



# GRADUATE PROGRAM IN NEUROSCIENCE

The Siebens-Drake Research Institute, The University of Western Ontario,  
1400 Western Road, Rm#216, London, Ontario, Canada N6G 2V4

## Program Introduction

The University of Western Ontario offers students the opportunity to pursue graduate studies in the interdisciplinary field of Neuroscience. Western's new program is unique within the province of Ontario in that it enables students to obtain an M.Sc. or Ph.D specifically in Neuroscience.

The Program is designed for students with a variety of interests and backgrounds. These can include such areas as computer science, mathematics, engineering, chemistry and physics as well as the more traditional areas of anatomy, pharmacology, psychology, physiology, zoology, neurology, ophthalmology and physical therapy. The M.Sc. program provides a strong foundation in Neuroscience, while the Ph.D program builds on this foundation and develops the research skills necessary for a career in Neuroscience.

The Program offers research training in a variety of areas including neural substrates of behavior, neurophysiology, neural development, neuropharmacology, neuroanatomy and cellular and molecular biology. Students are able to select supervisors from over 44 core members of the Program, consisting of scientists drawn from the Faculties of Medicine and Dentistry, Science, Social Science, and the Faculty of Health Sciences. These include the departments of Anatomy and Cell Biology, Biochemistry, Clinical Neurological Sciences, Oncology, Ophthalmology, Oral Biology, Pathology, Physiology and Pharmacology, Physical Rehabilitation, Psychiatry, Psychology, Physical Therapy and Zoology.

The University of Western Ontario campus is scenically situated on a large (375 acre) rolling campus which lies on the outskirts of the residential area of London, Ontario (pop. 300,000). The University received its charter in 1827 and is one of Canada's large and well-established centers of higher education with an enrollment of over 20,000.

## Policies and Guidelines

The Graduate Program in Neuroscience has primary academic responsibility at the University of Western Ontario for graduate level training in the Neurosciences.

The major features of the graduate programs in Neurosciences are:

- Emphasis on research
- Interdisciplinary approach
- Collective responsibility of faculty in establishing and maintaining high standards based on regular meetings of Advisory Committees and research seminars.
- Participation by graduate students in the academic life of the program, including service on the Program committee, and the Perspectives in Neuroscience seminar series.
- Interactions among graduate students, and graduate students and faculty.

The Neuroscience Program Committee will decide on the academic eligibility of all applicants. However, the final decision for admission to the University of Western Ontario is always made by the Faculty of Graduate Studies

### **Degrees offered**

Programs leading to the degrees of Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D) are offered. In addition, combined M.D-M.Sc. and M.D.-Ph.D programs are available for candidates who have been accepted into the M.D. program at the University of Western Ontario.

### **Objectives**

The goal of the graduate programs is to train professional scientists who will make significant contributions to the discipline of neuroscience. Graduates of the master's program will be capable of collaborating in research. Graduates of the doctoral program will be able to pursue independent careers in research and academic positions. Generally, however, it will be necessary to complete a period of post-doctoral training to ensure success as an independent investigator. Individuals receiving combined M.D.-Ph.D. degrees will, after special training, be prepared to enter careers in academic medicine.

To achieve these goals, the student, with the help of a supervisor and an Advisory Committee, develops and completes a research project, leading to the preparation of a thesis, and actively participates in the scientific/academic activities within the Program.

### **The Program**

The Program offers research training in a variety of areas including neural substrates of behaviour, neurophysiology, neural development, neuropharmacology, neuroanatomy, and cellular and molecular neurobiology. Students are able to select supervisors from over 35 core members of the Program, consisting of neuroscientists drawn from the Faculties of Medicine and Dentistry, Science, Social Science and Health Sciences. These include the departments of Anatomy & Cell Biology, Biochemistry, Clinical Neurological Sciences, Medical Biophysics, Ophthalmology, Oral Biology, Pathology, Pharmacology and Toxicology, Physical Rehabilitation, Physiology and Pharmacology, Psychology and Zoology.

