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 have 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 (qualifying) 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 and Program Coordinator. The program is funded in part by an NIH/NIGMS training grant (T32) in pharmacological sciences (“Predoctoral Training Program in Trans-disciplinary Pharmacological Sciences”), and its Principal Investigator is also intimately involved in the MPP program. 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. MPP faculty trainer research falls into the following 5 general focus areas:

1. Molecular structure and its role in disease
2. Neuropharmacology and neural circuit function
3. Receptor and channel pharmacology, physiology and signal transduction
4. Translational and clinical applications of pharmacology & physiology
5. Chemical biology and its 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, 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 Graduate Program Director, the Principal Investigator (PI) of the Pharmacology training grant (T32), and two to three faculty trainers, with representation of both senior and junior faculty. The Program Director is a faculty member appointed by the Dean of Biology and Medicine, or designate, upon recommendation by the MPPB Chair. 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 within the Graduate Program. The Graduate Program Committee also works with the T32 PI on policies relating to the training grant, and in deciding which trainers and trainees to include in that training program. Input from Graduate Program faculty and students is considered in the decision processes of the Graduate Program Committee.

II. Admission

Entering students are expected to have strong undergraduate qualifications in mathematics, physics, and chemistry as well as in biological sciences. The Graduate Program Committee selects applicants for interviews after the applications have been made available for review by the full Graduate Program faculty, and opinions solicited from the faculty. Admissions decisions are based on each applicant's research experience, letters of recommendation, personal statement, academic performance and interviews. Although GRE scores are considered in the decisions, they are weighted less heavily than the other factors because they have been shown to be inconsistent predictors of success in graduate school and in scientific careers. Each applicant selected for interview will receive a phone call and follow-up email from the Program Director inviting him or her to the MPP recruitment event at Brown. During the recruitment event, each invited applicant will meet with each member of the Graduate Program Committee, and additional interviews with specific faculty trainers will be arranged according to the expressed interests of the applicants and trainers.

The recruitment process consists of a dinner with current graduate students on the applicants' arrival date, followed by a day of interviewing, which begins with breakfast with the Program Director, includes lunch with the current students, and then ends with a dinner with the students and faculty. The following day, the applicants may opt to stay for breakfast with some of the current students and then explore the campus and surrounding areas on their own before departing; however, this last day's events are optional. Most, if not all, current MPP students participate in the recruitment event, and each applicant is paired with a student host. All recruiting expenses are covered by the Graduate Program. The application deadline and the dates for the recruitment event will be posted on the MPP web site before the start of each fall semester.

III. Advising

**Early academic advising.** Upon entering the program, students receive an orientation to the program from the Graduate Program Director and T32 PI during the "Fall Welcome Dinner" (see below, "Additional training activities and scientific interactions"). This orientation includes an introduction to the curriculum, as well as to other features of the program. This is followed with academic advising by the Graduate Program Director and Graduate Program Committee in individual meetings with each student. This academic advising involves discussion of possible electives and rotations for each student. When each student is affiliated with a thesis lab in the second year, the choice of any remaining electives also involves discussion with the Thesis Advisor for consideration of particular electives that may be helpful for the student's thesis project.

**Research advising.** Once the student is involved in thesis research, research-related advising is handled first by the Thesis Advisor and Thesis Committee, which meet at least twice per year to review progress and provide advice (see below, "Dissertation research"). However, general advising by the T32 PI, Program Director and Graduate Program Committee continues throughout the student's/trainee's time in the program. This advising occurs through regular meetings as well as ad hoc communications. The Program Director may call a meeting if deemed necessary from information from the Thesis Committee, Thesis Advisor or trainee.
Individual Development Plan (IDP). The IDP is a document composed by the student, and later modified in collaboration with the Thesis Advisor, to describe the scientific and career interests and goals of the student, and also the expectations of the Thesis Advisor. The initial IDP is developed in the first semester by each student as part of the RCR course offered by the Office of Graduate and Postdoctoral Studies, with help through our professional development course, BIOL 2190. After the Qualifying Exam, during the second year of the program, each student revises the IDP in collaboration with his or her Thesis Advisor, making clear the expectations of both student and advisor. An additional revision is made during the fourth year of the program. Each version of the IDP is submitted to the Program Director for review, with a copy to the Graduate Program Coordinator for the student's file. The Program Director may call a meeting if deemed necessary from information in the IDP.

