

# **GRADUATE PROGRAM IN NEUROSCIENCE**

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Program Guide  
2020-2021

NOTE: Due to COVID-19 restrictions, some timelines, deadlines and requirements may be modified.



Graduate School of  
Biomedical Sciences

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The requirements described in these guidelines may be amended or altered by the Graduate Program. Note that GSBS-wide policies supersede program specific policies.

# WELCOME AND KEY PROGRAM CONTACTS

Welcome to the Graduate Program in Neuroscience. This Program Guide provides key information and guidelines on the requirements of the program. It supplements information contained in the GSBS Catalog (<https://gsbs.tufts.edu/studentLife/schoolCatalogs>), which has the official degree requirements and course listings, and the GSBS Student Handbook (<https://gsbs.tufts.edu/studentLife/StudentHandbook>), which contains important information about topics such as the GSBS academic and registration policies, professional conduct guidelines, financial matters, and information about student benefits, services, and resources.

The Graduate Program in Neuroscience offers track of study and research based in Boston or at The Jackson Laboratory (JAX) in Bar Harbor, Maine. Both tracks follow the same general structure and curriculum, with the exceptions described in the following sections.

This Guide includes a listing of graduate students in the program and contact information for faculty, staff, and students. You can find information about the research interests and publications of the faculty, as well as up-to-date schedules of seminars, journal clubs and research reports on our website (<https://GSBS.tufts.edu/academics/neuroscience>). We would greatly appreciate any feedback from you to help us make this Guide more useful.

There are several people who can serve as valuable resources during your PhD training and are always willing to discuss any issues or concerns about the program, or direct you to the appropriate office. They are listed below, along with information on how to contact them.

The Program Director is elected by the graduate program faculty to administer the educational mission of the graduate program. The Program Director represents the interests of the program on the GSBS's Executive Council where policy matters concerning the School's programs are discussed and enacted.

The Student Advisor serves as a mentor to the first-year students, including providing specific advice on selecting appropriate sites for laboratory rotations, choosing elective courses, and identifying laboratories for thesis work.

The Qualifying Exam Advisor guides the student through the Qualifying Exam process providing advice on topic selection and approaches to constructing the written proposal and oral presentation. The Qualifying Exam Advisor can also advise on committee members for the examination.

The Admissions Director is responsible for recruiting high quality program candidates, identifying candidates for

## KEY PROGRAM CONTACTS

**Chris Dulla**, Program Director

South Cove 203	617-636-3844	<a href="mailto:chris.dulla@tufts.edu">chris.dulla@tufts.edu</a>
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**Maribel Rios**, Curriculum Director

Stearns 326	617-636-2748	<a href="mailto:maribel.rios@tufts.edu">maribel.rios@tufts.edu</a>
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**Michele Jacob**, Student Advisor & Qualifying Exam Advisor

Stearns 327	617-636-2429	<a href="mailto:michele.jacob@tufts.edu">michele.jacob@tufts.edu</a>
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**Leon Reijmers**, Admissions Director

Stearns 328B	617-636-0301	<a href="mailto:leon.reijmers@tufts.edu">leon.reijmers@tufts.edu</a>
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**Shelley Antonio**, Program Coordinator

Arnold 202	617-636-3796	<a href="mailto:shelley.antonio@tufts.edu">shelley.antonio@tufts.edu</a>
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**Robert Burgess**, Tufts at JAX Track in Neuroscience & Neurogenetics Director; Student Advisor & Qualifying Exam Advisor

JAX-B55-3925	207-288-6706	<a href="mailto:robert.burgess@jax.org">robert.burgess@jax.org</a>
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**Meredith Theeman**, JAX Director of Predoctoral & Postdoctoral Education

JAX-B1U4-2085	718-986-1368	<a href="mailto:meredith.theeman@jax.org">meredith.theeman@jax.org</a>
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**Sadi Quiñones Al Muhtaseb**, Graduate Student Council Representative

South Cove 201		<a href="mailto:sadi.quinones_al_muhtaseb@tufts.edu">sadi.quinones_al_muhtaseb@tufts.edu</a>
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**Najah Walton**, Graduate Student Council Representative

South Cove 201		<a href="mailto:najah.walton@tufts.edu">najah.walton@tufts.edu</a>
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interview from the applicant pool, arranging for interviews of these candidates with program faculty, and selecting the best candidates (with input from the faculty) to be given placement offers.

The Program Coordinator assists the Program Director in the functioning of the program as needed, coordinates messaging to the neuroscience program such as both Boston and JAX seminar announcements, as well as helps students schedule rooms, complete forms, plan events, and manage program requirements such as reports from the required biannual thesis committee meetings.

JAX Director of Predoctoral & Postdoctoral Education oversees and coordinates all Tufts at JAX programs and liaises with GSBS program directors and Dean regarding programmatic directions.

Graduate Student Council Representatives. A minimum of two representatives are elected by the students to serve as the program's representatives to the GSBS Graduate Student Council (GSC). The GSC organizes activities, including the Annual Relays, and the GSC Officers are ad hoc members of the GSBS Executive Council.

