

PROGRAM HANDBOOK

2019-20

Northwestern University Interdepartmental Neuroscience Program Student Handbook 2019-20

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Introduction

The Northwestern University Interdepartmental Neuroscience Program (NUIN) is a highly interactive and collaborative program, with faculty distributed across more than 20 departments on the Chicago and Evanston campuses. Our program encourages interdisciplinary research among 7 NU-affiliated centers, including the Feinberg School of Medicine, the Stanley Manne Children's Research Institute, and the Shirley Ryan AbilityLab (Chicago), the Weinberg College of Arts and Sciences, the McCormick School of Engineering, the School of Communication and the Kellogg School of Management (Evanston).

NUIN faculty represents a broad range of research interests including molecular and developmental neuroscience, cellular physiology, cognition and systems neuroscience, and medical or translational research. Training in research is supplemented with core and elective coursework, mentorship, teaching and other professional development opportunities.

This program attracts numerous applicants from a broad array of academic backgrounds, including computer science, chemistry, engineering, physics, and psychology, as well as neuroscience and biology. Our curriculum is designed to embrace this diversity while also providing intensive training in fundamental principles of neuroscience.

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1. Program Requirements and Milestones

1.1. Timeline and Overview

A. First Year

- NUIN 401-1 (2 credit units), 401-2, 401-3 – Fundamentals of Neuroscience (core course; 3 quarters)
- Electives (typically 1 or 2 electives in the first year)
- NUIN 490 – Responsible Conduct of Neuroscience Research (0 Unit)
- 3 laboratory rotations (additional if necessary)
- Seminar Attendance Requirement (6 per quarter in fall, winter, spring)
- Meet with Advising Committee 4 times during the year
- Join laboratory where thesis work will be conducted
- Create and submit an IDP

B. Second Year

- Select Concentration Area: Molecular and Developmental Neuroscience, Cellular Neurophysiology, or Systems and Cognitive Neuroscience
- Electives – including a Great Experiments course in chosen concentration area
- Complete Teaching Assistant requirement
- Meet with Advising Committee twice during the year
- Begin research in Thesis laboratory
- Pass Qualifying Exam at year's end and achieve PhD Candidacy
- Create and submit an IDP

C. Third Year

- Complete any remaining electives
- Conduct Thesis research
- Form Thesis Committee
- Have initial meeting with Thesis Committee
- Present Thesis Proposal (Prospectus)
- Create and submit an IDP

D. Fourth Year and beyond

- Conduct Thesis research
- Present 4th year seminar
- Meet with Thesis Chair (annually)
- Meet with Thesis Committee (annually)
- Create and submit an IDP (annually)
- Publish at least one first author article
- Write and defend dissertation

1.2. First Year of Study

A. Coursework

Students are required to enroll for 3 units per quarter.

1. Required Core Courses: NUIN students come from a diverse range of academic backgrounds including computer science, chemistry, engineering, physics, and psychology, as well as neuroscience and biology. The Fundamentals of Neuroscience series is designed to embrace this diversity while also providing intensive training in the basics of neuroscience. At the end of this series, students are expected to have essentially the same level of understanding of fundamental neuroscience. In order for this to occur, it is crucial that students take responsibility to identify potential gaps in knowledge and to work independently or with instructors or fellow students to fill in these gaps.
 - a. NUIN 401-1 (2 units; Fall quarter): This intensive course covers neurogenetics/cell biology and neural development/signaling pathways. Classes are scheduled on both the Evanston and Chicago campuses on M/W. Students should expect to dedicate approximately 20 hours per week to preparing for and attending this class.
 - b. NUIN 401-2 (1 unit; Winter quarter): This course covers cellular neurophysiology and sensory systems and is based on both the Evanston and Chicago Campuses.
 - c. NUIN 401-3 (1 unit; Spring quarter): This course covers motor systems and cognitive neuroscience and takes place in both Evanston and Chicago.
2. Electives
 - a. Students will need to register for an elective during the Winter and Spring quarters (1 unit each), and these are usually selected during quarterly advising. Course descriptions can be found in the Appendix (page 23).
3. Research
 - a. Students should register for at least 1 unit of NUIN 590 (Research) each quarter.
4. Non-credit course requirement
 - a. NUIN 490: Responsible Conduct of Research: This course is not only a program requirement, but is also required at the institutional and federal levels. Though it is a 0 unit course, attendance and participation is *required*. It is typically offered during the summer.

B. Laboratory Rotations Requirement

During the first year in the program, each student is required to complete research rotations in at least 3 different laboratories. These usually take place in fall, winter, and spring quarter, although some students elect to complete a rotation in the summer before matriculating. The rotation system allows students to explore various areas of neuroscience and different research environments before committing to a single lab to conduct thesis research. Students are expected to do at least 1 rotation on each campus since each has its own unique culture and research opportunities. Students who plan to do otherwise must prepare a written explanation with compelling scientific reasons for their choice of rotations, which will be considered for approval during quarterly advising sessions.

There are several goals associated with the laboratory research rotation experience. Of course, the primary goal is to identify a thesis laboratory. But more than that, laboratory rotations give students an opportunity to learn which research questions excite them, what techniques they favor, what kind of lab environment they think best suits them, and what qualities they prefer in an advisor. At the same time, of course, rotations provide faculty an important mechanism for

evaluating students as candidates to join their lab. Ideally, each student finds a good match with a thesis laboratory by the end of year one.

In most cases, thesis labs are identified within 3 rotations, but in some cases additional rotations are required. Students may do a 4th rotation, and under special circumstances, a 5th rotation—in these cases, students must meet with the Assistant Director to seek further advice on rotation selection.

Students who fail to find a laboratory after 5 quarters, or who receive 2 grades of “No Pass” in the NUIN 590 course associated with laboratory rotations, may be excluded from NUIN.

- a. Arranging Laboratory Rotations: Arranging laboratory rotations is primarily the responsibility of the student, though the NUIN Assistant Director and the student’s Advising Committee are always available to help. Subsequent to arranging each rotation, students submit a Research Rotation Advisor Agreement Form to the NUIN office. Typically a student should rotate in a lab only if there is a reasonable option to join that lab permanently, should the rotation go well. Students should not join a lab that is unlikely to have space or financial resources to support a new student in the near future. When interviewing prospective faculty advisors, it is important to ask whether the PI is accepting new students. An exception to these cautions exists for the student who identifies a thesis lab before completing all 3 rotations. Students in this situation still need to complete the requisite number of rotations, but the certainty of having a thesis lab affords them more flexibility. For example, a student might rotate in a lab in order to learn a specific technique to complement what he/she plans to do in his/her thesis lab. Faculty members are more open to such arrangements when they know the student will be in the lab short-term.
- b. Switching Laboratory Rotations: In rare cases, a student may realize early in a rotation that the laboratory is not a good match for the student’s interests and goals. If this is the case, the student may petition the Assistant Director to switch rotations. This must be done prior to the mid-point of the quarter, and with the permission of the PI of the newly chosen lab. The student will be held to the assignments/responsibilities (e.g. talks, presentations, write-ups) associated with the new rotation.
- c. Rotation Evaluations: Toward the end of the laboratory rotation, the rotation advisor completes an online evaluation that the student will receive. Students and rotation advisors are encouraged to have an exit interview to go over the evaluation and discuss how the rotation went. This is a valuable opportunity for the student to receive formative feedback. The rotation evaluation is used by the program as one measure of success in the laboratory.
- d. Laboratory Rotation Scientific Poster: At the end of the first rotation (usually fall), students will prepare a scientific poster describing their research project. Instruction on creating scientific posters will be provided towards the end of the fall quarter. A rough draft of the poster in electronic form is due by 11:59 pm on the Friday of exam week for the quarter. Posters are to be submitted to their individual GSTS account under the “Documents” tab. Students will finalize and present their posters during one of the recruiting events in winter quarter. (Students doing a rotation in the summer before their first year may elect to create a poster for their summer or fall rotation.) Students failing to submit by the deadline will receive an incomplete for the NUIN 590 course.