### **Faculty Members of the Program**

The Neuroscience Program offers two types of faculty membership - associate member and core member. Core membership carries with it the privilege of supervising graduate students, while associate members may participate in all aspects of academic activities but not graduate student supervision. Core members must have their membership approved by the Faculty of Graduate Studies. Associate membership may also apply to have affiliate membership with the Faculty of Graduate Studies. At the time of application for membership in the Neuroscience Program, the individual must be active in neuroscience research and hold a primary faculty appointment, at the rank of assistant professor or higher, in a department of the University of Western Ontario or an affiliated hospital or research institute.

### **The Program Committee**

This committee is comprised of 6 Core Members of faculty plus the Director of the Program, and is responsible for the administration of the graduate programs in Neuroscience. Its duties include: i) the evaluation of applicants for admission and for funding by internal and external sources; ii) the evaluation of requests for transfer from the masters to the doctoral program; iii) the establishment of Advisory Committees; iv) approval of the scope of and examiners for the Ph.D. comprehensive examinations, and for thesis examinations; v) the conduct of yearly reviews of the progress of each graduate student; vi) the coordination of program requests for funds from the Faculty of Graduate Studies and from other sources; vii) the preparation of reports for reviews of the graduate programs; viii) the formulation and presentation to the Program of changes in policies and guidelines for the programs.

The members of the Program Committee are elected by mail ballot by all core members of the program. Excluding the Director, no more than 2 members of the Program Committee are drawn from one academic department at any one time. Program Committee members serve terms of three years; members terms are staggered, normally two members elected each year, so that there is continuity of membership with some new members added each academic year. A student member, elected by the students, also serves as a member of the program Committee for a one-year term.

The director of program is selected by a search committee called by the Faculty of Graduate Studies, and is appointed for a term of 3 years. The Director reports to the Associate Dean (Biosciences Division) and the Dean of Graduate Studies.

### **Admission procedure**

The minimal admission standards are listed in the Calendar of the Faculty of Graduate Studies. Additional requirements of the Program are described in the Admissions document on the web site.

To apply for entry to the graduate program, a student must first complete an "Application for Admission" form, available from the graduate secretary, Ms. Anderson, or from the Faculty of Graduate Studies, and arrange for two letters of reference to be sent to the Program Office, Rm. 216, The Siebens-Drake Research Institute. The application is reviewed by the Program Committee. If the applicant is considered to be academically acceptable, the student must find a research supervisor before receiving final acceptance into the graduate program (see Responsibilities of the Supervisor below). There are no established rules for the linking up of student and supervisor. Students are advised to talk with and visit the laboratories of potential supervisors; these interviews can be arranged directly with the faculty member or through the graduate secretary, Ms. Anderson. A list of faculty and their current research interests is available from Ms. Anderson.

Only the Faculty of Graduate Studies can grant admission to the graduate program and does so by issuing an official "Offer of Admission and Permit to Register" form.

Students entering the program after completing an undergraduate degree, and those with graduate degrees from foreign countries whose academic transcripts are difficult to assess, are admitted to the M.Sc. program. They may subsequently change their registration to the doctoral program upon satisfying their Advisory Committee and the Program Committee that their progress has been exceptional. This must occur before the end of the fifth academic term of study. When considering a request for transfer from the M.Sc. to the Ph.D. program the student's Advisory Committee will consider whether the student's research project is of sufficient scope to expand into a Ph.D. project. The committee will also consider the student's publication record especially the student's role as primary author on one or more submitted, accepted, or published manuscripts in peer-reviewed journals in the student's research field. While there is no absolute time point at which transfer from the M.Sc. to the Ph.D. program must occur, it is generally considered that this should occur after the first M.Sc. year to allow sufficient time for assessment but before the end of the second M.Sc. year. A maximum of three terms spent in M.Sc. registration is credited towards the residency period for the Ph.D. degree.

Students contemplating a combined graduate-medical degree should consult with the Director of the Program as early as possible before enrolling in medicine to discuss the nature and timing of the program.

