

*Drexel University College of Medicine
Neuroscience Graduate Program*

**POLICIES AND PROCEDURES
2010-2011**

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PROGRAM OF STUDY FOR Ph.D. IN NEUROSCIENCE

A. Course Requirements

The curriculum includes two semesters of a “Core Curriculum” that is shared by all of the biomedical graduate programs and a series of programmatic courses specific for neuroscience students. All students in the Neuroscience Program must take the Core Curriculum including Scientific Integrity and Ethics (except for M.D./Ph.D. students and students who may have had comparable courses elsewhere) as well as the programmatic courses. All students in the Neuroscience program are required to take the following programmatic courses in the first year: Graduate Neuroscience I, Principles of Neuropharmacology, and Medical Neuroscience. In the second year, students must take Graduate Neuroscience II, Statistics for Neuro/Pharm Research, and at least one of three specialized neuroscience courses in the second semester of the second year (Advanced Cellular and Developmental Neuroscience, Advanced Systems Neurophysiology or Motor Systems). Electives may be taken at the discretion and advice of the student’s mentor and the Program Director. All students must participate in a seminar/discussion course (Journal Club), either Neurobiology Topics or Current Topics in Pharmacology and Physiology, starting in their second year and during every semester while in the program, prior to registering for Thesis Defense. Total number of research credits is variable for each student and will include the completion of an acceptable and publishable research project at the doctoral level. The Neuroscience Steering Committee will advise each student on the selection of the flexible aspects of the curriculum.

An additional notes about the Core Curriculum: Incoming Neuroscience students who have chosen to specialize in Neuroengineering or Systems/Behavioral Neuroscience will take a modified core curriculum called Molecular Biology and Biophysics in the first semester (rather than the traditional one). This course will cover basic aspects of molecular biology and biochemistry and will also focus on biophysics and the neurochemistry of excitable membranes. The Steering Committee will advise each student on taking this modified Core or the traditional Core. A portion of the lectures for this modified version of the first semester of Core Curriculum have relevance to all neuroscience students, and hence, the neuroscience students taking the traditional core will be asked to attend these particular lectures but will not be tested on them.

B. Curriculum

First Year Fall Semester

| | |
|---|-------------|
| Core Curriculum I or Molecular Biology and Biophysics | 6 |
| Graduate Neuroscience I | 2.5 |
| 1 st Lab Rotation | 4 |
| Total Credits: | 12.5 |

First Year Spring Semester

| | |
|---------------------------------|-----------|
| Core Curriculum II | 4 |
| Principles of Neuropharmacology | 3 |
| Medical Neuroscience | 6 |
| 2 nd Lab Rotation | 4 |
| Total Credits: | 17 |

Second Year Fall Semester

| | |
|--|-----------|
| Neuroscience 3rd Lab Rotation (summer) | 4 |
| Graduate Neuroscience II | 4 |
| Neuroscience Thesis Research | 9 |
| Journal Club* | 2 |
| Total Credits: | 19 |

Second Year Spring Semester

| | |
|---|-----------------|
| One Specialized Neuroscience Course (choice of 3) | |
| Advanced Cellular and Developmental Neuroscience | 2 |
| Advanced Systems Neurophysiology | 2 |
| Motor Systems | 4 |
| Neuroscience Thesis Research | 9 |
| Statistics for Neuro/Pharm Research | 2 |
| Journal Club* | 2 |
| Scientific Integrity and Ethics | 2 |
| Total Credits | 17 or 19 |

Third Year Semesters and Beyond

| | |
|--|-----------|
| Journal Club* | 2 |
| Neuroscience Thesis Research or Thesis Defense | 9 |
| Total Credits: | 11 |

*either Neurobiol Topics or Current Topics in Pharm/Phys

The Office of Biomedical Education has established criteria by which all students in all graduate programs will be uniformly evaluated regarding the Core Curriculum. Students must achieve a score of 80 in each semester of the Core in order to pass, and must achieve an overall average of 80 for both semesters of the Core in order to maintain stipend funding. Failed courses must be repeated. Funding revoked due to failure of the Core can resume upon re-establishing good standing, although the funds withheld will not be restored to the student. Regarding the Programmatic courses, a grade of B must be earned in each course. Programmatic courses must be repeated if the student earns a grade below a B in that particular course. Programmatic courses in which a student has earned a grade of B- can be remediated to a B. Students who fail more than one course or earn more than one grade below a B will be dismissed from the program at the discretion of the Neuroscience Steering Committee.

