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GRADUATE PROGRAM IN MOLECULAR PHARMACOLOGY & PHYSIOLOGY

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GRADUATE PROGRAM IN MOLECULAR PHARMACOLOGY & PHYSIOLOGY

The Graduate Program in Molecular Pharmacology and Physiology (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/or graduate teaching programs of the Division of Biology and Medicine. Attainment of the Ph.D. degree is expected to be completed in 4 to 5 years.

The MPP program is a small, intimate program in which there are typically 20-24 total students, with 3 to 5 (usually 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 of that grant is also intimately involved in the MPP program.

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 6 general focus areas, listed here in no specific order of importance:

1. *Neuropharmacology, neurophysiology and neural circuit function*
2. *Receptor and ion channel pharmacology, physiology and signal transduction*
3. *Structures of biological molecules and their roles in disease*
4. *Translational and clinical applications of pharmacology & physiology*
5. *Chemical biology, biophysics and their applications*
6. *Cancer biology and therapeutics*

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 (executive committee), a Curriculum Director who leads the core first-year courses, 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 NIH/NIGMS Pharmacology Training Grant (T32) the Curriculum Director, and

one to three other faculty, with broad representation. The Program Director is a faculty member appointed by the Dean of Biology and Medicine, or designate, upon recommendation by the MPPB Department 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 with input from the Graduate Program faculty trainers, who are given access to all applications. Admissions decisions are based on each applicant's research experience, letters of recommendation, personal statement, academic performance and interviews. GRE scores are not required or considered, since they have been shown to be inadequate predictors of success in graduate school and in scientific careers. Each applicant selected for interview receives a phone call and follow-up email from the Program Director inviting them to the MPP recruitment event at Brown. During the recruitment event, each invited applicant meets with each member of the Graduate Program Committee, and additional interviews with specific faculty trainers are arranged according to the expressed interests of the applicants and trainers. Current students in the program also interact extensively with the applicants during recruitment and provide the Graduate Program Committee with feedback from their own perspectives. This feedback has been extremely helpful in admissions decisions.

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 are posted on the MPP web site near the start of each fall semester.

III. Advising and Resources for Student Support

Academic advising. Before each student enters a lab for their dissertation research, the Program Director and Graduate Program Committee provide customized advising on curricular matters, research rotations, choosing a Thesis Advisor, and just generally navigating life in graduate school. At the beginning of the first year, entering students receive early advising in an MPP Orientation Session that includes their fellow first-year students, the Program Director, Curriculum Director and Program Coordinator, as well as the second-year students who have immediately relevant experience, having just gone through the same processes the previous year. One member of the Graduate Program Committee, the Curriculum Director, also advises the students as instructor of the MPP Professional Development Seminar course (BIOL 2190)

in their first semester, and like the Program Director, continues to closely mentor the students throughout their time in graduate school. For example, when the students are preparing their first-year talks at the end of the second semester, they once again practice with the Curriculum Director and their peers, just as they had practiced talks in BIOL 2190.

Once the students have entered their thesis labs, their Thesis Advisor and Thesis Committee play the largest role in their advising, especially in research matters, but the Program Director, Curriculum Director and other Graduate Program Committee members continue to advise them as needed, providing continuity throughout graduate school. In addition to scheduled meetings with the Graduate Program Committee or Program Director during key periods in which the students are choosing electives, rotation labs and Thesis Committee members, or preparing for their first Thesis Committee meeting or Qualifying Exam, there are frequent individual ad hoc meetings that occur throughout the student's time in the program, as a result of the open door policy of the Program Director and Curriculum Director. Finally, peer advising is very strong in our program (see below) and is especially helpful in academic planning by the first and second-year students.

Small group advisory meetings are also organized around specific topics, such as preparation for the Qualifying Exam and Thesis Defense, strategies for job searches, etc. These meetings are attended by the Program Director and students for whom the topics have immediate relevance, as well as by students or alumni/ae who have recently gone through the particular key processes and can offer their own advice and perspectives. In addition, students often organize more informal social group meetings (e.g., dinners) to discuss these same issues.

Research advising. Once the student is involved in thesis research, research-related advising is handled first by the Thesis Advisor and Thesis Committee, who interact with the student as a group at least twice per year to review progress and provide advice (see below, "Dissertation research"); one of the two meetings must be in person, attended by the entire committee (except for the outside member, described below, who can participate via email), but the other meeting may be handled electronically. 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 student/trainee.

