

YALE UNIVERSITY

*INTERDEPARTMENTAL NEUROSCIENCE PH.D.
PROGRAM (INP) HANDBOOK*

*GUIDELINES FOR GRADUATE STUDENTS
AND PARTICIPATING FACULTY*

*Prepared by C.A. Greer
June 2023*

NEUROSCIENCE TRACK ADMINISTRATIVE OFFICES

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Associate Dean	Michelle Nearon	436-1301
Financial Aid Office	email: gradfinaid@yale.edu	
Director	Sara Estrom	432-7980
Teaching Fellow Program		
Assistant Director	Howard el-Yasin	432-2757
Graduate Writing Center		
Assistant Dean and Director	Elena Kallestinova	432-7725
Student Services and Reception (general information; dissertation submission packets)		432-0461
Graduate Registrar	246 Church St.	432-2336
	https://registrar.yale.edu/students/graduate-students-0	
(registration; course schedules; grades; petitions for Master's Degrees; transcripts)		
University Registrar	246 Church St	436-0492
	https://registrar.yale.edu/	
(applications for departmental transfer; leaves of absence, withdrawal)		
Graduate Student Life/McDougal Center		
Assistant Dean	Lisa Brandes	432-8895
(McDougal Fellows, Orientation, Commencement, etc.)	https://gsas.yale.edu/resources-students/student-life-community/mcdougal-graduate-student-center	

BIOLOGICAL AND BIOMEDICAL SCIENCES

<https://medicine.yale.edu/bbs/>

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Administrative Director	John Alvaro	55 College St.	785-3735
Assistant Admin Director	Bonnie Ellis		785-5663
Asst. Director Program Assessment	Jennifer Claydon		737-1388
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MEDICAL SCIENTIST TRAINING PROGRAM

<https://medicine.yale.edu/mdphd/>

Director	Barbara Kazmierczak	TAC	785-4403
Associate Director	Reiko Fitzsimonds	317 ESH	737-5613
Program Coordinator	Cheryl DeFilippo	319 ESH	785-2103
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SPECIAL UNIVERSITY OFFICES

Campus Police 785-5555

<https://your.yale.edu/community/public-safety>

Yale Shuttle Services

<https://yaleshuttle.doublemap.com/map/>

Student Life: <https://www.yale.edu/life-yale>

Graduate Housing: <https://housing.yale.edu/graduate-housing>

Yale Health 55 Lock Street 432-0123

<https://yalehealth.yale.edu/>

Directory: <https://yalehealth.yale.edu/directory/departments>

Office of International Students & Scholars 421 Temple Street 432-2305

<https://oiss.yale.edu/>

Cushing Medical Library SHM 785-5354

<https://library.medicine.yale.edu/>

ITS Helpdesk <http://www.yale.edu/its/> 432-9000

Yale Hub <https://yub.yale.edu/>

OTHER

Cold Spring Harbor Laboratory

Cold Spring Harbor, NY 11724 (516) 367-8346

<https://www.cshl.edu/>

Marine Biological Laboratory

Woods Hole, MA 02543 (508) 548-3705

<https://www.mbl.edu/>

Society for Neuroscience

1121 14th Street, NW Suite 1010 Washington, DC 20005 (202) 962-4000

THE GRADUATE PROGRAM

Policy and Personnel

The Neuroscience Track is composed of the faculty and graduate program of the Interdepartmental Neuroscience Program (INP). The Interdepartmental Neuroscience Program is overseen by two co-directors who represent the Biomedical Sciences from each end of the Yale campus. Haig Keshishian is located at YSB 228 and can be reached at 432-3478. Charles Greer is located at Laudrer Hall 412 and can be reached at 785-4034. The day-to-day functioning of the Neuroscience Track and the Interdepartmental Neuroscience Program is handled by the Track Registrar who is located in the INP offices in the Hope Building. Kirstin Dion, the Senior Admin Assit. Deals with day-to-day functions of the program. Educational policy for the Neuroscience Track and the INP is decided upon and reviewed by the INP Executive Committee.

Neuroscience Track Student Committees

Advisory Committee

Each entering student is assigned a faculty advisory committee. This committee will be responsible for establishing the student's course of study and for monitoring progress in the first 1-2 years. This committee will meet with the student in September and DGS Charles Greer will meet with each first-year student in January and June as required.

Interdepartmental Neuroscience Program Committees

Qualifying Examination Committee

The qualifying exam committee will be comprised of 4 faculty members from 4 different areas of specialization from at least 2 different departments. Dr. Charles Greer or his representative will sit as a fifth, non-reading member of the committee (when not included in the original four faculty members), chairing each examination. This committee should be formed during the second year of study; the examination must be completed by June 1 of the second year. While pursuing completion of the Qualifying Exam students should register for Qual 999 – Preparing for Qualifying Exam

Thesis Prospectus Committee

For students who have completed their Qualifying Exam and are engaged in full-time research, a thesis prospectus committee will be formed which will consist of the student's thesis advisor and a minimum of 3 other ladder faculty members. The prospectus committee will be selected by the student, but each committee must be approved by a Director of the Program. Once this committee has approved the thesis prospectus (by June 1 of Year 3) the committee should meet with the student every six months until completion of the degree. After completing course requirements and beginning thesis research, usually in the 3rd year, students should register for DISR 999 – Dissertation Research – In Residence.

M.D. /Ph.D. Students

Questions related to the M.D./Ph.D. Program should be addressed to the Director of the Medical Scientist Training Program (MSTP), Barbara Kazmierczak (785-4403) or the Associate Director, Reiko Fitzsimonds (737-5613). However, all INP MD/PhD students must meet with DGS Charles Greer to discuss their program of study.

Responsible Conduct in Science

All First Year Neuroscience Track students, including MD/PhD students, are required to take our Bioethics in Neuroscience course (INP 580). Yale University believes that all individual research and research training should be conducted in a scientifically responsible and ethical manner. Yale's Guidelines for the Responsible Conduct of Research set forth the responsibilities of the faculty together with specific comments relating to the management, date, authorship and the evaluation of the scholarly efforts and research. This guideline builds upon information provided in the Faculty Handbook and various University policy statements: Policy on Collaborative Research; Patient Policy; University Policy on Academic Misconduct; and The University Policy on Conflict of Interest. It is Yale policy to encourage research and scholarly activities essential to the training of students, to the advancement of knowledge, and essential to the intellectual growth of the faculty. Yale expects that scholarly activities will be conducted with the highest ethical and professional standards. While professional standards may vary across fields, the University has developed a set of guiding principles and policies that are applicable to all research and scholarly activity at Yale.

<https://catalog.yale.edu/gsas/policies-regulations/academic-regulations/#personalconduct>

Additional specific policy and procedure govern the use of animals in research, the involvement of human subjects and experimentation with radioisotopes and other hazardous materials. All students are expected to complete required training in the areas that affect their research as soon as possible after joining a lab for a rotation or for dissertation work.

All fourth-year students are required to take BBS 503 Responsible Conduct in Research Refresher for Senior BBS Students which includes a large BBS wide meeting and an INP-specific follow up meeting.