There are three rotations in the curriculum for which the doctoral student will be assigned a Pass/Fail grade (M.S. students must do at least one and no more than 2 rotations). The purpose of these rotations is to enable the student to select the most appropriate Graduate Advisor to supervise the research project for the student. The Neuroscience Program Director and Steering Committee will advise each student on the selection of rotations, as well as on the progress and outcome of rotations. Flexibility will be afforded in certain situations in which the student may be able to select an advisor before completing all three rotations, or in situations wherein it is advisable to terminate a particular rotation early in favor of another choice. **Students may NOT arrange rotations without instruction and guidance from the Program Director.**

Unsatisfactory Performance in Journal Clubs

Three unexcused absences are allowed per year for journal clubs. More than three absences will result in a grade of Unsatisfactory (U). The “U” must be remediated to the satisfaction of the course director. Failure to remediate is grounds for dismissal from the program.

Unsatisfactory Performance in Laboratory Rotations

Laboratory rotations are graded on a Satisfactory (S) or Unsatisfactory (U) basis. Students receiving an “S” are rated on a performance scale ranging from Outstanding (1) to Poor (5). A “U” for a lab rotation is reserved for students that do not meet performance requirements, including attendance, of the rotation as stipulated by the program. A “U” for a laboratory rotation is grounds for dismissal from the program.

Laboratory Rotations

Upon arriving in the fall of the first year, each new student will embark on three required rotations, each of which is one semester in length. Students have the option of arriving early to either complete an entire rotation or a partial rotation in the preceding summer semester. Prior to arrival, students may communicate by email with the Program Director so that discussions may begin on potential rotations. Additional information and decisions on first rotations will be made upon the student arriving in person at Drexel. Students must not arrange rotations without the supervision of the Program Director. Once a rotation is underway, the student and faculty member must both stay in contact with the Program Director so that any problems that arise can be addressed, and especially if the rotation is proving to be unproductive. If the latter is the case, the rotation may be aborted early and substituted for a new one. Students must be aware that it is their responsibility to impress potential mentors during these rotations, as no mentor is required to take any student. Any student who is unable to identify a mentor willing to take him or her within the second year will not be able to continue in the program. In some cases, when an ideal match of student/mentor is determined prior to the completion of the third rotation, the third rotation can be waived at the discretion of the Program Director.

M.D./Ph.D. students

Due to their two years of medical school preparation prior to the start of their graduate training, students in the combined program are excused from the Core Curriculum, Graduate Neuroscience I, and Medical Neuroscience. Due to the time restrictions on their course of study, they must complete all course requirements during their first year of graduate training. Typically, an MD/PhD student will have selected a thesis laboratory by the start of their graduate training, but if not, the student must do so by the end of the first semester of graduate training. Therefore, the three-rotation requirement is waived, and M.D./Ph.D. students must register for Thesis Research starting in their first Fall semester. They are required to take Graduate Neuroscience II and Journal Club in the Fall semester and, Principles of Neuropharmacology, Neurobiology Topics, and one of the Neuroscience Specialized courses in the Spring semester. M.D./Ph.D. students must take the Preliminary Exam and the Qualifying Examination by the end of their first year of graduate training.

C. Preliminary Exam

1. The Preliminary Exam is a requirement of the Biomedical Graduate Education Committee. The Preliminary Examination for the Neuroscience Program, which will be overseen by a Chair appointed by the Steering Committee of the program, will be given in December of the second year, shortly after the completion of the Graduate Neuroscience II course. The exam will consist of written and oral components based on a broad knowledge of Cellular and Developmental Neuroscience, Neuroanatomy, Behavioral Neuroscience, and Systems Neuroscience. The subject

matter may be adjusted in one of these areas to accommodate students with a neuroengineering focus. The written component will be a take-home, open-book format, wherein the students will have 3 days to turn in their answers. The oral component will follow a week after the written exams are turned in, and questions will be based on the written answers provided by the student.

