

The **Program in Biochemistry, Structural, & Molecular Biology (BSMB)** is designed to provide students with the background, training and experience necessary to launch careers as independent scientific investigators.

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**General PhD Requirements:**

The PhD degree earned through the BSMB PhD Program requires the student to complete all degree requirements of both the Program and the Jefferson College of Life Sciences (JCLS). JCLS requirements are described in the JCLS Handbook and, in detail, in the "[Guide to the PhD Degree and Thesis Manual](#)".

**Curriculum:**

A minimum of 180 credits beyond the bachelor's degree is required. 54 of these credits must be from a combination of required and elective coursework, including journal clubs. The remaining credits are dissertation research credits. Full-time enrollment for the semesters are Fall - 20 credits, Winter – 10 credits, Spring – 30 credits, and Summer – 10 credits.

Ph.D. - 54 credits minimum

**Required major courses:** GC 550 (10 cr.), PR 613 (3 cr.), BI 614 (2 cr.), BI 525 (3 cr.), GC 665 (4 cr.)

**Required elective courses:** 3 (or more) to fill at least 12 credits

**Required minor courses:** GC 640 Research Ethics (1 cr.), GC 660 Statistics (3 cr.), GC 730 Planning & Writing a Research Grant (1 cr.) BI 715/725 Journal Club: 6 semesters (1 cr. each), BI 710, 720, 730 Seminar (1 cr. each until receiving permission to write thesis)

**Rotations:** minimum 3 (3 cr. each)

M.D./ Ph.D. students

**Required major courses:** PR 613 (3 cr.), BI 525 (3 cr.), GC 665 (4 cr.)

**Electives:** as desired to fulfill academic interests

**Required JCLS courses:** GC 640 Research Ethics (1 cr.), GC 660 Statistics (3 cr.), GC 730 Planning & Writing a Research Grant (1 cr.) BI 715/725 Journal Club: 6 semesters (1 cr. each), BI 710, 720, 730 Seminar (1 cr. each until receiving permission to write thesis)

**Transfer of Credits:**

A student may be able to receive transfer credits up to a maximum of 18 credits for graduate level courses taken at another institution per policy described in the JCLS Catalog. Check with your Program Director or the Training Programs Office for more details regarding credit transfers.

**Academic Performance:**

Average GPA: 3.0

Minimum grade in GC 550, PR 613, BI 614, GC 665 and BI 525: B

Minimum grade for all other graduate courses: B-

GC 550 students receiving a score below the mean for the biochemistry section may be required to retake that specific section of GC 550 the following year (regardless of their overall performance in this course).

Consequences for failure to meet expectations: Student will be placed on probation and will be given one opportunity to retake any course with a poor grade. If a student fails to rectify suboptimal performance within 1 year, the student will be dismissed from the BSMB program. Students who are in this position because of extraordinary circumstances may petition the Program Committee in writing to remain in the BSMB program. (Exception—a student with grade below B- on a course taught every other year will have two years to retake this course.)

**Laboratory Rotations:**

Students will perform three laboratory rotations in year 1. Students are required to submit a paper to the laboratory mentor describing the scientific project and results obtained. Students will also present the results of their rotation projects in 10-minute talks that are scheduled at the end of the rotations. Faculty will evaluate performance in talks and will provide feedback.

In the event a suitable research mentor cannot be identified by the end of the Spring semester of year 1, students can perform short rotations in the summer between year 1 and year 2. Students who fail to identify a thesis laboratory by the end of the 5<sup>th</sup> rotation will be dismissed from the BSMB program. Students who are in this position because of extraordinary circumstances may petition the Program Committee in writing to remain in the BSMB program.

**Presentation of Scientific Information**

All students must register for the graduate student journal club (BI 715, 725) starting in Spring of the first year and thereafter until 6 semesters have been completed. Students are encouraged to identify and participate in informal journal clubs and to attend presentations regularly after completion of the seminar requirement. Students must also register and attend the joint seminar series hosted by the Departments of Biochemistry & Molecular Biology and Pharmacology, Physiology, and Cancer Biology (BI 710, 720, 730) each semester while in the PhD Program until receiving permission to write the thesis. These weekly seminars include outside speakers, and Jefferson student and faculty research presentations. Starting in their third year, students will give a 30-minute presentation on their research once a year.

