with the Curriculum Committee to decide the outcome of all the exams. The Chairperson of each exam committee will then be responsible for communicating the outcome to the student and providing them with the written assessments (not the evaluation forms).

If the committee is recommending revisions before the student can pass the exam, indicate what the student needs to do to earn a pass and the date by which the revisions are due. If revisions are sought, clearly indicate what weaknesses need to be addressed. In most cases, students should be given 2 weeks to prepare written revisions. Students are required to orally re-defend the revised proposal with all or a portion of the committee before a pass can be granted. In cases where the student's initial performance is particularly weak, they should re-defend a new proposal. For the re-defense of a new proposal, an additional faculty member will be added to the exam committee. Students should be given 4 weeks to re-defend a new proposal. In both cases, students should write a cover letter addressing the changes they have made.

## PRELIMINARY EXAMINATION EVALUATION FORM

Student:

Committee Members: (chair)

1. Does the student demonstrate sufficient background knowledge pertinent to the proposed project?

outstanding                  good                  average                  poor

2. Does the proposed research test a significant question in the field?

outstanding                  good                  average                  poor

3. Will the proposed experiments test the question? (E.g. Does the student describe possible outcomes and their interpretations; does the student identify potential difficulties and alternative approaches?)

outstanding                  good                  average                  poor

4. Is the proposal well organized and clearly written?

outstanding                  good                  average                  poor

5. Does the student demonstrate sufficient knowledge of experimental techniques pertinent to the proposed project?

outstanding                  good                  average                  poor

6. Does the student demonstrate creativity and innovation?

outstanding                  good                  average                  poor

7. What are strengths of the proposal and/or oral examination?

8. What are weaknesses of the proposal and/or oral examination?

Recommendation to the Curriculum Committee (circle one)

pass                  revisions needed

If the student does not pass, what should be done to remedy weaknesses listed in #8? Please be explicit. Due date for revisions?

Chair: \_\_\_\_\_



## **GENERAL TIMETABLE FOR A PH.D. DEGREE IN BIOCHEMISTRY AND MOLECULAR BIOPHYSICS**

Your thesis will receive four levels of review prior to the time that it is accepted by the University to fulfill requirements for the Ph.D. degree. These levels of review include (a) evaluation by your thesis committee (which has primary responsibility for considering the content of your thesis with respect to academic standards), (b) evaluation by your thesis advisor (who must indicate satisfaction with your thesis and must ensure that any changes suggested by your Committee have been incorporated into the thesis), (c) evaluation by the Department (the Chair of which is responsible for certifying that the thesis meets the academic and other standards of the department), and (d) evaluation by the Dissertation Office (which has primary responsibility for considering your thesis with respect to physical standards of format and style).

### **TIMETABLE**

- 1.** Do your research.
- 2.** Write your thesis.
- 3.** Get all of the help you can! Pass as many drafts of your thesis as you feel conscionable past your advisor. Ask your colleagues to read your thesis. Confer with anyone else you can think of (valued faculty mentors, significant others, or whomever). Look at (and read) the thesis of other graduate students who have recently received their Ph.D. degrees.
- 4.** Submit semifinal, high quality copies of your thesis to members of your Thesis Committee a minimum of two weeks prior to the date of your thesis examination (Private Defense). At the same time (or even earlier), take a copy of your thesis of the Dissertation Office for its preliminary review. (This saves time and effort later in case any errors in physical make-up are discovered).
- 5.** Successfully pass your closed door thesis examination and successfully present your public seminar.
- 6.** Make all needed changes in your thesis (including those required by your Thesis Committee and any required by the Dissertation Office).
- 7.** Obtain a Departmental Thesis Approval form from the departmental office. Ask your advisor or the chair of your thesis committee to initial the form indicating that your revised thesis meets with his or her approval and that all changes required by your Thesis Advisory Committee have been incorporated into the final document.
- 8.** Submit the signed Departmental Thesis Approval form to the departmental office for approval by the Chair. (This usually requires only a day.)
- 9.** Submit the final version of your thesis to the Dissertation Office.

## FINANCIAL SUPPORT

All Ph.D. students are supported on divisional unendowed funds, training grants, or research grants. Currently, students supported on divisional unendowed funds are appointed for twelve months (4 quarters). After the first twelve months, the student is supported either by a training or research grant.

Training grant support usually lasts about two years, after which the student is supported by the research sponsor on a research grant. While on the training grant, tuition and health fees are paid directly and the student is provided with a stipend. After a student's support from a training grant ceases, and support is provided through a research grant, payment of health fees will become the responsibility of the student. **The student must also be aware that when their mechanism of support changes from a training grant to a research grant, there is a lag in pay. On the training grant, students are paid at the beginning of the quarter. On a research grant, students are paid at the end of the month.**

Payment of the student activity fee is the responsibility of the student, regardless of support source.

Above and beyond the stipend, some students may work as a Teaching Assistant for extra income. Such added work is subject to approval by the student's research advisor and the departmental chair.

Stipends are paid directly to the student direct deposit. Students supported by the division or training grant are paid by the first week of the quarter while Research Assistants are paid on the last business day of each month.

*In keeping with its long-standing traditions and policies, The University of Chicago, in admissions, employment, and access to programs considers students on the basis of individual merit and without regard to race, color, religion, sex, age, national or ethnic origin, handicap, or other factors irrelevant to fruitful participation in the programs of the University. The Affirmative Action Officer is the University official responsible for coordinating its adherence to this policy, and the related federal and state laws and regulations (including Section 505 of the Rehabilitation Act of 1973, as amended).*