### **Advisory committees**

An Advisory Committee is established for each student by the Program Committee in consultation with the student and supervisor. The supervisor is the chair of the committee. At least one member of the Program Committee is included on each Advisory Committee. At least two other members are chosen for their expertise in an area related to the proposed research topic. Appropriate experts from outside the Neuroscience Program and the University of Western Ontario may be included.

The Advisory Committee: i) guides the scientific progress of the student and ensures that the objectives of the graduate program are met; ii) is responsible for making recommendations to the program committee for the transfer of master's students to the Ph.D program; iii) is responsible for establishing the scope of the comprehensive exam for Ph.D students, in consultation with the program committee; iv) for the M.Sc. and Ph.D students, respectively, normally approves the thesis before it is submitted to the Program and to the Faculty of Graduate Studies for examination.

Within one month of entering the graduate program, students and their supervisors select two other faculty members to serve as an Advisory Committee; a member of the Program Committee also serves on each Advisory Committee. Each student meets with their Advisory Committee within the first two months of entering their program. The purpose of this initial, short (usually about 30 min) meeting is to introduce everyone, and to allow the Advisory Committee to become aware of the general project area. A written

report by the student is not required at this time, nor is it necessary to have the overall scope of the research project worked out. In addition, course work will be discussed at this meeting. Subsequently, each student meets with their Advisory Committee at approximately six-month intervals; this schedule is particularly important for M.Sc. students because of the short duration of their training program. These meetings, which generally last for about 1 hour, focus on the proposed research, progress to date and future plans. Students should be prepared to make a short (about 10 min) oral presentation of their project outline and recent research findings using an overhead projector and acetates or slides where necessary. A written report (generally not greater than 10 double-spaced pages, plus figures representing data) must be distributed by the student to members of the Advisory Committee at least one week before the meeting. The member of the Program Committee serving on the Advisory Committee prepares a written report of each meeting which goes into the student's file; a copy is given to the student and the supervisor.

Meetings can be convened by the student, the supervisor, or any member of the Advisory Committee. In addition to these formal meetings, members of the Advisory Committee can monitor the progress of the student by attending laboratory meetings at which students present reports on research. Advisory committee members should also attend presentations made by students in seminars.

### **Program Requirements**

The requirements for an M.Sc. degree in Neuroscience include:

- 1) A research thesis, which in the opinion of the Advisory Committee, would form at least one paper acceptable to a refereed journal. The thesis must be successfully defended in an oral examination. The examining committee will consist of two faculty members from the Neuroscience Program, at least one of whom must not have served on the student's Advisory Committee, and an additional faculty member from outside the Program.
- 2) The equivalent of 2.5 full courses to be determined by the Advisory Committee including a) Principles of Neuroscience (Neuroscience 500) and b) the Perspectives in Neuroscience Seminar (Neuroscience 510y). All students are required to pass Neuroscience 500 with an overall 70%. Attending 70% of the seminars in Neuroscience 510y is required for passing the course.

Students without a strong background in Neuroscience will be required to broaden their background in specific areas related to their research interests. Courses in Neuroscience which are available in the University are listed under "Courses"

In exceptional cases, when the research project has developed beyond that of an M.Sc., students may be permitted to transfer directly to the Ph.D without completing an dM.Sc. and research thesis.

The requirements for a Ph.D. degree in Neuroscience include:

- 1) A research thesis describing original scientific research. The thesis must be successfully defended in an oral examination which is preceded immediately by a public lecture. The public lecture should be of about 40-45 minutes duration and should describe the scope of research and a discussion of experimental findings. The oral presentation should be accompanied by slides; a question period by the audience will follow. The examination committee will consist of two faculty members from the Neuroscience Program, one member of the university who is not a member of the program and one member who is an expert in the field from outside the university.
- 2) Course requirements:
  - a) Principles of Neuroscience (Neuroscience 500) if not taken at the M.Sc. level. Exception from this course will not be granted for students having taken a survey course in neuroscience in other programs. All students are required to pass Neuroscience 500 with an overall 70%
  - b) Perspectives in Neuroscience (Neuroscience 510y); students will normally be required to enroll in this course in each academic year of their full-time enrollment. Attending 70% of the seminars is required for passing the course.
  - c) Research Proposals (Neuroscience 602y, 603y): a research proposal in the format of a CIHR or NSERC grant proposal in the student's area of research; the second grant is normally an expanded and more indepth version of the first grant.