**Individual Development Plans (IDPs)**

The BSMB Program and JCLS require an annual IDP for all predoctoral students. IDPs should be reviewed and discussed with the academic advisor (first year students), or the thesis advisor, and the thesis committee on an annual basis, or more frequently as warranted. This will ensure open bi-directional communication between trainees and faculty mentors to mutually assess short-term and long-term professional goals. The purpose is to ensure that periodic review and assessment of a student's current stage of professional development, and future plans, address both the general competencies and proficiencies established by the College and the BSMB program, as well as each trainee's individual professional development needs and goals. The IDP for first year students involves two sections, including Part A: Self-assessment of Skills, Motivations and Career Planning; Part B: Establishment of Plans and Goals for the Coming Year. The IDP for students in thesis labs involves three sections, including Part A: Self-assessment of Skills, Motivation and Career Planning; Part B: Assessment of Achievements and Goals; and Part C: Skills to Improve. The IDPs must be completed and signed by October 31 each year.

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**Academic Advisor:**

The BSMB Program Committee will designate an academic advisor for each student in their first year. This advisor will meet with the student in order to review their academic progress, to establish an acceptable curriculum, to ascertain the development of the student's research interests, and to discuss completion of the IDP. These meetings will occur at the beginning of the Fall term, at the ends of the Fall, Spring 1 and Spring 2 terms and as required through the course of the first year.

**Thesis Research:**

A thesis advisor will be selected on the basis of the student's research interests in consultation with the Academic Advisor and Program Director. Students must submit the choice of thesis advisor via email to the Training Programs Office (Danielle Park) who will obtain final approval from the BSMB Student Affairs and Promotion Subcommittee. Advisor requests should be received in the Training Programs Office by the first Friday of June. Final approvals will be distributed by the first Friday in July. The privilege to join and remain in a thesis advisor's laboratory is contingent upon satisfactory completion of curricular requirements, and maintenance of professional conduct.

The student, in consultation with the thesis advisor, will form a Thesis Advisory Committee consisting of the thesis advisor and at least three additional PhD or MD scientists, two of whom must be members of the BSMB Program. The purpose of this committee is two-fold: 1- To ensure that the student is progressing toward completion of a PhD project at a reasonable rate and to decide when the research goals have been met. 2- To administer the final examination of the thesis. In addition, the thesis advisory committee serves as a resource for guidance, mentorship, and trouble-shooting of difficulties that may arise throughout the duration of the thesis work. Committee members may also be drawn from other Jefferson PhD programs or from other institutions. Adding committee members who bring specific expertise as the research evolves is encouraged. One of the BSMB committee members, other than the thesis advisor, will serve as the committee chairperson. It is expected that members of the Thesis Research Committee will be available to help and counsel the student concerning the thesis research throughout its duration. The student is responsible for sending the membership of the Thesis Advisory Committee to the Training Programs Office as soon as it is formed or if its membership changes. The makeup of the committee and any changes must be approved by the BSMB Student Affairs and Promotion Subcommittee.

The first meeting of the Thesis Advisory Committee must take place by February 1 of the 2nd year. The purpose of the first meeting is to evaluate the scientific questions that the student will be asking and the experimental approaches that they will be using. Most emphasis should be placed on the background knowledge relevant to the research and development of hypotheses to be tested. Preliminary experimental data should be kept to a minimum to keep the time for this meeting to 1½ hours maximum.

Starting in the fall of year 3, the student is required to have a thesis committee meeting at least every 6 months during the period of their thesis studies. Students are required to submit the thesis proposal to their thesis committees after the comprehensive examination (described below) has been passed. Records of the outcome of these committee meetings are to be documented using the PhD Student Research Committee Report forms that are available for downloading from the JCLS web site. It is the student's responsibility to provide the forms to the thesis committee members and to return the completed forms to the Training Programs Office after each meeting.

In addition, the student will submit an annual BSMB Program progress report detailing the

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research accomplished in the preceding year. The report must be approved by the thesis advisor and be submitted to the Program Office by August 31 of each year. All of these requirements (meetings, reports) must be met before the program director will sign off on the student's biannual JCLS progress report (green sheet). In extraordinary circumstances, students may request in writing an extension of these deadlines. The request will be considered by the BSMB Student Affairs and Promotion Subcommittee.

