GRADUATE PROGRAM IN MOLECULAR PHARMACOLOGY & PHYSIOLOGY

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GRADUATE PROGRAM IN MOLECULAR PHARMACOLOGY & PHYSIOLOGY

The Graduate Program in Molecular Pharmacology and Physiology (MPP) offers advanced training appropriate for academic and research careers in fields of biology and medical sciences that include cellular, molecular, and organ systems pharmacology and physiology. Admission is ordinarily limited to applicants for the Ph.D. degree, but occasionally 5th-year masters students are admitted to the program; these are Brown students who have begun research as undergrads, and then chosen to stay at Brown for an extra year. The program does not normally admit external masters applicants. However, these students may apply to one of two other graduate programs affiliated with our department -- the Biotechnology program, and the Biomedical Engineering (BME) program, which falls under control of Brown's Center for Biomedical Engineering.

To fulfill Ph.D. requirements students must earn an A or B in required courses, 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.

The MPP program is a small, intimate program in which there are typically 20 total students, with 3 or 4 students admitted annually. As a result, the program is flexible and congenial, and students have extensive direct interactions with the faculty trainers, as well as with the Program Director, Associate Director and Program Coordinator. The program is funded in part by an NIH training grant (T32) in pharmacological sciences. In addition, the MPP program is very diverse, in terms of its research areas and curriculum, as well as in the racial, ethnic and cultural background of its students and faculty trainers.

MPP is a very interdisciplinary and collaborative program, drawing trainers from many departments, as well as from several hospitals. There are 41 faculty trainers, whose research falls into the following 5 focus areas:

1. Molecular structure
2. Receptor and channel pharmacology, physiology and signal transduction
3. Chemical biology and biophysics
4. Neural circuit function
5. Translational and clinical applications

I. Governance

The Graduate Program in Molecular Pharmacology and Physiology, a component of the Graduate Programs of the Division of Biology and Medicine, is administered by the Program Director, Associate Program Director, a standing Graduate Program Committee, and an ad hoc Thesis Committee for each graduate student, as described below.

The Graduate Program Committee is composed of the current Graduate Program Director and Associate Program Director, the Chair of the Department of Molecular Pharmacology, Physiology & Biotechnology (MPPB), and one to two additional faculty members chosen by the Program Director and Chair. The Program Director and Associate Director are faculty members appointed by the Dean of Biology and Medicine, or designate, upon recommendation by the Chair for a term of three years, renewable. The Graduate Program Committee is responsible for decisions related to resource allocations and policy, admissions recommendations to the Graduate School, graduate curriculum decisions, and designation of faculty as trainers or members within the Graduate Program, as outlined
below. Input from Graduate Program faculty is considered in the decision processes of the Graduate Program 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 serving on ad hoc committees, such as Thesis Committees. They may serve as Thesis Advisors for Masters students, and as co-mentors for Ph.D. students.

Trainers are faculty who may serve as Thesis Advisors for Ph.D. students. Trainers must conduct an active, funded research program and must be prepared to commit the time and effort required to supervise the student's research. They must commit to providing the financial resources to support the graduate student’s research project and his or her academic year and summer stipend after the first 3 semesters, when students are supported by the Division of Biology and Medicine. Ph.D. training is most appropriate in an environment where the student can interact with other active investigators and graduate students, as well as with the trainer.

Potential members and trainers are proposed to the Graduate Program Committee by existing trainers and members, who will provide the committee with documentation of the candidates' 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 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 Committee will select applicants for interviews after the applications have been made available for review by the full Graduate Program faculty, and opinions solicited from the faculty. On recruitment days, each invited applicant will meet with each member of the Graduate Program Committee. Additional interviews with specific faculty trainers will be arranged according to expressed interests of the applicants and trainers.

III. Counseling

Until the Thesis Committee is selected, counseling on academic matters and review of student progress will be carried out by the Graduate Program Committee, especially the Associate Program Director. 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 satisfactory/no credit (S/NC) 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. At Brown, each
one-semester course is worth one credit, and the normal full-time load is 4 credits per semester. However, graduate independent study (i.e., research, BIOL 2980) can be taken for up to 4 courses per semester if no other courses are taken in the same semester.

The success of students depends heavily on the consultation between the students and their advisory committees.

