

# **LABORATORY MEDICINE & PATHOBIOLOGY**

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**Self-Study 2007/08 – 2011/12**

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## 1. EXECUTIVE SUMMARY

The Department of Laboratory Medicine and Pathobiology (LMP) is a hybrid, clinical and basic science department in the Faculty of Medicine, University of Toronto. LMP was formed by a merger of three departments (Pathology, Clinical Biochemistry, Microbiology (clinicians)) and the inaugural Chair, Professor Avrum Gotlieb, expertly led the new department from 1997-2008. Professor Richard Hegele was recruited from the University of British Columbia and became second Chair of LMP on January 1, 2009. A strategic planning exercise was undertaken in 2009-10, which culminated in the “LMP Strategic Plan 2010-2015,” see Appendix 1.1, which has guided the setting of departmental priorities and activities.

LMP is a highly complex and diverse department, with activities in virtually all domains of undergraduate, graduate, postgraduate, professional and continuing education. The research agenda of LMP is broad: as the term “Pathobiology” within the departmental name indicates, LMP is committed to being a strong and vibrant enterprise for discovery, applied and translational research about the causes and mechanisms of disease. The “Laboratory Medicine” aspect of the departmental name refers to a commitment for translation of new knowledge into clinical practice to improve the health outcomes of patients and populations, and to inform health policy.

This self-study report covers the major activities and accomplishments of LMP since the last cyclical review that occurred in 2006/07, along with work in progress. Much has happened from the time Dr. Hegele became LMP Chair: global economic crisis; moving administrative offices from the Banting Institute to the Medical Sciences Building; expansion of the Faculty of Medicine to the Mississauga campus and growth in community-affiliated sites; accreditation of undergraduate medical education (2012) and postgraduate medical education (2013); introduction of new training programs such as Canada’s first Royal College-approved residency in Forensic Pathology; increased professionalization of Clinical Fellowships and introduction of Areas of Focused Competence (AFC) by Royal College; regional laboratory collaboration initiatives including the Toronto Central Local Health Integration Network’s Laboratory Collaborative and University Avenue Laboratories; ongoing evolution of the LMP Undergraduate Specialist Program in the Faculty of Arts and Sciences, Graduate Studies (MSc/ PhD) and post-PhD programs in Clinical Chemistry and Clinical Microbiology; revamped academic relationships with the Public Health Laboratories and Provincial Forensic Pathology Service, the list goes on and on.

Through these busy and challenging times, LMP has carried on its strong tradition of impressive productivity and achievement as evidenced by success in publication in high impact journals; success in operating grant and salary award competitions; and numerous prizes and honors that reflect the talent and accomplishments of faculty, staff, students and trainees in research, education, creative professional activity, administration, social responsibility and professionalism. Recruitment of exceptionally capable individuals to the department bodes well for the future.

LMP has transitioned from “start-up” into a mature enterprise, in which operational excellence, program excellence, and robust collaborations (including strong partnerships with affiliated hospitals, research institutes, agencies and other units) are crucial to LMP reaching its fullest potential as a major national and international department. Advances in electronic and digital technology represent key enabling mechanisms, and initiatives such as the “LMP Digital Laboratory Medicine Library” are poised to make considerable impact in the department’s academic mission.

In summary, the “What we do and why we do it” of LMP are well articulated through a simple yet compelling tagline, “Investigating Disease. Impacting Health.” This self-study report provides clear evidence that since the last cyclical review, LMP has accomplished a lot, and the department will continue to strive relentlessly for ever-increasing levels of performance and distinction.

## 2. INTRODUCTION AND CONTEXT

The University of Toronto Department of Laboratory Medicine and Pathobiology (LMP) was created in 1997 as a result of a merger of three departments (Pathology; Clinical Biochemistry; Microbiology (clinicians)) in the Faculty of Medicine. Having the name “Pathobiology” provided a strong indication from the outset that the new department would have a major research-intensive emphasis into the causes and mechanisms of disease. As such, LMP is a hybrid basic science and clinical department within the Faculty of Medicine and sits at an important intersection between discovery, applied and translational research, and clinical practice of patients and populations.

The inaugural Chair of LMP was Professor Avrum Gotlieb. During his tenure as Chair (1997-2008), Professor Gotlieb skillfully and effectively guided the new department such that by the time of the review of his second term (2006-07), the vast majority of issues related to the merger had been addressed. The second Chair of LMP, Professor Richard Hegele, was recruited from the University of British Columbia (UBC), Vancouver, BC, where he had been Professor and Head of the UBC Department of Pathology and Laboratory Medicine. Dr. Hegele began a 5-year term as LMP Chair on January 1, 2009. This current cyclical review covers the period from 2007-08 to 2011-12, which includes time in both Professor Gotlieb’s second term and Professor Hegele’s first term. Throughout this self-study document, updated information for 2012-13 will be provided when available.

At the last external review conducted in 2007, LMP was recognized as “A pre-eminent department on a national and broader international scenes” and that the “Human Resource of the Department is comparable to the top tier.” LMP was challenged to “...make clear choices for the future now that the task of merger is complete.” with the underlying understanding that “...recommendations that follow are simply considering ways to make a great department even greater.” The major recommendations made in 2007 and responses of the Department to them are discussed in Section 14 of this self-study report.

In May, 2009, LMP held an off-site retreat. This exercise resulted in identification of priorities to guide the LMP Strategic Plan Working Group, which was tasked with clarifying them into a cohesive strategic plan. In general terms, the LMP Strategic Plan 2010-2015 includes five major strategic priorities and expected outcomes:

1. Education. LMP will increase its emphasis on ensuring students and trainees obtain solid fundamentals pertinent to the discipline.
2. Faculty Development. LMP will attract, support and grow outstanding faculty educators.
3. Research Leadership. LMP will define and capitalize on its strengths and position to enhance knowledge creation and translation.
4. Digital Laboratory Medicine. LMP’s envisaged role is as the research and education “hub” with a single point of entry for diverse users.
5. Operational Excellence. Enhanced Departmental operations that support the academic mandate.

Concerning the prevailing circumstances when Professor Hegele became Chair, there was a global economic crisis which had profound effects on LMP and the Faculty of Medicine, including limited to no payouts from endowments. The introduction of a “new budget model” at the University of Toronto necessitated a fundamental change in administration, in which greater emphasis was placed on LMP to seek and rely upon external sources of revenue to support core operations. Departmental administrative offices were in the process of moving from the Banting Institute to the 6<sup>th</sup> floor of the Medical Sciences Building. A number of retirements of administrative staff were looming, providing the opportunity to recruit into roles conducive to operational excellence. Searches for two vacant tenure-stream faculty positions were in progress. Planning for the expansion of undergraduate and postgraduate medical education to the Mississauga campus, with creation of the Mississauga Academy of Medicine, was well underway, and this would necessitate LMP recruiting new part-time clinical faculty located at community-affiliated sites.

Regarding forensics, the findings of the Goudge Commission Inquiry into Pediatric Forensic Pathology in Ontario resulted in a major rethinking and revamping of approaches to forensic pathology in the Province of Ontario,

including the establishment of Canada's first Royal College-approved residency training program in Forensic Pathology, and the department's role with the Centre for Forensic Science and Medicine. Regarding microbiology, the Ontario Public Health Laboratories were brought in under the auspices of the newly created Ontario Agency for Health Protection and Promotion (OAHPP, now called "Public Health Ontario"), an agency that is arms-length from government and provides evidence-based input into public health decisions and policy for the Province. The Toronto Central Local Health Integration Network (TC LHIN) was soon to embark on an exercise in "Value and Affordability" which involved LMP participation in the "TC LHIN Laboratory Collaborative" and its subcomponent, "University Avenue Labs" in which the academic implications of potential scenarios were considered as part of the discourse.

Standards and expectations for fellowships showed considerable heterogeneity throughout the University of Toronto system, which led to the Dean's Task Force producing a document entitled, "Raising the Bar: Recommended Standards for the Management of Clinical Fellowships." Concerning faculty and career development, the approach to academic promotions was undergoing major revision from the so-called "planks" to a more holistic approach, and this provided opportunity for LMP to better define the standards for "creative professional activity" (CPA) which is especially relevant to many hospital-based clinical faculty.

Hospital-based pathologists were already showing considerable innovation and leadership in use of digital electronic approaches, particularly use of telepathology in anatomical pathology practice. By contrast, LMP was viewed neither as a leader nor as a resource for digital laboratory medicine. The education and research mandate of LMP provided context by which to approach digital laboratory medicine as an enabling platform for diverse users, ranging from undergraduate Arts and Science students, graduate students, post-doctoral fellows, health professions (undergraduate and postgraduate medical education, continuing education and professional development (CEPD), allied health professions), with the ability to use digital laboratory medicine to meet various accreditation standards such as undergraduate medical students requiring comparable educational experiences, whether they are based in downtown Toronto (St. George campus) or in Mississauga.

Concerning the research agenda, the 2007 external review challenged LMP to address "translational research", in which new knowledge created from discovery and applied research is validated, qualified and implemented to achieve improved health outcomes. The strategic planning process identified four areas of emphasis for LMP in translational research: biomarkers, biobanking, quality and informatics. Another area in which LMP worked in alignment with the Faculty of Medicine was in the establishment of thematic, cross-cutting areas of research, to strengthen our collegium through increased opportunities for interaction and collaboration.

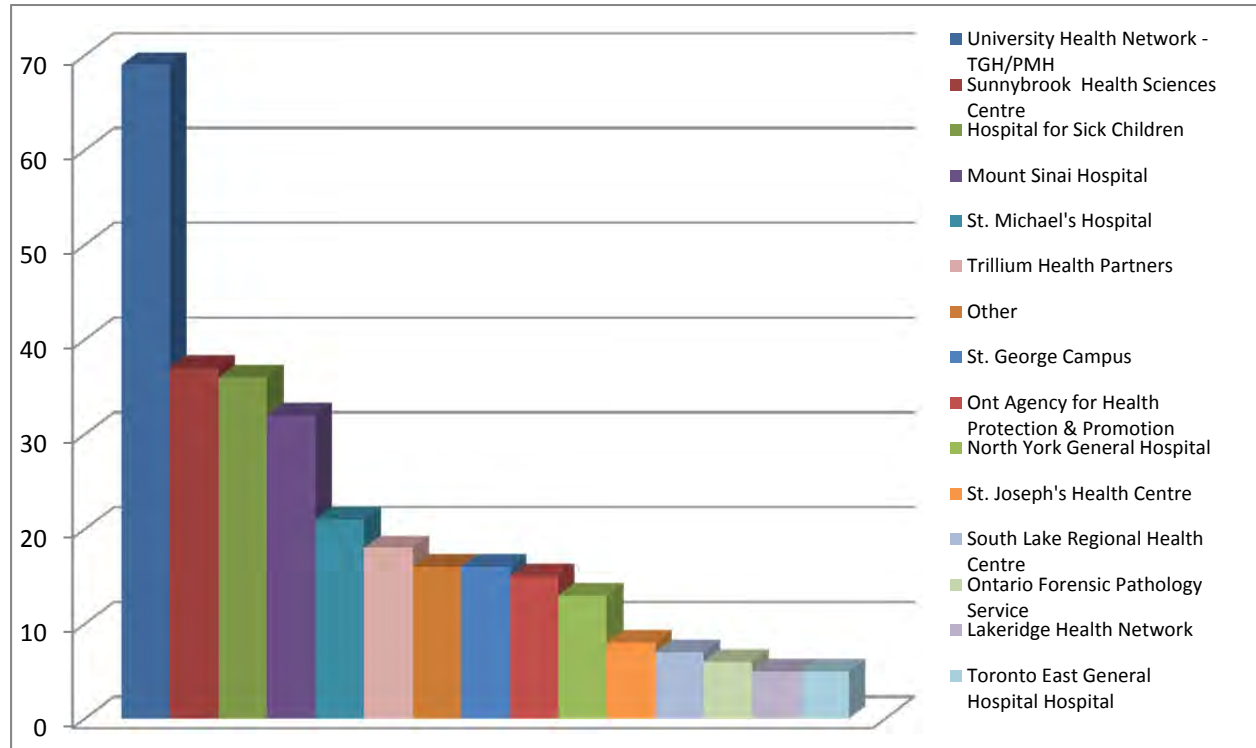
Over the last five years, the approach LMP has taken reflects the department having completed the transition from a "start-up" created through merger into a mature academic unit. For a diverse and complex department, LMP has articulated a common identity (i.e., "What we do and why we do it") through a simple yet elegant tagline, "Investigating Disease. Impacting Health." The underpinnings of the mature LMP enterprise include: operational excellence, program excellence, and enriched collaboration. Major efforts have focused on recruitment of talented and highly capable faculty, students and staff, and building solid structures to support the academic agenda. The education and research activities have been carefully scrutinized and numerous enhancements have been implemented. Partnerships and collaborations continue to evolve. LMP is arguably the only "full service" department not only in the Faculty of Medicine but at the University of Toronto, with activities in virtually all realms of education, major areas of research and in CPA. There are high expectations that come with profound responsibilities and LMP relentlessly pursues an ambitious agenda as is characteristic of a top tier national and international department.



### 3. FACULTY

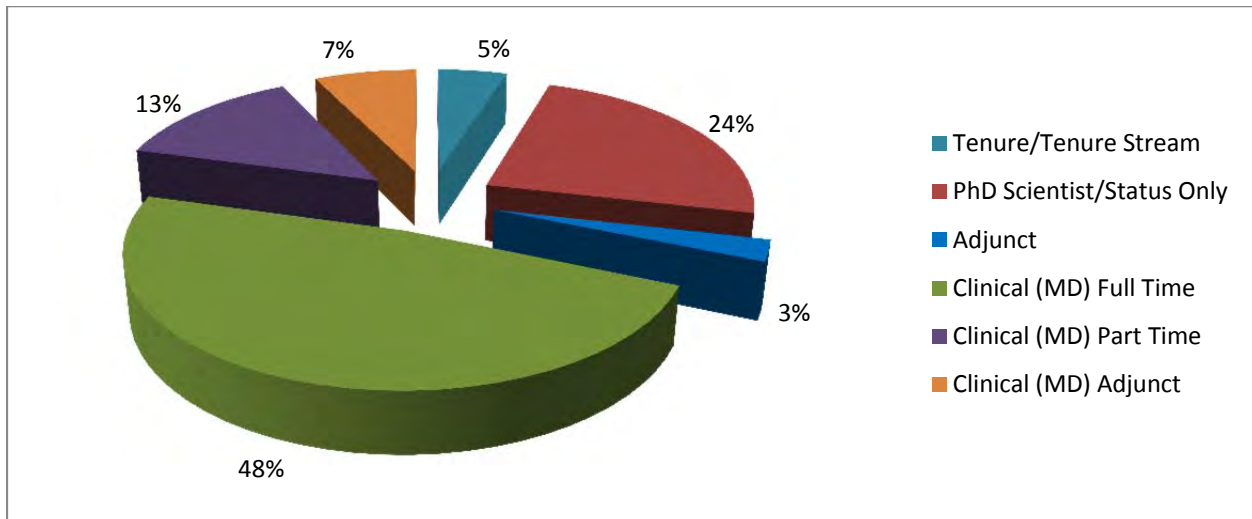
With over 350 faculty members (305 primary and 48 cross appointed), LMP is well positioned to offer a diverse array of research and clinical training opportunities. Our faculty members are involved in a broad spectrum of research and clinical practice leading to a fertile atmosphere for innovative interactions. Our members range from full-time basic scientists involved in discovery and mechanistic research, to pathologists, laboratory physicians and scientists involved in the clinical practice of pathology and laboratory medicine. The bar graph and pie charts below show the breakdown and distribution of LMP faculty.

#### Current Faculty at Core Sites

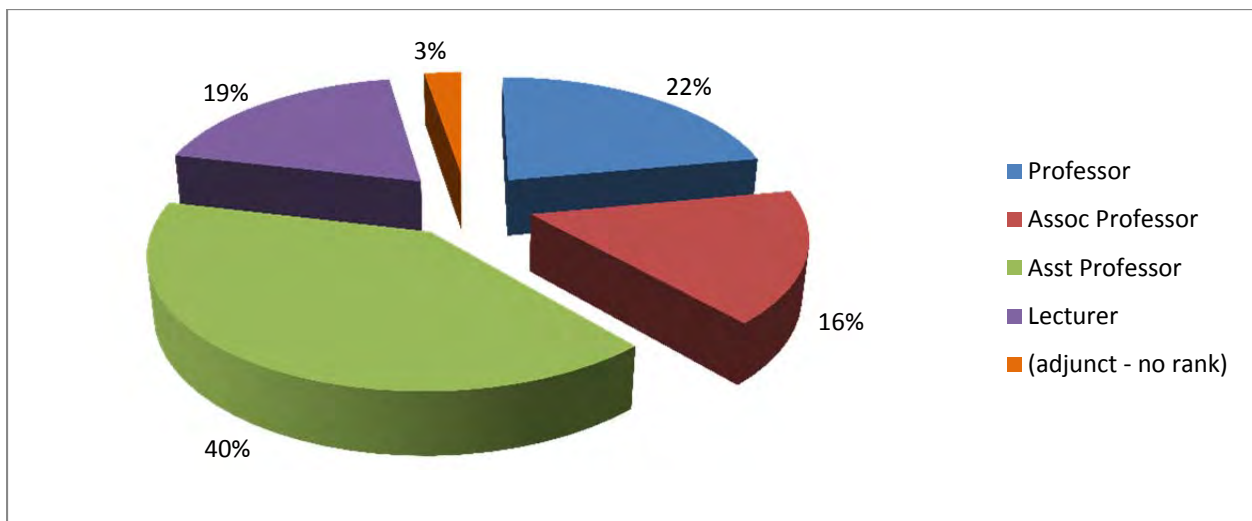


“Other” includes: Humber River Regional Hospital, Royal Victoria Hospital, The Scarborough Hospital, Sault Area Hospitals, William Osler Health Centre, Canadian Blood Services, Life Labs, ScienceHA

### Current Faculty Compliment by Appointment Type



### Current Faculty Compliment by Rank



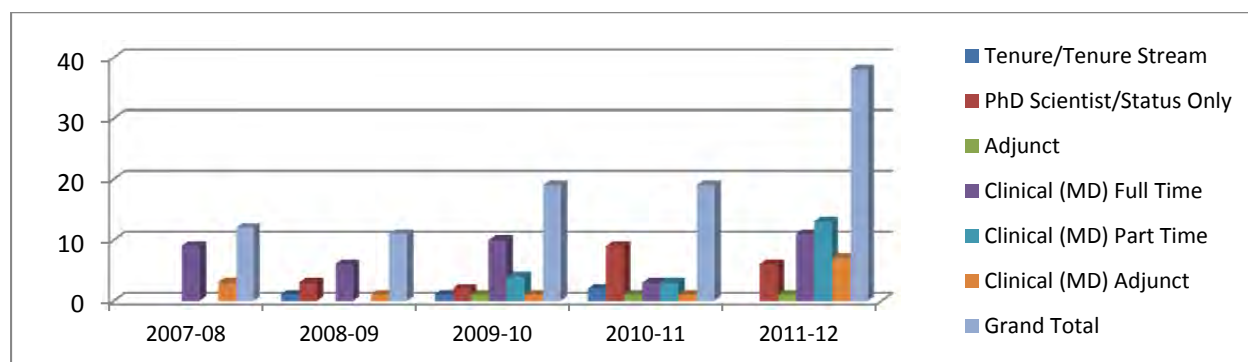
### Faculty Turnover

Over the past five years, LMP has seen substantial growth with 116 new primary academic appointments and 28 terminations, summarized in the Table and bar graph below. Clinical full-time faculty accounted for the majority of new appointments with 40, followed by 28 PhD Scientist (status only) and 24 clinical part-time. Most of these occurred over the last three years, with the highest count in 2011-12 with a surge in clinical part-time at our community affiliated hospitals. This was expected with the launch of the Mississauga Academy of Medicine in August 2011. There has also been significant growth at Toronto General Hospital (UHN) with 28 new full-time clinicians hired and at the Ontario Agency for Health Protection and Promotion (Public Health Ontario) who hired 2 full-time clinicians and 9 PhD Scientists. By contrast, the hospital research institutes have had 15 academic appointments terminated and this reflects a combination of factors, including effects from a chronically difficult research funding climate and changes in strategic directions and institutional priorities.

**Academic Appointments 2007/08 – 2011/12: New (Terminated)**

Institution	Clinical Adjunct	Clinical Full Time	Clinical Part Time	PhD Scientist (Status Only)	Tenure/ Tenure Stream	Adjunct	Total
Credit Valley Hospital	4 (0)		3 (0)	2 (0)			9 (0)
Hospital for Sick Children		0 (2)		5 (1)		1 (0)	6 (3)
Lakeridge Health Network			1 (2)	0 (1)			1 (3)
Mount Sinai Hospital		1 (0)	1 (0)	3 (5)			5 (5)
North York General Hospital			3 (0)	0 (1)		1 (0)	4 (1)
Ont Agency for Health Protection & Promotion		2 (0)		9 (0)			11 (0)
Ontario Forensic Pathology Service			4 (0)				4 (0)
Other	3 (0)	1 (0)		1 (2)		1 (0)	6 (2)
South Lake Regional Health Centre	6 (0)		1 (0)				7 (0)
St. George Campus					4 (0)		4 (1)
St. Joseph's Health Centre	3 (0)			1 (0)			4 (0)
St. Michael's Hospital		3 (1)		1 (0)			4 (1)
Sunnybrook Health Sciences Centre		10 (1)		0 (2)			10 (3)
Toronto East General Hospital			5 (0)				5 (0)
Trillium Health Centre - Mississauga	1 (0)		5 (0)				6 (0)
University Health Network - PMH		1 (0)		1 (1)			2 (1)
University Health Network - TGH	0 (1)	22 (3)	1 (0)	5 (1)			28 (5)
University Health Network - TWH		0 (1)	0 (1)				0 (2)
Women's College Hospital				0 (1)			0 (1)
<b>Total</b>	<b>17 (1)</b>	<b>40 (8)</b>	<b>24 (3)</b>	<b>28 (15)</b>	<b>4 (1)</b>	<b>3 (0)</b>	<b>116 (28)</b>

## Annual Growth in Faculty by Appointment Type



## Faculty Data

Refer to Appendix 3 for the following lists:

- 3.1 Primary Faculty
- 3.2 Cross-Appointed Faculty
- 3.3 Faculty Honors & Awards
- 3.4 Faculty Leadership Roles

Electronic copies of faculty CVs are provided on a USB stick. These are sorted alphabetically within two distinct groups: (1) Primary Appointed and (2) Cross Appointed.

## Professors Emeriti:

Andrew Baines  
 Reuben Baumal  
 Catherine Bergeron  
 Joan Boggs  
 Thomas Brown  
 Dean Chamberlain  
 Bruce Cruickshank  
 James Cullen  
 Irving Dardick  
 John Deck  
 Etienne deHarven  
 Sarma Dittikavi  
 Emmanuel Farber  
 Peter Fleming

Victor Fornasier  
 Arthur Franklin  
 David Goldberg  
 Alice Gray  
 Gilbert Hill  
 Harriette Kahn  
 Kolman Kovacs  
 Chin Liew  
 Donald Mickle  
 Joe Minta  
 Mario Moscarello  
 David Murray  
 Dominic Pantalony  
 William Paul

James Philips  
 Peter Pinkerton  
 Ali Qizilbash  
 Srinivasan Rajalakshmi  
 Alexander Ritchie  
 Roderick Ross  
 Malcolm Silver  
 Meredith Silver  
 Leslie Spence  
 Nikola Stanacev  
 Jan Steiner  
 Harry Strawbridge  
 Donald Thompson  
 Peter Van Nostrand

## Recruitment & Academic Appointments

LMP is an active participant in the recruitment of potential faculty members located in the fully affiliated hospitals and research institutes. The Department Chair (or his representative) sits on the search committee to determine the candidate's eligibility for an academic appointment. For Clinical Faculty appointments, the Faculty of Medicine requires the position to be posted on the University Affairs publication and the University of Toronto website.

Academic appointment requests must be made to the LMP Chair. The Departmental Appointments Committee (DAC) reviews new appointments to determine eligibility and rank. If the Chair concurs with the DAC's

recommendation, the appointment package is submitted to the Dean of the Faculty of Medicine/or Vice-Dean, Clinical Affairs, Faculty of Medicine for final approval. DAC Membership (as of March 2012):

- Ingrid Zbieranowski, Chair, DAC & Associate Professor, Sunnybrook Health Sciences Centre
- Harry Elsholtz, Associate Professor-Tenured & Graduate Coordinator
- Richard Hegele, Professor & Chair
- Frances Jamieson, Associate Professor, Public Health Laboratory
- Sarah Keating, Associate Professor, Mount Sinai Hospital
- Michael Pollanen, Associate Professor, Ontario Forensic Pathology Service
- Margaret Rand, Professor, Hospital for Sick Children
- Alexander Romaschin, Associate Professor, St. Michael's Hospital
- Theodore Van der Kwast, Professor, University Health Network
- Herman Yeger, Professor, Hospital for Sick Children
- Li Zhang, Professor, University Health Network

## Annual Review

All faculty appointed to LMP are required to participate in the annual academic review process. This is a mechanism to ensure that faculty members remain engaged in the department.

Faculty members are requested to submit an Annual Activity Report (AAR) describing scholarly and teaching activities for the period July 1 – June 30. The faculty member's hospital chief/research director signs off on the report prior to submission to the Department Chair, where applicable.

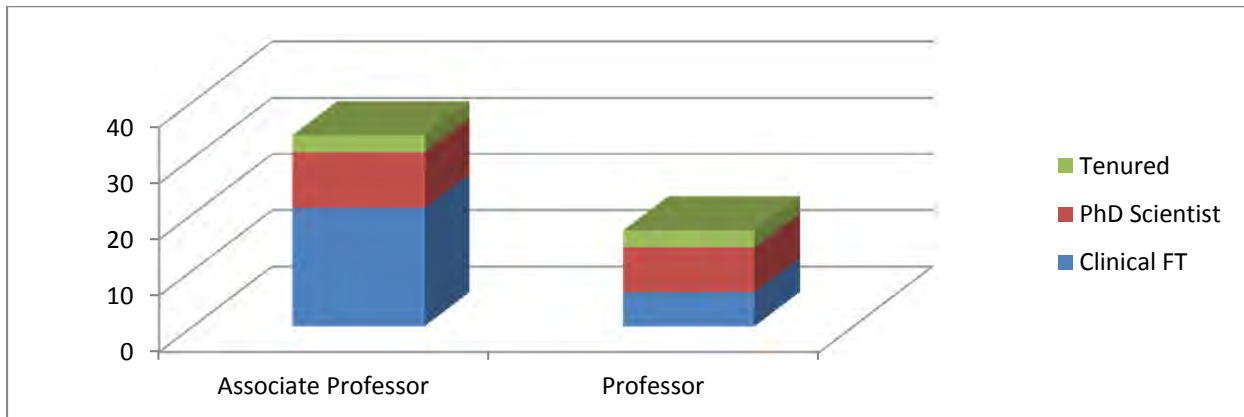
Tenure and tenure stream faculty and some hospital-based faculty undergo an in-depth annual review process. The faculty member meets with the Department Chair to discuss accomplishments over the past year and goals for the upcoming year. The department's Annual Review Committee, represented by the Chair, the Research Director, the Graduate Coordinator and the Undergraduate Coordinator, meet to review and set a final rating.

## Promotion

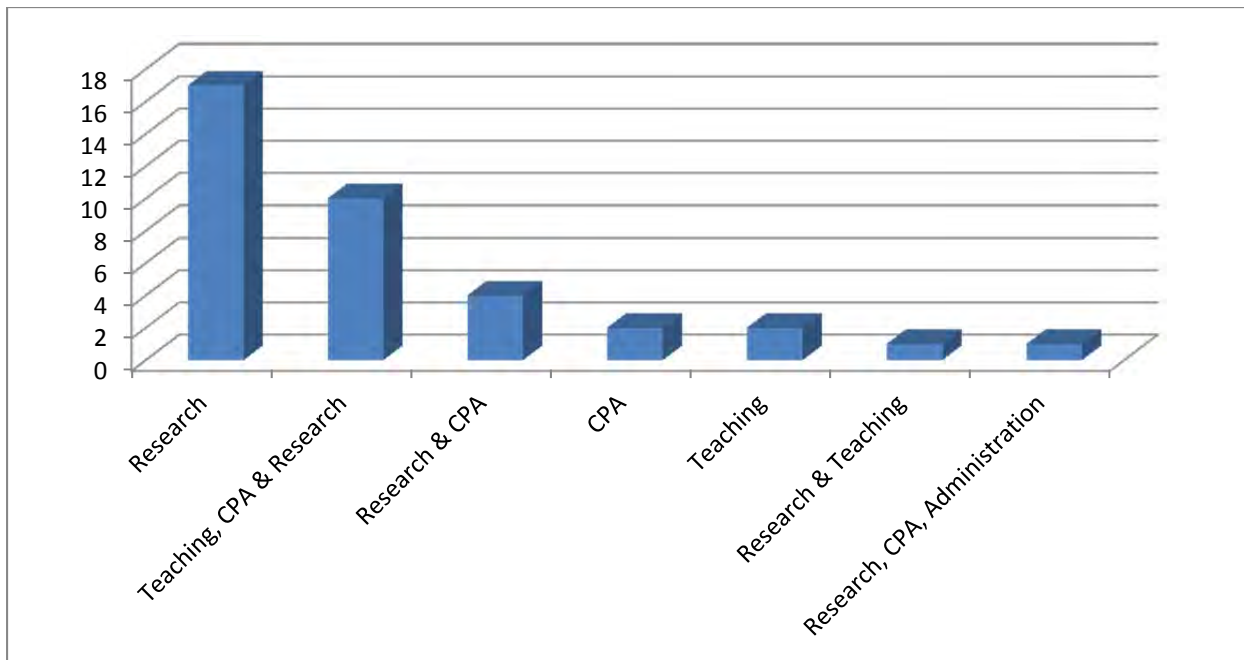
Each February, the Office of the Chair sends out a call for promotion to all faculty members. Those interested for consideration are requested to submit a letter of intent and an updated curriculum vitae. These documents are reviewed by the Department Chair and the Chair of the Departmental Promotions Committee. Candidates who are deemed to be promising candidates for promotion are requested to prepare a comprehensive dossier for review by the Departmental Promotions Committee. A timeline of the department's promotion review process and related documents can be found on our website, [www.lmp.utoronto.ca/faculty/information-existing-faculty-members/promotion-guidelines-2013-2014](http://www.lmp.utoronto.ca/faculty/information-existing-faculty-members/promotion-guidelines-2013-2014)

The bar graphs below summarize the results of academic promotion in LMP from 2007-2012, with a full list of faculty promotions provided in the accompanying table.

### Promotions 2007/08 – 2011/12



### Promotions by Platform Type 2007/08 – 2011/12



LMP Faculty Promotions 2007/08 – 2011/12			
Name	Year	Promoted to Rank of	Platform
Jeremy Mogridge	2007	Associate Professor	Research
Bayardo Perez-Ordóñez	2007	Associate Professor	Plank 1 - Research
Simon Raphael	2007	Associate Professor	Plank 5 - Teaching
Ian Crandall	2007	Associate Professor	Plank 4 - Teaching with CPA & Research
Andrew Evans	2007	Associate Professor	Research
Heyu Ni	2007	Associate Professor	Plank 1 - Research
Hilmi Ozcelik	2007	Associate Professor	Plank 1 - Research
Elizabeth Winsor	2007	Associate Professor	Plank 4 - Teaching with CPA & Research
Michelle Bendeck	2007	Professor	Plank 1 - Research
Bharati Bapat	2007	Professor	Research
William Chapman	2007	Professor	Plank 4 - Teaching with CPA & Research
JoAnne McLaurin	2007	Professor	Plank 1 - Research
Burton Yang	2007	Professor	Plank 1 - Research
Herman Yeger	2007	Professor	Plank 1 - Research
Mohamed Abdelhaleem	2008	Associate Professor	Plank 4 - Teaching with CPA & Research
Cynthia Hawkins	2008	Associate Professor	Plank 1 - Research
Maria Rozakis-Adcock	2008	Associate Professor	Research
Scott Boerner	2008	Associate Professor	Plank 4 - Teaching with CPA & Research
Jeannie Callum	2008	Associate Professor	Plank 4 - Teaching with CPA & Research
Danny Ghazarian	2008	Associate Professor	Plank 4 - Teaching with CPA & Research
Maha Guindi	2008	Associate Professor	Teaching
Chen Wang	2008	Associate Professor	Plank 3 - Research & CPA
Bernard Fernandes	2008	Professor	Plank 4 - Teaching with CPA & Research
Paul Hamel	2008	Professor	Plank 1 - Research
Jim Hu	2008	Professor	Plank 1 - Research
Mahmoud Khalifa	2008	Professor	Plank 4 - Teaching with CPA & Research
Margaret Rand	2008	Professor	Plank 1 - Research
Linda Sugar	2008	Professor	Plank 4 - Teaching with CPA & Research
Douglas Tkachuk	2009	Associate Professor	
Susan Done	2009	Associate Professor	Plank 1 - Research
Barry Hoffman	2009	Associate Professor	Plank 5 - Teaching
Sarah Keating	2009	Associate Professor	Plank 4 - Teaching with CPA & Research
Naomi Miller	2009	Associate Professor	Plank 2 - CPA
Janice Robertson	2009	Associate Professor	Plank 1 - Research
Reda Saad	2009	Associate Professor	Plank 4 - Teaching with CPA & Research
Joan Sweet	2009	Associate Professor	Plank 4 - Teaching with CPA & Research
Maria Zielenska	2009	Professor	Plank 1 - Research
David Hwang	2010	Associate Professor	Plank 1 - Research
Frances Jamieson	2010	Associate Professor	Plank 3 - Research & CPA
Golnar Rasty	2010	Associate Professor	Plank 2 - CPA
Gerold Schmitt-Ulms	2010	Associate Professor	Research
Gino Somers	2010	Associate Professor	Research
George Yousef	2010	Associate Professor	Plank 1 - Research
Isabelle Aubert	2011	Associate Professor	Research

LMP Faculty Promotions 2007/08 – 2011/12			
Name	Year	Promoted to Rank of	Platform
Stephen Girardin	2011	Associate Professor	Research
Kevin Katz	2011	Associate Professor	Research & CPA
Dean Rowe-Magnus	2011	Associate Professor	Research
Colin Mckerlie	2011	Professor	Plank 1 - Research
Nades Palaniyar	2012	Associate Professor	Research
Hong Chang	2012	Professor	Research & CPA
Michael Ohh	2012	Professor	Research & Teaching
Patricia Shaw	2012	Professor	Research, CPA, Administration

Previous Planks

1. Achievement in scholarship (research), excellence in scholarship (research) & effectiveness in teaching
2. Achievement in scholarship (CPA) with excellence in scholarship (CPA) and effectiveness in teaching
3. Achievement in scholarship (research & CPA) judged by excellence in scholarship (research & CPA) and effectiveness in teaching
4. Achievement in teaching with excellence in scholarship (CPA & research)
5. Sustained achievement in teaching with excellence in teaching sustained over many years



## 4. ACADEMIC PROGRAMS

### Undergraduate Pathobiology Specialist Program (A&S)

#### Program Description

The program was developed recognizing that a major thrust of research in life sciences today is directed towards exploiting cell and molecular biology, genomics, and proteomics, to understanding human disease. The program focuses on mechanisms of disease and is distinguished from medical pathology by emphasizing disease mechanisms rather than disease recognition. This necessarily requires a multidisciplinary approach, and our Department offers expertise in a range of bench-to-bedside approaches, from basic molecular studies, to whole organism biology, infectious disease, epidemiology and clinical trials. The students are encouraged to participate in all levels through seminar and summer research programs, but the didactic focus of the formal program is on cellular and molecular mechanisms.

Life Sciences students entering our Pathobiology Specialist program will complete first year courses in mathematics, physics, chemistry, and biology, and typically enter the Program in their second year. The Program then builds upon foundation courses in cell and molecular biology, physiology, biochemistry, genetics, immunology and statistics to present, in 3rd and 4th years, an in-depth exploration of current insights and research into mechanisms of disease. The program is research intensive in that our 3rd and 4th year level courses include material based upon the primary literature and require students to critique articles and produce research proposals. Hands-on research experience is strongly encouraged, and facilitated. In its 12 years of existence, the program has consistently attracted top students, and it is intended to select and challenge these top students. We accommodate up to 30 students per year.

#### Program Objectives

The University's Mission, as found in the Statement of Institutional Purpose (Oct. 15, 1992), states that "The University of Toronto is committed to being an internationally significant research university, with undergraduate, graduate and professional programs of excellent quality." To this end, we are providing an undergraduate Pathobiology Specialist program of high international caliber as indicated by the outcomes and metrics given below.

The objective of the program from the Departmental perspective is to educate medical scientists who will pursue high level academic careers in relevant fields, or inform other disciplines. Because we accept only superior students (see below) we expect all will pursue post-graduate studies. For the significant number of our graduates who choose medical school, our aim is to give a deeper understanding of the scientific foundations of medicine and equip them to use their future clinical environment to advance the science of diagnosis and treatment. For those who pursue graduate research, our objective is to produce a graduate who is capable of functioning as a high-level MSc or PhD student and complete a graduate degree in a timely fashion. It is also an objective that our graduates will be recognized by acceptance into the top graduate research and health professional schools on the continent. Our outcomes (compiled below) indicate that we are meeting these objectives.

#### Admission Requirements

Formerly we required completion of five 1st year credits, including one each from mathematics, chemistry, physics and biology, and based entry into our program in 2nd year on the GPA obtained in all courses. The Faculty of Arts and Science has now mandated that we may only designate 3 courses as required for entry, and base admission on the marks in those courses. While we disagree with this decision, we base admission upon 1st year math, chemistry and biology. We continue to require completion of a full credit in 1st year physics for graduation, and we endeavour to maintain our standards by remaining cognizant of our students' performance in all their courses. We have accepted students with GPA cutoff values ranging from 3.85 to 3.93 in recent years.