### **Comprehensive Examination:**

#### Goal:

The examination committee is to evaluate the student's abilities in the following areas:  
Formulate a well-written, realistic scientific proposal conforming to specific requirements.  
Defend specific elements of the proposed research plan in an oral setting.  
Engage in a scholarly discussion of topics from Biochemistry, Structural Biology, and Molecular Biology.

#### Format:

The comprehensive exam will consist of written and oral components. The written component will be a grant proposal on the student's thesis research. At the oral exam, the student will answer questions related to both the proposed research and general topics from the BSMB curriculum. The maximum time of the oral exam will be two hours.

#### Thesis Proposal:

The proposal must strictly abide by the rules for submission of an NIH NRSA F30/31, including the 6-page (plus one specific aims page) limit. The student is expected to clearly explain the questions to be addressed, their importance, the hypotheses to be tested, and the rationale behind these hypotheses. The experimental plan should delineate proper controls and potential outcomes, including ones that refute the tested hypotheses. The research scope should be appropriate for a graduate student to complete in 4 years of study.

In order for the examination committee to evaluate the student's writing ability, the student must prepare a grant proposal with minimal input from faculty and other research staff. The thesis advisor is permitted to help with the development of specific aims, but is forbidden to have any input on the written document. The examinee can seek guidance on grant organization and conceptual development from student colleagues and postdoctoral fellows. However, this assistance cannot extend to fine editing of any written material. At the time of submission, the examinee will be asked to provide a list of who contributed to the thesis proposal and in what capacity.

In the event that a student has submitted a grant on their thesis research to the NIH or other funding agency prior to the proposal due date, the student must notify the examination committee chairperson of this circumstance. The examination committee will determine, on a case-by-case basis, how best to assess the writing component of the comprehensive examination for such a student.

#### Oral Exam:

In the first part of the exam, to last no longer than one hour, the student will answer directed questions related to the thesis proposal (or alternate written component). These questions can address a wide variety of topics, including (but not limited to) the strength of a hypothesis, inclusion of proper control experiments, technical details of an experimental approach, and possibilities of alternate outcomes.

In the second part of the oral exam, the student will be asked questions designed to test their general knowledge of biochemistry and molecular pharmacology. Three days prior to the exam,  
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the committee chairman will supply the student with three broad subject areas. These subjects will be chosen based upon the student's designed curriculum (both required and elective courses). They are meant to be general starting points to probe the depth of a student's understanding of Year 1 and Year 2 coursework. The entire oral exam will last no longer than two hours.

The student is expected to defend their answers orally and at the whiteboard in "chalk talk" style. Only slides containing the student's own original data included in the thesis proposal will be permitted during the exam; they will only be shown at the request of the examination committee. To be clear, this oral exam will not follow the standard format for a formal defense of the thesis proposal; the thesis proposal will be presented to the thesis advisory committee at a later date and will not factor into the outcome the comprehensive exam. Further, both the proposal-related questions and general-knowledge subject areas represent starting points to examine the student's understanding. Discussions in the exam need not be limited to the specific topics of the questions.

Timeline:

First thesis advisory committee meeting	Before February 1 of 2 <sup>nd</sup> year (1 <sup>st</sup> year for M.D./Ph.D. students)
Scheduling of examination date by student	Before July 1 of 2 <sup>nd</sup> year
Grant proposal due date	3 weeks prior to the scheduled examination date
Oral examination date	Between July 1 and September 1 of 2 <sup>nd</sup> year (1 <sup>st</sup> year for M.D./Ph.D. students)
Retake of Oral examination (if necessary)	By October 15 of 3 <sup>rd</sup> year (2 <sup>nd</sup> year for M.D./Ph.D. students)
Proposal presentation to thesis advisory committee (not part of comprehensive exam)	During the Fall Term of 3 <sup>rd</sup> year (2 <sup>nd</sup> year for M.D./Ph.D. students)

Examination Committee:

The comprehensive examination committee will consist of a chairperson and two additional faculty that together represent the three research emphases of the BSMB Program. During the Spring I term, the program directors will appoint the three members of each student's committee. It is up to the student to schedule an oral exam between July 1 and September 1 on a date agreeable to these three committee members.