d) Additional courses required by the student's Advisory Committee to prepare the student for the comprehensive and/or to provide background for the student's particular area of research. Students who enter the PhD program from another discipline might have to take Principles of Neuroscience (Neuroscience 500).

e) Comprehensive Examination (Neuroscience 600, see description below): The program of study proposed for each student by his or her Advisory Committee will require the approval of the Program Committee to ensure common standards. The Program Committee will also monitor the progress of the student throughout the course of study indicators such as the student's research presentations in the Perspectives in Neuroscience Seminars Series, the Research Proposals, the comprehensive examination, and reports of the student's Advisory Committee as to research progress. The median duration of the PhD program is 5 years. The minimum residency requirement is 9 terms (3 years).

### **Comprehensive Examination for Ph.D. Students**

The comprehensive examination must be undertaken within the eighteen months of registration in the Ph.D. program. The scope and subject area of the comprehensive examination are suggested by the student and supervisor. In general, four areas of neuroscience, relating broadly to the student's thesis research, are covered. The suggested topics are submitted, in writing, by the student and supervisor to the Advisory Committee which further defines the examination content. The topics should be specified in sufficient detail appropriate for the Ph.D. level. For example, "cellular biology" would not provide sufficient detail; "cell-cell interactions" would provide sufficient detail. These topics are submitted, in writing, to the Course Manager for the Ph.D. comprehensive course who then presents them for discussion and approval to the Program Committee. Examiners, who may be suggested by the student, supervisor or Advisory Committee, are approved by the Program Committee. The student is informed of the areas and examiners which have been identified at least four weeks prior to the examination. Students should arrange to meet frequently with each examiner to discuss readings and areas which should be concentrated on for the examination.

The examination is administered by an examination committee consisting of a Chair appointed by the Program Committee and four examiners. Members of the Advisory Committee, excluding the supervisor, and extra-departmental faculty may serve on the examination committee. Details of the conduct of the exam are contained in a document called "Oral comprehensive examination for the Ph.D. Procedures for the conduct of the examination".

The examination consists of a written component and an oral component. The student is expected to be able to recall facts, recognize general concepts, use new information to solve novel problems, be aware of the historical development of the subdiscipline, and be familiar with the current research methods in his/her own related fields.

The oral component of the examination is normally taken approximately one week before the written component. The candidate is normally informed of the composition of the examining committee at least four weeks prior to the oral examination. The duration of the oral examination is usually about two hours. Only members of the examination committee can ask questions; other faculty can attend but do not participate. At the conclusion of the oral examination, the examinee leaves the room and then the chair invites discussion of the candidate's performance prior to calling for a vote. Pass or fail votes are collected by written ballot from members of the examination committee, with the majority opinion determining the result. The chair votes only in the event of a tie. At the conclusion of the examination, the chair verbally informs the student of the outcome and transmits any comments the examiners might suggest. The student is also provided with a letter from the chair of the examining committee stating the results of the examination and, where appropriate, comments on his/her performance.

The written examination consists of at least four principal questions prepared by the examination committee and approved by the Program Committee. The student will generally be given a choice within the principal questions. The examination will last four hours. Each question is graded by at least two faculty members. To pass the written component of the examination, an overall grade of "B" (70%) is required.

A student is permitted two attempts at the examination and if unsuccessful for a second time meets with the Advisory Committee to determine a course of action, which normally would involve withdrawal from the graduate program.

