

Ph.D. GRADUATE PROGRAM FOR STUDENTS IN THE DEPARTMENT OF MEDICINAL CHEMISTRY AND MOLECULAR PHARMACOLOGY

Introduction

The Department provides unparalleled opportunities for students to become expert scientists in areas that lie at the interface of chemistry, biology, and medicine. Graduate students are admitted into the Department of Medicinal Chemistry and Molecular Pharmacology for study towards the Ph.D. degree with the expectation that they will gain the ability to perform across discipline boundaries while focusing on the development of skills in one or more specialized areas. The following areas of research specialization are available within the Department:

1. Analytical Medicinal Chemistry
2. Computational and Biophysical Medicinal Chemistry
3. Medicinal, Bioorganic and Natural Products Chemistry
4. Medicinal Biochemistry and Molecular Biology
5. Molecular Pharmacology and Toxicology
6. Radiochemistry and Nuclear Pharmacy

Registration and Course Requirements

Proficiency in core areas is established during the first year of graduate school through examination and courses. All students must demonstrate proficiency in Biochemistry. Students who have had prior courses in Biochemistry should take the Biochemistry Proficiency Examination upon arrival. Those students whose scores indicate that they need further work in Biochemistry or those who have not taken a previous Biochemistry course must enroll in and pass with a grade of C or better 6 credit hours of approved Biochemistry coursework (MCMP 304-305, BCHM 561-562, other BCHM 500 or 600 level graduate courses, or other Biochemistry courses approved by the graduate advisory committee).

All students must demonstrate proficiency in Physical Chemistry. This can be achieved by completing a one semester undergraduate Physical Chemistry course with a grade of C or better or by passing CHEM 372 with a grade of C or better. Notice that graduate credit is not given for this course.

All students must demonstrate proficiency in basic Organic Chemistry. All students will take the Organic Chemistry Proficiency Examination upon arrival. Students whose scores indicate that they need further work in Organic Chemistry should plan to study organic chemistry independently during the fall semester (MCMP 490). Consultation and assistance will be available as needed from appropriate faculty. At the conclusion of the semester, students will be assessed by the faculty member who is directing the independent study course. That faculty member will forward a recommendation to the graduate advisory committee and a pass or not pass grade will be assigned. Alternatively, a student may elect to take CHEM 651. In that event, a student who passes with a grade of C or better will have met the Organic proficiency requirement.

Entering students will register for *at least* six and up to nine hours of courses during the first semester. They will also register for MCMP 598 (Research Rotations) for 3 credit hours. Students should enroll in any courses required to demonstrate proficiency plus advanced courses selected for their areas of interest. A roster of such courses will be provided to the graduate advisor.

For second-semester registration, a graduate student should register for courses in his/her major area of interest. The student should consult with his/her research advisor for course requirements and suggestions.

General Course Requirements All students in the Ph.D. program will take the research rotations course (MCMP 598). All students involved in laboratory work in MCMP must take the laboratory safety course (CHEM 605 or its equivalent). All graduate students in the MCMP Department must register for MCMP 696 (Seminar) each semester of each academic year they are in residence (summers are excluded). This registration will be for zero credit, Pass/Not Pass, except during the semesters in which the student presents a seminar, in which case the student will register for a grade and for one credit. (See *Seminar Requirement*.) Students are expected to take courses to demonstrate proficiency in Organic Chemistry, Biochemistry, and Physical Chemistry, if necessary, as noted above. All students must complete MCMP 570, a core course dealing with principles of medicinal chemistry, pharmacology, and physiology. Finally, all students must complete a course in research grant preparation prior to taking the original proposal examination. There are no other specific course requirements for the Ph.D. degree in MCMP. However, the student will typically be required by his/her major professor to take certain courses that are fundamental to the student's area of research.

Introduction to Research and Selection of a Major Professor

During their first semester new graduate students will carry out three four-week rotations. Each rotation must be carried out in a different laboratory. The primary emphasis of the rotation will be involvement in laboratory research. Appropriate safety clearance may be required for certain types of research.