# CURRICULUM OVERVIEW

## First-Year Overview

	Summer	Fall	Spring	Summer
Boston		Delayed Matriculation due to COVID	Rotations & Coursework	Rotations, Coursework & Thesis Research
Tufts at JAX		Rotations & Coursework*	Rotations & Coursework	Coursework & Thesis Research

## Second-Year Overview

	Fall	Spring	Summer
Tufts at JAX & Boston	Thesis Research* & 1st Thesis Advisory Committee meeting  Neuroscience Seminars, Research Seminars, Journal Club  Elective Coursework (if desired)	Thesis Research* & Qualifying Exam  Neuroscience Seminars, Research Seminars, Journal Club  Elective Coursework (if desired)	Thesis Research  Coursework

## Third-Year Overview

	Fall	Spring	Summer
Tufts at JAX & Boston	Thesis Research* & Thesis Advisory Committee meeting  Neuroscience Seminars, Research Seminars, Journal Club  Elective Coursework (if desired)	Thesis Research* & Thesis Advisory Committee meeting  Neuroscience Seminars, Research Seminars, Journal Club  Elective Coursework (if desired)	Thesis Research

\*Also weekly student presentations and journal club with Boston Neuroscience students and Graduate Seminar at JAX

*Please note: Journal Club is only required until the end of year 4 for Ph.D. students and the end of year 3 for M.D./Ph.D. students.*

### Required Courses

Students complete a series of required didactic courses designed to provide a strong knowledge base for their research. The GSBS Catalog for the year in which students were admitted lists these required courses (<https://gsbs.tufts.edu/studentLife/schoolCatalogs>). In addition, the Catalog contains course descriptions and progression plans for the first and second years.

### Elective Courses

Students are required to complete one elective course in addition to the required courses. Elective courses must be approved by the thesis advisor and the Program Director and should be used to explore students' interests and further their understanding of their thesis research fields. Courses may be chosen from any GSBS program or from other schools that allow cross-registration.

The advanced topics electives are offered on an alternating

# CURRICULUM OVERVIEW

schedule and students may elect to take them at any time. Thesis advisors and/or the thesis advisory committee may recommend students to take any courses they feel are necessary for an adequate academic base in the student's chosen research area.

## *Journal Club*

The overall goals of the Journal Club are to advance the students' skills in critically evaluating scientific literature, expand their didactic knowledge of concepts and techniques, and improve the student's presentation skills. Each year, the first Journal Club meeting will be led by two faculty facilitators to establish the format of Journal Club, the scientific rigor and discussion that will be expected, and answer student questions about how the Journal Club should be run. One faculty facilitator will attend each week to assist in the discussion, but the students will facilitate and guide the discussion. Each week, a post-doc or additional faculty member can be recruited to help with the Journal Club discussion, should the student presenter and faculty facilitator agree it is appropriate.

Students may choose to present Journal Club topics that they are familiar with, or they may wish to gain important experience by choosing topics that are new to them. Students will bring a few papers of interest to the faculty facilitator at least one week prior to the meeting to consult with the Journal Club faculty facilitator to choose a paper for presentation. The discussion should focus on the background of the study, an introduction to the methods being used if necessary, and how the study fills a knowledge gap in the field. The student will then lead a discussion of the study with a focus on how the study was performed, how the data is interpreted, and the rigor and statistical validity of the study. The faculty facilitator will jump in if these issues are not being sufficiently addressed to help guide the conversation.

Attendance in Journal Club is required and will be taken by the program administrator and/or faculty facilitators. After two missed meetings, the student will receive a warning. After a third unexcused absence the student will receive a failing grade. Reasons for an excused absence will be illness, travel to a meeting, or extenuating experimental duties. Students need to reach out to the Course Director, Dr. Chris Dulla, to receive an excused absence. PhD students must register each semester for 4 years and MD/PhD students for 3 years.

## *Graduate Seminar*

The goal of attending the Graduate Seminars is to improve the student's appreciation for how research progress is obtained and to raise awareness of recent advances in the field. All students must register each semester for graduate seminar except for those students who have permission to defend their thesis and are registered for PhD Degree Only. Tufts at JAX students fulfill the Graduate Seminar course requirements through attendance at JAX's weekly lab-wide seminar series and at twice-monthly Neuroscience Interest

Group meetings. Attendance will be taken at the Seminar Series by the Program Coordinator (Zoom seminars) or via a sign-up sheet (in person seminars). After two missed meetings, the student will receive a warning. After a third unexcused absence the student will receive a failing grade. Reasons for an excused absence will be illness, travel to a meeting, or extenuating experimental duties. Students need to reach out to the Course Director, Dr. Yongjie Yang, to receive an excused absence.

## *Research Presentations*

The goal of the Research Presentations is to allow students to develop critical skills in presenting their data, answering questions and critical thinking in a friendly environment. Additionally, they will learn about each other's ongoing research and may develop new collaborations. The entire neuroscience program is expected to attend and provide the students with constructive feedback on their study and on its rigor and the statistical approaches. Boston and JAX Neuroscience students must present an annual seminar of their research, except those students who have received permission to defend their theses. At the beginning of each year, a Faculty Facilitator will give a presentation covering the format that should be used, the expectation of discussion of strategies to increase rigor and reproducibility, and how the students should include information about their statistical approaches. The Student Research Presentation schedule is provided to students at the beginning of each academic year and will also be posted on the GSBS calendar. Research Presentations are attended by students, postdocs, faculty, and other interested members of the Program. At each meeting the Faculty Facilitator will give feedback and facilitate a discussion of the issues regarding rigor and reproducibility.