Brown now offers mentor training for our faculty trainers through workshops held by Advance-CTR (<https://www.brown.edu/initiatives/translational-research/mentoring-training-program>). Beginning in the 2020-2021 academic year, this training will be required of all MPP trainers. We are currently developing a system for refresher courses to be provided a few years apart.

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.

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 MPP graduates (e.g., from MIT, Harvard, Yale, etc.) advise 3rd-5th year students about thesis writing, the defense and career development after graduation. These mentoring interactions are facilitated by our professional development seminar course, BIOL 2190, which often provides organized lunch sessions for the students and alums, as well as formal career panels. Trainees who have obtained NSF or other individual fellowships also meet with, and advise, those who are preparing applications; this interaction typically takes place as part of BIOL 2190, when first-year students are working on practice applications for the NSF fellowships. In addition, extensive peer-to-peer advising takes place at other venues for student interactions (see below, **Additional Training and Scientific Interactions**).

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 training modules and other activities. Brown's CareerLab also provides career advising, and the Sheridan Center provides advising about teaching.

Resources for student support, including diversity and wellness resources.

The MPP Graduate Program Director should be informed of any disability or other condition that might require accommodation or modification of any of course procedures or other graduate program requirements. Students with this concern should register with **Student and Employee Accessibility Services (SEAS)** and provide the Graduate Program_Director with an academic accommodation letter from them. For more information, contact SEAS at (401) 863-9588 or SEAS@brown.edu.

In addition, Brown's Graduate School offers a wealth of information on student support services. See their web page on **Graduate Student Resources:**

<https://www.brown.edu/academics/gradschool/about/graduate-student-resources>

Especially useful is their link for **Student Support Services:**

<https://www.brown.edu/offices/student-support/student-support-services>.

Such services cover issues as wide-ranging as academic problems, medical leaves, financial need, gender harassment (Title IX), and general student health and well-being.

Particularly relevant right now is the link to graduate student **FAQs regarding the Covid-19 crisis:**

<https://www.brown.edu/academics/gradschool/covid-19-faqs-graduate-students>

The MPP graduate program is a very diverse one, and we welcome and support *all* students. The recent protests aimed at exposing and rectifying the anti-black racial injustice in the US, and specifically at Brown, have yielded many useful supporting resources. Some of these are listed in our MPP Graduate Program Resources Google drive, which is accessible to all MPP students and faculty:

<https://drive.google.com/drive/folders/105QBUxh9-1gzja4s4HIOLAMaWk91dL29>

Many diversity and inclusion resources also are provided by Brown's Office of Institutional Equity & Diversity: <https://www.brown.edu/about/administration/institutional-diversity/resources/resources-during-national-unrest-2020>

This office also provides useful links regarding racial injustice and the "Black Lives Matter" movement.

For general policy development regarding diversity and inclusion, and racial justice, an MPP student participates as a member in the departmental Diversity and Inclusion Action Plan (DIAP) Committee.

Finally, Brown University, and its Division of Biology & Medicine, also support numerous on-campus organizations and programs that promote inclusion and support campus diversity. These include:

- **Biomed Initiative to Maximize Student Development (IMSD)**: The IMSD program, entitled "Advancing the Culture of PhD Learning and Scholarship in Biology and Health Sciences", provides extensive research training support for students from underrepresented groups to increase their participation in the fields of biomedical and behavioral research. IMSD support includes individual advising, and very popular training modules that are accessible to all students at Brown, covering such topics as scientific writing, data analysis and scientific presentations. The program funded by the National Institute of General Medical Sciences (NIGMS), within the National Institutes of Health (NIH).
- **Office of Student and Employee Accessibility Services (SEAS)**: SEAS provides extensive support for students, staff, faculty and visitors with physical, psychological and learning disabilities. SEAS has provided advice during extensive improvements to our existing buildings, as well as construction of new buildings, to enhance handicapped accessibility. Handicapped-accessible transportation between all campus facilities is coordinated by SEAS, which provides a shuttle service.
- **Brown Leadership Alliance**: Since 1993, Brown has belonged to a consortium of more than 30 schools that support a Leadership Alliance. The Leadership Alliance Summer Research Early Identification Program provides mentoring and promotes summer research for underrepresented students in the life and physical sciences, social sciences, engineering, computer science, and applied mathematics. A large percentage of students from the Leadership Alliance summer program apply to the Brown graduate school, including to the MPP program.
- **Society for the Advancement of Hispanics, Chicanos and Native Americans in Science (SACNAS), Brown Chapter**: The Brown Chapter of SACNAS was started by an MPP graduate student, Teresa Ramirez (graduated 05/14). This society is a community of scientists dedicated to fostering the success of students from these underrepresented groups at Brown.
- **Brown Center for Students of Color**: This center serves as a source of support for American and International students of color at Brown, including a mentoring program for African Americans, Latinos, Asian/Asian Americans and Native Americans (ALANA; <https://www.brown.edu/about/administration/institutional-diversity/resources/campus-resources-students-faculty-staff-and-alumni/mentoring-and-professional-development>).
- **Nabrit Black Graduate Student Association (BGSA)**: Named for biologist Samuel Nabrit, Brown's first African-American PhD recipient, the BGSA promotes the intellectual and social