CURRICULUM

Outline

The first 3 to 4 semesters of graduate study are spent in formal course work, independent reading and laboratory rotations and early thesis work. Each student's program of study is designed in consultation with an advisory committee of the INP. This program should both satisfy the INP course requirements and serve as a good background for the thesis research.

Formal Courses

Each student is expected to gain a broad base of knowledge in selected areas through elective courses in Neuroscience and other disciplines. A complete list of courses available can be found in at <https://courses.yale.edu/>. Students are required to take four core courses, a course in statistics and data analysis, and one other elective course.

REQUIREMENTS FOR THE Ph.D. DEGREE

Courses - <https://courses.yale.edu/>

The Neuroscience Track requires the following Neuroscience courses:

- Principles of Neuroscience (INP 701)
- Foundations of Cellular and Molecular Neurobiology (INP 702)
- Foundations of Systems Neuroscience (INP 703)
- Bioethics in Neuroscience (INP 580)

Also required for first year Neuroscience Track students and second year INP students:

- INP 511 (Fall) & INP 512 (Spring), Lab Rotation for First-Year Students w/ Charles Greer

Required for all first-year Neuroscience graduate students. Rotation period is one term. Both terms required. Grading is Sat/Unsat.

- INP 513 (Fall) & INP 514 (Spring), Second-Year Thesis Research w/ Charles Greer
Required for all second-year INP graduate students. Both terms required. Grading is Sat/Unsat.
- One graduate level (500+) course in statistics and data analysis. The course can be selected from the following list; substitutions must be approved by the DGS. Students are encouraged to check which semester their preferred course will be offered. See appendix for examples of course descriptions.
 - Statistics and Data Analysis in Neuroscience (INP 599)
 - Modeling Biological Systems II (INP 562)
 - Computational Methods in Human Neuroscience (INP 558)
 - Machine Learning for Biology (GENE 555)
 - Multivariate Statistics (PSYC 518)
 - Introductory Statistics (S&DS 500)
 - Introduction to Statistics: Life Sciences (S&DS 501)
 - Introduction to Statistics: Data Analysis (S&DS 506)
 - Intensive Introductory Statistics (S&DS 520)
 - Data Exploration and Analysis (S&DS 530)

Students are required to complete one (1) additional elective course that may come from the following list, or from other Graduate level course listings in related departments. When selecting the elective course students should consult the course listings from the GSAS at the time of registration. Examples include:

- Cellular and Molecular Mechanisms of Neurological Disease (INP 507)
- Structural and Functional Organization of the Human Nervous System (INP 510)
- Tutorial (INP 519)
- Neuroimaging in Neuropsychiatry II: Clinical Applications (INP 521)
- Imaging Drugs in the Brain (INP 523/ENAS 880)
- Principles of Signal Transduction (PHAR 528)
- Neurobiology of Cortical Systems (INP 532) (only if INP 703 NOT taken)
- Function and Dysfunction of the Visual System (INP 533)
- How to Give a Talk (INP 540)
- Fundamentals of Neuroimaging (INP 585)
- Neuroeconomics (INP 597)
- Molecular Cell Biology (CBIO 602)
- Neurobiology (INP 720)

Grades

At the completion of a course, students are normally assigned a grade of Honors, High Pass, Pass or Fail. Seminar or research courses are usually graded either Satisfactory or Unsatisfactory. The Graduate School requires that Ph.D. students obtain **a minimum of two grades of Honors** in regular term courses by the end of the second year of study. Courses graded Satisfactory/Unsatisfactory may not be used to fulfill the Honors requirement.

Within the INP, students are expected to maintain an High Pass average (for purposes of calculating this average, Honors=3, High Pass=2, Pass=1, and Fail=0). All students will be reviewed academically at the end of the year and if any fail to meet this standard, they will be put on academic probation with specific instructions on how to show appropriate academic improvement. Students are also expected to maintain at least a High Pass or above average for all Neuroscience graduate courses, a grade of Pass is generally considered an unsatisfactory

grade, its name notwithstanding. Additional degree requirements are successful completion of both terms of Lab Rotation for First-Year Students (INP 511 and 512) and both terms of Second-Year Thesis Research (INP 513 and 514). To remain in good standing throughout their time in the Ph.D. program, students are expected to actively participate in classes, seminars, journal clubs and lab meetings, to produce high quality written work, and demonstrate regular progress toward completion of the dissertation.

Laboratory Rotations

Laboratory rotations are an essential component to interdisciplinary training and each student is required to complete a minimum of two rotations by the end of second semester. The rotations must be in different laboratories and, preferably, in different areas of Neuroscience.

At least one of these must be in the lab of an INP faculty member. The minimum duration of a rotation is 8 weeks but a full semester or a full summer is more common.

Each rotation should be long enough to allow the student to gain technical expertise and an appreciation of the practical aspects of an area of Neuroscience. The laboratory rotations can serve the dual functions of broadening a student's background and helping in the choice of a future thesis advisor. Should a particular laboratory does not meet the needs of a student, he/she is encouraged to discuss this with the DGS and consider moving to another lab. At the end of the rotation, the P.I. will complete the Rotation Evaluation form evaluating the participation of that student in the laboratory and they will submit this to the INP office. *Yes this does happen*

Laboratory/P.I. Affiliation

At the end of the laboratory rotations first-year students are expected to affiliate with the laboratory of a INP faculty member to begin pursuing the research that will lead to their Ph.D. These include the graduate school mentor form that must be signed by your PI and their department chair, and the mentorship agreement that must be signed by your PI. Affiliation forms and guidelines are available for the INP office. **The latest deadline is June 1st, at the end of the first year.**

The Qualifying Examination

A primary objective of an interdisciplinary program is training well-rounded students. The qualifying examination is viewed as one means of obtaining that goal. The Graduate School requires that "A general oral or written qualifying examination, separate from course examinations must be passed by the student in the major subject offered and such subordinate subjects as may be required by the department concerned". The INP qualifying examination involves directed reading with 4 members of the faculty and a written and an oral component. The Qualifying Examination must be completed by June 1 of the fourth (4th) term of enrollment.

A unanimous Pass vote from the Qualifying Examination committee is required. Students who do not pass the Qualifying Examination will be put on academic probation and will be required to either re-take parts of the qualifier and/or complete additional coursework. They will receive a letter from the DGS explaining why their performance was marginal and that they may be dismissed from the graduate program if they do not show improvement within one semester. Areas of weakness will be outlined as well as specific guidelines as to how they can demonstrate improvement. Proof of timely continual academic progress will be required.

Thesis Prospectus

The Graduate School requires that all students submit an outline of proposed thesis work before beginning the seventh semester. The Prospectus must be accepted and all requirements for Admission to Candidacy must be completed by May 31 of the sixth term of enrollment. Students who do not meet this deadline will be required to petition the Graduate School for permission to register for the following semester and will be placed on academic probation until these requirements have been met.

The prospectus should consist of a written summary of research accomplished and planned, together with a tentative title for the thesis. This must be approved by the student's Thesis Prospectus Committee and accepted by the Director of Graduate Studies. The prospectus must be submitted at least 6 months before submitting the final dissertation. The thesis committee includes the student's P.I. and 3 additional faculty. At least 3 of the thesis committee faculty must be members of the Yale faculty.