- e. Laboratory Rotation Report: At the end of their second rotation, students will write a scholarly report, 6-8 pages in length, organized as described below. Reports are to be submitted by 11:59 pm on the last day of final exams for the quarter. Reports are to be submitted electronically, one copy to the advisor and one copy to the individual GSTS account under the “Documents” tab. The advisor will communicate his/her assessment of the report to the Assistant Director as part of their evaluation of the rotation student. Students failing to submit by the deadline will receive
- f. Scientific Research Talk: At the end of the third rotation, students will present a research talk to their peers and their research advisor. The research advisor should notify the NUIN Assistant Director or Senior Program coordinator to confirm that this has been completed.
- g. Rotation Report Suggested Elements:
- Title Page. The title of the research project, student’s name, and rotation lab.
 - Abstract. Provide a clear, concise, summary of the research project. Do not exceed a half page.
 - Introduction. Briefly sketch the background to the research project. Indicate the importance of the project to long-term research goals. Include relevant references. Do not exceed 2 pages (not including references).
 - Experimental Design and Methods. Describe the procedures and biological materials used in the project. Clearly indicate the contributions of others currently involved in the project. Do not exceed 2 pages.
 - Results. Describe the results of all experiments. Use tables and figures to present data.
 - Conclusions/Discussion. Discuss interpretation of results, significance of findings, limitations of the procedures, and future research directions. Do not exceed 2 pages.
 - References. List all references cited in the text, including all authors and the full title of the publication.

C. Seminar Requirement

Most good scientists consider it important and valuable to regularly attend seminars and colloquia, even when the topic is not directly related to their own work. It is an effective way to stay up to date with research with which one may not be familiar, and that may be (unexpectedly) relevant to one’s ongoing work. It also provides opportunities to interact with colleagues and guest speakers.

To promote these habits and expose students to research beyond Northwestern, first year students are required to attend a minimum of **6** seminars by non-Northwestern researchers each quarter except summer. To document attendance, students are required to complete a brief, signed statement indicating which seminars they attended (speaker name, institution, title, date) and a 2 to 3 sentence summary or critique of each seminar. The Seminar Attendance form is due by the **end of Friday of the exam week for the quarter and can be submitted electronically via the individual GSTS Documents folder.**

Although compliance will not be tied to a grade, students will not be eligible for NUIN training-grant support or other privileges if they have not complied with the seminar attendance requirement, and will not be admitted to candidacy until missed seminars have been made up.

D. Advising

During the 1st year, students meet quarterly with an Advisory Committee consisting of the NUIN Assistant Director and one member of the Faculty Advising and Progress to Degree Committee. This committee advises students regarding course selection, lab rotations, and helps to identify and address any potential problems. Students need not wait for formal meetings to receive advice and are encouraged to seek out any member of their committee as needed.

E. Selection of Thesis Lab

Thesis labs are selected based on research interests and mentorship, and most importantly, a mutual fit between the advisor, lab and student.

Once the thesis lab has been selected and agreed upon by the student and advisor, students should send an email to the Assistant Director and Senior Program Coordinator stating the choice of thesis lab. NUIN will then send a Thesis Advisor Agreement letter to the thesis advisor outlining the funding structure and program requirements. This letter must be signed by the advisor, department chair and student, and returned to the program. Under this agreement, students are ensured continued financial support throughout the duration of their PhD studies as long as they remain in good academic standing.

F. Individual Development Plans (IDPs)

By the end of the first year of study (as soon as the thesis lab has been selected), students must meet with their advisors to discuss and report an Individual Training Plan (IDP; see Appendix page 23). The IDP is designed to allow the advisor and student to set annual goals towards research progress and career development. The first IDP should be created as soon as a student joins and thesis lab, and must be completed annually thereafter. The IDPs must be submitted to NUIN or uploaded to GSTS no later than the beginning of each academic year.

1.3. Second Year of Study

A. Selection of Concentration area

By the start of the second year, students must choose to concentrate in one of 3 areas:

- Molecular and Developmental Neuroscience
- Cellular Neurophysiology
- Systems and Cognitive Neuroscience

Students should pick their Concentration Area in consultation with their advisors based on the body of information most pertinent to the students' intended research. The Concentration Areas are meant to give depth to the intended area of research, **not** enforce narrowness. This choice dictates which Great Experiments course elective the student must take (*see "Coursework" below) and which Qualifying Exam the student will take.

B. Coursework

In addition to the 4 units of Core/Required courses (e.g. Fundamentals of Neuroscience, Year 1), 2 units of electives must include at least one Great Experiments Course, and one Biostatistics course.

- a. **"Great Experiments" elective:** The Great Experiments courses are intended to provide students with a scholarly experiment-based historical perspective of their chosen

concentration area. Via an in-depth reading of primary literature, students learn about the major ideas, findings, technical advances, and paradigm shifts that propelled the field forward. Students may take more than 1 Great Experiments course, but are required to take the 1 in their chosen area of concentration.

- NUIN 411-1 – Great Experiments in Molecular and Developmental Neuroscience
- NUIN 411-2 – Great Experiments in Cellular Neurophysiology
- NUIN 411-3 – Great Experiments in Systems and Cognitive Neuroscience

b. Biostatistics elective: A **biostatistics** course is required of all students, to be selected in consultation with student's advising committee and with consideration of prior knowledge and thesis research. Courses that may meet this requirement include:

- NUIN 408 – Statistics and Data Analysis for Neuroscience
- PH 302 – Introduction to Biostatistics
- EPI BIO 302 – Introduction to Biostatistics
- EPI BIO 402 – Intermediate Biostatistics
- EPI 421 – Intermediate Biostatistics
- Psych 351 – Advanced Statistics and Experimental Design

At the discretion of the Advising Committee, this requirement may be waived in cases that a student has extensive prior knowledge that is more than sufficient for the anticipated thesis research.

c. Selecting additional electives: In addition to the Biostatistics and Great Experiments courses, students take 3 true electives. These may be chosen from among courses offered through NUIN, the department of the student's advisor, DGP, IBiS, or other departments. Electives should be chosen in consultation with the advisor and/or the Student Advising Committee, but most importantly, should be chosen because they are relevant to the student's thesis research.

d. Registration for "Research": During the first 8 quarters in NUIN, students register for NUIN 590 – Research. The number of units is selectable, and must be chosen to bring the total units taken to 3 (the criterion for full time student status). (MSTPs register for NUIN 590 during each of their first 8 quarters in the graduate school phase. If graduate courses were taken during any Summer quarters during the M1-2 phase, they count toward the total of 8 required 590 quarters.)

C. Teaching Assistantship

Students are expected to serve as a Teaching Assistant (TA) for 2 quarters. (For MSTP students the requirement is 1 quarter.) This requirement is typically completed during the student's second year, although some students TA during their third year. This requirement serves two purposes: it provides the TAs valuable experience and training in teaching, and it provides valuable support to courses, benefitting both instructors and students and generally improving the quality of the educational experience. The TA experience varies greatly, but should provide graduate students with a real teaching opportunity (discussion and review sessions, individual lectures, etc.), and should not be limited to photocopying papers and grading exams.

TA assignments are made during the summer before second year. At that time, NUIN asks rising second year students to rank their preferences from a list of TA opportunities. Assignments are made taking into account student preferences as well as the TA needs that

NUIN is obligated to fill. Most TA-ships are in Biological Sciences (EV) and Neuroscience undergraduate courses (EV), but some exist in NUIN (EV/CH).