Prior to the first week of classes, an informal poster session will be held in which each professor engaged in research, assisted by members of his/her group, will present a poster describing ongoing research. At this session, new graduate students will obtain an overview of research being conducted in the department, and will have the opportunity to discuss research opportunities informally with faculty and other graduate students. In the following week, new graduate students should continue discussions with faculty and their research groups either informally or by appointment. The posters used in the poster sessions will remain up in the hallway during this time. During the second week of classes, new graduate students will be asked to choose the faculty with whom they wish to carry out research rotations, and faculty will be asked to specify the rotation periods during which they have openings in their laboratories. The Department Head will arrange these rotations and will inform students and faculty of the rotation schedule.

The graduate student should meet on the first day of the rotation period with the professor, who will inform the student of his/her expectations for the rotation. Each professor will evaluate and inform the Department Head of the student's satisfactory performance during the rotation. The Department Head will assign a composite grade (Pass/Not Pass) in MCMP 598 on the basis of the evaluations.

During the last week of the first semester, new graduate students will submit a ranked list of choices for a major professor (dissertation advisor), and professors will indicate the number of openings available in their laboratories. Students will be assigned to laboratories by the Department Head as soon as possible thereafter. Every effort will be made to accommodate the students' preferences.

Selection of Graduate Committee; Plan of Study

During the second semester in residence, each student will, in consultation with his/her major professor, select his/her graduate committee and file a Plan of Study. Each student's graduate committee must be comprised of at least four faculty, one of whom is the student's major professor; the committee must contain at least one additional member from within the MCMP Department and one member from outside of the MCMP Department. The courses listed on the Plan of Study will be those suggested by the student's major professor, the student's graduate committee, and/or the student's own interests. No specific courses are required for the Plan of Study except for those required to achieve proficiency and those noted in "Registration and Course Requirements." While the MCMP PhD program does not have an explicit course credit requirement, there is an expectation that students will demonstrate breadth in their plans of study by completing courses in multiple disciplines. A typical MCMP plan of study would include twenty credit hours or more of actual didactic coursework (excluding seminar credits) that demonstrates broad exposure to scientific areas.

The Plan of Study is an official Graduate School document that must be approved by the student, his/her graduate committee, the Department Head, and the Dean's Office. In effect it is an academic contract that recognizes appointment of the student's graduate committee and specifies the coursework obligations of the student. The graduate committee can insist that the student add courses to the Plan of Study, but normally such additions should occur no later than the time of the original proposal/examination. A student who has not filed a Plan of Study by the end of the summer following the second semester in residence will not be allowed to register for the following fall semester and will therefore receive no financial support until this requirement has been met.

Language Requirements

With the exception noted in the following paragraph, there is no formal foreign language or English language requirement in the MCMP Graduate Program.

Note, however, that all students are required to serve as a teaching assistant (TA) for at least one semester (see *Teaching Assistantship Requirement*). Because all graduate students at Purdue for whom English is not the first language must demonstrate oral English proficiency before serving in a TA position that involves meaningful student contact, oral English proficiency sufficient to satisfy the Purdue requirement is a *de facto* requirement of the MCMP Graduate Program. TA support cannot be guaranteed for students who do not meet the oral English proficiency requirement. Students must fulfill the oral English proficiency requirement during the first year in residence to remain in good standing.

The Purdue University Graduate Council has delegated to individual departments the responsibility of assessing whether a student has demonstrated proficiency in written English appropriate to the Ph.D. degree. *Proficiency in written English is essential to good scientific communication.* Several demonstrations of this proficiency are built into this program: the seminar abstract; reports for the student's annual committee meetings; research reports required by the major professor; the proposal for the original proposal/examination; papers prepared for submission to research journals; and the dissertation. A student who is not deemed to be proficient in written English at any point during his/her Ph.D. program may be required by his/her major professor and/or committee to seek remediation either through private tutors or through various

programs offered by the University. All students are free to use the Writing Laboratory in Heavilon Hall, and students for whom English is not the first language may take ENGL 002 as an elective.