Teaching Requirement

Neuroscience students, as well as others in the BBS, have a two semester TA requirement. This policy will address how and when these requirements will best be met.

First-year students may not TA without written permission from the DGS. One semester of teaching must be completed by the end of the third year and it is preferable that the second semester of teaching be completed no later than end of the 4th year.

Priority teaching assignments in Principles of Neuroscience, Foundations of Cellular and Molecular Neurobiology, Foundations of Systems Neuroscience, Bioethics in Neuroscience, and Data Analysis and Statistics in Neuroscience should be filled first as the INP "owns" these courses. Students who have taken Neurobiology (INP 720) and Structural and Functional Organization of the Human Nervous System (INP 510 - TAs selected by Thomas Biederer upon application directly to him) may apply to teach in these courses. Other opportunities may be chosen from the list of TA positions circulated annually by the BBS. If not from that list of courses, the course must have approval of the DGS. Students selected for a TA position in the Ethics course should note that two years of teaching in this course is required but that it does fulfill the two TA requirements.

Individual Professional Development Plan (IDP)

Many NIH-based training grants require trainees to complete a professional development plan as they move through different training and career phases. The INP Executive Committee feels that this is also an excellent planning tool for ALL trainees regardless of funding source (!). In recent years, there has been a surge in activity coming out of the BBS, the Graduate School as well as various student/postdoc career groups to bring to campus more information about career advice and options available (academic and non-academic tracks) and all students should utilize these resources. NIH is also very interested in providing trainees with more opportunities to explore careers using the skills gained from earning a PhD in non-academic research positions. To help with planning for your own professional goals, NIH has suggested the use of this website for graduate students: <http://myidp.sciencecareers.org/> By the time you are advanced to Candidacy, you should have an Individual Development Plan in place. We do not require you to submit the plan to the program, just to certify that you have a plan – this is on the Thesis Committee Report Form.

Admission to Candidacy

Following the GSAS guidelines, students who have satisfied the Program's course requirements, laboratory rotations, the Graduate School Honors requirement, have successfully completed the qualifying exam, and have an approved prospectus will be formally admitted to Candidacy for the Ph.D. degree. The Graduate School requires that this be completed before the beginning of the seventh semester.

Thesis Defense

All INP students are required to present a public seminar of their thesis research. This seminar is to be immediately followed by a closed oral defense of the student's thesis research with their committee.

Master's Degrees

The Neuroscience Track does not admit students for a terminal master's degree, but the Graduate School provides for the optional awarding of a Master of Philosophy degree. The minimum general requirements for this degree are that a student shall have completed all requirements for the Ph.D. except the dissertation. The terminal M.S. is awarded only to students who are not continuing for the Ph.D. degree and have successfully completed our equivalent of 30 credit hours in the doctoral program. This includes a passing grade in the four required courses plus one statistics and one elective course, a minimum of 2 Honors grades, and successful completion of both First-Year laboratory rotations (INP 511 and 512) and both semesters of Second Year Thesis Research (INP 513 and 514). Students are not admitted for this degree. Students will be automatically petitioned for the MPhil during the semester after they have completed these requirements.

Publications

The Graduate School requires that publications based upon the dissertation results should include a statement to that effect. For example, the author should state that the paper is based upon: "a dissertation submitted to fulfill in part the requirements for the Degree of Doctor of Philosophy at Yale University".

The INP is supported by a Training Grant funded by NINDS. To cite that support the following statement to be included in both the thesis and ALL publications on which the student is an author: "This investigation was supported by T32 NS041228 from the National Institute of Neurological Disorders and Stroke. *All students should include this citation regardless of the source of their support since the T32 broadly supports the program*

Other funding which the student has received (i.e. Gruber, NSF, individual NRSAs, etc.) should be similarly acknowledged.

Residence Requirement

The minimal residence requirement for the graduate school is three years; the maximum period of enrollment for the Ph.D. degree is normally six years. The maximum time may be extended by special petition, but only if all requirements for the Ph.D. except for the completion of research and submission of the dissertation have been fulfilled. If you must petition for Extended Registration, please do so in a timely fashion.

Vacation Policy

The total vacation time that a student may take is negotiable with the DGS or thesis adviser, but in general it is expected that the student would take no more than two weeks of vacation beyond the stated University holidays and the Christmas Eve to New Year's Day recess. Upon matriculation, students should transition from a 'school' ethos to a full-time research schedule.

Evaluation *Do we want to keep this? Not sure how long it's been since this happened.*

As each requirement is fulfilled, the student will receive formal evaluation of progress. First year students will receive summaries of rotation and academic standing evaluations, second year students will receive a summary of the Qualifying Examination performance at the end of the oral exam. Third year students and beyond will receive written feedback on the prospectus and subsequent thesis committee meetings, to be written by the committee chair, with copies to the committee members and the INP office. Each student's file will be reviewed annually to ensure that milestones are met.

INP DEPARTMENTAL REQUIREMENTS FOR MD/PhD STUDENTS

Course Requirements (3):

Three Graduate School courses are required. Students must obtain a grade of Honors in two of these courses. The Honors requirement must be completed by the end of the second year of full-time graduate work. The INP has two specific required courses, Principles of Neuroscience (INP 701) and Structural and Functional Analysis of the Human Nervous System (INP 510). INP 510 is part of the Connections to the World curriculum and is taken in the Fall of the 2nd year of the Medical School curriculum. One more elective graduate level course is required. Graduate courses taken during the first two years of medical school will count towards the student's elective requirement in the INP, provided the student has registered to receive a graduate grade in the course. Examples are CBIO 601 and MB&B 800. In the case of students accepted into the MD/PhD Program during their first year of medical school, a letter from the faculty member in charge of the first-year course indicating the grade achieved in the course is required and an official transcript from the Medical School must be submitted to the Graduate School. The INP also requires affiliated MD/PhD students to register for INP 513 and 514, Second-Year Thesis Research in the first two semesters of affiliation with the graduate program.

Laboratory Rotations:

Two rotations are required; rotations in another department/program will count towards this requirement upon approval of the INP Director of Graduate Studies. These are typically completed during the summer between the first and second year of medical school.

Teaching Requirements:

MD/PhD students are required to TA one term. Previous teaching (as TA) in the histology labs or other M.D. curriculum courses does count toward this requirement if the student taught while enrolled at Yale as an MD-PhD student.

Qualifying Exam:

MD/PhD students must complete their qualifying exam before the end of their first year as an affiliated graduate student. If affiliation begins in September of the third year, then the qualifying exam must be completed by the end of May of that year.

Prospectus:

MD/PhD students must complete and submit their thesis prospectus by the end of the second year as an affiliated graduate student. If affiliation begins in September of the third year, then the prospectus must be submitted and approved by the end of May of the fourth year.

Please note that every thesis prospectus MUST be approved by the Student's Thesis Committee.