Be responsible with your assignment. Keep in mind that this is a job. Prior approval from your PI and from the course instructor is required if you should need to take time away from your TA responsibilities (e.g. to travel to a conference or presentation).

All new TAs should attend a one-day TGS-sponsored workshop for new teaching assistants, offered in September every year.

D. Advising

Second year students meet twice with the Advising Committee. The purpose of these meetings is to ensure that the transition into the thesis lab is going smoothly, to help in selection of remaining electives, to review deadlines for upcoming milestones, and to specifically address any questions or concerns related to the Qualifying Exam and Thesis Proposal.

E. Qualifying Exam

The Qualifying Exams are oral, with two parts: 1) General Knowledge; and 2) Research. Students are graded *Pass* or *No Pass* on each part. Students are notified of their grades shortly after all students within the Concentration Area have finished their exams (typically within 12-24 hours). All students receive detailed feedback from the examination committee within 1-2 weeks after the exam. Students who receive a grade of *No Pass* should use feedback to address the areas of weakness, and are permitted to retake the exam (in whole or part) at a time deemed appropriate by NUIN leadership and the examining committee in consultation with the student and advisor. Typically, retakes are held within 2-5 months of the first exam. **Students failing to pass the exam a second time will be dismissed from NUIN.**

The General Knowledge section of the Qualifying exam tests knowledge and concepts common to all well-educated neuroscientists as well as knowledge and concepts related to each student's chosen Concentration Area. The material is drawn primarily from the Fundamentals first year course sequence and the concentration area's Great Experiments course. Broad study guidelines for each concentration are made available several months in advance of the exam.

The Research section of the Qualifying exam is a chalk talk (i.e., drawing on the board but using no slides or other prepared visual aids) in which each student presents and answers questions about the research they have conducted or will conduct in their thesis laboratory, including the Rationale, Approach, Results, Interpretation, and Significance, regardless of the outcome(s) of the experiments. The purpose of this section is to demonstrate the progress of the student's scientific and experimental reasoning to the Committee. Preliminary data are not required. In many cases, the project presented will develop into a thesis project, but this is not a requirement.

F. Individual Development Plan

The IDP is designed to allow the advisor and student to set annual goals towards research progress and career development. The IDPs must be submitted to NUIN no later than the beginning of each academic year.

1.4. Third year of study

A. Coursework

Beginning with the 9th quarter of study, students register for TGS 500—Advanced Doctoral Study, and possibly elective courses. (TGS 500 has no unit value.) Elective requirements must be completed within twelve quarters. Based on TGS guidelines, NUIN requires all students to have **9 credit units of graded coursework**. Thus, any remaining electives should be taken during the third year.

B. Thesis Committee Selection

Each student, in consultation with her/his advisor, is expected to form a Thesis Committee as soon as possible after passing the Qualifying Exam, and by no later than the end of winter quarter of the third year (or of the G2 year for MSTPs). This is done in consultation with the advisor. **Students are required to meet with the Thesis Committee, either individually or as a group, at least once before the Thesis Proposal is presented.** It is the student's responsibility to enter the Thesis Committee information in CAESAR using the PhD Prospectus form.

A NUIN Thesis Committee must satisfy the following criteria:

- At least 4 core members. Additional members are allowed.
 - At least 3 core members (including the chair and advisor) must be full-time members of the Northwestern Graduate Faculty.
 - A 4th core member is either a member of the Northwestern Graduate Faculty **OR** a scientist with appropriate graduate training experience working outside Northwestern.
- At least 1 of the core members must be from a different department than the research advisor. (A member from outside NU can satisfy this requirement.)
- The research advisor and the committee chairperson must both be NUIN members or preceptors.
- The research advisor cannot be the committee chairperson.

C. Thesis Proposal (Prospectus)

By the end of the third year (G2 year for MSTPs), each student is expected to complete a Thesis Proposal that includes a written document, and an oral presentation of the proposed project to the Thesis Committee. This serves to sharpen the student's focus on specific research goals, enables the student to gain experience in preparing research proposals, and helps to identify weaknesses in the research plan.

Thesis proposal meetings should be scheduled no later than October 31st. In the event of extenuating circumstances, a student may request an extension of this deadline by sending a petition to the Assistant Director. The petition should explain the special circumstances warranting an extension, propose a plan and timeline for completion of the milestone, and be signed by the student and the Thesis Advisor.

- a. **Scheduling the Thesis Proposal Defense:** The written proposal must be submitted to the members of the Thesis Committee **at least 2 weeks before the presentation**. Scheduling of the oral presentation is the responsibility of the student. *Note that the Thesis Proposal is not an examination, but an opportunity for formal feedback from the Committee.*

- b. The Written Thesis Proposal:** The Thesis Proposal should be single-spaced using Arial 11-pt font, on standard size (8 1/2" x 11") paper with 1-inch side, top and bottom margins, between 10-12 pages in length. NUIN suggests guidelines for the Thesis Proposal; however, students should ask their advisor and Thesis Committee for specific requirements, which may deviate from the suggestions below.
- **Title Page:** The proposal title and the student's name, printed on a separate cover page.
 - **Abstract:** A synopsis of the proposed project, including the rationale for the proposed research, a statement of specific aims and objectives, the experimental approaches to be used, and the potential significance of the research. Suggested length: 0.5-1 page.
 - **Specific Aims:** Provide a clear, concise point-by-point summary of the aims of the research proposed. Suggested length: 0.5-1 page.
 - **Background and Significance:** Explain background information necessary to understand the proposed project and its significance in relation to long-term research objectives. This section should include a critical evaluation of existing knowledge and should identify forward progress that the project is intended to provide. Reference this section thoroughly with a focus on primary literature rather than review articles. Suggested length: 3-4 pages.
 - **Preliminary Data.** Succinctly describe preliminary experiments that justify the rationale and/or demonstrate the feasibility of the proposed research. Include figures with legends. Suggested length: 2-3 pages.
 - **Experimental Design and Methods.** Discuss the experimental design and procedures that will be used to accomplish the specific aims of the project. Describe the protocols to be used and provide a tentative sequence or timetable for the investigation. Include the means by which data will be analyzed and interpreted. Describe any new methodology and its advantage(s) over existing methodologies. Discuss potential technical difficulties and/or limitations, limitations in interpretation of the results, and alternative approaches that could be used to achieve the aims. Suggested length: 3-4 pages.
 - **References.** List all references cited in the text, including all authors and the full title of the publication.
- c. Oral Presentation of the Thesis Proposal:** The oral presentation of the thesis proposal should include a formal presentation of the Background and Significance of the project, relevant Preliminary Data, and the major elements of the Experimental Design and Methods. Students should prepare approximately 45 minutes worth of slides, but should expect to answer questions from the committee throughout the presentation, as well as participate in a discussion at the end. Often, this means the meetings last more than 1 hour, and this should be considered when scheduling. These procedures are designed to allow the thesis committee to critically review and offer suggestions to strengthen the proposal.
- d. Submitting the Thesis Committee Meeting Report:** Students should take the [Thesis Committee Meeting Report](#) form with them to the meeting, where it should be completed and signed by all present members, and returned to NUIN offices.

D. Individual Development Plan

The IDP is designed to allow the advisor and student to set annual goals towards research progress and career development. The IDPs must be submitted to NUIN no later than the beginning of each academic year.

