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GRADUATE PROGRAM IN MOLECULAR PHARMACOLOGY & PHYSIOLOGY

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GRADUATE PROGRAM IN MOLECULAR PHARMACOLOGY & PHYSIOLOGY

The Graduate Program in Molecular Pharmacology and Physiology offers advanced training appropriate for academic and research careers in fields of biology and medical sciences that include cellular, molecular, comparative, and organ systems pharmacology and physiology. Admission is ordinarily limited to applicants for the Ph.D degree. Students interested in the field of biomedical engineering at Brown University may apply to the department's graduate program in BioMedical Engineering.

To fulfill Ph.D. requirements students must pass a preliminary research examination according to established schedules, complete and publicly defend a doctoral dissertation, and participate in the undergraduate and graduate teaching programs of the Division of Biology and Medicine. Attainment of the Ph.D. degree normally requires four to five years for Ph.D. candidates and three to four years of graduate work for M.D./Ph.D. candidates.

I. Governance

The Graduate Program in Molecular Pharmacology and Physiology is administered by the Program Director and a series of standing and ad hoc committees, as a component of the Graduate Program of the Division of Biology and Medicine. Standing committees are the Steering Committee and the Graduate Program Committee, described below. Ad hoc committees include a Preliminary Advisory Committee and a Thesis Committee for each graduate student. These committees, chosen at appropriate stages in the student's career, are described below.

The Steering Committee is composed of the current Graduate Program Director(s) and the Chair of the Department of Molecular Pharmacology, Physiology, & Biotechnology. The Program Director(s) are faculty members appointed by the Dean of Biology and Medicine or designate upon recommendation by the Steering Committee for a term of three years, renewable. The Steering Committee is responsible for establishing policy, allocating resources and designating faculty as trainers or members within the Graduate Program, as outlined below.

The Graduate Program Committee is composed of the Program Directors and one additional faculty member. The faculty member is appointed by the Program Directors in consultation with the Steering Committee. The term for faculty members of the Graduate Program Committee is three years, renewable. The responsibilities of the Graduate Program Committee include admissions recommendations to the Graduate School and curriculum recommendations to the Steering Committee.

The faculty of the Graduate Program will be divided, with respect to graduate training, into two categories, members and trainers.

Members will have an active research interest in the areas encompassed by the Program. They will participate in the activities of the Program by involvement in an upper level course, or by attending program seminars or journal clubs, or by serving on ad hoc committees. They may serve as thesis advisors for Master of Science or Master of Medical Science students.

Trainers are faculty who may serve as thesis advisors for Ph.D. students. Trainers must conduct an active research program and must be prepared to commit the time and effort required to supervise the student's research. They need to commit to have the financial resources to support the graduate student's research project and their academic year and summer stipend. Ph.D. training is most appropriate in an environment where the student can interact with other active investigators and graduate students. Trainers who are members of the MPPB department are expected to offer at least one upper level course every other year, either alone or as a leading instructor in a group. Trainers from other departments are expected to participate in at least the core course (BI0217/BI0218) by giving one or more special topics lectures in their field.

Potential members and trainers are proposed to the Steering Committee by one of its members, who will provide the committee with documentation of the candidate's credentials. Designation of faculty status, as a member or trainer, is made on the basis of the credentials, subject to review every three years.

II. Admission

Entering students are expected to have strong undergraduate qualifications in mathematics, physics, and chemistry as well as in biological sciences. Typically, incoming students will usually have at least two years of college chemistry and biology and one year of calculus and physics. Students who are admitted without having sufficient background in all of these topics will be encouraged to take the appropriate introductory level courses at Brown before enrolling in advanced courses in the respective area.

The Graduate Program will make recommendations to the full faculty for interviews and acceptance after the applications have been made available for review by the faculty.

III. Counseling

Until the Thesis Advisory Committee is selected, counseling on academic matters and review of student progress will be carried out by the Graduate Program Committee, especially the Program Directors. This committee will advise the student on academic matters and review the student's progress each semester until the thesis committee is selected (see below).