## Curriculum and Program Delivery

The core course (LMP300Y - Introduction to Pathobiology) in year 3 is restricted to our Specialist students and provides an intimate learning environment with strong faculty contact. In addition to surveying basic aspects of pathobiology, students are taught to write thought-provoking essays on controversial topics in the field, and to critique current articles from the scientific literature. Another required course (LMP365H - Neoplasia) deals specifically with cancer biology. In both of these courses students spend a three week segment examining human specimens - in the first with freshly dissected cardiac tissue, in the second looking at gross and microscopic tumour specimens. During year 3 students also gain an understanding of infectious disease and the host immune response, through the requirement for courses in microbiology and/or immunology (MGY377H, MGY378H)/IMM334Y. Some pursue this in greater depth in our 4th year courses (Infection and Inflammation, Immunopathobiology, Microbial Pathogenesis). The requirement in 4th year is to take at least four of our 400-level courses. In outcome, the student will be aware of our current understanding of disease mechanisms, and have learned the principles of hypothesis-oriented research to achieve and communicate original contributions to the endeavour.

We offer two 3rd year courses that are exclusions for students in our Specialist our program: LMP301H is a general introduction to clinical biochemistry, and LMP363H is a more general introduction to pathobiology. These are in a sense “bookend” courses for our discipline of laboratory medicine, and are intended for the broader University community. Both are requirements for students in the Pharmacology and Toxicology programs.

The following is a formal calendar description of our Program:

**Detailed Course Requirements for Pathobiology Specialist Program:** This is a limited enrolment subject. Eligibility is competitive and based on marks in 3.0 of the following required first-year courses: BIO120H1, BIO130H1, (CHM138H1, CHM139H1)/CHM151Y1, (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

(13.5 Full course equivalents including at least 2 at the 400 level)

- **First Year:** BIO120H1; BIO130H1; (CHM138H1, CHM139H1)/CHM151Y1; (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1; (PHY131H1, PHY132H1)/(PHY151H1, 152H1)
- **Second Year:** BCH210H1; BIO230H1; BIO260H1/HMB265H1; CHM220H1; CHM247H1/CHM249H1; PSL300H1; PSL301H1; STA220H1/BIO220H1
- **Third Year:** BCH370H1; BCH311H1/CSB349H1; IMM334Y1/(MGY377H1, MGY378H1); LMP300Y1; LMP365H1
- **Fourth Year:** At least 4 of LMP402H1, LMP403H1, LMP404H1, LMP405Y1, LMP406H1, LMP410H1, LMP412H1, LMP415H1, LMP436H1 (Note: If the research project LMP405Y1 is taken, three additional courses from the list are still required.)

A complete collection of course syllabi is also included in Appendix 4.1.

### Meeting Degree Expectations

Expectations for Hons. BSc students at the University of Toronto include acquisition of Depth of Knowledge; Competencies in Critical and Creative Thinking, Communication, Information Literacy, Quantitative Reasoning, and Social and Ethical Responsibility; and Integrative, Inquiry-based activity. Below describes how our program achieves these expectations:

**A. Depth of Knowledge:** Our graduates have a strong foundation in the basic sciences through their courses in Biology, Chemistry and Mathematics in the first two years, and in Physics in First Year. They additionally study core courses in Biochemistry, Physiology, and Immunology/Microbiology. Depth of Knowledge in the interdisciplinary subject of Pathobiology (Mechanisms of Disease) comes in Years 3 and 4. In year 3 they take a core course that integrates their knowledge of the biological and physical sciences in what some describe as the most rigorous course of their Undergraduate experience, and also an in-depth half-credit devoted to the biology of cancer. We are able to keep the bar high because we have maintained a GPA cut off for entry above 3.8 in recent years. In

Year 4, students take at least 4 courses in specialized areas of Pathobiology, that may include a research project under an assigned supervisor and which is expected to result in a report in a format suitable for publication in a current journal in the field.

Based on all available evidence from conversation with our past and recent graduates, we believe we are providing a preparation that is in keeping with the goals of our University's, and our Program's objectives. The outcomes of our graduates are impressive, with many excelling in top graduate, professional and postgraduate programs across North America.

## B. Competencies

**i. Critical and Creative Thinking:** Students are presented with a broad range of topics relating to current research in disease mechanisms and are expected to integrate several disciplines in the basic life sciences. A weekly tutorial is given in LMP300Y that covers material from that week's lectures and puts it in the broader context of material that has preceded it, and that which will follow. When appropriate, material is integrated from our weekly Departmental research seminars, notable local lectures (e.g., Gairdner awards), etc., into the tutorials. Two major term papers in the core LMP300Y course involve analysis of the current literature, and critical analysis and future directions are major aspects of the marking schemes for both these assignments. Paragraph-style answers are implemented on all term tests and exams in LMP courses that are included in the Specialist Program, and instructors set open-ended questions that require integrative and creative thinking. Fourth-year research projects and research proposals, as well as our subsidized summer research program, further cultivate and evaluate creative thinking.

**ii. Communication:** The required courses in Year 3 require students to present thoughtful interpretations of the subject material, in term papers and on the tests and exams. All tests and exams in LMP300Y and LMP365, as well as all Year 4 courses (of which the students must take 4) are short essay format. One aspect of the "Lunch and Learn" seminars (see Section 4c) coordinated by our Students' Union (LMPSU) with Faculty input is scientific writing, and tutorials on scientific writing and evaluating journal articles are included in LMP300Y. Some of our 4th Year courses (e.g., LMP406H) require a CIHR-style research proposal, others (e.g., LMP404H) are based heavily on student presentations, and LMP415H has a one-page written assignment weekly. Students who choose the LMP405 research project prepare and defend a report in which they are expected perform more or less at the level of an MSc thesis defence. Students participating in our subsidized summer student program are required to present a poster at a research day held each August in the lobby of the Medical Sciences Building, and learn further communications skills through mandatory attendance at Departmental seminars.

**iii. Information Literacy:** Our 3rd and 4th Year courses require students to prepare term papers and research proposals that in turn require them to have facility with accessing the current scientific literature. For instance, in LMP300Y, the first term assignment is a critical essay on a topic of uncertain scientific resolution, and they are requested to back up their arguments with typically about 30 references to the recent scientific literature. This requires a significant amount of independent study over a couple of months, while digesting the relevant course work. In second term, they choose a paper relevant to the course, cognizant of the impact factor of the journal, and review it critically in this context. A weekly tutorial outside of class time is provided, and it addresses issues of scientific publishing, citation, and critical review, at the appropriate times through the terms. Most 4th Year courses are taught from original journal articles. None of our 3rd or 4th Year courses uses a text book, although notes and on-line sources are provided for each lecture. Beginning in Third Year second term, most lectures refer to the original literature for background preparation or class discussion.

**iv. Quantitative Reasoning:** The required courses in First Year Physics and Mathematics, Second Year statistics, and Second Year Physical Chemistry should provide the student experiences in quantitative reasoning well above the societal average. Deficits would be picked up as the students are required to analyze data critically from published articles in our higher-level courses.

**v. Social and Ethical Responsibility:** The students are introduced to issues of bioethics in their required First and Second Year biology courses. The study of human disease at a higher level is inherently an exercise in social responsibility. Throughout our higher-level courses, issues of medical ethics frequently arise. Examples include a discussion on the use of a curative procedure with a 5-10% fatality rate in childhood thalassemia when parents may opt for a safe but unpleasant alternative (LMP300Y), background material on some major clinical trials in blood disorders (LMP300Y) and diabetes (LMP406H), and a guest lecture on shaken-baby syndrome (LMP404H). A 2-hour lecture on animal models often engages lively debate on issues of animal rights vs. the obligation to understand human disease (LMP300Y). Before undertaking the demonstration components in our compulsory Third Year courses, students must be prepared in the respectful observance of human remains, and of course this is significantly reinforced for those who attend an autopsy in LMP415H.

**C. An Integrative, Inquiry-Based Activity:** This is served by the Third Year core course, LMP300Y (Introduction to Pathobiology). It surveys the discipline and also provides one or two week introductions to many of our in-depth 400-level courses (of which the students take 4). A first term assignment requires a critical essay on a controversial topic that has arisen during the course (each student is assigned a different question, such as: do auxiliary genes really modify the phenotype of cystic fibrosis?, or is the calcium paradox in reperfusion injury real?) and the second term assignment requires students to choose and review critically an article from the recent literature. Practical experience in LMP300Y and LMP365H were described in section 3 above, and in addition the laboratory experience of BCH370H is required. While the Fourth Year research project (LMP405Y) is not mandatory, many of our students take it, and the Department facilitates summer research by subsidizing stipends after Years 2 and 3. LMPSU runs a monthly "Lunch and Learn" seminar for Year 2 students (attended by higher level students as well), with support and advice from the Faculty. This includes a mix of topical research seminars and practical advice on careers in science and medicine.

Each of the courses included in our program is coordinated by an active and well-published scientist, and all are CIHR- and/or NIH-funded (with one exception - our forensic pathobiology course LMP415H is coordinated by the Chief Forensic Pathologist of the Province of Ontario, who nevertheless also conducts active research). The list of lecturers in the syllabi included in Appendix 4.1 can be cross-referenced to the faculty member's CV to document that our students are being taught by active scientists and clinician scientists.

Our program offers specific in-depth courses devoted to the major diseases prevalent in our society - cancer, cardiovascular disease, neurodegenerative disease, and infectious diseases - in addition to more specialized topics. In doing so we are able to cover the spectrum of state-of-the-art knowledge, hypotheses, and methodology in current medical research. All of our course coordinators and the large majority of our teachers are active, well-funded researchers. None of our program courses uses a textbook - teaching is from the current primary literature and annually updated lecture notes. This is appropriate for our students, most of whom engage in some level of research by 3rd year and aspire to go on to further academic work after graduation.

#### *Program Structure, Curriculum, etc.*

Because of the interdisciplinary nature of the subject, students spend the first two years taking basic and foundation courses that are selected both to provide a thorough foundation for understanding current medical research, and also provide required prerequisites for relevant upper-level courses. To qualify as a discipline, however, we then require an in-depth exploration in 3rd and 4th year, where the foundation courses are built upon in the focus of disease mechanisms, requiring 1.5 credits of our compulsory 3rd year courses and a selection of four courses from amongst our 4th year offerings. The overall requirement of "13.5 Full course equivalents including at least 2 at the 400 level" is in keeping with the guidelines of the Faculty of Arts and Science, while offering sufficient flexibility to take additional courses depending on the student's interest.

Of note, in our graduating class of 2012, more than 1/3 of our students had completed more than the required 20 credits, and about 1/2 took courses to qualify for a Major in another subject in addition to our Specialist degree (popular choices being physiology, human biology, and statistics).

**Specific learning outcomes:**

The formative courses in years 1 and 2 provide a minimum basis in the recognized branches of physical and biological sciences that students will build upon in years 3 and 4 to develop the intellectual and technical skills for a productive career in medical research. We recognize, however, that many of our graduates choose to pursue an MD or MD/PhD program, and we concern ourselves with ensuring that this group will take with them a deeper insight into disease mechanisms, and be well equipped for academic careers as physician-scientists.

As indicated above, the core course (LMP300Y) in year 3 is restricted to our Specialists and provides students with an intimate learning environment with strong faculty contact, a broad survey of basic aspects of pathobiology, the opportunity to write essays on controversial topics in the field, and to critique current articles from the scientific literature. Another required course (LMP365H) deals specifically with neoplasia (i.e., cancer biology). In both these courses students spend a three week segment examining human specimens - in the first with freshly dissected cardiac tissue, in the second looking at gross and microscopic tumour specimens. During year 3 students also gain an understanding of infectious disease and the host immune response, through the requirement for (MGY377H, MGY378H)/IMM334Y. Some pursue this in greater depth in our 4th year courses (Infection and Inflammation, Immunopathobiology, Microbial Pathogenesis), while others stream toward more organ-based study of disease such as Cardiovascular Pathobiology, Lymphatic Pathobiology, and Neurodegenerative Disease.

In summary, the student will be aware of our current understanding of disease mechanisms, and have learned the principles of hypothesis-oriented research to achieve and communicate original contributions to the endeavour.

We are unaware of another program like ours, in particular one that has an in-depth research emphasis. I am aware of one other Ontario University that offers an undergraduate science program in Pathobiology, in which undergraduate science students learn aspects of the medical curriculum's pathology toward fulfillment of degree requirements.

***Learning Beyond the Classroom***

Our undergraduate coordinator sits on a committee that surveys and facilitates research opportunities for undergraduate Life Sciences students at the University of Toronto. Their current data base of research opportunities, well publicized to the students, is found at [www.facmed.utoronto.ca/programs/GLSE/Undergraduate\\_Research\\_Opportunities.htm](http://www.facmed.utoronto.ca/programs/GLSE/Undergraduate_Research_Opportunities.htm) Extracted from this website is the Table of Contents and the section for Laboratory Medicine and Pathobiology:

**Life Sciences Undergraduate Research Opportunities at the St. George Campus include:**

- Undergraduate Life Sciences Departments, Faculty of Medicine
- Cognate Undergraduate Life Sciences Departments, Faculty of Arts and Science
- Undergraduate Life Sciences Departments, Leslie Dan Faculty of Pharmacy
- Extra Departmental Units, Faculty of Medicine
- Fully-Affiliated Hospitals / Research Institutes
- Miscellaneous Summer Research Studentships
- Colleges
- Research Opportunity Program (ROP) / Research Excursions
- Centre for International Experience (CIE) / Summer Abroad / Science Abroad / International Course Modules
- Undergraduate Research Opportunity Program (UROP)
- Undergraduate Research Fund
- Natural Sciences and Engineering Research Council of Canada (NSERC)

**Undergraduate Life Sciences Departments, Faculty of Medicine**

- Division of Anatomy
- Biochemistry
- Immunology
- Laboratory Medicine and Pathobiology
- Molecular Genetics
- Nutritional Sciences
- Pharmacology and Toxicology
- Physiology

**Cognate Undergraduate Life Sciences Departments, Faculty of Arts and Science**

- Cell and Systems Biology
- Chemistry
- Ecology and Evolutionary Biology
- Human Biology Program
- Mathematics
- Medical Biophysics
- Physics
- Psychology

**Undergraduate Life Sciences Departments, Leslie Dan Faculty of Pharmacy**

- Pharmaceutical Chemistry

**Extra Departmental Units, Faculty of Medicine**

- Banting and Best Diabetes Centre
- Donnelly Centre for Cellular and Biomolecular Research
- Institute of Medical Science

**Undergraduate Research Opportunities Laboratory Medicine and Pathobiology**

- Research Opportunity Program (ROP) LMP229Y: Credit course for supervised participation in faculty research project. DR=SCI ; BR=None
- Project in Laboratory Medicine and Pathobiology LMP405Y: A self-contained research project to be completed under the supervision of a faculty member. The student will normally have completed three full years of study, and is expected to devote at least one full day per week to the project. Admission is by arrangement with the Department and with a particular supervisor. A list of potential supervisors is available from the Departmental Office and on our web site. Prerequisite: BCH210H1/BCH242Y1, LMP300Y1/LMP363H1/LMP365H1 and permission of department. DR=SCI; BR=4
- LMP Summer Student Research Program: The program is comprised of three obligatory elements: a research experience, attendance at weekly lectures and presentation of a poster during the Summer Student Poster Day. Students are expected to engage in full-time research for at least 12 weeks.
- Undergraduate Student Research Award - Natural Sciences and Engineering Research Council of Canada (NSERC): Students are expected to engage in full-time research for a 16 week period.
- Undergraduate Research Opportunity Program (UROP): The department awards these to students applying for summer research programs. There is no specific application form. Contact the department for more information.

It is encouraging that in a survey conducted by this committee last year, of 383 senior-year University of Toronto Life Sciences students who responded, 79.5% had tried to get research experience during their undergraduate years, and 84% of those were successful. Of course this excludes students who did not reply to the survey, but anecdotally these numbers would seem a good match to our Pathobiology cohort.

We offer the LMP299Y research opportunities program (ROP) as a credit course in 2nd year. Not many faculty or students participate (about 5 per year), probably because the students have a busy course load in 2nd year and our faculty have access to senior and graduate students. We offer LMP405Y as a senior research thesis in the final year, and about half of our Specialist students take this. (Some do research in other Departments.) In between, we have an active summer research program that accommodates about 70 students per year. These come from other Universities, other Departments, and of course our own students. To facilitate participation and engagement of our students and faculty in summer research, the Department subsidizes half the stipend (\$2,400) of any Pathobiology Specialist working with a faculty member in our Department.



Our very active Students' Union (LMPSU) is another major player in enhancing learning beyond the classroom. With encouragement from the faculty, but often too on their own initiative, because we have selected high academic achievers, they host lunch-and-learn seminars that range from basic science to medical ethics to "when not to do an MD/PhD".

Impressively, LMPSU recently organized a one-day cancer symposium that included basic and clinical plenary lectures by speakers from other institutions, a networking lunch with multiple funding agencies, and an ethics panel. There were approximately 200 attendees, including about 50 first-year students showing enthusiasm to explore our Department. A report of the event is found at:

[www.lmp.utoronto.ca/news/news/current-news/successful-first-undergraduate-conference-cancer](http://www.lmp.utoronto.ca/news/news/current-news/successful-first-undergraduate-conference-cancer)

### ***Student-Faculty Interaction***

Our classes are small by University of Toronto standards (generally less than 30 students in our program courses), facilitating good student-faculty interaction. Students in our core 3rd year course are encouraged to seek out professors for research project supervision, if they have not already done so. None of our campus-based faculty keeps office hours, rather offering an open-door policy.

LMPSU is a highly engaged student union, and in addition to their own social and academic events, the members invite faculty to their elections, host faculty events to meet 2nd-year students, etc. They also arrange periodic lunch-and-learn seminars where faculty are often invited to speak on research, career advice, etc.

The Pathobiology students have a standing invitation to attend our Departmental seminars along with the graduate students.

Our delivery is strongly didactic classroom teaching. This is appropriate, given that an interdisciplinary approach to current medical science requires mastery of a large amount of material. However, we are always focused on imparting thinking rather than memorization. Thus, we use critical essays and research proposals not only as a means of evaluation (see below) but as a means of teaching. The focus in our lectures is on current research, and implicitly on its hypothesis-driven nature. Our strong emphasis upon, and support of, summer research and research project courses further improves our students' experiences as they move toward an independent academic research/clinical career.

Courses offered in support of the program are listed under "Curriculum and Program Delivery".

### **Assessment of Learning**

Most undergraduate Life Sciences students at U of T experience large classes and multiple choice tests in their first two years of science courses. By maintaining small class sizes, we can break this pattern in our program and base evaluations on critical thinking and hypothesis evaluation. Evaluation requirements are given for most courses in the syllabi in Appendix 4.1.

Based on the premise that if our students can communicate clearly, they are thinking clearly, we give them the opportunity to do so by using examinations and tests that involve short answer or essay questions. Other means of evaluation in our various courses include critical essays (LMP300), critiques of articles (LMP300, LMP415), lab tests (LMP300, LMP365), research proposals (LMP406, LMP412), weekly written assignments (LMP415), and student seminars (LMP404, LMP415). These various modes of evaluation serve two purposes: the instructors can evaluate the level of student comprehension and functioning in the variety of ways needed for further productive study, and the students are given multiple opportunities to reveal their knowledge.

## Student Awards

A major aspect of professional development for our students is the opportunity to engage in research, as discussed above. In addition, they are in a rich environment for gaining experience in health care volunteerism, given the size and diversity of our faculty, and many choose to do so.

Two Departmental awards are significant:

1. **Top Aggregate Mark.** The student with the top aggregate mark in our required “Introduction to Pathobiology” and “Neoplasia” courses is given a certificate and cash award from the Department.
2. **Gornall Prize.** The student graduating from the program with the highest cumulative GPA over their 4 years is given the Gornall Prize, funded by an endowment from the late Allan Gornall, who was Chair of Clinical Biochemistry at the University of Toronto in the 1960/1970’s. It consists of a plaque and a cash award. Recent winners (and their current positions) are:
  - 2007 - Vinca Chow (MD/PhD, Stanford)
  - 2008 - Helena Dhamko (Internal Medicine Resident, Ottawa)
  - 2009 - Alice Li (MD, Yale), Lawson Ng (MD, Toronto)
  - 2010 - Runjun Kumar (MD/PhD, Washington University, St. Louis)
  - 2011 - Nicole Choi (MD, Toronto)
  - 2012 - Qi Jiang (PhD, Toronto)

## Student Funding

As documented elsewhere in the Research component of the cyclic review, we have over 200 faculty members with independent research funding, about 70 of whom take research students in any given summer period.

As noted above, the Department subsidizes Summer Student stipends by \$2,400 for Pathobiology Specialists working in our Department.

A database of research funding for all Life Sciences students has been compiled, available along with Opportunities for Research at [www.facmed.utoronto.ca/programs/GLSE/Undergraduate\\_Research\\_Opportunities.htm](http://www.facmed.utoronto.ca/programs/GLSE/Undergraduate_Research_Opportunities.htm) (See Section “Learning Beyond the Classroom”).

## Quality Indicators

The University provides survey statistics on program quality indicators, and these are included in Appendix 4.2. However, these are not complete and not always relevant, so they are discussed here with interpretation and supplementary information.

The enrollment data (Appendix 4.2, Section A) match our records reasonably well, and include Years 2, 3 and 4 of our program. Enrollment has been steady at about 30 students per year, with a dip in 2011/2012. This reflects increasing popularity of “double major” options, and is discussed under “challenges” below.

The grade level for admission data (Appendix 4.2, Section B) are not particularly useful for assessing our program, as they reflect averages of the students on graduation from high school, and they do not enter our program until 2nd year university. Relevant numbers would be the GPA cutoff values based on university courses upon entry into our program. These data are not currently available, but may become so as the office responsible for compiling these data has taken note of our request. Anecdotally, the cutoff for entry into our program has varied in the range 3.85 to 3.93, placing it consistently at the highest among the Basic Medical Sciences. These are consistent with high school averages in the mid 90’s.

There are discrepancies in the entry data provided by the University, notably over the last 3 years, when we have continued to take up to 30 students. (Note especially the number 6 for Fall 2010, yet 27 students were enrolled at



the end of their 3rd year in Spring 2012.) Comparison of our total enrollments and exit data also confirm the discrepancy.

The final year academic achievement data (also Appendix 4.2, Section B) appears to be accurate. These exit GPA values of 3.73 to 3.87 over the past 5 years indicate that we are consistently graduating among the highest academic achievers at the University.

The course evaluation data (Appendix 4.3) indicate a general level of satisfaction among our students. Note for instance on Q.6, that the large majority of students rate the quality of learning experience in our courses as Good, Very Good, or Excellent (in roughly equal numbers; Appendix 4.3, Graph B). Taking Q.1 - Q.6 together, we rate similar to all Arts and Science programs (Appendix 4.3, Graph A). Note however, that the number of respondents (Appendix 4.3, Table C) lists 253-261 respondents - much higher than the total number of students in our Pathobiology program (enrollment data, Appendix 4.2). The reason is that these data include students in our two large courses, LMP301 and LMP363, which are exclusions from our program and are taken only by students in other programs, thus diluting the responses of our program students.

The data on Student Satisfaction (Appendix 4.3, Section C) indicate that we rate lower than all Arts and Science programs and U15 comparators on Level of Academic Challenge (LAC) and Active and Collaborative Learning (ACL), and higher on Student-Faculty Interaction (SFI) and Enriching Academic Experiences (EAE). Questions 12-14 reflect the overall Institutional experience rather than our specific program.

Because of dilution of the course satisfaction data by the large number of students outside our program taking LMP301 and LMP363, we are including in Appendix 4.4 data for the last two years available from surveys of our programmatic courses, conducted by the Arts and Science Student Union and published in the "Anti-Calendar."

Rates of graduation and employment rates (bottom of Appendix 4.3) do not compile data from our program. Our attrition rate is low, with most students now finishing our program. (As noted above, data in Appendix 4.2, Section B would indicate that we are graduating more students than we accept, and the reason is discrepant enrollment data provided by the University.) In earlier years, we were losing up to 15-20% of our class at the end of 3rd year, to medical schools. As medical schools have been more reluctant in recent years to accept students before completion of an undergraduate degree, this loss has abated.

The best indicator of our program outcome is the students' location in the year following graduation. We have been able to collect these outcomes for 99 of 141 students graduating between 2007 and 2012, inclusive.

Of 141 students graduating with a BSc in Pathobiology between 2007 and 2012, we have been able to track the outcome in the year following graduation of 99 (70%). The outcomes are as follows:

- MD program, Toronto – 26
- MD program, other Canadian Universities – 19
- MD program, U.S. – 4
- MD/PhD program – 3 (Stanford, Pennsylvania, Washington U.)
- Graduate science programs, Toronto – 30
- Graduate science programs, other Canadian – 1
- Pharmacy – 6
- Masters of Public Health – 2 (Toronto, Yale)
- Nursing - 2

The following outcomes were represented by one student each:

- Law
- Teachers' College
- Radiation Sciences professional program
- Ontario College of Art and Design (MSc)
- Health Care Consultant
- Volunteering

Our program is rather unique. Indeed, in the NSSE database, only 6 other students were identified as enrolled in Pathology / Experimental Pathology in the 15 comparator Canadian Universities (see Appendix 4.3), and the University NSSE representative was unable to tell us where these students were.

## Quality Enhancement

Since the introduction of our program (2000/2001) we have brought several new courses on line, most recently a unique course in Forensic Pathobiology (LMP415) in Spring 2011.

Faculty work closely with the LMPSU to facilitate student initiatives outside the classroom (e.g., the Cancer Research Symposium, described above).

We select our teaching assistants from our top graduate students who are mostly former graduates of our program, and encourage them to give guest lectures and tutorials from the students' perspective. A former Specialist student, now a Pathology medical resident, gives a lecture in LMP300, and the students interact with medical residents in the laboratory components of LMP300 and LMP363.

In addition to our own strong faculty, we involve faculty from other Departments in our undergraduate teaching. Indeed, a former faculty member who has been the head of Wisconsin Blood Services for the past 4 years continues to give an annual lecture in LMP300.

A major enhancement of our program is its research-intensive nature, and our subsidized summer student program noted above. In addition to the laboratory work, the students attend weekly research seminars, and present a poster on their research at a special event held at the end of the summer.

## Challenges

i) Several years ago the Faculty of Arts and Science encouraged Departments to offer Major and Minor programs in addition to their Specialist. They now allow students to graduate as Honours students with a double major instead of a specialist qualification. There is significant interdisciplinarity required in the study of Pathobiology, and we do not feel one can undertake the lesser requirements of a major and be considered to have a sufficient knowledge of disease mechanisms. Nevertheless, two perceptions are prevalent among undergraduates that favour the double major. Some see it as an option that will be less demanding of their effort and perhaps contribute to better grades. And some see it as a desirable route to a broader range of experiences.

While this has slightly decreased our applicant pool and enrollments over the past two years, we have maintained our admission standards. Keeping our desired balance between student numbers and quality will be a challenge, and we take opportunities to get the message out to high school and 1st year students of the advantages of a Specialist. The students currently enrolled in our program are among our best ambassadors for this. As noted above, about half our students do a Major in addition to our Specialist, and in no way suffer from breadth of experience.

ii) Two of our popular 4th year courses are in danger of disappearing. LMP404 (Bone and Skeletal Disorders) was offered by a dynamic young faculty member who tragically passed away four years ago. We have struggled to keep the course viable but it has not been offered for 2 years. Finding a suitable coordinator to reintroduce it, ideally with a broader musculoskeletal basis, is proving to be a challenge.

LMP412 (Lymphatic Pathobiology) has been a very popular course, mainly because of the coordinator, who is retiring at the end of 2013. Given the highly specialized nature of the course, and that the coordinator teaches a large portion of the course himself, continuing a course in lymphatics may be difficult.

## Opportunities

i) One of the unique opportunities in our program is to expose students to both fresh autopsy material and museum specimens, in the context of explaining how the molecular and cellular mechanisms of disease transform tissues and organs. Currently, this is restricted to a couple of sessions in each of our required 3rd year courses, but

it is tremendously popular with the students. With the number of clinical faculty we have, there is a great opportunity to expand this mode of instruction significantly.

ii) The potential loss of the courses LMP404 and LMP412 affords an opportunity to revitalize our curriculum by bringing in new courses. A logical replacement for LMP404 would be a course with a more musculoskeletal and developmental content. A replacement for the Lymphatics course could have a more biophysical and pathophysiological slant towards fluid dynamics of blood, lymph and CSF. It could then pair nicely as a partner course to our existing LMP406 (Cardiovascular Pathobiology), which has a strong cellular and molecular slant.

iii) Our LMP300 course, Introduction to Pathobiology, is required for, and restricted to, Pathobiology Specialists. This full year course might be broken into two half courses, and the first half (say, Pathobiology I) could be taught in 2nd year. This would engage our students in the small class setting and the Departmental attachment earlier, and it is feasible; the first half of the existing course deals with some general aspects of pathology, and with special topics like oxidative stress, ion channels and transporters, iron metabolism, and calcium biology that do not necessarily build directly on the 2nd year foundation courses as prerequisites. Reducing the 3rd year requirement, then, to two half courses (Pathobiology II and the existing Neoplasia course) would free up some space for 3rd year students to take another higher level course such as Histology or Embryology.

### Student input

We asked our Student Union to conduct a broad and independent consultation of students currently in our Pathobiology program. Their report is found at Section 13. Report of Students.

A number of profiles submitted by current and former students, with their thoughts on the program, are found on our web site at [www.lmp.utoronto.ca/undergraduate/student-profiles-undergraduate](http://www.lmp.utoronto.ca/undergraduate/student-profiles-undergraduate).

## Graduate - MSc and PhD

### Graduate Program Description

The Graduate Program in LMP provides a curriculum of courses and a broad-based multidisciplinary approach to research in mechanisms of human disease leading to Master of Science and Doctor of Philosophy degrees. Key areas of study in the Department include Cancer, Vascular and Cardiovascular Pathobiology, Immunopathology, Lymphatics, and Transplantation, Neuropathobiology and Endocrine Disorders, Bone and Matrix Pathobiology, Microbiology and Infectious Disease.

The **MSc Program** provides advanced training in Laboratory Medicine and Pathobiology and consists of graduate level coursework and a research-based thesis. Coursework is focused on molecular and cellular mechanisms of disease, and includes weekly student and faculty seminars. MSc students present their thesis research at the in-class seminars, and also in poster format at the annual Graduate Student Research Day. MSc research is supervised by an advisory committee. The thesis document and oral defense should demonstrate that the MSc candidate has carried out original research in a specific area of pathobiology, understands the strengths and weaknesses of the research, and is able to effectively present and defend her/his findings before an examining committee.

The **PhD Program** leads to a doctoral degree in Laboratory Medicine and Pathobiology and provides the foundation for the candidate to conduct research as an independent scientist. In comparison to the MSc Program, PhD studies require completion of more extensive coursework and a more substantial research thesis that is publishable – usually as two to three papers – in recognized peer-reviewed journals. PhD candidates present their research multiple times at in-class seminars and Graduate Student Research Days. The thesis is defended before an examining committee consisting of advisory committee members and arm's length thesis appraisers, and approved by the University of Toronto's School of Graduate Studies. It is expected that at least one thesis research-based paper is accepted for publication at the time of the final oral exam.

The **MD/ PhD Program** is available to a select cohort of highly qualified students -- combining Medical School training with advanced scientific research at the doctoral level. After finishing two years of MD training, MD/ PhD candidates who join the LMP Graduate Program complete all requirements for the PhD degree as noted above, before returning to Medical School.

### Program Objectives

#### *GENERAL*

Consistent with the overall mission of the University of Toronto and the vision of the Faculty of Medicine, the LMP Graduate Program aims to provide excellent quality education and research training to MSc and PhD students, thereby developing future leaders in the biomedical and health sciences. We expect that through scientific discovery, innovation, application, and communication of knowledge the contributions of LMP graduates to our communities will be significant. Given the scientific breadth of the field of Laboratory Medicine and Pathobiology we encourage our students to extend their graduate learning experience beyond the boundaries of their thesis-oriented studies, to a broader mandate of "Investigating Disease. Impacting Health."

#### *MSC PROGRAM*

The major aims of the MSc Program are for registrants to develop their critical and analytical thinking in the field of Laboratory Medicine and Pathobiology, and to achieve effectiveness in scholarly communication - written and verbal - in the biomedical sciences. Toward these goals MSc students carry out a laboratory-based research project, write and defend a thesis, and complete coursework that includes (a) didactic team-teaching by LMP faculty, (b) oral presentations of thesis research and a journal article not closely related to their thesis, (c) written critiques of journal articles, and (d) a research proposal.

All MSc students complete the Departmental flagship course, LMP1404H, Molecular & Cellular Mechanisms of Disease, normally within the first year of the Program. LMP1404H is a 'heavy' one term course: two 2.5-hour classes per week (total class time = 60 hrs) that covers a range of topics in pathobiology. This course is intended to provide MSc students with a solid background across the broad discipline of pathobiology. MSc students also take LMP1001Y, Graduate Seminars in Laboratory Medicine and Pathobiology, a mandatory credit/ non-credit course that runs weekly for the full academic year. Each MSc student gives a presentation of his/her thesis research, followed by questions from the class, and the course coordinators. LMP1001Y provides opportunity for MSc students to develop skills in critical thinking, and organization/ delivery of a scientific presentation. These skills are further developed through poster presentations at the annual Graduate Student Research Day, which all LMP graduate students attend. Student seminars are followed each week by a faculty lecture, which all students attend as part of their LMP1001Y credit.

Thesis research provides the practical opportunity for MSc students to further enhance their critical skills, and learn about experimental design and data interpretation. The thesis Supervisor and advisory committee (at least two additional graduate faculty members) provide input and monitor the progress of the student. Committee meetings are held every 9 to 12 months, or more often if closer monitoring of a project is needed. A satisfactory thesis, that normally includes publication quality data for one paper, is completed at the end of the MSc program, and the candidate must pass an oral examination based on the thesis project.

### **PHD PROGRAM**

The LMP PhD Program is designed to prepare candidates for careers in research/ teaching of Pathobiology and related sciences. Emphasis is placed on candidates acquiring broad background knowledge of the field, and developing independence in the design and execution of research experiments. PhD trainees also develop advanced skills in scientific communication through interactive courses, seminars, research events and writing of proposals, critiques and thesis related publications. In addition, LMP faculty have a strong track record of sending their graduate students to national and international meetings to present research findings, which provides excellent opportunities for enhancing communication skills, networking, and career development.

PhD students complete the coursework described above for MSc students (i.e., LMP1404H, and LMP1001Y seminars) plus 3 additional half-courses related to their thesis - either offered by LMP or another U of T Department. With the approval of the Graduate Coordinator senior PhD students may be permitted to take one half-course less closely related to their thesis research, but with relevance to their post-graduate careers (e.g., management/business, law, or education).

Research progress is monitored and regularly assessed by the Supervisor and the advisory committee which meets every 9 to 12 months. For PhD-track MSc students the advisory committee makes the recommendation for PhD reclassification, normally held between 16 and 20 months after the start of graduate studies. The advisory committee also decides when a PhD candidate can begin thesis-writing, based on the satisfactory completion of doctoral course requirements, and publishable data. PhD candidates submit a written dissertation and defend it in a Final Oral Examination administered by the U of T School of Graduate Studies.

### **MD/ PHD PROGRAM**

Coursework and thesis research objectives are identical to those described for the PhD Program

## **Admission Requirements**

LMP graduate admission requirements are closely aligned with key learning outcomes: (1) gaining a strong theoretical background in laboratory medicine and pathobiology, (2) acquiring research skills to apply cutting edge techniques to the investigation of pathobiological processes, (3) developing analytical and critical abilities for the evaluation of research data, and the design and optimization of novel research strategies, (4) developing written and verbal skills for clear effective communication of research findings. In reviewing graduate applications the admissions committee seeks to identify students with the greatest potential to fulfill these expectations of the Graduate Program.

### *Master of Science Admission Requirements*

- (1) Completion of an appropriate bachelor's degree in life sciences from a recognized university, or a professional degree (e.g., MD, DDS, DVM, or equivalent), with a minimum "A-" or 80% average over the final two years of study.
- (2) Strong letters of recommendation from two referees (normally faculty members) familiar with the applicant's academic work and/or laboratory experience.
- (3) Research experience as documented by the referees, and preferably as evidenced by publications, abstracts, or presentations.
- (4) Securing of a supervisor. Applicants satisfying the above 3 criteria are given conditional acceptance to the MSc Program. Completion of the 'agreement to supervise' by a qualified faculty member is the final step in the admission process

Applicants are accepted to the MSc Program by the LMP graduate admissions committee on the basis of academic excellence and a successful interview with a member of the LMP graduate faculty. Excellent students with high academic standing (normally minimum "A-" average on MSc courses) who have clearly demonstrated the ability to do research at the doctoral level may be considered for transfer to the PhD program (described below).

### *Doctor of Philosophy Admission Requirements*

There are three routes of entry to the PhD program:

#### **For new students:**

- 1) MSc graduates and applicants with an MD, DDS, DVM (or equivalent) degree with an "A-" average or higher in graduate courses, or in an appropriate BSc program if there were no course requirements in the MSc program.
  - a) Three strongly supportive letters of recommendation from faculty members familiar with the applicant's academic work. Normally, the referees should include the applicant's MSc thesis supervisor, and at least one member of the applicant's MSc advisory committee.
  - b) Substantial research experience, evidenced by peer-reviewed publications, abstracts, or presentations.
  - c) Securing of a supervisor. Applicants satisfying the above 2 criteria are given conditional acceptance to the MSc Program. Completion of the 'agreement to supervise' by a qualified faculty member is the final step in the admission process

As noted for MSc applicants, new PhD applicants who meet the above requirements for admission must also complete a successful interview with a member of the departmental graduate faculty.