1.5. Fourth Year and Beyond

- A. Registration:** Beginning with the 9th quarter of study, students register for TGS 500—Advanced Doctoral Study, and possibly elective courses. (TGS 500 has no units value.) Elective requirements must be completed within twelve quarters.
- B. Advising for Advanced Students:** The NUIN faculty committee for Advising and Progress to Degree exists to “check in” on advanced students and to serve as a resource for advanced students, should problems arise that are most appropriately handled outside of the laboratory or thesis committee environment. Students should feel comfortable approaching any member of this committee should the need arise.
- C. Fourth Year Seminar Requirement:** Sometime during the fourth year, NUIN students are expected to give a public seminar in order to gain practice and experience presenting their research to a larger audience. There are numerous forums on campus where this requirement can be fulfilled. Examples include departmental colloquia, topical campus seminar series, programs associated with NIH T32 Training Programs, and the annual NUIN Retreat. Students should notify the Assistant Director and Program Manager as soon as the seminar is scheduled. *NUIN strongly encourages students to take advantage of opportunities to present their work, many of which will be available prior to the fourth year of studies.*
- D. First Author Publication:** It is a condition of graduation that each NUIN student have at least one first author, peer reviewed journal article published, in press, or accepted for publication. A co-first author publication satisfies this requirement. Students should account for the time required for a manuscript to be reviewed, revised and resubmitted when planning graduation. In fact, students are encouraged to keep this requirement in mind from early in their training and satisfy it well before graduation. The Assistant Director and Senior Program Coordinator should be notified when first author manuscripts are accepted for publication.
- E. Thesis Committee Meetings:** In an effort to help students maintain steady progress toward their PhD following their thesis proposal, NUIN requires that each student meet with his or her Thesis Committee at least once a year. It is the student’s responsibility, in consultation with the thesis advisor and committee Chair, to arrange these meetings. Scheduling committee meetings requires coordination of 3-4 faculty members’ schedules, whose calendars are often booked weeks/months in advance. Thus, it is recommended that students begin scheduling 4-6 weeks in advance of when the meeting should occur.

Students should view these meetings as opportune times to communicate with their committee members, not only about their progress, but also any outstanding questions or difficulties encountered along the way. The collective expertise of the thesis committee is an invaluable resource!

- a. **Thesis Committee Meeting Status Report:** In advance of each committee meeting, including the defense of the Thesis Proposal, the student should complete the first sections of the [Thesis Committee Meeting Report](#) available as a fillable pdf on the NUIN web site. At the meeting the committee, together with the student, should complete the remainder of the report. The report is designed to assess the student's progress since the last meeting, establish clear goals and expectations for the period before the next meeting, and set a target date for the next meeting. All committee members and the student must sign off on the status report, which is returned to the NUIN office. This formal status report serves as a reminder to the student, the thesis advisor, and the thesis committee members that a requirement for continued enrollment in NUIN, including the NUIN guarantee of stipend and tuition support, is "adequate progress toward the degree." The annual committee meetings are an important yearly confirmation that progress is being made, and any concern otherwise should be conveyed to the student at this time. The thesis committee should also notify NUIN if unsatisfactory progress has been made. Insufficient progress, as documented in these meetings, may be reason for dismissal from the program.
- b. **Thesis Committee Meeting—permission to write:** A penultimate Thesis Committee meeting should be scheduled approximately 3 months prior to the intended thesis defense date, in which the committee grants "permission to write" and discusses an appropriate timeline for thesis completion. Alternatively, students may obtain formal permission to write from each of their thesis committee members following one-on-one meetings in which the timeline to completion is discussed.

F. Individual Development Plan

The IDP is designed to allow the advisor and student to set annual goals towards research progress and career development. The IDPs must be submitted to NUIN in the fall quarter (no later than Oct 1) of each academic year.

G. Dissertation and Thesis Defense

The thesis defense is the culmination of a student's work at Northwestern University. Students are required to write a dissertation, which should include:

- A scholarly Introduction to the field and the background/rationale for the specific questions addressed by the thesis research;
- A series of data chapters describing research conducted by the student;
- A final Discussion chapter.

Text and figures from published papers may be included (original or modified) as part of a data chapter under the following conditions:

1) **First author papers** may be included in their original (or modified) form as long as the student wrote and contributed significantly to editing a large majority of the text in the published paper. It is expected that such chapters will have an Introduction and Discussion that are of length and detail expected for a dissertation. If the published paper is limited in length by journal policies, the student should include a supplemental Discussion and/or Introduction linking the chapter to the rest of the dissertation. The thesis should include a statement *signed by the student and thesis advisor* that the student is the primary author of the first author manuscripts that are included as chapters.

2) **Middle author papers** may be included in their original (or modified) form, however, the chapter must include an Introduction and Discussion written by the student that highlights and

focuses on the details and interpretation of experiments conducted by the student.

At the end of the introductory chapter of the dissertation, the student must provide an overview of the data chapters, indicating whether the work is published or unpublished. For published work, the full citation should be included and it should be stated whether the chapter is the published or an edited version. The contributions of the student and other authors to the scientific (design, experiments, analysis) and written work must be clearly stated. If edits have been made, the nature of the modifications (e.g. incorporation of published supplemental figures into the body of the narrative, inclusion of additional relevant data acquired after publication, expansion of intro or discussion, etc.) should be stated. For unpublished work, the contributions of the student and any other individuals to the scientific work (design, experiments, analysis) must be stated.

Overall, it is expected that the dissertation will include details and scholarly discussions that may go above and beyond what one might find in typical journal articles (e.g. related experiments that were beyond the scope of the paper, or additional experimental details that were omitted due to space constraints). *It is the responsibility of the student and the thesis committee to ensure that the dissertation meets NUIN standards and properly attributes authorship.*

A draft of the thesis should be submitted to the thesis advisor with sufficient time for the advisor to evaluate it before distribution to the Thesis committee. Students may not distribute their thesis to their committee until the thesis advisor provisionally approves it. Once the advisor approves the thesis, it then should be submitted to the Thesis committee at least 2 weeks before the scheduled private defense date. Thesis committee members must agree before the defense that the thesis is at a level worth defending. If any committee member has a serious and justifiable objection to the thesis as written, the committee member will make his/her concerns known to the thesis advisor, student, and NUIN Director, and the thesis defense must be rescheduled.

- a. **Thesis Defense:** Once the committee members agree that the thesis is of acceptable quality, the private Thesis Defense should be completed as scheduled.
- b. **Public Seminar:** Upon successful completion of the private thesis defense, the student will schedule a public seminar. Students should notify NUIN (Assistant Director and Senior Program Coordinator) once the public seminar is scheduled so that it can be distributed to the NUIN listserv. The public seminar should not be advertised until the private defense has been passed.

Both the public seminar and any revisions that are agreed upon as reasonable by the Thesis committee must be completed successfully before the Ph.D.-granting documents are signed by all Thesis committee members. Students are strongly encouraged to engage in regular communication with their committee members. In the rare circumstance that a consensus cannot be reached regarding necessary revisions, a student or thesis advisor may appeal a Thesis committee's recommendations to the NUIN Director. Final submission of the written document must conform to any requirements of The Graduate School.

2. Academic Progress

Academic Progress is assessed after each quarter. Students failing to make satisfactory academic progress will receive written notice from NUIN or The Graduate School and be placed on probation. In conjunction with the student's advisor, advising committee, and/or thesis committee, as appropriate, a plan and timeline will be developed to reestablish good standing. A failure to meet these conditions may result in dismissal from the program.

Students must be making satisfactory academic progress in order to remain in good standing in NUIN and The Graduate School (TGS). All graduate students must satisfy The Graduate School's criteria for satisfactory academic progress.

2.1. Overview of NUIN's Criteria for Satisfactory Academic Progress

- Maintain a GPA of at least 3.0. (This is also a Graduate School requirement.)
- Earn a grade of B– or higher in each of the NUIN required core courses
- Earn a grade of B– or higher in one of the Great Experiments course electives
- Successfully complete 3 laboratory rotations
- Meet NUIN's milestone deadlines
- Make satisfactory progress on thesis research as determined by a student's advisor and thesis committee.