### **Program Thesis Examination for the Degree of Doctor of Philosophy**

This examination is required by the Neuroscience Program before the thesis is sent to the Faculty of Graduate Studies for the Senate Examination. The examination is conducted by the candidate's Advisory Committee, with the supervisor or Program representative as the chairperson. The Advisory Committee can request that additional program faculty members serve on the examination committee. The examiners will make suggestions for improvement and corrections of the thesis.

Students may not submit their theses for defense prior to the completion of all of the above academic requirements. Assuming minimal revisions of the PhD thesis draft, the student should allow 3 weeks for the Program thesis examination, and 7 weeks for scheduling the Senate PhD examination from the time of submission.

### **Preparation of Thesis**

Students should consult the Guide for the Preparation of Thesis, published by the Faculty of Graduate Studies, for criteria and specifications. Basically, there are three procedural steps for thesis submission:

1. Submission of the thesis for examination. Doctoral candidates are required to submit to the Faculty of Graduate Studies the original and four copies of their thesis for examination, with a completed Thesis Submission Form. Master's candidates submit to the Program Office the original and three copies of their thesis for examination.
2. Oral examination. For the M.Sc. degree oral examinations are arranged by the Program; the Faculty of Graduate Studies makes the arrangements for the Ph.D. orals.
3. Submission of the thesis for acceptance as partial fulfillment of graduation requirements. Candidates for master's and doctoral degrees who have successfully completed their oral examinations and who have made all required revisions to their theses must submit the original and two copies to the Faculty of Graduate Studies.

Students will be required to pay a cost-recovery fee for the binding and microfilming of theses, as follows:

Microfiche for deposit in the National Library (Ph.D. Thesis only), registration with international abstracting service, and binding of 1 official copy for Weldon Library - approximately \$105.00

Binding of personal copies for the student - \$20.00/copy

(An additional copy of each thesis will continue to be required of each student for the Program but the \$20.00 cost of binding will, as is now the case, be charged to the Program.)

A new guide for the preparation of theses may be obtained from the web site of the Faculty of Graduate Studies at the following location: <http://www.uwo.ca/grad>. One notable change is that theses copies submitted for examination purposes may now be double-sided. The final copies must still be single-sided. Students will be required to pay the cost-recovery fee for the binding and microfilming of theses. The current fees are available from the Program office.

### **Teaching Assistantship**

The Neuroscience Program has a limited number of Teaching Assistantships (TAs), normally quarter-time TAs and awarded to continuing PhD students. TAs from other departments may be available to some neuroscience students depending on their background training and the department of their supervisor. The student must apply directly to the department that provides the TA. To be eligible for consideration, the student must have a B+ average. TAs are compensated for their services at rates negotiated by the Society for Graduate Students (SOGS).

### **Financial Support**

The current minimal stipends are \$17,000 per annum for a PhD student and \$16,000 per annum for an MSc student. The stipends include all support provided by the Faculty of Graduate Studies, Neuroscience Program and supervisor.

There are several types of support for students: 1) Graduate students are supported by awards from external granting agencies at the federal level (e.g., Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council) or at a provincial level (e.g., Ontario Graduate Scholarship, and Ontario Graduate Scholarship Science and Technology). A graduate student with a competitive national award may also receive Graduate Tuition Scholarship (GTS), to be decided by the Faculty of Graduate Studies. The GTS covers the full value of the graduate tuition and activity fees. It may be held for a maximum of two years for MSc students and up to four years for PhD students who maintain an A average. 2) All eligible students of the Neuroscience Program are considered for the Special University Scholarships (SUSs). SUSs are paid from a budget provided by the Faculty of Graduate Studies to the Neuroscience Program. Currently, the typical amount of SUS provided to an eligible student is equivalent to the tuition and activities fees charged to the student. Students with external support are normally not provided with SUS. 3) In addition, many graduate students are paid a stipend from the supervisor's research grant. 4) A graduate student may qualify as Teaching Assistants (TAs). The Neuroscience Program offers a limited number of TAs. However, the home department of your supervisor may consider you for a TA and various departments, notably those with large undergraduate enrolment, may consider Neuroscience graduate students for TAs. 5) Foreign students holding an A average may qualify for an International Graduate Student Scholarship (IGSS), awarded by the Faculty of Graduate Studies following nomination by the Program. 6) Entering graduate students with a high A average will be considered for the Presidential Graduate Scholarship, awarded by the Faculty of Graduate Studies. 7) The Program currently provides partial financial support to graduate students who presented at national and international meetings, and for learning new skills that are not available on campus.

