The **Program in Biochemistry & Molecular Pharmacology (BMP)** is designed to take a multidisciplinary approach to the field by providing the student with a strong basic knowledge of biochemistry, cell biology, pharmacology and molecular biology, with additional exposure to other areas of related interest. The ultimate goal of this program is to provide aspiring students with the background, training and experience necessary to launch careers as independent scientific investigators.

**Program Director:**
Michael Root, MD, PhD  phone: 3-4564  BMP-program@jefferson.edu

**BMP Graduate Studies Committee:**
Gino Cingolani, PhD, John Pascal, PhD, Natalia Riobo, PhD, Philip Wedegaertner, PhD, Diane Merry, PhD, Andrew Aplin, PhD, Mark Fortini, PhD, Steven McMahon, PhD, Charles Scott, PhD, Edward Winter, PhD, Jim Jaynes, PhD, and Michael Root, MD, PhD

**Training Programs Office:** 910 BLSB  fax: 215-503-0622
Joanne Balitzky  phone: 3-6687  Joanne.Balitzky@jefferson.edu
Kathleen Kieser  phone: 3-4636  Kathleen.Kieser@jefferson.edu

**General PhD Requirements:**
The PhD degree earned through the BMP PhD Program requires the student to complete all degree requirements of both the Program and the Jefferson Graduate School of Biomedical Sciences (JGSBS). JGSBS requirements are described in the JGSBS catalog and, in greater detail, in the “Guide to the PhD Degree and Thesis Manual” available at [http://www.jefferson.edu/JGSBS/policies/](http://www.jefferson.edu/JGSBS/policies/)

**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 seminar/journal club. At least 18 of these credits must be from outside the major Program (all courses not designated BIxxx count). The remaining credits are dissertation research credits. Full time enrollment in the Fall Semester is 20 credits, Spring I and II combined is 30 credits, and Summer Semester is 10 credits.

**Ph.D.-only students, 54 credits minimum**
- Required major courses: GC550 (10 cr), PR613 (3 cr), BI525 (3 cr)
- Required elective courses: 3 (or more) to fill at least 9 credits
- Required minor courses: GC640 (Ethics, 1 cr), NS740 (Statistics, 2 cr), GC730 (Grant Writing, 1 cr)
- BI 715, 725, 735 Journal Club: 9 semesters (1 cr per semester)
- BI 710, 720, 730 Biochemistry & Molecular Pharmacology Seminar (1 cr per semester until receiving permission to write thesis)

- Rotations: minimum 3 (3 cr each)
- See appendix for sample course schedule

**M.D.-Ph.D. students**
- Required major courses: GC550D (Toolboxes only, 3 cr), PR613 (3 cr), BI525 (3 cr)
- Required elective courses: 1 (or more) of at least 3 credits
- Required minor courses: GC640 (Ethics, 1 cr), NS740 (Statistics, 2 cr), GC730 (Grant Writing, 1 cr)
- BI 715, 725, 735 Journal Club: 9 semesters (1 cr per semester)
- BI 710, 720, 730 Biochemistry & Molecular Pharmacology Seminar (1 cr per semester 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 JGSBS 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 GC550, PR613 and BI525: B
Minimum grade for all other graduate courses: B-

GC550 students receiving a score below the mean for the biochemistry section may be required to retake that specific section of GC550 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, he/she will be dismissed from the BMP program. Students who are in this position as a result of extraordinary circumstances may petition the Program Committee in writing to remain in the BMP 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 rotations in year 1 and will be required to present their research in a 10 minute talk during a scheduled conference at the completion of each academic term. Students who join a thesis lab in Spring II will give a talk on the work from their thesis lab in the Spring II presentation. Performance in talks will be evaluated by faculty in attendance and feedback will be provided.

In the event a suitable research mentor cannot be identified by Spring II of year 1, students will be asked to perform two short rotations in the summer between year 1 and year 2. Students who fail to identify a thesis laboratory by the end of the 5th rotation will be dismissed from the BMP program. Students who are in this position as a result of extraordinary circumstances may petition the Program Committee in writing to remain in the BMP program.

Presentation of Scientific Information
All students must register for the graduate student journal club (BI 715, 725 and 735) starting in Spring I of the first year and for each trimester thereafter until 9 semesters have been completed. The seminar course includes one hour of journal club per week. Students are encouraged to identify and participate in informal journal clubs and to attend presentations regularly after completion of the seminar requirement. All students must also register for Biochemistry & Molecular Pharmacology Seminar (BI 710, 720, 730) each semester while in the PhD Program until receiving permission to write thesis. These weekly seminars include outside speakers, research in progress and faculty research presentations. Starting in their third year, each student will give a 30-minute talk on his/her research once a year in the weekly "Research in Progress" Seminar series for pre- and postdoctoral trainees. In addition, senior graduate students (4th year and above) with significant accomplishments will be invited to give an hour long presentation in the weekly Biochemistry and Molecular Biology seminar series.