2.2. Failure to Make Satisfactory Academic Progress

A. Grounds for Probation:

- a. **Unsatisfactory GPA:** Students are required by NUIN and TGS to maintain a GPA of 3.0 or higher. If a student's GPA drops below 3.0, early in the subsequent quarter s/he will be notified in writing and placed on probation. The student will have 3 quarters in which to reach the GPA criterion and return from probation. Students who do not successfully remediate their GPA within the allotted timeframe will be excluded from NUIN, unless a petition for probation extension is requested and approved.
- b. **Unsatisfactory grade in NUIN required core courses:** Students must earn a grade of B– or higher in NUIN's required courses (e.g. the Fundamentals series). Courses in which the grade earned was below B– will not count toward fulfilling NUIN's coursework requirement. Per Northwestern policy, however, grades in *all* courses contribute to the GPA calculation.

Students earning a grade below B– in a NUIN **core** course must retake the course and are formally considered to be on probation until the course is passed. Students who do not earn at least a B– in the second attempt will be excluded from NUIN at the end of the quarter.

If a grade below B– is earned in an **elective** course, the student may retake the course or replace it with another elective, including Great Experiments courses. A low grade in an elective will not automatically result in probation.

- c. Incompletely fulfilling coursework and lab rotation requirements
 - Students failing to submit a **Laboratory Rotation Scientific Poster** by the deadline will receive an incomplete for the NUIN 590 course.
 - Students failing to submit a **Laboratory Rotation Report** by the specified deadline will receive an incomplete for the NUIN 590 course.
 - Although compliance will not be tied to a grade, students will not be eligible for NUIN training-grant support if they have not complied with the **Seminar Attendance Requirements**, and will not be admitted to candidacy until missed seminars have been made up.
 - Students who have 3 or more "Incompletes" will be placed on probation.

- d. Unsatisfactory completion of laboratory rotations/Inability to Secure a thesis lab:** Students are required to satisfactorily complete at least 3 laboratory research rotations, a process expected to culminate in the student joining a laboratory to conduct thesis research. NUIN works closely with students to help them succeed in finding prospective laboratories, but completing laboratory rotations and finding a thesis lab is ultimately the student's responsibility.

Students who fail to find a laboratory after 5 quarters, or who receive 2 grades of "No Pass" in the NUIN 590 course associated with laboratory rotations, may be excluded from NUIN.

- e. Failure to meet NUIN's major milestone deadlines:**

- **NUIN Qualifying Exam:** Students who receive a grade of "No Pass" on the **Qualifying Exam** will receive feedback on areas of weakness, and will be permitted to retake the exam. Students who fail to pass the exam a second time will be dismissed from NUIN.
- **Thesis Proposal:** Students who do not form their Thesis Committee or complete the Thesis Proposal Defense by the respective deadlines will be notified and immediately placed on probation.

With the exception of the Qualifying Exam, students have 1 additional quarter in which to complete the requirement or else risk exclusion from NUIN. Students who feel there are compelling circumstances that warrant an extension of milestone deadlines may petition the NUIN Advisory Board ***well in advance of the deadline***.

- f. Unsatisfactory progress on thesis research:** Students should seek frequent and regular feedback from their thesis advisor and are required to meet with their Thesis Committee at least once every twelve months – more frequently if the committee requires. If a student is deemed to be making unsatisfactory progress, the advisor or Thesis Committee Chair will notify the NUIN Assistant Director. In conjunction with the student's advisor, Thesis Committee, and NUIN Advising and Progress to Degree Committee, a plan with well-defined expectations and deadlines will be developed for reestablishing good standing. The student will receive written notice of the plan and be placed on probation. A failure to satisfy the conditions for reestablishing good standing within the specified period of probation is grounds for exclusion from the program.

Students are expected to complete their PhD work in a timely manner. Consequently, as a student approaches the end of his or her thesis work it is especially important for the student, advisor, and Thesis Committee to agree in writing on a timeline for finishing. If the completion deadline is not met, and had been established at least 6 months in advance, the advisor and thesis committee may recommend to the NUIN Advisory Board that the student be placed on probation 1 additional quarter. A student who still has not completed all PhD requirements by the end of the probation quarter may, with the consent of their advisor and Thesis Committee, continue working toward their degree, but funding is at the discretion of the advisor.

B. Remediation from Probation

A student who is not making satisfactory academic progress will be notified in writing of the reason and placed on ***probation*** for a specified period of time, the length of which depends on the reason for probation. During the probation period, funding is continued. Students failing to return to good standing within the specified period of time may lose funding, or be dismissed

from NUIN in a process formally known as **exclusion**. Instances of probation become part of a student's permanent NUIN record. Under some circumstances, students may wish to petition for a probation extension. Those who wish to do so must notify NUIN's Assistant Director and either Academic or Thesis Advisor, and should proceed further according to TGS' policy.

C. Disruptive Behavior

NUIN students are expected to be professional, self-motivated, engaged and responsive to their advisors and to NUIN administration. Furthermore, students are required to conduct research in accordance with [health and safety regulations](#) and [ethical standards](#) as outlined by Northwestern University and the Responsible Conduct of Research course (NUIN 490).

NUIN students are also subject to the code of conduct detailed in the [Northwestern University Student Handbook](#).

Any behavior that disrupts the University community should be reported to NUIN Administration and/or TGS in confidence. These cases, which may be grounds for dismissal, will be referred to the appropriate University officials. Should the student be perceived to act in a manner that is disruptive to normal lab functions, the advisor should request a meeting of the student, advisor and NUIN administration to discuss ways to remedy the problem. Other University support staff (e.g. TGS Student Services) may be included as appropriate. If the behavior is not corrected in a timely manner (set during the meeting), the advisor will notify the NUIN Director in writing detailing the continued disruptive behavior and petitioning for permission to dismiss the student from the lab. Students who are dismissed from their thesis lab may petition the NUIN Advisory Board to find a new thesis lab. If approved, the student will be granted 1 month to find a new thesis lab. Failure to do so within this time frame will result in dismissal.

D. NUIN Annual Status Reports

At the end of each academic year, each student will receive an Annual Status Report from NUIN administration. These reports will serve to notify students of their current status in the program as:

- Satisfactory progress
- Unsatisfactory progress
 - Risk of probation
 - Probation
 - Risk of dismissal

Annual Status Reports will be generated based on Academic Advising (1st year students), GPAs and IDPs (2nd year and beyond students). Students who are notified of "Unsatisfactory Progress" will be expected to meet with their advisor and the NUIN Assistant Director to come up with a detailed plan of remediation.

3. Related and Dual Degrees

3.1. Medical Scientists Training Program (MSTP)

A. Coursework

For the courses taken in the M1 and M2 years, NUIN will give credit for 5 of the required 9 units of graded coursework. That means MSTP students **must take at least 4 graded courses**, fewer if they happened to take one or more during the M1-2 years. 2 of these courses must include:

- Great Experiments (NUIN 411-1, -2, or -3): The Great Experiments courses are particularly relevant for each of the concentration areas, which form the basis for graduate study. Moreover, each Great Experiments Course provides important material for the Qualifying Exam.
- Biostatistics: Students choose an appropriate biostatistics course based on the type of research they are doing. Students who already have a strong grounding in statistics appropriate for their research may receive permission to take an elective instead.
- The remaining courses will be electives relevant to your research and interests. They can be NUIN courses, or appropriate courses in other programs/departments.

Although MSTP students are not required to take any of the NUIN Fundamentals of Neuroscience courses (NUIN 401-1,2,3), much of the material on the NUIN qualifying exams is drawn from these courses. Although MSTP students are given credit for a number of their medical school courses, these courses do not provide the same breadth or depth of neuroscience training as the NUIN Fundamentals courses. This can create gaps in knowledge that are uncovered during the Qualifying Exam. Therefore, **we strongly encourage MSTP students to take one or more of the Fundamentals courses**. These count toward the NUIN coursework requirements. At a minimum, MSTP students should review the NUIN Fundamentals course syllabi to identify what material for which they are responsible.