Peer-to-peer advising. The MPP students have developed a program of peer-to-peer mentoring that is very effective. Aside from frequent informal discussions, they have established a system (usually involving getting together over lunch or dinner) in which 2nd year students advise 1st year students (especially about rotations), 3rd year students advise 2nd year students (especially about the Qualifying Exam), and local graduates advise 3rd-5th year students about thesis writing, the defense and career development after graduation. In addition, extensive peer-to-peer advising takes place at the pre-seminar lunches and other venues for student interactions (see below).

Other advising and mentoring. Students often form very useful informal mentoring relationships with various faculty trainers (including T32 trainers). In addition, mentoring is also available from the Office of Graduate and Postdoctoral Studies, and through IMSD activities and interactions. Brown's CareerLab also provides career advising, and the Sheridan Center provides advising about teaching.

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 (see next section re. mandatory S/NC courses). 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 course credits per semester, depending on the number of other courses taken in the same semester. The success of students depends heavily on the consultation between the students and their advisory committees.

IV.A. Graded Coursework

The MPP Graduate Program requires all entering graduate students to complete five courses and acquire proficiency in the areas of pharmacology and physiology by the end of their second year of graduate study. These courses must be taken for a grade, and students must earn a B or better. If an elective course is only offered pass/fail (mandatory S/NC), the student must provide verification from the instructor that the grade would have been a B or better. Failure to obtain a B or better in any of these courses will place the student on academic warning, and the Graduate Program Committee will determine what steps are required to provide the student with the opportunity to improve performance and return to good standing. In addition, the students must pass a short, intensive Biostatistics course (see below) designed to meet the needs of our students. All students are required to complete the following courses:
The core course, BIOL 2170, "Molecular Pharmacology and Physiology", which covers receptor-ligand interactions and binding methodologies, pharmacodynamics, pharmacokinetics, and cellular and organ systems physiology. This course involves typical lecture-based instruction, as well as in-depth problem solving sessions in the relevant areas. This course is taken during the first semester of the program.

BIOL 2190, “MPP Professional Development Seminar”, in which the students receive instruction and practice in oral presentations and scientific writing. This course also provides help with writing their IDPs (see above) and NSF fellowship applications (see below). Career development is further fostered in this course by interaction with occasional guest lecturers with diverse scientific careers who are invited to discuss their career paths. These invited lecturers include scientists from the pharmaceutical industry, Brown faculty (including T32 trainers), former MPP students, members of the Sheridan Center for Teaching and Learning, and someone from the Office of Graduate and Postdoctoral Studies to discuss issues relating to external funding. Students also are trained in reading and analyzing the primary literature in this course, as well as in BIOL 2170, and this skill is further developed by journal clubs run by individual labs, and in student data clubs. This course is taken in the first semester of the program.

Three elective courses, to be approved by the Graduate Program Director, based on guidelines set by the Graduate Program Committee. These courses must in some way advance the development of the student in his or her research area. In some cases, electives are used to fill a gap in background that is critical to the student's advancement. In other cases, electives are used to expand the student's knowledge into new areas and/or expose him or her to new research tools. During a meeting with the Program 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.

Numerous electives are open to the students. The electives include (but are not limited to) such courses as:

- Physiological Pharmacology (BIOL 2160)
- Molecular Targets of Drug Discovery (BIOL 2145)
- Topics in Signal Transduction (BIOL 1110)
- Biomolecular Interactions: Health, Disease and Drug Design (BIOL 1300).
- Drug and Gene Delivery (BIOL 2110)
- Stem Cell Engineering (BIOL 1150)
- Advanced Molecular and Cellular Neurobiology (BIOL 2030/2040)
- Cancer Biology (BIOL 1290)
- Advanced Biochemistry (BIOL 2270)
- Protein Biophysics and Structural Biology (BIOL 1200)
- Chemical Biology (BIOL 1230)
- Pharmacokinetics and Drug Design (BIOL 2135)
- In vitro Models of Disease (BIOL 2167)
- Quantitative Approaches in Biology (BIOL 2010)
The Intensive Biostatistics course (Applied Statistics for Biomedical Researchers; no course number). This course is an intensive course taught in January, between the first and second semesters of the first year. The course is taught as daily (Mon-Fri) 2-hour classes for 2 sequential weeks. The January timing was chosen to benefit students who are doing laboratory rotations and preparing for their thesis research. It is a very interactive course focused on biostatistics in experimental design and analysis, and tailored to the practical needs of our students. It is taken pass/fail; students who fail will be allowed to re-take the course. Our MPP students, including all T32 trainees, take this course along with students from the Biomedical Engineering (BME) and Biotechnology graduate programs. Although this course includes an introduction to analysis of big data sets, students planning to use big data sets in their research also are encouraged to take BIOL 2010, which emphasizes bioinformatics, as one of their electives.