environment, and professional success, of Brown's African American graduate students.

Membership is open to all Brown graduate students.

- **Women in Science and Engineering (WiSE):** This group helps create a community of and for women in the sciences at Brown University and increases the number of resources women in the STEM fields at Brown have available to them. Originally founded for undergraduates, more recently the formation of a graduate student affinity group (**GWISE**) was initiated by Lauren Quatrocchi, a recent graduate of the MPP program and former trainee on our NIH/NIGMS T32 Predoctoral Training Program in Trans-disciplinary Pharmacological Sciences.
- **Center for the Study of Race and Ethnicity:** The Center for the Study of Race and Ethnicity in America promotes research, art and scholarship in the areas of race and ethnicity.
- **Office of Student Veterans and Commissioning Programs (OSVCP):** The OSVCP provides support for student veterans and current or prospective participants in officer commissioning programs at Brown.
- **LGBTQ Center:** This center, and the [Sarah Doyle Women's Center](#), work together to provide support, resources and advocacy to promote an open, safe and inclusive environment for lesbian, gay, bisexual, transgender, queer and questioning students, faculty and staff at Brown. This center also supports "[Trans](#)" resources at Brown, as well as the [Brown Safe Zone](#) program.

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; students must register for a total of 4 credits each semester to be considered full-time. 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***. 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. In consultation with the appropriate Graduate School deans, and, as appropriate, with the Thesis Advisor and/or Thesis Committee, 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.

During the first year, all students will take 4 specific required courses: a core course in Molecular Pharmacology & Physiology (BIOL 2170) and a Professional Development Seminar (BIOL 2190) in the fall semester; a short, intensive biostatistics course (Practical Statistics) in January between the first and second semesters; and Molecular Targets of Drug Discovery (BIOL 2145) in the spring. To learn more about rigor and reproducibility in science, each student must also take a 5th required course in the fall semester of the second year: Current Topics in Signal Transduction (BIOL 2410). Finally, the students are required to take an elective course relevant for their thesis research or their broader scientific career goals. The biostatistics course is taken pass/fail, but the other four courses are taken for a grade, which must be a B or better. The required courses are described below:

- The core course, BIOL 2170, “Molecular Pharmacology and Physiology”, covers receptor families and signaling, receptor-ligand interactions and binding methodologies, pharmacodynamics, pharmacokinetics, and cellular and organ systems physiology. This course involves lecture-based instruction, as well as in-depth problem solving sessions, discussions of the literature in the relevant areas, and considerations of rigor and reproducibility. This course is taken in the first semester.
- 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 instruction in writing 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, as part of their training in rigor and reproducibility, which also includes work in BIOL 2170, BIOL 2145 and BIOL 2410, and this skill is further developed by journal clubs run by individual labs, and in student data club meetings (see below). This course is taken in the first semester of the program.
- BIOL 2145, “Molecular Targets of Drug Discovery”, focuses on the identification of drug targets and the development of those targets through the pre-clinical phase. Guest speakers from the pharmaceutical industry give weekly lectures on specific drug targets, followed by career advice. The course also emphasizes ethical issues and concerns in drug research and development through weekly student-led discussions of current topics related to the pharmaceutical industry. The culminating oral project requires the students to choose their own “target” and develop that target through the pre-clinical phase. This course is especially useful in preparing for the Pfizer summer internships (see below).
- "Practical Statistics" (no course number), a short, intensive biostatistics course (class time 3 hours every weekday for two weeks). The goal of this course is for graduate students to gain practical knowledge on executing selected statistical analyses with validated statistical software that requires minimal programming and coding. This course focuses on teaching students the basics on how to use foundational statistical methods and the statistical software JMP to aid with experimental design, visualizing their data, and to learn to select and use the appropriate statistical methods (e.g., ANOVA, Mann-Whitney U, etc.). The course is taken by our beginning MPP students, along those from two other graduate programs associated with our MPPB department: Biotechnology and Biomedical Engineering.

