UNIVERSITY OF WASHINGTON

The Graduate Program in Neurobiology & Behavior
Program Requirements – Autumn 2007

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Introduction

The goal of the Graduate Program in Neurobiology & Behavior is to produce the best Neuroscientists possible. The breath of our faculty allow us to provide interdisciplinary training drawing from a cornucopia of topics, techniques and perspectives, including neuroanatomy, biochemistry, molecular biology, physiology, biophysics, pharmacology, computational modeling and behavior. A graduate of our program will be well versed in the Neurosciences, scholarly, and equipped to pursue a variety of career paths.

Curriculum

Core Sequence. During the first year students take a three-quarter sequence of graduate level courses that provide exposure to the core set of principles of neuroscience. The three courses (NEUBEH 501, 502, & 503) cover topics in cellular neurophysiology, cellular and molecular neurobiology, developmental neurobiology, neuroanatomy, neuropharmacology, systems neuroscience, cognition and behavior. In the Autumn quarter, students take two 5-week courses which complement the material in NEUBEH 501. These courses (CONJ 531 & CONJ 532) provide wider exposure to topics in cell physiology, synaptic transmission, and signal transduction mechanisms. NEUBEH 502 and 503, required in Winter and Spring quarters, respectively, provide a mixture of survey and in-depth focus on topics in systems neuroscience. Quantitative approaches to neurobiology are highlighted in courses on computational neuroscience (NEUBEH 528), mathematical tools for neuroscience (NEUBEH 545) and in-depth membrane biophysics (NEUBEH 532).

Electives. Students typically round out their course work with electives in areas of interest. Students must complete electives totaling at least 10 credits. The list of potential courses is quite large as new electives are offered each year. Please consult the Program's Elective Course List for an up-to-date listing. In addition, students may petition the Directors to receive credit for courses that are not part of the pre-approved list, but are deemed important for the student's dissertation project. Director approval for any elective not on the list is required *before* the student enrolls in the course. Students may also petition for credit for courses taken at other institutions while enrolled in the program, such as summer courses at Cold Spring Harbor or Woods Hole. Electives may be taken for a grade or on a pass/fail basis.

Journal Club/Seminar Series. First and second year students are required to participate in a weekly Program-wide journal club (NEUBEH 527) with presentations by both students and faculty in the Program. Students receive credit for this course during their first two years, but are encouraged to attend throughout the remainder of their graduate careers. All students are expected to attend the Program seminar series (NEUBEH 510) throughout their graduate careers.

Lab Rotations. During the first year, students are required to complete three one-quarter laboratory rotations (NEUBEH 526). At the end of each rotation, students submit an abstract and deliver a short oral presentation describing their work. The rotation advisor will provide a written evaluation of the student's performance. Students should contact the Program Office at the beginning of each quarter with the name of their rotation advisor. All students in the Program are expected to attend the quarterly rotation talks.

N&B Program Requirements – Autumn 2007

Required Graduate Student Courses

NEUBEH 501: Introduction to Neurobiology: Molecular & Cellular Neurobiology. (3) *(Offered: A) Perkel, Sullivan, Carlson, Bothwell*

Concepts and techniques of molecular and cell biology as applied to understanding development and function of the nervous system. Required for all first year students.

NEUBEH 502: Introduction to Neurobiology: Sensory & Motor Systems. (3) *(Offered: W) Sherk*

Introduction to neuroanatomy and modules on sensory and motor systems, examination of macroscopic and microscopic neural tissues. Required for all first year students.

NEUBEH 503: Cognitive and Integrative Neuroscience (3) *(Offered: Sp) Phillips*

A discussion of higher neural processes like learning, memory, and decision making. Lecture and laboratory discussion of original literature, exercises in data analysis and quantitative reasoning. Required for all first year students.

NEUBEH 510: Seminar in Neurobiology (0.5) *(Offered: A, W, Sp)*

Bi-weekly seminar on current topics in neuroscience. To be taken for credit throughout graduate training. Alt weeks with NEUBEH 527. Required for 1st and 2nd Year students

NEUBEH 515: Teaching Practicum in Neurobiology & Behavior (3-6) *(Offered: A, W, Sp, S)*

Supervised training in the teaching of neuroscience and related scientific topics. Teaching internships are assigned as part of the annual "match" or by approval by one of the Directors.