BIOL 2980, "Graduate Independent Study", which includes research lab rotations and dissertation research (see below), amounting to at least 19 credits, in addition to the required 5 didactic course credits, meeting the University’s requirement of 24 minimum course credits for the Ph.D.

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 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. Students entering the Program with a Master’s Degree in the area of molecular biology, cellular biology, biochemistry, or other related fields will work with the Program Director to ensure that their course work, and overlap with previous courses, is minimized.

IV.B. Research rotations. In addition to fulfilling course requirements, students are required to complete three laboratory rotations during their first year of graduate study -- one rotation in the fall and two in the spring. Students are expected to spend essentially the entire first academic year involved in research rotations, along with their coursework. Although there may be some variation due to faculty trainers’ schedules, the three rotation periods are approximately: 1) the second week of classes in September through December 20; 2) February 1 through March 31; and 3) April 1 through May 31. Lab rotations expose the student to various research areas, and help the student choose a thesis lab that best suits them. 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 between 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 each faculty trainer before requesting a rotation in his or 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.

Each student should email or meet in advance with the Program Director to discuss rotation possibilities, and to report any developments or difficulties encountered in setting up or carrying out rotations, or in finding a thesis lab. Students are required to satisfactorily complete 3 full rotations by the end of the second semester, and are expected to be accepted into a faculty trainer’s laboratory by
then as well. If a student has performed well in the 3 rotations, but still is not able to find a good fit, he or she may obtain permission of the Graduate Program Committee (via the Program Director) to complete up to 3 additional one-month rotations in the summer after the first year (one rotation each, for June, July and August). The student must be placed in a thesis lab by September 1 of the third semester. If there are extenuating circumstances beyond the student's control, the Graduate Program Committee may decide to grant an extension to this deadline (See section below on Academic Warning and Dismissal).

A description of each faculty trainer’s relevant research appears on the MPP website: (http://brown.edu/academics/molecular-pharmacology-physiology-and-biotechnology/graduate/mpp/mpp-graduate-program-trainers), and on individual faculty websites.

To facilitate rotation choices, first-year students are introduced to MPP trainers and potential projects through Faculty/Student Breakfast meetings with individual trainers during the first few weeks of their first semester (see below). So that the incoming students can begin their first rotations early in the first semester, the Program Director contacts them the summer before they matriculate to help them choose their first rotation labs.

Students are not allowed to conduct thesis research in a lab without having completed a rotation in that lab. Furthermore, students are expected to perform their lab rotations with official MPP faculty trainers; if a student is interested in research with a professor who is not currently an MPP trainer, he or she must discuss this issue with the Program Director -- prior to setting up a rotation -- to determine if it is feasible to add this professor to the MPP trainer list.

When setting up a rotation, each student will complete a Rotation Agreement Form with the rotation advisor to insure that there is agreement on expectations. At the end of each rotation, the rotation advisor will complete a Rotation Evaluation Form and discuss the evaluation with the student so that the assessment of the student's performance in the rotation is clear. The student is responsible for obtaining the forms from the MPP web site and returning the completed and signed forms to the Program Director and Program Coordinator. If, before the end of a rotation, the student and/or advisor determine that there is not a good fit, the rotation can be terminated early only with the approval of the Program Director and the Graduate Program Committee. In this event, the student will discuss with the Program Director the selection and timing of a replacement rotation.

The rotations are completed as graduate independent study (BIOL 2980), for which the students receive grades. During the first and second semesters, the Program Director is selected as the instructor for BIOL 2980, and he/she collects input from the respective research rotation advisors in assigning the course grade. This input is obtained via Rotation Evaluation Forms. In subsequent semesters, BIOL 2980 encompasses thesis research; thus, beyond the first 2 semesters, each student's Thesis Advisor is indicated as the instructor for BIOL 2980, and assigns the grade directly. As with other courses, the student must earn a B or better in BIOL 2980 to remain in good standing.