- BIOL 2410, “Current Topics in Signal Transduction”, emphasizes understanding current scientific problems, new experimental techniques and experimental design, including rigor and reproducibility. The course has a section for advanced undergraduate students (BIOL 1110) and one for graduate students (BIOL 2410) that will include in-depth assignments and discussions about rigor and reproducibility, using as examples students’ own data as well as published findings, some validated and some invalidated by subsequent work. This course will be taken in the fall semester of the second year and requires knowledge from BIOL 2170 and the Practical Statistics course taken in the first year.

- BIOL 2980, "Graduate Independent Study", 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.

- Elective Courses. Elective courses can be taken any time before the thesis defense, and students may take more than the one required elective. However, in taking multiple electives, the students should keep in mind that each elective takes time away from their thesis research, thus delaying their PhD. Although we are very flexible regarding a student's choice of elective, before registering for an elective course, students are required to obtain approval from the Graduate Program Director, after giving some thought to their immediate and long-term scientific and career goals. If they are already in a thesis lab, it is a good idea to discuss potential courses with their Thesis Advisor to determine if there is a particular course that is especially relevant and useful for their thesis research. The students have numerous relevant elective courses available to them, including the following examples:

- Physiological Pharmacology (BIOL 2160)
- Drug and Gene Delivery (BIOL 2110)
- Pharmacokinetics and Drug Design (BIOL 2135)
- In vitro Models for Disease (BIOL 2167)
- Biomolecular Interactions: Health, Disease and Drug Design (BIOL 2300).
- Stem Cell Engineering (BIOL 1150)
- Cancer Biology (BIOL 1290)
- Advanced Biochemistry (BIOL 2270)
- Advanced Molecular and Cellular Neurobiology (BIOL 2030/2040)
- Chemical Biology (CHEM 1230)
- Quantitative Approaches to Biology (BIOL 2010)
- Molecular Mechanisms of Disease (BIOL 2860)

Course Credit Transfers: students who have taken graduate level courses (e.g., for a masters degree) before attending Brown, and would like to transfer some of those credits in lieu of one or two electives, should meet with the Graduate Program Director to discuss the necessary procedure for transfer. The courses must be approved by the Director, based on syllabi, transcripts and course descriptions. After approval by the Director, a form must be submitted to the Registrar, along with an official transcript from the former institution. The form is available at the Registrar's web page, and the student and Graduate Program Director complete the form together.

IV.B. Research rotations and Pfizer Summer Internships. 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, mentoring philosophies, placement of laboratory alumni in the research field after leaving the laboratory, and future scientific interests. It is also often possible to sit in on a professor's lab meeting before officially setting up a rotation to get a better feel for the dynamics of the lab and the relationships between the professor and the lab members, as well as the lab members with each other. Thus, a student involved in a rotation in the fall semester may be able to take a little time out here and there to sit in on lab meetings of prospective advisors for the two spring rotations. ***Each student is required to discuss potential rotations with the Graduate Program Director before approaching the faculty trainers.*** 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. The list of official MPP faculty trainers, along with a description of each faculty trainer's relevant research, appears on the MPP website: <https://www.brown.edu/academics/mpp-graduate-program/people/faculty-trainers>.

Additional information about each trainer also appears on their individual Brown web pages, linked to their entries on our web site.

Each student should discuss with the Program Director any developments or difficulties encountered in setting up or carrying out rotations, or in finding a thesis lab. Emailed notification of approved rotations should also be sent by the student to the Graduate Program Coordinator and Graduate Program Director as soon as the rotation plans are finalized; this notification will be followed up with a Rotation Agreement Form, as described below. Students are required to satisfactorily complete 3 ***full*** rotations (with a grade of A or B) by the end of the second semester, and are expected to be accepted into a faculty trainer's laboratory by then as well.