All Boston and JAX Neuroscience students are required to attend these meetings. Attendance will be taken at the Research Presentations by the Program Coordinator (Zoom seminars) or via a sign-up sheet (in person seminars). After two missed meetings, the student will receive a warning. After a third unexcused absence the student will receive a failing grade. Reasons for an excused absence will be illness, travel to a meeting, or extenuating experimental duties. Students need to reach out to the Course Director, Dr. Michele Jacob, to receive an excused absence.

## *Tufts at JAX Curriculum Plan*

Tufts at JAX students begin their graduate studies at JAX, where they complete their research rotations, coursework (largely via videoconferencing), and thesis dissertation research. Thesis committee meetings, qualifying exams, and dissertation defenses all take place at JAX, with videoconferencing to enable continued interactions with, and guidance from, the Boston community.

## *Requirements for the Master of Science Degree*

A student in good standing in the doctoral program who is unable to complete the requirements for the PhD degree

# CURRICULUM OVERVIEW

may be allowed to write and defend a Master's thesis. Permission to submit a Master's thesis must be obtained in advance from the Program faculty and will only be granted if compelling reasons for leaving the PhD program are provided and if specific guidelines are followed and specific criteria are met. Master's Degree Requirements can be found in the GSBS Handbook (<https://gsbs.tufts.edu/studentLife/StudentHandbook>).

A Master's candidate may only begin writing the thesis after obtaining explicit permission to do so from the thesis advisory committee. The student's thesis must describe original laboratory research carried out by the candidate under the supervision of a faculty member, and must form a coherent body of work of publishable quality, even though the scope of the work may not permit publication. The Master's thesis should be presented in the same format as a PhD thesis, as required by the GSBS. The suitability of the Master's thesis will be determined by the thesis advisory committee after an oral defense of the thesis by the candidate and is subject to ratification by the program.

# LABORATORY ROTATIONS

## *Purpose*

Laboratory rotations are designed to acquaint students with some of the research projects of current interest in the program, to allow students to assess the suitability of a particular lab for their thesis research, and to allow faculty members to assess the suitability of individual students for work in their labs. Neuroscience students complete the Neuroscience Research Techniques course (NRSC 0233). This year, due to COVID, this course will be taught online beginning in the Spring of 2021. After that, they complete three laboratory rotations.

## *Rotation Matching Process*

Students choose rotations based on their interests and the willingness of the rotation mentor to accept a student. There is a matching process coordinated by the Student Advisor and the GSBS Dean. Students are strongly encouraged to choose rotations that expose them to areas of research that interest them and with which they may not already be familiar.

The GSBS Laboratory Rotation Policy is published in the Handbook (<https://gsbs.tufts.edu/studentLife/StudentHandbook>) and the dates for laboratory rotations are posted on the GSBS website in the Academic Calendar (<https://GSBS.tufts.edu/studentLife>).

**Boston Students:** Several weeks before rotations begin the GSBS Dean's Office emails students a list of available faculty laboratories. This email contains a link to a survey in which students are to enter their first, second, and third choices for rotations. The Program Student Advisors meet with students to discuss their possible matches. Information regarding the research areas of program faculty members can be found at the GSBS website (<https://GSBS.tufts.edu/facultyResearch/faculty>). In addition, students should meet with potential mentors during the last three weeks of the immediately prior rotation, but no commitment can be made about whether or not the student may rotate in a lab before all rotation matches are announced. Students should share their interests and mentors should discuss the possible projects available in the lab. All students will be notified of their matches simultaneously by their Student Advisors.

**Tufts at JAX Students:** Several weeks before the first-year fall term, Tufts at JAX provides students a list of available rotation laboratories at JAX for the upcoming academic year. In preparation for the first rotation, students should contact faculty members to discuss potential projects. Students should seek a meeting with the Tufts at JAX Neuroscience & Neurogenetics Student Advisor to discuss their preferences before making a commitment to a particular lab. The Tufts at JAX Program Coordinator will confirm rotation matches with students and faculty. Students are welcome to contact potential future rotation supervisors at any time to discuss projects and plan for the Spring semester but should not feel obliged to do so nor should they commit to a future rotation.

# LABORATORY ROTATIONS

Each rotation is evaluated by the rotation mentor. Grades are given for each rotation. When multiple rotations are completed in one semester, the grades are averaged to obtain the grade for the Laboratory Rotations course. If only one rotation is completed in a term, the grade for that rotation is reported as the grade for the course.

# QUALIFYING EXAMINATION

## *Purpose*

A Qualifying Examination is given to all doctoral candidates. The purpose of the examination is to determine whether a student: 1) has adequate general knowledge in their research topic, 2) is able to formulate experiments designed to test biological hypotheses, 3) can critically analyze experimental results, 4) has the ability to communicate both orally and in writing; 5) demonstrates rigor and 6) has creativity.

## *Guidance for the Qualifying Exam*

Each year, rising Y2 students will meet with the Qualifying Exam Advisor (Student Advisor) and Program Director to discuss the format and timing of the Qualifying exam. Students will be able to ask questions about how to develop and organize their written proposal. Specific items for discussion will be how to develop a project with the proper scope, how to develop a project that is unique from their mentor's R01s, how to get guidance but have the proposal still be a representation of original ideas, issues of rigor and statistics, and how to format the proposal. At this meeting, students will all receive copies of previously funded F31 applications from the Neuroscience Program to help guide them and give them some idea of the structure and format of the written proposal. The exam proposal is the student's product, they may discuss the ideas with others, but the thesis mentor may not directly design, write or edit the exam proposal.