Responsible Conduct of Research (RCR)

All NUIN students, including MSTP students, are required to take NUIN 490, the Responsible Conduct of Research. You should plan to take it during your G1 year. Note that this is a 0 unit course and does not count towards the 9 units of required coursework.

B. Registration

In addition to any graded courses, you will register for NUIN 590 (Research) during the first 8 quarters of your graduate work. (This number is reduced by the number of quarters you may have registered for NUIN 590 during M1-2 years.) The number of 590 units is selectable in CAESAR, chosen such that the TOTAL number of units registered in a quarter is 3-4. After completing 8 quarters of NUIN 590 registration, in subsequent quarters, you register for TGS 500 instead, usually until graduation.

C. TA Requirement

MSTP students in NUIN are required to TA for 1 quarter during their G1-2 years. Teaching assignments are determined by the NUIN Assistant Director in conjunction with course directors. MSTP students may be assigned to teach typical undergraduate / graduate courses, but may also be given the option to TA a medical school course (e.g. Neuroanatomy). If an MSTP student wishes to fulfill the NUIN TA requirement by teaching in a medical school

course, s/he must be granted approval to do so by the NUIN Assistant Director three months prior to the start of the fall quarter.

D. Qualifying Exam

MSTP students are expected to take the Qualifying Exam at the very end of the G1 year, with the NUIN students who are finishing up their second year. Each concentration area runs its own exam, which is entirely oral. Details about the Qualifying Exam are outlined in the Year 2 section above (Page 10).

E. Student Advising

NUIN first and second year students meet with a faculty advisor and NUIN Assistant Director 6 times during the first 2 years. MSTP students will be included in this process, at least for the first few meetings, to insure that students are on track.

F. Thesis Committee Meetings and Thesis Proposal

MSTP students are required to form their Thesis Committees by the end of winter quarter of their G2 year. MSTP students are required to defend their Thesis Proposals by the end of their G2 year. Student and committee must complete a Thesis Committee Meeting Status Report and submit it to the NUIN office after each meeting. See Appendix page 23, or here: [Thesis Committee Status Report](#).

3.2. Master's Policy

In rare circumstances, a NUIN student and/or their advisor may reach the conclusion that a student will not continue in the NUIN program to earn a PhD. In cases in which all of the following criteria are met, the student may petition the NUIN Advisory Board for permission to pursue a Master of Science degree.

A. Criteria for petition to pursue a NUIN Master of Science degree:

- The student must have spent at least 2 years in the NUIN program, completed 9 credits of approved coursework, and be in good academic standing.
- The student must have passed both the General Knowledge and Research sections of the NUIN Qualifying Exam.
- The student must have completed a sufficient body of independent research to compose and defend a research-based Master's thesis before a committee of faculty (details below).

B. Procedure for petition to pursue a NUIN Master of Science degree:

If all of the criteria above have been met, the student and advisor should compose a letter to the NUIN Advisory Board providing details of the student's academic history at Northwestern including coursework and Qualifying Exam results, a succinct description of the student's independent research accomplishments on which the thesis will be based, and a detailed plan for completion of the Master's degree. The plan for completion of a Master's degree should include names of faculty who have agreed to serve on the student's Master's thesis committee, a timeline for completion of the thesis, and evidence of the advisor's commitment to mentor the student and assume responsibility for progress, successful completion, and defense of a written thesis. The source of financial support, if any, for the student during this period should also be addressed. If the student has already formed a thesis committee, written support from thesis committee members should also be provided. The Master's thesis committee should be composed of at least 3 faculty members (in addition to the advisor), including at least one from

a department other than the advisor's home department. Both student and advisor must sign the petition letter.

C. Procedure for completing a NUIN Master's degree:

If permission to pursue a Master's degree is granted by the NUIN Advisory Board, the student must complete and successfully defend a written Master's thesis within the timeframe specified in the letter to the Advisory Board. To ensure that the scope of the research to be included in the thesis is appropriate, the student must present a thesis proposal to their committee and obtain written approval of the proposal. The thesis proposal should be a 2-5 page document composed by the student outlining the scientific rationale for the project and the experiments to be included in the thesis. Once the proposal is approved by all thesis committee members, the student may proceed with any remaining work on the project and complete the thesis document. The thesis itself should include an Introduction chapter explaining the background/rationale for the specific questions addressed by the thesis research, at least one Data chapter describing research conducted by the student, and a final Discussion chapter. The thesis must be written by the student and provisionally approved by the advisor before submission to the committee, at least 2 weeks in advance of the scheduled defense.

The thesis defense must be attended by the student, the advisor, and all committee members and will consist of a presentation by the student of the background and experiments contained within the thesis and a rigorous discussion of the presented research. Students should be aware that revisions may be required by the thesis committee and time to complete revisions and/or defend the thesis a second time should be taken into consideration when scheduling the defense. The student should bring to the defense a hard copy of the Master's Degree Completion form (from CAESAR) and submit the signed form to the NUIN office once all committee members approve the thesis and its defense. The student should submit a final electronic version of the thesis to NUIN.

Note that permission to pursue a Master's degree will not be granted under the following conditions:

- For research that is not already substantially complete
- For an extensive literature review
- For premature departure from the program without independent research accomplishments
- For time spent in the NUIN program

3.3. Transfers

In some cases, students join NUIN with credit from graduate level courses taken prior to matriculation. TGS does not allow transfer credits. Therefore, all students must meet the 9-unit requirement set by the program and TGS. In some cases, students may be exempt from certain NUIN coursework requirements if their graduate level transcripts show mastery of overlapping topics (e.g. biostatistics). These exemptions must be petitioned for and approved during quarterly Advising Meetings during the first year of study. If approved, students must find other electives to fulfill the 9-unit requirement.

3.4. Vacation Policy

All vacation or absences should be cleared with the PI or other designated supervisor prior to the absence. The longer the intended absence, the further in advance you should receive approval. NUIN students are paid throughout the year, so time off and absences should be approved in an appropriate and timely manner.

4. Financial Matters

Entering NUIN students receive a University Fellowship and are fully supported (including tuition, stipend, and health insurance) during their first year. The expectation is that all NUIN students in good standing will continue to receive full support for the duration of their graduate studies. The NUIN stipend for 2019-20 is \$32,844. First year students also receive \$1,000 for moving expenses.

4.1. Tuition:

All NUIN students are fully supported by a University Fellowship during their first year, including the summer quarter. Students typically join a laboratory in the latter portion of their first year, but the advisor bears no financial responsibility during the first year. NUIN students also receive support from a Graduate Assistantship during fall and winter quarters of their second year. Students become the full responsibility of their advisor beginning spring quarter of their second year. The advisor assumes full responsibility for ensuring that NUIN students are fully supported until the completion of all PhD requirements. This information will be outlined in the “New Advisor” letter, which is sent to the student, advisor, and department chair upon selection of the Thesis lab.

4.2. Stipend:

In 2019-20, the stipend for NUIN students is \$32,844. NUIN takes seriously the commitment to provide its students with the full NUIN level stipend. Exceptions are made only if a student fails to be making satisfactory academic progress. In these cases, students will be notified well in advance of stipend suspension.

4.3. Benefits:

Northwestern requires all full-time students to maintain health insurance coverage. Full-time students may either enroll in the NU Insurance Plan or use private health insurance. Northwestern also offers health insurance to spouses, children, and same sex domestic partners through the NU/Aetna plan. Optional Dental insurance is also available.