Most students are able to enter a lab for their thesis work by the end of the second semester, after completing the 3 required rotations. If a student is not accepted into a lab by the end of the 3 rotations, they may obtain ***permission of the Graduate Program Committee*** to complete up to 3 additional one-month rotations in the summer after the second semester (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 a student is not accepted into a lab for their thesis work after 5 rotations, they will be placed on academic warning; if they are not accepted into a lab after 6 rotations, their status may move from warning to termination, and they may be dismissed from the MPP graduate program, based on deliberations of the Graduate Program Committee. If, by July 1 following the second semester, a student is not able to find a faculty trainer willing to accept them for a 4th rotation, they will be placed on academic warning, and if the student still is unable to find

a lab for the 4th rotation by August 1, they may be placed on termination status, after review by the Graduate Program Committee.

If a student has entered a particular lab for their thesis research, but then needs to leave that lab at any point, they must satisfactorily perform a one-month rotation in another lab before being allowed to join that lab. If the student's performance during that rotation is not satisfactory, they will be placed on academic warning, and must satisfactorily perform a one-month rotation in a second replacement lab. If this condition is not met, and the student has not been accepted into a new lab within 2 months of leaving the original lab, the student will be placed on termination status, and may be dismissed from the MPP program, under consideration by the Graduate Program Committee.

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 talks with them by phone during the late spring or early summer before they matriculate to help them choose their first rotation labs. These discussions revolve around the students' research interests and the type of mentoring style they think might work best for them. Following the phone discussions, and often follow-up emails, the students contact their prospective rotation advisors for permission to begin a rotation in the fall.

When setting up a rotation, each student will complete a **Rotation Agreement Form** with the rotation advisor to ensure 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. If the student receives a B in BIOL 2980, their academic standing may be reduced from good to satisfactory. If the student receives a C in BIOL 2980, they will be placed on academic warning.

Near the end of the second semester of the first year, each first-year student is required to give a **short oral presentation** (about 10-13 minutes) summarizing one of their rotation projects to the entire MPPB Department and other interested members of the Brown community (all first year students -- usually 4 -- present in single one hour-long session, usually near the end of May).

Some advice for rotations: It is extremely important that students take the rotations very seriously, work very hard, and take ownership of their rotation projects. They should be thinking deeply about their

projects and the "big picture", finding and reading the appropriate literature, asking questions as needed, and learning to troubleshoot their own research. Rotations are not just for students to judge the lab, project and mentor. Each student is also being judged regarding suitability as a potential new lab member. Just coming into a lab now and then and following a pre-determined protocol does not qualify as functioning as a graduate student. Neither does putting in a certain number of hours in the lab but not actually doing science when present. If the student takes the experience too lightly, they may end up with no invitations to join a lab for their thesis research, which is cause for placement on academic warning, with eventual dismissal from the program a distinct possibility. A successful career in science requires a huge, life-long commitment of time, effort and thought, and this all begins in graduate school. This kind of commitment requires a passion for scientific research. If this passion is not present, a student should give serious thought to whether this is the correct path for them. Choosing another path for which they have greater passion is not failure; it is a sign of maturity. Students should feel free to discuss these ideas with the Program Director.

Pfizer Summer Internships. These internships are designed to provide interested students with a glimpse of life in the pharmaceutical industry. They are **optional** 8-10 week internships at a Pfizer facility in either Cambridge, MA, or Groton, CT, usually starting around mid-June. They are only available to students who have just passed their first year in the program (i.e., internships take place in the summer between the first and second years of the program). The Program Director considers the students' research interests in working with the Pfizer administration to obtain good matches between the students and Pfizer mentors. The Program Director collects feedback from both the students and their advisors about the quality of the internship and the students' performance. All travel expenses are provided by the Division of Biology & Medicine, including car rentals, public transit fees, etc., as needed. The students continue to be paid their usual Brown summer stipend as well.

IV.C. Non-graded coursework. All MPP students, including T32 trainees, must also participate in, and pass, 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"). The course now also introduces the topic of rigor and reproducibility.