Near the end of the second semester of the first year, each first-year student is required to give a short oral presentation summarizing one of his or her rotation projects to the entire MPPB Department and other interested members of the Brown community (all first year students -- usually 4 -- present in one hour-long session, usually near the end of May).

IV.C. Non-graded coursework. All MPP students, including T32 trainees, must also participate in training in the Ethics of Responsible Conduct in Research (RCR), as well as training in Lab Safety, Radiation Safety, Biohazard Safety, Hazardous Chemical Safety and Animal Care and Use, as applicable.
**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” (RCR), 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. The IDP is also initiated in the RCR course (see above, "Advising").

**IV.D. Fellowship Applications.** NSF fellowship applications are required in the first semester for all eligible students. The students work with their first lab rotation advisors to construct a project for the fellowship application. They also receive help with their applications in BIOL 2190, and from individual meetings with the Graduate Program Director. Since NSF does not require that they stick with that project, the students sometimes end up being NSF funded in a different trainer's lab. Students who are not eligible for NSF fellowships (e.g., international students, those with master's degrees) work with someone in the Office of Graduate and Postdoctoral Studies to identify other available fellowships. The NSF applications are due in November of the students' first semester at Brown. Our students have had excellent success with NSF fellowships and others (Ford, NIH/NRSA, AHA, APS, Hughes/Gilliam). Students who are successful in obtaining their own individual fellowships are generally eligible for additional compensation during their fellowship years (see section below on Financial Support).

**IV.E. Academic Plan for the First Two Years**

**Semester I:**  
BIOL 2170 -- core course in molecular pharmacology & physiology  
BIOL 2190 -- professional development course  
2 credits of BIOL 2980 (taken as a first research rotation) to make 4 credits total  
Responsible Conduct for Research (RCR)  
NSF application -- write and submit by early November (with help in BIOL 2190)  
Write initial version of Individual Development Plan (IDP), within RCR course

January between Semesters I and II: Two-week Biostatistics course (no course number)

**Semester II:**  
One to two elective courses (3 electives required for entire PhD)  
2 to 3 credits of BIOL 2980 (taken as 2 consecutive research rotations), as needed to make a total of 4 credits.

**Semester III:**  
One or 2 elective courses (3 electives required for entire PhD)  
2 to 3 credits of BIOL 2980 for thesis research, to make a total of 4 credits/semester  
Teaching assistantship in either semester III or IV (not both)

**Semester IV:**  
One or 2 elective courses (3 electives required for entire PhD)  
2 to 3 credits of BIOL 2980 for thesis research, to make a total of 4 credits/semester  
Teaching assistantship in either semester III or IV (not both)  
Qualifying ("Preliminary") Exam, which includes writing a thesis proposal

After the first 2 years, students focus intensively on their thesis research, presenting at scientific meetings, and writing publications and a Ph.D. thesis.

**V. Dissertation Research**

**V.A. Qualifying Examination, Thesis Committee and Thesis Proposal.** Upon completion of the first year of graduate study, students commit to a lab for their thesis work. Each student works closely with
his or her Thesis Advisor toward developing a research proposal that will culminate in the Qualifying Examination ("Preliminary Exam") by the end of the student’s 4th semester of graduate study. At that point, the student and advisor will have selected a Thesis Committee, which consists of the Thesis Advisor, three other members of the Brown Faculty, and an authority in the area of the thesis research from another institution. A member of the Thesis Committee will serve as Chair; this person cannot be the Thesis Advisor or the external member, and preferably should be someone who has prior experience on MPP Thesis Committees (typically a member of the MPPB department).

**Thesis Proposal.** In preparation for the Qualifying Exam, the student will develop and write a formal Thesis Proposal in close collaboration with his or her thesis advisor. The thesis proposal should be approximately 10 single-spaced pages in length, including figures and tables (bibliography extra). This document will be written in the style of an NIH predoctoral research grant proposal, including an abstract and sections on specific aims, background and significance, proposed methods and experimental approaches, interpretation of expected results, pitfalls and alternative approaches, preliminary data, and bibliography. 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, revise the written document for submission as a predoctoral fellowship application to a funding agency such as the NIH after completion of the Qualifying Examination.