Admission to Candidacy:

MD/PhD students are required to have been admitted to candidacy by the end of the second year as an affiliated graduate student. Generally, the submission of the thesis prospectus is the final requirement for admission to candidacy and paperwork for both is submitted to the Graduate School at the same time.

Other requirements:

All graduate students who are admitted to candidacy are required to have thesis committee meetings every 6 months. All graduate students are required to give a student research presentation annually and are expected to attend Student Research Talks as well as INP-sponsored journal clubs and other INP-sponsored events.

Affiliation requirement:

A copy of the student's application to the MD/PhD program, a copy of the student's current transcript and notation of rotations completed must be submitted to the INP office. The DGS must have this information in hand before the official MD-PhD student affiliation form can be approved.

Typical Timeline:

Year One: MD/PhD students complete courses in the Medical School and register for selected courses in the Graduate School. Those identifying Neuroscience as their probable Ph.D. field should take the required course Principles of Neuroscience in the Fall semester. This is the recommended timing. Other medical school curriculum courses with graduate school listings may be taken for graduate school credit to fulfill our requirement and indeed, it is recommended that this be done. Two laboratory rotations should be completed in the summer. The DGS and the INP Office may be of assistance in identifying appropriate laboratories based on the student's interests.

Year Two: Courses in the Medical School are typically taken. MD-PhD students should take INP 510 in the Fall of the second year for graduate school credit/grade. Part 1 of the Boards is taken.

Year Three: Students will affiliate with their thesis lab in September of the third year. All paperwork should be completed (affiliation form completed and copy of student's academic record including application transferred to the Interdepartmental Neuroscience Program Office). Qualifying Examination must be completed within one year of laboratory/program affiliation. This is a graduate school rule and graduate school registration for the following semester may be held up if this requirement is not fulfilled in a timely manner.

Year Four: The Thesis Prospectus must be approved and submitted to the Graduate School by the end of the second year of laboratory/PI affiliation. Registration for the following semester may be held up if this requirement is not fulfilled in a timely manner. The Thesis Committee approves the prospectus and required paperwork is then delivered to the INP Office by the student. The INP Office will then complete the Admission to Candidacy paperwork and submit it to the Graduate School. The Prospectus must be submitted to the Graduate School at least six months before the dissertation is submitted.

Year Five: Dissertation research in residence continues. Thesis committee meetings are required every 6 months.

Year Six: We require that MD/PhD students defend their dissertations before returning to fulfill the remaining Medical School requirements.

Year Seven: Student completes all remaining requirements and graduates in May.

While this is considered a guideline for a typical MD/PhD student, we recognize that not every student will follow this path. Any digression from this timeline must be discussed and approved by the DGS, with appropriate notes to the student's file and copies to the MD-PhD Office. Continued participation in the INP is subject to the satisfactory completion of requirements in a timely fashion and if any question arises about the satisfactory progress of a student and the qualifying examination committee or the thesis committee cannot agree on an appropriate resolution, then the INP Executive Committee will have the authority of the INP faculty to determine a course of action.

PROCEDURES FOR THE QUALIFYING EXAMINATION, THESIS PROSPECTUS AND DISSERTATION

Qualifying Examination

During the second year, each student will choose a qualifying examination committee, which is to be comprised of four faculty members representing four different areas of specialization. The student's advisor may not be a reader on the Qualifying Exam Committee. Dr. Charles Greer or his representative will chair each committee. He may also act as both a reader and chair.

Each of the four faculty members, in discussion with the student, will select ten - fifteen important papers from their field of specialization that the student will read, study and discuss with the faculty member. It is recommended that the student meet on a regular basis with each faculty member to discuss the assigned papers over a six-week period. A typical scenario would involve a minimum of four to six sessions with each faculty advisor.

No later than three months after receiving the papers, each committee member will prepare two essay questions based upon the readings. These eight questions will be presented to the student, who will select three questions representing three different areas of specialization. The student will have forty-eight hours to write the essays. Library and literature resources may be used, and the student may complete the exam in the location of their choice. Any one of the answers should not exceed the equivalent of three type-written pages single-spaced; references may be included at the discretion of the student or at the request of the faculty. The complete assigned reading list should be submitted with the final written examination.

No later than *one week* after the written exam is started, an oral examination focusing on the readings will be held with the student and the members of the committee. The oral exam is typically for 2 hours.

As described above, the Qualifying Examination has three parts, all of which are evaluated. The student's performance in meetings and discussions with faculty committee members, the written examination, and the oral examination are assessed when the committee members are all present for the oral examination. Second year students will receive a summary of the Qualifying Examination performance at the end of the oral exam.

The qualifying examination must be completed by June 1 of the second year. Exemption from this deadline requires the approval of the INP Director of Graduate Studies. A unanimous Pass vote from the Qualifying Examination committee is required. Students who do not pass the Qualifying Examination will be dismissed from the program or put on temporary academic probation. At the discretion of the committee, the student may be offered a second attempt at the Exam or required to either re-take parts of the qualifier and/or complete additional coursework.

Thesis Prospectus

Prior to the writing the thesis, the student will attend at least 2 formal meetings with the thesis advisor and a committee of a minimum of 3 additional ladder faculty members. At the first meeting (presentation of the Prospectus) the committee members should select a member of the committee who is NOT the advisor to chair the committee. Two weeks prior to the first meeting the student will distribute a short document of no more than 6-10 pages which includes a title for the project, a brief introduction to the problem(s) being studied, the techniques being employed and a short discussion of potential outcomes and/or pitfalls. This document should be modeled on the NIH NRSA Predoctoral fellowship guidelines and eligible students are encouraged to submit the final document for consideration by NIH. It is expected that the written prospectus be developed in close consultation with the student's P.I. The first meeting of the thesis committee must occur prior to the end of the third year. It is strongly recommended that this meeting occur early in the third year as to gain the maximum benefit from the committee members in the design of the thesis project. The student will make a concise presentation to the committee and then this meeting should address the strengths and weaknesses of the proposed research. The thesis prospectus must be approved by the committee and the Program Director and submitted to the Graduate School by May 31 in partial completion of the requirements for admission to candidacy for the Ph.D. degree. The student must be admitted to candidacy to be eligible to register for the seventh semester.

The second and all subsequent committee meetings will take the form of an interim progress report before which the student sends a short (no more than two pages) progress report to the committee. At the committee meeting the student makes a presentation of progress to date and the committee discusses the progress and/or problems relevant to the thesis. These meetings typically last approximately one hour. The chair of the committee will write a summary of the meeting using the form available from the INP which will be copied to the committee members, including the student. A copy must also go to the INP or Neuroscience office. Students are required to meet with their committees at least once a year, more often if judged appropriate by the thesis committee. Annual registration with the Graduate School is dependent on fulfillment of this requirement.

It is expected that the thesis prospectus committee will also serve as the final thesis defense committee. Changes in a student's thesis committee require approval of a Director of Graduate Studies. It is expected that the student will be in continual communication with the thesis committee during completion of the research and preparation of the written document and, again, at minimum, formal committee meetings must take place annually, with documentation of completion to be forwarded to the INP office.