IV. Course of Study

The University requires 24 course credits for graduation at the Ph.D. level, of which a maximum of 8 can be transferred from other institutions. Courses must be taken for a grade rather than on a credit/no credit basis. Additionally, students in the M.D./Ph.D. program can receive 8 credits for satisfactory completion of the first two years of the Program in Medicine.

The success of students depends heavily on the consultation between the student and the advisory committee.

Curriculum Guidelines

Attaining proficiency in the MPP core areas -- Entering graduate students in the MPP Program are expected to have or to acquire proficiency in the areas central to the Program's curriculum (pharmacology, physiology, receptor biology, signaling, structural biology, drug design). This proficiency should be established by the end of the first year of graduate study. Proficiency in the core areas of the MPP Program may be gained by taking the core course – Receptors, Channels and Signaling (BI0217), and other graduate (200-level) courses that are conducted in a seminar format. Typically, decisions regarding the specific courses to be taken are made in consultation with the advisory committee.

MPP graduate course work -- Every MPP graduate student will be expected to successfully complete a total of five courses, usually within the first three semesters. Students will acquire proficiency in the areas central to the MPP curriculum through course work at Brown unless equivalent qualifications are evident from advanced course work completed at previously attended academic institutions. At least three of the five required courses should be graduate (200-level) seminar-format courses. Courses that can be used to satisfy this requirement are reviewed and selected annually by the MPP Graduate Program Committee. The current list of suitable courses is appended to this document. In addition to taking the five required courses, students are encouraged to increase their breadth of understanding in MPP areas by taking additional courses as electives, possibly on an audit basis, throughout their stay in the MPP Graduate Program. These electives may include seminars or lecture courses at the advanced undergraduate (100-level) or graduate (200-level) level. If the same or similar courses are offered as 100 or 200 level courses, the 200-level course needs to be chosen.

Students must pass all five required courses with at least a B grade or the equivalent performance. Courses taken S/NC must be passed at B-level performance as evaluated by the instructor. If B-level performance is not attained in a required course, the student will be placed on academic probation and it will be at the discretion of the MPP Graduate Program Committee to decide whether the student must retake the course or if the requirement may be satisfied in some other way. If B-level performance is not attained in two required courses, the Steering Committee will decide whether the student should be given the option of taking two more courses or to remove the student from the Program. If B-level performance is not attained in three required courses, the student will be removed from the Program.

During advisory committee meetings at the beginning of each semester, students will propose courses to be taken. In preparation for these meetings, it is suggested that students contact the faculty members with whom they may be interested in performing their laboratory research rotations to discuss any specific courses that are deemed necessary, or that would be appropriate, for the intended area of research.

Students entering with advanced course work -- To help place students in appropriate MPP core courses, students entering with previous graduate level training should, before coming to Brown, submit to the Program Director descriptions(s) of the course(s) or equivalent experience. These descriptions should include a syllabus or list of topics, the name(s) of the text(s) or readings, the nature of laboratory experience, the duration and number of weekly hours in the course, and any other information that may be helpful. This information will be evaluated by faculty designated by the Program Director, from the respective subject areas,

who will recommend whether the student should take a more basic course, a more advanced course, or be deemed proficient in that area without additional course work. The recommendations of the faculty evaluators will form part of the basis for the pre-registration discussion between the student and the advisory committee. Students entering the Program with a Master's Degree in the area of molecular biology, cellular biology, or biochemistry will work with their advisory committees to ensure that their course work, and overlap with previous courses, is minimized.

Course work and lab rotations to be accomplished during the first year - In their first year in the Program, students must establish proficiency in the core areas of the MPP Graduate Program (pharmacology, physiology, receptor biology, signaling, structural biology, drug design) as stated above. In addition, one of the three required lab rotations will also be performed in this first semester.