Grade-Point (GPA) Requirement

Graduate students in MCMP are required to maintain a “B” average in *all* courses taken for a grade. A student whose cumulative grade-point average (GPA) drops below 3.0 (out of 4.0) will be placed on probation and must achieve a “B” average in the subsequent semester. To be released from probation the student must restore his/her cumulative GPA to 3.0 or better within one year. Any student who fails to meet the GPA requirement will be reviewed by the department faculty and may be dropped from the program.

No course on the Plan of Study that has been completed for a grade can be dropped from the Plan of Study.

Graduate Committee Meetings

Every student is required to hold a meeting of his/her graduate committee at least annually. In preparation for each meeting, the student, in consultation with his/her research advisor, will prepare a written report not exceeding five (5) pages in length (plus figures, tables, and references) describing his/her research aims and results. The written report must be submitted to the committee no later than five (5) days prior to the meeting. During the meeting the student is expected to make an oral presentation and discuss research progress with the committee. A report form (to be obtained by the student from the graduate secretary) will be filled out by the committee during the meeting. The student may then add his/her comments and should return the form immediately to the MCMP graduate secretary.

The first required meeting of the committee will be no later than the end of the spring semester of the second year. The student’s progress will be assessed by the committee and will be reported in writing to the graduate secretary. Although student assessment is one purpose of the committee meeting, another equally important purpose is for the student (and his/her professor) to receive feedback from outside the student’s immediate research group. The goal of this feedback is to lay out the best and most productive approaches possible to the research problem. Subsequent annual meetings must be scheduled by March 15 and held no later than May 1 of each year. The committee may require meetings to be held at shorter intervals.

A student who fails to hold a required annual meeting will not be allowed to register for the semester following the one in which his/her meeting was to be held, and financial support will also be withheld until the meeting is held.

Written Assessment

The progress of students in developing the critical thinking skills required of a Ph.D. level scientist is measured through a series of written examinations, which begin during the second semester of residence.

Goal The written assessment provides a platform for development of critical thinking and problem-solving skills based on the analysis of contemporary literature in the areas of medicinal chemistry and molecular pharmacology.

Exam Format Written examinations will be given six times during the year (February, April, June, August, October, and December). First year graduate students normally will be expected to take their first examination in February of their second semester. At each examination period one question will be offered from each of three general areas:

- 1) Chemistry and Chemical Biology
- 2) Quantitative and Analytical Sciences
- 3) Molecular and Cellular Biology

The student will select only one of the three questions to answer from any of the three areas. There are no restrictions on the student's selection of a question. It is expected that the examination will require about two hours to complete.

Questions A reading list of three papers from the contemporary literature, which will serve as the basis for the written assessment, will be provided 3 days prior to the date of each examination period. Typically, examinations will be held on a Monday with the reading material distributed on the preceding Thursday. Although the questions may not necessarily be drawn directly from the papers included on the reading list, the assigned reading will serve as a suitable template or background for the questions. These questions may also be related to on-campus seminars for which a background paper has been assigned.

Scoring Within one week following an examination period, each question will be graded by the faculty who authored the question. Examinations will be scored using 2 points for a high pass, 1 point for a pass, and 0 points for a no pass. The written assessment requirement is completed when a student has accrued a total of 4 points. This must be accomplished by December of a student's second year in the program.

Exam Follow up After each examination, the faculty mentor who authored the exam question will arrange a meeting session to provide the students who did not receive a high pass an opportunity to receive direct feedback and guidance.