Curriculum Guidelines for the Ph.D. in Molecular Pharmacology and Physiology

Attaining proficiency in the MPP core areas -- Entering graduate students in the MPP Ph.D. Program are expected to have, or to acquire, proficiency in the areas central to the Program’s curriculum (pharmacology and physiology). This proficiency should be established by the end of the first year of graduate study, and is based on three specific required courses. Proficiency in the core areas of the MPP Program is gained by taking the MPP core course — BIOL2170, "Molecular Pharmacology & Physiology". In addition, proficiency in quantitative skills is required. This requirement is met by taking one of four courses in quantitative methods: BIOL2010 "Quantitative Approaches in Biology", CLPS2906 "Experimental Design", PHP2510 "Principles of Biostatistics and Data Analysis" or APMA2610 "Recent Applications of Probability and Statistics". A third required course, BIOL2190A ("MPP Professional Development Seminar"), is a career development course taken by all first-year MPP students in which they receive training in reading scientific literature; writing abstracts, papers and grants; and producing professional talks about their research. This course also exposes the students to scientists from many types of jobs to provide an overview of career opportunities.

MPP graduate course work -- Every MPP doctoral 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. Three of the five courses must be graduate-level courses (i.e., at least at the 2000 level), and this requirement is met by the required courses listed above (BIOL2170, BIOL2190 and the quantitative methods course). The remaining two required courses can be chosen by the student in consultation with the Associate Director and/or the Graduate Program Committee and Thesis Advisor, based on the student’s general research direction and goals, and their expected thesis research area. In addition to taking the five required courses, students may also 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 (1000-level) or graduate (2000-level) level. If the same or similar courses are offered as 1000 or 2000 level courses, the 2000-level course should be chosen. With approval of the Associate Director, courses lower than the 1000 level may be taken to fill gaps in the student’s background knowledge.

Students must pass all five required courses with at least a B grade or the equivalent performance. Courses taken S/NC must be passed with at least 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 less than a B-level performance is attained in two required courses, the Graduate Program Committee will decide whether the student should be given the option of taking two more courses or will be expelled from the Program. If B-level performance is not attained in three required courses, the student will be expelled from the Program.

During a meeting with the Program Director and Associate Director just before the beginning of each semester, each student will propose courses to be taken. In preparation for these meetings, it is
suggested that first-year 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. The final (fifth) required course, usually taken in semester 3 or 4, should be selected to maximize preparation for a successful PhD, and should be selected in consultation with the student's Thesis Advisor.

**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 Associate 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 Associate Director, from the respective subject areas, who will recommend whether the student should take a 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 Program Director and Associate Director. Students entering the Program with a Master's Degree in the area of molecular biology, cellular biology, or biochemistry will work with the Associate Director 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 at Brown University** - In their first semester in the Program, students must establish proficiency in the core areas of the MPP Graduate Program (pharmacology and physiology), as stated above. In addition, one or two of the three required lab rotations will also be performed in this first semester. Thus, in the first semester of the first year, each MPP student will take the required courses, BIOL2170 and BIOL 2190, as well as one to two research rotations as Graduate Independent Study (BIOL2980), completing the total full-time load of 4 credits for the semester (the student must select a double credit for BIOL2980 when registering on Banner). During the second semester, the students will take an elective and/or one of the quantitative methods courses, as well as two to three credits of Graduate Independent Study (BIOL2980), to cover one to two research rotations; again, the total credits should equal 4 (so credits of BIOL 2980 should be adjusted accordingly). During the first and second semesters, the Associate Director is selected as the instructor for BIOL2980, and he/she collects input from the respective research rotation advisors in assigning the course grade; in subsequent semesters, each student's Thesis Advisor is indicated as the instructor for BIOL2980, and assigns the grade directly. In addition to the above courses, each student will take the research ethics course described below, which is required, but does not count for credit; registration for this course is via response to an email that each student will receive from the Office of Graduate and Postdoctoral Studies, Division of Biology & Medicine. Note that students must choose one of 4 quantitative methods courses; since some courses are offered in spring and some in fall, some students will fill this requirement during the spring of their first year, and some during the fall of their second year.

The course plan for the **first year at Brown** should look like this:

**Semester I:**  
BIOL2170  
BIOL2190  
Two credits of BIOL2980 (taken as 1 to 2 research rotations)  
Responsible Conduct for Research (RCR, see below)

**Semester II:**  
An elective course and/or a required quantitative methods course (see above)  
Two or three credits of BIOL2980 (taken as 1 to 2 consecutive research rotations), as needed to make a total of 4 credits.
The second elective course required to fulfill the 5-course minimum will be taken in one of the subsequent semesters, usually the 3rd or 4th semester, along with thesis research.