V. Student Seminars

Graduate students are expected to attend and participate in departmental weekly seminars, colloquia and journal club activities of the program. Each student must present one departmental seminar within one year of passing the Preliminary Research Exam. This must be based on the student's original research, and should also review research in its field to show proficiency in the literature.

VI. Teaching

The minimum teaching requirement for one semester is highly recommended. Prior teaching experience, comparable to that which would be obtained at Brown, is applicable toward fulfillment of the teaching requirement. The teaching requirement may be fulfilled only by teaching in courses in which graduate students conduct a discussion or laboratory section or present a small number of lectures.

Foreign students must obtain certification from the Center for Language Studies (English for International Teaching Assistants) before they can be teaching assistants. Students will have until the end of the fall semester of their second year to demonstrate proficiency in English and obtain certification from the Center for Language Studies (Brown University requirement). Each student must be certified at level 2 or better to meet the Program requirements. It is inherent upon each international student to schedule an evaluation with the ESL office upon arrival at Brown and to accomplish the required proficiency within the first year of graduate studies. If the student's command of spoken English does not meet this proficiency, the student must enroll in the appropriate ESL course(s) recommended by the office of English for International Teaching Assistants. For further information, contact Barbara Gourlay, Coordinator, English for International Teaching Assistants, Box E, Center for Language Studies, Brown University; or by phone at 863-2546, or 863-3043. Failing this is grounds for dismissal from the MPP graduate program.

VII. Research

Entering MPP graduate students are required to prepare a NSF Graduate Research Fellowship Program (GRFP) Application (deadline ~ November 1st). The MPP program director(s) will work with the graduate students to prepare a competitive application. The MPP graduate steering committee will decide if and how many applications will be submitted.

Students are required to participate in research rotations in at least three different labs. Usually these rotations are finished by the end of the 2nd semester. A laboratory rotation can take the form of the graduate course, Bio 296, Graduate Independent Study. Rotations provide the opportunity to gain exposure to different techniques and ways of thinking about scientific problems. All three rotations are usually carried out during the fall and spring semester of the first year, running 4-6 weeks each. Rotations are a crucial part of the first academic year. It will allow the student and the trainer to see how well they work together. If a student is certain he/she wants to remain in one particular laboratory before completing 3 lab rotations, an exemption might be allowed after careful discussions with the MPP graduate program steering committee. Students in the MPP program will need to present research performed during their rotations during a departmental seminar. Students will receive written evaluations (by all attending trainers) and oral feedback from the MPP program director. Students should discuss the amount of time to be spent in the lab, the specific projects one will work on, etc. with the MPP trainer before starting their rotations. Each student should have a realistic idea of what they should accomplish during the rotation. Rotations are a critical part of the 1st academic year, and the evaluations are as critical as the course performance.

The choice of a Ph.D. thesis advisor and research area will be made no later than by the beginning of the third semester. The most important factors for choosing a laboratory is the professor's ability to train and challenge the student to do science in a stimulating atmosphere. The intellectual environment of the laboratory and the dynamics of the interaction with the mentor and student should be foremost in this decision. These considerations should be as important as the scientific area of choice. The student is advised to talk to faculty trainers before choosing his/her laboratory to determine the amount of professor/student interaction, teaching philosophies, placement of laboratory alumni in the research field after leaving the laboratory, and scientific interest in the future. Further, students are advised to talk with their peers who have already worked in the different labs, in order to get a feel for the environment.

Failure to be placed into a graduate trainer's laboratory by this time is grounds for dismissal from the MPP graduate program. The student will officially notify the MPP graduate program director in writing of his/her decision.

VIII. Preliminary Research Examination

By the end of semester 4, the student will submit a written proposal for thesis research, which will form the basis of an oral, preliminary examination. The exam will consist of a brief oral presentation (20-30 minutes) of the proposal by the student followed by discussion of the thesis proposal with the committee. Written notification of successful completion of the preliminary examination will be sent by the chair of the Thesis Advisory Committee to the Program Director(s) for inclusion in the student's record.