It is advisable that the student and thesis advisor meet with the thesis committee a few months before the student writes the formal thesis proposal. At this meeting, the student will present the general research plan, and obtain informal feedback from the committee prior to the official Qualifying Exam.

**The Qualifying Examination** consists of a brief (20-30 minute) oral presentation of the research proposal by the student to the Thesis Committee, followed by questioning of the student and discussion of the proposal by the Committee, and finally completion of a Qualifying Examination Report by the Thesis Committee Chair in consultation with the rest of the committee, to be sent to the Program Director and Program Coordinator. The student shall obtain the blank form from the MPP web site and provide it to the Thesis Committee Chair.

Major goals for the Qualifying 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.

Once the student passes the Qualifying Exam, he or she is officially considered a candidate for the Ph.D. A student may fail the Qualifying Exam based on an unsatisfactory written thesis proposal and/or oral portion of the exam. Failure to take and pass the Qualifying Exam by June 1 in Semester 4 is grounds for placement on academic warning. Under special circumstances, permission may be granted by the Graduate Program Committee for an extension of the deadline for scheduling a Qualifying Exam into the summer following semester 4. If a student passes the Qualifying Exam with a contingency (e.g., the requirement to take an additional course, re-write some portion(s) of the thesis proposal, or obtain additional results), the Thesis Committee will specify the requirements to pass the Exam, and will set appropriate deadlines for completion of those requirements. In the interim, the student will be placed on academic warning. Failure to pass the Qualifying Exam, or to meet the requirements of a contingent pass by the deadline, is grounds for dismissal from the program.
V.B. Progress Reports between the Qualifying Exam and the Defense. After completion of the Qualifying Examination, the student meets with the Thesis Committee at least twice per year, and progress reports will be submitted to the Graduate Program Director (with cc to the Program Coordinator), who may request meetings with the student, and/or Advisor or Thesis Committee, on an as-needed basis. Before each Thesis Committee meeting, the student will discuss recent progress and future goals with his or her Thesis Advisor and then complete a Committee Meeting Report Form to take to the Committee meeting. Sufficient space should be left in each box of the form for the Committee to modify or supplement the progress and goals statements. The revised form will be signed by all Committee members in attendance (i.e., usually not including the outside reader) and submitted to the MPP Program Director and Program Coordinator. The blank form is accessible on the MPP web site.

V.C. Dissertation (Thesis) and Doctoral Defense. Typically, the Final Defense of the Ph.D. occurs in the fourth or fifth year of graduate study. Each student is required to have a Pre-defense Meeting with his or her Thesis Committee 1-3 months before the defense. The thesis should be in near final form by this point and the student will make an oral presentation to the committee and be questioned about the project, thesis and relevant background. After approval of the proposed thesis following this meeting, the student will schedule his or her Final Defense in preparation for graduation. The Thesis has the standard format and must meet the requirements of the Brown University Graduate School. The written thesis is delivered to the Thesis Committee members at least two weeks prior to the Defense. The Thesis Defense is held as a public lecture, followed by a closed-door examination open to all Brown faculty members, with required attendance by the Thesis Committee, including its external member ("outside reader"). Although the outside reader is not required to attend the Qualifying Exam or Pre-defense Meeting, early involvement of this committee member is in the best interest of the student; if the outside reader gives feedback on the Thesis Proposal and on the Thesis prior to the Qualifying Exam and Defense, respectively, there will be a much lower chance of surprise criticisms for the student. Failure of the Defense is grounds for dismissal from the program.

The Thesis must include an abstract, a general Introduction chapter, a general Methods chapter, Results chapters, and a general Discussion chapter, in addition to other appropriate sections (references, table of contents, etc.). Some or all of the Results chapters can be simply the published or submitted manuscripts reformatted for the Thesis (double-spaced, correct margins, etc.). If so, they may contain all the usual components of a published paper, including their own brief introductions, methods, results and discussions. However, these short sections within each Results chapter do not obviate the need for the general chapters mentioned above, which focus on the entire body of work (all results) and its relation to existing literature and progress in the research field. In addition, since publications often have multiple authors, the first page of each such Results chapter must include a proper citation (authors in their published order, journal, volume, page numbers and year), as well as an explicit statement saying which parts of the paper were provided by the student, and which parts by each other author. Detailed instructions on preparation and format of the Ph.D. dissertation should be obtained from the Graduate School. Here is a useful link that supplies most information about completion of the Ph.D., from publishing the dissertation to various surveys and questionnaires, as well as actions needed to make sure the student doesn’t owe any money to Brown:
http://www.brown.edu/academics/gradschool/academics/rules-regulations/dissertation-guidelines#completion