Students are urged to apply for external support from granting agencies. Application deadlines for major scholarships are usually in the Fall preceding entrance into the Program. Students should consult with potential supervisors for advice in completing these applications well in advance of the deadlines.

### **Vacations**

The normal vacation allowance for graduate students is three weeks per year with the approval of the supervisor. Students should advise their supervisor of requested dates as early as possible.

### **Responsibilities of the Student**

Completing a graduate program in an experimental science is a challenging task. Dedication, concentration and continuity of purpose are fundamental ingredients required for success. Students should be aware that the opportunity to perform experimental work is a privilege; this should be remembered at all times in studies with experimental animals as well as with human volunteers, when the highest ethical and technical standards must be observed. It follows that a lot of hard work is required for which there is no substitute.

Every effort should be made to ensure that the research will provide publishable results that will mark the scientific merit of the student.

Long-term success as a research scientist requires a breadth of knowledge beyond the thesis topic and the ability to adopt new approaches as the discipline develops. Consequently, flexibility is required. Other encouraged activities include the development of novel approaches or techniques, or the introduction into the supervisor's laboratory of new techniques. Participation in collaborative research projects, at the University of Western Ontario or at other institutions, is also encouraged. Students should attend and present their work at broadly based meetings such as the Society for Neuroscience in order to interact with individuals outside their own research specialty.

### **Responsibilities of the Supervisor**

Before accepting a graduate student, it is the responsibility of the supervisor to ensure the availability of adequate space and facilities for the planned work. In addition, there should be a reasonable expectation of continuing grant support. A copy of a letter specifying the financial support of the supervisor addressed to the student must be provided to the Neuroscience Program when admitting a student to a degree program, or when transferring to the PhD. If a teaching assistantship is offered by the supervisor's home department, it should also be specified in the letter. The supervisor should also provide a) advice on the selection of projects which should ensure that the program is not of undue length and which should lead to results publishable in a high quality journal; b) guidance in making logical critical interpretation of scientific data;

c) guidance in writing scientific English with skill; d) assistance in acquiring, in addition to technical skills, an historical perspective of neuroscience; e) assistance in planning future steps in a student's career; f) help in the preparation of material for presentation at meetings; g) introductions to members of the research community in which the student is likely to work; h) approval of the thesis before it is submitted to the Advisory Committee. The supervisor is expected to attend the research seminar given by the student at the Neuroscience seminar (Neuroscience 510y).

### **Appeals**

Appeals may be made on academic issues such as: accuracy or appropriateness of grades on examinations, assignments, or courses; fairness or appropriateness of general grading practices; a waiver of a progression requirement; or the appropriateness of sanctions imposed for a scholastic offence. For issues arising from coursework, appeals normally must be made in the first instance to the faculty member who teaches the course. If this does not satisfactorily resolve the issue, or if the issue concerns a topic not directly related to matters arising from a specific course, appeals must be made to the Director of the Graduate Program in Neuroscience. Having exhausted all stages of appeal within the Graduate Program in Neuroscience, a student may appeal to the Dean of Graduate Studies. A booklet containing information relevant to appeals to the Dean of Graduate Studies entitled, "Information for a graduate student wishing to make an appeal to the Faculty of Graduate Studies" is available from the Faculty of Graduate Studies. General principles of fairness, confidentiality, subject of an appeal, grounds of the appeal, relief requested, onus, standard of proof, and documentation that are applied to appeals by graduate students in the Program in Neuroscience are those described in the "Information for a graduate student wishing to make an appeal to the Faculty of Graduate Studies" booklet.