- 2) Direct PhD entry is available for a select cohort of highly qualified BSc graduates having completed an appropriate undergraduate program in the life sciences from a recognized university. Direct entry candidates require a minimum "A" or 85% average in the final two years, and significant research experience evidenced by co-authorship on conference abstracts, manuscripts, or accepted peer-reviewed papers. Direct PhD entry also requires (a) exceptional letters of support from referees who can speak to the candidate's research achievements and potential, and (b) a meeting with the LMP Graduate Coordinator, to assess the candidate's level of maturity, preparedness and commitment needed to excel in doctoral studies.

#### **For MSc students registered in the LMP Graduate Program:**

- 3) Transfer to the PhD program may be recommended for MSc students who have excelled in graduate level coursework and research, and have strong support from their Supervisor and advisory committee members. Passing of an oral reclassification exam, usually held 16 to 20 months after the start of the MSc program (and no later than 24 months), is required for PhD entry by this route. The examining committee consists of at least six voting members who are graduate faculty at the U of T: the Supervisor and advisory committee members, two additional graduate faculty members, one of whom is from another graduate department, and the exam Chair - the LMP Graduate Coordinator or his representative.

### **International Applicants**

The above admission requirements pertain to domestic students, i.e., Canadian citizens and permanent residents. Special consideration for international students on a study visa is noted here: All incoming LMP graduate students must have a good command of English. Applicants educated outside Canada, or whose native language is not English, are required to provide evidence of competence in English by completing one of the recognized English language proficiency tests listed below. Minimum score requirements in TOEFL testing (score = 600 for the paper-based test) or IELTS testing (7 for paper-based test) must be met before students can be considered for the LMP Graduate Program. Language test scores submitted with the application must be less than two years old.

**Graduate Record Examination (GRE):** Applicants educated outside Canada are required to take the GRE General and GRE Subject Test (Biochemistry, Cell and Molecular Biology), and scores must be submitted as part of the application. The score requirement is normally at or above the 80th percentile. Test results cannot be more than two years old.

Note: The guaranteed stipend commitment to international students is substantially greater than to domestic students due to the differential tuition fee. As a result, whereas domestic students are given conditional acceptance to the LMP Graduate Program prior to securing a thesis Supervisor, international students require a faculty 'sponsor' before admission is confirmed.

### **Graduate Recruitment, Rotations, and Undergraduate Feeder Streams**

Unlike some graduate programs in the U of T Faculty of Medicine, the LMP Program does not have laboratory rotations in which accepted graduate students complete short-term internships with several faculty members before selecting a Supervisor. The LMP Graduate Program offers two mechanisms by which undergraduate students can familiarize themselves with Departmental faculty members and the wide array of research opportunities available:

(1) a summer student research program, and (2) an Arts & Science Specialist Program in Pathobiology. In particular, the full-year undergraduate Research Project course LMP405Y, which the majority of Specialist students complete, provides an extended opportunity for future graduate students to be introduced to pathobiology research in the Department.

## **Curriculum and Program Delivery**

### **MSc Program Requirements**

**MSc Coursework:** MSc students are required to take the 0.5 credit course LMP1404H *Molecular and Cellular Mechanisms of Disease* (60 hours) in the first year of the Program. In rare cases, a student may be advised by her/his advisory committee to take an additional course to strengthen her/his background in a particular area. All MSc students also take the credit/no-credit course, LMP 1001Y *Graduate Seminars in Laboratory Medicine and Pathobiology*, which is held weekly through the academic year, and is attended by students for the duration of the MSc program. LMP1001Y is a 2 hour class consisting of one hour of student presentations with question periods (two presentations per class); each MSc student presents once in this class, usually in the second year of the MSc program. Student seminars are followed by a one hour faculty guest lecture. The faculty talks are given by basic research scientists and clinician scientists from the University of Toronto community and abroad, who deliver exciting cutting edge lectures on the many areas of study represented by Laboratory Medicine and Pathobiology. Although the required amount of coursework for the LMP MSc degree is not extensive - to maximize the available time for research - MSc students intending to transfer to the PhD program may take additional courses in their first two years of graduate study. Transfer credits for these courses can be applied toward the course requirements of the PhD program.

**MSc Thesis and Learning Outcomes:** Following completion of the Departmental core course LMP1404H in year 1 of the Program, MSc students are expected to focus on their research and thesis-writing. The thesis document and oral defense should demonstrate that the candidate has acquired both depth and breadth of knowledge in pathobiology, and skills in designing/ applying modern experimental methodology to scholarly hypothesis-driven inquiry. MSc candidates should understand (a) how to assess their thesis data in a critical manner, (b) what



caveats and weaknesses are associated with their experimental work, and (c) which future experiments are most important to advance the thesis research. The thesis and defense should demonstrate that the MSc candidate has acquired effective written and verbal communication skills. Although an accepted peer-reviewed publication is not a requirement for the MSc degree, the MSc thesis is expected to generate the equivalent of one publishable paper.

### **PhD Program Requirements**

**PhD Coursework:** Like MSc students, PhD students are required to take the 0.5 credit course LMP1404H *Molecular and Cellular Mechanisms of Disease* (60 hours) in the first year of the Program. Those who may have completed this course previously (e.g., LMP MSc graduates continuing in the PhD program) take an alternative half-course as approved by the Graduate Coordinator. PhD students also take the credit/no-credit course, LMP 1001Y *Graduate Seminars in Laboratory Medicine and Pathobiology*, held weekly through the academic year, and attended by students for the duration of the PhD program. PhD students are required to present at least twice in LMP 1001Y prior to defending their thesis. In addition to LMP1404H and LMP1001Y, PhD students are required to take three 0.5 credit course equivalents, of which at least one half course is from LMP. One exception to this requirement – PhD students having completed the undergraduate Pathobiology Specialist Program (or equivalent) are required to take only two additional half-courses. Although PhD coursework is normally selected to enhance training within the thesis subject area, as noted above (Program Objectives) senior doctoral students may, with the approval of the Graduate Coordinator, take one half-course that is less closely related to their thesis research, but with relevance to their anticipated post-graduate career development (e.g., business, law, education).

**PhD Thesis and Learning Outcomes:** Other than the continuing seminar course, LMP1001Y, PhD students are expected to have all course requirements completed by the end of the third year of study (or fourth year for students that transfer from MSc), in order to ‘achieve candidacy’ with the School of Graduate Studies. The remainder of the PhD program is devoted to completion of thesis-related research, dissemination of research results through publication, and writing/ defense of the thesis. The PhD thesis documents a substantial amount of high quality original research in pathobiology, involving a systematic investigation of disease-related hypotheses, and typically leading to the publication of 2-3 peer-reviewed papers. PhD candidates, trained through the mentorship of their Supervisor and advisory committee, are expected to demonstrate clear potential to function as independent research scientists. The development of autonomous thinking in PhD candidates is enhanced also by more extensive graduate level coursework in the doctoral Program, with its emphasis on critique- and proposal writing, presentation/ defense of research articles, and in-class debate. PhD theses must pass a rigorous internal review from the candidate’s advisory committee and two ‘arms-length’ appraisers (faculty members of the U of T School of Graduate Studies) before receiving Departmental approval. After completion of the Departmental review, a U of T External is selected, and upon SGS approval the thesis undergoes external review. Successful completion of the PhD program requires that the candidate defend her/ his thesis before the final oral exam committee which consists of 4 to 6 voting members, of which at least two must not have been associated with the thesis research.

### **Degree Learning Expectations**

Degree Learning Expectations (DLEs) at the University of Toronto are attached in Appendix 4.5, and include the following: (1) Depth and breadth of knowledge, (2) Research and scholarship, (3) Level of application of knowledge, (4) Professional capacity/ autonomy, (5) Level of communication skills, and (6) Awareness of limits of knowledge.

### **Graduate Program Structure, Curriculum and Innovation**

The Graduate Department of Laboratory Medicine & Pathobiology is well-positioned to help its MSc and PhD students fulfill these DLEs, and to excel as they develop expertise in pathobiology-oriented research. The Graduate Program now has over 140 engaged faculty members at the U of T St George campus and affiliated hospitals, actively involved in research and teaching. Many of our faculty are at the forefront of their respective fields of research, and as described elsewhere in this Brief, overall funding for the LMP Graduate Department is excellent. Excellent funding creates the capacity needed for graduate student recruitment. LMP Graduate Program is structured to be research-intensive for MSc and PhD students, without an excessively heavy course-load. This



allows optimal time for graduate students to design and carry out research that leads to high quality publications. That said, the graduate courses offered by LMP are first-rate, with state-of-the-art curricula on pathobiology-relevant topics: e.g., infectious diseases and antibiotic resistance, genomics/ proteomics in personalized medicine, biobanking in translational research, cellular imaging methods, etc. Students have the opportunity for close interaction with faculty through these mostly team-taught graduate courses, and can also interact with faculty at the weekly LMP faculty research seminars and other Departmental research events (e.g., Graduate Student Research Day, Pritzker Lecture, Laurence Becker Symposium) and various hospital-sponsored research events. It is noteworthy, that in addition to local research events LMP graduate students have ample opportunity to interact with faculty outside Toronto by attending regional, national and international scientific conferences. LMP faculty are fully committed to enhancing the 'graduate experience' by sending their graduate students abroad to present their research findings. Indeed, University-wide surveys have shown that the satisfaction level of LMP graduate students in this regard is well above the university mean.

### *Graduate Courses*

A list of graduate courses is attached in Appendix 4.6

## **Assessment of Learning**

### *Graduate Courses*

Assessment of learning in LMP graduate courses is documented by letter grade, with the exception of the credit/no-credit research seminar course, LMP1001Y. LMP Course instructors use a range of evaluation tools to assess student performance, typically a combination of written assignments (e.g., critiques, research proposals), mid-terms, quizzes, and oral presentations. Class participation can also contribute to the final course grade, but normally not more than 10% of the total. For new graduate course proposals, both the content and mark weighting must be reviewed and approved by the LMP Graduate Curriculum and the Faculty of Medicine Graduate Curriculum Committee.

### *Thesis Advisory Committee Meetings*

All students have a Thesis Supervisor confirmed (and in some cases a Co-Supervisor) at the outset of their Graduate Program. An advisory committee is appointed within the first 4 – 6 months of the Program, and consists of the Supervisor(s) and at least two U of T graduate faculty members with research expertise relevant to the thesis topic. In selecting committee members, students are advised to look both within and outside the LMP Department to identify faculty who will be of greatest 'scientific' value to the goals and objectives of the thesis research.

It is required by the Department and U of T School of Graduate Studies that the advisory committee evaluates the student's progress annually. LMP students normally schedule their first advisory committee meeting within 6 – 9 months of starting the Graduate Program. Punctual scheduling of committee meetings is tracked by the LMP Graduate Office, and students who are late are notified accordingly. In preparation for the meeting, students distribute a written report to their advisory committee describing the background of the project, rationale/hypothesis, results to date, and proposed experiments. At the meeting, the student gives a slide-presentation style summary of the written report, and addresses questions from the committee. During the question period the committee assesses the student's overall intellect and thinking skills, critical ability, preparedness, organization, and effectiveness in communication. The emphasis of the questioning/ discussion is on the research project (e.g., its originality, significance, feasibility, time-line, prioritization of experiments, etc). However, the committee meeting is also a key opportunity for the committee to test the student's general knowledge as it relates to the proposed thesis work, and the broader context of pathobiology. Broader comprehensive testing is especially important for direct entry PhD students, to assess early on their suitability for doctoral studies. At the end of the question period, the committee prepares a meeting report (usually with the student present) outlining her/ his performance – e.g., knowledge, research completed, and experiments proposed. The reports are reviewed by the Graduate Coordinator, who follows up on any concerns that may be flagged by the committee. When students are in the final year of the Graduate Program, advisory committee meetings focus on MSc/ PhD completion issues (i.e., time-lines, critical experiments to finish), or PhD transfer in the case of second year MSc students.

### ***PhD Transfer Examination***

As briefly described above (Doctor of Philosophy Admission Requirements) MSc students with long-term interest in a research-oriented career, and who have excelled in graduate level coursework and research, may be recommended for PhD reclassification in year 2 of their MSc studies. An assessment of the candidate's performance and future potential in the PhD Program is made at an oral examination by a committee consisting of at least six voting members who are graduate faculty at the U of T: the Supervisor and advisory committee members, two additional graduate faculty members, one of whom is from another graduate department, and the exam Chair - the LMP Graduate Coordinator or his representative. Prior to the exam the candidate distributes a written report that includes the research results obtained as a MSc student, and the doctoral research proposed. At the exam, the candidate summarizes the report in a 30-minute oral presentation to the committee, who then proceed to question the candidate to assess her/ his background knowledge, critical thinking, communication skills, and proficiency in executing experiments in a careful reproducible manner. Committee members then vote on PhD transfer of the candidate; more than one negative vote or abstention results in a fail. During the period covered by this review, all PhD transfer candidates were successful.

### ***MSc Thesis Defense***

At the end of the MSc Program, students are evaluated on the basis of their written thesis and an oral examination. The examination committee consists of at least four voting members, including graduate faculty on the advisory committee and an External examiner and Chair. At the defense, the candidate gives a 20 minute presentation on the thesis research, which is followed by questions from the committee. A decision to pass or fail is made on the basis of thesis quality, and the candidate's performance during the question period. Although not all MSc projects lead to a peer-reviewed publication at the time of the thesis defense, all candidates are expected to demonstrate theoretical and practical proficiency in their area of study with a clear understanding of the significance of their MSc results, and the inherent limitations associated with the project. Candidates should be able to propose alternate strategies that in future would address or circumvent weaknesses in their thesis-based experiments. Following the question period, the committee members have a vote, with more than one negative vote or abstention resulting in a fail. During the period covered by this review, one MSc candidate was unsuccessful, and the defense was adjourned. The examination committee reconvened the following month to reassess the candidate; the outcome of the second defense was successful.

### ***PhD Final Oral Exam (FOE)***

As outlined for MSc students completing their graduate program (above) PhD students are evaluated on the basis of a written thesis and an oral examination. Unlike the MSc thesis, the PhD thesis undergoes two levels of review: internal and external to the University of Toronto.

Internal thesis reviewers include the Supervisor and advisory committee members, plus two arm's-length graduate faculty members from U of T who were not involved with the PhD thesis project. When all internal reviewers agree that the thesis is acceptable, pending minor changes, a University External appraiser is nominated, and approved by the School of Graduate Studies (SGS). The External appraiser reviews the thesis and submits a written appraisal at least two weeks before the final oral exam (FOE). The external appraisal is distributed to all internal thesis reviewers and the PhD candidate prior to the oral exam. Consistent with SGS regulations the FOE Committee is made up of at least four voting members (Quorum) and at most six voting members, which can include the Supervisor, internal reviewers and External appraiser. Note - the Quorum must contain at least two voting members who were not associated with the design or execution of the thesis research. SGS appoints a non-voting administrative Chair (a non-LMP graduate faculty member) who oversees the oral exam. Following a 20-minute oral presentation at the FOE, the candidate is questioned by the committee on the content of the thesis and an assessment is made of the candidate's mastery of the thesis research. The committee members then vote, with more than one negative vote or abstention resulting in a failed FOE. During the period covered by this review, all PhD candidates successfully passed the FOE.

## Student Awards and Professional Development

### Student Awards

One of the leading indicators of 'high quality' MSc and PhD students in a graduate program is their success rate in external award competitions. The major sources for these awards include both provincial (e.g., Ontario Ministry – OGS) and national (e.g., CIHR, NSERC) funding bodies. The data in the charts/ tables below show that LMP graduate students – both MSc and PhD – compete very well with their peers in the Faculty of Medicine and the U of T Life Sciences Division. During the period 2004 – 2012, LMP students outperformed the Fac Med/ Life Sci means in most years. Especially encouraging for the LMP Department is the upward trajectory of MSc and PhD external awards from 2008-2009 onward. This augurs well for future success of LMP students in external award competitions. As noted briefly below, a metric that highlights the excellence of LMP graduate students is their consistent success rate in the annual Vanier Canada Graduate Scholarship Competition. One to three awards have been won by LMP nominees each year since the Vanier program was established, resulting in the highest Departmental ratio of “Vanier winners: total PhD students” in the U of T Faculty of Medicine.

### Master of Science – Scholarships and Awards

During the period 2004-05 through 2011-12, 24.2% of MSc students have received external, merit-based scholarships or awards (see Table below).

Over the last three years (2009-10 through 2011-12), an upward trend is seen: on average, 31.3% of MSc students have external, merit-based scholarships or awards.

Overall, LMP demonstrates higher averages than both Faculty of Medicine and Life Sciences at U of T, in both periods (all years, and last three years). For example, the Faculty of Medicine average over all years is 20.3%, and over last three years is 21.4%; and Life Sciences/U of T numbers are similar, at 20.5% and 22.3%.

Percentage of Research Master's Students with External Fellowships/Scholarships									
Academic Year	Laboratory Medicine & Pathobiology			Faculty of Medicine			Life Sciences		
	Students with Fellowships or Scholarships	All Students	% with Fellowship or Scholarship	Students with Fellowship or Scholarship	All Students	% with Fellowship or Scholarship	Students with Fellowships or Scholarships	All Students	% with Fellowship or Scholarship
2004-05	9	51	17.6%	133	668	19.9%	165	863	19.1%
2005-06	7	45	15.6%	127	634	20.0%	161	843	19.1%
2006-07	11	52	21.2%	118	646	18.3%	139	847	16.4%
2007-08	14	64	21.9%	166	914	18.2%	186	907	20.5%
2008-09	19	80	23.8%	200	931	21.5%	198	905	21.9%
2009-10	24	75	32.0%	184	906	20.3%	168	846	19.9%
2010-11	23	72	31.9%	202	942	21.4%	199	865	23.0%
2011-12	20	67	29.9%	219	970	22.6%	214	894	23.9%

Data Source: Graduate Student Income Cube, 2004-05 to 2011-12 (Notes #1-3)

### *Doctor of Philosophy – Scholarships and Awards*

During the period 2004-05 through 2011-12, 34.5% of PhD students received external, merit-based scholarships or awards (see Table below).

Over the last three years (2009-10 through 2011-12), an upward trend is seen: on average, 41.4% of PhD students have external, merit-based scholarships or awards.

Overall, LMP demonstrates higher averages than both Faculty of Medicine and Life Sciences at U of T, in both periods (all years, and last three years). For example, the Faculty of Medicine average over all years is 31.9%, and over last three years is 34.7%; and Life Sciences/U of T numbers are similar, at 29.4% and 31.1%.

Percentage of Doctoral Students with External Fellowships/Scholarships									
Academic Year	Laboratory Medicine & Pathobiology			Faculty of Medicine			Life Sciences		
	Students with Fellowships or Scholarships	All Students	% with Fellowship or Scholarship	Students with Fellowship or Scholarship	All Students	% with Fellowship or Scholarship	Students with Fellowships or Scholarships	All Students	% with Fellowship or Scholarship
2004-05	19	85	22.4%	239	820	29.1%	351	1,218	28.8%
2005-06	25	88	28.4%	237	866	27.4%	355	1,286	27.6%
2006-07	27	75	36.0%	248	936	26.5%	371	1,391	26.7%
2007-08	31	98	31.6%	399	1,215	32.8%	416	1,423	29.2%
2008-09	32	97	33.0%	432	1,237	34.9%	439	1,462	30.0%
2009-10	35	89	39.3%	444	1,278	34.7%	450	1,503	29.9%
2010-11	45	100	45.0%	433	1,275	34.0%	428	1,480	28.9%
2011-12	44	110	40.0%	467	1,319	35.4%	515	1,497	34.4%

Data Source: Graduate Student Income Cube, 2004-05 to 2011-12 (Notes #1-3)

### *Vanier Canada Graduate Scholarships*

The Vanier Canada Graduate Scholarship (Vanier CGS) was created to attract and retain world-class doctoral students and to establish Canada as a global centre of excellence in research and higher learning. The scholarship is valued at \$50,000 per year for up to three years of doctoral study. It is the most prestigious national graduate scholarship in Canada.

Since the creation of the scholarships in 2009, doctoral students in LMP have been offered 10 Vanier CGS awards (9 from CIHR and 1 from NSERC). Only one other department at the Faculty of Medicine has more awards: the Institute of Medical Science (IMS), with 13 awards (all from CIHR). It should be noted that the IMS graduate program is the largest in terms of student enrolment at Faculty of Medicine, and currently has more than twice the number of doctoral students than LMP.

### Internal, Competitive Awards

LMP Graduate Students also demonstrate success in obtaining merit-based awards that are internal to the faculty and/or the university (see Table below). Many of these awards are equally competitive to external awards and have significant monetary value, for example:

- Connaught International Doctoral Scholarship: \$35,000/yr (for 4 yrs)
- Hospital for Sick Children Research Training Competition: \$21,000
- Peterborough KM Hunter Graduate Studentship: \$20,000
- Vision Sciences Research Fellowship: \$20,000
- Frank Fletcher Memorial Scholarship: \$15,000
- Ontario Graduate Scholarship in Science and Technology: \$15,000
- Scace Graduate Fellowships: \$10,000
- Banting and Best Diabetes Centre Graduate Awards: \$10,000-18,000

### LMP Master's Students with Internal Awards

Percentage of Research Master's Students with Internal Fellowships/Scholarships			
Academic Year	Students with Fellowships or Scholarships	All Students	% with Fellowship or Scholarship
2007-08	17	64	27%
2008-09*	11	80	14%
2009-10*	7	75	9%
2010-11	13	72	18%
2011-12	26	67	39%
2012-13	23	64	36%

\*Noticeable reduction in awards due to impact of economic instability on payouts from university endowments, which represent a majority of internal awards.

Source: GradSIS: number of registered PhD students with internal merit-based awards.

Note: Does not include Departmental awards.

### LMP Doctoral Students with Internal Awards

Percentage of Doctoral Students with Internal Fellowships/Scholarships			
Academic Year	Students with Fellowships or Scholarships	All Students	% with Fellowship or Scholarship
2007-08	23	98	23%
2008-09*	22	97	23%
2009-10*	28	89	31%
2010-11	26	100	26%
2011-12	30	110	27%
2012-13	30	99	30%

\*Impact of economic instability on doctoral awards affected value of awards, rather than number of awards offered.

Source: GradSIS: number of registered PhD students with internal merit-based awards.

Note: Does not include Departmental awards, nor doctoral thesis completion grants (discontinued in 2009).

## Professional Development

LMP graduate students can consider a range of career options as they near completion of their MSc and PhD programs. Many choose to continue post-graduate research training with the goal of a future academic faculty position or a senior scientist position in a university hospital or affiliated research institute. For this reason the Department and LMP graduate faculty are strongly committed to having graduate students attend and present at

national/ international conferences where they can make contacts and establish networks important for their research careers.

Others students prefer to apply their graduate training to alternative career paths in business, government, the private sector, education or law. In recognition of the breadth of career opportunities – and also the accompanying hurdles – the LMP Department and our Graduate Student Executive - CLAMPS, together with the Faculty of Medicine, the School of Graduate Studies and the Graduate Student Union all contribute to providing senior graduate students with up-to-date information, and interactive sessions that will help them with making informed career decisions. As previously noted (Program Objectives – PhD) doctoral students nearing candidacy can choose to take for credit a graduate level course not closely related to their thesis topic, that may introduce them to a new subject area important for an alternative career choice. Moreover, CLAMPS periodically uses the LMP1001Y seminar time slot as a forum to invite speakers representing an array of career opportunities. In this regard we are especially interested in inviting recent LMP graduate alumni who have developed successful careers. In 2012, for example, the speakers included two LMP PhD alumni, recently graduated: one, a Scientific Evaluator with Health Canada (Ottawa); the other, a Senior Editor with *Nature Medicine* (New York). Both found their new careers rewarding, and emphasized the important role of their doctoral studies in LMP.

## Student Funding

### Stipend

Master's and Doctoral graduate students receive a guaranteed minimum stipend which provides for a living allowance and covers the cost of tuition and fees. This is part of the Harmonized Student Stipend Arrangement for the Basic Science & Clinical Graduate Departments in the Faculty of Medicine, University of Toronto (for full arrangement see Appendix 4.7).

The stipends are given based on the academic year, i.e., September 1<sup>st</sup> to August 31<sup>st</sup>, and are paid through awards, scholarships, or from the Supervisor's grant funding on the basis of Research Assistantships. Students receiving competitive and external awards in the amount of \$15,000 or more have a merit bonus of \$3,000 added to the stipend. See Appendix 4.7 for details on the current arrangement.

For the academic year 2011-12, the stipends were as follows:

- Master's students: \$15,000 living allowance + tuition and fees
- Doctoral students: \$16,000 living allowance + tuition and fees
- Merit bonus: \$3,000

A number of Teaching Assistantships are also available to graduate students; salaries from these activities are permitted to be kept in addition to the stipend.

### Travel Awards

The Department of Laboratory Medicine and Pathobiology encourages students and trainees to present their research at national and international scientific conferences. The department provides a travel supplement of up to \$600 (per graduate student, per academic year) to defray travel expenses. Award recipients should be first-author presenters at the meeting.

### Visiting Trainee Graduate Award

This award supports PhD students who wish to attend a workshop or visit an international laboratory in order to learn a state-of-the-art research methodology. The awards are used to partially defray costs associated with travel and/or accommodation. Since 2007 one award (\$1,000 each) has been given annually. Students should be within the first three years of graduate studies.

Award Recipients (2007-present):

- Sheron Perera: AACR Smuckler Memorial Pathobiology of Cancer Workshop: Aspen, CO.
- Ryan Russel: New polycythemia mouse model: University of Pennsylvania, Philadelphia, PA.

- Paul Nagy: New mouse model deficient for vesicular acetylcholine transporter: Robarts Research Institute, London, ON
- Josh Lopes: Fluorescence molecular tomography (FMT): Harvard Medical School, Boston, MA.
- Halil Aydin: RapiData Collection and Structure Solving: A Course in Macromolecular X-Ray Diffraction Measurement. Brookhaven National Lab, Upton, NY.

### *Stuart Alan Hoffman Memorial Prize*

This award is given annually to a recent alumnus of the graduate program. The purpose of the award is to acknowledge and reward "a graduate student who has shown special ability in the research field, having in mind the character as well as the research ability of the candidate." Graduate students in either the MSc or PhD program are eligible for nomination. Excellence in research may be documented by an accepted thesis (MSc or PhD), published papers, or manuscripts in press.

Award Recipients (thesis research field, key publications (year), post-graduate activities):

- 2012: Andrea Conroy, PhD: Placental and Cerebral Malaria – African field work J Expt Med (2008), PLoS One (2010, 2011): PDF, U Toronto
- 2011: Paul Northcott, PhD: Medulloblastoma Genomics; Nat Genet (2009); PDF, U Heidelberg
- 2010: Daniel Y Lee, PhD: MicroRNA/ Tumor Growth; PNAS (2007), Nat Cell Biol (2009); PDF, Harvard University
- 2009: Christopher Franco, PhD: Atherogenesis; Circ Res (2008, 2009); Clinician-Scientist, UBC
- 2008: Zuyao Ni, PhD: Chromatin remodeling; Nat Immunol (2008), J Immunol (2007); PDF, U of T
- 2007: Megan Ford, PhD: Autoimmunity/ transplantation; J Expt Med (2002); PDF, U of T

### *Departmental Awards*

The Department has several awards available for current students:

Award Name	Amount	#	Description
Ontario Graduate Scholarships in Science and Technology/ Canadian Arthritis Network	\$15,000	1-2	Merit-based, for graduate students engaged in arthritis research
Dr. Rajalakshmi S. Dittakavi and Dr. Prema M. Rao Graduate Awards in LMP	\$700-800*	1-2	Merit-based, for graduate students pursuing study and research on the cause, prevention, pathogenesis and cure of cancer; second award to a graduate student to present research at annual AACR meeting.
Meredith & Malcolm Silver Scholarship in Cardiovascular Studies	Up to \$2,300*	1	Merit-based, for graduate students engaged in cardiovascular research
Meredith & Malcolm Silver Scholarship in Cardiovascular Studies (OSOTF)	Up to \$4,500*	1	Merit- and need-based, for graduate students engaged in cardiovascular research
Graduate Award in LMP	Up to \$300-500*	1	Merit- and need-based
Norman Bethune Award	Up to \$1,800*	1	Recognizes excellent PhD students in the first two years of the program (or within two years of transfer from Master's)
University of Toronto Fellowships	\$5,000	30-40	Merit-based, offered to students in their first term of the program

\* Award value is based on annual endowment payout



## Quality Indicators

### 1. Graduate Enrolment

Although the quality of students recruited to the LMP Graduate Program is very high, one area in which we have underperformed is in enrolment growth, particularly in the PhD program. During the period 2005 – 2010, we observed an increase in MSc enrolment, but because of a concomitant decline in the number of PhD students during that period the total head count for the Graduate Program remained steady at approximately 150. A substantial jump in PhD student enrolment was observed in Fall 2011, with a slight decline in MSc enrolment. We attribute the higher PhD count that year to an increase in excellent new PhD applications, but also significant internal growth through increased PhD transfers. The latter is a positive indicator that MSc students are satisfied with their Supervisor and the Graduate Program, and are willing to make a longer term commitment to graduate education in LMP. Over the past two years LMP graduate enrolment has averaged a head count of 160. We continue our efforts to grow enrolment, for example, by enhancing awareness about the program through an excellent new graduate website, and by growing capacity for graduate supervision through new academic primary and cross-appointments of faculty to LMP.

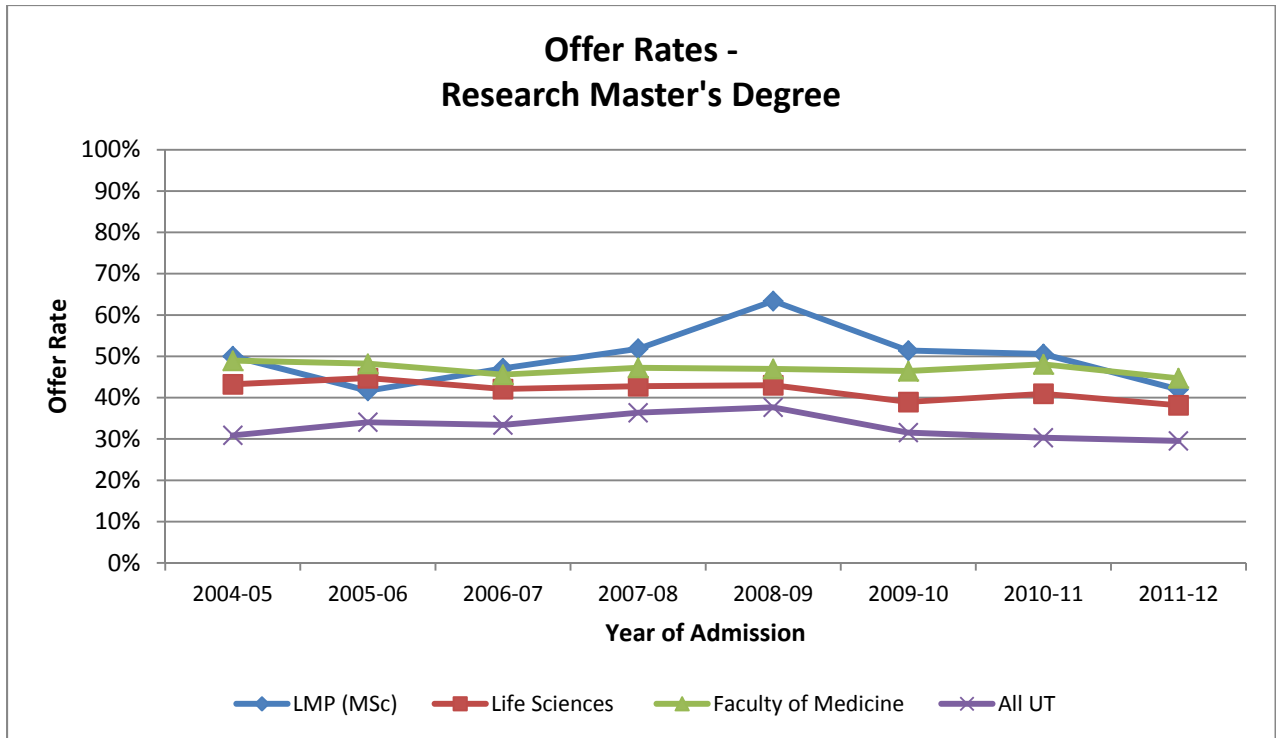
### 2. Application and Registration

**MSc Students:** Analysis of the offer/ acceptance rates of new MSc recruits to LMP (Table and figures below) shows offer rates comparable to those of the Faculty of Medicine with a peak above the mean in 2008-2009, and an overall acceptance rate that falls below that of the Faculty of Medicine. Although some of our top MSc applicants apply to more than one graduate program, and may therefore be lost to the recruitment efforts of other Departments or Universities, we doubt that this has major bearing on our overall MSc applicant acceptance rates. We are aware, for example, that a significant number of MSc applicants offered admission to other graduate programs join the LMP program, suggesting the net result of inter-program competition is essentially neutral. Rather, evidence suggests that the disparity between our offer and acceptance rates is related to MSc applicants being accepted to medical school, or other professional programs, and opting to pursue those career directions instead. Our emphasis on choosing MSc applicants with excellent transcripts, notably with top grades in the life/ biomedical sciences, means we will likely face some competition from medical/ professional schools in future.