2. The Preliminary Exam will be administered by a committee of faculty members who are involved in the instruction of the programmatic courses. The questions will cover general concepts as well as specific information.

3. A grade of pass or fail will be assigned. If the student fails, he or she must repeat and pass the exam within two months (60 days) of failing. If the student fails a second time, he or she will be dismissed from the program. Students passing but performing poorly on certain aspects of the test may be asked to remediate those particular aspects of the test.

4. There will be a programmatic “memory” of the performance of the student that will be carried forward, so that repeated demonstration of the same weaknesses in the Qualifying Exam and Thesis Proposal may be grounds for dismissal from the program.

D. Qualifying Exam

1. The Qualifying Exam is a requirement of the Biomedical Graduate Education Committee and will include both written and oral components.

2. Students will take the Qualifying Exam by the end of the second year (July 31). Examination dates will be set by the Steering Committee. The exams will be scheduled in July approximately one month after the end of second year Spring semester classes.

3. Each student is required to write a mock research grant application. The total length of the document must be 12 pages (not including references), single-spaced, half-inch margins, 11-point Ariel. The format will be that of the most up-to-date instructions for the NIH R01. The topic of the application will be somewhat related to the research interests of the student but will be clearly outside of the research project of the student and will challenge the student to think in new directions.

4. The Program Director will appoint a Chair to oversee the entire process for all students in the Program. Together, the Chair of the Committee and the mentor of each student will develop the topic for the student’s mock grant application. *After this point, the participation of the student’s own mentor will cease completely.* The Chair will meet with the student and discuss the exam format and the topic thoroughly with the student. Upon receiving approval for the topic of the application, the student will have four weeks to prepare the document, and distribute it to the committee.

5. The Chair will select a committee to implement the exam; the student’s mentor will not be a member of the committee, but may be asked to silently observe the oral portion of the exam. The committee will have one week to review the application, after which the student will have the oral exam, which is a defense of the document. The oral exam will generally last 75 minutes, but this can be shortened or lengthened depending on the circumstances that ensue. The student will first present a 15-minute summary and PowerPoint-presentation of his or her proposal, without interruptions from the committee. The 15-minute time limit will be strictly enforced. After this, the committee members will question the student for the remaining portion of the exam. The vast majority of the questions will be confined to the research proposal and the checklist, although any committee member may ask anything that seems appropriate for the discussion.

6. Whether the student passes or fails the exam will be determined by the committee. The student, mentor, or any member of the committee can appeal the decision to the Neuroscience Steering Committee if there are any irregularities that should be addressed.

7. If the student fails the exam, he or she has a period of 3 months (90 days) to repeat the entire process, with a new topic, but the same committee. The student may request a change in the committee membership if he or she feels that there is bias, but such requests will only be honored if the Steering Committee is convinced that such bias exists. A second failure results in dismissal from the doctoral program.

8. Upon passing the Qualifying Exam, the student will be admitted to candidacy for the Ph.D. degree.

E. Thesis Advisory Committee

1. By six months after passing the Qualifying Exam, the student will propose members of the faculty to serve on the Thesis Advisory Committee subject to approval by the Program Director. Once formed, this committee will meet every six months to review the student's progress.

a. Three or four of the five voting members of the Committee must be Graduate School faculty from the Neuroscience Graduate Program. To complete the five member Committee the student may select individuals who are members of the Graduate School faculty but not members of the Neuroscience Graduate Program or individuals who are specialists in the field but from outside the university (as approved by the Biomedical Graduate Education Committee).

b. The student's major advisor is a voting member of the Committee but cannot chair the Committee.

c. The Chair of the Committee must not be a collaborator on the student's research project and must not have any apparent conflicts of interest related to the publication or funding of the student's project. It is also the responsibility of the Chair to ensure that there is sufficient balance on the committee to ensure a rigorous and unbiased critique of the student's project and progress.