Academic Advisor:
The BMP Program Committee will designate an academic advisor for each student in his/her first year. This advisor will meet with the student in order to review his/her academic progress, to establish an acceptable curriculum, and to ascertain the development of the student's research interests. These meetings will occur at the beginning of the Fall term, at the ends of the Fall, Spring1 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 Training Programs Office (Joanne Balitzky) who will obtain final approval from the Student Affairs and Promotion Subcommittee. Emails should be received in 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, adequate progress in scientific aptitude, 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 Ph.D. scientists, two of whom must be members of the BMP Program. The
The purpose of this committee is two-fold: 1- To ensure that the student is progressing toward completion of a Ph.D. 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 who are not BMP faculty may be a member of another Jefferson PhD program or may be from another institution. Adding individuals to the committee that bring specific expertise as the research evolves is encouraged. One of the BMP faculty 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 first meeting of the Thesis Advisory Committee must take place by March 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 he/she will be using. Most emphasis should be placed 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 period of his/her thesis studies. The meeting in the fall of year 3 will be a formal review of the thesis proposal submitted as a requirement of the comprehensive examination. 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 BMP web site. Student Research Committee Report forms should be returned to the Training Programs Office.

In addition, the student will submit an annual BMP Program progress report detailing the 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 JGSBS progress report (green sheet). In extraordinary circumstances, students may request in writing an extension of these deadlines. The request will be considered by the Student Affairs and Promotion Subcommittee.

Comprehensive Examination:

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

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 specific questions related to both the proposed research and general topics from biochemistry and molecular pharmacology. 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 to the scientific field, 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 his/her thesis research to the NIH or other funding agency prior to the proposal due date, the student must notify the examination committee chairman 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:**
The oral exam will take place between 2-6 weeks after submission of the thesis proposal. 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 his/her general knowledge of biochemistry and molecular pharmacology. Three days prior to the exam, 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 whole oral exam will last no longer than two hours.

The student is expected to defend his/her 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 of biochemistry, molecular pharmacology, and experimental design. Discussions in the exam need not be limited to the specific topics of the questions.

**Timeline:**

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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<tbody>
<tr>
<td>First thesis advisory committee meeting</td>
<td>Before March 1 of 2nd year (1st year for M.D.-Ph.D. students)</td>
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<tr>
<td>Grant proposal due date</td>
<td>July 1 of 2nd year (1st year for M.D.-Ph.D. students)</td>
</tr>
<tr>
<td>Oral examination date</td>
<td>Between July 15 and August 15 of 2nd year (1st year for M.D.-Ph.D. students)</td>
</tr>
<tr>
<td>Retake of Oral examination (if necessary)</td>
<td>By October 15 of 3rd year (2nd year for M.D.-Ph.D. students)</td>
</tr>
<tr>
<td>Proposal presentation to thesis advisory committee (not part of comprehensive exam)</td>
<td>Fall Term of 3rd year (2nd year for M.D.-Ph.D. students)</td>
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</tbody>
</table>

**Examination Committee:**
The comprehensive examination committee will consist of a chairperson and two additional faculty that together represent the three research emphases of the BMP Program. During the Spring I term, the Student Affairs and Promotion Subcommittee will appoint the three members of each student’s committee. It is up to the student to schedule an oral exam between July 15 and August 15 on a date agreeable to these three committee members.
Preparation for the Oral Exam:
Prior to receiving his/her 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 his/her own.

Outcomes:
The comprehensive exam will be graded in three parts, each scored pass/fail:
1. Written grant proposal
2. Defense of research (oral exam part 1)
3. 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 basic facts of biochemistry and molecular biology, 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
1. rewritten grant proposal correcting identified deficiencies.
2. written assignment related to defense of research (e.g., table of outcomes and how the examinee would explore each).
3. 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 15 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 faculty 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 BMP program.

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. JGSBS is notified by use of Chairperson’s report (see above). At this time the student and committee will also designate the format of the thesis.

Thesis Defense:
All PhD candidates must successfully present a public seminar and defend the Thesis prior to graduation. The JGSBS Dean attends the defense. In the oral defense, the candidate must demonstrate competence in his or her 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 generally 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 his/her designate) and is composed of members of the Research Advisory Committee. An external member is optional but recommended. The JGSBS Dean or his designate is an ex-officio member of all Defense Committees.

Scheduling the Seminar and Defense:
At least one month before the planned date, the student is responsible for scheduling the date and time of the defense with the JGSBS Dean’s Office (contact Lisa DiCampli, 3-8982). Contact the Training Programs Office to reserve a room and AV equipment for the public seminar.