4.4. Taxes

In your status as a University Fellow your first year, taxes will NOT automatically be withheld from your stipend check. This does not mean that you will not owe taxes on this income; it just means that taxes are not automatically withheld. As such, you may wish to fill out a W-4 form to get some money withheld each month. NOTE: It is not enough to put on the form the number of dependents (like you normally would for a job); you actually have to specify an amount on the form. A typical amount would be approximately 12% for federal taxes and 3% for state taxes, but this amount will vary based on your personal financial situation. If you have questions you can contact payroll or review the TGS [financial information page](#):

Be aware that your payroll status will change (typically as early as start of year 2) if and when you are paid as a Graduate Assistant or Research Assistant. In those cases taxes will automatically be withheld and you should modify your W-4.

Reminder: If you are coming from a state outside of Illinois, you will likely have to file taxes in 2 states as a first year student.

For international students, please see tax information from the Northwestern [International Office](#).

5. Appendix

5.1. People and Places

Dr. Geoffrey Swanson , Director	NUIN_DIR@northwestern.edu
Dr. Thomas Bozza , Associate Director	bozza@northwestern.edu
Dr. Jena Pitman , Assistant Director	jpl@northwestern.edu
Dr. Cassandra VanDunk , Manager of Training and Program Development	cassandra.vandunk@northwestern.edu
Marisa Davis , Senior Program Coordinator	marisa.davis@northwestern.edu
Asta Stekovic , Program Accounting Specialist	NUIN_Finance@northwestern.edu
Alexus Diaz , NUIN Program Assistant	NUIN@northwestern.edu

5.2. Northwestern University Resources

Center for Public Safety	https://sps.northwestern.edu/center-for-public-safety/	800-323-4011
Center for Student Involvement	http://www.northwestern.edu/studentaffairs/csi/	847-491-2350
Collaborative Learning and Integrated Mentoring in the Biosciences (CLIMB)	http://www.northwestern.edu/climb/index.html	312-503-8286
Counseling and Psychological Services (CAPS)	http://www.northwestern.edu/counseling/	847-491-2151
Intercampus Shuttle	http://www.northwestern.edu/userservices/transportation/shuttles/	312-503-8129
International Office	http://www.northwestern.edu/international/	847-491-5613
Northwestern Academic Calendar	http://www.registrar.northwestern.edu/calendars/	
Office for Research Safety	https://researchsafety.northwestern.edu/	847-491-5581 312-503-8300
Office of the Registrar	http://www.registrar.northwestern.edu/	847-491-5234
Parking	http://www.northwestern.edu/up/parking/	847-491-3319 312-503-1103
Students with Disabilities (AccessibleNU)	https://www.northwestern.edu/accessiblenu/	847-467-5530
Student Health Services: CH	http://www-chicago.nuhs.northwestern.edu/	312-695-8134
Student Health Services: EV	http://www.nuhs.northwestern.edu/evanston/default.aspx	847-491-8100
The Graduate School	http://www.tgs.northwestern.edu/	847-491-5279
Graduate Student Tracking System	http://gsts.northwestern.edu/	

5.3. Forms

- A. [Rotation Advisor Agreement](#)
- B. [Seminar Attendance Form](#)
- C. [Thesis Committee Meeting Report](#)

5.4. [Northwestern 2019-20 Academic Calendar](#)

5.5. Individual Development Plans (IDP)

IDPs are designed to provide 1) a planning process to allow trainees to outline research goals and career development needs, and 2) a forum for trainees and mentors to discuss progress, effort and support towards these goals. Of note, NIH has made the IDP a requirement for any trainee supported by a NIH award. Furthermore, the IDP will inform NUIN's required annual assessment of good standing sent to students, advisors and TGS.

NUIN has tailored a 3-part IDP to outline the following:

1. Progress during the last year: includes progress towards coursework, research and career development. This section should be completed by the student and evaluated by the advisor.
2. Goals for this Year: outlines coursework, research and career development goals and should be completed jointly with student and advisor.
3. Summary of Progress towards Degree Completion: this section is a summary of NUIN requirements and milestones. Students should indicate which have been completed; an estimated date of completion should be discussed between the student and advisor for those that remain incomplete.

NUIN requires IDPs to be completed annually. We feel strongly that students and advisors will mutually benefit from completing and discussing the IDPs. As stated above, the forms will also be used to assess each student's status as they work towards the completion of their PhD, and will guide reporting in the Annual Status Reports sent to students, advisors and TGS.

5.6. Course Schedule and Descriptions:

The course schedule is subject to change. For an up-to-date list of NUIN courses and an up-to-date course listing, please see the [NUIN website](#).

NUIN 401-1,2,3 Fundamentals of Neuroscience (Gallio, Ma, DeCaen, Bozza, Baker, Kahnt)

(2 units Fall quarter, 1 unit Winter/Spring quarter; offered every year; required for NUIN students)

This 3 quarter long course sequence introduces students to a wide array of topics in neuroscience, spanning molecules to behavior. Fall quarter focuses on neurogenetics/cell biology and neural development/signaling pathways; Winter focuses on cellular neurophysiology and sensory transduction and processing; and Spring covers topics in motor systems and cognitive neuroscience.

NUIN 408: Statistics and Data Analysis for Neuroscience (Acosta, Heckman, Schwartz, Solla)

(1 unit; offered every year)

The goal of this elective is to provide students with basic training in experimental design and in quantitative methods used to analyze many kinds of data obtained with a variety of techniques. The course will be divided into 3 components focusing on Probability and Statistics, Linear Systems, and Signal Analysis. Examples will be drawn from a range of research areas from molecular to cellular to systems level neuroscience.

NUIN 411-1 Great Experiments in Molecular & Developmental Neuroscience (Garcia-Añoveros)

(1 unit; offered every year)

This course fulfills the Great Experiments Course requirement for second year graduate students in the

Northwestern University Interdepartmental Neuroscience program concentrating in Molecular and Developmental Neuroscience. The general aim of the course is to fill the informational and intellectual gap in the current formal curriculum between the basic overview of this topic provided by the first-year core course (NUIN 401) and the highly focused, often recent material covered in special topics courses taken as electives. In this course, students will read and discuss classic papers that generated concepts that form the basis for our understanding of development, function and diseases of the nervous system at the molecular/genetic level.

NUIN 411-2 Great Experiments in Cellular Neurophysiology (Raman)

(1 unit; offered every year)

This course fulfills the Great Experiments Course requirement for second year graduate students in the Northwestern University Interdepartmental Neuroscience program concentrating in Cellular Neurophysiology. The general aim of the course is to fill the informational and intellectual gap in the current formal curriculum between the basic overview of cellular neurophysiology and biophysics provided by the first-year core course (NUIN 401) and the highly focused, often recent material covered in special topics courses taken as electives. In this course, students will read and will be guided through written problem sets (before class) and discussions (within class) of a series of classic papers in cellular neuroscience.

NUIN 411-3 Great Experiments in Systems & Cognitive Neuroscience (Kozorovitskiy, Dombeck)

(1 unit; offered every year)

This course fulfills the Great Experiments Course requirement for second year graduate students in the Northwestern University Interdepartmental Neuroscience program concentrating in Systems and Cognitive Neuroscience. The general aim of the course is to fill the gap between the basic overview of Systems and Cognitive Neuroscience provided by the first-year core course (NUIN 401) and the highly focused, often recent material covered in special topics courses taken as electives. Students will read a series of classic papers in systems and cognitive Neuroscience.