Students should communicate early and frequently with the Graduate Program Coordinator as they make their plans for a Defense.
In addition to the Thesis, **one or more publications in peer-reviewed journals are expected and strongly recommended before graduation.** This is critically important for a student's future success.

VI. Additional Training Activities and Scientific Interactions.

**The Fall Welcome Dinner** for the students, held by the Program Director and T32 PI, at the beginning of each fall semester introduces students in the entering class to current students (including T32 trainees). The dinner is followed by a poster session. At this meeting, the incoming students receive an orientation to the program and our training grant, including key features like coursework, lab rotations, etc. The discussion will also include what is expected of doctoral students in general (in contrast with what was expected of them in college). Faculty trainers will *not* attend this meeting, but instead will be involved in individual dinner and breakfast meetings (see below), as well as the retreat.

**Faculty-student breakfasts** for first-year MPP students to learn about each faculty trainer's research and to assist in selecting appropriate research rotations. These are one-hour sessions that occur about 3 to 5 per week at the beginning of the fall semester, with one trainer and all beginning students at each breakfast session. Each faculty trainer discusses his or her research (with or without powerpoint slides), and the trainer and students use this opportunity to get to know each other.

**The Annual MPP Graduate Program Retreat** is held in mid- to late May each year at a site on campus, partially sponsored by our training grant (T32). The retreat is centered around scientific talks and posters by students and faculty trainers. The schedule includes: 1) breakfast; 2) short morning talks by faculty and students (including T32 trainers and trainees); 3) lunch; 4) the keynote lecture by a T32-sponsored distinguished speaker from outside Brown; and 5) an afternoon poster session. Before the poster session, there is a T32 breakout session to discuss training grant issues and new ideas for improving the program. At the end of the day, there also is participation in games (e.g., volleyball).

**Monthly Data Club** meetings are attended by all MPP students as well as students from other graduate programs. These sessions are student-organized and provide a forum for our trainees to present their work in progress to their peers, and to interact scientifically with students from other graduate programs, thus broadening their perspectives and their connections.

**Pre-seminar lunches** are attended by all MPP students immediately before our departmental noon seminars on Fridays. The goal of these lunches is to bring together all MPP students at least once a week, since their research labs are somewhat spread out, being located at various campus and hospital buildings. Although there is a strong social component to this lunch, the students also use this opportunity to discuss their technical difficulties and search for input and research connections.

**Weekly seminars** in MPPB occur throughout the academic year, and feature respected scientists from around the country. MPP students are required to attend these seminars, and are encouraged to attend other weekly seminars of interest presented by Neuroscience, MCB and other departments, as well as monthly *Bench to Bedside* seminars (Neuroscience), and various PhD defenses and journal clubs. These provide a huge variety of scientific interactions outside our specific graduate program.

**Student-organized peer-mentoring lunches and dinners** were initiated by students to advise those entering the program after them. So, for example, 2nd year students take 1st years out for lunch to give them advice on adjusting to graduate school and selecting lab rotations; 3rd years take 2nd years out to help prepare them for their qualifying exams; and more senior trainees invite local graduates (e.g., from Harvard, MIT, Yale, or local pharmaceutical companies) to provide advice on thesis writing. 
and the defense, as well as on job searches and career options. Trainees who have obtained NSF or other individual fellowships also meet with, and advise, those who are preparing applications.

**Monthly T32 Dinners** are attended by one T32 faculty trainer and the current and past T32 trainees, with a round-table discussion of the trainer's research and career path, as well as of trainee experiences and questions. A different faculty trainer hosts the dinner each month. These dinners allow maintained interactions between T32 trainers and trainees beyond the first year.