NEUBEH 526: Introduction to Laboratory Research in Neurobiology & Behavior (4) *(Offered: A, W, Sp, S)*

Students carry out research projects in the laboratories of different faculty members on a quarterly rotation basis.

NEUBEH 527: Current Topics in Neurobiology & Behavior (1) *(Offered: A, W, Sp)*

Presentations by students and faculty on current scientific literature; complements the topics in the seminar series. To be taken for credit throughout the first two years; attendance is encouraged throughout graduate training. (This course is concurrent with NEUBEH 510, alt weeks) Required for 1st and 2nd Year students.

NEUBEH 532: Discussion in Cell Signaling and Molecular Physiology. (2) *(Offered: W) Rieke*

Discussion of fundamental issues in cell excitability and molecular and cellular physiology. Focuses on problem solving and reading from original literature. Emphasizes student participation. Required for all first year students.

CONJ 531, 532: (Each is a 5 week course) Molecular Basis of Cell Function. (3) *(Offered: A)*

Plasma membrane, including membrane structure, ion channels, transmembrane signaling. Conj 531 & Conj 532 are required for all first year students.

NEUBEH 600: Neurobiology & Behavior Research/Independent Study. (Variable-max 10 cr.) *(Offered: A, W, Sp, S)*

Independent research. Taken prior to General Examination.

NEUBEH 800: Doctoral Dissertation (Variable-max 10 cr.) *(Offered: A, W, Sp, S)*

Dissertation Research. Taken after completion of General Examination. Limited to graduate students in the program.

Graduate School Minimum Requirements

It is the responsibility of the student to meet the following minimum graduate school requirements. Most are met by the program requirements but they should be considered when selecting your elective courses.

1. At least 18 credits of your course work must be at the graduate level and must be completed prior to scheduling your General Exam. The Graduate School accepts numerical grades in 400-level courses approved as part of the major and all 500-level courses.

2. Presentation of a minimum of three years (nine full-time quarters) of resident study, two of them at the UW with at least one year in continuous full-time residence. The continuous year may be satisfied by completing three full-time quarters out of any four consecutive quarters at the UW and must be completed prior to the General Examination. The residence requirement for the doctoral degree cannot be met solely by part-time study. A minimum of two academic years of resident study must be completed prior to scheduling the General Examination.

3. A minimum cumulative GPA of 3.00 is required for a graduate degree. The Graduate School provides the N&B Program with a quarterly Low Scholarship Report which lists the names of graduate students whose GPA's fall below 3.0 either cumulatively or for that quarter. The N&B Program reviews the status of each student on the low scholarship printout and sends to the Graduate School a specific recommendation--i.e. no action, warn, probation, final probation, or drop--for each case. A "no action" or "warn" recommendation does not appear on the student's permanent record. The Registrar will record only those actions recommending probation, final probation, and drop.

4. The student must pass the General Exam. Registration as a graduate student is required the quarter the exam is taken.

5. The student must prepare a doctoral dissertation on a topic in neuroscience. The topic and scope of the dissertation are developed with guidance from the dissertation advisor and thesis committee. There is no clear-cut definition of a minimum requirement for a thesis. However, the dissertation should describe original research that advances the field of neuroscience and clearly indicates training in research. A reasonable goal for many students is two first-author articles targeted for professional, peer-reviewed journals, such as The Journal of Neuroscience. Credit for the dissertation ordinarily should be at least one-third of the total credit. The Candidate must register for a minimum of 27 credits of dissertation over a period of at least three-quarters.

6. The student must pass a Final Examination, usually devoted to the defense of the dissertation. The General and Final Examinations cannot be scheduled during the same quarter. Registration as a graduate student is required the quarter the exam is taken and the degree is conferred.

7. Completion of all work for the doctoral degree must be done within ten years of matriculation. This includes quarters spent On-Leave or out of status as well as applicable work from the master's degree from the University of Washington or a master's degree from another institution, if applied toward one year of resident study other than the continuous full-time year of study.

8. Registration must be maintained as a full- or part-time graduate student at the University for the quarter in which the degree is conferred (see detailed information under Final Quarter Registration).