## *Timing of the Qualifying Exam*

The Qualifying Examination must be completed by the end of Spring Semester of the 2nd year for PhD students. MD/PhD students must complete the exam by the end of Spring of the 1st year. Any additional required re-examination must be successfully completed by August 31. The exam is normally administered after the student has had at least one thesis committee meeting, which is usually held midway through the preceding fall term. Prior to the exam, the student will receive feedback from the committee and the student Qualifying Exam advisor about the feasibility of the proposed research. **A one-page specific aims section, outlining the proposal, must be written by the student and approved by the thesis committee, the Qualifying Exam Advisor, and the Program Director before the student is permitted to write the proposal.** Students should schedule examination dates at least two months in advance. **The complete written proposal should be submitted to the examination committee at least 10 days prior to the examination date. If the qualifying exam committee does not receive these documents by the deadline, the student must reschedule the qualifying exam.** The qualifying exam can serve as the Spring TAC meeting, pending approval from the TAC. If approved, both the Qualifying Exam form and the TAC form need to be submitted to the Dean's Office.

# QUALIFYING EXAMINATION

## *Selection of the Qualifying Exam Committee*

**Boston Students:** Members of the examination committee will be selected by the student and approved by the Student Advisor. The committee will consist of 3 or 4 faculty members and will not include the student's thesis advisor (although the latter may attend the exam but not participate). One examination committee member may be from outside the program. Given that the Qualifying Exam proposal is based on the student's thesis research, the Qualifying Exam committee will usually be the same as the thesis advisory committee (the TAC minus the mentor). This provides for continuity and allows the TAC to offer guidance about the proposal at the first committee meeting and leading up to the Qualifying Exam.

**Tufts at JAX Students:** Members of the examination committee will be selected by the student and approved by the Tufts at JAX Neuroscience & Neurogenetics Qualifying Exam Advisor. The committee will consist of three faculty members and will not include the student's thesis advisor, who is likewise excluded from the exam. One Qualifying Exam committee member must be from Boston Neuroscience; the remainder may be from either Boston Neuroscience or Tufts at JAX (and hold a faculty appointment at GSBS). Given that the Qualifying Exam proposal is based on the student's thesis research, the Qualifying Exam committee will usually be the same as the thesis advisory committee (the TAC minus the mentor). This provides for continuity and allows the TAC to offer guidance about the proposal at the first committee meeting and leading up to the Qualifying Exam.

## *Overview of the Qualifying Exam Process*

For the Qualifying Examination, students are required to write and defend orally an original research proposal. The subject of the research proposal should be an area of the student's choice that is related to future thesis work.

A research proposal will be used by the faculty to assess the student's capabilities in these areas. In addition to the proposal, the committee will test the candidate's general neuroscience knowledge base, particularly as related to the proposed project. This may include questions about the background literature and foundational knowledge relevant for the proposal. The examination process should be a learning experience for the student and identify any areas of weakness that may need additional work.

## *Format of the Written Qualifying Exam*

The research proposal will be written by the student in a modified NIH F31 NRSA fellowship format (see below) and should represent the best effort of the student to present her/his own ideas in a clearly written, error-free, and concise document. As mentioned above, students are required to write a 1-page specific aims page that they send for approval to the thesis committee, the Qualifying Exam Advisor, and the Program Director before the student is permitted to write the proposal. Students are encouraged to discuss the scientific merits of their proposals with

faculty, postdocs and other graduate students. Faculty will not suggest proposal topics, play an active role in the development of the proposal, or review the proposal prior to submission. Faculty will, however, be happy to discuss the logic of the proposal, the structure of the aims, the ability of the proposal to address a gap in our knowledge, and the feasibility and scope of the planned experimental approaches for the project. Review of the written material by other students and postdoctoral fellows is permitted in the interest of producing a clear and concise document, but the student is responsible for all writing and ideas in the document.

## *Format of the Oral Qualifying Exam*

The student should be prepared to give a 30-minute oral presentation of the research proposal that he or she may practice with other students and postdoctoral fellows. The student should feel free to prepare additional explanatory materials about the proposal that can be used during the exam. Questions and discussion will follow. The exam should be limited to 2½ hours and will be based on a formal research proposal submitted by the student (the format of which is detailed below) that describes his/her chosen thesis research area. The oral portion of the examination will (a) assess the student's broad knowledge in the field of neuroscience (based on didactic coursework, journal club, and seminars) and (b) evaluate the student's insight into his/her specific thesis area. For the latter, the student should demonstrate an in-depth understanding of the historical literature in the thesis area, an ability to define an important, unanswered question, and the capacity to design appropriate, feasible, rigorous experiments with which to answer the question. Although specific methodological details will not be emphasized, the student should understand the theoretical bases, practical utility, and limitations of methods to be employed in the experiments.

## The Research Proposal

The research proposal is, in part, an assessment of the student's ability to frame hypotheses and identify questions of scientific importance. Written communication is also an important component of a successful academic career. The proposal's NIH fellowship application format is meant not only to give students some practice at NIH grant writing, but when deemed appropriate, to facilitate the student's conversion of the Qualifying Examination document into an NIH Individual NRSA fellowship application.

The complete proposal should be no more than 7 pages in length (single-spaced, not including references). Student should include figures of preliminary data, graphic models, or other visual representation of their ideas, as appropriate. These figures are included in the 7-page limit. The student must fully document evidence and statements through appropriate literature citations. It is particularly important that a clear distinction be made between the student's original ideas and data, and those published by others. Citations to the latter should include all authors and the full title of the article in each reference and appear in Literature Cited at



# QUALIFYING EXAMINATION

the end of the research plan, as described below.