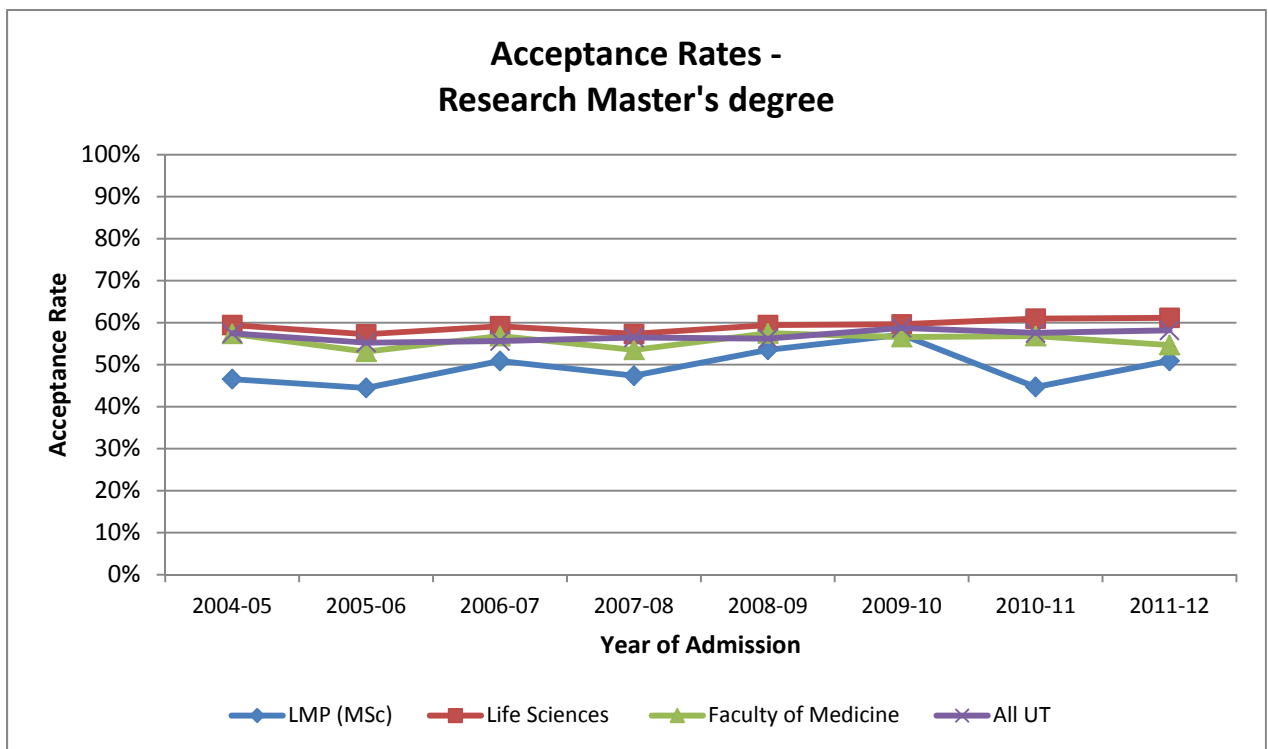
Research Master's Degree (MSc)								
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
<b>Applications</b>	116	108	121	110	112	109	93	131
<b>Offers</b>	58	45	57	57	71	56	47	55
<b>New Registrants</b>	27	20	29	27	38	32	21	28

Data obtained from ROSI (Note #8)





(Note #9)

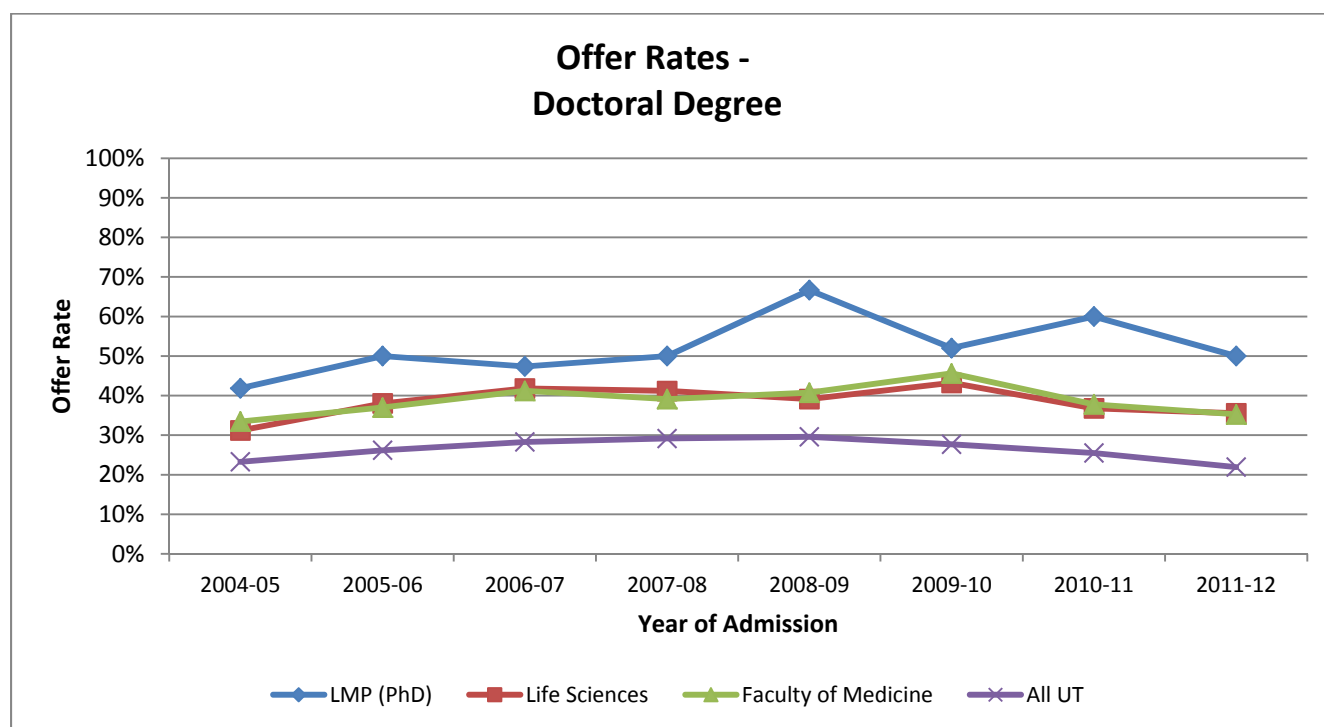


(Note #10)

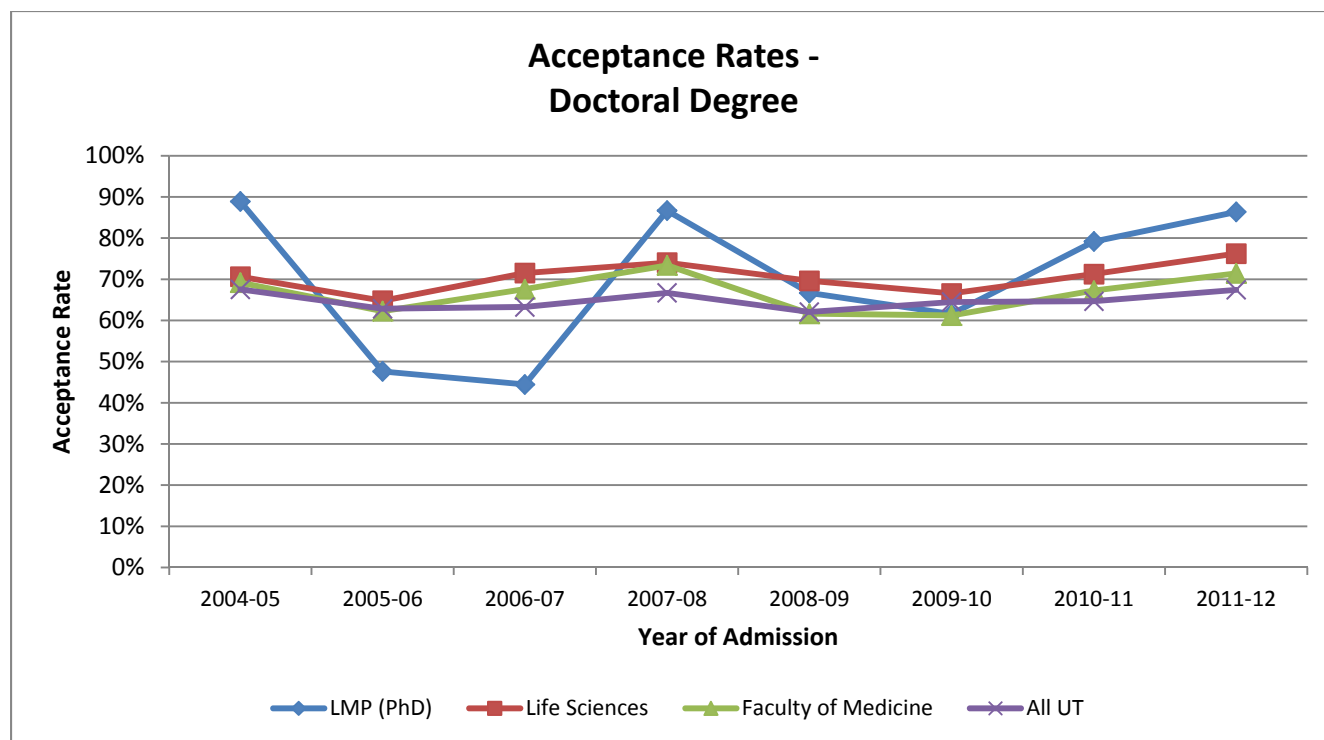
**PhD Students:** Analysis of the offer/ acceptance rates of new PhD recruits to LMP (Table and figures below) shows offer rates are higher than those of the Faculty of Medicine during the period 2004-2012. Although the reasons for the difference are not obvious it is unlikely that the higher offer rates reflect a lower LMP admission standard relative to other Faculty of Medicine Departments, as LMP PhD students perform very strongly in their academic program, and outperform the Faculty mean in their success rates for securing external funding. The LMP acceptance rate appears to show significant variability from 2004-2012, again making interpretation difficult. It is interesting that after 2009-2010, there is an uptrend in the PhD acceptance rate, consistent with an increase in the PhD student head count during the same period.

Doctoral Degree (PhD)								
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
<b>Applications</b>	43	42	19	30	27	25	40	44
<b>Offers</b>	18	21	9	15	18	13	24	22
<b>New Registrants</b>	16	10	4	13	12	8	19	19

Data obtained from ROSI (Note #8)



(Note #9)



(Note #10)

### 3. Attrition Rates

From 2007 to 2012, the graduate program had 8 Master's students (2.4%) and 11 Doctoral students (2.5%) voluntarily withdraw from their studies. Most were due to personal reasons.

During this period, two doctoral students transferred from LMP to another graduate program within the Faculty of Medicine – both were due to reasons of research fit.

During this period, no students were terminated from the graduate program.

### 4. Time to Completion (TTC)

**MSc Students:** The time to program completion (TTC) for MSc students in LMP (see Table below) is somewhat shorter than that of Faculty of Medicine Departments overall. During the 8 year period 2004 – 2012, the LMP TTC mean falls below that of the Faculty of Medicine TTC mean 7 out of 8 times. While the LMP Department recognizes that the MSc program should not be unnecessarily prolonged, and that students who are 'serious' about research should transfer to the PhD, it is important that the MSc thesis represents a body of original publishable work, that can contribute to the success of the Supervisor's research program. Moreover it is vital that the MSc graduate finishes the Program in LMP having met the learning outcomes outlined above, including: (1) gaining a strong background knowledge in pathobiology, (2) acquiring practical skills for pathobiology research, (3) developing analytical and critical abilities, and (4) effective communication skills. Close monitoring of the MSc student's progress by the Supervisor and advisory committee is key – and when it clear that the above benchmarks have been met the MSc candidate should be strongly encouraged to write and defend her/ his thesis.

Time to Completion - Research Master's Students								
Graduation Year	LMP (MSc, FT)		Medicine		Life Sciences		All U of T	
	Number of Graduates	Mean TTC years	Number of Graduates	Mean TTC years	Number of Graduates	Mean TTC years	Number of Graduates	Mean TTC years
2004-05	23	2.33	187	2.50	267	2.49	1111	1.79
2005-06	17	2.18	222	2.50	318	2.48	1149	1.77
2006-07	15	2.49	201	2.51	299	2.34	1079	1.73
2007-08	14	2.60	192	2.48	297	2.45	1112	1.68
2008-09	21	2.44	193	2.45	293	2.39	1319	1.60
2009-10	17	2.39	227	2.44	352	2.36	1299	1.67
2010-11	27	2.23	258	2.53	361	2.42	1257	1.74
2011-12	14	2.45	248	2.54	364	2.45	1227	1.78

Data Source: ROSI, screen 4BEA (Years to Graduate) for 2004-05 to 2011-12. (Notes #4-7)

**PhD Students:** The time to program completion (TTC) for PhD students in LMP (see Table below) is close to 6 years and compares favorably with the TTC for Faculty of Medicine Departments overall. During the 8 year period 2004 – 2012, the LMP TTC mean falls below that of the Faculty of Medicine TTC mean 5 out of 8 times. Unlike the MSc Program, PhD Program length is defined largely by the completion of a substantial body of scholarly work that leads to two or more peer-reviewed papers, and at least part of which should be accepted for publication at the time of the thesis defense. This Program requirement contributes to the variability of PhD program length in LMP such that some PhD candidates are ready to write up and defend in 4.5 years while others take 7 years or more. As for MSc students (see TTC above) monitoring of PhD student progress by the Supervisor and advisory committee is critical in later stages of the doctoral Program, and in some cases consultation with the Graduate Coordinator is important for establishing a time-line that the PhD candidate can follow to complete the Program.

Time to Completion - Doctoral Students								
Graduation Year	LMP (PhD, FT)		Medicine		Life Sciences		All U of T	
	Number of Graduates	Mean TTC (years)	Number of Graduates	Mean TTC years	Number of Graduates	Mean TTC (years)	Number of Graduates	Mean TTC (years)
2004-05	15	6.18	144	5.72	214	5.68	648	5.49
2005-06	15	5.62	135	5.74	184	5.73	643	5.54
2006-07	13	6.20	147	5.74	202	5.75	636	5.53
2007-08	17	5.69	173	5.86	243	5.91	711	5.63
2008-09	22	5.70	162	6.04	240	5.91	697	5.67
2009-10	17	5.65	187	5.78	255	5.81	738	5.58
2010-11	16	5.92	185	5.93	259	5.79	789	5.75
2011-12	15	6.47	214	6.21	300	6.07	805	5.79

Data Source: ROSI, screen 4BEA (Years to Graduate) for 2004-05 to 2011-12. (Notes #4-7)

### 5. *Student in-course reports on teaching*

Many graduate courses use anonymous, paper-based course evaluations to collect student feedback on teaching and other aspects of the course - for example: LMP 1404H, LMP 1001Y, LMP 1510H. Some graduate courses in LMP have very small classes (< 6 students), therefore it is not practical to use anonymous evaluation surveys due to the heightened risk of identification of the student. In these cases, alternative methods of feedback are elicited such as email comments and oral discussion.

The Faculty of Medicine has recently introduced online course evaluations. The Department has not yet adopted this method of obtaining feedback because there are still many limitations with survey design and question selection; therefore, at present we find the paper-based surveys provide more valuable feedback for our range of courses.

A sample of the teaching evaluation is attached in Appendix 4.8.

### 6. *Student Satisfaction – Canadian Graduate and Professional Student Survey (CGPSS) 2010*

The CGPSS 2010 survey received 37% response rate from LMP graduate students, evenly distributed between MSc and PhD students. More specific demographic data was not provided (e.g., year of study, gender, legal status, etc.).

- Results from the 2010 CGPSS survey indicate that almost all LMP graduate students are satisfied with the program:
- 93.3% of respondents felt the overall quality of their graduate program was either 'excellent,' 'very good,' or 'good' (Section IV, question #2-3).
- 94.3% of respondents would 'definitely' or 'probably' recommend the university to someone else considering their graduate program.

See Appendix 4.9 for the detailed Student Survey

## Graduates

### 1. *Rates of Graduation*

All graduate students who have attempted a thesis defense have been successful in doing so, and therefore have completed the program.

From September 2007 to September 2012, a total of 5 students have lapsed from the program: 2 MSc and 3 PhD. This represents only 0.6% of the overall enrolment for that period.

### 2. *Employment Rates Post-graduation*

**Master of Science:** From September 2007 to September 2012, LMP graduated 99 MSc students. From these 99 MSc graduates, 22 were employed in academic areas, 11 were employed in private industry, and 5 held positions in non-profit or government. Other than employment, 57 graduates went on to pursue further education, primarily in professional medicine programs. An additional 3 graduates engaged in other meaningful occupation such as childrearing. Information for 1 alumnus was not available.

**Doctor of Philosophy:** From September 2007 to September 2012, LMP graduated 100 PhD students. From these 100 graduates, 47 continued on to postdoctoral fellowships, and 14 landed faculty positions or employment in academic research. Another 22 graduates were employed in private industry, and 6 held positions in non-profit or government. In terms of further education, 7 continued their studies in professional medicine, and 1 in another professional program. An additional 2 graduates engaged in other meaningful occupation such as childrearing. Information for 1 alumnus was not available.

### Overall Trends

- 64% of graduates are employed
- 33% of graduates pursued further studies
- 3% of graduates were engaged in other meaningful occupation
- The majority of alumni obtained employment or pursued further studies in Ontario. A significant minority went on to positions or institutions in the United States, with the remainder dispersed between locations in other parts of Canada or internationally.

### Notable Alumni

#### Post-Doctoral Fellowships

- Jennifer Estall: NRC H.L. Holmes Award
- Geeth Gunawardana: CIHR Banting Post-Doctoral Fellowship
- Rahul Kushwah: CIHR Banting Post-Doctoral Fellowship
- Conglei Li: CIHR Post-Doctoral Fellowship
- Maria De Rosa: NSERC Industrial R&D Post-Doctoral Fellowship
- Joel Watts: CIHR Banting Post-Doctoral Fellowship

#### Faculty Positions

- George Charames, Laboratory Medicine & Pathobiology, University of Toronto
- Vathany Kulasingam, Laboratory Medicine & Pathobiology, University of Toronto
- Irina Voronov, Dentistry, University of Toronto
- Paul Kongkham, University of Toronto (UHN and Sick Kids)
- Joel Watts, University of California at San Francisco, School of Medicine
- Arnold Etame, University of South Florida
- Julie Shaw, University of Ottawa
- Fariborz Rashid-Kolvear, University of Calgary
- Juana Gonzalez-Santos, York University (lecturer)

### 3. Graduate Student Publications

All graduate students publish peer-reviewed manuscripts during their program and/or shortly after completion. Below are listed some recent noteworthy publications by current graduate students and alumni.

#### Current Students (LMP student names underlined>)

- ***Delineation of two clinically and molecularly distinct subgroups of posterior fossa ependymoma.*** \*\*Witt H, \*\*Mack SC, Ryzhova M, Bender S, Sill M, Isserlin R, Benner A, Hielscher T, Milde T, Remke M, Jones DT, Northcott PA, Garzia L, Bertrand KC, Wittmann A, Yao Y, Roberts SS, Massimi L, Van Meter T, Weiss WA, Gupta N, Grajkowska W, Lach B, Cho YJ, von Deimling A, Kulozik AE, Witt O, Bader GD, Hawkins CE, Tabori U, Guha A, Rutka JT, Lichter P, Korshunov A, Taylor MD, Pfister SM. Cancer Cell 16; 20(2):143-57 (2011).
- ***Identification of an innate T helper type 17 response to intestinal bacterial pathogens.*** \*\*Geddes K, \*\*Rubino SJ, Magalhaes JG, Streutker C, Le Bourhis L, Cho JH, Robertson SJ, Kim CJ, Kaul R, Philpott DJ, Girardin SE. Nature Medicine 17(7): 837-44 (2011)
- ***Dual elimination of the glucagon and GLP-1 receptors in mice reveals plasticity in the incretin axis.*** Ali S, Lamont BJ, Charron MJ, Drucker DJ. Journal of Clinical Investigation 121(5): 1917-29 (2011)
- ***Perinuclear cohibin complexes maintain replicative life span via roles at distinct silent chromatin domains.*** \*\*Chan JN, \*\*Poon BP, \*\*Salvi J, Olsen JB, Emili A, Mekhail K. Developmental Cell 20(6): 867-79 (2011).
- ***Subgroup-specific structural variation across 1,000 medulloblastoma genomes.*** \*\*Northcott PA, \*\*Shih DJ, Peacock J, Garzia L, Morrissy AS, Zichner T, Stütz AM, Korshunov A, Reimand J, Schumacher SE, Beroukhi R, Ellison DW, Marshall CR, Lionel AC, Mack S, Dubuc A, Yao Y, Ramaswamy V, Luu B, Rolider A, Cavalli FM, Wang X, Remke M, Wu X, Chiu RY, Chu A, Chuah E, Corbett RD, Hoad GR, Jackman SD, Li Y, Lo A, Mungall KL, Nip KM,

Qian JQ, Raymond AG, Thiessen NT, Varhol RJ, Birol I, Moore RA, Mungall AJ, Holt R, Kawauchi D, Roussel MF, Kool M, Jones DT, Witt H, Fernandez-L A, Kenney AM, Wechsler-Reya RJ, Dirks P, Aviv T, Grajkowska WA, Perek-Polnik M, Haberler CC, Delattre O, Reynaud SS, Doz FF, Pernet-Fattet SS, Cho BK, Kim SK, Wang KC, Scheurlen W, Eberhart CG, Fèvre-Montange M, Jouvét A, Pollack IF, Fan X, Muraszko KM, Gillespie GY, Di Rocco C, Massimi L, Michiels EM, Kloosterhof NK, French PJ, Kros JM, Olson JM, Ellenbogen RG, Zitterbart K, Kren L, Thompson RC, Cooper MK, Lach B, McLendon RE, Bigner DD, Fontebasso A, Albrecht S, Jabado N, Lindsey JC, Bailey S, Gupta N, Weiss WA, Bognár L, Klekner A, Van Meter TE, Kumabe T, Tominaga T, Elbabaa SK, Leonard JR, Rubin JB, Liau LM, Van Meir EG, Fouladi M, Nakamura H, Cinalli G, Garami M, Hauser P, Saad AG, Iolascon A, Jung S, Carlotti CG, Vibhakar R, Ra YS, Robinson S, Zollo M, Faria CC, Chan JA, Levy ML, Sorensen PH, Meyerson M, Pomeroy SL, Cho YJ, Bader GD, Tabori U, Hawkins CE, Bouffet E, Scherer SW, Rutka JT, Malkin D, Clifford SC, Jones SJ, Korbelt JO, Pfister SM, Marra MA, Taylor MD. *Nature* 488(7409): 49-56 (2012).

- **Markers of survival and metastatic potential in childhood CNS primitive neuro-ectodermal brain tumours: an integrative genomic analysis.** Picard D, Miller S, Hawkins CE, Bouffet E, Rogers HA, Chan TS, Kim SK, Ra YS, Fangusaro J, Korshunov A, Toledano H, Nakamura H, Hayden JT, Chan J, Lafay-Cousin L, Hu P, Fan X, Muraszko KM, Pomeroy SL, Lau CC, Ng HK, Jones C, Van Meter T, Clifford SC, Eberhart C, Gajjar A, Pfister SM, Grundy RG, Huang A. *Lancet Oncology* 13(8): 838-48 (2012).

\*\*denotes equal contribution by authors

#### Alumni (LMP student names underlined)

- **The chromatin-remodeling enzyme BRG1 coordinates CIITA induction through many interdependent distal enhancers.** Ni Z, Abou El Hassan M, Xu Z, Yu T, Bremner R. *Nature Immunology* 9(7): 785-93 (2008).
- **Multiple recurrent genetic events converge on control of histone lysine methylation in medulloblastoma.** Northcott PA, Nakahara Y, Wu X, Feuk L, Ellison DW, Croul S, Mack S, Kongkham PN, Peacock J, Dubuc A, Ra YS, Zilberberg K, McLeod J, Scherer SW, Sunil Rao J, Eberhart CG, Grajkowska W, Gillespie Y, Lach B, Grundy R, Pollack IF, Hamilton RL, Van Meter T, Carlotti CG, Boop F, Bigner D, Gilbertson RJ, Rutka JT, Taylor MD. *Nature Genetics* 41(4):465-72 (2009).
- **Gli2 and p53 cooperate to regulate IGFBP-3- mediated chondrocyte apoptosis in the progression from benign to malignant cartilage tumors.** Ho L, Stojanovski A, Whetstone H, Wei QX, Mau E, Wunder JS, Alman B. *Cancer Cell* 16(2): 126-36 (2009).
- **Division and apoptosis of E2f-deficient retinal progenitors.** \*\*Chen D, \*\*Pacal M, Wenzel P, Knoepfler PS, Leone G, Bremner R. *Nature* 462(7275): 925-9 (2009).
- **MicroRNA MiR-17 retards tissue growth and represses fibronectin expression.** \*\*Shan SW, \*\* Lee DY, Deng Z, Shatseva T, Jeyapalan Z, Du WW, Zhang Y, Xuan JW, Yee SP, Siragam V, Yang BB. *Nature Cell Biology* 11(8): 1031-8 (2009).
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LM, Richmond TD, Hickey MM, Barber DL, Cheresch DA, Simon MC, Irwin MS, Kim WY, Ohh M. **Nature Medicine** 17(7): 845-53 (2011).

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#### 4. Other Measures of Performance

- **Canadian Student Health Research Forum (CSHRF):** CSHRF is a CIHR-sponsored national poster competition for doctoral students conducting research in the health sciences at universities across Canada. Hosted by the University of Manitoba (Winnipeg), the annual event involves some 200 top PhD delegates selected by their graduate Departments. Each year LMP nominates 3-4 doctoral students to represent the Department and university by presenting their research at the conference. Our graduate students have been very successful each year and consistently received poster prizes, which demonstrates the excellent quality of our graduate students at a national level:
  - 2012: Adrian Dubuc (Gold Medal), Stephen Mack (Gold Medal), Safina Ali (Silver medal)
  - 2011: Joanna Smeeton (Gold medal), Azza Eissa (Silver medal), Sepehr Ehsani (Honorable mention)
  - 2010: Stephen Rubino (Silver medal), Ken Kron (Honorable mention)
  - 2009: Roxana Sufan (Gold medal), Paul Northcott (Gold Medal), Ioannis Prassas (Silver medal)
  - 2008: Miralem Mrkonjic (Gold medal), Ryan Ward (Silver medal)
- **Lap-Chee Tsui CIHR Publication Award – Finalist 2012:** Paul Northcott (alumnus) and David Shih (doctoral student)

## Quality Enhancement

### Graduate Experience – Mentorship, Consultation, and Conflict Resolution

The success of students in the LMP Graduate Program will depend in part on the experiences they have outside the laboratory -- whether they: (a) feel integrated within the Department and the broader university community, (b) have adequate support and guidance as they start their research, (c) can easily discuss matters related to their courses, research program, career development, etc, and (d) have somewhere to turn if conflicts should arise, for example, with the Supervisor, co-workers, or personal relationships.

LMP makes it a priority to provide the support graduate students need through a concerted effort of the Graduate Coordinator, Graduate Administrators, and the CLAMPS Student Executive. CLAMPS regularly organizes social and sports events that bring LMP graduate students together and help to build camaraderie and team spirit. They have also established a successful mentorship program that is available to new students (especially MSc students) who can benefit from interacting with more senior graduate students. The Graduate Coordinator and Administrators have an open door policy that allows students to meet on short notice to discuss any matters that may be of concern.

We believe that this approach is effective and contributes to the well-being and overall satisfaction of LMP graduate students (as documented above). Indeed, as indicated in the 2010 CGPSS Departmental Report, 93% of LMP graduate students rated the quality of the Graduate Program as 'good to excellent' (slightly above the 88% satisfaction observed for the University). As the Graduate Coordinator, Prof H. Elsholtz, plays a leadership role in overseeing the success of the Program, a separate survey was conducted to assess his performance as part of the External Review. LMP graduate students – current and alumni/ MSc and PhD – were invited to submit letters of evaluation. These have been included (with names removed), see Appendix 4.10.



### Graduate Professional Skills (GPS)

GPS is an initiative from the School of Graduate Studies to help all graduate students become fully prepared for their future. GPS focuses on skills beyond those conventionally learned within a disciplinary program, skills that may be critical to success in the wide range of careers that graduates enter, both within and outside academe.

The GPS consists of a range of free “offerings” in the form of co-curricular courses, workshops, seminars, and placements in four program areas: Research-Related Skills, Communication & Interpersonal Skills, Teaching Competence, and Personal Effectiveness. Successful completion of a program is recognized by a notation on the student’s transcript. GPS offerings are regularly promoted to our graduate students.

### Notes for Graduate Report

#### 1. General notes about the Graduate Student Income Cube:

- i) The Cube only contains students who were actively registered at the end of each session and only counts each student once per year.
- ii) The Cube contains data for awards administered through U of T for all years, but only includes data for awards administered through affiliated hospitals from 2007-08 onwards.
  - At the departmental level, hospital-administered awards for 2005-06 and 2006-07 have been supplemented by Medicine using GradSIS records. However, hospital data could not be supplemented for 2004-05, as GradSIS data are unavailable for that year.
  - At the Faculty level, data for affiliated hospitals are not available for 2005-06 and 2006-07.
  - Affiliated hospital data are not available in any year for the SGS Division level.
- iii) The Cube does not include OSAP loans.
- iv) The Cube does not include students registered in ‘self-funded’ academic programs (i.e., Executive MBA, MMPA, MMF, MEngDM, MEngTel).

#### 2. Extraction criteria for the Income Cube:

‘Students with Fellowships/Scholarships’ data represent the number of full-time students receiving external, merit-based awards in the given year. The data are based on extracts from the Graduate Student Income Cube using the following parameters:

- i) All Income: Awards – Fellowships/Scholarships
- ii) All Sources = External
- iii) All Programs by Faculty = Medicine – Laboratory Medicine & Pathobiology (or All Programs by Faculty = Medicine or SGS Division = Division IV: Life Sciences)
- iv) Degree Type = 'Doctoral Program' or 'Master's - Doctoral Stream'
- v) Attendance Type = Full-time
- vi) Measures = Student Count
- vii) For all other options, default values were used.

Note: Some merit-based awards may also be found in the ‘Awards – Other’ category (such as book prizes and other non-monetary awards) but due to the nature of the data, these were not included in the tables and graphs above.

#### 3. Extraction criteria for the Income Cube:

‘All Students’ data represent the number of full-time students registered in the department in the given year. The data are based on extracts from the Graduate Student Income Cube using the following parameters:

- viii) All Income= [default] (includes the following categories: ‘No Income for at least 1 session’, ‘Award Income’, ‘Employment Income’, and ‘Research Stipend’)
- ix) All Sources = [default] (includes the following categories: ‘No Income for at least 1 session’, ‘Internal’, ‘External’)
- x) All Programs by Faculty = Medicine – Laboratory Medicine & Pathobiology (or All Programs by Faculty = Medicine or SGS Division = Division IV: Life Sciences)
- xi) Degree Type = 'Doctoral Program' or 'Master's - Doctoral Stream'
- xii) Attendance Type = Full-time

- xiii) Measures = Student Count
  - xiv) For all others options, default values were used (incl. 'All Income' and 'All Sources').
4. Time-to-completion (TTC) calculations only include sessions in which students are registered. Sessions on leave or lapsed sessions are not part of the TTC values.
  5. Time-to-completion values are based on a student's first to last registered session. For students that transfer from a research master's to a PhD degree, TTC is counted from the first session of the master's program to the last session of the doctoral program.
  6. Comparative data for the Division and all U of T include all research/professional master's or doctoral degrees in the corresponding attendance class (i.e., full- or part-time).
  7. In some individual years, the number of graduates can be very low. In these cases, the mean time-to-completion may not be representative and should be interpreted with caution.
  8. Data obtained from ROSI using screen 4BEG (Admissions Statistics). Input criteria: Years from = 20049; Number of Years = 8; Type of Program = DOC, MAST, PMAS; Primary Org Code = SGS; Second Org Code = LMP
  9. 'Offer rate' calculated by dividing the number of offers by the number of applications for a given academic year.
  10. 'Acceptance rate' calculated by dividing the number of new registrants by the number of offers made for a given academic year.

## Postgraduate (Residency) Training Programs Report

### Overview

The Residency Training Programs in LMP are designed to provide residents with a firm foundation in the knowledge, skills and attitudes that will allow them to become leaders in their field. Each program offers integrated training that helps residents attain the professional competencies and be prepared for independent and competent practice. All LMP residency programs employ robust and well-established systems of formal evaluation that fulfill the requirements of the Royal College of Physicians and Surgeons of Canada (RCPC) and the American Board of Pathology (ABP).

#### Residency Programs at LMP:

- Anatomical Pathology
- Forensic Pathology
- General Pathology
- Hematological Pathology
- Medical Microbiology
- Neuropathology

In April 2013 five of the Residency Programs were reviewed externally by the RCPC. Because it is a new program, the RCPC review of the Forensic Pathology program was postponed. All six Programs were recommended for the status of “accredited” to be confirmed this fall.

There are a total of 56 residents currently enrolled in six residency programs.

Five Fully Affiliated Teaching Hospitals and six Community Hospitals participate in resident training across the Greater Toronto Area (GTA). Other training sites include the Ontario Forensic Pathology Service, the Ontario Agency for Health Protection and Promotion and Canadian Blood Services. The quality of the case material at the University of Toronto is arguably among the best in the world, given the size and diversity of the population. Opportunities in the community have been expanded by forging stronger links with several community hospitals in the GTA.

The residents are taught by a large and engaged Clinical Faculty, many of whom are considered as national or international leaders in their fields, to an extent that is not easily matched elsewhere in Canada.

The resources in equipment and faculty at LMP provide learning opportunities at the cutting edge of Laboratory Medicine; the resources available especially in molecular pathology and telepathology are impressive.

Between 2007, the time of the last Royal College External Review, and 2013, all programs in LMP have made tremendous strides in developing their Program Objectives, Curriculum and Evaluations within the CanMEDS teaching framework mandated by the Royal College<sup>1</sup>. All programs have undertaken thorough review of their content and evaluation practices, some making substantial additions, changes and improvements.

The content of the programs is delivered through a wide variety of techniques in diverse settings. All programs ensure that residents have daily interaction with supervisors at the training sites, weekly lectures and a number of other educational activities integrated into their training to emphasize learning across all CanMEDs competencies.

The LMP Residency Training Programs have also embraced on-line and digital tools for content delivery, especially in teaching and evaluating residents. Examples of these tools include:

- On-line courses to supplement teaching activities
- On-line journaling for reflective self-assessment
- Use of Whole Slide Imaging and virtual microscopy during exams, slide clubs, and didactic teaching sessions

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<sup>1</sup> CanMEDS is an educational framework identifying and describing seven roles that lead to optimal health and health care outcomes: medical expert (central role), communicator, collaborator, manager, health advocate, scholar and professional.

LMP has an enriched atmosphere for research and is considered to be one of the top research Departments of its kind in North America. In a field like Laboratory Medicine, residents need to be trained for tomorrow: initiatives such as the molecular pathology rotation and the innovative longitudinal research elective for Anatomical Pathology residents are specific activities designed to meet these challenges.

All residents are expected to undertake research and other scholarly projects, and to present their work at professional meetings and conferences. The Department hosts an Annual Postgraduate Research Day every spring which provides a forum where residents can gain experience presenting their research, obtain feedback on their projects, gain greater familiarity with what research other trainees are doing, publicize their research within the department, and have a chance to win research awards.

## Residency Programs at a Glance

Anatomical Pathology	
<b>Program Length:</b>	Five years
<b># of Residents Currently Enrolled</b>	40
<b>Program Delivery:</b>	Mandatory and elective rotations, lectures/ hospital rounds, online learning
<b>Evaluation Methods:</b>	Direct Observation, Written, Slide and Oral Exams, Resident Portfolio
<b>Program Director:</b>	S. Raphael
<b>Accreditation:</b>	Royal College of Physicians & Surgeons of Canada, American Board of Pathology
<b>Accreditation Status:</b>	Accredited Program (April 2013)

Forensic Pathology	
<b>Program Length:</b>	One year
<b># of Residents Currently Enrolled</b>	2
<b>Program Delivery:</b>	Mandatory and elective rotations, lectures/rounds
<b>Evaluation Methods:</b>	Direct Observation, Written and Practice Exams, Resident Portfolio
<b>Program Director:</b>	M. Pollanen
<b>Accreditation:</b>	Royal College of Physicians & Surgeons of Canada
<b>Accreditation Status:</b>	Accredited Program (April 2013)

General Pathology	
<b>Program Length:</b>	Five years
<b># of Residents Currently Enrolled</b>	2
<b>Program Delivery:</b>	Mandatory and elective rotations, lectures/ hospital rounds, online learning
<b>Evaluation Methods:</b>	Direct Observation, Written, Slide and Oral Exams, Resident Portfolio
<b>Program Director:</b>	R. Hegele
<b>Accreditation:</b>	Royal College of Physicians & Surgeons of Canada, American Board of Pathology
<b>Accreditation Status:</b>	Accredited Program (April 2013)

Hematological Pathology	
<b>Program Length:</b>	Four years
<b># of Residents Currently Enrolled</b>	4
<b>Program Delivery:</b>	Mandatory and elective rotations, lectures/ rounds, on-line learning
<b>Evaluation Methods:</b>	Direct Observation, Practice Exams
<b>Program Director:</b>	B. Fernandes
<b>Accreditation:</b>	Royal College of Physicians & Surgeons of Canada, American Board of Pathology
<b>Accreditation Status:</b>	Accredited Program (April 2013)

Medical Microbiology	
<b>Program Length:</b>	Five years
<b># of Residents Currently Enrolled</b>	4
<b>Program Delivery:</b>	Mandatory and elective rotations, lectures/ rounds, on-line learning
<b>Evaluation Methods:</b>	Direct Observation, Practice Exams, Resident Portfolio
<b>Program Director:</b>	T. Mazzulli
<b>Accreditation:</b>	Royal College of Physicians & Surgeons of Canada, American Board of Pathology
<b>Accreditation Status:</b>	Accredited Program (April 2013)

Neuropathology	
<b>Program Length:</b>	Five years
<b># of Residents Currently Enrolled</b>	4
<b>Program Delivery:</b>	Mandatory and elective rotations, lectures/ rounds, online learning
<b>Evaluation Methods:</b>	Direct Observation, Practice Exams, Resident Portfolio
<b>Program Director:</b>	J. Keith
<b>Accreditation:</b>	Royal College of Physicians & Surgeons of Canada, American Board of Pathology
<b>Accreditation Status:</b>	Accredited Program (April 2013)

## Recent Developments in Residency Training at LMP

**Forensic Pathology Program:** In 2008, the Department admitted its first residents into the Forensic Pathology Residency Training Program, the first Royal College accredited residency training program of its kind in Canada. Forensic Pathology is a one-year post-specialty training program open to qualified candidates who have completed RCPC training in Anatomical or General Pathology. Dr. Michael Pollanen, Associate Professor, LMP and Chief Forensic Pathologist of Ontario is the Program Director. Training occurs in the Ontario Forensic Pathology Service in Toronto.

**Molecular Pathology Rotation:** In 2010 the Anatomical Pathology program re-developed the Molecular Pathology rotation, expanding its duration from 2 weeks to 3 months and making it mandatory for all residents to complete. This rotation is designed to expose residents to the wide variety of techniques used in cytogenetics and molecular pathology. The Rotation is coordinated by Dr. Aaron Pollett and includes time spent at Mount Sinai Hospital, Hospital for Sick Children and UHN – Toronto General Hospital.

**Pathology Informatics Course:** Dr. George Yousef has developed a Pathology Informatics course that is delivered on-line and will be undertaken by Anatomical Pathology residents as part of their Molecular Pathology rotation. Pathology informatics is an emerging subspecialty of pathology that is focused on the utilization of information technology to improve patient management and research in the field of pathology. Informatics is expected to have major impact on the advancement of the profession. The field of digital pathology/ pathology informatics is broad and encompasses a wide variety of activities and applications, including digital imaging, telepathology, electronic data mining, electronic storage, and reporting, and others. This course was recently approved by the Residency Program Committee of Anatomical Pathology and will be rolled out in the 2013-2014 academic year. It was also recognized as one of the priorities by the LMP Strategic Plan Working Group during the most recent strategic plan development. Due to the uniqueness of this topic, the Department has already received requests from universities in Alberta and British Columbia to make the subject material of this course web-based accessible. It is also planned that very soon this course will be web-based accessible to practicing pathologists for CME credits.

**Use of Digital Laboratory Medicine Resources:** All of the Residency Programs use some form of Digital Laboratory Medicine Resources to deliver program content, as a tool for teaching, or as part of the practical exams. For example:

- Anatomical Pathology uses Whole Slide Images during the bi-annual practice exam
- Neuropathology collects digital Neuropathology slides to present during their Unknown Slide Rounds
- Medical Microbiology uses virtual microscopy during their practice exams

**Neuropathology Lecture Series:** The Neuropathology Program has developed The National Neuropathology Lecture Series, an on-line learning tool for use by Canadian Neuropathology residents and members of the Canadian Association of Neuropathologists (CANP). Over the next two years, 12 individual one hour lectures will be created and recorded at various Canadian Neuropathology residency training sites following a curriculum that was collaboratively developed to address identified gaps in Canadian Neuropathology residency training. The lectures will then be uploaded to a customized password protected Portal website on the U of T PGME server.

The following lectures are currently available:

- Lecture 1: Genetics of Alzheimer Disease by Dr Ekaterina Rogaeva
- Lecture 2: ARX in normal and abnormal brain development by Dr Jeffrey Golden

**CanMEDs Enrichment Course:** To supplement education in non-Medical Expert CanMEDS roles in Anatomical Pathology, Dr. Simon Raphael developed a CanMEDs Enrichment Course. Residents view an online lecture based on one of the CanMEDs competencies as they are encountered in Anatomical Pathology. They are then asked to complete a series of questions about the lecture. Progress through the course is monitored by the Program Director and is reviewed with the Program Director annually.