2. Following the bi-annual review by the Committee, a brief statement of the student's progress must be signed by each Committee member and submitted to the Steering Committee.

F. Thesis Proposal

1. The Thesis Proposal is a crucial exercise through which each student will be thoroughly evaluated by his or her Thesis Advisory Committee to ascertain his or her competence and appropriateness to continue in the doctoral program. The conclusion of the committee will be based on several factors (see below), which includes shortcomings displayed in any element of the program to date and the degree to which the student has overcome these shortcomings.

2. The Thesis Proposal document must be submitted by PhD candidates within one year of passing the Qualifying Exam. In the case of MD/PhD candidates, the document must be submitted within 6 months of passing the Qualifying Exam. Under special circumstances this can be extended via written request to, and approval from, the Steering Committee. The Thesis Proposal must be written in the style and within the page limitations of an NIH R01 grant application and handed in 10 working days prior to formal presentation of the Thesis Proposal to his/her Thesis Advisory Committee. Page limits, font size, and other matters of format are precisely what are advised in the most up-to-date NIH R01 instructions. Upon approval of the Thesis Proposal the student will continue with his/her thesis research, culminating on the presentation of the Ph.D. dissertation for defense.

3. At the time of the proposal the student must present a brief (10-15 minute) oral summary of his/her intended research project followed by a detailed question and answer session.

4. The Thesis Advisory Committee will reach a decision on the student's performance. If the decision is positive, the student may continue with his/her thesis research. If the decision is negative, the student can re-submit a revised or new proposal in three months and process will be

undertaken a second time. If the decision is negative a second time, the student will either be dismissed from the program or recommended for a terminal Master's degree.

5. The decision of the Committee will be based on:
 - a. the thesis proposal document
 - b. the oral presentation
 - c. performance in the questions and answers session
 - d. demonstration that the student has overcome any and all shortcomings displayed in any element of the program to date, including the Preliminary Exam and the Qualifying Exam
 - e. the committee being convinced that the student's abilities and performance in the laboratory are sufficient to actually conduct the proposed research effectively

F. Thesis

A thesis based on original research is requisite in partial fulfillment of requirements for the Ph.D. degree. The format of the thesis has been described in detail by the Office of Biomedical Graduate Studies, and this format must be followed precisely.

G. Defense

1. A candidate may not present him/herself for the final thesis defense until he or she has completed 24 calendar weeks of residence after satisfactory completion of the Thesis Proposal, and has the approval of his/her major advisor.
2. At least four weeks prior to the date of the commencement at which the degree is to be conferred, typewritten or photocopies of the thesis must be distributed to each member of the advisory-examination committee. Also at this time, the Chair of the Committee, or the Program Coordinator must notify the Office of Biomedical Graduate Studies, the Registrar's Office and all departments involved in graduate education of the scheduled date of the thesis defense.
3. The thesis defense will take place no less than two weeks and no more than four weeks after the thesis has been distributed to the members of the examination committee, except under written direction of the Steering Committee.
4. The thesis defense will be public. The candidate will be formally introduced by his/her advisor or the Chair of the Committee. The candidate will present a 45-minute seminar on his/her research, followed by questions from the Examination Committee and the general audience. After this initial question and answer period, the chair will dismiss the audience. The Examination Committee will meet in private with the candidate to complete the examination process.
5. The Thesis Examination Committee shall decide upon the merits of the candidate's performance on the thesis defense. To be recommended for a doctoral degree, the candidate must receive approval of the Committee with no more than one dissenting vote. By permission of the Committee a candidate who has failed the final thesis defense may present him or herself for re-examination after three, but not more than twelve months. This re-examination must be taken within a calendar year of failure to pass the first examination. A report on each final thesis defense whether passed, failed, or recommended for re-examination must be filed by the Committee in the Office of Biomedical Graduate Studies.
6. Not later than four weeks prior to the commencement at which the degree is to be conferred, three copies of the completed thesis suitable for binding and bearing the approval of the advisory-examination Committee must be deposited in the Office of Biomedical Graduate Studies. One of these copies is to be placed on file in the COM Library, Graduate Office and the Neurobiology & Anatomy Library. An unbound copy of the thesis must also be presented to the

Office of Biomedical Graduate Studies for microfilming by University Microfilms, Ann Arbor Michigan. The abstract will be published in Dissertation Abstract by University Microfilms. The cost of preparation, reproduction and personal binding copies are the candidate's responsibility.

