

# PROTEIN FUNCTION DISCOVERY

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## Program Outline

The Collaborative Program in Protein Function Discovery is based on the Graduate Programs in the Departments of Anatomy and Cell Biology, Biochemistry, Biology, Microbiology and Immunology, Pathology and Pharmacology and Toxicology. The Program aims to train doctoral students in the key research technologies needed to elucidate protein structure and function and to provide a research environment where the student can apply these skills to important topics in basic science and health research.

## Facilities

In addition to the research facilities available in the participating Departments the Collaborative Program has six laboratories outfitted with state-of-the-art equipment for protein characterization. Five of the laboratories are located in Botterell Hall, the major building for the basic medical sciences. These include a Proteomics and Mass Spectrometry laboratory containing MALDI-TOF and Q-TOF mass spectrometers; a Bioinformatics Center equipped for modeling protein structures; an Imaging Center containing a multi-photon confocal laser microscope, a digital fluorescence microscope, a fluorescence activated cell sorter and a cell microinjector; a Protein Interaction Laboratory outfitted with Biacore, analytical ultracentrifuge, micro-calorimeters, fluorescence lifetime spectrometer and rapid scanning CD and UV spectrophotometer; and a Protein Structure Determination Center containing a 600 MHz NMR spectrometer and facilities for X-ray crystallography. A Cell and Protein Production facility equipped with several bio-fermenters is located in Dupuis Hall.

## Financial Assistance

The Collaborative Program in Protein Function Discovery is funded by the Canadian Institutes for Health Research (CIHR) as a National Training Program. The Program provides full financial support to students during the first year of graduate studies. All students are encouraged to apply for financial support in the form of fellowships and studentships from external funding agencies. Research assistantships funded from grants held by faculty members and departmental teaching assistantships are also available.

## Fields of Research

The current research interests of each member of the Collaborative Program are summarized on our website [www.queens-pfd.ca](http://www.queens-pfd.ca) (<http://www.queens-pfd.ca/>). The Program offers research and courses that emphasize an integrated approach to the elucidation of protein

structure and function and embraces the following fields: bioinformatics; protein expression and purification; biochemical and biophysical analysis of proteins; three-dimensional structural analysis of proteins; proteomics and mass spectrometry; protein imaging in cells; protein function in model organisms; protein function in health and disease.

## Programs of Study

Admission to the Collaborative Program is limited. The Program encourages the enrolment of students from a variety of backgrounds and disciplines, but strong preference will be given to students who intend to pursue a doctoral degree. Students interested in applying to the Program should first contact the Director of the Collaborative Graduate Program. Applicants must apply to, and be accepted by, the graduate program of one of the participating Departments. An Admissions Committee, comprised of faculty from the participating Departments, will then review the applications and recommend students for admission to the Collaborative Program.

## Master of Science and Doctor of Philosophy

All entering students will undertake an intensive "Training Period" during which they will take the three courses offered by in the PROT-82- series. These courses provide the theoretical background and hands-on training in key technologies and involve research rotations through the laboratories of faculty associated with the program. A Supervisory Committee consisting of three faculty members associated with the Collaborative Program will be established for each student. The Supervisory Committee will be responsible for monitoring and evaluating the student's progress and will advise the student on the choice of a research supervisor.

Students who successfully complete the Training Period will select a research supervisor from among the faculty associated with the Collaborative Program and will undertake a thesis research project. Transfer between Departments is allowed following the training period, so that students will have the option of selecting a research supervisor from any Department affiliated with the Collaborative Program. Students will be required to satisfy all the academic requirements of the Department-of-registration, which may include additional course requirements.

## Faculty

### Head

Mak, A.S.

### Coordinator of Graduate Studies



Côté, G.P.

**Faculty**

Martin, N.L., Smith, S.P.

## Courses

### **PROT 824 Biophysical Analysis of Proteins**

This course will consist of seminars and lectures covering topics such as equilibrium binding, enzyme kinetics, hydrodynamics, fluorescence, light scattering and spectroscopy. Protein structure determination using x-ray crystallography and NMR spectroscopy will be covered.

Specific emphasis will be placed on the application of biophysical techniques to gain important insights into protein function, interactions and structure. A good working knowledge of introductory calculus and chemistry is required. Offered jointly with BCHM 824. PREREQUISITE BCHM 313 or its equivalent or permission of the coordinator. Enrolment is limited. Fall term, three hours.

### **PROT 825 Practical Approaches to Protein Function Discovery**

A laboratory-based course designed to introduce students to a variety of state-of-the-art techniques to characterize proteins. Students will receive hands-on experience in techniques such as cell culture, protein expression and purification, 2D gel electrophoresis, mass spectrometry, analytical ultracentrifugation, surface plasmon resonance, micro-calorimetry, NMR spectroscopy, x-ray crystallography, immunofluorescence techniques and confocal laser microscopy. Students will learn the proper use of equipment and how to collect, analyze and present experimental data. Enrolment is limited. Fall-winter terms. Tutorials and laboratory.

COREQUISITE PROT 824

### **PROT 826 Laboratory Rotations in Protein Function Discovery Research**

Students carry out three 10 week-long research rotations in the laboratories of faculty associated with the Collaborative Graduate Program. Rotations are chosen according to the interests of the students and in consultation with faculty. Upon joining a lab, the student becomes a fully participating member of the research group, engaging in various research and research-related activities. The rotations introduce students to many of the skills and concepts that they will use throughout their careers and provide a basis for the student's selection of a research area in which to perform dissertation research. At the end of each rotation period students will be evaluated on oral/written presentations.

Enrolment is limited. Fall-winter terms. Laboratory research. COREQUISITE PROT 824 and PROT 825