**QA/ QI Rotation:** In 2009, a rotation in Laboratory Management QA/ QI was established. Coordinated by Dr. Mahmoud Khalifa, the elective is offered at Sunnybrook Health Sciences Centre where both the Chief and Director of Surgical Pathology have made this topic an academic focus of their careers. This elective offers the resident exposure to a variety of QA issues on a case-based approach. The resident also assists the Director of Surgical Pathology in the composition of the quarterly QA report.

**PGY2 School:** In 2009, the Chief Resident in Anatomical Pathology developed a new Academic Half-Day curriculum to be delivered exclusively to PGY2 residents beginning their Core Surgical Pathology rotations (this includes AP, GP and NP residents who have completed their PGY1 Clinical Rotations). These seminars are coordinated and taught by the senior residents and are designed to provide the PGY2 residents with a foundation in the knowledge, techniques and approach required for core training. The seminars are held in July and August, during the regular Academic Half-Day summer hiatus and have become an integral part of the program for junior residents. Each year, the PGY2 School seminars are organized and coordinated by the current Chief Resident.

**Community Hospital Rotations:** Credit Valley, Trillium Health Care Centre and Toronto East General Hospital have all added Community Pathology opportunities for residents, and there has been revitalization of engagement with St. Joseph's Health Centre and North York General Hospital.

## Objectives

Each residency program has overall objectives that emphasize the specific competencies required for their specialty. Below are the overall objectives for each Residency Training Program in LMP.

### *Anatomical Pathology*

**Medical Expert:** Render accurate and timely diagnoses and clearly communicated opinions for patients and other health care providers to prognosticate and guide treatment and further investigation.

**Communicator and Collaborator:** Communicate and collaborate effectively with a wide variety of other professionals both inside and outside the laboratory with an attitude of mutual respect to accomplish the above.

**Scholar:** Utilize new and developing technologies in diagnosis to accomplish the above.

**Manager:** Lead and/or collaborate in advancement of medical knowledge, as well as educate other professionals in appropriate use of anatomical pathology services in order to optimize care and resources.

### *Forensic Pathology*

The three cornerstones of modern forensic pathology and death investigation are: (i) the evidence-based approach to forensic medicine; (ii) the multi-disciplinary approach to death investigation; and (iii) the provision of reliable expert witness testimony in criminal justice system and other legal proceedings.

On this basis, there are three main goals for the forensic pathology residency at the University of Toronto:

1. To train residents in the evidence-based approach to forensic pathology to allow them to adequately perform medicolegal autopsies and to formulate and communicate balanced and reasonable expert opinions on cause of death and related medicolegal issues.
2. To train residents to recognize the primacy of the multi-disciplinary approach to the medicolegal investigation of death and to recognize the proper role and contribution of the forensic pathologist to the death investigation process.
3. To train the resident to function as a reliable expert witness when proffering expert testimony in the legal system, including criminal trials.

### *Hematological Pathology*

The Hematological Pathology training program will ensure that specialists in Hematological Pathology have the confidence to act as consultants to clinicians with respect to appropriate investigation, diagnosis and monitoring of disorders of blood cells, bone marrow, lymph nodes, spleen, and hemostasis. The resident will be expected to be competent in all aspects of organizing and running a transfusion medicine service as well as to be competent in laboratory management issues of blood and blood product procurement and issuing. The resident would have a broad experience in both clinical and laboratory practice. The resident will understand the needs of laboratory hematology in adult, pediatric, and community setting.

The resident will acquire an understanding of scientific, technical, and operational management principles applicable to Hematological Pathology. The resident will be familiar with the medical disorders affecting blood cells, hemostatic proteins, bone marrow, lymph nodes and spleens and the approach to their investigation, diagnosis, and monitoring as well as a general knowledge of the therapeutic interventions of these disorders.

The resident will demonstrate the knowledge, skills, and attitudes related to gender, sexual orientation, culture, ethnicity, and ethics pertinent to Hematological Pathology and incorporate these into research methodology, data presentation and analysis. The resident will acquire a working knowledge of the theoretical basis of the specialty including its foundations and the basic medical sciences and research.

On completion of training, the resident is expected to be a competent specialist in hematologic pathology capable of assuming the consultant's role in this specialty and display aptitude in all CanMEDS competencies.

### *Medical Microbiology*

By the completion of their training, the individual should be competent to practice Medical Microbiology in the following four key areas:

1. Scientific and administrative direction of a clinical microbiology laboratory.
2. Creation and direction of a hospital infection control program.
3. Provision of clinical consultations on the investigation, diagnosis, and treatment of patient suffering from infectious diseases.
4. Public health and communicable disease epidemiology and prevention.



### **Neuropathology**

The overall goals of the Neuropathology Training Program are to acquire the knowledge and skills to qualify and function as a specialist in Neuropathology as follows:

1. Acquire the technical skills pertinent to the practice of neuropathology.
2. Be proficient in neuroanatomy, neurohistology, myology and ultrastructure of the nervous system and muscle.
3. Have a working knowledge of those areas of neurophysiology, neurochemistry and molecular biology that are important in the interpretation of disease and selection of therapeutic procedures.
4. Formulate a neuropathologic diagnosis after gross and microscopic examination of biopsy and autopsy specimens.
5. Integrate clinical, radiologic, neurophysiologic, and laboratory data in the formulation of the pathophysiology of the disease process.
6. Communicate effectively the material in #4 and #5 above with clinical colleagues.
7. Effectively teach neuropathology to medical students, trainees in pathology and other disciplines, clinical colleagues, colleagues in other Laboratory Medicine specialties, and the lay public.
8. Effectively expand the knowledge base in neuropathology, the neurosciences, and pathology by studies of clinical material and/or basic research.
9. Gain competence in diagnostic Anatomical Pathology.
10. Know the principles of Bioethics as related to Laboratory Medicine.
11. Have knowledge of Laboratory Management.

### **General Pathology**

With an increased emphasis on specialization and sub-specialization in Pathology and Laboratory Medicine, and recognizing the strengths of the University Department, LMP is phasing out the General Pathology program. Since 2010, the General Pathology Residency Program has no longer been accepting any new residents. Closely integrated with other well-established postgraduate programs in the department, especially Anatomical Pathology, the General Pathology Program is committed to continuing to provide a high-quality program until the currently enrolled residents have completed their training. Having the LMP Chair serve as Program Director sends a strong message of our commitment to current trainees successfully completing requirements to sit the Royal College examination.

## **Admission Requirements**

### **PGY1 Entry Programs**

PGY1 admissions to the Residency programs in LMP are centralized through the Canadian Resident Matching Service (CaRMS). Applicants to any residency program through CaRMS must meet minimum basic eligibility requirements of having Citizenship or Permanent Residency status in Canada and have completed or are completing a medical degree from:

- A Liaison Committee on Medical Education/ Committee on Accreditation on Canadian Medical Schools (LCME/ CACMS) accredited school
- A school of osteopathic medicine
- An international medical school listed with the International Medical Education Directory (IMED), published by the Foundation for the Advancement of International Medical Education and Research (FAIMER)<sup>2</sup>

Through the CaRMS system, candidates apply to “Laboratory Medicine” at the University of Toronto. In their application, candidates indicate which residency program they are applying to and may apply to more than one residency program within LMP. Each program reviews applications and interviews candidates independently. Once

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<sup>2</sup> CaRMS Main Residency Match (R-1 match) Eligibility - Basic Criteria [www.carms.ca/eng/r1\\_eligibility\\_e.shtml](http://www.carms.ca/eng/r1_eligibility_e.shtml)



all interviews are concluded, the Program Directors from each program meet to create a final ranking list which is submitted to CaRMS.

Each year, there are 20-30 applicants from graduates of Canadian medical schools and 125 – 150 applicants from international medical schools. A large majority of the applications are for the Anatomical Pathology program, with approximately 20-25 Canadian applicants and 130 international applicants each year. The smaller programs typically have 1 – 2 Canadian applicants and 5 – 10 international applicants. The LMP residency programs accept 5 Canadian Medical Graduates (CMG) and 3 International Medical Graduates (IMG) each year. Since 2007, all positions available in the Department have been filled in the first CaRMS match iteration.

### *Forensic Pathology*

Since the Forensic Pathology program is a post-primary specialty program, it does not participate in the CaRMS match process. Instead, admission to the program is handled more like a Clinical Fellowship. Applicants must have completed Royal College Specialty training in Anatomical or General Pathology. Interested applicants are asked to submit an application form, letter of interest, CV, letters of reference and records of past performance. Application packages are reviewed by the Program Director, in direct consultation with the Forensic Pathology Residency Program Committee. All applicants undertake an elective rotation with the Forensic Pathology Service and are assessed during their rotation using the evaluation criteria for residency electives (Forensic Pathology In-Training Evaluation Report).

### *Sponsored Trainees*

In the past, some programs have considered and accepted applications from non-Canadian applicants whose training costs are sponsored by their home country. Admission and selection requirements for these trainees are the same as for CaRMS applicants except for the Citizenship status requirement. This is a rare occurrence and Programs usually only consider applications when there have not been acceptable CaRMS applicants and when program capacity can handle the additional trainees. Currently there are 2 sponsored residents training in Neuropathology, 1 sponsored resident in Anatomical Pathology and 1 sponsored resident in Hematological Pathology.

### *Admission Statistics 2007 – 2012<sup>3</sup>*

PGY1 Entry	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
AP	11	9	12	7	5	6
GP	0	1	2	0	0	0
HP	1	0	0	0	1	1
MM	0	2	0	1	1	0
NP	0	0	2	1	1	1
Other Entry Pathways <sup>4</sup>	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
AP	3	2	0	1	0	0
FP	0	2	2	1	1	2
GP	0	0	1	0	0	0
HP	1	0	1	0	1	0
MM	4	1	0	2	0	0
NP	0	0	0	0	0	0
<b>Total</b>	<b>20</b>	<b>17</b>	<b>20</b>	<b>13</b>	<b>10</b>	<b>10</b>

Recognizing that the number of jobs available for Laboratory Medicine Specialists in the GTA and throughout Ontario has been decreasing, the LMP Residency Programs reduced their CaRMS quotas from 14 to 8 (5 CMG and 3 IMG), in the 2010 match.

<sup>3</sup> Data from PGME Registration records in POWER 2007 - 2012

<sup>4</sup> Pathways open to qualified trainees to enter specialty training at a later stage in their Residency training.

## Delivery

### *Residency Training Committee*

Each Residency Program is administered by a Program Director who is assisted by a Residency Program Committee (RPC). Each program committee consists of:

- Representatives from each teaching site participating in the instruction of residents
- Resident representatives
- Chair of LMP as ex-officio
- The Anatomical Pathology RPC also has members that fulfill a particular role in the program: Remediation Coordinator, Academic Half-Day Coordinator and an Objectives Reviewer.

Each RPC is chaired by the respective Program Director and meet at least quarterly.

Meetings amongst all Program Directors are held at least once per year, during the time of candidate ranking for the upcoming CaRMS match.

### *Program Content*

The content of the program is delivered through a wide variety of techniques in diverse settings. Residents have daily interaction with supervisors at the training sites, weekly lectures and a number of other educational activities integrated into their training to emphasize learning across all CanMEDs competencies. Detailed descriptions of the mechanisms employed by each residency program to teach core knowledge and skills for each of the CanMEDS competencies are attached in Appendix 4.11

**Rotations:** The rotation requirements for residency programs are defined in the Royal College Specialty Training Requirements for each specialty. All residency programs in LMP meet or exceed these requirements. For all PGY1 entry programs, the first one to two years is spent in rotating medicine and surgical subspecialties, before the resident begins their core specialty rotations. After the core rotations, residents undertake a series of mandatory senior rotations or selectives. The last years of the programs are spent in senior elective rotations, including research. For detailed Rotation Requirements for each Residency Program, see Appendix 4.12

**Academic Half-Day:** Each program provides its own specialty specific didactic component as part of the delivery of content in their programs. Residents in all programs have long acknowledged the Academic Half Day as a core part of their training. They have ample time to travel to and attend these sessions, and are relieved from all service duties without exception. For detailed schedules of the Academic Half-Day for each program for the past two years, see Appendix 4.13

**Scholarly Activities:** Research and other scholarly activity are expected for all residents completing their residency. Research is strongly supported within the residency programs through a number of mechanisms.

The Anatomical Pathology Program offers a longitudinal Research Elective wherein residents who qualify will be allowed to have ½ day off per week over 6 months or more to finish a presented abstract for publication. In the other programs, research can be undertaken as part of a resident's senior elective time.

Most residents obtain funding for their research through faculty grants. This includes those in the Clinician Investigator Program. Individual hospitals fund the fees of resident research including the performance of research, the preparation of posters or papers for publication and travel to meetings.

Protected paid conference leave is an integral part of the PAIRO-CAHO contract between residents in Ontario and the Hospitals. Up to seven working days per annum is given to residents as paid professional education days. Residents are encouraged to attend workshops, predominantly those held locally, or special courses if thought to be valuable. Residents who present papers or participate in a conference are provided with funds, by LMP, to help defray the costs of travel and accommodations. Other funding is available from hospital-based sources. Residents regularly participate in annual meetings of the professional associations in their specialty.

The Postgraduate Research Day is an opportunity for residents to share their research with the rest of the Department and compete for prizes. Presentation of research at this event is mandatory for all Anatomical Pathology residents in PGY 2-4.

**Clinician-Scientist Program:** The Clinician-Scientist Program supports residents wishing to undertake a graduate degree under the auspices of the Clinician Investigator Program in the Faculty of Medicine. LMP provides supplemental funding above the graduate stipend in order to ensure that trainees receive a salary appropriate to their level of training. Trainees are expected to apply for postgraduate research fellowship awards from external, peer-reviewed grant funding agencies.

**Other Educational Activities:** Beyond rotations and lectures, the LMP residency programs employ a diverse range of educational activities to ensure a well-rounded educational program for their residents. On-line courses, hospital rounds and resident retreats are examples some of the activities residents participate in. For detailed descriptions of these activities, see Appendix 4.14.

**PGCorEd:** In the PGY1 entry Programs, a supplemental academic program is taught through the web based PGCorEd™ modules for PGY1 & 2 residents. PGCorEd™ is an educational initiative of the Postgraduate Medical Education (PGME) Office at the University of Toronto. PGCorEd™ is comprised of a series of self-directed, web-based learning modules for residency training programs via the University of Toronto's Learning Portal. PGCorEd™ modules are mandatory academic activities for 1st and 2nd year Postgraduate Medicine Residents (PGY1/PGY2). 8 modules are currently required:

- Communication Basics©
- Communication Essentials©
- End of Life Care©
- Patient Safety©
- Resident as Collaborator©
- Resident as Learner and Teacher©
- Resident as Manager©
- Resident as Professional ©

PGCorEd™ modules focus on generic foundational competencies linked to the CanMEDS roles, in particular, the CanMEDS intrinsic roles.

## Evaluation of Resident Performance

Residents are assessed at multiple opportunities throughout their training. The LMP Residency Programs have each developed and implemented different mechanisms by which resident performance is assessed to adequately capture the specialty specific skills and knowledge required by practicing physicians in their fields. All programs employ the following assessment tools:

- Verbal informal immediate feedback of performance
- Mid-rotation evaluation of long rotations
- Direct Observation, captured by In-Training Evaluation Reports (ITERS)
- Face to face meetings to discuss ITERS
- Practice exams (oral, written, practical, or some combination of these three)
- Periodic review of performance with Program Director

See Appendix 4.15 for detailed descriptions of the evaluation methods employed by each program.

## Awards

**LMP Travel Award:** LMP encourages students and trainees to present their research at national and international scientific meetings. The department provides a travel supplement to defray some of the travel expenses.

**LMP Postgraduate Research Day Awards:** All LMP Postgraduate trainees can compete for PG Research Day Awards for Best Poster Presentation (Clinical Stream), Best Poster Presentation (Research Stream) and Best Podium Presentation.

**Stanley Raphael Award:** In 2013, the Anatomical Pathology Program will present the first annual Stanley Raphael Award which recognizes a PGY4 or PGY5 Anatomical Pathology resident who has developed the best attributes of

the professional in Anatomical Pathology as defined by the following (excerpted from the Royal College Guidelines):

- Exhibit appropriate professional behaviors in practice, including honesty, integrity, commitment, compassion, respect and altruism
- Demonstrate a commitment to delivering the highest quality care and maintenance of competence
- Balance personal and professional priorities to ensure personal health and a sustainable practice
- Strive to heighten personal and professional awareness and insight
- Recognize other professionals in need and respond appropriately

The Prize is \$1000.00 and is awarded at the LMP Annual Banquet and Reunion.

**Norman Bethune Award:** The aim of this award is to recognize and encourage young, talented researchers on the threshold of their careers. All microbiology residents and diploma trainees are eligible to apply. The prize, worth approximately \$3000.00, is awarded annually at the LMP Annual Banquet and Reunion.

## Funding

Most trainees in the LMP Residency Programs are funded by the Ontario Ministry of Health and Long-Term Care. The exceptions are sponsored trainees who are generally funded by their home governments.

## Quality Enhancement

### *Ongoing Review of the Programs*

Residents have the ability to evaluate all rotations they complete using the POWER On-line evaluation system. These evaluations are regularly monitored by the Program Administrator and Program Directors and are typically reviewed on an annual basis. The resident representatives in each program are members of their respective RPCs and will bring any resident concerns about their program to the committees. All Program Directors meet with their residents at least annually; this is another opportunity for residents to provide feedback to the program.

In **Anatomical Pathology**, reviews are done at each RPC meeting by the site directors at each affiliated hospital on a rotational basis. The site director presents a summary of resident evaluations over the past year and a summary of the written comments as provided by the on-line evaluation system, POWER. These reports address the issues of individual rotations and resources.

### *Teacher Evaluation and Feedback*

Residents have the ability to evaluate all teachers using the POWER On-line evaluation system. Residents have choice over how many and which teachers they will evaluate on a given rotation. The evaluations are stored on the central POWER site.

Teachers have access to summary aggregate reports for prior years once a minimum of three evaluations have been completed. These reports are part of the annual review process with the service chiefs.

An 'alert' system is built into POWER so that the Program Directors are alerted whenever a teacher or rotation receives a score below 3 (on a scale of 5). These are investigated in real time to ensure no threat to resident well-being and educational integrity are present and appropriate action is taken.

If a teacher gets more than one failing grade, these are discussed by the Program Director with the Chair to determine any further action which might need to be taken.

The PGME office provides a 'report card' each year to the program detailing the completion rates for teacher evaluation forms and comparators including year-over-year change and PGME benchmarks. Finally, an annual report is produced by the PGME office that outlines average teaching and rotations scores for each rotation across all hospitals, again comparing sites and year over year change.

In Anatomical Pathology, Resident feedback is collected during each Academic Half-Day session. This feedback is aggregated and scores and comments are given back to the individual instructors, as well as the Academic Half-Day Coordinator.

## Quality Indicators

### *Resident Research Productivity*

Emphasis on research in the residency programs is evident in the number of peer-reviewed publications the residents produce (see Table below). Most residents will work on at least one research project during their training, many will complete one or more per year. Resident research is often presented at professional meetings and conferences and are often the recipients of awards presented at these meetings (e.g. Stowell-Orbison Award at USCAP).

Resident Publications 2006 – 2012 by Program					
Anatomical Pathology	Forensic Pathology	General Pathology	Hematological Pathology	Medical Microbiology	Neuropathology
161	4 (since 2008)	5	16	61	8

### *CaRMS Match Rates*

The Residency Programs at LMP attract quality applicants from Canada and internationally. Resident matching is coordinated across all medical schools in Canada through CaRMS; and the match between a candidate and a program depends upon both the rank a program gives a candidate, and the rank a candidate gives the program. Since 2007, the LMP Residency Programs have matched the first or second of their top ranked candidates in all years but one. The Programs have also fulfilled their match quotas every year. The candidates ranked highly by the LMP Residency Programs are in turn ranking the LMP Programs highly.

### *Program Completion Rates*

Typically, residents accepted into a residency program will go on to complete their training and attrition is a rare occurrence (see Table below). Of the 90 residents accepted into LMP Residency training since 2007, 6 have transferred to other specialty programs in the University of Toronto, Faculty of Medicine. No residents have transferred from the LMP residency programs since 2011.

LMP Graduates by Program						
Session End	Anatomical Pathology	Forensic Pathology	General Pathology	Hematological Pathology	Medical Microbiology	Grand Total
2007-2008	6	N/A	0	0	5	11
2008-2009	9	2	0	0	2	13
2009-2010	5	2	1	2	1	11
2010-2011	4	1	1	1	0	7
2011-2012	10	1	0	0	2	13
<b>Grand Total</b>	<b>34</b>	<b>6</b>	<b>2</b>	<b>3</b>	<b>10</b>	<b>55</b>

### *Employment Rates of Graduates*

All residents who have completed their training since 2007 are actively practicing physicians (see Table below). Most are working in their specialty at a teaching hospital or community hospital; a majority of graduates currently working in teaching hospitals or in the Government Agencies are located in the GTA and are faculty members of LMP and the Residency Programs. Immediately after graduation most residents will continue their training in a Subspecialty Clinical Fellowship, usually at the University of Toronto. Some will go to the United States or abroad for further training. Those who do go abroad for subspecialty training will often return to LMP as Faculty Members once their training is complete.

<b>LMP Graduates by Employment Type</b>						
<b>Session End</b>	<b>Teaching Hospital</b>	<b>Community Hospital</b>	<b>Government</b>	<b>Independent Practice</b>	<b>Subspecialty Training</b>	<b>Grand Total</b>
<b>2007-2008</b>	6	1	2	2	0	11
<b>2008-2009</b>	5	4	4	0	0	13
<b>2009-2010</b>	4	5	2	0	0	11
<b>2010-2011</b>	4	3	0	0	0	7
<b>2011-2012</b>	2	4	1	0	6	13
<b>Grand Total</b>	<b>21</b>	<b>17</b>	<b>9</b>	<b>2</b>	<b>6</b>	<b>55</b>

## LMP Clinical Fellowship Program

### Overview

The program is organized and funded by the affiliated teaching hospitals including the University Health Network, Mount Sinai Hospital, Sunnybrook Health Sciences Centre, St. Michael's Hospital, and The Hospital for Sick Children.

Fellowship training takes place in clinical and/or research environment(s) within teaching hospital settings. In addition to subspecialty training, trainees will participate in applied laboratory research projects and/or basic research. Fellowships are available for one or two years.

### Fellowship Training Sites

The Hospital for Sick Children	Ontario Forensic Pathology Service	Sunnybrook Health Science Centre
Mount Sinai Hospital	St. Michael's Hospital	The University Health Network

### Subspecialties Available\*:

Bone and Joint Pathology	Genitourinary Pathology	Pediatric Pathology
Breast Pathology	Gynecological Pathology	Soft Tissue Pathology
Cardiovascular Pathology	Hematological Pathology	Surgical Pathology
Cytopathology	Medical Microbiology	Transfusion Medicine
Endocrine Pathology	Molecular Diagnostics/Cytogenetics	Urological Pathology
Forensic Pathology	Neuropathology	
Gastrointestinal/Hepatopathology	Oncologic Pathology	

\* Not all subspecialties are available every year

## Recent Developments in the Clinical Fellowship Program

### Clinical Fellowship Program Committee

In the Fall 2010, following the recommendations of the PGME study: *Raising the Bar: Recommended Standards for the Management of Clinical Fellowships*, LMP appointed Dr. Golnar Rasty as the LMP Clinical Fellowship Director, and struck the Clinical Fellowships Program Committee (CFPC) to be chaired by Dr. Rasty. As Director, Dr. Rasty also represents the department at the PGME on the Fellowship Advisory Committee of the Faculty of Medicine. The CFPC consists of members from each of the affiliated teaching hospitals as well as representation from currently enrolled trainee(s) and the LMP Chair as ex-officio. The CFPC immediately set out to implement and/or formalize the recommendations to departments from *Raising the Bar*:

- Establish a standard approach to program entry
- Develop templates for educational goals and objectives
- Establish standards for evaluation, appeals and issuing certificates
- Ensure offer letters comply with guiding principles

### Royal College Accreditation of Fellowships

Until 2011 Clinical Fellowships in Canada have not been accredited by the Royal College of Physicians and Surgeons of Canada (RCPS). Recently, the RCPS have created a framework for accreditation of Fellowships called "Areas of Focused Competence" (AFC). The Transfusion Medicine Program at the University of Toronto has recently been approved as an AFC. A proposal for a Cytopathology AFC at the University of Toronto is under development.

## Objectives

Each Fellowship has unique goals and objectives, but all fellowships adhere to the same standards for admission and evaluation. A template for educational objectives for clinical fellows has been developed in order to ensure a more consistent approach to education for clinical fellows. The specific Goals and Objectives for every new trainee are reviewed and approved by the Program Director.

All Clinical Fellowships must meet the following overall objectives:

1. **Medical Expert:** As Medical Experts, physicians integrate all of the CanMEDS Roles, applying medical knowledge, clinical skills, and professional attitudes in their provision of patient-centered care. Medical Expert is the central physician Role in the CanMEDS framework
  - 1.1. Is able to function in an autonomous manner with little or no supervision from faculty in the intraoperative setting.
  - 1.2. Is able to accurately diagnose microscopically the full range of pathologic specimens at the level of a junior staff member. Accuracy will be at the level expected for a practicing Laboratory Medicine specialist in this subspecialty.
  - 1.3. Is able to handle the full volume of material expected of a practicing Laboratory Medicine specialist in this subspecialty.
2. **Communicator:** As Communicators, physicians effectively facilitate the doctor-patient relationship and the dynamic exchanges that occur before, during, and after the medical encounter
  - 2.1. Is able to compose succinct, accurate reports. Will not require any significant revision to reports.
  - 2.2. Is able to relay patient reports in a reliable manner verbally in the operative and non-operative setting.
  - 2.3. Is able to communicate in an appropriate and professional manner expected of a practicing pathologist with lab staff, peers, supervisors and clinical staff.
3. **Collaborator:** As Collaborators, physicians effectively work within a healthcare team to achieve optimal patient care
  - 3.1. Interacts appropriately with supervisors, peers and laboratory staff and resolves conflict in a professional and effective manner.
4. **Manager:** As Managers, physicians are integral participants in healthcare organizations, organizing sustainable practices, making decisions about allocating resources, and contributing to the effectiveness of the healthcare system.
  - 4.1. Manages own time effectively and efficiently.
  - 4.2. Understands principles of Lab Management including principles of quality assurance and quality management.
5. **Health Advocate:** As Health Advocates, physicians responsibly use their expertise and influence to advance the health and well-being of individual patients, communities, and populations.
  - 5.1. Recognizes the effect his or her work will have on individual patients.
  - 5.2. Orders tests and investigations in a manner that is not wasteful of the resources of the health care system.
6. **Scholar:** As Scholars, physicians demonstrate a lifelong commitment to reflective learning, as well as the creation, dissemination, application and translation of medical knowledge.
  - 6.1. Researches in appropriate depth around his or her cases, using recent materials.
  - 6.2. Is able to critically and professionally evaluate written and verbal opinions on controversial pathologic issues.
  - 6.3. Teaches residents well.
7. **Professional:** As Professionals, physicians are committed to the health and well-being of individuals and society through ethical practice, profession-led regulation, and high personal standards of behaviour.
  - 7.1. Takes responsibility for cases as if they were his or her own.
  - 7.2. Demonstrates the energy and persistence necessary in order to consistently be accurate.
  - 7.3. Acts in a professional manner with all lab and hospital staff including supervisors and peers.
  - 7.4. Contributes to the formulation of a respectful and harmonious work environment.



## Admission

Clinical Fellows must meet the minimum eligibility requirements for licensure with the College of Physicians and Surgeons of Ontario (CPSO) to take up training at the University of Toronto. The Postgraduate Dean, Faculty of Medicine, at the University of Toronto does not support acceptance of the Medical Council of Canada Evaluating Examination as an alternative to specialist recognition. Applicants must have completed residency training in a Laboratory Medicine specialty or sub-specialty, or a complimentary specialty, prior to commencing fellowship training in LMP.

Applicants whose first language and/or language of medical school and patient care was neither English nor French, are required to take the TOEFL Internet Based Test (iBT). Minimal acceptable scores are an overall score of 93 with a minimum score of 24 on the Speaking section. Test results must be submitted at the time of application to the training program and must have been taken within the last two years.

All applications for LMP Clinical Fellowships are sent to the LMP Postgraduate Office, compiled and posted to a secure website where the Fellowship Coordinators from each hospital can review them. Application review and interviews are handled independently by each hospital.

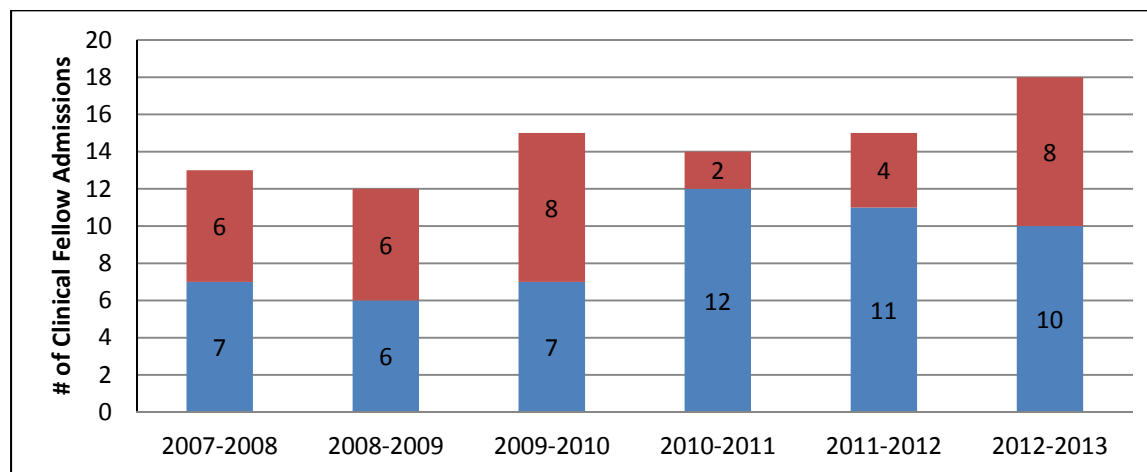
The Clinical Fellowships program receives approximately 30-40 applications per year for about 10 hospital funded positions.

### *Externally Funded Fellows*

Applicants who are sponsored by their home institutions or governments, or are self-funded are also considered for Clinical Fellowship positions at the hospitals. These trainees must meet the same eligibility requirements as other fellows and must have a minimum funding amount equivalent to a PGY1 residency trainee.

### *Admissions to the LMP Clinical Fellowship Program<sup>5</sup>*

The bar graph below presents LMP Clinical Fellowship admissions by year and funding source. Blue represents Hospital funded fellows; red represents externally funded fellows.



<sup>5</sup> Based on registration records of Clinical Fellows at LMP maintained in the POWER On-line registration system.

## Evaluation

Clinical Fellows are formally evaluated four times per year by their supervisors through the on-line evaluation system, POWER. The evaluation forms are standard and based directly on the overall goals and objectives for Clinical Fellowships. Space is provided for supervisors to assess the trainee against goals specific to that Fellowship. The Fellows must pass their evaluations in order to receive a Certificate of Completion from LMP and the PGME.

## Quality Enhancement

The founding of the Clinical Fellowship Program Committee has provided a framework in which to receive more formalized feedback on the program, and where the hospital fellowship directors can share best practices. Fellows are asked to fill out teaching and hospital evaluations periodically throughout their training. To maintain the anonymity of the Fellows, these evaluations are released to the individual supervisors two years after the Fellow has completed their training. The Program Director can see the feedback in real time and will bring general comments about the program to the committee for discussion or action, where appropriate.

The Fellowship Director conducts an exit interview with all Clinical Fellows prior to their departure. Feedback from these interviews is brought to the Committee.

## Postdoctoral Training Program in Clinical Chemistry

### Overview

The Postdoctoral Training Program in Clinical Chemistry (Diploma Program), established in 1968, is a program for PhD graduates in biochemistry and related sciences to train as clinical chemists. The two-year program includes training in hematology and microbiology, to allow graduates to function in core laboratory settings. Candidates rotate through the clinical laboratories of several teaching hospitals affiliated with the University of Toronto. The program meets the training requirements necessary to sit the written and oral examinations for certification set by the Canadian Academy for Clinical Biochemistry (CACB) and the American Board of Clinical Chemistry (ABCC).

Candidates will spend approximately half of their time in a hospital laboratory and they will meet with their hospital supervisor weekly to discuss their progress.

Postdoctoral Training Program in Clinical Chemistry	
<b>Program Length:</b>	Two Years
<b># of Trainees Currently Enrolled</b>	5
<b>Program Delivery:</b>	Hospital Rotations, formal courses, tutorials and journal clubs
<b>Evaluation Methods:</b>	Direct Observation, practice oral exams, written exams and other coursework
<b>Program Director:</b>	K. Adeli
<b>Accreditation:</b>	Canadian Academy of Clinical Biochemistry, Commission on Accreditation in Clinical Chemistry
<b>Accreditation Status:</b>	CACB (2012-2017), ComACC (2010-2015)

### Objectives

#### By the end of the first year, the candidate must have:

- Completed the clinical chemistry laboratory rotation based on the Laboratory Training Manual
- Demonstrated a comprehensive, practical and theoretical knowledge of all the important routine procedures carried out in a modern clinical chemistry laboratory
- Demonstrated an understanding of the operation, trouble-shooting and ordinary maintenance of all laboratory equipment, including automated instruments
- Undertaken analytical, clinical or quality assessment projects

#### By the end of the second year, the candidate must have:

- Completed rotations through required hospital laboratories (paediatric chemistry laboratory, second general chemistry laboratory)
- Undertaken teaching assignments in clinical biochemistry as requested by their supervisors
- Undertaken more extensive analytical, clinical or quality assessment projects, with the aim of presentation or publication
- Undertaken specialization or research
- Completed rotations through required hospital laboratories (haematology, immunology, microbiology, pathology, molecular biology)

#### In all years, the candidates must have:

- Completed required courses at a satisfactory academic level
- Attended journal club and case presentation sessions
- Attended seminars, conferences, rounds and lectures
- Completed other required aspects of the Program

## Admission

The Clinical Chemistry Program normally accepts 2 PhDs in one year and 3 in the next. Up to 5 trainees are in the training program at any one time (including first and second year trainees).

### Eligibility Requirements

- PhD in Biochemistry or a related science (eg, Biology, Chemistry, Immunology, Nutrition, Pharmacology, Physiology)
- PhD defense must be completed before the session start date of July 1
- Canadian citizen or status as landed immigrant
- Good communication skills - written and verbal
- A minimum of B+ in relevant courses and overall average during graduate studies
- Please Note: Individuals may apply up to a maximum of three times to this program

### Items which are considered

- Strong background in chemistry or biochemistry with adequate background in the other disciplines
- Third-year level course in physiology or equivalent
- Research record, relevance to clinical chemistry
- Relevant experience in clinical chemistry, hematology, microbiology, molecular biology
- Commitment of candidate to the field of clinical chemistry

## Delivery

**Administration:** The program is coordinated in the long term by a Coordinating Committee, which meets approximately quarterly (four times a year). Representation on this committee is obtained from hospital training sites, and the Academic Division Head (Dr Eleftherios Diamandis) sits on the committee as ex-officio. Dr Khosrow Adeli is currently the Committee Chair, assisted by the Postgraduate Coordinator in the LMP department, as well as 4 other committee members. In the short term, the Committee Chair acts as Program Coordinator, and assigns training sites to trainees each year, attempting to pair them with other students, including medical residents.

**Hospital Rotations:** The Program Director, with the Diploma Program Coordinating Committee, plans the rotations of the residents. Factors taken into account include number of candidates, space in each centre, the location of medical biochemistry residents, and grouping of candidates. Training in clinical chemistry consists of major (5-7 month) rotations in three main training hospitals (MSH, UHN, HSC) and shorter rotations in two other teaching hospitals (SHSC, SMH).

### Expectations of hospital training sites include:

- Emphasis on practical bench experience with exposure to instrumentation, methodology and safety. Trainees should be able to operate and troubleshoot standard equipment and perform all emergency tests and a number of specialized tests at the hospital
- Exposure to clinical material (rounds, interesting cases, etc.)
- Opportunities for trainees to make oral presentations (e.g., seminar, question-and-answer session)
- Attendance at management sessions, involvement in problem solving
- Completion of "Evaluation of Diploma Trainee by Hospital Supervisor" form by the last week of the rotation
- The CACB Syllabus is the guide to the depth of knowledge required

**Laboratory Management:** The Trainees are required to participate in the online American Association for Clinical Chemistry (AACC) management course and obtain a certificate. The cost of this online course is covered by the LMP department through the textbook fund/professional development funds provided to the trainees each year. Hospital sites also encourage students to attend management meetings, hold discussions with Chief Technologists, participate in the budget process, etc. Safety training is provided during hospital orientation before the start of rotations

**Course Work:**

- **LMP 1505 - Analytical Clinical Biochemistry:** Topics covered include spectroscopy, enzymology, separation methods, immunochemistry, electrochemistry, instrumental methods of analysis and a variety of other analytical techniques that are commonly used in clinical laboratories.
- **MNU 111S - Metabolism & Nutrition:** This course covers the fundamental principles of the basic medical life sciences: Biochemistry, Clinical Biochemistry, Histology, Molecular Biology, Nutrition, Pharmacology and Physiology, and applies these to the study, diagnosis and treatment of endocrine, reproductive, renal, metabolic, hepatobiliary, gastrointestinal and cardiovascular disease.
- **LMP 1407 - Introductory Biostatistics and Clinical Investigation:** The course is intended to provide a "user's guide" to biostatistics and the SPSS statistical software package. This course does not require previous experience in biostatistics, but rather is meant to introduce a broad audience of graduate students to statistical concepts. The aim is to develop an ability to understand the statistical implications of various experimental designs and hypotheses, and to analyze and present research results clearly and objectively.