Neuroengineering Students

Drexel University has a neuroengineering program served by two PhD programs: Biomedical Engineering (in the School of Biomedical Engineering and Health Science); and Neuroscience (in the College of Medicine). Doctoral Students with a focus on neuroengineering who matriculate within the Graduate Program in Neuroscience in the College of Medicine are held to every rule and detail outlined in the present document. However, it is also understood that these students may need more flexibility in the Curriculum, such as taking additional courses offered outside of the College of Medicine as well as at least one different question on the Preliminary Exam. In terms of rotations and the final choice of mentor, neuroengineering students within the Graduate Program in Neuroscience are required to select faculty members within the College of Medicine, although exceptions can be made. Neuroengineering students will be under the supervision of the Program Director and Steering Committee of the Graduate Program in Neuroscience, and will receive additional guidance from the "program director" for neuroengineering.

PROGRAM OF STUDY FOR M.S. IN NEUROSCIENCE

- A. **Course Requirements.** Identical to doctoral program except that the research project need not be as extensive, and hence the total number of research credits will typically be fewer.
- B. **Thesis Requirement.** The laboratory for the thesis project must be selected by June of the first year. The thesis project need not be independent but rather must be at the suggestion and guidance of the major advisor. The research project must be appropriate for completion and thesis defense no later than August of the third year. Laboratory work begins during summer after the first year and continue through the second year.
- C. **Thesis Advisory Committee.** By the end of the third semester (December 31), the student will propose members of the faculty to serve on the Thesis Advisory Committee subject to approval by the Steering Committee. Once formed this committee will meet every six months to review the student's progress. The committee consists of at least three voting members of the Committee who must be Graduate School faculty from the Neuroscience Graduate Program. The student's major advisor is a voting member of the Committee but cannot chair the Committee. The Chair of the Committee must not be a collaborator on the student's research project and must not have any apparent conflicts of interest related to the publication or funding of the student's project. It is also the responsibility of the Chair to ensure that there is sufficient balance on the committee to ensure a rigorous and unbiased critique of the student's project and progress. Following the bi-annual review by the Committee, a brief statement of the student's progress must be signed by each Committee member and submitted to the Steering Committee.
- D. **Thesis Proposal.**
 1. In lieu of the Qualifying Exam, Master's degree students will defend their thesis proposal to their thesis advisory committee. The Thesis Proposal document will be submitted by the student within 6 months after completing the Advanced Neuroscience course (usually, the summer

between the second and third years). Under special circumstances this can be extended (no more than 12 months but all proposals for extensions will be given due consideration; approval must be obtained through written request to the Steering Committee). The Thesis Proposal must be written in the style and within the page limitations of an NIH grant application and handed in 10 working days prior to formal presentation of the Thesis Proposal to his/her Thesis Advisory Committee. Page limit is 12 pages, arial, 11 point, half inch margins, single-spaced. Upon approval of the Thesis Proposal the student will continue with his/her thesis research, culminating on the presentation of the M.S. thesis for defense.

2. At the time of the proposal the student will present a brief (10-15 minute) oral summary of his/her intended research project followed by a detailed question and answer session with the Thesis Advisory Committee.

4. The Thesis Advisory Committee will then reach a decision. If the decision is positive, the student may continue with his/her thesis research. If the decision is negative, the student can re-submit a revised or new proposal in three months. If the Thesis Proposal is rejected a second time, the student will be either dismissed from the program or recommended for a non-thesis Master's degree.

E. Thesis Defense

1. A written thesis is required with oral defense before the thesis advisory committee. A candidate may not present him/herself for the final thesis defense until he or she has completed 18 calendar weeks of residence after satisfactory completion of the Thesis Proposal, and has the approval of his/her major advisor.