**Training in Research Ethics** -- In addition to the MPP core courses, the ethics course offered by the Division of Biology and Medicine, entitled “Responsible Conduct in Research”, must be successfully passed in the 1st semester, and its refresher course passed in the 4th year. MPP students will receive emails from the Division's Office of Graduate and Postdoctoral Studies regarding scheduling and sign-up procedures for the course.

**NSF graduate fellowship application.** All 1st year graduate students are required to prepare an NSF Graduate Research Fellowship Program (GRFP) application (deadline typically in early November) if they are eligible. However, some students are not eligible (e.g., foreign students and those who hold masters degrees); these students are required to seek out and apply for other fellowships for which they are eligible. Instruction and individual help with writing of this grant application will be provided in the required first-semester MPP career development course, BIOL 2190. In addition, fellowship workshops will be offered by the Graduate School, and weekly email updates provide information of various other types of fellowships for which MPP students are eligible (“Graduate and Postdoc Studies Weekly Update”). Finally, the Graduate and Postdoc Studies Office can provide critical help with grant writing and with locating other grant opportunities, through individual meetings with Brenda Slaney, arranged with her by the students.

Students who are successful in obtaining their own individual fellowships are generally eligible for additional compensation during their fellowship years in the form of a stipend bonus $1800/yr) from the Division of Biology & Medicine, as well as additional funds from the MPP Graduate Program ($1500/yr) to spend on research-related expenses, such as laptops, research supplies and travel to conferences.

**V. Student Seminars**

Graduate students are required to attend and participate in weekly MPPB departmental seminars, and are expected to participate in relevant colloquia and journal club activities of the MPP Program and other graduate programs, depending on the relevance to the individual student’s research interests. For example, students are encouraged to attend the “Bench to Bedside” lecture series organized by the Department of Neuroscience to receive an initial introduction to translational research. Students are also expected to attend the thesis defense seminars of other MPP students.

In the spring of the first year, each student will present a brief seminar to the department on a research rotation experience, in addition to presenting a seminar in class in BIOL2190. In addition, each student must present one full-length seminar to the entire department within one year after passing the Preliminary Research Exam. This “3rd-year seminar” must be based on the student's original research, and should also review relevant background research to show familiarity with the literature. Members of the Brown community outside the MPPB department also may attend the first and third year seminars.

**VI. Teaching**

Each student is required to serve as a teaching assistant for one semester-long course. Extensive prior teaching experience may be applicable toward fulfillment of the teaching requirement, with permission of the Associate Director, in consultation with the Graduate Program Committee. 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 serve as 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 the responsibility of 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 the coordinator for the English for International Teaching Assistants program, Center for Language Studies, Brown University; or by phone at 863-2546, or 863-3043. Failing to meet the English proficiency requirement is grounds for dismissal from the MPP graduate program.

VII. Research

Students are required to participate in research rotations in at least three different labs. Each student should discuss possible research rotation labs with the Associate Director prior to contacting the individual research advisors (MPP faculty trainers). The 3 rotations must be finished by the end of the 2nd semester of the first year; in special circumstances, extensions into the summer can be made with permission of the Associate Director. A laboratory rotation generally takes the form of the graduate course, BIOL2980, Graduate Independent Study. Normally all three rotations are carried out during the fall and spring semester of the first year, running 4-8 weeks each. Rotations allow the student and trainer to see how well they work together, and whether there is a good fit between the student and the specific field of research. In addition, rotations provide an opportunity to gain exposure to different techniques and ways of thinking about scientific problems. As mentioned above, students in the MPP program will need to present research performed during one of their rotations during a brief departmental seminar; they will receive oral feedback from the MPP Program Director, Associate Director, and faculty trainers in attendance. Before starting a research rotation, each student should discuss with the relevant MPP trainer the amount of time to be spent in the lab, the specific projects to work on, etc. Each student should have a realistic idea of what he or she should accomplish during the rotation. Rotations are a critical part of the first academic year, and evaluations of the rotations are at least as critical as the students’ performance in regular courses.

The choice of a Ph.D. Thesis Advisor and research area will be made no later than by the end of the second semester; in special circumstances, extensions into the summer can be made with permission of the Associate Director. The most important factor 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 at least as important as the scientific area of choice. The student is advised to talk with 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 future scientific interests. Further, students are advised to talk with their peers who have already worked in the different labs to get a feel for the environment.