The examining committee, designated the Thesis Advisory Committee, shall consist of the thesis advisor, three other members of the Brown Faculty, and an authority in the area of the thesis research from another institution. The Thesis Advisory Committee should not be chaired by the student's thesis advisor. If a committee member cannot attend the exam, his/her written critique should be available to the committee at least one week in advance. Members of the committee will be asked to serve by the thesis advisor after being selected jointly by the advisor and the student. The thesis advisor should send a memo to the Graduate Program Director(s) listing the membership of the committee, for inclusion in the student's files. The thesis advisor should also schedule the meeting times of this committee.

The thesis proposal will be no more than 8 single-spaced pages in length. This document will be written in the style of an NIH predoctoral research grant proposal including sections on specific aims and goals, significance, background, proposed methods and experimental approaches, interpretation of expected results, and a report on preliminary progress. A final draft of the thesis proposal shall be provided to all Thesis Advisory Committee members at least two weeks prior to the date of the oral examination. The proposal is to be developed by the student, with only minimal involvement of the research advisor or others in the laboratory. It is strongly recommended that the student, when possible, submit the written document as a predoctoral fellowship application to a funding agency such as the NIH after completion of the Research Examination.

Major goals for this examination are to evaluate the student's comprehension of the scientific literature in the area of the thesis research as well as in related areas and to evaluate the student's ability to define scientific questions and to develop experimental strategies.

The thesis advisor should arrange a meeting of the Brown affiliated members of the Thesis Advisory Committee with the student at least once a year after completion of the preliminary examination. The purpose of this committee is to follow the progress of the student, to help the student with difficulties encountered in the dissertation research, and to aid with the evolution of the project. These meetings could be scheduled for the intersession between semesters in the academic year, a time when both faculty and students are likely to be available and free of teaching responsibilities. The student will prepare a brief (about one page) written report of progress and proposed work to be distributed to committee members prior to each annual meeting. A copy of the student's annual progress report should be sent to the Program Director(s) for inclusion in the student's file. In addition, the MPP graduate program director(s) may schedule an annual meeting with the student.

IX. Ph.D. Thesis

The Thesis Committee consists of the thesis advisor, three other members of the Brown faculty, and a reader external to Brown. The doctoral thesis should represent a comprehensive summation of the student's total research effort. It is expected to contribute significantly to the field of study and to be of sufficient quality to merit publication in a refereed journal. The thesis can be presented in either of two formats. The first format, which may be used by any degree candidate, should contain the following elements:

- a) Abstract - less than 350 words summarizing the thesis problem, methods used to solve the problem, the results, and conclusions.
- b) Introduction - a comprehensive review of the field and reasons for performing the research.
- c) Methods and Results - a description of the research performed.
- d) Discussion - an evaluation of the contribution of the thesis research to the field of study and consideration of future directions

The second format may only be used by candidates whose thesis work forms the basis for two or more papers accepted for publication in refereed journals. In this case the published papers (or relevant portions of the manuscripts) may be substituted for the Methods and Results section of the thesis. Otherwise the format should be the same as that given above; i.e., it should contain a complete Abstract, Introduction, and Discussion.

If portions of the student's work have been done in collaboration with other investigators, the candidate should explicitly state his/her contribution to the work. **Detailed instructions on preparation and format of the Ph.D. dissertation should be obtained from the Graduate School.**

After submission of the thesis, the student will present his/her work in a seminar, following which there will be an oral examination attended by members of the Thesis Committee and other faculty members who choose to participate. The thesis advisor will schedule the thesis defense and notify the Program Director(s) and all program faculties at least one week before the defense. Faculty members are encouraged to read each thesis submitted, attend the seminar, and participate in the examination.