**Journal Clubs and Tutorials:** Alternating Tutorials and Journal Clubs covering topics relevant to Clinical Chemistry are held every week from September to June. Tutorials are delivered by teaching faculty in the program. Journal Clubs are led, on a rotating basis, by the trainees, with a member from the teaching faculty acting as a mentor.

**Research:** In the summer of their first year, and throughout their second year, trainees are encouraged to participate in research projects under the supervision of their hospital training program director. Graduates of the UofT program typically complete several projects and publish/present several manuscripts/abstracts during their two-year program. The Toronto program is very academically oriented and encourages research as a critical component of the clinical chemistry discipline.

**Evaluation of Trainees:** During the formal coursework, trainees are evaluated by examination, problem sets, term papers, oral examination. For apprenticeship work, trainees are evaluated as "incomplete" for a weekly topic if knowledge is poor or assignments incomplete. At the end of each hospital rotation, trainees are evaluated by their rotation supervisors through a formal assessment form. The program holds individual training committee meetings with candidates each year to review each candidate's progress. This is a mock oral exam to assess their readiness to sit the CACB certification exams.

## Awards

All trainees are provided \$600 when presenting an abstract at a clinical chemistry conference. They are also eligible for an internal travel award (Allan Pollard award), which is valued at \$2000 (awarded to one fellow each year). They are also eligible and frequently obtain travel awards from the Canadian Society of Clinical Chemists (CSCC), Ontario Society of Clinical Chemists (OSCC), and AACC.

## Funding

The Ontario Ministry of Health and Long-term Care issues 7 fellowships over two years, for the Province of Ontario (all training programs), to be shared between UofT (2-3 fellowships per year) and McMaster University (1 fellowship per year). The trainees are then paid through the department payroll. A Sanford Jackson fellowship is available for a third year of training for interested/ qualified graduates.

## Quality Enhancement

The Program Director meets with trainees once a month, asking for critique. Candidates have 2-3 formal meetings with the training committee to review their progress over the course of their training and are asked to give feedback about the program. Courses and lecturers are evaluated by students at the end of each course (sometimes mid-way through). Apprenticeship training evaluation forms are used at the end of each hospital rotation, to evaluate supervisors and programs. Starting in July 2013, the Clinical Chemistry Trainees will be registered with the Postgraduate Medical Education Office (PGME) of the Faculty of Medicine, thus allowing the program to take advantage of the POWER On-line evaluation system to collect trainee feedback regarding individual teachers and hospital rotations.

## Postdoctoral Training Program in Clinical Microbiology

### Overview

The Postdoctoral Training Program in Clinical Microbiology is a program for PhD graduates in microbiology to train as clinical microbiologists, functioning in a diagnostic microbiology laboratory setting. The three-year program includes training in the microbiology laboratories of the teaching hospitals and the Ontario Public Health Labs, as well as didactic lectures and seminars. The program meets the training requirements necessary to sit the certification examinations administered by the Canadian College of Microbiologists (CCM) as well as the American Board examinations.

Postdoctoral Training Program in Clinical Microbiology	
<b>Program Length:</b>	Three Years
<b># of Trainees Currently Enrolled</b>	3
<b>Program Delivery:</b>	Hospital Rotations, lectures
<b>Evaluation Methods:</b>	Direct Observation, practice oral exams, written exams and practical exams
<b>Program Director:</b>	T. Mazzulli
<b>Accreditation:</b>	Trainees completing this program are eligible to sit the examinations for certification by the Canadian College of Microbiologists and/or the American Board.
<b>Accreditation Status:</b>	Accredited by the Canadian College for Microbiology (CCM)

### Objectives

During each rotation and throughout the program, trainees are expected to meet the following objectives.

#### Microbiological Knowledge

- General Knowledge of Microbiology: Trainee has sufficient knowledge of applied clinical microbiology to be a resource person in this area and to initiate new developments. Judgments and opinions are sound. Troubleshooting is logical.
- Technical Bench Skills: The trainee can function without help performing routine procedures.
- Knowledge of Basic Science: The trainee has a reasonable knowledge of microbial physiology, pathogenic mechanisms, and host responses sufficient to explain the pathogenesis of common infectious diseases, and is capable of filling gaps in knowledge where necessary. Trainee knows enough in this area to be able to assimilate advances in knowledge.
- Knowledge of Virology: The trainee has a sound overall knowledge of the principles of virus/cell interaction and is able to apply these to the diagnosis and management of patients with virus diseases.
- Parasitology: Trainee has an adequate knowledge of microscopic morphology, life cycles and clinical manifestations of parasites, and usually makes a correct microscopic diagnosis.
- Mycology: Trainee is competent to obtain specimens and culture fungi, is able to prepare specimens for examination and is familiar with the appearance of most clinically important fungi. The trainee knows about and is competent to use current antifungal medications.
- Infection Control: Trainee is able to make sensible decisions about infection control matters which are based on a thorough understanding of the principles of epidemiology and organism transmission. The trainee can write articulate and rational infection control policies. Faced with an outbreak the trainee can present a workable and defensible plan of action.

#### Clinical

- Historical Data (consults): History usually complete and accurate; most important information provided.
- Diagnostic Ability: Most likely diagnosis usually correct; differential diagnosis includes common problems.
- Investigative Planning: Investigation plan appropriate, reflects current standards of practice; most tests logically ordered and interpreted correctly.

- Therapy and Prevention: Readily applies principles of treatment and ongoing assessment; appropriately attends to preventative measures.
- Judgement and Decision Making: Uses good judgment resulting from evaluation of factors; makes good clinical decisions based on clinical information and general knowledge.

**Administrative**

- Quality Systems: Trainee understands, and would be capable of developing adequate QA/CQI program.
- Management Ability: The trainee understands the legislative and financial aspects of management and will be a good administrator. The trainee will usually be prepared to make difficult decisions.
- Safety: Understands need for and respects safety precautions and is prepared to live by the same safety rules as other laboratory staff. Has a working knowledge of WHMIS.

**Academic**

- Case Presentation and teaching: The trainee can make a well organized, relevant and appropriately directed presentation at rounds or in-service to a group of health care professionals, with well prepared and organized use of audio visual aids.
- Research and Investigative: Trainee can, with some advice, initiate and develop a project to the point of presentation at a national level, and can conduct appropriate investigations to evaluate new methods.
- Current Awareness: The trainee reads regularly and critically and is up to date in most important diagnostic and therapeutic matters.

**Personal Qualities**

- Ethical Standards: The trainee is ethical and honest in dealings with patients, other health care professionals and commercial organizations.
- Interpersonal Skills: The trainee is approachable, interacts well with colleagues, is not intimidating or offensive and will give help when asked. The trainee is able to explain and defend positions well to all categories of staff firmly, but without being offensive, arrogant or patronizing. Functions well as a team member.
- Relationship with Technical Staff: The trainee relates well to technical staff who are willing to help with training in return for which the resident will help out with the work and do some teaching. The trainee will sometimes, at the beginning of independent practice, need further direction and help with some management issues.
- Self-assessment Ability and Insight: Most of the time the trainee is aware of when help is needed and when it is not. Can handle criticism in an appropriate and professional manner.
- Punctuality, reliability and personal organization: Arrives on time for meetings, does not forget. Completes assigned tasks by deadline.

## Admission

The Program accepts one new trainee per year. At any given time, there are a maximum of three trainees in the program. Applicants must have a PhD in microbiology or a related field prior to the start of their training which commences July 1 of each year. Individuals may apply during the final year of their PhD, but any offer of acceptance would be contingent on the individual successfully completing and defending their thesis prior to the start of the program.

## Funding

The Ontario Ministry of Health and Long-term Care issues fellowships, which are then paid through the department payroll. These fellowships are for a 3-year period.

## Delivery

The Clinical Microbiology Training Program is closely aligned with the structure of the last three years of the Medical Microbiology Residency. The Program is administered by the Medical Microbiology Training Committee, consisting of representatives from each training site and the Program Director as Chair. The committee assists the Program Director in the planning, organizing and supervision of the program.



**Rotations:** Trainees spend 6 months at each of the participating institution's microbiology laboratories. Throughout each rotation, the staff microbiologist supervises the trainee. Practical bench teaching is conducted by the technologists at the bench-side. Each individual microbiology laboratory provides a schedule and rotation specific training objectives, the general components will include the following:

- Bench Rotations
- Laboratory management
- Technical manual
- Plate Rounds
- Seminars, Lectures and Rounds

Trainees are expected to attend (and present on a rotating basis) at the Microbiology Lecture Series. In addition, each microbiology lab/hospital/public health lab will have its own set of weekly rounds/seminars/teaching sessions related to microbiology/infectious diseases which the trainees are expected to attend while on those specific rotations.

**Evaluation:** At the end of each hospital rotation, trainees are evaluated by their rotation supervisors through a formal assessment form. The Program Director meets with each trainee at least annually. Practice oral, written and practical exams are held annually.

## Awards

**LMP Travel Award:** LMP encourages students and trainees to present their research at national and international scientific meetings. The department provides a travel supplement to defray some of the travel expenses.

**Norman Bethune Award:** The aim of this award is to recognize and encourage young, talented researchers on the threshold of their careers. All microbiology residents and diploma trainees are eligible to apply. The prize, worth approximately \$3000.00, is awarded annually at the LMP Annual Banquet and Reunion.

## Quality Enhancement

The Program Director and site coordinators bring feedback from the trainees to the Program Committee meetings for discussion and action, where appropriate. Starting in July 2013, the Clinical Microbiology Trainees will be registered with the PGME, thus allowing the program to take advantage of the POWER On-line evaluation system to collect trainee feedback regarding individual teachers and hospital rotations.

## 5. OTHER EDUCATIONAL ACTIVITIES

### Undergraduate Medical Education

Education on the causes and mechanisms of disease is a key fundamental component to undergraduate medical education, in which students learn the language of disease and obtain vital background for clinical training and practice. Similar to other schools in North America, the University of Toronto has implemented an integrated curriculum in which a defined “Pathology” course is no longer offered in the second year of the curriculum. Pathobiology is taught primarily within a second year course entitled, “Mechanisms, Manifestations and Management of Disease” (MMMD), although occasional lectures are given in the first year courses by members of the LMP faculty. MMMD is a 36-week long course that runs throughout the second year of medical school and provides a link between the basic sciences taught in the first year of the undergraduate medical education curriculum and clinical disciplines that are taught in the upper years. The first 9 weeks of MMMD focus on disease mechanisms, with emphasis on how changes in disease that occur at the tissue, cellular and molecular levels correlate with clinical manifestations. In the remaining 27 weeks, systems-based medicine is taught, and students learn about integrated approaches to disease, from tissue and cellular events to clinical manifestations, diagnosis and therapy. LMP faculty serve as lecturers, seminar leaders, and problem-based learning (PBL) tutors in MMMD and, through participation in this course, have opportunities for student contact time. The Undergraduate Medical Education program of the University of Toronto, Faculty of Medicine underwent an accreditation site visit by LCME/CaCMS in 2012, and results of this exercise indicated no deficiencies related to pathology/ laboratory medicine within the curriculum.

The LMP Undergraduate Medical Education Director, Dr. Eleanor Latta, has played a major role in the design and implementation of MMMD, and she serves as course co-coordinator. One quality measure of achievement is that Dr. Latta is this year’s recipient of a W.T. Aikins Award from the Faculty of Medicine, the most prestigious award for undergraduate medical education given at the University of Toronto, in recognition of her contributions to course development and curriculum design.

With the expansion of the undergraduate medical education program to the Mississauga Academy of Medicine, LMP recruited local Trillium/Credit Valley Hospital-based faculty to serve as PBL tutors in MMMD, and this involved faculty development in relevant instructional and evaluation methods. The first iteration of MMMD involving the Mississauga Academy of Medicine occurred in the 2012-13 academic year, and was characterized by a number of lectures delivered at the Mississauga site and televised to the St. George campus. The goal is for 20% of MMMD lectures to originate at the Mississauga campus, and local Mississauga faculty are now involved in giving lectures in Genetics and Microbiology.

In accordance with the implementation of the LMP Strategic Plan 2010-2015, Dr. Latta chairs a departmental Undergraduate Medical Education Committee that has faculty representation from the major pathology and laboratory medicine disciplines. In addition to MMMD, LMP has involvement in other undergraduate medical student electives, with numbers of student electives undertaken in LMP since 2007 listed in the Table below.

<b>Medical Student Electives at LMP 2007-2012</b>	
2007	27
2008	29
2009	33
2010	26
2011	15
2012	11

In 2011, a new fourth year course, “Transition to Residency” (TTR) was introduced. This 14-week course introduces students to a wide range of activities which promote graded responsibility and personal development through chosen selectives. LMP offers a variety of different selective experiences to the fourth year medical students, in pathology, clinical chemistry, and in partnership with other clinical disciplines. The number of students whose activities are attributed to LMP are listed in the Table below.

<b>TTR Students at LMP 2011-2012</b>	
2011	4
2012	7

A recent initiative saw the creation of a student-directed “Laboratory Medicine Interest Group” (LMIG) in 2012-13. The group was coordinated by two second year medical students who recruited interested students in first and second year for visits to various laboratory departments at different hospitals around Toronto. LMP Faculty were involved in showing the students around the laboratory, showing them some interesting cases, answering questions and emphasizing the role of the laboratory in patient care. The laboratory visits were enthusiastically received by the students, and the goal is to expand LMIG in 2013-14 to include visits to the Coroner’s Office and possibly Public Health Laboratories.

One priority area for LMP in undergraduate medical education is to contribute in producing physicians who aim to improve laboratory utilization in the context of effective use of health care resources. Dr. Latta has worked with colleagues across Canada to define “exit competencies” in pathology and laboratory medicine for all students who graduate from Canadian medical schools, and these were submitted to the Canadian Association of Pathologists-Association/Canadienne des Pathologistes in 2012.

Concerning opportunities for LMP in undergraduate medical education, the “CREMS” summer research program is designed for undergraduate medical students to obtain research experience in the summer months, and deliverables include: preparation of written research report, attendance at seminars, and presentation at the Annual U of T Medical Student Research Day. This is one area in which LMP can make major inroads. Future priorities for LMP in undergraduate medical education are to strengthen relationships within the integrated curriculum so that laboratory medicine, pathology and pathobiology are valued and recognized throughout the four years. With the development of new “exit competencies” in Laboratory Medicine, the next goals will involve the implementation of a longitudinal LMP experience throughout clerkship. With exciting developments in personalized/ precision medicine, there are new opportunities for LMP to enhance its relevance and immediacy in physician education, whereby the traditional focus on pathophysiology can be augmented to reinforcing the critical role of pathology and laboratory medicine in informing patient management, risk stratification, etc. Personalized/precision medicine also provides attractive opportunities for the recruitment of students into pathology and laboratory medicine. By being a strong, relevant and visible presence in the undergraduate medical education curriculum, LMP has the ability to inform and inspire future physicians.

### **Continuing Education Professional Development (CEPD)**

At the last cyclical review, continuing medical education was considered by the external reviewers as an area of LMP that was ripe for further growth and development, and potential new revenue streams to the department. The Faculty of Medicine has completed a major revamping with the rebranding of Continuing Education and Professional Development—CEPD. This development was opportune for LMP, as it has provided a means to learn new concepts, approaches and best practices from other clinical departments which have had greater experience at the forefront of CEPD. For example, various departments in the Faculty of Medicine have developed simulations for use in education, eLearning, etc. LMP continues to have a number of popular CE offerings (e.g., Pathology Update, held each November) that are for the most part structured along traditional CME formats of audiences listening to expert speakers, etc. An inventory of current LMP CEPD offerings shows a wide diversity of choices intended for various target audiences:

**LMP General**

- LMP Seminar Series (Mondays, 4-5 p.m.), MSB
- LMP Undergraduate Conference on Cancer 2013 (Jan. 13, 2013), MSB
- LMP Cardiovascular Theme Half Day (Mar. 25, 2013), George Ignatieff Theatre, Trinity College

**Anatomical Pathology**

- Pathology Update 2012 (Nov. 10, 2012), Metropolitan Hotel
- Bedard Symposium – Diagnostic Cytopathology, Mt. Sinai Hospital (Nov. 24, 2012), Mount Sinai Hospital
- Laurence Becker Symposium 2012 (Jun. 6, 2012), Hospital for Sick Children
- Saturday in Pathology at the University (Jun. 23, 2012), Sunnybrook
- Pathogenesis and Clinical Treatment of the Immune Cytopenias (Apr. 26, 2013), Li Ka Shing Knowledge Institute, St. Michael's
- 5<sup>th</sup> International Symposium on Kallikrein and Kallikrein-Related Peptidases (Sept. 28, 2013), Li Ka Shing Knowledge Institute, St. Michael's
- Quality Program in Cancer Pathology (May 4, 2013), UHN-Sunnybrook

**Forensic Pathology**

- 2012 Annual Education course for Coroners and Pathologists (Nov. 24, 2012), Bram and Bluma Appel Salon
- Centre for Forensic Science: Advancements in the Modern Autopsy (May 23, 2013), MSB

**Laboratory Genetics**

- 2013 Great Lakes Chromosome Conference (May 17, 2013), 89 Chestnut St.

**Hematological Pathology and Transfusion Medicine**

- Excellent Care for All – A Transfusion Medicine Perspective (Mar. 23-24, 2012), Westin Harbourcastle
- Patient Blood Management – An idea whose time has come (Sept. 15, 2012), Li Ka Shing Knowledge Institute, St. Michael's
- 2012 National Sickle Cell Conference (Nov. 3, 2012), Montreal, QC (Course Director: J. Pendergrast, LMP)
- Canadian Blood Services-ORBCoN Spring Symposium (Apr. 13, 2013), Courtyard Marriott, Toronto
- Bloody Easy Online (Jun. 30, 2013), Online
- Bloody Easy Lite (Aug. 13, 2013), Online

**Neuropathology**

- City-wide Neuropathology Rounds (Weekly, 4-5 p.m.), Hospital for Sick Children
- 7<sup>th</sup> Annual Canadian Neuroscience Meeting (May 21-24, 2013), Sheraton Centre Hotel, Toronto
- University of Toronto Neuropathology Day (annual event)

**Clinical Biochemistry**

- Journal Club (bi-weekly, Tuesdays)
- Tutorials (bi-weekly, Tuesdays)
- Hospital for Sick Children Clinical Biochemistry Rounds (monthly, Wednesday)
- Ontario Society of Clinical Biochemists meeting (annually, November)

**Clinical and Medical Microbiology**

- Annual Academic Research Day (Microbiology-Infectious Diseases (ID)) (May 28, 2013)
- ID/Medical Microbiology Retreat (1 week, annually)
- Plate Rounds (weekly)
- Clinical Rounds (weekly)
- ID/Microbiology Rounds (weekly)
- Question of the Week (weekly)

Dr. Nadia Ismiil, LMP CEPD Director, has invested considerable effort in establishing relationships with CEPD leadership in the Faculty of Medicine and becoming knowledgeable with contemporary approaches and issues in adult learning, etc. There is a critical mass of LMP faculty who are motivated to develop innovative education offerings suitable to CE. The development of digital laboratory medicine (see below) is being done with the intent of being an enabling mechanism for innovation in CE in LMP. With the recent announcement of the College of Physicians and Surgeons of Ontario (CPSO), in which the goal is to have the competence of every physician in Ontario evaluated every 10 years, there is greater impetus for LMP to more aggressively assume greater leadership in CE.

Concerning Professional Development (the “PD” part of “CEPD”), Professor Hegele assigned a departmental task force to define what “Creative Professional Activity” entails for LMP in the context of recognition for academic promotion at the University of Toronto. This was done in recognition of a large constituency of LMP faculty being hospital-based pathologists, laboratory physicians and scientists who are engaged primarily in clinical service. This task force produced a report which has since guided the LMP Departmental Appointments Committee in assessing files for academic promotion, academic job activity profiles and clarity in accountability in performance evaluation. The success of this exercise is evidenced by the results of senior promotions in LMP during the 2012-13 cycle, in which seven of the nine LMP faculty members who were successfully promoted to rank of Associate Professor or Professor had a prominent component of CPA to their dossiers.

Concerning mentoring, this area was identified as a priority in the LMP Strategic Plan 2010-2015. To build and operationalize a culture of mentoring within LMP, Professor Hegele participated on a Faculty of Medicine task force on mentoring in 2011-12 and the work of this group yielded a number of practical recommendations. To make mentoring both pragmatic and relevant to LMP, the department has started to use success stories in academic promotion (particularly in CPA) as a means to promote mentoring within the department. One important development is that LMP faculty who have recently been promoted have generously agreed to have their dossiers made available for viewing by others considering academic promotion, and to share their experiences.

**Allied Health Professions and Miscellaneous**

LMP faculty members participate in the education of numerous professions, including Nursing, Dentistry, Pharmacy, Physical Therapy, Biomedical Engineering, and Law at the University of Toronto. LMP faculty also participate in education of students enrolled at the Michener Institute (e.g., medical laboratory technologists). There is work in progress to form affiliations with some of the Toronto Hospital sites for practicums of a professional Master’s of Clinical Science program of Western University, for students who are training to become Pathologists’ Assistants.

**Digital Laboratory Medicine**

One of the areas identified for future development by the department at the 2009 off-site retreat was “Digital Laboratory Medicine” (DLM). For LMP, DLM encompasses all areas of laboratory medicine, and in its fully developed form goes far beyond whole-slide imaging as pertains to anatomical pathology. DLM is not intended for use in patient care or professional practice; rather, the departmental approach is academic and particularly focused on education. For example, in the accreditation of undergraduate medical education by LCME/CaCMS, there is a standard in which students who are part of a geographically distributed program (in the case of

University of Toronto Faculty of Medicine, the St. George and Mississauga campuses) must have comparable educational experiences. DLM represents a clear mechanism to meet this standard. In addition, in postgraduate medical education, pathologists and laboratory physicians and scientists have often maintained private collections of interesting examples of disease entities for use in training of residents and fellows. This has resulted in marked variability over what trainees may be exposed to during their programs. The promise of DLM is that it “democratizes” this situation, by providing high quality educational materials to be accessible by qualified users, and confers other advantages such as no longer needing to prepare multiple “recuts” of glass slides to distribute to trainees, etc. DLM also enables standardization in group learning situations, including distance learning. Further, as part of the curriculum of academic degree programs (BSc, MSc, PhD) or in the allied health professions, DLM can provide educational materials for students to understand the appearance of pathobiological processes (e.g., acute inflammation, neoplasia) toward meeting curricular requirements. The overarching motivation for LMP embarking on DLM is the value it can bring to multiple educational domains of the department.

The initial project within DLM is the LMP Digital Laboratory Medicine Library. This initiative has been developed on two fronts simultaneously: 1) technical, and 2) governance/ oversight. Concerning technical aspects, LMP has engaged the information technology unit of the Faculty of Medicine (“Discovery Commons”) and has been testing a web-based platform for secure access and viewing of annotated digitized images, in a searchable database. Concerning governance/ oversight, LMP approached key stakeholders at the Hospital for Sick Children (SickKids), including Research Ethics Board, Health Records, Privacy, Legal, Clinical Operations, and others, to develop a robust Project Charter and this has culminated in the sign-off of a Material Transfer Agreement (MTA) between the Hospital and U of T in March, 2013. The SickKids-U of T MTA represents a major accomplishment in defining the scope, expectations, governance, responsibilities, sustainability and ongoing evolution of the Library and the next step is to use MTA as a template that can be extended to other University of Toronto-affiliated hospitals and agencies.

## 6. RESEARCH

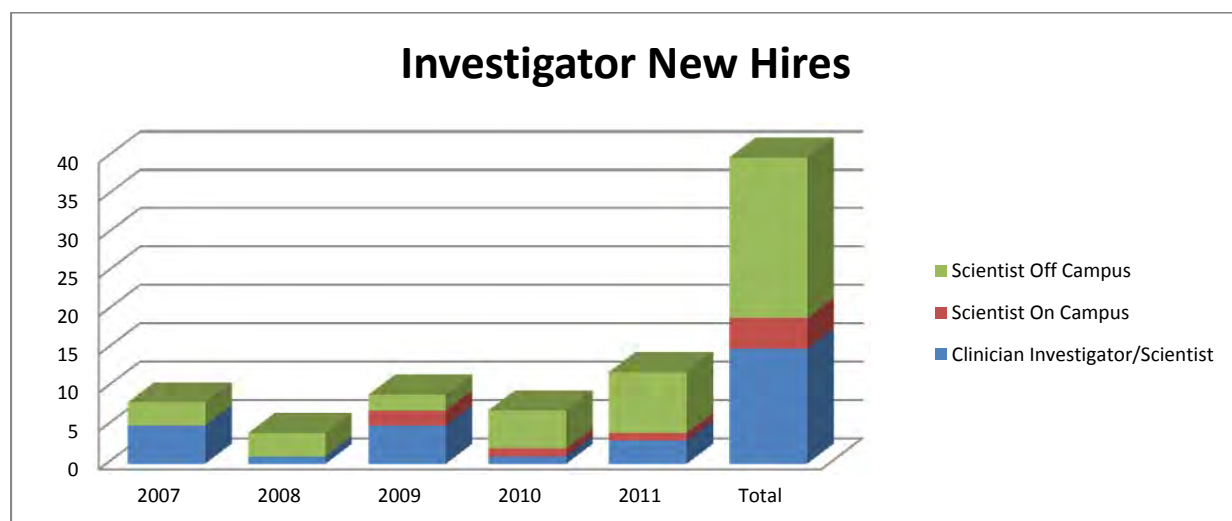
### Introduction

The major emphasis in LMP is on the creation and the communication of knowledge focusing on the causes and mechanisms of disease. Our ultimate goal is to translate knowledge into improved medical practice and health outcomes and to inform health policy. LMP is a large, diverse, and widely geographically distributed department. There are over 300 primarily appointed faculty members who span a broad spectrum of expertise and activity from full-time basic scientists performing discovery research, to pathologists and laboratory physicians and clinical laboratory scientists involved in the clinical practice of pathology and laboratory medicine. Of these faculty members, 119 are funded scientists. The faculty are spread throughout the city: a core group of tenured basic scientists is located on the St. George campus in the Medical Sciences Building (MSB), while others are located among all of the affiliated hospitals, and a few in the community-affiliated hospitals of the University of Toronto and various government institutions. The number of research faculty members currently holding research funding in each appointment category are listed in the Table below.

Clinical Administrator	7
Clinical Investigator	25
Clinical Scientist	9
Clinical Teacher	11
Scientist On Campus	12
Scientist Off Campus	33

Note: Twenty-two of the 119 faculty funded during the period of this review are no longer with the department. All appointments noted above are full-time.

LMP has experienced an unprecedented period of expansion of the tenure-stream basic science faculty in the MSB, more than doubling this group in just over 10 years. In the last 5 years we have continued to grow, recruiting 40 new scientists/clinician scientists, with 4 recruited to tenure-stream appointments and establishing labs on campus in the MSB. In addition there have been 36 new recruits located in research institutes at the affiliated hospitals and various government institutions. These appointments are summarized in the Figure below.



## Research Leadership

In its last strategic planning exercise (2009-10), LMP identified an important initiative to develop a research leadership structure. Consequently, a Research Director was appointed in 2011 (Professor Michelle Bendeck) with part-time administrative support (Sue Balaga). The goals of the Research Director are to provide navigational assistance to department members via a single point of entry, to enhance ability to compete for research grants, and to partner with affiliated research institutes, enhancing linkages, resources and to foster collaborations.

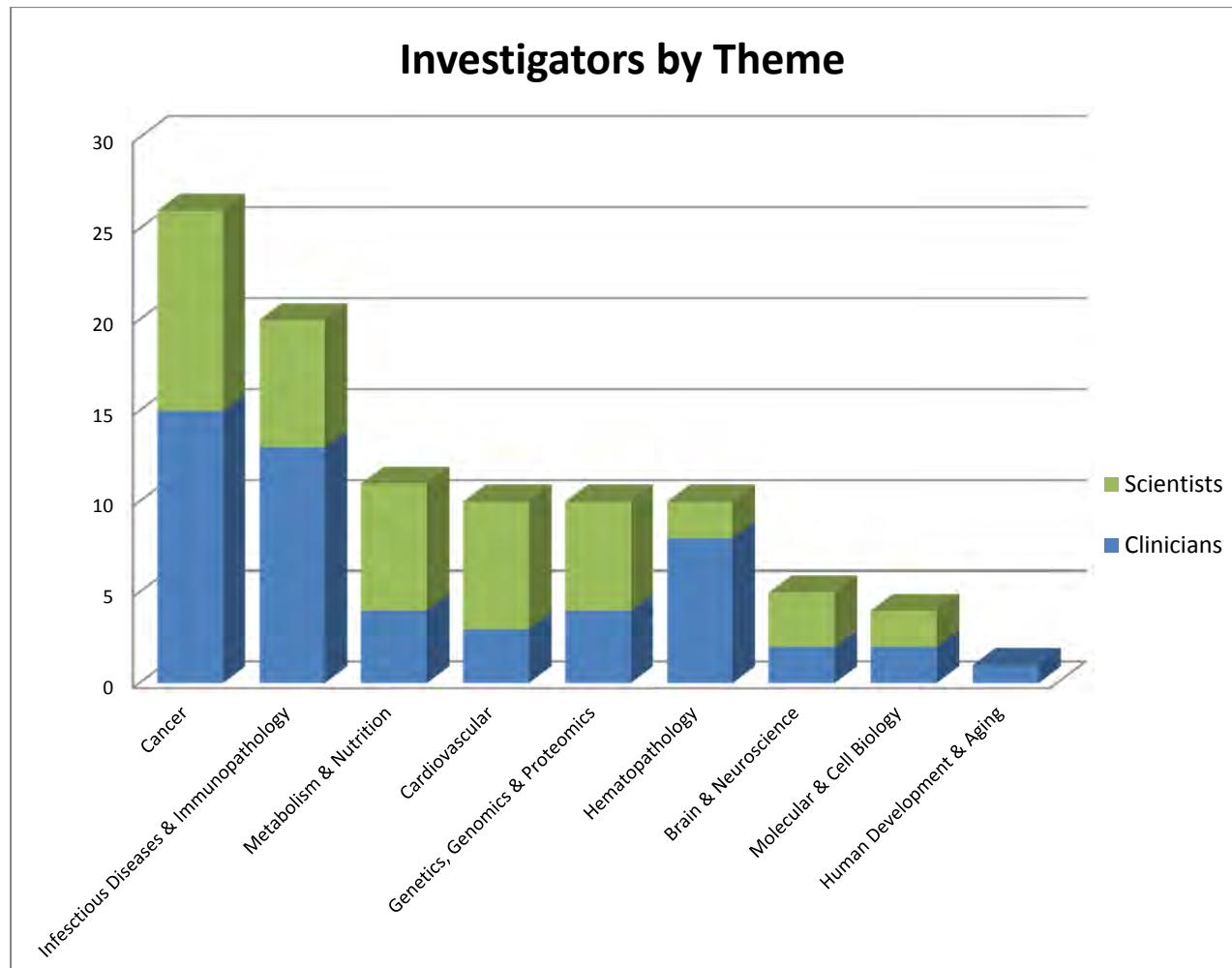
## Internal Peer Review

A structured internal peer review process for grant applications was initiated in the fall of 2011, and runs twice each year in parallel with CIHR application deadlines. This allows any investigator to have their proposal reviewed by 2 colleagues, and gives other investigators the opportunity to participate and gain experience in peer review. The review is voluntary, and is not meant to supersede or replace mechanisms in place in our affiliated research institutes. However, we have had investigators from our on-campus group and in-hospital groups participate, and we have facilitated review of applications to agencies outside the CIHR.

## Research Themes

LMP, in keeping with its large and diverse faculty, enjoys a diverse set of research areas and expertise. During the past year, we have engaged in a strategy to classify faculty into research themes. The following 9 themes are represented: Brain and Neuroscience, Cancer, Cardiovascular, Genetics Genomics and Proteomics, Hematopathology, Human Development and Aging, Infectious Diseases and Immunopathology, Metabolism and Nutrition, and Molecular and Cell Biology. The number of primary appointed researchers in each category is shown in the Figure below. Involvement in each of the research areas is further enhanced by the activity of LMP Graduate Faculty cross-appointed from other departments and by clinical faculty specializing in specific areas. These themes provide a framework to encourage the development of smaller working groups to communicate, collaborate and share expertise. Secondary goals of this exercise were to clarify and revitalize the department website, making it easier for students to find supervisors and outside researchers to find collaborators. This was done in parallel with a similar effort such that our themes are well aligned with those newly identified in the Faculty of Medicine.





Note: This chart reflects faculty researchers who are primary to LMP. Numbers are higher when all LMP graduate faculty (including faculty both primary and cross-appointed to LMP) and clinician teachers are included.

**Cancer:** To improve cancer treatment and reduce the burden of this disease, our researchers strive to expand their understanding of cancer biology. By using multi-disciplinary approaches, they elucidate the underpinnings of cancer hallmarks and translate these discoveries into novel cancer therapeutics. Our researchers focus on various aspects related to key hallmarks of cancer such as: genome instability, cell death resistance, proliferative signaling, evasion of growth suppressors, invasion/metastasis, angiogenesis, energy metabolism, cancer stem cells, inflammation and immune evasion.

**Infectious diseases and immunopathology:** Viral, bacterial, fungal and parasitic pathogens are major threats to the Canadian and global public health infrastructure. From uncovering the molecular mechanisms of bacterial antibiotic resistance, malarial infection, effects of toxins on cellular function, viral entry and replication, to the immune restriction of microbial pathogens, researchers in this area bring a diverse breadth of focus that is key to the development of new countermeasures, such as vaccines, antibodies, therapeutics, and diagnostics.

**Cardiovascular:** Cardiovascular disease is the leading cause of death in the Western world. Our researchers study the response of the cardiovascular system to physical and biochemical stresses during disease. They investigate the influence of hemodynamics, inflammatory and thrombotic mechanisms in atherosclerosis. They also investigate the remodeling of the extracellular matrix and signaling between cells and matrix in vascular disease. Collaborations within the department are fostered, and basic and clinical scientists are encouraged to translate their research into new discoveries and treatments.

**Genetics and genomics:** Our researchers uncover how relationships between genes and/or proteins are set and integrated within large molecular networks. From the identification of genetic mutations underlying disease to the development of prognostic technologies that impact health care delivery, this area of research is critical to the pursuit of personalized and translational medicine. Areas of investigation include: molecular evolution, chromatin structure and function, epigenetics, structural analysis of nucleic acids and proteins, repetitive DNA, genome stability, copy number variation.

**Hematopathology:** Researchers investigate the nature of disease of the hematopoietic system and related organs, including the bone marrow, spleen, thymus, lymph node and vasculature. Diseases of this system are myriad and include hereditary and congenital disorders, as well as acquired disorders. Our researchers focus on: platelets and blood coagulation system in bleeding disorders and cardiovascular diseases, the immune system in hematological disease, molecular and cellular aspects of hematopoiesis, myelodysplastic syndromes.

**Brain and Neuroscience.** Researchers investigate developmental, degenerative and neoplastic disease of the nervous system, including advanced imaging, biomarker discovery, and new drug development.

We have started to hold regular research retreats centered on each theme. The first of these took place in March 2013, when a Cardiovascular Theme half-day was held on campus. There were 8 faculty speakers, and more than 50 attendees including graduate and undergraduate students, postdoctoral fellows, research staff and faculty. The day was a success, with enthusiastic comments from many people. While we often enjoy hearing lectures from prestigious visiting scientists, it is rare that we hear from our own local experts. Many commented that they often need to travel to distant locales to meet a collaborator from their own city. We will schedule the next retreat on Infectious Diseases and Immunology in the fall of 2013. These “mini-retreats” will increase interactions between hospital and campus based researchers, students and trainees. One long-term goal is for these retreats to lead to productive collaborations and the initiation of group grant applications in the future.

## Translational Research in LMP

Along with world renowned expertise in the study of the causes and mechanisms of disease, the department has considerable interest in key areas of translational research including biomarkers of disease, tissue biobanking, and digital laboratory medicine. Over the last 5 years these translational initiatives have received intense attention, and they benefit from collaborations of LMP investigators with other departments with facilities for genomics, proteomics and high throughput screening technologies. During the 2009-10 Strategic Planning exercise, LMP identified four areas of emphasis in translational research: biomarkers, biobanking, quality and informatics.

LMP has considerable strength in these areas. Below find a partial list (by no means exhaustive) intended to provide a flavor for the types of activities and accomplishments in translational research occurring in LMP:

- Professors Eleftherios Diamandis has longstanding accomplishment in biomarker discovery in cancer.
- Professor Ming-Sound Tsao is an international authority on tissue-based cancer research.
- Professor Arun Seth has implemented numerous cancer and infectious disease-related biomarkers into clinical laboratory practice.
- Professor George Yousef is one of the next generation of anatomical pathology clinician-scientists who does tissue-based biomarker discovery and validation, and has made new insights concerning kidney cancer.
- Professor Patricia Shaw has made major contributions to defining the paradigm in which a proportion of ovarian cancers are actually of Fallopian tube origin, and this has implications in patient management.
- Professor Don Low is engaged in several research groups funded by CIHR, PSI, WSIB, studying risk factors and treatment for influenza virus and *C. difficile*.
- With funding from CIHR, NIH and the Gates foundation, Professor Kevin Kain studies the effects of malaria in 9 trials on global health in low resource settings.
- Professor Christine Cserti is engaged in research to determine whether the transfusion of type O blood improves outcomes in malaria patients.
- Professor Richard Hegele is evaluating compounds designed to inhibit the interaction between respiratory syncytial virus and its cellular receptor.