2. At least four weeks prior to the date of the commencement at which the degree is to be conferred, typewritten or photocopies of the thesis must be distributed to each member of the advisory-examination committee. Also at this time, the Chair of the Committee, or the Program Coordinator must notify the Office of Biomedical Graduate Studies, the Registrar's Office and all departments involved in graduate education of the scheduled date of the thesis defense.

3. The thesis defense will take place no less than two weeks and no more than four weeks after the thesis has been distributed to the members of the examination committee, except under written direction of the Steering Committee.

4. The thesis defense will be public. The candidate will be formally introduced by his/her advisor or the Chair of the Committee. The candidate will present a 30-minute seminar on his/her research, followed by questions from the Examination Committee and the general audience. After this initial question and answer period, the chair will dismiss the audience. The Examination Committee will meet in private with the candidate to complete the examination process.

5. The Thesis Examination Committee shall decide upon the merits of the candidate's performance on the thesis defense. To be recommended for a Masters degree, the candidate must receive unanimous approval of the Committee. By permission of the Committee a candidate who has failed the final thesis defense may present him or herself for re-examination after three, but not more than twelve months. This re-examination must be taken within a calendar year of failure to pass the first examination. A report on each final thesis defense whether passed, failed, or recommended for re-examination must be filed by the Committee in the Office of Biomedical Graduate Studies.

6. Not later than four weeks prior to the commencement at which the degree is to be conferred, three copies of the completed thesis suitable for binding and bearing the approval of the advisory-examination Committee must be deposited in the Office of Biomedical Graduate Studies. One of these copies is to be placed on file in the COM Library, Graduate Office and the Neurobiology &

Anatomy Library. An unbound copy of the thesis must also be presented to the Office of Biomedical Graduate Studies for microfilming by University Microfilms, Ann Arbor Michigan. The abstract will be published in Dissertation Abstract by University Microfilms. The cost of preparation, reproduction and personal binding copies are the candidate's responsibility.

PROGRAM OF STUDY FOR NON-THESIS M.S. IN NEUROSCIENCE

The Faculty of the Neuroscience Program has approved the option of a non-thesis MS degree in which students can earn the degree by taking additional classes and writing a literature review paper as opposed to conducting original laboratory research. The requirements for a M.S. degree without thesis as mandated by the Biomedical Graduate Program Committee of the COM are a minimum of 36 credit hours of course work (with a 3.0 or higher GPA) consisting of the Core Curriculum (10 credit hours), Neuroscience program courses (at least 22 credit hours, listed on pages 2-3 of this document), and preparation of a scholarly paper (Literature Review, 4 credit hours). Neither lab rotations nor thesis research credits count toward this degree.

Courses outside of the Neuroscience program may be taken on the advice and discretion of the Program Director and the faculty mentor. Credit for a graduate course requires a minimum grade of "B."

The student must choose a faculty mentor in the first year, no later than June 30. The role of the mentor is to provide guidance in selecting the topic for the scholarly paper, and in helping the student perform the literature search, and, in writing the document. The selected topic must be approved by Steering Committee of the Neuroscience Program.

The scholarly paper reviews a topic in detail based on the primary research literature. The body of the paper must be 35-50 double spaced pages (11 pt font, Arial). This page number does not include citations but citations must be provided as well. The following format must be followed:

- Abstract (250 words)
- Body of Paper
 - Introduction – what is the purpose and scope of the review
 - Literature review – review and contrast findings in the field; identify unresolved issues and shortcomings of technical approaches
 - Summary – what are the key findings of the review
 - Conclusion- what gaps in our knowledge or unanswered questions emerge from the review; what are potential future directions for research in this area.

Successful completion of the literature review will be subject to the approval of the mentor/advisor and the graduate program advisory committee.

TRANSFERING BETWEEN DOCTORAL AND M.S. PROGRAMS

Under certain circumstances, the faculty may recommend that a student be transferred from the M.S. program to the Ph.D. program, transferred from the Ph.D. program to the M.S. program, or transferred from the Ph.D. program or the thesis-oriented M.S. program to the non-thesis M.S. option. Students may elect to apply for program transfers with the approval of the Program Director.