NUIN 417 Neurodegeneration: Alzheimer's disease as a case study (Klein)

(1 unit; offered every year)

This discussion course considers neuroscience research into the cause and treatment of Alzheimer's disease. AD is the greatest cause of dementia and is being intensively investigated. The odds of getting the disease are 1 in 5 for a woman, 1 in 8 for a man. Presently AD has no effective therapeutics and lacks clear-cut diagnostics. Progress in discovering disease mechanisms, however, is exciting, and it illustrates the importance of understanding fundamental neuroscience. Topics germane to AD that can be considered over the quarter include neuropathology; human genetics; structural biology; transgenic modeling; synapse morphology and function; plasticity and memory; brain cell biology and signaling mechanisms; epigenetics; brain imaging; nanotechnology; vaccine development; drug discovery; and gene therapy. Overall, AD provides a case study for other neurological disorders, and its mechanisms appear relevant to Parkinson's, prionoses, Huntington's, traumatic brain injury, stroke, mental retardation and other conditions. Beyond dealing with the cause, diagnosis, and treatment of AD, the course is designed for students to practice and improve skills in presentation, organization of facts, writing, and grantsmanship.

NUIN 424: Sensory Transduction and Early Visual Processing (DeVries, Schwartz)

(1 unit; offered every year)

This course focuses on the first stages of the reception and processing of sensory information in the nervous system. While we will survey the mechanosensory, olfactory, and auditory systems in 1 class each, we will go into greater depth in our coverage of the early visual system. Each three-hour session will be lead by an expert in the field. We will begin with a brief introduction to the topic, and the rest of the time will be spent on a detailed discussion of 2-4 papers from the primary literature, a mixture of classics and modern advances. Participation is required, and students will be evaluated based on demonstrating a critical understanding of the assigned papers.

NUIN 433 Neurobiology of Disease (DiDonato, Opal, Ozdinler, Stegh)

(1 unit; offered alternate years)

This is a survey course aiming to orient graduate students in Neuroscience or related disciplines to important neurological diseases and general aspects of related research. For every session, a neurological clinician

presents an hour of material aimed at oriented the students to the disease process in question (for example, multiple sclerosis), which is followed by a second lecture given by a basic scientist focused on a relatively narrow research question. Papers are discussed in a second session related to the research question. The examination consists of writing a small NIH-style grant on a neuroscience research question.

NUIN 438 Molecular and Cellular Aspects of Motor Neuron Biology (Ozdinler)

(1 unit; offered alternate years)

The goal of this course is to convey the new information and the recent knowledge generated about motor neuron biology to students, who are interested in movement, movement disorders, motor neuron diseases, and cell biology in general.

NUIN 440 Advanced Neuroanatomy (Baker, Perkins)

(1 unit; offered every year)

Designed to provide a fundamental understanding of neuroanatomy, this course considers the nervous system from both structural and functional perspectives, resulting in an integrated view of the brain. In addition to lectures and demonstrations, half the time is devoted to laboratory exercises in which students view histological sections and participate in the dissection of a human brain. This course extends over only 7 weeks of the quarter.

NUIN 441 Biophysical Signal Processing for Movement And Rehabilitation Sciences (Acosta)

(1 unit; offered alternate years)

Students in this course learn how to collect and analyze kinematic, kinetic and electrophysiological data associated with the neuromusculoskeletal system. Emphasis is on understanding and implementing time and frequency domain signal processing methods important for analyzing movement data. Students develop and implement the signal processing tools using Matlab. This course is not intended for engineering graduate students to replace complete courses in signal processing.

NUIN 442 Issues In Movement And Rehabilitation Science (Dewald, Tysseling)

(1 unit; offered alternate years)

This course emphasizes literature on contemporary issues pertaining to key principles and models in the field of movement and rehabilitation science. In the first half of the course, theoretical, biological, physical, behavioral, and computational approaches to understanding the control of movement in the context of rehabilitation are explored. These building blocks are then applied to analysis of common disorders of movement control and contemporary and evolving therapeutic approaches used in rehabilitation. Topics include stroke, spinal cord injury, Parkinson's disease and movement disorders, cerebellar disease, cerebral palsy, sensory disorders, aging, and muscle and joint pathologies.

NUIN 455 Instrumentation for Neuroscience (Baker)

(1 unit; offered every year)

This is a practical course in electronics and mechanical instrumentation ranging from Ohm's law, power supplies, and fasteners, to machining, microprocessors, and computers. We cover the basics of instrumentation theory, design, construction, use, repair, and safety. We emphasize basic machine shop practices and basic to intermediate level applications of active electronics devices (integrated circuits or ICs). No prior knowledge is required

NUIN 470 Cellular and Molecular Basis of Information Storage (Contractor)

(1 unit; offered alternate years)

A literature-based course focusing on the cellular and molecular mechanisms by which information is stored in the nervous system. A theoretical and historical review will review contributions of Cajal and Hebb, among others. Consideration of how synapses change will review mechanisms of long term potentiation and dendritic excitability; and studies of learning and synaptic plasticity using electron microscopy, 2 photon confocal microscopy and Golgi neuronal imaging techniques. Progress in understanding how memory for space (including place cells), associations and fear is formed will be reviewed. Finally, the relation of genes to synapses and memory will be considered in the context of transgenic and gene knockout studies in mammals and invertebrates.

NUIN 473 Mechanisms of Aging and Dementia (Disterhoft, Vassar)

(1 unit; offered alternate years)

This course is designed to familiarize the student with aging and age-related dementias such as Alzheimer's disease, Frontal lobe dementias and Parkinson's Disease. Lectures will be given on incidence, diagnostics, and mechanisms studied in cell and animal models and in humans. Sessions will be 2 hours long – the first hour will be in a lecture format; the second will involve student-led discussions of papers relevant to the lecture topic. Student presentations of current literature and class participation will determine a portion of the grade; the balance will depend on a written and oral presentation to the class of a research proposal relevant to topics covered during the course.

NUIN 480 – Neural Control of Movement (L. Miller)

(1 unit; offered alternate years)

This class is intended to be primarily a discussion of the classic and current literature related to the brain's control of movement. Students will be expected to read 3-4 assigned papers per week, a combination of classic and new studies. The readings will be made available on the blackboard system. The instructor will introduce each theme or set of papers in the class session on Monday. The class will discuss the papers on Friday. The student leading the discussion will be expected to present some material from at least 2 additional papers, which must be discussed with the instructor by Wednesday. You should prepare a 1-page handout summarizing the main points to be covered in the paper, and a couple critical figures from the other papers you've found. Any student who is not presenting a given paper will be expected to e-mail several discussion questions to the presenter and instructor by Thursday. Grading will be based on the quality of the presentation, overall class participation, and a short (3000-4000 words) paper due at the end of the quarter. The paper should synthesize material from 2 of the Friday sessions. The class will assume a good background in the anatomy and physiology of the motor systems.

NUIN 481 Neural Mechanisms of Pain (Apkarian)

(1 unit; offered alternate years)

Different aspects of pain research, including inflammation, peripheral, spinal cord, brainstem, thalamus and cortical circuits for acute and chronic pain mechanisms are covered. Application of genetic, molecular, electrophysiological, and human brain imaging approaches to unravel mechanisms of pain and analgesia are explored.

NUIN 486 – The Biology of Sleep (Allada)

(1 unit; offered alternate years)

This course is a literature-based seminar course that deals with genetic, physiological, pharmacological, and behavioral approaches to sleep, with particular emphasis on the role that genes play in regulating sleep.

NUIN 490 Responsible Conduct in Neuroscience Research (Pitman-Leung)

(0 unit; offered every year)

Through a combination of lecture and discussion, students will explore the ethical dimensions of biomedical research. Emphasis will be on practicing skills in moral reasoning and identifying relevant institutional, professional, and governmental regulations and guidelines. Ethical issues special to or unique to neuroscience will be presented by student groups.

NUIN 590 – Research (Davis)

Students register for 1-3 units per quarter until accumulating 9 quarters of residency in the NUIN program.

Signature Page

I _____, certify I have reviewed the 2019-20 NUIN Handbook and understand that I can consult the NUIN directorate at any time with questions.

Signature, Date