9. A student must satisfy the requirements that are in force at the time the degree is to be awarded.

Supervisory Committee

Students must establish a Supervisory Committee by Winter Quarter of the second year in the Program. (See Appendix A: Supervisory Committee Appointment.) This Committee serves several important functions, including evaluating the student's progress, advising the student on their research, and conducting the student's General Exam. Students can meet with their Supervisory Committees as often as necessary, but a minimum of one meeting per year is required to ensure adequate and timely progress toward the PhD degree. It is expected that the first meeting will take place soon after the committee has been formed, well before the General Exam is scheduled. These meetings are not examinations. They consist of a presentation on progress and future plans and extensive discussion. The Committee should approve the student's progress before the General Exam is scheduled. (See Appendix B: Doctoral Supervisory Committee - Annual Meeting).

The Committee is made up of Faculty that the student selects, in consultation with the Supervisor, and with approval of the Program Directors. The Supervisory Committee must contain at least three individuals who are members of the Program training faculty. At least one member of the Committee should represent an area of neuroscience outside the student's immediate area of research. A criterion for "outside" status is membership in a focus group outside the field of the dissertation advisor. In addition, the student will select a Graduate School Representative (GSR) to the Supervisory Committee. The GSR represents the interests of the student and should not have a primary appointment in the Supervisor's home department, nor be part of the N&B list in Graduate Faculty Locator. It is suggested that the Committee contain at least four members (in addition to the GSR) to avoid having to cancel the General Exam if a committee member cannot attend. While it is not always possible to have all of the Supervisory Committee members attend each meeting, it is a requirement of the Graduate School that your advisor(s) and the GSR attend your General Exam. **NOTE: The Supervisory Committee must be appointed at least 1 month before the warrant (request to schedule the exam) is submitted to the Dean of the Graduate School. Contact the N&B Program Office to request your Committee for Director and Graduate School approval.**

General Examination

Students should take the general exam at the end of the second year (approximately Spring Quarter; no later than Summer Quarter). The General Exam consists of two written components and two oral sections. The written parts consist of a brief research proposal and answers to questions on prepared topics. The oral sections consist of a 20 minute presentation on the thesis proposal and questioning about topics related to the area of the dissertation and general knowledge. Details on the format of the General Exam are provided in Appendix C.

Prior to the Examination, the student should designate a member of the Committee to serve as the General Examination Secretary, who will be responsible for administering the General Examination.

Note: In order to schedule your General Exam, you will need to submit a warrant to the Dean of the Graduate School. You can obtain a warrant from the Graduate School's website: (http://www.grad.washington.edu/forms/forms.htm) and follow the most current instructions for submission. **Warrant requests must be filled out, signed and delivered to the Graduate School at least 3 weeks before the General Exam**

Dissertation and Final Exam

The Dissertation and Final Exam will proceed according to the rules of the Graduate School. See the UW Graduate School Style and Policy Manual for Thesis and Dissertations (http://www.grad.washington.edu/stsv/00thesistempl.htm). For the Neurobiology & Behavior Program, all dissertation students are required to submit preliminary copies of their dissertation to their Supervisory Committee for review six (6) weeks before their planned defense date. Students must establish their Reading Committee (advisor/s, plus two members of their Supervisory Committee) at least two (2) months before their defense. As with the General Examination, **all warrant requests for the Final Examination must be submitted to the Graduate at least 3 weeks before Final Exam.**

Training and Teaching

We expect our students to develop proficiency in teaching neurobiology to undergraduate and/or graduate students. A minimum of two teaching quarter credits (total of 6 course credits) are required for graduation (Teaching Practicum, NEUBEH 515). At the end of year 1 and until this requirement is completed, each student selects his or her preferences for teaching internships for the following academic year. The faculty conduct a “match” to optimize these preferences in light of the opportunities available and demand. Students have the option to postpone teaching one year if there are compelling reasons. A list of the current opportunities can be found in Appendix D (Teaching Requirement Fulfillment Form). Students must fulfill their teaching requirement through the match.

Student Progress Evaluations

At the end of each academic year, all students who have been in a dissertation lab for the past year must have an evaluation of progress by their dissertation advisor. (First year students are evaluated during their rotations.) The advisor and student must complete the evaluation form, sign and return it to the Program Office by the established deadline. Each student must attach a brief summary of their progress during the past year. The evaluations are reviewed by the Graduate Training Committee and any concerns and/or problems are referred to the Directors.