Students failing to achieve the required four points in the written cumulative examinations who 1) successfully write and defend an M.S. thesis in the department of Medicinal Chemistry and Molecular Pharmacology and 2) apply to the MCMP Graduate Admissions committee and are re-admitted to the Ph.D. program after completion of the M.S. degree, shall be granted one additional opportunity to obtain the remaining point(s) needed to fulfill the written assessment requirement. All re-admissions to the MCMP Ph.D. program shall be contingent upon the successful completion of the written examination in this one additional attempt. This additional examination will occur in the first examination cycle following the contingent re-admission to the PhD program. The transition back into the Ph.D. program shall be planned and coordinated with the Chair of the MCMP Graduate Advisory Committee.

Original Proposal/Examination

Once the student has passed the written assessment and completed the grant writing course (MCMP 690), he/she may schedule the defense of the original proposal. The initial defense must be held no later than the end of the second semester of the second academic year. The student may *begin work* on the proposal at any time.

The subject of the original research proposal shall be in an area chosen by the student. It may be on any topic, including the area of the student's thesis research, but must represent original and creative new ideas. Whatever the area, the student *should propose experiments that could be accomplished by a single individual in a period of two years*. The student's major professor may not critique the research proposal prior to submission of the proposal to the examining committee. Thus, this examination should test the student's ability to formulate and address a few research questions and to anticipate the types of results to be obtained and how they are to be interpreted. The examination is *not* meant to test the student's ability to propose a lifelong research program.

The examination will not only assess the science involved in the proposal but will also assess the quality of the presentation and the writing.

The proposal document should consist of:

- 1) The **MCMP Departmental Oral Prelim Cover Sheet** found at <http://www.mcmp.purdue.edu/graduateprogram/forms/MCMPOralPrelimCover.doc>
- 2) A **summary of the student's current thesis research** (1-2 pages)
- 3) The **Research Plan**.

The **Research Plan** should include sufficient information for evaluation of the project and follow NIH guidelines regarding page formatting (i.e., margins, font type, font size, etc.).

(See below for specific NIH formatting guidelines)

The proposal document should consist of:

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|------------------------------|---|
| A. Project Summary/ Abstract | one paragraph (15-25 lines) separate page |
| B. Specific aims | 1 page maximum |
| C. Research strategy | 7 pages total |
| 1. Significance | 1 page maximum |
| 2. Innovation | 1/2 page maximum |
| 3. Approach | 5 - 6 pages |
| D. Literature cited | |

The following sections should be included:

A. Project Summary. It is meant to serve as a succinct and accurate description of the proposed work when separated from the application. State the application's broad, long-term objectives and specific aims, making reference to the health relatedness of the project (i.e., relevance to the mission of the agency). Describe concisely the research design and methods for achieving the stated goals. This section should be informative to other persons working in the same or related fields and insofar as possible understandable to a scientifically or technically literate reader. Avoid describing past accomplishments and the use of the first person.

B. Specific Aims. State concisely the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved. List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, challenge an existing paradigm or clinical practice, address a critical barrier to progress in the field, or develop new technology.

C. Research Strategy. Must include Significance, Innovation, and Approach. For the first two sections, you can lump all aims into one Significance and one Innovation section (most popular choice) or you can repeat each section individually for each aim. Preliminary data can be included here if available.

1. Significance. Explain the importance of the problem or critical barrier to progress in the field that the proposed project addresses. Explain how the proposed project will improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields. Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved.

2. Innovation. Explain how the application challenges and seeks to shift current research or clinical practice paradigms. Describe any novel theoretical concepts, approaches or methodologies, instrumentation or intervention(s) to be developed or used, and any advantage over existing methodologies, instrumentation or intervention(s). Explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation or interventions.

3. Approach. Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Unless addressed separately, include how the data will be collected, analyzed, and interpreted. Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims. If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high risk aspects of the proposed work. Point out any procedures, situations, or materials that may be hazardous to personnel and precautions to be exercised.

D. Literature Cited. List all references. Each reference must include the title, names of all authors, book or journal title, volume number, page numbers, and year of publication. The **Literature Cited** section is NOT included in the page limitations for Sections C.