Preparation for the Oral Exam:

Prior to receiving their three subjects, a student may study for the oral exam with other students and partake in mock oral exams. Faculty are not to be involved in these mock exams. After receiving the subjects from the committee chairperson, the student must finish preparing for the oral exam on their own.

Outcomes:

The comprehensive exam will be graded in three parts, each scored pass/fail:

- Written grant proposal
- Defense of research (oral exam part 1)
- Fund of knowledge (oral exam part 2)

The written grant proposal will be assessed on the basis of organization and logical flow, conceptual development of questions and hypotheses, appropriateness of experimental plan, handling of alternate outcomes and adherence to NRSA guidelines. Oral defense of research will be assessed on the student's ability to correctly identify what is being asked and to appropriately answer with complete descriptions. Fund of knowledge will be assessed by the student's ability to discuss concepts of biochemistry and molecular biology in a scholarly manner, to propose creative solutions to biochemical problems, and to critically evaluate results of biochemical experiments in order to come to thoughtful conclusions.

A student must pass all three parts of the examination in order to pass the comprehensive exam.

Passing two of the three parts of the exam will result in a conditional pass and will require written remediation. At the discretion of the committee, this assignment can take the form of:

- A rewritten grant proposal correcting identified deficiencies.
- A written assignment related to defense of research (e.g., table of outcomes and how the examinee would explore each).
- A written assignment related to a perceived deficiency in fund of knowledge.

This writing assignment will be due within 1 month of the oral examination and will be evaluated by the examination committee for adequacy.

Passing only one or none of the parts of the exam will result in failure and the examinee will be required to retake the comprehensive exam. This retake must be completed by October 15th of the 3rd year. For this re-examination, the committee will be expanded to include the program director and two senior faculty members. At most, only one of these additional faculties can be a member of the student's thesis advisory committee. If the grant proposal requires rewriting, the document will be due two weeks before the new oral exam. At the discretion of the re-examination committee, the oral exam can focus on the proposal defense, on general knowledge or on both.

Failure to attain a grade of pass or conditional pass for the retake will result in dismissal from the BSMB program.

## **Final Thesis**

### Readiness to Write the Thesis:

Before the student begins writing, the research advisor, research advisory committee, and candidate must reach a consensus on the content of the thesis and the format – either traditional or manuscript (download the [“Guide to the PhD Degree and Thesis Manual”](#) from the JCLS website for further details).

### Thesis Defense:

All PhD candidates must successfully present a public seminar and defend the thesis prior to graduation. In the oral defense, the candidate must demonstrate competence in their specific area of research as well as successfully defend the thesis research. By the time of the thesis defense, the research work performed by the student should have reached a stage of completion such that at least one paper, representing work to which the student has been a primary contributor (though not necessarily sole first author), has been published or accepted for publication in a peer-reviewed journal. If the candidate wishes to graduate in the upcoming Spring Commencement, the thesis defense must be passed and the final approved copy of the thesis must be turned into the Dean's office no later than April 1 of that year.

### Final Examination (Defense) Committee:

The final examination committee is chaired by the Program Director (or their designate) and is composed of members of the Research Advisory Committee. The committee may elect to invite an external member with expertise in the area of investigation.

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### Scheduling the Seminar and Defense:

At least two months before the planned date, the student is responsible for scheduling the date and time of the defense, that is agreeable with the Thesis Examination Committee. A 12:00 PM -1:00 PM time is recommended since classes are not scheduled during this hour and this maximizes attendance. The student must contact the Training Programs Office to reserve a room for the public seminar.

### Letter from the Program Director:

The Training Programs Office will put together the letter from the Program Director.

The following information is necessary for this letter 30 days before the defense date or sooner:

- Date/Time of Public Thesis Defense
- Thesis Title
- Students name as it should appear on the diploma
- Members of the Final Examination Committee; e-mail address for any members outside the University
- Stipend End Date (for JCLS Financial Office use only; it will not appear on other defense documents)

At least three weeks prior to the Thesis Defense, the PhD candidate should send the draft of the thesis to the Dean's Office (Training Program Coordinator), Program Director, and each member of the Final Examination Committee. See the "[Guide to the PhD Degree and Thesis Manual](#)".