Dissertation and Defense

During the final stages of thesis research, the student should maintain especially close communication with the thesis advisor and committee to most effectively establish the content and composition of the dissertation. As the dissertation nears completion to the satisfaction of the thesis committee, a date for the defense should be scheduled by the student and the committee in consultation with the INP office. No later than two weeks before the defense is to take place, the “final” draft of the dissertation shall be distributed to the committee members. The thesis committee will consist of 4 members, including the thesis advisor and 3 additional faculty. An outside reader (outside the University) is optional and is not required by the Graduate School or the INP. The thesis advisor may be an active participant during the defense and may ask questions or reformulate questions asked by other members of the committee or may act as an advocate on behalf of the student. The thesis advisor will remain present during the committee deliberations at the conclusion of the thesis defense.

The thesis defense consists of two parts: 1) An open seminar to which all members of the academic community will be invited; and 2) An oral defense of the thesis, which will include only the student and the thesis committee. The final oral defense should not exceed two hours. When the defense has been completed, the student will leave the room and the committee will discuss acceptance of the thesis (with or without revisions) or remand it to the student for further work. Once all changes have been made to the satisfaction of the committee, the student can submit the dissertation and all required paperwork to the Graduate School. An official Reader Report is then sent to each committee member who will submit this written report to the Graduate School and the Directors, who will approve the award of the Ph.D.

Dissertation Submission

The student must inform the INP office of their intent to petition for the Ph.D. degree (by the February 15th deadline for a May award; September 1st deadline for a December award). The sequence of events is 1) get permission from the committee to move forward; 2) do the public seminar/defense; and 3) submit the thesis to the GSAS. Notification of the INP office should be early so that rooms can be reserved, a poster developed, faculty/committee schedules locked in, etc. The Dissertation Submission Packet is found on the Registrar’s website: <https://registrar.yale.edu/students/dissertation-submission>. Full instructions on petitioning for degree, formatting your dissertation and all required forms and fees are found there.

REGISTRATION

General Information

All students in residence or *in absentia* are required to register with the Graduate School. Failure to do so will result in ineligibility to use University facilities, including the Libraries and the Health Services.

You will receive notification of the Online Course Selection deadline each semester. All students must complete the Online Course Selection. Online Course Selection and Instructions for same are found on the Yale Hub: <https://yub.yale.edu/>

International Student Registration

International students must register at the Office of International Students and Scholars (421 Temple St.) before registering with the Graduate School. International students are strongly encouraged to use this office as a resource for any problems related to their foreign-student status.

***In Absentia* Registration**

Students whose circumstances require full-time study at another institution, or dissertation research on a full-time basis outside the New Haven area can register *in absentia* provided he/she receives prior written approval of the Program Directors and the Dean of the Graduate School. Students who register *in absentia* do not qualify for Yale Health Plan services unless they are paying full tuition but may enroll themselves and their dependents at full cost.

Parental Leave - <https://catalog.yale.edu/gsas/policies-regulations/academic-regulations/#parentalsupportandrelief>

Registered Ph.D. students who wish to modify their academic responsibilities because of the birth or adoption of a child may request parental support and relief during or following the term in which the birth or adoption occurs. For the whole of the term in which the support and relief are granted, the student's academic clock stops, effectively adding an additional term to the total time to degree. During this period, students remain registered full-time, receive a standard financial aid stipend and Health Award, and receive modified departmental academic expectations that best suit the specific situation. The precise nature of the academic responsibilities undertaken or suspended during this period should be a matter of consultation between the adviser and the student, with the understanding that students are entitled to full relief from responsibilities for at least an eight-week period. Most students take an entire term of parental relief, but the relief may be split in two, with a student taking only eight weeks of relief during the term in which, or just after, a birth or adoption occurs and then receiving an additional eight weeks of stipend funded by the Graduate School postponed to a later term. Parental relief may not be combined with other funding. To arrange for parental relief, a student should contact the appropriate associate dean four months prior to a birth or adoption. This benefit is limited to two birth or adoption events.

Leave of Absence

A student in good standing who wishes to interrupt their study temporarily for personal reasons (i.e. maternity leave, financial necessity, health problems or other extenuating personal circumstances) may, with approval of the Directors and the Dean, be granted a leave of absence of up to one year for students who have successfully completed one year of study and two years for students who have been admitted to candidacy for the Ph.D. degree. Students on leave may not engage in full-time degree-related activities during the period of leave. However, students may participate in full-time teaching or other full-time employment or pursue training for a special skill while on leave of absence. Students on leave of absence need not apply for readmission before returning to Yale. However, to be considered for financial aid in the year following a leave of absence, students must submit a formal application to the Program by February 1 of the year preceding return. Students on leave will not be enrolled in the Yale Health Plan but may continue membership by paying full fees.

Tuition

Full tuition is charged for all Ph.D. students for 8 semesters, except in the case of students who have completed all degree requirements (including submission of the dissertation) in less than four continuous years from the date of entry into the Ph.D. program. After eight semesters, the student must continue registering until the dissertation is submitted or the terminal date is passed.

Tuition charges for students who are considering leaves of absence or registration *in absentia* should be arranged in consultation with the Graduate School.

FINANCIAL AID

Sources of Support

For the 2023-2024 year, all students will receive tuition plus a stipend of \$42,500 (12 months). The most common sources of support are:

1. National Research Service Awards: Each year, the National Institute of Health (NIH) provides Yale with funds for graduate student tuition and stipends. The Graduate School and/or the Medical School provides students with a stipend supplement. These awards are available for a maximum of 5 years. There is no "Payback" obligation for pre-doctoral support.
2. External Fellowships: Several external fellowships which are administered by federal or private sources are also available to graduate students in Biomedical Sciences. The INP strongly encourages students to apply for any outside fellowships. In particular, those awarded by the NIH, National Science Foundation, the Department of Defense and the Homeland Security Office as well as private foundations. More senior students are strongly encouraged to submit Predoctoral NRSA applications. Most applications are now completely online and assistance in completing the business aspect of the applications is provided.

Fellowship activation

Students who are awarded NSFs and other outside fellowships (excluding NRSAs) may activate these awards only **as of September 1**. All Fellowship Activation dates must be discussed with the INP office prior to submission.

3. University Fellowships: These fellowships are awarded by the Graduate School and/or the Medical School.
4. Research Assistantships: Research grants and contracts awarded by outside agencies to support the research projects of individual faculty members may provide funds for Research Assistantships for graduate students. These appointments are decided by faculty negotiation. In most cases, these appointments are given to senior students who are engaged in full-time dissertation research in the laboratory of the P.I. granting the funds.

Pay Periods

The Graduate and Professional student payroll runs on a semi-monthly schedule of payments (the 15th and last business day of each month). Instructions to set up Direct Deposit and for using all the features of the "My Pay and Info" site are available at: <http://your.yale.edu/> using the "Workday" link. Incoming graduate students will receive their first paycheck on August 31.

Loans

For information on the various types of graduate student loans, consult the Financial Aid Office. The Office of the Dean of the GSAS may also be contacted for financial emergencies.

Travel Money

First-year Neuroscience Track and second-year INP students are provided with travel funds for use toward one scientific meeting per year. See the INP Office to make arrangements for this. First year students are expected to attend the Society for Neuroscience annual meeting in the fall.