The student will officially notify the MPP Associate Program Director in writing (an email is sufficient) of his/her decision once there is an agreement with a particular trainer who will serve as that student's Thesis Advisor. Failure to be placed into a graduate trainer’s laboratory by the end of the
second semester is grounds for dismissal from the MPP Graduate Program. The student should keep the Associate Director apprised of developments in lab rotations, especially regarding any potential difficulty he or she may be having regarding choice of a lab.

A short description of each faculty trainer’s relevant research is listed below, and each trainer's home department is given in parentheses. More detailed descriptions are located on the MPP website: (http://brown.edu/academics/molecular-pharmacology-physiology-and-biotechnology/graduate/mpp/mpp-graduate-program-trainers), and on individual faculty websites.

**Gilad Barnea (Neuroscience):** Uses molecular genetic approaches to understand how the mammalian brain processes olfactory information and translates it into behavioral outputs.

**David Berson (Neuroscience):** Explores the structure and function of ganglion cells, the retinal neurons that communicate directly with the brain.

**Wayne Bowen (MPPB):** Studies sigma receptors and their role in cancer cell and neuronal survival; develops novel small molecule anti-tumor and neuroprotective agents that target sigma receptors.

**Linda Carpenter (Psychiatry & Human Behavior, Butler Hospital):** Studies noninvasive neuromodulation treatments for depression and other psychiatric disorders, using devices such as those designed to deliver transcranial magnetic stimulation, transcranial direct current stimulation, and vagus nerve stimulation. She investigates EEG, imaging, genetics, and inflammatory, and neuroendocrine biomarkers of mood disorders.

**Gaurav Choudhary (Medicine, VA Hospital):** Evaluates the mechanisms underlying vascular dysfunction and cardiac dysfunction seen in pulmonary vascular diseases.

**Barry Connors (Neuroscience):** Uses cellular physiology and optogenetics to define circuits in the mammalian brain, primarily the neocortex and thalamus.

**Kareen Coulombe (Engineering):** Develops new ways to engineer functional human cardiac tissue to regenerate heart muscle after irreversible damage.

**Eric Darling (MPPB):** Investigates the relationship between the biological function of cells and tissues and their micro/nano-scale mechanical properties. Particular emphasis is given to mesenchymal stem cells, regenerative medicine, and musculoskeletal tissues.

**Suzanne de la Monte (Neurosurgery; Pathology & Laboratory Medicine; Rhode Island and Miriam Hospitals):** Studies the roles of brain insulin deficiency and insulin resistance in neurodegeneration. Three diseases of major interest are: Alzheimer's, alcoholic brain and liver degeneration, and fetal alcohol syndrome.

**Alexandra Deaconescu (Molecular and Cell Biology and Biochemistry ["MCB"])**: Studies the biochemical and biophysical underpinnings of DNA transactions essential for the maintenance of genomes and for controlling the flow of genetic information.

**Sarah Delaney (Chemistry):** Investigates the biological consequences of DNA damage.

**Patrycja Dubielecka-Szczerba (Medicine, Rhode Island Hospital):** Identifies new targets for therapies aimed at eradicating drug resistant leukemic stem cells responsible for relapse.

**Nicolas Fawzi (MPPB):** Uses NMR spectroscopy and complementary techniques to elucidate the structure, dynamics and molecular interactions of protein aggregates implicated in neurodegenerative disease.

**Philip Gruppuso (MCB; Pediatrics, Hasbro Children's Hospital):** Studies the regulation of normal and abnormal somatic growth, using liver as a model system and employing in vivo and in vitro models.

**Elizabeth Harrington (Medicine, VA Hospital):** Characterizes intracellular signaling mechanisms that regulate endothelial cell functions and/or responses to environmental cues.

**Anne Hart (Neuroscience):** Uses genetic and molecular approaches in the small nematode C. elegans to understand the conserved mechanisms underlying neurodegenerative disease and nervous system function.

**Edward Hawrot (MPPB):** Uses biochemical and pharmacological studies aimed at understanding the fundamental structure-function relationship of nicotinic acetylcholine receptors (nAChRs).


Gerwald Jogl (MCB): Uses X-ray crystallography as the main research tool (together with biochemical and biophysical approaches) to study the structure and function of proteins and macromolecular complexes.