Brevity and clarity in the written and oral presentations are indicators of a student's ability to create a well-reasoned and focused approach to a research objective and, thus, reflect on the likelihood that the specific aims of the project will be achieved. Proposals should include sufficient, but concise, information to facilitate an effective evaluation without the need for other materials. The proposal should be organized according to the guidelines below and should communicate to the reader (a) why the work is important (b) what has and has not already been done (c) what experiments will be proposed to extend current knowledge in the field, and (d) how the work will be carried out. Do not exceed 7 pages for items 1-4, below. All tables and graphs must be included within the 7-page limit.

## 1. Specific Aims (1/2 – 1 page)

Begin with a paragraph to introduce the long-term objectives of your work, then communicate concisely your specific research aims and what you intend to accomplish. Frame your aims in terms of an hypothesis to be tested, and briefly summarize what approaches will be used to test it.

## 2. Background and Significance (1 – 2 pages)

The point of this section is to emphasize the importance of your proposed studies in the context of the larger research area. Critically evaluate existing knowledge and specifically identify the gaps that the project is intended to fill. Throughout this section, relate your specific aims to the broader objectives.

## 3. Research Approach (3 – 4 pages)

Describe the research design and the procedures to be used to accomplish the specific aims of the project. Include the means by which the data will be collected, analyzed, and interpreted. Do not emphasize details (e.g., recipes for buffered solutions). Describe any new methodology and its advantage over existing methodologies. Discuss the potential difficulties and limitations of the proposed procedures and propose alternative approaches to achieve the aims should the initial approach prove ineffective. Describe how the results obtained from the proposed experiments might be interpreted relative to the hypothesis being tested, and how they will contribute to the overall knowledge in the area. Both the interpretation of results and alternative approaches should be included in an "Outcomes, potential pitfalls and alternative approaches" section at the end of each aim.

## 4. Conclusions and Future Directions (1/2 page)

Summarize the big picture significance of the data to be obtained and speculate on possible future directions of the research.

## 5. Literature Cited (outside of the 7-page limit)

the examination committee in private session. The exam will be graded *Pass*, *Fail* or *Provisional Pass*, and a report that includes this grade plus a summary of the student's performance (emphasizing areas of weakness that should be addressed in the future by the student's mentor) will be submitted to the Program Director and the GSBS Registrar's Office.

- In the case of a *Pass*, no further work is required on the Qualifying Exam.
- A *Provisional Pass* is intended to communicate to the student that while important aspects of the Qualifying Examination were satisfactory, one or more important aspects of the examination were unsatisfactory. It is also intended to convey that the examining committee observed sufficient strength in the examination to have confidence that the student can and will successfully fulfill the conditions imposed by the committee. In all cases in which a Provisional Pass grade is given, the examination committee should specify in writing to the student the requirements to be achieved and the time frame in which the conditions must be satisfied.
- If the requirements for a *Provisional Pass* are not fulfilled within the time frame specified, the *Provisional Pass* grade will convert to a grade of *Fail*.

Failure to pass the Qualifying Exam is grounds for dismissal from the School. The final decision on dismissal from the program will be made by Program Director in consultation with QEC/TAC following a review of the student's complete academic record. If the Program director and QEC/TAC decide dismissal is appropriate, the student will be notified within one week. If the student is granted an appeal and not dismissed at that time, the Program Director and QEC/TAC will decide an appropriate course of action consistent with the program's requirement that a student pass the QE before beginning full time thesis research. The expectations, requirements, and timeline for meeting those requirements will be established by the Program director and TAC/QEC at that meeting. In line with the timeline given to the student (not to exceed three months), the Program Director and QEC/TAC will review the student's progress towards passing the QE. The Program Director and QEC/TAC will then make a final decision if the student passes the QE and advances to thesis research or is dismissed from the program.

## *Evaluation of the Qualifying Exam*

Final assessment of exam performance will be made by

# RESEARCH, CAREER PLANNING, AND THESIS

## *Selection of a Boston Thesis Advisor*

Students are matched with thesis mentors after completing their laboratory rotations. The centralized matching system is designed to maximize the chances that students are matched with one of their top choices. Starting in the middle of their final rotation, students should begin to discuss with potential thesis advisors the range of research projects that may be open to a student. No such discussions should occur at any earlier time. At no time should a student expect, or faculty members provide, any guidance or commitment as to the likelihood that the student would be accepted into the lab. At this stage, all students are afforded an equal opportunity to discuss potential projects with all faculty members who have indicated a willingness to accept one or more students.

Each student will submit a list of his/her first, second and third choices of thesis labs. The student advisor will make known to relevant faculty members the names of students who have listed the faculty member as a first choice. Each faculty member will then have the option to indicate their interest and ability to accept the student(s) or to decline. When more than one student asks to be accepted into the same lab and only one space is available, the faculty member has the option of choosing which student to accept. If a student is not accepted into his/her first lab choice, every effort will be made to assure that that student's second choice is successful. The final decisions are made in coordination with the Student Advisors from all GSBS programs and the GSBS Dean's office. In summary, faculty members do not recruit students into their labs and students should not make commitments to faculty members or ask for commitments from faculty members except through the process described above.