Conference Travel Fund - <https://gsa.yale.edu/ctf>

The Conference Travel Fund aims to support the professional development of graduate students by providing financial assistance to present papers and posters at conferences on a competitive basis. Conference funds are disbursed three times per year with application deadlines on October 15th, February 15th and May 1st.

LECTURES, SEMINARS AND JOURNAL CLUBS

Yale graduate students in the Biomedical Sciences have access to many relevant research seminars, journal clubs, retreats, and symposia. Neuro students are expected to attend:

Seminar Series

The cooperative seminar series sponsored by the Department of Neuroscience and the INP provides an opportunity for students and post-docs in the neuroscience community at Yale to interact on a one-to-one basis with visiting neuroscientists in an informal setting. The seminars are held on Mondays at noon September through June in the Medical School. Neuro students may nominate speakers, drawing from the fields of cellular and molecular neurobiology, neurophysiology, developmental neurobiology, and systems/computational neuroscience, and make the invitations themselves. Nominations will be coordinated with those from the Department of Neuroscience. For the INP sponsored speakers, a student host coordinates lunch and dinner with interested graduate students and the speaker. Following each seminar, graduate students are invited to have dinner with the speaker. Contact the INP office for additional information.

Journal Clubs

The INP student-directed journal club brings together neuro graduate students to discuss current papers in the field. Members meet on a biweekly basis and take turns in leading the discussions. The Journal Club is an excellent opportunity to practice presenting papers in a congenial and collegial atmosphere, to keep apprised of neuroscience research and to maintain contact with fellow students, events, and research within the expansive Yale neuroscience community. Anyone with an interest in neuroscience is invited, but members are encouraged to attend regularly. Announcements are sent for each scheduled date. The paper to be presented is always available via email announcement prior to the Journal Club. The Journal Club is exclusive for graduate students and does not include postdocs, faculty, or technical assistants.

Student Research Talks

To maintain regular interactions among the student body, INP students participate in a regular "In Progress" seminar series. At these seminars, students make short presentations of research-in-progress to Neuroscience students, postdocs, and faculty. This gives graduate students a unique opportunity to have their work evaluated by their peers and faculty. Second year students working with a faculty committee coordinate the scheduling the talks on Tuesdays at noon; lunch is provided. All INP students are expected to attend. Talks will be given by 2nd, 3rd, 4th, and 5th year students. 2nd year students should plan on a 10-minute talks

with an additional 5 minutes for discussion, 3rd and 4th a 15-minute talk with an additional 5 for discussion, and 5th year students a 20-minute talk with an additional 5 for discussion.

Guidelines for these presentations are as follows:

- Talks should consist of a clear and well-organized presentation of the background and rationale for the research, and the recent findings.
- Begin your talk by introducing yourself and announce in whose lab you are working. For clarity, you should make sure that the first few slides give adequate background for your presentation. Your audience is quite diverse. After giving the background, go through your data, presenting it in as clear a fashion as possible. Pay attention to the order in which you present your information and to the way your data slides are set up. Make sure you arrange the data in a fashion that is logical and easy to interpret. This will avoid confusion and save time. End by clearly stating your conclusions. Practicing your talk in front of a mentor, members of your lab, and/or a few friends is a good idea.
- Second year students are often nervous about giving these seminars because they feel they do not have sufficient data. This should not be a concern. Use the opportunity to practice presenting. These talks should be no more than 10 minutes.
- More senior students should focus on the more recent experiments. Do not try to gloss over problem areas. Remember that a primary function of these seminars is to get feedback from your colleagues. Someone in the audience may have an idea which could help, and you should encourage such ideas to come out. These talks should be fifteen or twenty-five minutes long, as indicated above.

Annual Interdepartmental Neuroscience Program NeuroDay

This annual event is open to all members of the Yale Neuroscience community. It features presentations by faculty, students, and postdocs. There is also ample time for informal discussion to enable attendees to become acquainted with current Neuroscience research on the Yale campus as well as opportunities to interact with students, postdoctoral fellows, and faculty from all areas of neuroscience at Yale.

A host of other Seminar Series and Journal Clubs are also found throughout Yale and may be of interest to subsets of INP students. Examples include:

Department Day Time Location

- Molecular Psychiatry (BSTP) Monday 3:45 pm W212 CMHC
- John B. Pierce Seminar Monday 11:00 am JBPierce Lib.
- Child Study Center Grand Rounds Tuesday 1:00 pm Cohen Aud
- Biology Department Seminar Wednesday 4:30 pm 202 OML
- Cellular & Molecular Physiology Seminar Thursday 4:00 B145 SHM
- Molecular Biophysics and Biochem. Seminar Wednesday 4:00 OML/BASS/Hope
- Pharmacology Seminar Thursday 12:30 Giarman Room
- Psychiatry Grand Rounds Friday 10:15 am CMHC Aud.

OFF-CAMPUS NEUROSCIENCE COURSES

Neuroscience students are encouraged to take advantage of the several Neuroscience Summer and Short Courses which are offered in various regions. First and second year students must have permission from an INP Program Director to apply for these courses. Although many summer courses are offered internationally, those offered by the Marine Biological Laboratory

(Woods Hole, MA) and Cold Spring Harbor Laboratory (Cold Spring Harbor, NY) are among the very best. Course listings can be found on the home pages of these institutions.

Marine Biological Laboratory, Woods Hole, MA

- (508) 289-7401, admissions@mbi.edu, <http://www.mbl.edu>

Cold Spring Harbor, Cold Spring Harbor, NY

- (516) 367-8345, meetings@cshl.org,

CAMPUS FACILITIES AND MISCELLANEOUS INFORMATION

Libraries

Extensive library services are available that can help with research, access to rare books, etc. Full information and guidelines can be found at:

<https://web.library.yale.edu/collection-development/biological-and-biomedical-sciences>

The McDougal Graduate Student Center

McDougal Center- <https://gsas.yale.edu/life-yale/mcdougal-graduate-student-center-space-collaborating-programs>, mcdougal.center@yale.edu,

At Yale, there is no general campus center, student union, or student center for the entire University community. For graduate students, much of student life is based in their respective departments and schools, and dormitories or apartment complexes. The McDougal Center (135 Prospect St.) is a place where graduate students from across the campus regularly meet and share interests.

Mission- A generous gift from Mr. Alfred McDougal, a Yale alumnus, and his wife, Ms. Nancy Lauter, enabled Yale in 1997 to create the McDougal Graduate Student Center. The McDougal Center provides space and program funding for building intellectual, cultural, and social life, and for facilitating professional development activities across the departments of the Graduate School of Arts and Sciences. The McDougal Center warmly welcomes the participation of students from other Yale Graduate and Professional Schools, postdoctoral fellows, faculty, staff, alumni/ae of the Graduate School, and members of the larger Yale community. Its web site provides all kinds of information relating to graduate student life. The Center provides members of the graduate student community with a place of their own on campus.

Student Life Programs - Lisa Brandes, Director, 432-8273.