Satisfactory Progress

Satisfactory progress is not just a matter of maintaining a satisfactory (3.0) GPA. The N&B Program also expects that students enter a dissertation laboratory by the end of their third rotation (a fourth rotation will be allowed at the approval of the Directors), and that the student will reach their academic milestones (Supervisory Committee, General Examination, Final Examination) in a timely manner. Each student will be expected to meet with their Supervisory Committee at least once a year. Each student will be evaluated by their advisor and this evaluation will be reviewed by the Graduate Training Committee. Any student who is judged not to be making satisfactory progress may be reviewed by the Graduate Training Committee and the Directors at any time, and action will be taken to address the lack of progress. Failure to meet established milestones can result in a Program Probation and if not resolved to the satisfaction of the Directors, may result in formal sanctions and removal from the Program. The requirements are in place to facilitate progress toward the dissertation and a successful graduate school experience. We encourage students to perceive them not as hurdles but as stepping stones.

Appendix A:
Supervisory Committee Appointment
Graduate Program in Neurobiology & Behavior

Student: _____ Student # _____

The Supervisory Committee should contain at least three individuals who are members of the Program training faculty. It is suggested that you might appoint four faculty in case you have an unexpected absence at your general exam. At least one member of the Committee should represent an area of neuroscience outside your immediate area of research. In addition, you will select a Graduate School Representative (GSR) to your Supervisory Committee. The GSR must be at your general exam. It is your responsibility to contact all members of your Committee and to make sure that they will be available for your exam: **The Supervisory committee must be appointed at least 1 month before the warrant for the General Exam is submitted to the Dean of the Graduate School.**

Please appoint the following faculty as my Supervisory Committee.

1. Chairman: _____

2. GSR: _____

3. _____

4. _____

5. _____

6. _____

NOTE: Include Name, Title, Department and Box #.

Expected Quarter of General Exam: _____

Return this form to the Program Office or send an email to neubehav@u.washington.edu

Appendix B:
Doctoral Supervisory Committee - Annual Meeting
Graduate Program in Neurobiology & Behavior

Student: _____ Meeting Date: _____

Committee Members Attending

1. _____

2. _____

3. _____

4. _____

5. _____

Description of Academic/Research Progress:

Other Committee Comments/Recommendations:

Approved: _____

Committee Chair Signature *Date*

Return this form with Chair's signature to the Program Office ASAP.

Appendix C:
General Examination
Graduate Program in Neurobiology & Behavior

This document summarizes the revised general examination adopted by the faculty of the program in Neurobiology and Behavior on 24 March, 2005. It incorporates recommendations proposed at this meeting. In addition, it incorporates many constructive ideas from faculty and students in response to earlier proposals, circulated over the past 9 months.

This document contains (A) the principles motivating the revision, (B) the new policy and procedures for the general exam, (C) an explanation of how the new exam satisfies the motivating principles, and (D) a revision history.

The proposal was developed by the General Exam Committee: Tom Reh, Eliot Brenowitz, David Perkel, Neil Nathanson, Fred Rieke and Michael Shadlen.

A. Guiding principles

1. Retain an emphasis on formulating a novel scientific question and devising a method to answer it.
2. Accelerate progress through the program and toward the PhD.
3. Improve the rigor of the exam, especially in areas of general knowledge.
4. Improve the consistency in implementation.
5. Avoid overburdening the students.

B. Proposal

By the end of winter quarter of year 2, the student is required to establish a thesis committee. One member is identified as outside the student's immediate field. A criterion for "outside" status is membership in a focus group outside the field of the dissertation advisor. The general examination must be completed by the end of autumn quarter of year 3. The student is expected to meet with members of the thesis committee during year two either individually or as a group.

The student is required to meet with committee members (not the GSR) either individually or in a pre-exam meeting before the examination to identify one or two topics of general knowledge in which to prepare. These areas are selected by the committee member in an area of his or her expertise but tailored to the student's area of interest. Although the thesis committee members will ultimately serve to advise the student on progress toward the dissertation, their role before the general examination is to identify areas of neuroscience in which depth and breadth of knowledge are likely to be helpful to the student's training in neurobiology and behavior. The committee member and the student should clarify the scope, but there is much latitude here. For example, the area may be broadly defined (e.g., development, the olfactory system, ion channels, learning and memory, etc.) or more focused (apoptosis, tyrosine kinase signaling, voltage gating, signal to noise determinants in retina, role of superior colliculus in gaze control, etc.). Together, the student and the committee member should develop a reading list based on standard texts, review papers and primary scientific literature. The committee member should keep in mind that the student will be preparing in several areas, depending on the number of committee members and the number of topics they require.