MD/PhD students usually select a thesis advisor after completing two summer rotations during medical school and upon entering the program. Additionally, they may undertake selectives to interact with labs of interest during the academic year.

A student who chooses a faculty thesis mentor in a research lab that is not part of the Neuroscience Program must decide whether to switch graduate programs or stay within the Program. In the latter case, the student would be required to meet all the requirements of the Program, the thesis advisor would have to be approved by the Neuroscience Program Faculty, and the student's thesis project would have to be judged appropriate for a degree in Neuroscience.

## *Selection of a Tufts at JAX Thesis Advisor*

Tufts at JAX Neuroscience & Neurogenetics students are matched with thesis mentors after completing their laboratory rotations. At any time during the rotation period, students are encouraged to discuss potential thesis projects with faculty and to ask any questions related to mentoring or supervision that will help the student determine the best laboratory environment for their thesis. At no time should a student expect, or faculty members provide, any guidance

or commitment as to the likelihood that the student would be accepted into the lab. Throughout the rotation period, all students are afforded an equal opportunity to discuss potential projects with all faculty members who have indicated a willingness to accept one or more students.

Toward the end of their final rotation, students will discuss their preferred thesis lab(s) with the Tufts at JAX Neuroscience & Neurogenetics Student Advisor, who will then assess the mutual interest in such a match. In the event of a mutually agreed upon match and confirmation of sufficient funding, the Tufts at JAX Student Advisor will inform the student and mentor of the match. In the rare event of discordance in the matching process, the Tufts at JAX Student Advisor will assist the student to find an alternative laboratory. In summary, faculty members do not recruit students into their labs and students should not make commitments to faculty members or ask for commitments from faculty members except through the process described above at the conclusion of the first-year rotation period.

## *Selection of the Thesis Advisory Committee*

PhD students select their Thesis Advisory Committee early in the fall semester of their second graduate year, and MD/PhD students do so during fall of their first graduate year. Students are responsible for holding their first TAC meeting before the end of this semester.

The Committee should consist of at least three members of the program (including the student's research advisor). The TAC committee will be chaired by one of the members (not the thesis advisor). The TAC committee members can change during the course of the student's thesis project as needed and as agreed to by the committee and the student. This committee will serve as the core of both the qualifying exam committee and thesis defense committee. A committee member from outside Tufts University will take part in the student's final oral defense of thesis; this examiner can be added to the committee at any point but typically takes part in at least one committee meeting prior to the student's defense of thesis.

For Tufts at JAX committees, the Committee should consist of four faculty members of the Neuroscience program, including the student's thesis research advisor and at least one faculty member from Boston. The Thesis Advisory Committee will form the core of the dissertation examination committee. A committee member external to both Tufts University and The Jackson Laboratory will take part in the student's final oral dissertation defense. This external examiner may replace one member of the regular Thesis Advisory Committee for the dissertation defense, though not the thesis advisor nor the committee member from Boston.

## *Thesis Proposal*

The student will prepare a written proposal on the thesis topic (with aims, background, and experimental overview), to be distributed to the thesis committee members prior to the first committee meeting. Please note, this is a different

# RESEARCH, CAREER PLANNING, AND THESIS

document from the written qualifying exam (please see below) and there is no specific page limit on the thesis proposal. The length of the proposal is up to the student and their advisor and reflects the evolving state of the project. Unlike the qualifying exam, the student and their advisor can work together to draft this document. Over the course of training, and for each subsequent committee meeting, this document will be refined based on experimental results. Students will use the thesis topic as the basis for a Qualifying Examination (described above in this Program Guide).

## Career Planning

All research trainees must have an Individual Development Plan (IDP) to help them develop their career paths. Tufts has created two forms to assist students in identifying their career goals and the current activities they participate in to achieve them. These forms are available at <https://GSBS.tufts.edu/studentLife/currentStudents/forms>.

- The IDP form is intended help students consider their career aspirations as well as the types of skills and attributes that may affect these aspirations and students' ability to attain their goals. It is not intended to predict or identify careers that match their skills. The document is for students' personal use only. Students are not required to share this document with anyone or provide anyone at Tufts with a copy of the completed document. Students may, however, choose to share the document with mentors who may suggest ways to improve skills that are appropriate to the career path(s) being considered. This document should be a living document and one that is updated as students advance in their training.
- The Training and Career Goals Progress Report form is designed to help students think about what they are learning and how to develop professionally. Students are asked to complete this form with a reflective assessment of their current progress and the plans for reaching both short- and long-term career goals. Note that some questions on the form may not apply depending on a student's stage of training. This annual progress report is designed to provide ongoing documentation of progress made towards career goals. Once a year, students complete this form and submit it to their thesis committees along with their research reports for discussion at a TAC meeting. It is the responsibility of thesis committees to provide advice on the resources that will help students achieve their goals at Tufts and beyond.

IDPs have proven so valuable that NIH has mandated that every trainee that it supports have one. Students can learn about IDPs at this site, <http://myidp.sciencecareers.org/>. They may also talk with their mentors, Student Advisors, Program Directors, or Associate Dean about career planning, in addition to their Thesis Advisory Committees.

## Thesis Advisory Committee Meetings and Assessment of Research Progress

Neuroscience students are responsible for holding their first Thesis Advisory Committee (TAC) meeting before the end of the fall semester of their second graduate year. MD/PhD students must hold their first TAC meeting in the fall semester of their first graduate year.

