

# PATHOLOGY AND MOLECULAR MEDICINE

## Fields of Research

Pathology is a study of disease and the mechanisms leading to injury. It involves a wide range of biochemical, molecular, cellular and clinical approaches. Fields of interest in the department include: cancer biology, drug resistance, metastasis, programmed cell death and cell cycle regulation, transgenic mouse models of gene function, cell differentiation and gene regulation, hemostasis/thrombosis, amyloidosis and Alzheimer's disease, disturbances in protein synthesis, and human genetics (including human gene mapping). Detailed information on faculty research interests is presented in a brochure which is available on request. See also the Department of Pathology WEB Page: <http://www.path.queensu.ca/>.

## Departmental Facilities

Excellent facilities are available for training in experimental pathology and basic research in cell and molecular biology. Facilities and techniques include hemtological analysis, electron microscopy, histochemistry, immunohistology, flow cytometry, two-photo confocal fluorescence microscopy, microinjection with fluorescence image analysis and time lapse capability, transgenic mice facilities for production of transgenic over-expressing and gene-knock out models, cell fractionation, tissue culture; column chromatography, DNA, RNA and protein electrophoresis; gene cloning and sequencing, using of isotopes and microarray-based global gene expression profiling.

## Financial Assistance

Graduate students are encouraged to apply for financial support in the form of fellowships and studentships from external granting agencies. Graduate research assistantships, funded from grants to staff members, and teaching assistantships, funded by the University, are also available. Departmental policy ensures a minimum stipend support for graduate students.

## Postgraduate Activities

Postgraduate training programs leading to certification and fellowship in the Royal College of Physicians and Surgeons of Canada and the American Board of Pathology are offered through the Faculty of Medicine to medical graduates.

## Faculty

### Head

Berman, D.

### Coordinator of Graduate Studies

Greer, P.A.

### Professor

Berman, D., Callum, J., Cole, S.P.C., Davey, S., Feilotter, H., Greer, P.A., LeBrun, D., Lillicrap, D.P., Manley, P.N., Mulligan, L., Panchenko, A., Rossiter, J.P., SenGupta, S., Yang, X.

### Associate Professor

Boag, A.H., Childs, T., Good, D., Hurlbut, D.J., Nicol, C., Quest, G., Rauh, M., Renwick, N., Varma, S.

### Assistant Professor

Cotrell, T., Crocker, S., Davidson, C.M., Farmer, P., Gong, Y., Grin, A., Huang, Y., Manduch, M., Oleschuk, C., Orr, C., Ren, K. Schneider, M., Sheth, P., Tanguay, J., Wang, A., Wang, T., Xu, A.

### Professor Emeritus

Deeley, R.G., Elliott, B.E., Giles, A., Haust, D., Shepherd, L.E., Steele, H., Young, I.D., Zoutman, D.

### Adjunct Professor

Farmer, J., Squire, J.

### Adjunct Associate Professor

Tomalty, L.L.

### Adjunct Assistant Professor

Ghaffari, A., Hough, C.

### Cross-Appointed

Basta, S., Evans, G.A., Fichtinger, G., Gooding, R., James, P., Lee, D., Maurice, D.H., Mousavi, P., Mueller, C.R., Petkovich, P.M., Raptis, L.H., Tayade, T., Walia, J., Young, P.G.

## Programs

- Pathology and Molecular Medicine - Doctor of Philosophy (<https://queensu-ca-public.courseleaf.com/graduate-studies/programs-study/pathology-molecular-medicine/pathology-molecular-medicine-phd/>)
- Pathology and Molecular Medicine - Master of Science (<https://queensu-ca-public.courseleaf.com/graduate-studies/programs-study/pathology-molecular-medicine/pathology-molecular-medicine-ms/>)

## Courses

All courses are 3.0 credit units except PATH 899 and 999, which are 6.0 credit units.

### PATH 822 Experimental Cancer Therapeutics

Intended for students engaged or interested in pre-clinical cancer research. Both medical and basic science trainees are encouraged to take this course. Specific areas to be



covered include introduction to new drug development, molecular basis of oncogenic transformation and signalling pathways, challenges with current cancer therapeutics, molecular approaches to profiling human cancers as tools for identifying biochemical and genetic abnormalities and developing criteria for reliable prognostic indicators; strategies for novel target and drug discovery, as well as experimental drug delivery; novel imaging approaches to enhance the sensitivity of preclinical testing and selection of responsive patients; preclinical (in vitro and animal) models for validating experimental targets; clinical drug development and testing of novel anti-cancer drugs; and the molecular basis for variability in tumour responses. Half course, lectures and seminars.