Julie Kauer (MPPB): Identifies molecular mechanisms involved in synaptic plasticity and modulation of neuronal excitability using electrophysiological techniques in brain slices.

Karla Kaun (Neuroscience): Uses the fruit fly, Drosophila melanogaster, to investigate the neural substrates of drug reward at the molecular and cellular level.

Gideon Koren (Medicine, Rhode Island Hospital; Cardiovascular Research Center): Elucidates the regulation of expression voltage-gated potassium channels and mechanisms of sudden death.

John Marshall (MPPB): Studies on the treatment of cognitive disorders with a focus on BDNF signaling in Angelman syndrome, trafficking of glutamate receptors and ubiquitination.


Ulrike Mende (Medicine, Rhode Island Hospital; Cardiovascular Research Center): Studies the role of cardiac myocytes and fibroblasts in the remodeling response of the heart to hemodynamic stress and injury.

Jeffrey Morgan (MPPB): Uses 3D cell culture to devise new methods for phenotypic drug discovery, toxicity testing and the engineering of organs.

Eric Morrow (MCB; Psychiatry & Human Behavior): Investigates the genetic and molecular mechanisms underlying disorders of cognitive development, such as intellectual disability and autism.

Elena Oancea (MPPB): Investigates signal transduction and ion channel physiology in melanocytes.

Rebecca Page (MCB): Studies the molecular basis of MAP kinase regulation by its interaction with kinases, via scaffolding proteins, and phosphatases.

Wolfgang Peti (MPPB): Elucidates the molecular and functional basis of signaling processes essential to interfere with neurodegenerative and other neuronal diseases, cancer and diabetes.

Jonathan Reichner (Surgery, Rhode Island Hospital): Studies neutrophil integrins as receptors for detection of potential pathogens.

Jacob Rosenstein (Engineering): Designs new high-performance electronic circuits and combines them with new materials and biophysical systems.


Jason Sello (Chemistry): Utilizes naturally occurring antibiotics and the organisms from which they come. Streptomyces bacteria and their antibiotics are the primary subjects of research.

Anita Shukla (Engineering): Works on developing advanced biomaterials solutions to combat microbial infections, and studies stem cell differentiation.

Jay Tang (Physics): Studies bacterial motility and adhesion, with the goal of understanding the physical principles behind various biological functions.


Ian Wong (Engineering): Engineers new technologies to study cancer cell invasion, phenotypic plasticity and therapeutic resistance.

Peng Zhang (Medicine, Rhode Island Hospital; Cardiovascular Research Center): Studies molecular mechanisms of cardiac remodeling and fibrosis in response to hemodynamic stress and injury.

Anatoly Zhitkovich (Pathology & Laboratory Medicine): Investigates molecular mechanisms responsible for cell death and mutagenicity of DNA-reactive carcinogenic chemicals and anticancer drugs.
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 (sometimes called "Qualifying Exam"). 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 examining committee (designated the Thesis Committee). Written notification of successful completion of the Preliminary Examination will be sent by the chair of the Thesis Committee to the Associate Director for inclusion in the student's record.

The Thesis 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 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 student after being selected jointly by the advisor and the student (the outside member of the committee is often invited by the Thesis Advisor, rather than by the student, depending on whether the student already knows this outside person). The Thesis Advisor should send a memo (email is fine) to the Associate Director listing the membership of the committee, for inclusion in the student's files. The student should also schedule the meeting times of this committee.

The thesis proposal should be no more than 10 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 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 Preliminary 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. However, this examination also is an opportunity to obtain initial input from the Thesis Committee on the feasibility of the project and possible improvements to the research plan.

Research Progress Meetings and Reports after the Preliminary Examination

The student will provide a research update to all Brown-affiliated members of the Thesis Committee at least twice a year after completion of the Preliminary Examination. At least one of those two updates must be presented as part of a meeting with the Thesis Committee; the second one can be accomplished as a Thesis Committee meeting, or via email exchanges with the members. Additional updates and/or meetings per year may be requested by the student, the Thesis Advisor, a Thesis Committee member, the Associate Director or Director, or the Graduate Program Committee, especially for students beyond year 3 of the Program. The purpose of the Thesis 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. The student will prepare a brief (about one page) written report of progress and proposed work (and proposed timeline for completion, for students after the 3rd year) to be distributed to committee members prior to each meeting. After the committee meeting, a copy of the student's progress report should be sent to the Associate Director and Program Coordinator (Jessica Bello) for review and inclusion in the student's file. This report should contain any changes
suggested by the Thesis Committee at the time of the meeting or email exchanges, and should be approved by the Thesis Committee members. In addition, the MPP Associate Program Director may schedule occasional meetings with the student and/or Thesis Advisor to assess progress.