**Initiative to Maximize Student Development (IMSD) training modules** are optional and provide interaction with graduate students from the entire university, as well as more exposure to faculty trainers and very useful tools for excelling in graduate school and in a scientific career. There are about a dozen of these modules, each of which is typically 6 hours in length, presented in three two-hour blocks within a week, and offered at various times of year, including during the academic year, and in summer and winter breaks. They are taught by Brown faculty, including many MPP T32 trainers. Some examples of modules are "De-mystifying the PhD" and "Scientific Writing"; more examples are included on the Brown IMSD web site.

**VII. Student Seminars**

In the spring of the first year, each student will present a brief seminar (typically about 15 minutes) to the department on a research rotation experience, in addition to presenting a seminar in class in BIOL 2190. 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.

**VIII. Teaching**

Each MPP student is required to serve as a teaching assistant for one semester-long course (usually a pharmacology or physiology course). 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. The Program Director matches the students with specific courses based on the student's strengths and interests and on instructor input.

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. Failing to meet the English proficiency requirement is grounds for dismissal from the MPP graduate program.
Students also may obtain teaching certificates by taking certificate-granting courses through Brown's Sheridan Center: http://www.brown.edu/about/administration/sheridan-center/
In addition, some MPP students have designed and taught summer courses for high school students at Brown, either alone or jointly with other graduate students.

The unique structure of the Division of Biology and Medicine at Brown means that all basic science departments are responsible for a large part of undergraduate Biology teaching, and most of the labs within the Division attract outstanding undergraduate student researchers. Therefore, nearly every graduate student in the program interacts with, or formally mentors, at least one undergraduate student in the lab, in addition to his or her teaching assistantship responsibilities. This opportunity provides invaluable hands-on experience with day-to-day teaching in the lab.

IX. Financial Support

All students offered admission into the Division of Biology and Medicine graduate programs are guaranteed five years of financial support including stipend, health insurance, and tuition and fees, contingent on making satisfactory progress toward the Ph.D. degree. This support comes from a combination of resources including teaching assistantships, Division fellowships, predoctoral training grants, research grants, and individual fellowships awarded both extramurally and/or through Brown. In addition, the MPP program provides each first-year student with $1200 towards a new computer and computer-related software or hardware. Each student who obtains a competitive extramural individual fellowship (e.g., from NSF) is awarded an extra $1800 per year in Divisional stipend support plus $1500 per year in MPP program support to be used toward research and educational costs. In addition, the Division supports $650 per year to cover travel expenses for scientific meetings beginning in a student’s 2nd year, and the MPP program supports an additional $500 per year in travel support when the student is presenting his or her work in a poster or talk.

X. 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 5th year 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. There is also no financial aid for Masters candidates.

Master of Science (Sc.M.) 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.

Master of Arts (M.A.) Degree

A written thesis is not required.
Transitional M.A. Degree

Students working toward a Ph.D. degree in the MPP program may request a "transitional" Master of Arts degree after successfully completing the 5 required courses described above in the section on Course of Study/Graded Coursework. There is no financial burden for obtaining this degree, since it is granted during the Ph.D. program. The degree is requested by the student via email to Lisa_Cote@Brown.edu in the Registrar's office; the request must contain the following information: your full name and Banner ID, the department/grad program (i.e., MPPB Department/MPP Graduate Program), and Master of Arts (MA) degree (not ScM). Ms. Cote will respond with further instructions. Note that in general this degree is not very useful in your career unless you fail to complete the Ph.D.

XI. 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.

XII. 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.

XIII. Academic Warning and 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.

Reasons for being placed on warning status include, but are not limited to:

- Earning a grade that is lower than a B in any course, or failing the MPP Biostatistics course twice.
- Failing to take the Qualifying Exam by June 1 in the 4th semester
- Failing the Qualifying Exam, or failing to meet the requirements and deadlines to pass the Qualifying Exam after receiving a pass with contingencies.
- Failing to be accepted into a thesis lab after 5 rotations
- Failing to complete 3 full rotations during the first academic year
- Failing to find a host laboratory for a 4th rotation by July 1 following the 2nd semester

Each warning letter will contain conditions for return back to good academic standing, as well as deadlines for meeting those requirements. If the designated requirements are not met by the specified deadlines, the student will move from warning status to termination status, and can be dismissed from the program.

In addition, the following specific circumstances, can also lead to termination:

- Failure to be accepted into a thesis lab after 6 rotations
- Failure to find a host lab for the 4th rotation by August 1 following the second semester