- Professor Jeffrey Lee using structural biology approaches to inform intelligent drug design for HIV and other viral infections.
- Professor JoAnne McLaurin is evaluating compounds that can slow the progress of Alzheimer disease.
- Professor Bhushan Kapur has developed a point of care toxicology test for acetaminophen, salicylates and methanol based on a finger-prick blood sample, which is now on the Canadian market.
- Professor Don Mahuran has conducted research on two approved drugs, pyrimethamine and ambroxal which show promise in the treatment of GM2-gangliosidosis and Gaucher disease.
- Professor David Muñoz is studying the effects of NSAIDs on the evolution of Alzheimer disease in humans.
- Professor Cynthia Hawkins and colleagues at the Hospital for Sick Children have made major discoveries into novel biomarkers of paediatric brain tumors and biology of cancer stem cells.
- Professor Khosrow Adeli has been involved in developing a smartphone app to bring clinical research findings direct to physicians and lab professionals, and through the CALIPER Study, defining normal pediatric reference ranges of clinical laboratory tests.
- Professors Aaron Pollett, Martin Chang and George Yousef are enhancing the academic agenda for laboratory informatics.
- Professors Mahmoud Khalifa and Simon Raphael are enhancing the academic agenda for laboratory quality in anatomical pathology.
- Professor Andrew Evans is an international authority on implementation of telepathology in anatomical pathology practice.

Importantly, in addition to existing strengths in these areas, LMP has benefitted from a number of targeted recruitments to advance the translational research agenda for the department. For example, Professor John Bartlett, an expert in cancer biomarkers and clinical trials research, is the Director of Transformative Pathology for the Ontario Institute of Cancer Research and holds his primary academic appointment in LMP. In addition, Dr. Michael Roehrl was recruited to University Health Network and is charged with a major leadership role in biobanking at UHN and for the Faculty of Medicine. A recent recruit to Mount Sinai Hospital, George Charames, is enhancing molecular diagnostics. Next generation sequencing and bioinformatics are emerging areas being implemented throughout the department.

## Department Seminar Series

Weekly seminars held on campus at the MSB, including several special named annual lectures held each year both on campus and at our affiliated hospitals, are attended by faculty and trainees from across the GTA. This active research seminar schedule serves to bridge the gaps between our diverse faculty members across the city and to strengthen our departmental collegium. The named lectures and lecturers over the term of this review include:

- DSR Sarma Lectureship in Oncologic Pathology, Laboratory Medicine and Pathobiology, U of T (February)
  - 2012 Marco Marra, Genome Science Centre, BC Cancer Agency and Univ. of British Columbia
  - 2011 No lecture given (Dr. Marra rescheduled)
  - 2010 Samuel Aparicio, BC Cancer Agency and Univ. of British Columbia
  - 2009 Mina Bissell, Univ. of California Berkeley
  - 2008 Robert Korneluk, Children's Hospital of Eastern Ontario, Ottawa
  - 2007 Mary J.C. Hendrix, Northwestern University, Chicago
- Pritzker Day, Pathology and Laboratory Medicine, Mount Sinai Hospital (June)
  - 2012 Ulysses Balis, Univ. of Michigan
  - 2011 David Huntsman, Univ. of British Columbia
  - 2010 Christopher Fletcher, Brigham and Women's Hospital-Harvard University
  - 2009 Allen Gown, PhenoPath Labs, Seattle, WA
  - 2008 Jennifer Hunt, Massachusetts General Hospital-Harvard University
  - 2007 Ralph Hruban, Johns Hopkins University

- Laurence Becker Symposium “Advances in Paediatric Laboratory Medicine”, Paediatric Laboratory Medicine, The Hospital for Sick Children (June)
  - 2012 Richard S. Weinsilboum, Mayo Clinic, Rochester, MN
  - 2011 Edward R.B. McCabe, Univ. of Colorado, Aurora, CO
  - 2010 Samuel Weiss, Univ. of Calgary, Calgary, AB
  - 2009 Division Heads, Department of Paediatric Laboratory Medicine, Hosp. for Sick Children
  - 2008 Randall T. Hayden, St. Jude’s Children’s Research Hospital, Memphis, TN; Sharad Rassekh, British Columbia Children’s Hospital, Vancouver, BC
  - 2007 Anthony J. Demitris, Univ. of Pittsburgh Medical Center; Raj P Kapur, Seattle Children’s Hospital; Elizabeth Perlman, Children’s Memorial Hospital, Chicago, IL
- William Anderson Memorial Lectureship, UHN - Toronto General Hospital (September)
  - 2012 Mark A. Rubin, Weill Cornell Medical College, New York
  - 2011 Stefano Pileri, Bologna University School of Medicine, Italy
  - 2010 Arul Chinaian, Univ. of Michigan
  - 2009 Kathleen Cho, Univ. of Michigan
  - 2008 Peter Watson, BC Cancer Agency, Univ. of British Columbia
  - 2007 Kevin Leslie, Mayo Clinic Scottsdale
- Roderick Ross Research Day & Lectureship, Laboratory Medicine, St. Michael’s (September/ October)
  - 2012 Iris Schrijver, Stanford University
  - 2011 Michel Bergeron, University Laval, Quebec
  - 2010 Elizabeth Montgomery, Johns Hopkins University
  - 2009 Barney Graham, National Institutes of Health, Bethesda, MD
  - 2008 Torsten Nielsen, Univ. of British Columbia
  - 2007 Jack Gauldie, McMaster University
- Dr. Frederick Jaffe Memorial Lectureship in Forensic Medicine, Centre for Forensic Science and Medicine (October)
  - 2012 Morris V. Tidball-Binz, International Committee of the Red Cross, Geneva
- B. Lowell Langille Vascular Biology Lectureship, Laboratory Medicine and Pathobiology, U of T (October)
  - 2012 Holger Gerhardt, London Research Institute-Cancer Research UK
  - 2011 Alan Daugherty, Univ. of Kentucky
  - 2010 Ralf Adams, Max-Planck Institute Muenster, Germany
  - 2009 Harry Dietz, Johns Hopkins University
- John B. Walter Dermatopathology Lectureship, Laboratory Medicine and Pathobiology, U of T (November)
  - 2012 Craig A. Gedye, Princess Margaret Hospital
  - 2011 Neil Crowson, Univ. of Oklahoma
  - 2010 Martin C. Mihm, Jr., Brigham and Women’s Hospital-Harvard University
  - 2009 Yuan Chang, Univ. of Pittsburgh Cancer Institute
  - 2008 Victor Tron, Queen’s University
  - 2007 Victor Prieto, Univ. of Texas MD Anderson Cancer Center
- Neuropathology Day, Laboratory Medicine and Pathobiology, U of T (November/ December)
  - 2012 Jeffrey A. Golden, Brigham and Women’s Hospital-Harvard University
  - 2011 Ann McKee, Centre for the Study of Traumatic Encephalopathy, Boston University
  - 2010 David Ellison, St. Jude Children’s Research Hospital, Memphis, TN
  - 2009 John Woulfe, Ottawa Hospital Research Institute, Univ. of Ottawa
  - 2008 Steven A. Moore, Univ. of Iowa College of Medicine

## Campus Group

There are 14 faculty members in the tenure stream located in the MSB on the University of Toronto campus. It is important to maintain our on-campus research activities to provide an academic focus, provide cohesion for our geographically dispersed department, and to strengthen our research presence at the university. Importantly, this group provides a solid base for our research-oriented teaching activities in the undergraduate and graduate programs. See section below “Research Activity Supports the Learning of Graduate and Undergraduate Students”. In the past 5 years we have expanded our on-campus group with the recruitment of 2 exceptionally strong researchers into tenure-stream appointments (Karim Mekhail and Jeffrey Lee, both of whom have since been awarded Canada Research Chairs); a clinician/scientist (our Chair, Richard Hegele), and Associate Dean Research, Alison Buchan. We have also consolidated important activities of our tenured faculty with the relocation of Harry Elsholtz and David Irwin to the Medical Sciences Building. This continues a period of faculty growth and renewal in LMP that began over 10 years ago.

In the future it will be important to continue to develop and nurture this group. One tenured faculty member retired last year, and this position has since remained unfilled. Although it is difficult to predict future retirements we anticipate that one or two more new positions will be filled in the coming years. This will allow maintenance of our strong research presence, and ensure the continuity of teaching programs.

LMP is also working to promote relationships and collaborations with its hospital research institute based investigators. To this end support is provided for two new recruits at UHN: Jason Fish, a joint appointment with the Heart and Stroke Richard Lewar Center (and Canada Research Chair awardee), and Clinton Robbins.

## Research Activity Supports the Learning of Graduate and Undergraduate Students

LMP has a long history of supporting excellence in graduate and postdoctoral training, notably we are the only clinical department at the University of Toronto that runs our own graduate research program. In 2011-12, we had 177 graduate students enrolled in our program. Students and postdoctoral fellows (PDFs) in the department received significant levels of support in the form of scholarships and awards. Over the past 5 years studentship/fellowship support from the Tri-councils totaled \$2,445,994, and from other sponsors \$7,747,300.

Over the past 5 years we have made significant progress in integrating PDFs within departmental activities. We hold an annual Postgraduate Research Day that includes residents and PDFs. There is a separate stream of presentation awards for the PDFs, whose research projects are often longer and more in-depth than the residents. Starting last year (2011-2012) we offered an annual award to support PDFs travelling to national or international meetings to present their research. This award is named in memory of a late faculty member, Dr. Wolfgang Vogel, and supported by funds donated in his memory.

We have several research-related activities incorporated into our undergraduate Pathobiology Specialist Program. We offer a 4<sup>th</sup> year research project course (LMP 405Y) in which students spend a minimum of 10 hours per week in a research lab conducting experiments. At the end of the year, they hand in a written report on their work, and give a presentation which is graded by the course coordinator, the supervisor and one other researcher. We also support a very active undergraduate summer research program which accepts approximately 70 students per year for 12 weeks of full-time laboratory based research. Students are required to attend a weekly seminar series with presentations given by faculty members, and to present their research at a poster day in early August. Students in the department are supported by a variety of summer scholarship awards including the University of Toronto Research Opportunity Program, Banting and Best Diabetes Center, the Heart and Stroke Richard Lewar Cardiovascular Center, and NSERC summerships.

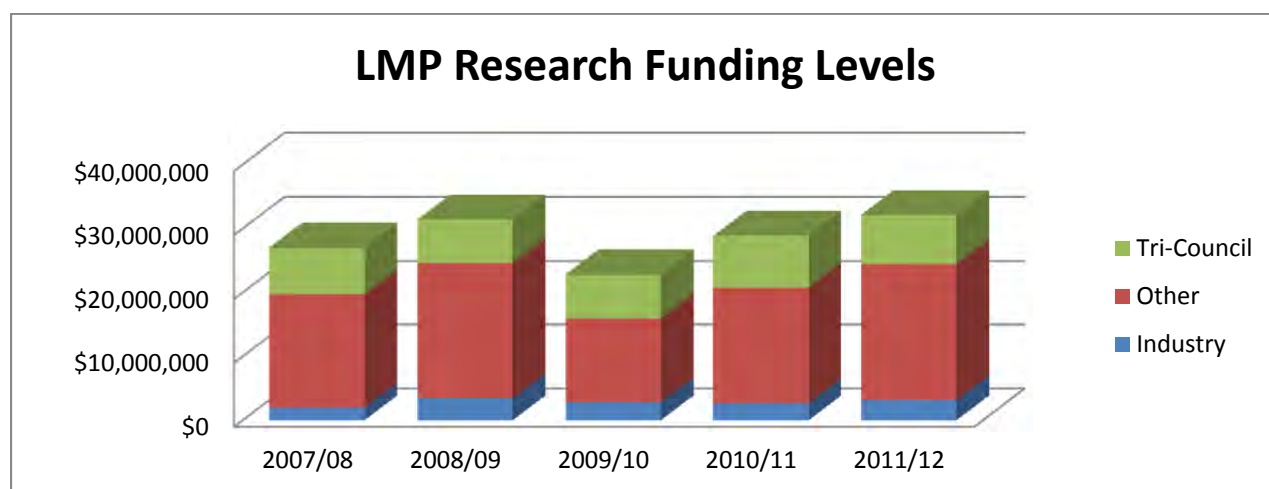
The assembly of the campus-based LMP faculty group has enabled the coalescence of the research and teaching mandates in the undergraduate Pathobiology Specialist program. Each course is co-ordinated by one of our campus-based tenure stream faculty members. We offer an innovative style of team teaching for this program, all

coordinators bring in research experts from the research-rich Toronto community to teach our students. Thus the students gain knowledge of the most recent and state of the art research methodologies and results.

## Benchmarks of Research Success

### Funding

The University of Toronto has provided funding information for the Department of Laboratory Medicine and Pathobiology. The research funding in LMP over the years 2007-2011 is shown in the Figure below. Total funding was \$142,165,566. Of this total \$36,780,841 was received from Tri-council, \$492,654 from Canada Foundation for Innovation (CFI), and \$104,892,071 from other sources including charitable foundations, hospital and industry. It is notable that Tricouncil funding accounted for only 26% of total research funding in the department. This suggests that investigators have been successful in diversifying their funding sources, which is important in these financially challenging times. Other major funding sources are listed in the Table below.



Cancer Research Society Inc	\$540,750
Canadian Blood Services	\$742,993
Canadian Breast Cancer Foundation	\$4,158,815
Canadian Cancer Society	\$7,107,437
Crohn's & Colitis Foundation of Canada	\$649,820
Heart & Stroke Foundation of Canada	\$2,050,082
Heart & Stroke Foundation of Ont	\$7,996,686
Kidney Foundation of Canada	\$685,238
Multiple Sclerosis Society of Canada	\$1,280,187
NCE: Canadian Arthritis Network	\$1,673,830
Ontario Institute for Cancer Research	\$5,423,076
National Institutes of Health (US)	\$9,688,643
US Office of Army Research	\$942,188

## Salary/Career Awards and Named Chairs

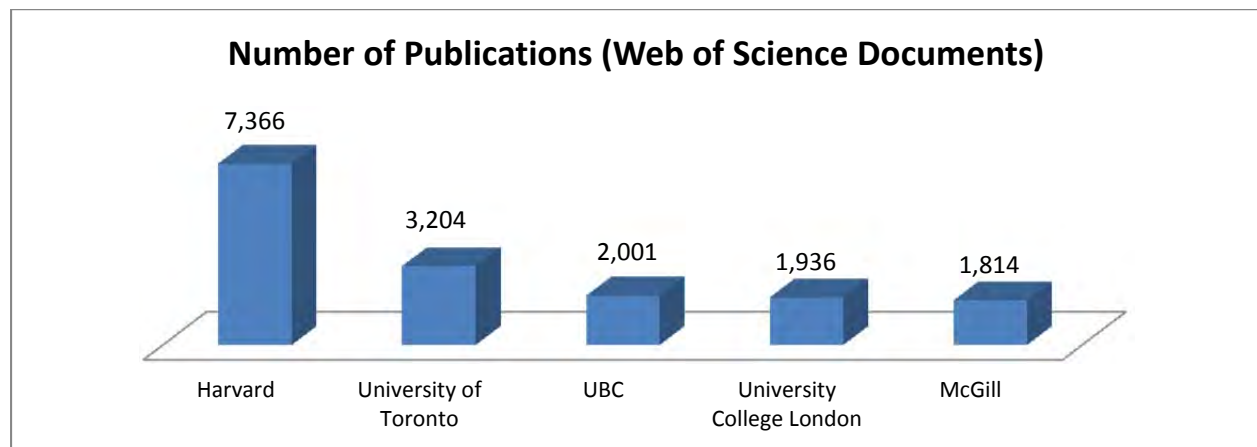
In the past five years, LMP faculty have been successful in securing numerous Salary/Career Awards:

- 6 Tier 2 Canada Research Chairs (Fish, Girardin, Lee, Mekhail, Mogridge, Ohh)
- 4 Heart and Stroke Foundation Career Investigators (Bendeck, Cybulsky, Hinek, Yang)
- 2 CIHR New Investigator Awards (Lee, McLaurin)

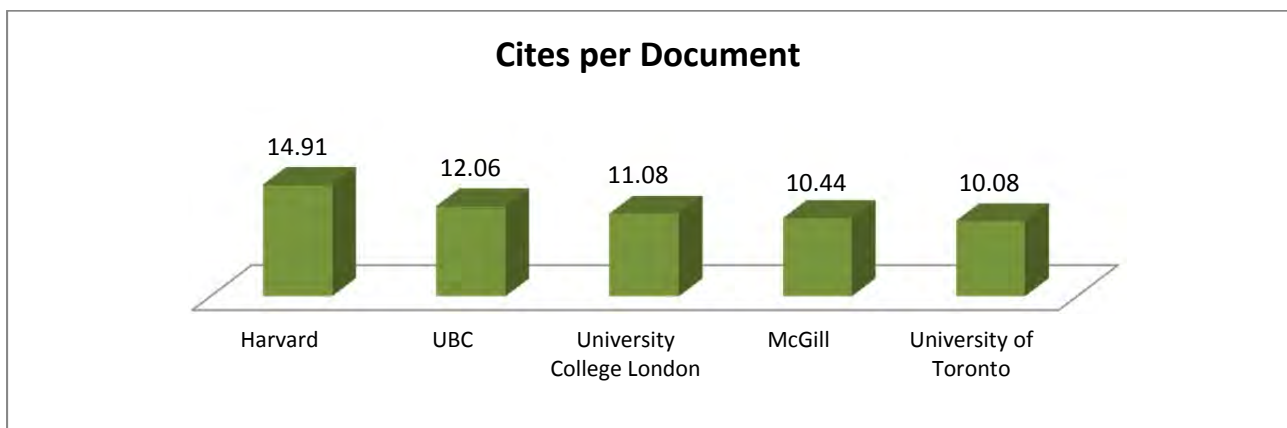
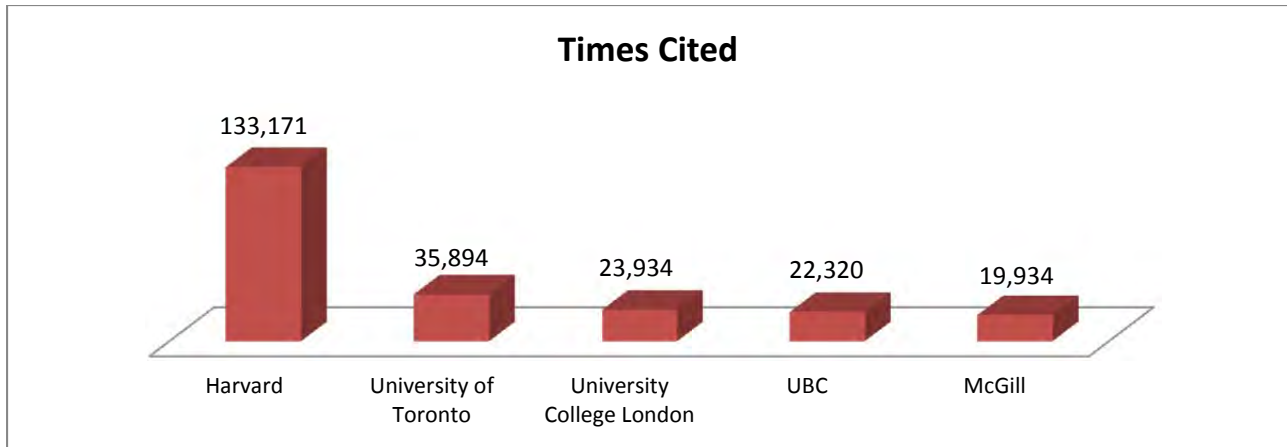
LMP faculty also hold several named chairs, including: Inaugural Maria H. Bacardi Chair in Transplantation (Li Zhang); M. Qasim Choksi Chair in Lung Cancer Translational Research (Ming-Sound Tsao); Hold'em for Life Chair in Prostate Cancer Biomarkers (Eleftherios Diamandis). The JC Boileau Grant Chair in Oncologic Pathology, a joint chair of the Ontario Cancer Institute, University Health Network and LMP, is currently vacant.

## Publications

This is a key metric in assessing the activity and success of research and scholarship in the department (three bar graphs below). However, the limitations inherent in these data are that the University compiles data according to subject area, and the broad subject areas of pathology, microbiology and biochemistry and molecular biology are all represented in LMP, but the data may also be attributed to members of other university departments. Nevertheless, the University of Toronto has the highest number of publications in these areas of the Canadian comparator universities, higher than University College London during the period 2007-2011, and less than Harvard University. The publications are cited more often than those of comparable departments in Canadian Universities, and University College London, but less than those at Harvard. The average citations per publication can be compared across institutions, and here Toronto is performing comparably to McGill and University College London, but a little lower than UBC.



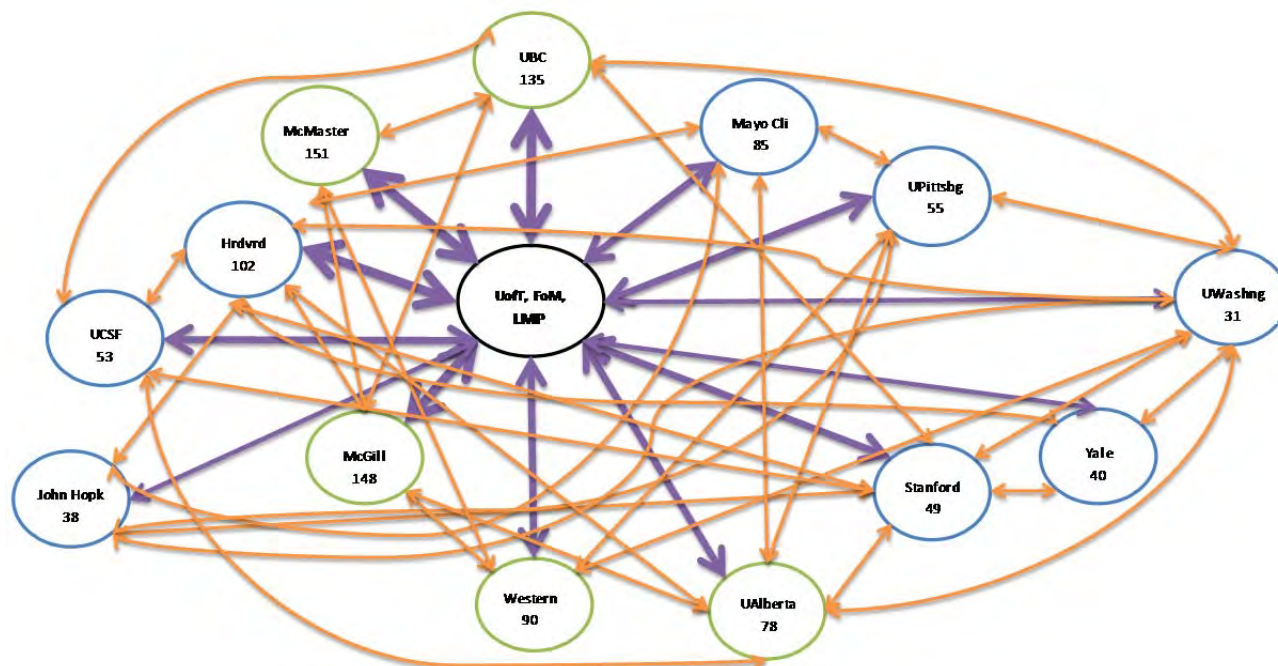






## National and International Activities and Reputations of Faculty

The graphic below shows that LMP enjoys numerous relationships with external institutions and speaks to our department’s vigor in being an outward (as well as an inward)-looking unit.



Source: Ego Network – Institutional (based on publications)

Subject Areas: Biochemistry & Molecular Biology; Microbiology; Pathology

Period: 2007- 2012

Many LMP faculty have established national and international reputations. Our faculty members are frequently invited to speak at other institutions, and to present research at conferences. Faculty members hold prominent positions as editors of high impact journals, and members of prestigious scientific societies. LMP is well-represented on the executive of many organizations, and faculty members have held leadership positions (including the presidencies) of:

Name	Organization	Position	Start	End
Adeli, Khosrow	Commission on Accreditation in Clinical Chemistry	President	2007	2010
Bendeck, Michelle	Canadian Society of Atherosclerosis, Thrombosis and Vascular Biology	President	2012	2014
Butany, Jagdish	Society for Cardiovascular Pathology	President	2007	2009
Butany, Jagdish	Cardiovascular Pathology	Editorial Board - Co-Editor-in-Chief	2001	2011
Butany, Jagdish	Cdn Assoc of Pathologists	President	2006	2009
Butany, Jagdish	Cdn Assoc of Pathologists & the Royal College of Physicians & Surgeons of Canada	Chair, Maintenance of Certification Committee	1997	present
Cole, David E.C.	Natural Sciences and Engineering Research Council of Canada	Chair, External Scientific Advisory Committee	2008	2010
Cole, David E.C.	Clinical Biochemistry	Editorial Board - Associate Editor	2007	2011

Name	Organization	Position	Start	End
Cybulsky, Myron	Heart and Stroke Foundation of Ontario	Chair, Grants Allocation Committee	2012	2014
Diamandis, Eleftherios	International Society for Enzymology	President	2008	2011
El-Zimaity, Hala	Gastrointestinal Pathology Society	Secretary and Treasurer	2007	2013
Gotlieb, Avrum	Canadian Chairs of Pathology and Laboratory Medicine	President	2002	2008
Gotlieb, Avrum	Federation of Societies of Experimental Biology	Board Member	2002	2009
Gotlieb, Avrum	Federation of Societies of Experimental Biology	Vice President for Science Policy, Elect, VP, Past VP	2007	2010
Gotlieb, Avrum	Cardiovascular Pathology	Editorial Board - Co-Editor	2002	2011
Hegele, Richard	Canadian Chairs of Pathology and Laboratory Medicine	President	2009	present
Hegele, Richard	OICR, OAHPP, SLRI, OHRI	Chair, Executive Committee of the Ontario Biospecimen Research Platform	2011	present
Hu, Jim	Canadian Cystic Fibrosis Foundation	Chair, Research Subcommittee	2006	2009
Hwang, David	Canadian Partnership Against Cancer (CPAC)	Chair, Pathology and Staging Multidisciplinary Expert Panel for Lung Cancer	2012	present
Jamieson, Frances	Public Health Ontario Laboratories	Chair, Medical and Clinical Microbiologists	2010	present
Jamieson, Frances	Association of Medical Microbiologists of Ontario	President	2005	2007
Kandel, Rita	Osteoarthritis Research Society International World Congress	Chair, Program Committee	2013	
Kandel, Rita	CIHR Bone Health Research Consensus Conference	Co-Lead	2009	
Keating, Sarah	Canadian Association of Pathologists	Co-Director	2010	2012
Low, Donald	American Society for Microbiology	Chair, Elect of Division A, United States	2006	2007
Low, Donald	Health Canada	Chair, National Advisory Committee on Chemical, Biological, Radio-nuclear Safety, Security and Research	2001	present
Low, Donald	Council of Canadian Academies	Chair, Advisory Committee on the Assessment of Pandemic Flu and Respiratory Protective Equipment	2007	
McKerlie, Colin	EU CASIMIR Consortium	Chair, International Advisory Group	2007	present
McKerlie, Colin	Federation of International Mouse Resources	Board Member	2005	present
Munoz, David	Canadian Association of Neuropathologists	President	2009	present
O'Malley, Frances	International Society of Breast Pathology	Secretary	2006	2007
Pollanen, Michael	Royal College of Physicians and Surgeons of Canada	Founder, Subspeciality of Forensic Pathology	2011	
Pollanen, Michael	Canadian Association of Pathologists	Founding Chair, Forensic Pathology Section	2007	
Pollett, Aaron	Canadian Association of Pathologists	Chair, Professional Affairs Committee	2003	present

Name	Organization	Position	Start	End
Rand, Margaret	Heart and Stroke Foundation of Ontario	Board Director	2003	2011
Rasty, Golnar	Canadian Association of Pathologists	Chair, Anatomic Pathology	2012	present
Richardson, Susan	Canadian Foundation for Infectious Diseases	President	2011	present
Salahshor, Sima	World Conference on Breast Cancer Foundation	Chair, Scientific-Medical Advisory Committee	2010	present
Shago, Mary	Canadian College of Medical Geneticists	Secretary	2005	2008
Taylor, Glenn	Society for Pediatric Pathology	President	2013	2014
Templeton, Douglas	IUPAC, Division of Chemistry and Human Health	Division President	2008	2011
Templeton, Douglas	IUPAC, Division of Chemistry and Human Health	Acting President	2012	2013
Thorner, Paul Scott	Royal College of Physicians and Surgeons of Canada	Chair, Awards Committee	2012	present
Tinckam, Kathryn	Canadian Society of Transplantation	Chair, Annual Scientific Meeting Planning Committee	2012	2013
Tsao, Ming-Sound	International Association for the Study of Lung Cancer	Chair, International Staging Panel	2011	present
Tsao, Ming-Sound	International Association for the Study of Lung Cancer	Chair, Pathology Panel	2011	2013
Tsao, Ming-Sound	NCIC Clinical Trials Group	Co-Chair, Correlative Science and Tumor Biology Committee	2006	present
van der Kwast, Theodorus	European Randomized Study of Screening for Prostate Cancer	Chairman, Pathology Committee	1996	present
van der Kwast, Theodorus	International Society of Urological Pathology	Chairman, working group 2 ISUP Consensus Conference	2009	

## Brief Summary of Progress in Specific Issues Identified in Last Cyclical Review

In the previous cyclical review of LMP, areas highlighted by the external reviewers included the following:

### 1. “should assume a leadership role in development of translational research – biobanks, biomarkers and imaging.”

In the LMP Strategic Plan 2010-2015, the Department has articulated four areas (biomarkers, biobanking, quality and informatics) as areas of emphasis in the departmental translational research agenda. Areas of existing strength have since been bolstered by a number of high profile, targeted recruitments. The LMP graduate course in cellular imaging (LMP1006H) has been reinvigorated by a superb Adjunct Faculty member, Dr. Sima Salahor.

### 2. “role for pathology in core facility development- informatics, multiplexed data handling”

Digital laboratory medicine is an area undergoing major development in LMP; new courses and educational offerings now exist, particularly in graduate/ post-graduate education. Bioinformatics is an area of priority recruitment in many spheres involving LMP, including cancer, infectious disease, and pediatrics.

### 3. “vision – more emphasis on not losing ground than on moving to the next level” “the department can reach for higher levels of excellence.” “choices and positioning of the department in relation to opportunities in research need full articulation.” “bring greater visibility to depts. Research.”

The challenging research funding climate over the last number of years has resulted in faculty having to adapt to find and secure funding from “non-traditional” sources. We have endeavored to build a stronger collegium within LMP, and have emphasized the importance of forging strong partnerships, both between institutions and between individuals holding appointments in other units, as relevant to obtaining larger group grants, etc. Concerning the quality of recruits, the two individuals recruited into tenure-stream faculty positions since 2009 have secured Canada Research Chairs, as has a joint recruit between LMP and a hospital research institute.

#### **4. “a significant proportion of extramural research funding supports hospital-based research investigators”**

LMP considers this to be a departmental strength, particularly as pertains to enhancing the translational research agenda.

### **Future Challenges and Opportunities**

The biggest challenge facing investigators across Canada is the current climate for research funding. We have been fortunate to secure funds for new recruitment and the expansion of our scientific infrastructure, however research operating funding has not kept pace with this. Compounding this problem is the redirection of funds away from discovery research towards targeted or directed areas of research in areas such as health services and health policy. During the past few years we have been active in communicating our concerns and suggestions for ways to support the basic science mission with the Dean’s office, and with the CIHR, however it seems that there will be little alteration in the course of the CIHR. Furthermore, several of the health care charitable organizations, namely the Canadian Cancer Society and the Heart and Stroke Foundation are diverting more of their funds to targeted research areas. In light of this, it is encouraging to see that the research funding base in LMP is broad with support from industry and many different national and international agencies. This speaks to the resilience and adaptability of our faculty and we must continue to look for new opportunities to form integrative research teams, and to engage in the translation of our knowledge and discoveries from investigating disease into impacting health.

## 7. ORGANIZATION AND FINANCIAL STRUCTURE

### Resources & Infrastructure

#### LMP Committees

LMP committees are established in guiding departmental operations and in satisfying requirements of various accreditation bodies:

**A) Executive (Combined Chiefs and Executive Committee: CCEC)** – LMP Chair (Hegele), Fully Affiliated Hospital Chiefs (Asa, Hegele, Jothy, Kandel, Khalifa, Reis, Simor), Division Heads (Butany, Diamandis, Low), Directors (Bendeck, Raphael, Templeton), Graduate Coordinator (Elsholtz), Administrative Manager (Kreutzer)

Brief Overview: Information exchange, deliberation of issues and decision-making advisory to LMP Chair.

**B) Departmental Appointments Committee (DAC)** – Elsholtz, Hegele (ex-officio), Jamieson, Keating, Pollanen, Rand, Romaschin, van der Kwast, Yeger, Zbieranowski (Chair), Zhang

Brief Overview: Assessment and recommendations for LMP appointments, reappointments, and promotions; representation of major areas of expertise and disciplines within the department at the rank of Associate Professor or above; advisory to LMP Chair.

**C) Education** – Templeton (Chair), Adeli, Butany, Chapman, Elsholtz, Hoffman, Latta, Raphael

Brief Overview: To coordinate Departmental teaching activities when opportunities for economy or synergism in delivery of didactic material exist; to facilitate preparation of faculty teaching dossiers, career development, and teaching awards.

**D) Undergraduate Course Coordinators** – Templeton (Chair), Yip/Fu, Bapat, Ohh, Cybulsky/Mogridge, Adeyi/Ni, Yeger, Bendeck, McLaurin, Johnston, Pollanen, Girardin, 2 TAs, LMPSU President or delegate

Brief Overview: To assess the delivery and quality of our undergraduate Arts and Science courses over the past academic year, identify any problems experienced by students or faculty, and plan accordingly for next year.

**E) Graduate Admissions Committee** – Committee Chair (Elsholtz), LMP Chair (Hegele, ex-officio), Faculty (Irwin)

Brief Overview: Reviews applications for admission to the Master's and Doctoral programs, and determines final decisions.

**F) Graduate Appeals Committee** – Committee Chair (Boggs), Faculty Representatives (Jothy, Kandel, Templeton)

Brief Overview: Responds to, and decides on, formal appeal requests at the Departmental level related to substantive or procedural matters, including grades, program requirements, decisions about the student's continuation in the program, or with respect to the application of a decision with regard to academic regulations and requirements to a student, according to the School of Graduate Studies policies and guidelines.

**G) Graduate Awards Committee** – Committee Chair (Elsholtz), Faculty Representatives (Done, Irwin, Ni)

Brief Overview: Performs ranking, adjudication and/or nominee selection of award applications for external and internal competitive awards, and for the Department's annual graduate student ranking. The committee also ranks applications for awards for post-doctoral fellows, as necessary.

**H) Graduate Curriculum Committee** – Chair, (Minta\*), LMP Chair (Hegele, ex-officio), Faculty Representatives (Elsholtz, Kandel, Templeton), Graduate Student Representatives (McCarthy, Shikatani)

Brief Overview: Reviews and approves new course proposals and changes to existing graduate courses, for submission to the Faculty of Medicine graduate curriculum committee for final review and approval.

\* Retired in 2012 (Elsholtz currently interim Chair)

**I) Undergraduate Medical Education Committee** – Committee Chair: Director, Undergraduate Medical Education (Latta), Faculty Representatives (Chesney, Dickson, Fischer, Iakovlev, Pavenski, Poutanen, Roswell, Serra, Taylor, Yip)

Brief Overview: Provides input into pathology, laboratory medicine and pathobiology curriculum content for undergraduate medical education; liaison at training sites for electives, selectives and undergraduate learning.

**J) Postgraduate (Residency) Education** – Committee Chair: Director, Postgraduate Education (Raphael); LMP Chair (Hegele, ex-officio), Royal College Residency Program Directors (Fernandes, Keith, Mazzulli, Pollanen)

Brief Overview: Ranking of CaRMS applicants; Planning/discussion and recommendations in areas of common concern to postgraduate education.

**K) Combined Anatomical Pathology/General Pathology Residency Program Committee** – Committee Chair: AP Program Director (Raphael), General Pathology Program Director and LMP Chair (Hegele), Training Site Representatives (Al-Haddad, Brennan, Chung, Ghazarian, Hafezi-Bakhtiari, Henry, Latta, Kamel, Moid, Mulligan, Nanji, Plotkin, Rose, Sade), Research Coordinator (Yousef), Remediation Coordinator (Ismiil), Cognate Program Representatives (Fernandes-Hematological Pathology, Hoffman-Chemistry, Mazzulli-Microbiology), Resident Representatives (Allo, Francis, Hojilla).

Brief Overview: Runs the University of Toronto Anatomical and General Pathology Residency Programs in accordance with Royal College accreditation requirements.

**L) Forensic Pathology Residency Program Committee** – Committee Chair: Program Director (Pollanen) LMP Chair (Hegele, ex-officio), Training Site Representatives (Pickup, Rose), Anatomical Pathology Program Director (Raphael), Resident Representative (Rajagopalan).

Brief Overview: Runs the University of Toronto Forensic Pathology Residency Program in accordance with Royal College accreditation requirements.

**M) Hematological Pathology Residency Program Committee** – Committee Chair: Program Director (Fernandes) LMP Chair (Hegele, ex-officio), Training Site Representatives (Abdelhaleem, Chesney, Macdonald, Musani), Clinical Hematology Program Director (Piliotis), Resident Representatives (Liebman, Khzam, Tsui, Liontos).

Brief Overview: Runs the University of Toronto Hematological Pathology Residency Program in accordance with Royal College accreditation requirements.