IV.D. Fellowship Applications. All eligible students are required to submit NSF predoctoral fellowship applications in the first semester of their second year (usually due in October). Each student works with his or her thesis research advisor to construct a project for the fellowship application. To prepare for the grant writing process, students receive instruction and assistance in writing a "practice application" during the first semester of their first year, in the career development seminar, BIOL 2190. 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. In addition, students are strongly encouraged to apply for other types of fellowships during their first and second years,

depending on eligibility and deadlines. Our students have had excellent success with NSF fellowships and with others (Ford, NIH/NRSA, AHA, APS, Hughes/Gilliam, NIH F99/K00). 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, including practice NSF application
2 credits of BIOL 2980 (taken as a first research rotation) to make 4 credits total
Responsible Conduct for Research (RCR)
Write initial version of Individual Development Plan (IDP), within RCR course
Submit applications for any fellowships for which there is eligibility, except NSF, which is submitted in year 2, semester 1.

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

Semester II: BIOL 2145 -- molecular targets of drug discovery
Elective courses as desired (only one required for entire PhD duration)
2 to 3 credits of BIOL 2980 (taken as 2 consecutive research rotations), as needed to make a total of 4 credits.
Submit applications for any fellowships for which there is eligibility, except NSF, which is submitted in year 2, semester 1.
Present at scientific meetings, and publish, as appropriate.

Summer between years 1 and 2: Optional internship at Pfizer (8-10 weeks in either Groton, CT, or Cambridge, MA).

Semester III: BIOL 2410 -- current topics in signal transduction
Elective courses as desired (only one required for entire PhD duration)
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)
NSF application -- submit by deadline (usually in October); and/or submit other fellowship applications, depending on eligibility.
Present at scientific meetings, and publish, as appropriate.

Semester IV: Elective courses as desired (only one required for entire PhD duration)
Up to 4 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
Submit applications for any fellowships for which there is eligibility, except NSF, which is submitted in semester III.
Present at scientific meetings, and publish, as appropriate.

After the first 2 years, students focus intensively on their thesis research, presenting at scientific meetings, and writing publications and a Ph.D. thesis. If they have not yet completed an elective, students also may do this after the first two years.

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 to develop 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 (which may include hospital-based faculty with a Brown affiliation), and an authority in the area of the thesis research from another institution. Often the outside member of the thesis committee is not brought in until after the preliminary exam; however, it is prudent to at least obtain input from the outside member on the thesis proposal, and to provide progress reports and notices of any proposed changes in the research plan as the student proceeds with thesis research. If the outside member is not included until just before the defense, as has often occurred, the student and advisor risk being surprised by major criticisms that delay the student's completion of the PhD. A member of the Thesis Committee will serve as Chair; this person cannot be the Thesis Advisor or the external member, and must be someone who has prior experience training MPP Ph.D. students and/or serving on MPP Thesis Committees; normally, this person is a member of the MPPB department, but exceptions are made if the person has sufficient experience in MPP student training. Students are required to discuss the proposed Thesis Committee composition with the Program Director before finalization.

Thesis Proposal. In preparation for the Qualifying Exam, the student will develop and write a formal Thesis Proposal in close collaboration with the 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 Thesis 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 (often called the "pre-prelim"), the student will present an outline of the general research plan, and obtain informal feedback from the committee prior to the official Qualifying Exam. This meeting is not meant to be a practice Qualifying Exam. At this point, the writing of the proposal is not expected to be completed. The student should just present an outline of the proposed project, and obtain some general feedback and perhaps some suggested topics or papers for the student to use as background. It is also a good time for the student to become familiar with

the expertise and style of the Thesis Committee members. The student is not expected to be tested with questions, as will be the case in the Qualifying Exam.

The Qualifying Examination (or "Prelim") 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 in hardcopy form as well as in pdf. The hardcopy version can be used to save time for the Thesis Committee Chair, who may enter handwritten comments on the form during the discussion of the Thesis Committee at the end of the Exam, rather than having to type the comments into the pdf after the exam.