X. Financial Support

Graduate students who are candidates for the Ph.D. are generally accepted into the Program of Molecular Pharmacology & Physiology with a commitment of financial support while their research and academic studies progress satisfactorily. Divisional support is provided during the first 12 months in which the student is taking courses and laboratory rotations. During the summer, the student is expected to begin research in the laboratory of a graduate trainer. Second year students typically receive support for one semester as teaching assistants. Faculty who accept graduate students into their laboratories under the auspices of the MPP Program need to provide both academic year and summer support for their students who have fulfilled the minimum teaching requirement, and who are not receiving support from other sources. This support will include stipends for both academic year and summer; one tuition credit or registration fee per semester as appropriate; health insurance; and the health services fee.

Any student who has passed the Preliminary Research Examination may request up to \$400/year from the Program Director(s) who administers the Graduate Program budget for travel funds to attend scientific meetings if the student is presenting an abstract at the meeting. Students may also request the Program Director(s) to have the Program budget pay their final dissertation fee (approximately \$50).

XI. M.S. Degree

In some cases, students will be admitted to the program as candidates for the M.S. degree only. Such students are not eligible for financial aid. The M.S. degree requires 8 course credits, and 1 credit can be transferred for post-baccalaureate work done elsewhere. In addition to Divisional requirements, a written thesis based on original research must be completed and accepted by a committee consisting of the research advisor plus two additional members of the Brown faculty. There is no teaching requirement for the M.S. degree.

XII. M.D./Ph.D. Degree

Applicants to the Brown University Program in Medicine may also apply to the M.D./Ph.D. Program. M.D./Ph.D. students must complete all of the Program requirements specified for the Ph.D. degree.

XIII. Master of Medical Science Degree

Medical students who are enrolled in the Program in Medicine may apply to the Master of Medical Science Program. In addition to Divisional requirements, a written thesis must be completed and evaluated as given above for the Master's degree.

XIV. M.A. Degree

In some cases, students will be admitted to the program as candidates for the M.A. degree only. Such students are not eligible for financial aid. The M.A. degree requires 8 course credits, and 1 credit can be transferred for post-baccalaureate work done elsewhere. A written thesis is not required. There is no teaching requirement for the M.A. degree.

XV. Leave of Absence

For the leave of absence the MPP graduate program follows the general guidelines of the Brown University graduate school. During the course of graduate study, a student may need to request a leave of absence. Applications for leaves of absence should be sent to the MPP Graduate Program Director(s) before December 1st and thereafter to the Graduate School by December 15th of the year preceding the year in which the leave is to be taken. Failure to inform the Graduate School means that the student will still be considered active and will be billed for tuition. Departmental Directors of Graduate Study (DGSs) must approve all leave of absence applications.

Students must use the standard form to request a leave and should attach a separate note explaining the reason for their request. The DGS should sign the form to indicate approval and forward it to the Graduate School for approval by the Dean. Leaves of absence are normally granted for one year. To return to active status, students must notify the Graduate School in writing by May 1st for a fall-semester return or November 1st for a spring-semester return. The DGS should be aware that granting a leave implies that the program will be willing to readmit the student, though sometimes only if certain conditions are met. Any such conditions should be put in writing and clearly understood by all parties. Students on leave do

not have access to the library or other facilities, including the University's electronic resources. If the student is an alumna/us (such as a master's degree holder) he or she may use the library under that status. Borrowing privileges may also be purchased for a nominal fee. A student who has taken a leave of absence should write to the MPP Graduate Program Director(s) requesting readmission. The DGS should then endorse and forward the request to the Graduate School for approval by the Dean.

XVI. Dismissal

A student may be dismissed from the Graduate Program for academic or non-academic reasons. The Graduate Program Committee will review each case and place its recommendation before the full faculty convened by the Program Directors. Two thirds of the faculty will constitute a quorum and a decision to accept the recommendation of the Graduate Program Committee will require a favorable majority vote. Appeal of such decisions is to the Dean of the Graduate School.