Graduate Student Organizations

The Graduate Student Assembly - <https://gsa.yale.edu/>

The Graduate Student Assembly (GSA) is the elected body of Yale students in the Graduate School of Arts and Sciences. The Assembly's goals are to:

- Identify the needs and concerns of graduate students, consider possible solutions, and present these to the Dean and other administrators.

- Discuss and advise on changes to Graduate School policy proposed by the administration.
- Provide a means for communication and deliberation both among graduate students, and between graduate students and other members of the university community.

Meetings are open to all Graduate Students. Check the website for dates, times, and location.

The Graduate-Professional Student Senate - <https://gpss.yale.edu/>

GPSS is a university-wide organization representing the interests of all graduate and professional students and provides a means of voicing concerns to the University administration as well as to the various departments and schools.

The Graduate and Professional Student Center at Yale – <https://gryphonspub.com>

Gryphon's Pub provides a central meeting place for graduate and professional students, faculty, and alumni. Open only to members and their guests, Gryphon's Pub operates a full-service bar with reduced prices, sponsors receptions, dances and parties and hosts conferences, rehearsals, and exhibitions.

There are many other formal student organizations at Yale, covering a broad spectrum of interests and activities including an active graduate-professional intramural sports league.

Grievance Procedures

For students who feel they have been treated unfairly in some capacity by an individual or group within the University, several courses of action are available. First, the advice of the thesis advisor, the Graduate Student Affairs Committee or either of the Program Co-Directors may be sought. Alternatively, if the matter is one which is not appropriate to raise within the Program administrative structure, other University agencies may be contacted, which include: 1) The Dean of the Graduate School; or 2) The Deputy Provost (Stephanie Spangler), whose office is especially concerned with matters relating to equal rights for minorities and for women. In addition, the Dean of Graduate Studies has appointed a standing Grievance Committee to receive and review student complaints of sexual harassment. This Committee is comprised of six members (2 faculty; one member of the Graduate School Administration; two students; and one counselor). Students may bring questions about procedure, seek informal advice, or present a complaint to any member of the board, either orally or in writing.

University Health Services

The Yale Health Plan (<https://yalehealth.yale.edu/>) is a comprehensive health care program, located at the University Health Care Services Center (55 Lock Street) which is available to all faculty, students, and staff. All Yale students who are enrolled in graduate study at least half-time are automatically members of the YHP and are eligible for ambulatory care services and the use of the infirmary at no additional cost. Yale requires that students have hospitalization and specialty care coverage as well. For all graduate students who do not have this coverage from another source, it will be provided at no cost to the student. If NOT WANTED, each student must complete the waiver form online by September 15.

Students may also enroll their spouses and dependents by filing an application with the YHP. The Graduate School will pay for half of this fee. The rest of the fee is applied through the Bursar's office. Only those spouses and dependents specifically enrolled are eligible to receive YHP benefits and services. In addition to primary and emergency care, a full range of specialty services are available, including Allergy, Dermatology, Otolaryngology, General Surgery, Mental

Hygiene, Neurology, Obstetrics and Gynecology, Ophthalmology, Orthopedic Surgery, Optometry, Contact Lenses, and Urology.

For first-year students, YHP membership begins August 16.

Prior to registration, a complete medical examination form and health report must be submitted to the YHP. If these forms are not available, YHP will provide the necessary examinations, and will bill the student a charge. Additional information can be obtained by contacting the Member Services Office at (203) 432-0246.

Dining Facilities

Several University dining facilities are maintained for the convenience of students, faculty, and staff. In the Medical School area these include:

1. Marigold's (367 Cedar St., adjacent to SHM).
2. Yale-New Haven Hospital Cafeteria (Main – 1st floor of the Hospital)
3. Atrium Café (Main Lobby of the Hospital, 1st floor)

4. Yale-New Haven Hospital Cafeteria (2nd floor of the Clinic Building, 330 Cedar St)

Shuttle Buses

Schedules and routes can be found here: <https://your.yale.edu/work-yale/campus-services/yale-transit/shuttle>

The Yale Shuttle Bus is a campus-wide service operated by the University. Shuttles run every 20 minutes during peak hours, and every 40 minutes for the remaining time, starting at 7:20 a.m. until 6:00 p.m. The Shuttle is free with a valid Yale identification card. Schedule information is also available in SHM CE 1 or at the Parking Service Office, Hendrie Hall, 165 Elm St.

Evening Transportation

<https://gsa.yale.edu/compass/living-new-haven/getting-around-transportation-and-safety/yale-shuttle-system>

Yale Nighttime Shuttle Service. 203 432-6330: Buses run from 6:00 p.m. to 7:30 a.m. Monday through Sunday (seven nights a week). This service runs on a scheduled route around the campus and takes dispatched calls for off-route pickups. Service is available on call-in @ 2-6330 from any campus phone for service.

In addition to these services, the University Police provide transportation 24 hours a day for medical emergencies to the University Health Services. Call 432-4400 for this service.

Parking

Parking is available in various locations around campus on both a regular and a special service basis. Inquiries and applications for permits should be directed to the Medical School Parking Office, Basement of SHM (785-4201) for the Medical School Area or the Office of Parking and Transit Services, 155 Whitney Ave (432-9790) for the Science Hill district.

Security

Yale Security emphasizes that the campus is not immune to crime, property loss or personal injury. Individuals are urged to walk in groups, or request to be escorted by the Student Patrol Service which has been set up by the University Police to provide for safety on the streets and in the parking lots. Night-time transportation is available for students working late in the evenings.

Identification Card

During registration, incoming students will receive an identification card for access to campus facilities. In case of a lost or stolen ID card a new ID can be issued for a fee at the Medical School Support Center (CE 1 SHM) 9:00 a.m.-12:00 p.m.

Email Addresses

All neuroscience students can be reached by email. Use the generic Yale address format of `firstname.lastname@yale.edu`.

All neuroscience faculty can be reached by email. Use the generic Yale address format of `firstname.lastname@yale.edu`.

Computer Accounts

Each incoming graduate student is set up with a free computer account, including email access. Username (netid) and PIN number are sent to incoming students in the summer. This account gives you access to the Internet, MedLine, ORBIS, etc.

Keys

Most areas on campus are now accessible by swipe-access with your current ID. Departmental keys (for labs, etc.) should be obtained through the specific department's business office.

Mail

New students may have their mail sent to the INP office where it will be held for pick up or forwarded to the department in which the student is currently working.

ATM

In the Medical School area, there is an ATM and Bank of America branch at 330 Cedar Street, between the Clinic Building and FMB on the first floor (go to the Information Desk and turn left). There is another ATM located on the main floor of the hospital.