The general format of the exam: 1) the student leaves the room initially while the Thesis Advisor briefs the rest of the Thesis Committee on the student's progress at that point, and there is a general discussion on the quality of the written Thesis Proposal; 2) the student re-enters the room and gives the oral presentation; the Thesis Committee members ask questions and provide feedback during and after the presentation (the Thesis Advisor does not participate in the questioning, and does not answer the questions for the student, although they may help clarify a question if the student does not seem to understand it); 3) the student leaves the room while the Thesis Committee discusses the student's performance and decides whether the student passes or fails the exam, or whether they pass with contingencies. In the latter case, the Thesis Committee will decide and communicate what the student must do to pass, and when that extra effort must be completed. For example, the student may be required to re-write sections of the proposal, take a course to fill a gap in background knowledge, or read some literature and write an analysis based on that. Once the student has satisfactorily completed these tasks (by the specified dates), the contingencies will be removed, and the Exam result will be changed to a Pass.

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, to develop experimental strategies, and to actually do experiments. However, this examination also is an opportunity to obtain input from the Thesis Committee on the feasibility of the project and possible improvements to the research plan. The student is ***not*** expected to have obtained extensive preliminary data, but they should have enough data to illustrate that they are capable of collecting and understanding data, and understanding the methods they are using and why such methods were picked.

Once the student passes the Qualifying Exam, they are 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, via the Graduate Program Director, 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, as mentioned above 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. Although in-person meetings are preferable, one of the two meetings may be conducted via email or other electronic means, rather than in person (during the Covid-19 crisis, all meetings may be electronic, including via Zoom or another virtual mechanism). Before each Thesis Committee meeting, the student will discuss recent progress and future goals with the Thesis Advisor and then complete a **Committee Meeting Report Form** to present to the Thesis Committee. 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 (usually not including the outside reader, although it is a good idea for this member to receive a copy) and submitted to the MPP Program Director and Program Coordinator. For electronic meetings, the Thesis Committee's approval of the report may be communicated via email. The blank form is accessible on the MPP web site. It is the student's responsibility to make sure that the progress meetings occur twice a year, on schedule (approximately every 6 months).

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 the 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 planned thesis following this meeting, the student will schedule the 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 around the time of the Qualifying Exam, and on the Thesis prior to the Defense, 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, Results chapters, and a general Discussion chapter, in addition to other appropriate sections (references, table of contents, etc.). Most theses also include a general Methods chapter, but some describe the methods within each Results chapter. 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, especially since rooms for the Defense must be scheduled far in advance. Examples of successful theses from our MPP graduates are available with the Graduate Program Coordinator, as well as through the Brown University Library.

In addition to the Thesis, ***one or more first-authored 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 the other current students (including T32 trainees), most of whom they met at least briefly during the recruitment events. At this meeting, there will be further discussion of the topics raised during the incoming students' orientation meeting, 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 in the annual spring MPP retreat. The exception to this is the attendance at the Welcome Dinner by the Graduate Program Committee.

Faculty-student breakfasts for first-year MPP students to learn about each faculty trainer's research and to assist in selecting appropriate research rotations for the spring. 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 and to discuss various possible rotation projects.

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 student posters and scientific talks by students and faculty trainers. A typical retreat schedule includes: 1) breakfast and a student poster session; 2) morning research talks by students (including T32 trainees); 3) lunch; 4) a breakout session of the students with the Graduate Program Committee; 5) T32 faculty trainer research talks; 6) a coffee break and a breakout session of the faculty trainers with the Graduate Program Committee; 7) the keynote lecture by a T32-sponsored distinguished speaker from outside Brown; and 8) drinks and hors d'oeuvres at a local restaurant. At the breakout sessions of students and faculty with the

Graduate Program Committee, there are discussions of training grant issues and new ideas for improving the program.

Monthly Data Club meetings are attended by all MPP students, and occasionally by 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 as relevant, thus broadening their perspectives and their connections.

Weekly seminars in the MPPB department 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 that may be 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. See the **Peer-to-peer Advising** description above, under **Advising and Resources for Student Support**.

Monthly T32 Dinners. Each of these is attended by one T32 faculty trainer and several students, including current and past T32 trainees. Each dinner includes a round-table discussion of the trainer's research and career path, as well as of student 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. Since the total number of T32 trainees in our program is very small, and the dinners have been very successful, their initial attendance by T32 trainees, has been broadened to include all students in the MPP program.

Initiative to Maximize Student Development (IMSD) training modules are optional and provide interactions 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. The modules 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. Finally, a few students also present talks at our annual retreat in the spring. Of course, the students also present talks and/or posters at national and international scientific conferences.