PAGE LIMITATIONS:

Do not exceed 7 pages for the Research Strategy (Item C). All tables, graphs, figures, diagrams, and charts must be included within the 7 page limit. There is no requirement to use all 7 pages.

Current NIH Guidelines for Page Formatting.

Font

- Use an *Arial, Helvetica, Palatino Linotype or Georgia* typeface and a font size of 11points or larger. (A Symbol font may be used to insert Greek letters or special characters; the font size requirement still applies.)
- Type density, including characters and spaces, must be no more than 15 characters per inch.
- Type may be no more than six lines per inch.
- Use black ink that can be clearly copied.
- Print must be clear and legible.

Page Margins

- Use *standard size (8 ½" x 11")* sheets of paper.
- Use at least one-half inch margins (top, bottom, left, and right) for all pages, including continuation pages.

Application PAGING

- The application must be single-sided and single-spaced.
- Consecutively number pages throughout the application. Do not use suffixes (e.g., 5a, 5b).
- Do not include unnumbered pages.

Figures, Graphs, Diagrams, Charts, Tables, Figure Legends, and Footnotes

- You may use a smaller type size but it must be in black ink, readily legible, and follow the font typeface requirement.

The student is expected to continue laboratory research during the time that he/she is preparing the original proposal.

Upon selection of the examination topic, the proposed topic (detailed title and abstract) must be submitted in writing to the Chair of the Graduate Advisory Committee by the end of January (Spring semester of second year). The Graduate Advisory Committee will appoint an Examination Committee consisting of at least one and no more than two members of the student's Advisory Committee, one of whom will serve as the chair of the committee, and 2-3 additional MCMP faculty. The student's major professor will not serve on the Examination Committee, but may attend the presentation as an observer and must leave the room during committee deliberations.

The written proposal and thesis research summary must be prescreened by the committee before the student submits an official request for an examination. The chair of the examination committee will coordinate this preliminary evaluation. Once approval is granted the student may request an official examination date. All examination dates must be requested at least two weeks in advance of the examination to the Graduate School in Young Graduate House. Since it is frequently necessary to schedule meetings involving multiple faculty members far in advance, students are advised to secure a date and time with all members of the committee at least one month prior to the anticipated defense. Thus, the written proposal must be submitted to the committee at least three weeks in advance of the selected date. The committee is obligated to review the proposal and advise the student at least two weeks in advance of the date of the official examination. If the proposal is acceptable as written or only requires minor revision, the student will be advised to proceed with the official request for examination on the date initially reserved with the faculty committee. If, on the other hand, substantial revision of the written proposal is required, the student will be advised to establish a new target date commensurate with the extent of revision recommended by the committee. It is

strongly advised that students arrange an examination date that is well in advance of the end of the second semester of the second academic year.

There are two possible outcomes to the examination. (1) The student passes outright and is admitted to candidacy for the Ph.D. degree. (2) The student does not pass the examination and is allowed to repeat the defense in the following semester (University regulations stipulate that a reexamination cannot be scheduled within the same semester). A student who does not pass his/her defense upon a second attempt will not be allowed to continue for the Ph.D. degree.

Students who do not schedule their original proposal/examination by the required deadline will be considered to have not passed their first attempt. Students in this category must schedule their second attempt during the following semester, and will forfeit a subsequent attempt in the event that they do not pass this examination.

Seminar Requirement

A student must register for MCMP 696 (Seminar) for zero credit except in the semesters during which the student presents a seminar. In those semesters, the student will register for one credit of MCMP 696 for a grade. Students are required to attend all MCMP seminars during the semesters in which they are in residence, and are encouraged to seek out and attend seminars in other departments or programs that are important to their research interests. Failure to attend seminars will result in the assignment of an unsatisfactory (U) grade.

Each student in the Ph.D. program will present two seminars. The first will be presented during the second academic year, and will be a literature-based seminar in a field not related to the student's Ph.D. research. The student may choose a topic with approval of the Seminar Coordinator, or may choose a topic from a list of topics provided by faculty. The faculty member whose topic is chosen will advise the student on his/her seminar. More detailed guidelines for this seminar will be provided at the appropriate time by the Seminar Coordinator.