**IX. Ph.D. Thesis**

As stated above, 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, and is expected to contribute significantly to the field of study. One or more publications in peer-reviewed journals are expected and highly recommended. 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 papers accepted for publication in refereed journals. In this case, the published papers (or relevant portions of the manuscripts) may be included as specific chapters within the Results section of the thesis. Unpublished results can then be included in separate chapters of the Results section. Although each published paper will contain specific methods, it is also useful to include a section in the thesis that provides general methods, especially if some results chapters are unpublished. 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. For theses that follow the second format, this is generally accomplished by preceding the relevant results chapter with a page that states which parts of the following published paper were performed by the student and which parts were performed by the other authors. **Detailed instructions on preparation and format of the Ph.D. dissertation should be obtained from the Graduate School.**

In the last few months of the student's dissertation research, he or she will meet with the Thesis Committee ("pre-Defense meeting") to present a preview of what will appear in the thesis, and to set an approximate date for the Thesis Defense. At the Defense, the student will present his/her work in a seminar, and then undergo a closed-door oral examination attended by members of the Thesis Committee and other faculty members who choose to participate. The thesis must be submitted to the Thesis Committee at least 2 weeks prior to the Thesis Defense. The student will schedule the Defense and notify the Associate Director and Program Coordinator (Jessica Bello), at least one month before the Defense; the Program Coordinator will notify all program faculty at least one week before the Defense. Faculty members are encouraged to attend the Defense seminar.
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 (up to 5 years). 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 Divisional 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 may request up to $500/year from the Associate Director who administers the Graduate Program budget for travel funds to attend scientific conferences if the student is presenting an abstract describing research at a Brown laboratory (including Brown-affiliated hospital labs). Students applying for graduate program travel funds must also apply for travel awards from the conference organization, if available. Students in their second year and beyond also are eligible to apply for additional travel funds ($500) from the Division of Biology & Medicine (Office of Graduate and Postdoctoral Studies). Applications for the Divisional funds must be made at least one month prior to the planned travel.

To insure that each entering first-year student is equipped with needed computing power for graduate studies, he or she is provided with $1200 to spend on a computer (laptop or desktop) or computer accessories (e.g., printer). Purchases must be made via Brown University through the services of a departmental administrative assistant.

Students who obtain individual external fellowships are also eligible for additional compensation (see above, NSF graduate fellowship application).

XI. Masters Degrees

Currently, the MPP Graduate Program admits Brown's 5th-year Masters students, but not external masters students. Masters students are not eligible for financial aid. A Masters degree requires 8 course credits, and one of these must be the main MPP core course, BIOL 2170 (Molecular Pharmacology and Physiology). Other courses for the Masters degree are decided in consultation with the MPP Graduate Program Committee to reflect the individual student's research/career interests. Students must pass all courses with at least a B grade; courses taken S/NC must be passed with at least B-level performance as evaluated by the instructor. There is no teaching requirement for a Masters degree.

M.S. Degree

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.

M.A. Degree

A written thesis is not required. There is no teaching requirement for the M.A. degree.
XII. M.D./Ph.D. Degree

Students in Brown's M.D./Ph.D. Program may participate in the MPP Graduate Program. These students must complete all of the MPP Program requirements specified for the Ph.D. degree, except that they are not required to serve as teaching assistants, and may receive course credit for the first 2 years of medical school, including exemption from our core courses BIOL2170, the quantitative methods course, and the 2 elective courses. They are encouraged to take BIOL2190 for their scientific career development.

XIII. 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 before December 1st and thereafter to the Graduate School by December 15th of the year preceding the academic 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. The Graduate Program Director must approve all leave of absence applications, in consultation with the Graduate Program Committee. Students must use the standard form to request a leave and should attach a separate note explaining the reason for their request. The Graduate Program Director 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 Graduate Program Director 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 requesting readmission. The Program Director should then endorse and forward the request to the Graduate School for approval by the Dean.

XIV. 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 notify the Graduate School of its decision. The first step in this process is placement of the student on academic warning, in writing. Detailed procedures are described in the Graduate School Handbook. Appeal of such decisions is to the Dean of the Graduate School.