Subsequently, two meetings a year, one in the fall semester and one in the spring semester, will be necessary for satisfactory performance in the graduate research course. For each meeting the student will prepare a TAC report on the GSBS TAC evaluation form, and they will update their thesis proposal document with their progress. **Both documents must be given to the TAC at least 1 week prior to the meeting. If the TAC does not receive these documents 1 week before the meeting, the student must reschedule the TAC meeting.** Student should reach out to their TAC chair if issues arise in getting forms to the TAC by the deadline. In addition, once/year the student will prepare a Training and Career Goals Progress Report for discussion with the TAC. Failure to hold meetings in a timely fashion will result in an Incomplete grade for research for the semester which will become a failing grade if not completed by the end of the subsequent term.

Students should summarize their research progress and plans on the most up to date TAC Evaluation form on the GSBS website (<https://GSBS.tufts.edu/studentLife/currentStudents/forms>). After the Committee meeting, the TAC Chair enters the Committee's assessment on the Thesis Advisory Committee Evaluation form and assigns a grade for Graduate Research. The form is signed by all members and an electronic copy is sent to the GSBS Registrar who records the grade on the student's transcript. The completed TAC report is also submitted to the Program Coordinator to track completion of this requirement.

At the first committee meeting, the student will summarize his/her general research topic and define initial hypotheses. Subsequent meetings will refine (or re-define) hypotheses and/or serve as research updates for the committee. It is the responsibility of the student to provide the committee members with the TAC Evaluation Form and Progress Report at least one week prior to each meeting.

The following format is suggested for progress reports (but no page limits are enforced).

- Short introduction to the research topic (1-2 pages); this can be updated prior to each committee meeting.
- Specific Aims section listing and describing the specific aims of your research (1 page or less).
- Research Progress section describing the progress made towards each specific aim. Hypotheses should be stated. Methods and approaches should be mentioned but not described in detail. Figures (with legends) can be embedded in the text or appended at the end of the document. This section will grow in length as students complete experiments relevant for each aim (see example page below). Within this

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section, text describing research completed since the last committee meeting should be highlighted in some easily distinguishable way (e.g., in italics or a different color font).

- Publications resulting from work (include those submitted or in preparation).
- Meetings attended (or which you plan to attend) during the current academic year.
- When you are close to finishing your thesis research, a timeline for completion of studies can be included in the progress report.

An example of information to include in the progress report for each aim is shown below. This example was provided by Dr. Ian Schmitt. It is only an example and you may choose to modify the format to the needs of your research project. For example, you may wish to include short sections summarizing the results shown in each figure. The same information should be provided in abbreviated form, using bullets if you choose, for question #2 on the TAC Evaluation Form, "Summary of research progress since the last report".

1. Specific Aim 1: I will test the hypothesis that wakefulness increases synaptic adenosine in the hippocampus and cortex and that this increase depends on SNARE function in Astrocytes.

While wakefulness-dependent changes in the level of adenosine have been measured in some brain regions using microdialysis based methods, this method has rather low temporal resolution and does not access synaptic adenosine. To overcome this problem, I will measure tonic A1 receptor-dependent inhibition at the CA3-CA1 synapse in hippocampal slices and use to quantify the level of adenosine at the synapse. I will then ask whether normal or enforced wakefulness increases synaptic adenosine and whether astrocytic dnSNARE expression prevents this increase. To obtain a corresponding measurement in vivo, I will measure the effect of pharmacological manipulation of A1 receptors on slow oscillations in local field potential recordings in the intact organism during periods of high sleep pressure following normal or enforced wakefulness. The experiments for this aim are listed below.

- a. Goal: Test whether normal or enforced wakefulness increases inhibition by extracellular adenosine at the Schaffer collateral synapse.

Method: I will obtain field recordings in acute slices taken at distinct time-points across the circadian period or following enforced wakefulness. To measure synaptic adenosine mediated inhibition, 200 nM 8-cyclopentyl-1, 3-dimethylxanthine (CPT, an adenosine A1 receptor selective antagonist) will be applied for thirty minutes. The increase in field potential slope produced following relief of inhibition by this drug will be taken as a measure of adenosine tone: the steady-state level of synaptic adenosine

acting on presynaptic, inhibitory A1 receptors.

Status: Complete, See Figure 1

- b. Goal: Determine whether astrocytic gliosis mediate wakefulness-dependent changes in extracellular adenosine through a SNARE dependent mechanism.

Method: I will use the adenosine tone assay described in (1) above in the dnSNARE transgenic mouse model. Measurements will be obtained from slices taken following either normal sleep or following enforced wakefulness.

Status: Complete, See Figures 2-3

- c. Goal: Measure the effect of wakefulness-dependent increase in adenosine on cortical synaptic and network activity in the intact mouse.

Method: At either ZT 0, at the termination of the waking period, or ZT 4, following 4 hours of the normal sleep period, local field recordings will be obtained from WT mice under urethane anesthesia. Mice will first undergo craniotomy surgery to allow placement of the local field potential electrode. The tungsten recording electrode will then be positioned in the somatosensory cortex, which shows robust signaling and which is responsible for the dominant components of EEG recording based markers of sleep pressure (low frequency Slow Wave Activity). Urethane will be employed to enhance slow wave activity in the cortex. Following acquisition of baseline frequency profile, CPT will be applied to the cortical surface and the resulting change will be taken as a measure of the adenosine acting on cortical synapses. This method has previously been employed in our laboratory.