Letter from the Program Director:
At least one month before the planned Defense, contact the Training Programs Office to generate letter from the Program Director to the JGSBS Dean. The following information is necessary for this letter:

1. date, time, location of Public Seminar and Thesis Defense
2. thesis title
3. your name as it should appear on the diploma
4. members of the Final Examination Committee; addresses for any outside the University
5. the date on which the student stipend payment will stop (this information is for JCGS Financial Office use only; it will not appear on other defense documents)

At least three weeks before the Thesis Defense, the PhD candidate should deliver one copy of the thesis draft to the Dean’s Office, one copy to the student’s Program Director, and one copy to each of the Final Examination Committee members. See the “JGSBS Guide to the PhD Degree and Thesis Manual” at JGSBS Policies and Guidelines for details regarding submission of final thesis copies and additional required documents after the defense.
Appendix I – Sample Course Schedule

<table>
<thead>
<tr>
<th>Semester</th>
<th>Year 1</th>
<th>Year II</th>
</tr>
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</table>
| Fall – 20 credits | ● GC 550, Foundations of Biomedical Science, 10 credits  
● BI 511, Research Rotation 1, 3 credits  
● BI 710 Seminar in Biochemistry & Molecular Pharmacology, 1 credit  
● BI 910, Research, 6 credits | ● Elective, see list below, variable credits  
● GC 730, Planning & Writing a Research Grant, 1 credit  
● BI 710, Seminar in Biochemistry & Molecular Pharmacology, 2 credits  
● BI 715, Journal Club, 1 credit  
● BI 910, Research, variable credits to total 20 |
| Spring – 30 credits | ● BI 525, Biochemistry – Genetics Information Transfer, 3 credits – Spring I  
● PR 613, Macromolecular Structure, 3 credits – Spring I  
● GC 640, Research Ethics, 3 credits – Spring I  
● BI 720, Seminar in Biochemistry & Molecular Pharmacology, 1 credits – Spring I  
● BI 725, Journal Club, 1 credit – Spring I  
● BI 521, Research Rotation 2, 3 credits – Spring I  
● Elective, see list below, variable credits – Spring II  
● NS 740, Applied Statistics, 2 credits – Spring II  
● BI 730, Seminar in Biochemistry & Molecular Pharmacology, 1 credits – Spring II  
● BI 735, Journal Club, 1 credit – Spring II  
● BI 531, Research Rotation 3, 3 credits – Spring II  
● BI 920, Research, variable credits to total 30 | ● Elective(s), see list below, variable credits – Spring I and Spring II  
● BI 720, Seminar in Biochemistry & Molecular Pharmacology, 2 credits – Spring I  
● BI 725, Journal Club, 1 credit – Spring I  
● BI 730, Seminar in Biochemistry & Molecular Pharmacology, 2 credits – Spring II  
● BI 735, Journal Club, 1 credit – Spring II  
● BI 920, Research, variable credits to total 30 |
| Summer – 10 credits | ● BI 930, Research, 10 credits | ● BI 930, Research, 10 credits |

Common Electives

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Credits</th>
<th>Semester Offered</th>
</tr>
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<tbody>
<tr>
<td>BI 612</td>
<td>Advanced Topics in Protein Function and Dysfunction</td>
<td>3</td>
<td>Fall</td>
</tr>
<tr>
<td>BI 614</td>
<td>Macromolecular Function</td>
<td>3</td>
<td>Spring 2</td>
</tr>
<tr>
<td>BI 535</td>
<td>Biochemistry-Metabolism</td>
<td>3</td>
<td>Spring 2</td>
</tr>
<tr>
<td>PR 522</td>
<td>General Pharmacology</td>
<td>3</td>
<td>Fall</td>
</tr>
<tr>
<td>GC 630</td>
<td>Fundamentals of Clinical Trials</td>
<td>3</td>
<td>Fall</td>
</tr>
<tr>
<td>GC 645</td>
<td>Genomics and Bioinformatics</td>
<td>3</td>
<td>Spring 2</td>
</tr>
<tr>
<td>GC 665</td>
<td>Cell Signaling</td>
<td>4</td>
<td>Spring 2</td>
</tr>
<tr>
<td>GE 612</td>
<td>Genetics of Model Organisms</td>
<td>3</td>
<td>Spring 1</td>
</tr>
<tr>
<td>GE 636</td>
<td>Regulation of Cell Cycle &amp; Apoptosis</td>
<td>3</td>
<td>Fall</td>
</tr>
<tr>
<td>GE 637</td>
<td>Advanced Human Genetics</td>
<td>3</td>
<td>Spring 2</td>
</tr>
<tr>
<td>GE 651</td>
<td>Pathobiology of Cancer</td>
<td>2</td>
<td>Spring 1</td>
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<tr>
<td>GE 652</td>
<td>Molecular Basis of Cancer</td>
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<tr>
<td>CB 615</td>
<td>Developmental Biology I - Embryology</td>
<td>3</td>
<td>Fall</td>
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<td>CB 625</td>
<td>Mechanisms of Development</td>
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<td>Spring 1</td>
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<tr>
<td>IMP 505 A</td>
<td>Fundamentals of Immunology</td>
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<td>Spring 1</td>
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<tr>
<td>IMP 505 B</td>
<td>Immune System in Health &amp; Disease</td>
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<td>Spring 1</td>
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<tr>
<td>NS 700</td>
<td>Cellular Neurophysiology</td>
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<td>Spring 1</td>
</tr>
<tr>
<td>NS 715</td>
<td>Molecular &amp; Cellular Neuroscience</td>
<td>3</td>
<td>Spring 2</td>
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