RECREATIONAL OPPORTUNITIES

1. University Athletic Facilities are available for standard fees. They include:
 - a. Payne Whitney Gymnasium (70 Tower Parkway; 432-1444), for sports, dance, exercise and swimming. <http://sportsandrecreation.yale.edu/>
 - b. Ingalls Skating Rink (73 Sachem Street; 432-4771) for ice skating sessions between mid-October and April.
 - c. The Yale Golf Course (Ray Road; 432-0895).
 - d. Cullman Tennis Courts (for indoor tennis, late October through late April) and outdoor courts (Derby Avenue; 432-0693).
 - e. The Yale Sailing Center (Short Beach, Branford; 488-9330), which has equipment available for rent and offers sailing lessons.
 - f. Outdoor Education Center (East Lyme, Ct.) Call 432-2492 for info.
2. Musical Opportunities/Activities include:
 - a. The Yale Symphony Orchestra, which is comprised of students from all levels within the University.
 - b. A variety of choral groups, encompassing several musical styles. For more information, contact the Music Department at 432-2986.
 - c. The Yale School of Music sponsors frequent recitals, which are listed in the Weekly Bulletin & Calendar.
 - d. The New Haven Symphony Orchestra and the Woolsey Hall Concert Series. Tickets are available at the New Haven Symphony Office, 33 Whitney Avenue.
3. Theatrical Productions

- a. The Yale Repertory Theatre (Chapel and York; 432-1234)
 - b. The Long Wharf Theatre Company (222 Sargent Drive; 787-4282)
 - c. The Yale Cabaret (217 Park Street; 432-1566)
 - d. The Shubert Theatre (College Street)
4. University Museums
- a. The Peabody Museum of Natural History (Sachem & Whitney; 432-5050), Exhibits of the natural history of the New England area, with extensive collections in geology, anthropology and ornithology. Displays include minerals; birds of Connecticut; fossil plants, fish, birds, reptiles and mammals; and, of course, dinosaurs.
 - b. The Yale Art Gallery (Chapel & York Street; 432-2600) includes extensive collections of 17th, 18th and 19th century paintings and furnishings.
 - c. The British Art Center (Chapel & High Street; 432-2858) contains a collection of British paintings, drawings, prints, rare books and sculpture assembled over the past 35 years by Paul Mellon.

NEUROSCIENCE TRACK COMMITTEES

Admissions Committee (2022 - 2024)

Michael Higley (Chair)
Charles Greer
Haig Keshishian
Kristen Brennand
Will Cafferty
Alicia Che
Jonathan Demb
Jess Cardin
Janghoo Lim
Ellen Hoffman
Dustin Scheinost
Damon Clark
Sreeganga Chandra

Diversity Coordinator:

Will Cafferty

Executive Committee:

Charles Greer, Co-Director
Haig Keshishian, Co-Director
Jess Cardin, Neuroscience
Damon Clark, MCDB
Barbara Ehrlich, Pharmacology
Steve Chang, Psychology
Slav Bagriantsev, C&M Physiology
Ralph DiLeone, Psychiatry
Will Cafferty, Neurology
Mike Higley, (DGA) Neuroscience
Peter Niesman, Student Representative
Alex Rich, Student Representative

Curriculum Committee:

Grievance Committee:

Other Committees:

The composition of these committees is subject to rotation or change on an annual basis.

APPENDIX

Courses fulfilling the Statistics and Data Analysis requirement

INP 599, Statistics and Data Analysis in Neuroscience, John Murray, Hyojung Seo

This course focuses on practical applications of various statistical models and tests commonly used in neuroscience research. It covers basic probability theory, hypothesis testing, and maximum likelihood estimation, as well as model comparison. The specific models and tests covered include ANOVA, regression, time series analyses, and dimension reduction techniques (e.g., PCA). Examples and homework will be given in MATLAB, which will be introduced at the beginning of the course. Previous experience in programming and basic statistics is desirable but not required.

INP 562/AMTH 765/CB&B 562/MB&B 562/MCDB 562/PHYS 562, Modeling Biological Systems II Damon Clark, Thierry Emonet, Joe Howard

This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: [MCDB 561](#) or equivalent, or a 200-level biology course, or permission of the instructor.

PSYC 518a, Multivariate Statistics

This is a practical course in statistics that covers classical null-hypothesis significance testing (e.g., binomial and chi-squared tests), regression analyses (multiple regressions, generalized linear models, and mixed-effects models), modern statistical methods (bootstraps and cross-validation), basics of Bayesian data analysis (hierarchical Bayesian models, Bayes factors), and basics of machine learning for data analysis (principal component analysis and classifiers). This course focuses on how to intuitively understand what different tests do, how to run them using R, and how to interpret the results. The course favors intuitions over mathematical rigor, but it's impossible to teach statistics without some math.

PSYC 558/INP 558, Computational Methods in Human Neuroscience, Nicholas Turk-Browne

This course provides training on how to use computational science for the advanced analysis of brain imaging data, primarily from functional magnetic resonance imaging (fMRI). Topics include scientific programming, high-performance computing, machine learning, network/graph analysis, real-time neurofeedback, nonparametric statistics, and functional alignment. Prerequisite: some prior experience with programming, data preprocessing, and basic fMRI analysis.

GENE 555/CB&B 555/CPSC 553, Machine Learning for Biology Smita Krishnaswamy

This course introduces biology as a systems and data science through open computational problems in biology, the types of high-throughput data that are being produced by modern biological technologies, and computational approaches that may be used to tackle such problems. We cover applications of machine-learning methods in the analysis of high-throughput biological data, especially focusing on genomic and proteomic data, including denoising data; nonlinear dimensionality reduction for visualization and progression analysis; unsupervised clustering; and information theoretic analysis of gene regulatory and signaling networks. Students' grades are based on programming assignments, a midterm, a paper presentation, and a final project.

S&DS 500, Introductory Statistics

An introduction to statistical reasoning. Topics include numerical and graphical summaries of data, data acquisition and experimental design, probability, hypothesis testing, confidence intervals, correlation and regression. Application of statistical concepts to data; analysis of real-world problems.

S&DS 501a, Introduction to Statistics: Life Sciences Walter Jetz and Jonathan Reuning-Scherer Statistical and probabilistic analysis of biological problems, presented with a unified foundation in basic statistical theory. Problems are drawn from genetics, ecology, epidemiology, and bioinformatics.

S&DS 506, Introduction to Statistics: Data Analysis

An introduction to probability and statistics with emphasis on data analysis. Note: [S&DS 501–506](#) offer a basic introduction to statistics, including numerical and graphical summaries of data, probability, hypothesis testing, confidence intervals, and regression. Each course focuses on applications to a particular field of study and is taught jointly by two instructors, one specializing in statistics and the other in the relevant area of application. The first seven weeks are attended by all students in [S&DS 501–506](#) together as general concepts and methods of statistics are developed. The course separates for the last six and a half weeks, which develop the concepts with examples and applications. Computers are used for data analysis. These courses are alternatives; they do not form a sequence, and only one may be taken for credit.

S&DS 520, Intensive Introductory Statistics

An introduction to statistical reasoning designed for students with particular interest in data science and computing. Using the R language, topics include exploratory data analysis, probability, hypothesis testing, confidence intervals, regression, statistical modeling, and simulation. Computing is taught and used extensively throughout the course. Application of statistical concepts to the analysis of real-world data science problems.

S&DS 530, Data Exploration and Analysis

Survey of statistical methods: plots, transformations, regression, analysis of variance, clustering, principal components, contingency tables, and time series analysis. The R computing language and Web data sources are used.