Status: Essentially Complete, See Figure 3

Each TAC meeting begins with a short evaluation of student progress by the committee; the student leaves the room during this process. The student then presents a short oral presentation of about 30 minutes that emphasizes progress since the last committee meeting. The committee will review the student's work and provide research guidance.

At the end of the meeting, the student's mentor leaves the room, and the student has the option to privately discuss any laboratory problems or issues with the committee. The goal of this time is to provide the student with a safe space to discuss any problems that may have come up with their mentor or their training. Discussions during this time are expected to be confidential, as allowed and appropriate. After each meeting, the Committee Chair completes the second part of the TAC Evaluation form and transmits it to the student and other committee members for their input. The student can add her/his own comments (if desired) and return the revised document to the committee chair. The TAC chair will then forward the completed signed document to the student and Program Coordinator.

# RESEARCH, CAREER PLANNING, AND THESIS

## *Thesis Format and Defense*

**Prior to their thesis defense, students are required to submit a manuscript for publication on which the student is a first author or co-first author.** They are required to share a draft of that manuscript with their Thesis Advisory Committee for approval by the TAC members before the permission to defend can be granted. Exceptions to this rule are permitted and require approval from the Program Director, Student Advisor, Curriculum Director, and Admission Director. The student should also identify an outside examiner with appropriate expertise as soon as they are preparing to request permission to defend. They should seek input from their thesis mentor and TAC members for this selection, and confirm the willingness and availability of the outside examiner to participate in the defense, key to the planning process prior to official permission to defend. To formally receive permission to defend, the student will have their TAC sign a TAC Report form indicating they have permission and submit this form to the GSBS office. Once the student has received permission to defend, they have 3 months to schedule and defend their thesis.

When a student receives permission to defend, he/she should make an appointment to meet with the Associate Dean. Students will receive instructions on all aspects of the process used to complete the degree, thesis formatting guidelines and information about Commencement Ceremonies at Tufts University.

To complete their graduate studies, students must write a thesis and defend their research in an oral examination. **Students distribute their thesis to their Thesis Defense Committee members at least two weeks before their scheduled defense. If the Thesis Defense Committee does not receive the thesis at least two weeks before the scheduled defense, the student is required to reschedule their defense to a later date.** The chair of the thesis committee will contact all committee members, including the outside examiner, 48-72 hours prior to the defense to determine if the thesis is generally acceptable to the committee.

The oral thesis defense is the culmination of the thesis process and consists of both a public presentation of approximately 45-60 minutes, followed by a closed discussion period with the committee and outside examiner. The public presentation is the opportunity for the student's lab and the GSBS community at large to hear the research. Consequently, all public presentations will take place as follows:

- In Boston for students in Boston or Medford labs
- In Portland for students in Maine Medical Center Research Institute Labs
- In Bar Harbor for students at The Jackson Laboratory

Public presentations should also be available remotely for faculty and students on different campuses. For those students who may be working at affiliated (non-Tufts/MMCRI/JAX) labs, the defense should take place at the location the student was originally placed.

It is expected that all members of the Thesis Advisory Committee (TAC) plus the approved outside examiner will be present onsite at both the public presentation and closed discussion. However, if necessary and unavoidable, up to one committee member may participate in the presentation and the discussion remotely. During social distancing and limited on-campus presence, thesis presentations and discussions may be held remotely.

During the deliberations of the thesis examination committee, the committee should determine what revisions need to be made to the thesis document and the amount of time needed to complete those particular revisions. If required, the student will make the revisions and submit their revised thesis to the committee chair and advisor for final approval. There is no follow up oral examination. The GSBS Time-from-Thesis-Defense-to-Completion Policy, governing thesis revisions and continued receipt of a stipend, is in the Student Handbook (<https://gsbs.tufts.edu/studentLife/StudentHandbook>).

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	Yehya Barakatalroudaini (JAX)	TBD
	Katrina Blandino	TBD
	Theresa Harvey	TBD
	Samia Pratt (JAX)	TBD
	Justine Tang	TBD
	Frank Zamudio	TBD
2nd Year		
	Stella Chen (MD/PhD)	Maribel Rios
	Jinglin "Doris" Ji	Steve Moss
	Jacob Klickstein (MD/PhD)	Malavika Raman
	Archana Nagarajan	TBD
	Tionna Ouellette (JAX)	Kristen O'Connell
	Garrett Scarpa	Jamie Maguire
	Najah Walton	Jamie Maguire
3rd Year		
	Noell Cho	Steve Moss
	Maria Iuliano	Thomas Biederer
	Brendan Kenyon (MD/PhD)	Pedram Hamrah
	Eric Teboul	Jamie Maguire
	Sabrina Yen (MD/PhD)	Steve Moss
4th Year		
	Catherine Choi	Steve Moss
	Alyssa DiLeo	Jamie Maguire
	Jonathan Louie (MD/PhD)	Jim Schwob
	Sadi Quiñones Al Muhtaseb	Chris Dulla
	Bethany Rennich	Peter Juo
5th Year		
	Samantha Howard	Dong Kong
	Maia Kipman (MD/PhD)	David Walt
	Kathryn Lee	Steve Moss
	Katherine Watters	Thomas Biederer
6th Year		
	Dominique Ameroso	Maribel Rios
	Minagi Ozawa	Leon Reijmers
7th Year		
	Camila Barrios Camacho	Jim Schwob