**PREREQUISITES:** Recommended courses: ANAT 311, BCHM 310, PHAR 340, MICR 360, PATH 310, CANC 440, or equivalents, or with permission of the department. The number of students may be restricted.

### **PATH 823 Cancer Biology**

The aim of this course is to introduce and discuss essential questions in the basic science of oncology. Trainees with an interest in cancer research are encouraged to take this course. Topics include pathology of cancer, cancer genetics, growth factors, signal transduction, oncogenes, suppressor genes, early stage tumorigenesis, tumor immunology and metastasis. A general theme for the course will be mechanisms regulating neoplastic transformation and tumor progression. In order to provide a balance and high profile in all areas, various staff members in the Cancer Research Institute and associated departments have been selected as session leaders in this course. Half course, lectures and seminars; Fall term. L. Mulligan.

**PREREQUISITES:** Recommended courses: ANAT 311, BCHM 411 or BCHM 431, MICR 360 or equivalents, or with permission of the department. The number of students may be restricted.

### **PATH 826 The Molecular Basis of Disease**

This course covers several diseases that highlight the genetic, biochemical, physiologic, anatomic, and general etiologic factors that play a role in the progression of each disease from its inception to death or recovery. Some of the topics will be drawn from the ongoing research within the Department of Pathology and Molecular Medicine. The perspective will demonstrate that each disease is the result of an evolving interplay of genetic and environmental factors. (Jointly with PATH 430. Additional work prescribed for graduate students.) Half-course, lectures and seminars; Winter term. D. Lillcrap.

**PREREQUISITE:** PATH 410 or ANAT 309, BCHM 310, PHGY 212, or equivalent. Class size will be limited to 12 students with preference given to undergraduate students.

### **PATH 827 Research Project in Pathology**

Research projects in the physiological, biological, genetic and molecular basis of disease. Students will review the literature related to their proposed graduate research thesis project and write a series of essays on topics selected in consultation with a supervisory committee consisting of their supervisor and two other faculty. They will also develop a written draft research proposal that will be presented to their supervisory committee and defended in a final oral examination. To be taken by all students in the first full term of the graduate program. P. Greer (course coordinator).

### **PATH 828 Bioinformatics for Cancer Research**

Bioinformatics is an essential component of biological and health science research given the ongoing developments in generating large amounts of data in short periods of time. This course introduces tools and methods to manage and analyze the results obtained in cancer research. Topics include study design, basic statistics for clinical and genetic research, data-mining approaches and alternative methods to statistics for data analysis, and signaling pathways analysis. The course will cover the appropriate pre-processing and data analysis techniques for various genetic data types such as microarray, tissue microarrays, methylation, NanoString, RNAseq, miRNAseq, proteomics and qRT-PCR. Students with little computing background, but who are interested in pursuing or collaborating with bioinformatic research, are encouraged to enroll.

### **PATH 830 (MSc)**

#### **PATH 930 (PhD) Pathology and Molecular Medicine Research Seminar Series**

This seminar series consists of weekly presentations by visiting external speakers, Queen's faculty, and Departmental MSc and PhD students. Internal faculty and external visiting speakers will be selected by the Graduate Program coordinator with input from faculty and students.

MSc students will give 1/2 hour seminars in their first year, and one hour seminars in their second year; PhD students will give 1 hour seminars in their first and third years, and an exit seminar in their final year. Attendance by all Departmental graduate students is compulsory and will be monitored by the Graduate Program Coordinator. Departmental faculty will provide evaluations of student presentations consisting of a mark and written comments relating to introduction and background, presentation of results and response to questions. A final mark and summary of faculty evaluations will be compiled by the coordinator and provided to the student and supervisor. Students are required to provide a written summary outlining their research progress to their supervisory committee five days prior to their seminar. Fall/Winter terms. P. Greer



**PATH 899 Master's Thesis Research**

**PATH 999 Ph.D. Thesis Research**