The second seminar will be on the student's thesis research and will be presented immediately prior to (typically the same day or one day before) the thesis examination. The student's graduate committee will be in attendance and this seminar will serve as the oral presentation for the Ph.D. Final Examination.

Teaching Assistantship (TA) Requirement

The faculty of the MCMP Department believes that a teaching experience is a vital part of the Ph.D. program. Each Ph.D. student must serve as a half-time teaching assistant for at least one semester in a position that involves meaningful student contact. (Laboratory TAs, recitation instructors, and the like are considered to have meaningful student contact; TA positions that involve *only* grading papers, lab preparation, or instrument maintenance do not involve meaningful student contact.)

A student for whom English is not the native language must, of course, meet the University requirement for proficiency in spoken English prior to his/her serving as a TA with "meaningful student contact." Graduate students who cannot meet this requirement will be unable to fulfill the TA requirement and hence, cannot receive a Ph.D. degree from the MCMP Department.

Graduate students *may* serve as TAs for more than one semester, and, of necessity, some of these positions may involve tasks that do not involve student contact.

Students who display excellence in teaching can be nominated for the School's Kienly Award for Teaching Assistants. In addition, TAs who express an interest in college teaching as a career may be given the opportunity to prepare and conduct occasional regular classes under the close supervision of a faculty mentor.

Dissertation/Thesis and Final Examination

Each student will prepare a dissertation or thesis that describes his/her research. This will be an original document written entirely by the student, and must adhere to the thesis-format rules of the Graduate School. When the major professor is satisfied that the dissertation is satisfactory in all respects, the student will present the *complete* dissertation to his/her committee at least two weeks prior to the final oral examination.

In the final examination, the student's graduate committee will examine the student's dissertation for both scientific rigor and appropriate presentation, including use of written English. Upon passing this examination, the student is certified for the Ph.D. degree.

Time and Progress to Degree

The student's graduate committee, through its annual meetings, is charged with monitoring the student's timely research progress toward his/her degree. In addition, the MCMP graduate office will monitor the student to assure that he/she meets the various deadlines: filing the Plan of Study, holding the yearly committee meetings, taking and passing the written assessment and original proposal, etc.

Failure to meet departmental requirements as outlined in this document may result in dismissal from the program.

To expedite the progress towards degree completion, students are encouraged to devote full-time effort to their graduate courses and thesis research.

A student's major professor and/or graduate committee are charged with determining at all times whether a student is making reasonable progress toward the degree. A student who is not making satisfactory research progress will be given a "U" grade in research. Any student receiving a "U" in research will be placed on probation. A student must hold a graduate committee meeting soon after receipt of the "U" grade for review of the probationary status. A student who fails to remove probationary status by exhibiting satisfactory research performance in the subsequent semester (i.e. receipt of another "U" grade) may be dismissed from the program following a review of the student's record by the Graduate Advisory Committee and Department. Probationary status in research may also be considered grounds for withholding financial support.

Any student who is in the sixth or seventh year of study toward a Ph.D. degree must be reviewed semiannually for progress toward the degree. Such students are obligated to schedule an advisory committee meeting every six months or more frequently if the committee deems them necessary. The student's major professor and graduate committee should be prepared to show why that student should continue in the program. The Department is under no obligation to provide financial support to any student past his/her fifth year of graduate study, and financial support will terminate after seven years of graduate study.

School of Pharmacy rules state that any student who fails to complete all requirements for the Ph.D. degree within eight (8) calendar years will be dismissed from the program unless an appeal is made to the Associate Dean for Graduate Programs.

Document Version

This document was originally approved on August 2, 1996. The current document is revised and amended to reflect the intent of the faculty for the Department of Medicinal Chemistry and Molecular Pharmacology. Last revision January 2012 based on December 2011 faculty meeting to update OP procedures/policies.