VIII. Teaching

Each MPP student is required to serve as a teaching assistant for one semester-long course (usually a pharmacology [BIOL 1260] or physiology [BIOL 0800] 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. The teaching requirement is normally filled in either the fall or spring semester of the student's second year in the program. Students are strongly encouraged to take the Sheridan Center's workshop entitled "New TA Orientation to Teaching at Brown". This is a 3-hour hands-on workshop taught at the beginning of each semester, which provides the opportunity for interactive discussions of teaching roles and responsibilities with experienced TAs and faculty, and which also offers teaching resources. A teaching assistant is expected to attend all lectures, perform whatever work is necessary to be proficient in the course material, be on time and reliable, provide office hours and review sessions as required by the faculty member directing the course, and perform grading functions as requested. Review sessions may be held weekly, as well as shortly before exams. The TA is also expected to respond to emails and other ad hoc communications from the students in the course as they request help with the course material; in some cases the response may just be to assure the student that the issues will be covered in office hours or review sessions, rather than responding in detail to long emails. Feedback to the TA on their performance will be provided personally by the faculty member directing the course, and also by the course manager in the case of BIOL 0800. This feedback will be provided occasionally during the course, and also at the end of the course. The faculty member will also provide feedback regarding the TA's performance to the Program Director.

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 Center for Language Studies 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 interested in additional teaching experience may attend various workshops and also obtain *teaching certificates* by completing certificate-granting courses provided by the 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. These Summer@Brown teaching opportunities are available through the School of Professional Studies. This activity is not recommended

for beginning students, who need to focus on establishing themselves in a thesis lab and passing their Qualifying Exam.

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*** (orders for these items must be made through Brown by a special procedure), and the ***Division of Biology & Medicine provides a transitional stipend of \$1200 to aid in relocation expenses in September of the first year***. Each student who obtains a competitive extramural individual fellowship (e.g., from NSF, NIH, Ford, etc.) 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 (applications due a month before the conference), and the ***MPP program supports an additional \$500*** per year in travel support for any student who is presenting their work in a poster or talk at a scientific conference. The ***Graduate School also provides up to \$1,000*** per year for students presenting at international conferences. The Graduate Program Coordinator can provide more detailed procedural information.

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/Director 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.

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

The MPP Graduate Program does not offer transitional masters degrees.

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, in lieu of our required didactic courses. They are encouraged to take BIOL 2190 for their scientific career development. M.D./Ph.D. candidates may complete their research lab rotations in the summers preceding their first year in MPP.

XII. Leave of Absence

For leaves of absence, the MPP graduate program follows the guidelines of the Brown University Graduate School: <https://www.brown.edu/academics/gradschool/leaves-absence>

Applications for leaves of absence should be sent to the MPP Graduate Program Director for approval using the forms provided by the Graduate School. The Program Director will consult with the Graduate Program Committee in evaluating the request. 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. The guidelines and timelines of leaves of absence, and returns from those leaves, are provided at the above Graduate School website. If the student fails to appropriately inform the Graduate School of an intention to take a leave of absence, they will be considered still active and will be billed for tuition.

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 consult with the Graduate School regarding its decision. The first step in this process is placement of the student on academic warning, in writing, which is also discussed with the Graduate School. Detailed procedures are described in the Graduate School Handbook. Appeal of such decisions is to the Dean of the Graduate School. Procedures relating to dismissal for academic misconduct are addressed separately in the Graduate School Handbook.

Reasons for being placed on warning status by the Program 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.

- Failure to take the Qualifying Exam by June 1 in the 4th semester, unless an extension has been approved by the Graduate Program Committee
- Failure to be accepted into a thesis lab after 5 rotations
- Failure to complete 3 full lab rotations during the first academic year
- Unsatisfactory progress in the thesis research, as determined by the Thesis Committee

Each warning letter will describe the problems and specify requirements for return 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 to termination status, and may be dismissed from the program.

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

- Failure to meet the requirements of a warning letter within the deadlines provided
- Failure to be accepted into a thesis lab after 6 rotations
- Failing the Qualifying Exam, or failing to meet the requirements and deadlines to pass the Qualifying Exam after receiving a pass with contingencies
- Failure to find a new lab within 2 months after leaving one's original thesis lab

Grievance Procedures:

If a student believes a warning or dismissal is unjust, they may appeal the process according to the Graduate School grievance procedures:

<https://www.brown.edu/academics/gradschool/graduate-student-grievance-procedures>