To schedule the general exam, the student's advisor and the committee as a whole must be satisfied that the student is making progress in the laboratory. A student who has not demonstrated dedication and some degree of acumen in areas relevant to conducting the thesis research will not be eligible to take the general exam. When scheduling the general exam, the student should identify a member of the committee who will serve as chair for the examination. The student selects the chair with concurrence of the thesis advisor. The thesis advisor and the GSR are not eligible. The student, thesis advisor and examination chair should notify the N&B office of this arrangement by email. The role of the committee chair will be spelled out below.

B.1. Format of the written exam. There are two parts: (1) a brief thesis proposal with emphasis on background and rationale; (2) answers to three "knowledge" questions, which are submitted by the committee.

(1) Thesis proposal. The document should develop the background and rationale for the proposed dissertation research, and it should outline an experimental plan to address one fundamental question. The document should be **no more than five pages single spaced, plus bibliography**. It should (*i*) emphasize published studies pertinent to the proposed research area, (*ii*) develop the rationale for the proposed study, emphasizing gaps in current knowledge in the proposed research area, (*iii*) advance one or two hypotheses (*iv*) describe an experimental strategy to test the hypothesis. Preliminary data should not be included. Detailed methodology and a formal list of specific aims can be deferred until the first thesis committee meeting. The proposal is due 2 weeks before the exam. For purposes of the general examination, the student will be evaluated on scholarship, clarity and content of the proposal, logical development of a scientific hypothesis, and overall merit of the strategy. A more complete research plan is expected at the first thesis committee meeting, which is to be held by the end of spring quarter in the 3rd year. Its format is flexible (up to the committee). It is not part of the general exam.

(2) Questions on general knowledge. Two weeks prior to the examination date, the chair of the exam will obtain 1-2 questions from each member of the committee. The questions can be essay, problem format, or analysis. The answers should require no more than 2 pages per examiner (not per question). The chair will choose a subset of the questions submitted by the committee. The GSR is not expected to submit questions, but he or she may do so at the discretion of the examination chair. The student has 1 week to complete all answers. The answers to all questions shall be provided to all committee members one week before the oral examination. A PDF attachment to an email is the preferred format.

B.2. Format of the oral exam. The examination begins with a **20 minute** "chalk-talk" about the proposed research. The focus is on the rationale for the project and the proposed experimental strategy; background information should be presented only when directly relevant. The committee will examine the student on themes related to the proposal, principles of experimental design, and any other areas that are seen as pertinent to the goal of developing a rigorous scientific inquiry in the student's proposed dissertation area. Though preliminary data are not required for the oral exam, **a maximum of two data slides** may be presented as supporting material. This part of the exam is expected to last approximately one hour. The second part of the exam will focus on general knowledge. The topics are expected to include the areas previously identified by committee members with the student. Questions on general knowledge, covered in the 1st year curriculum are also to be part of the process.

The chair of the examination will control the conduct of the oral exam. This is a committee member chosen in advance by the student who is not the GSR or the student's advisor. The advisor is discouraged from participating in discussion during the exam.

B.3. Dissertation proposal meeting. After passing the General Exam, the candidate must remain in good academic standing by meeting the program requirements and by making progress on the dissertation. The program requires that the student assemble a meeting of the thesis committee once per year. The GSR is not required to attend, but he or she should be invited. The first post-exam meeting should occur no later end of spring quarter of the 3rd year. Prior to this meeting the student should modify the original thesis proposal from the general exam in three ways: (1) incorporate any comments and suggestions from the general exam; (2) add a complete set of specific aims; and (3) provide a general description of experimental design and methods, which should be limited to two pages. The student can include some preliminary data as available. **The revised proposal should be no more than 10 single spaced pages.** It should be distributed to the Supervisory Committee at least one (1) week prior to the meeting. The goal of this meeting is for the committee members to provide the student with constructive suggestions for the student's dissertation research, and the meeting will **not** be held in an exam format.

Appendix D:
Teaching Requirement Fulfillment Form
Graduate Program in Neurobiology & Behavior

_____ has completed _____quarter (s) as a

teaching intern for my course(s) _____

during the following quarters: 1) _____quarter _____ year

2) _____quarter _____ year.

Faculty Name (print):_____

Faculty Signature:_____

Student Signature:_____

Please return this form to the Program office at Box 357750