**N) Combined Medical Microbiology Residency-Clinical Microbiology Training Program Committee** – Committee Chair: Program Director (Mazzulli), LMP Chair (Hegele, ex-officio), Division Head (Low), Training Site Representatives (Allen, Boggild, Katz, Matukas, Mazzulli, Poutanen, Richardson, Simor), Trainee Representatives (Kus, Lowe).

Brief Overview: Runs the University of Toronto Medical Microbiology Residency Program and post-PhD Clinical Microbiology Training Program in accordance with applicable accreditation requirements.



**O) Clinical Microbiology Training Program Selection Committee** – Committee Chair (Mazzulli); Faculty Representatives (Allen, Matukas, Poutanen, Richardson, Simor), Trainee Representatives (Kus, Low)

Brief Overview: Coordinates assessment and selection of applicants to the University of Toronto post-PhD training program in Clinical Microbiology.

**P) Neuropathology Residency Program Committee** – Committee Chair: Program Director (Keith), LMP Chair (Hegele, ex-officio), Training Site Representatives (Croul, Halliday, Hawkins, Hazrati, Karamchandani, Kiehl, Muñoz, Shannon), Resident Representative (Al-Khotani).

Brief Overview: Runs the University of Toronto Neuropathology Residency Program in accordance with Royal College accreditation requirements.

**Q) Clinical Fellowship** – Committee Chair: Director (Rasty) LMP Chair (Hegele, ex-officio), Site/Discipline Representatives (Fernandes, Han, Mazzulli, Mulligan, Nanji, Taylor), Trainee Representative (Fragalla)

Brief Overview: Implementation of standards for Clinical Fellowships at the University of Toronto; consideration of new Areas of Focused Competence from the Royal College of Physicians and Surgeons of Canada.

**R) Transfusion Medicine AFC Committee** – Committee Chair: AFC Director (Lau), LMP Chair (Hegele, ex-officio), Site Representatives (Callum, Cserti-Gazdewich, Pavenski, Pendergrast, Shehata, Skeate), Trainee Representative (Lieberman)

Brief Overview: Runs the University of Toronto Transfusion Medicine AFC Program in accordance with Royal College accreditation requirements.

**S) Cytopathology AFC Committee** – Committee Chair (Boerner), LMP Chair (Hegele, ex-officio), Ghorab, Iakolev, Nanji, Rasty.

Brief Overview: To develop, implement and run the University of Toronto Cytopathology AFC Program in accordance with Royal College accreditation requirements.

**T) Clinical Chemistry Diploma Coordinating Committee** – Committee Chair (Adeli), LMP Chair (Hegele, ex-officio), Division Head (Diamandis), Site Representatives (Cole, Hoffman, Romaschin, Yip)

Brief Overview: Coordinates assessment and selection of applicants, operations, curriculum and accreditation of post-PhD diploma program.

**U) LMP Digital Laboratory Medicine Library Governance Oversight Committee** – To be established.

Brief Overview: To provide governance and accountability in adjudication of materials to be included and removed from the Library, and appropriate use of materials.

In addition to these standing committees, LMP creates short-term task forces and working groups on specific topics to inform departmental planning. Examples over the last five years include: the Strategic Plan Working Group, and Task Force on Defining Creative Professional Activity in LMP.

## Administration and Department Support

In 2009, the Chair and administrative staff relocated from the Banting Institute to the Medical Sciences Building. This was a major move uniting our administrative operations with our on-campus tenured/tenure-stream faculty and their laboratories. The new location remains easily accessible to our affiliated hospital sites and research institutes where the majority of our clinical faculty and PhD (status only) scientists are located.

LMP now occupies just over two thirds of the 6<sup>th</sup> floor of the MSB with additional space acquired and renovated to accommodate offices for the Chair and the 10 staff who relocated, along with 2 new student/trainee rooms

(outfitted with 25 desks wired for power and internet access), a large boardroom, a small meeting room and two kitchenettes. One additional research lab was also secured for the Chair.

In 2010, the LMP Chair launched the “LMP Strategic Plan 2010-2015” (see appendix 1.1 for a copy). Committed to exceptional operations in support of our priority areas (education, faculty development, research leadership and digital laboratory medicine), Operational Excellence was the fifth priority to be identified. As a result, we underwent a review of our administrative operations resulting in the upgrade of three existing positions and the creation of two new positions. LMP currently has the appropriate complement of staff (11.8 FTE, including the Administrative Manager) for the administration and management of our programs and the general running of the department. See Figure: Department of Laboratory Medicine & Pathobiology: Organizational Chart at the end of this section.

The two new positions, Website and Communications Coordinator and Special Projects Coordinator, have been instrumental in supporting a number of key initiatives:

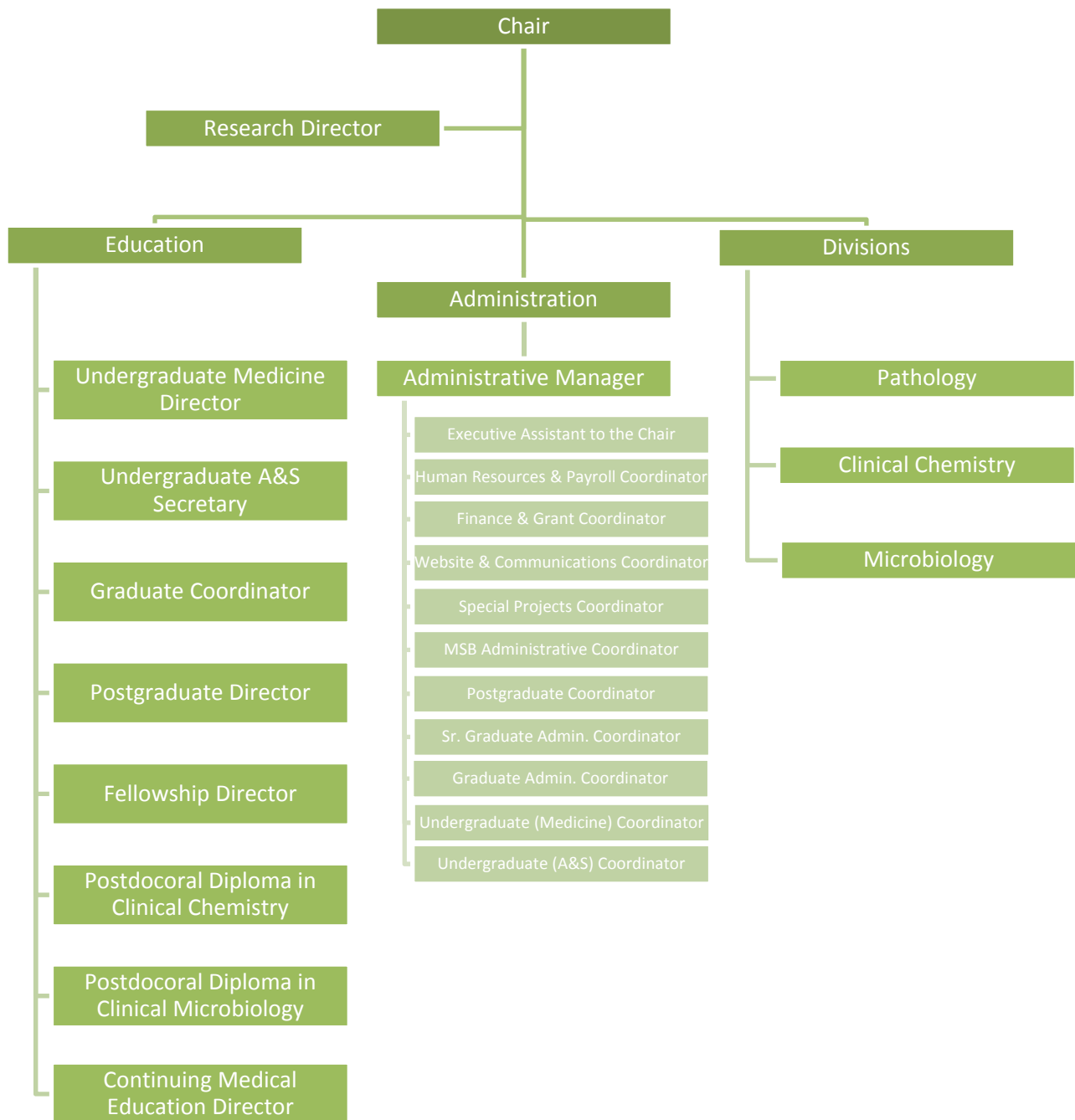
**Overhaul of the LMP website and communications:** The project began with the creation of a meaningful tagline reflecting LMP’s broad mandate and distinctive role within the Faculty of Medicine: “Investigating disease. Impacting Health.” This then led to the design of a fresh new look for LMP and the development and launch of a new and dynamic website. The site launched in December 2012, and the feedback from faculty, students and staff has been consistently positive. We have seen an increase in traffic to the site and that our visitors are engaged. The success of the new site reinforces LMP as a department that represents quality and excellence and supports the priorities outlined in the LMP Strategic Plan 2010-2015. We are continuing to develop our communication material (including seminar posters, promotional pieces, and the launch of a new newsletter, see additional information in our sample binder of LMP Promotional Materials).

**Development and implementation of a digital educational library:** The web-based LMP Digital Laboratory Medicine Library will provide an educational hub for instructors and learners to access a broad range of interesting and unique case material secured from a wide variety of collections. The system has been developed and is now undergoing departmental testing with the plan to run a pilot this fall 2013.

**Rollout of WebCV:** Over the past year, LMP has rolled out the Faculty of Medicine’s WebCV to LMP primary faculty. The program is intended to provide users with one point of data entry to meet a variety of needs: the generation of CVs and reports to support annual academic reviews/reappointments and the U of T promotions process; uploading of data to the CIHR Common CV; benchmarking and performance reporting (e.g., metrics re: publications, awards, etc.). Although the project has run into a few hiccups along the way, we are committed to seeing this system through to fruition and sustainability. We have assigned an administrative lead to work with our project staff, the Faculty of Medicine and our own faculty in order to work through the issues.



**Department of Laboratory Medicine & Pathobiology: Organizational Chart**



## Finances

LMP is in a solid financial position. As with most operations, the majority of our budget supports U of T paid salaries for tenured/tenure-stream faculty and the administrative staff. Revenue streams from undergraduate teaching in Arts and Science, graduate student enrollment (including expansion) and postgraduate, in conjunction with our base, are capable of meeting our core academic responsibilities both now and into the future. In addition to our core expenses, we fund/assist in funding a wide variety of academic events and initiatives in support of our students and trainees:

- Collaborative graduate programs (administrative fee)
- Travel grants (graduate and postgraduate)
- Professional development/text book allowance (residents)
- Summer student stipend subsidy (A&S Pathobiology Specialist students)
- Annual lectureship support (each affiliated hospital)
- Research day/poster day (undergraduate, graduate and postgraduate)
- Annual orientation/welcome (graduate and postgraduate)
- Career evening (postgraduate)
- Neuropathology Day (postgraduate)
- Various social events (e.g. seasonal celebrations, pizza/sushi night, summer picnic, volleyball challenge)
- Graduation reception (A&S Pathobiology Specialist Students)
- Cancer Fair (A&S Pathobiology Specialist Students)
- Annual Banquet student/trainee subsidy (all students & trainees)

Although relatively small for a department of our size, there are a number of trust funds in place to support our named lectures and various student and trainee awards. We have begun working with the Faculty of Medicine Advancement Office to develop strategic plans for engaging our alumni and enhancing fundraising opportunities.

Successful Canada Research Chairs and career awards (details are contained in Section 6. Research) have allowed us to embark on special projects as outlined above and to support any required infrastructure as needed.

Through the efforts of one of our junior tenure-stream faculty and our graduate students, LMP is now organizing a semi-annual scientific product show for vendors. The revenue provides funding for graduate student activities, classroom refreshments and a small amount left over to cover maintenance contracts on some of our aging research equipment on campus.

We also secure some funding from the Ministry of Health and Long Term Care that is specifically targeted in support of our Diploma Programs in Clinical Biochemistry and Clinical Microbiology. This level of funding is well below what our resident trainees receive and has not increased in many years, nor is it likely to increase based on the results of numerous discussions with the Ministry. Consequently, we have begun fundraising efforts to assist these trainees with some of their educational costs (e.g., on-line courses, attending conferences, etc.).

## 8. RESOURCES AND INFRASTRUCTURE

LMP faculty are located on campus and throughout our fully affiliated hospitals and research institutes, community affiliated hospitals and various government institutes and agencies (Ontario Cancer Institute, Ontario Agency for Health Protection and Promotion (Public Health Ontario), Ontario Forensic Pathology Service).

The Medical Sciences Building (MSB) is the administrative hub for LMP and where our 12 tenured/tenure stream faculty are located, occupying just over two-thirds of the 6th floor. Renovations to accommodate the move of the Chair and administrative offices from the Banting Institute to the MSB also included the addition of a large and mid-size conference room, two student rooms (equipped with 25 desks, IT connection and locked storage), and a kitchen/lunch room.

All other locations provide appropriate office and student/trainee space supported by central communications/IT support for the individuals who are based at those sites.

### Research Infrastructure

The Department has access to a vast array of state-of-the-art equipment and core facilities, located within individual laboratories, and in facilities located both on campus and in affiliated research institutes (on a fee-for-service or collaborative basis). A brief overview of research infrastructure that is available at the various sites is provided below.

#### Campus Based – MSB

Each investigator has a private office and assigned lab space. Two smaller interior labs accommodate overflow bench space and are assigned on an as needed basis. Specialized equipment rooms house microscopes and biohazard level 1 and 2 tissue culture. Additional equipment rooms house a variety of standard and highly specialized equipment.

Given that major funding organizations are no longer supporting equipment and maintenance grants, it has become a challenge for LMP to maintain and/or replace aging equipment or to acquire novel instrumentation once it is developed. Our remaining option is to apply to the Canada Foundation for Innovation (CFI) for this support. New investigators recruited to LMP have been quite successful in securing CFI funding to set up their labs.

Much of the routinely used communal equipment at the MSB is aging or inadequate and requires upgrading or replacement. These include heavily used centrifuges, autoclaves, ice machines, etc. The Department is looking for various streams of revenue to help support future maintenance contracts on common equipment as warranties expire. For example, LMP holds a successful scientific product show twice a year for which some of the proceeds are utilized for this purpose.

The MSB itself is nearing the end of its serviceable lifespan, with issues related to plumbing, electrical, asbestos abatement, etc. The Vice Dean, Research and International Relations, is leading an effort to renew basic science infrastructure in the Faculty of Medicine, with the goal of construction of a new building.

On site infrastructure (unless noted otherwise):

Equipment:

- Real-Time PCR (CFX 384) unit
- Confocal microscope optimized for three dimensional imaging of yeast genomes
- Microscopy: confocal, fluorescence, polscope
- Frogbio Gel Imager
- X-ray generator and diffractometer
- Mass spectrometry
- Laser Capture Microdissection and qRT-PCR – Marsden Lab at SMH

- Telemetry and BP measurement (Physiology)
- Hypoxia chamber

Core facilities:

- ChIP-Sequencing facility (Samuel Lunenfeld Research Institute of Mount Sinai Hospital)
- Mass Spectrometry (CCBR & Dept. of Molecular Genetics, SickKids)
- Fluorescence microscopy and imaging facilities
- Imaging Facility for Electron Microscopy
- Imaging Facility at Department of Cell and Systems Biology
- Advanced Optical Microscopy Facility – Toronto General Hospital
- Department of Comparative Medicine (mice)
- Mouse Histopathology Core - TCP Mount Sinai Hospital
- Transgenic Mouse Physiology Core – Mouse Ultrasound/Echocardiography – Lewar Centre
- DNA sequencing facility (MaRS – SickKids)
- Advanced Protein Technology Centre (SickKids)
- Structural Genomics Consortium X-ray diffraction facility (MaRS)
- Center for Microfluidic Systems –Advanced Imaging Center
- Flow cytometry facility, Faculty of Medicine
- Irradiator, FOM
- NMR, Fluorescence - Lash Miller core facility CD - 5th Floor MSB
- Fluorescent plate reader (Biochemistry)

### Campus-Based – Tanz Centre for Research in Neurodegenerative Disease (CRND)

<http://tanz.med.utoronto.ca/>

The current space occupied by the Tanz CRND is similar to the space that will become available following its move to the Krembil Discovery Tower (KDT) at Toronto Western Hospital in July, 2013.

Core facilities/services:

- Neuropathology / immunohistochemistry
- DNA sequencing
- Protein synthesis
- Mass spectrometry
- Microscopy
- Animal facilities (MSB/CCBR)
- Centrifuge room
- Radioactive room
- Prion room
- Lentivirus room
- Protein synthesis
- DNA molecular biology room
- Histology service

Equipment:

- Quadrupole/time-of-flight tandem mass spectrometer
- Confocal microscope
- Peptide synthesizer
- DNA sequencer
- Sample robot
- Biosafety Cabinet
- 2 CO<sub>2</sub> cell culture incubators

- Leica DMI 6000 inverted deconvolution microscope
- Eppendorf microinjection system
- Imaging workstation supported by Volocity Imaging Software
- Leica DM 6000 upright deconvolution microscope
- Imaging workstation supported by Volocity Imaging Software

Relocation to the KDT will provide additional access to services/facilities:

- Animal handling and procedural facility
- Animal behavioral suite facility
- Flow analyzer and FACS sorter facility
- Vector Core facility
- Wright Imaging facility
- Sterilization and glass washing services

A recent successful CFI application (together with CAMH and UHN) will further allow CRND to update mass spectrometry equipment and purchase a live cell imaging platform coinciding with the move to the KDT.

## The Hospital for Sick Children

### *The Hospital for Sick Children Research Institute*

[www.sickkids.ca/research/](http://www.sickkids.ca/research/)

Currently researchers are accommodated within 6 buildings. A new facility, the Centre for Research and Learning, will be completed in the summer of 2013. This 21 story state-of-the-art building is designed to facilitate collaborative research and will consolidate researchers and core facilities into one location.

Core Facilities:

- Genetic analysis (Centre for Applied Genomics)
- Proteomics (SPARC BioCenter)
- Clinical research (Physiological Research Unit)
- Biostatistics (Biostatistics, Design and Analysis Services)
- Bioinformatics (Centre for Computational Medicine)
- Flow cytometry facilities
- Laboratory animal services
- Microscopy and imaging facilities

### *Department of Paediatric Laboratory Medicine (DPLM)*

[www.sickkids.ca/PaediatricLaboratoryMedicine/index.html](http://www.sickkids.ca/PaediatricLaboratoryMedicine/index.html)

DPLM consists of five Divisions (Pathology, Microbiology, Haematopathology, Clinical Biochemistry and Molecular Genetics). In addition to research activity that occurs within each Division, DPLM provides technical services to researchers from the Research Institute and other units. For example, the Division of Pathology provides research support in:

- Histology (including special stains and histochemistry)
- Immunohistochemistry (including immunoperoxidase, immunofluorescence and in situ hybridization)
- Electron microscopy (including transmission and scanning electron microscopy, immunogold labeling, freeze fracture, tomographic studies and other advanced ultrastructural techniques)

## Mt. Sinai Hospital

### *Samuel Lunenfeld Research Institute (SLRI)*

[www.lunenfeld.ca/](http://www.lunenfeld.ca/)

#### Equipment:

- ABI Real Time PCR machine
- BD FACS array Bioanalyzer
- Floor Model Centrifuge and Ultracentrifuge
- Biomechanical Suite for Bone Research: Equipment includes Instron E10000, Instron E1000, Instron 8500, and Skyscan 1172 Micro CT
- Common Radiation Suites
- Core CMHD Bone Histology lab for undecalcified tissue- where tissue is cut and embedded in plastic (see below)
- Core Flow Cytometry facility (see below)
- Core Glass-washing, Sterilization and Media Prep facility
- Core High Content Screening Laboratory (see below)
- Core Microscope facility (see below)
- Core Mouse ES cell facility (see below)
- Core Viral Tissue culture facility
- Proteomics and Mass Spectrometry Core facility (see below)
- GE Typhoon FLA 9500 variable mode laser scanner
- Gel documentation systems
- Histology core facility (see below)
- iPS cell tissue culture facility
- Li core Odyssey IR Detection System for Western Blots
- Liquid Scintillation Counter
- Lyophilizer
- Millipore point of use lab water systems
- Perkin Elmer Wizard Gamma Counter
- Powder safe weighing station
- Sonicator
- Stacked shaking incubator
- Tissue culture facility with Biological safety cabinets, CO2 incubators, Microscopes
- UV Vis Spectrophotometer
- Viral Tissue culture facility with Biological safety cabinets, CO2 incubators, Microscopes

#### Core Services or Technology Centres:

- Biospecimen Repository and Processing Lab: Includes Tecan Evo Freedom 200 robotic workstations to process biospecimens, and isolate DNA or RNA from source samples, and a liquid nitrogen freezer storage facility
- Biobank: Established to support perinatal research programs by providing access to human tissue specimens and associated clinical data which are collected according to the highest technical and ethical standards
- Computing and Network Services: Maintains a fully staffed IT core with Computer help desk, High Performance Computing, IT network and 3000 sf Data Centre. Has over 100 servers in various support capacities, and 200 node cluster, with total storage of approximately 1PB
- Electrophysiology Suite: Includes 3 electrophysiology rigs with equipment to record from single cells or fields of cells in acute brain slices. One rig is used to record from *C. elegans* (neurons and muscle) and cultured neurons. A MEA2100 high-density electrophysiology unit that is based on microarray technology is on order

- ES Cell Core: Centralized facility for the handling and manipulation of mouse ES cells; located on the 4th floor 25 Orde St. The Core provides the users from institute laboratories with quality-controlled ES cells developed at SLRI as well as reagents necessary for the experiments
- Flow Cytometry Facilities: Equipped with a Beckman Coulter MoFlo Cell Sorter, a Beckman Coulter Gallios, and an Amnins ImageStream Mark II. Additional analyzers will be arriving soon
- High Content Analysis/Screening Facility: Includes two GE IN Cell Analyzer 6000 instruments for high performance laser confocal imaging high content assays and screens, an IN Cell Analyzer 1000, a Cellomics ArrayScan II, an Opera Evotec, and a Celigo S Imaging Cell Cytometer
- Histology Core: Includes Leica CV5030 Robotic Coverslipper, Leica AutoStainer XL Automated slide stainer, Thermo Scientific Excelsior ES Automated tissue processor, Thermo Shandon Histocentre3 Embedder, Leica RM 2255 Rotary Microtome, Leica CM3050 S Cryostat
- Microscopy and Imaging Core: Instrumentation includes: Leica inverted + dissecting histo-fluorescence, Olympus Optigrid-SIM histo-fluorescence, AP Deltavision Core Deconvolution, two Quorum Yokogawa Spinning Disk Confocal Microscopes, Nikon C1si Laser-scanning Confocal, SP2 Leica 2-Photon Confocal Laser Scanner, and a two photon laser ready ZEISS LSM 780 Point Scanning Microscope. In addition, there is a BX61 for Color photography with Visiopharm stereology/image analysis and Leica DMRXE for color slide reading
- Proteomics and Mass Spectrometry: Consists of a variety of mass spectrometers and separation systems used primarily to identify small amounts of proteins and their chemical modifications from complex biological samples. Equipment includes:
  - 2 ABSciex 4000QTRAP instruments, nano or capillary or micro LC-MS setup capability
  - 1 ABSciex 5500QTRAP with nano-LC-MS setup
  - 3 Thermo LTQ instruments with nano-LC-MS setup, and 1 with ETD
  - 3 Thermo Orbitrap instruments; 1 VelosPro, 1 Elite, 1 classic & all 3 nano-LC-MS setup
  - 3 ABSciex 5600 TripleTOF with nano-LC-MS setup
  - 1 Agilent 6550 QqTOF with nano chip-cube and micro LC-MS setup.
- Robotics and High Throughput Screening Facility: Assists in the development of chemical and cellular assays for a variety of high-throughput experiments using a range of advanced robotic and analysis instrumentation as well as chemical and RNAi libraries. The facility is undergoing upgrading but currently consists of a CRS Dimension Modular Automation Platform with 3m conveyor belt and a series of small robotic arms each of which connects the belt to a specific peripheral, including a Biomek FX liquid handler, washers, incubators, and readers, an Offline Biomek FX liquid handler, and a Sciclone inL10. A state-of-the-art Compound management system and integrated liquid handling and dispensing platform will soon be installed along with other integrated platforms for chemical and cellular assays.
- Toronto Centre for Phenogenomics (TCP): A state-of-the-art facility for the production, housing, and preclinical analysis of genetically altered mice
- The Centre for Modeling Human Disease (CMHD): Contains Mouse Phenotyping labs and screening tools for in-depth analysis of the major physiological systems in the mouse - Physiology, Blood screening, Neurobehavior analyses, Pathology and Histology services
- TCP Transgenic Core Facility: TG Core has pioneered innovative technologies to create genetically engineered model organisms

### *Department of Microbiology*

[www.mountsinai.on.ca/care/microbiology](http://www.mountsinai.on.ca/care/microbiology)

#### Core Facilities:

- Access to research space in the Department of Microbiology is provided for activities that support departmental programming and research, and includes dedicated freezer space, refrigerator space, and storage space. It houses three full-time research technologists and has the space to accommodate up to ~3 more as necessary to meet project needs. Space beyond that is shared with the clinical lab and can be tight – it is mostly used in the summer months doing methods evaluation projects. The clinical lab is very

accommodating and research personnel will often work later hours to work around using shared equipment and bench space.

- There is space for a single research technologist; this limits the nature of studies that can be performed, and does not permit the unit to accept summer or graduate students interested in projects with a laboratory component.

## Public Health Ontario Labs

[www.oahpp.ca/services/public-health-laboratories.html](http://www.oahpp.ca/services/public-health-laboratories.html)

The creation of Public Health Ontario has reinvigorated the research enterprise of provincial reference laboratories. Research laboratories at Public Health Ontario Laboratories (PHOL) Toronto are equipped with state-of-the-art instruments for genomics and gene expression analysis, in addition to certified facilities for culture, characterization and analysis of human pathogens of public health interest. The research organization is staffed with technicians, molecular specialists, and clinical/medical microbiologists. BioSafety Level-3 laboratory space and dedicated Bioinformatics Support Facilities are available.

Technologies on site include:

- Conventional and real time PCR and other in-vitro nucleic acid amplification methods
- Nucleic acid extraction robotics
- High throughput standard and capillary nucleic acid electrophoresis
- Sequencing technologies are state-of-the-art and include equipment with ABI sequencing capacity, as well as next-generation platforms with Illumina, Roche and Ion Torrent technologies
- Light and fluorescence microscopy and other imaging technologies

## St. Michael's Hospital

*Keenan Research Centre and the Li Ka Shing Knowledge Institute*

[www.stmichaelshospital.com/research/index.php](http://www.stmichaelshospital.com/research/index.php); [www.stmichaelshospital.com/knowledgeinstitute/research.php](http://www.stmichaelshospital.com/knowledgeinstitute/research.php)

The Li Ka Shing Knowledge Institute was completed in 2011. The Keenan Research Centre resides within the Institute.

Core Facilities:

- Support a wide variety of physiological, cellular and molecular biological techniques as well as providing shared access to regularly maintained state of the art equipment
- Common Floor Facilities include: cell culture facilities, analytical laboratories, radioisotope rooms, biohazard rooms, cold rooms, glasswashing, temperature controlled room, emergency freezer storage, liquid nitrogen dispensing
- Unique RCF Facilities include: flow cytometry, gel imaging, dark room, molecular biology/pathology room, virus lab, histology lab, bacterial lab

Research Bioimaging Centre:

- Includes a diverse selection of both cutting edge and traditional equipment to do a variety of different experiments and analysis. Includes imaging expertise and advice and training new users
- Widefield upright and inverted microscopes with epifluorescence and updated CCD cameras
- Confocal microscopes
- Fully motorized live cell system with stage-top incubators for long-term recordings, using Definite Focus to keep objects in focus. Excitation uses a combination of filter cubes and LED filter combinations and a structured illumination module removes some blurring
- Computer workstations are available for post-processing data, offering, in addition to the standard Photoshop and Image J programs, a deconvolution package (Autoquant), filamentous 3D reconstruction



(NeuroLucida), colocalization coefficient measurements and a state-of-the-art 3D rendering and measurement package (Imaris from Bitplane)

Research Vivarium:

- 22,000 sq feet multi-user facility that includes animal housing facilities for mice, rats, guinea pigs, rabbits, dogs, pigs and zebrafish. These animals are housed in conventional as well as in specialized housing (e.g., immune compromised, biohazardous, and specific pathogen free (SPF))
- Includes: procedural and examination rooms, necropsy facilities and a fully equipped suite of five operating rooms

Specialty Services:

- Zebrafish Centre for Advanced Drug Discovery and Molecular Pathology

Specialist Equipment:

- Distinct intravital microscopy suites, thromboelastography, aggregometry and perfusion chamber infrastructure
- Time-sensitive upstream functions (platelet preparations, blood products, cell labeling, etc.) requires unique equipment

## Sunnybrook Health Sciences Centre

### *Sunnybrook Research Institute (SRI)*

<http://sunnybrook.ca/research/>

Core Facilities:

- MRI systems (1.5T, 3T and the 7T Bruker animal scanner). Includes focused ultrasound (FUS) transducers adapted for small animal work and human clinical trials
- Two-photon fluorescence microscope and an Olympus FluoView FV1000MPE multiphoton microscope, upgraded in 2012, with two Titanium-sapphire lasers for simultaneous imaging and photostimulation and optimized for near-infrared wavelength imaging. Deconvolution system with apotome on a Zeiss Axiovert 200 and an LSM 510 confocal image system on a Zeiss Axiovert 100. (The LSM 510 confocal microscope, although it is acceptable to capture images, it is outdated and very slow requiring a substantial amount of time to acquire images, which are of sub-optimal quality, especially in the z-axis. SRI is looking into the possibility of upgrading this confocal microscope to a LSM700 in a near future.)
- Bitplane's core scientific software module IMARIS that allows data visualization, analysis, segmentation and interpretation of 3D and 4D microscopy datasets
- Antibody facility
- Centre for Cytometry and Scanning Microscopy
- Histology Laboratory
- Molecular Genetics
- Proteomics
- Research Computing
- Statistical Consulting
- Transgenic & Gene Targeting Facility

SRI Genomics Core Facility:

- Genome sequencing: SOLiD 5500xl system
- Targeted sequencing: Ion Personal Genome Machine system
- Quantitation, Quality, Sizing: BioAnalyzer 2100
- Gene Expression: StepOne Plus
- Fluorescence based quantitation: Qubit

SRI received new CFI funding to build a \$160 million dollar Centre for Research in Image-Guided Therapeutics, and including the Neurointervention Centre for the development of methods for treating dementia, such as Alzheimer's disease (AD).

At present, vivarium space for large and small animals is under pressure for vivaria, particularly surgical and behavioral suites specialized for specific research projects. SRI management is receptive to working toward improving the space for the mouse vivarium and related behavioral studies.

### *Department of Pathology*

<http://sunnybrook.ca/content/?page=dept-labs-apat>

Equipment:

- Histology: Rapid Tissue Processors; Routine Tissue Processors; Microtomes; Embedding Units; H&E Stainers (including oven, 3 staining modules, coverslipper); Automated special stainer
- Immunohistochemistry: IHC Stainers; Microwave processor (FISH)
- Surgical Pathology: Cassette Labellers; Cryostat
- Cytology: Coverslipper – Cytology; Thinprep; SurePath; Cytospin

### *Department of Microbiology*

<http://sunnybrook.ca/content/?page=dept-labs-microb-home>

Comparative Medicine:

- Biohazard suites: Two suites are operational in the sub-basement of SRI. They consist of 4 rooms each (2 antechambers and 2 animal rooms), an autoclave, one or two biosafety cabinet(s), and ventilated racks for mouse housing. All animal work is done in one of these two suites.
- Softwall containment unit: This HEPA-filtered softwall enclosure houses the Caron 6030 environmental chamber and biosafety cabinet located in the innermost biohazard suite room. The purpose is provide an extra level of protection during transmission experiments.
- Caron 6030 Environmental Chamber: This chamber provides the requirements for a controlled environment with respect to percent relative humidity and temperature. Animals are housed in this chamber during transmission experiments.
- Other: Bead homogenizer, dissection materials, bead sterilizer

Wet Lab:

- Incubators: 2 CO<sub>2</sub> tissue culture and one bacterial/egg incubator
- Real time PCR system
- Coriolis µ: Air sampling unit for virus detection (infectious bioaerosols work); used in clinical setting and shortly with animals
- Centrifuges: Microcentrifuge, Multipurpose centrifuge, High speed centrifuge
- Microplate reader
- Nanodrop
- Conventional PCR, Western blotting, pipettes, etc.

Clinical Microbiology Lab:

- Clinical samples/isolates/information

### *Molecular Diagnostics*

<http://sunnybrook.ca/content/?page=dept-labs-moleserv>

- Extraction: EZ1Advanced XL DNA extractor; MagNa Pure LC DNA extractor; QIAgility robot
- Gel Analysis: AlphaImager
- PCR: Thermal cycle MJ PTC 200; GeneAmp 9700 PCR system; Thermal cycler 9600; cobas 4800
- Sequencing: PRISM Gene analyzer 3100; 3500 Sequencer
- Plate Reader: CytoFlour 4000

- Resplex: LiquiChip
- Other: NanoDrop spectrophotometer

## University Health Network (UHN)

[www.uhnres.utoronto.ca/institutes/](http://www.uhnres.utoronto.ca/institutes/)

Resources and Core Facilities:

- Applied Molecular Profiling Laboratory (AMPL)—see below
- The UHN Advanced Optical Microscopy Facility (AOMF)
- Clinical Genetics Centre (CGC)
- UHN Biobank
- Center for Molecular Design and Preformulations (CMDP)
- Guided Therapeutics Program (GTx)
- Microarray Centre
- OCI/PMH/CFIBCR Flow Cytometry Facility
- UHN Pathology Research Program (PRP) Laboratory—see below
- Philip S. Orsino Cell Therapy Facility
- Real-Time PCR Common Equipment
- RITT Industrial BioDevelopment Laboratory
- Structural Proteomics in Toronto
- STTARR (Spatio-Temporal Targeting and Amplification of Radiation Response Innovation Centre) (Core I, Cellular; Core II, Preclinical; Core III, Clinical; Core IV, Image Analysis and Registration)
- TMDT Flow Cytometry Facility
- Wright Cell Imaging Facility
- Specialized dark room for light sensitive fish
- Radioisotope room

### *UHN – Applied Molecular Profiling Laboratory (AMPL)*

[www.uhnres.utoronto.ca/programs/AMPL/](http://www.uhnres.utoronto.ca/programs/AMPL/)

AMPL is an integrated centre with core technologies in Cytomics, Genomics and Pharmacokinetics for the molecular profiling of tumour samples and tumour response in clinical and preclinical studies.

The Centre offers consultation on biomarkers to develop research programs and clinical study protocols. It processes specimens for clinical trials conducted by Princess Margaret Hospital (PMH) investigators, the PMH Drug Development Program (DDP), the National Cancer Institute of Canada Clinical Trials Group (NCIC-CTG), and industry sponsored projects. It also provides a continuum of quality control procedures starting from specimen collection, preparation and analysis. Services include:

Cytomics:

- ELISA
- Tissue preparation, tissue microarray construction, immunolabelling
- Multispectral image capture for immuno-histochemistry/-fluorescence & analysis
- R&D flow cytometry, single-cell signal activation analysis

Genomics:

- FISH
- Gene mutations & single nucleotide polymorphisms (sequencing, multi-plex mutation analysis, real-time-qPCR, next generation sequencing)

Pharmacokinetics:

- HPLC analysis of blood and tissue samples

Usage arrangements (collaboration vs user fee):

- Fee-for-service – customizable work process
- Consultation for study design
- Method development & optimization
- Sample collection & preparation
- Assay, data interpretation & presentation
- Training
- Collaborative projects are limited based on current R&D directions of AMPL

### *UHN - Pathology Research Program (PRP) Laboratory*

[www.uhntrainees.ca/index.php/item/uhn-pathology-research-program-prp-laboratory.html?category\\_id=4](http://www.uhntrainees.ca/index.php/item/uhn-pathology-research-program-prp-laboratory.html?category_id=4)

The PRP Laboratory is a research laboratory of the Pathology Department at UHN offering consultative and technical services to researchers and clinical trials investigators for histological, immunohistochemistry and FISH cytogenetics investigations. Testing can be performed on human tissues for clinical trial investigations, as well as human or animal model research projects. Testing services are customizable to client need, but follow standard practices designed to ensure quality of outcome. Expertise & Services include:

Histology:

- Handling of tissues, cultured cells, cell suspension and smear preparations
- Fixation of tissue/cell preparations
- Processing tissues to paraffin or frozen blocks
- Sectioning paraffin and frozen blocks to create slide preparations for staining
- Special Stains and immunohistochemistry studies on all slide preparations
- Paraffin and frozen sectioning for DNA/RNA extraction using DNase/RNase free methods
- Preparation, sectioning and staining of tissue microarrays

Immunohistochemistry:

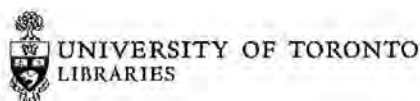
- Antibody optimization
- Single and multiple marker labelling using both chromogenic and fluorescence techniques

FISH cytogenetic studies:

- Fluorescence in-situ hybridization for various cytogenetic abnormalities

## 9. ACADEMIC SERVICES

### Library Report



#### University of Toronto Libraries Report for Laboratory Medicine and Pathobiology, Faculty of Arts and Science, 2013

**Context:** The University of Toronto Library (UTL) system is the largest academic library in Canada and is currently ranked fourth among academic research libraries in North America, behind Harvard, Yale and Columbia.<sup>1</sup> The research and special collections, together with the undergraduate libraries comprise almost 11.5 million print volumes, nearly 5.5 million microform volumes, more than 17,000 journal subscriptions, in addition to a rich collection of manuscripts, films, and cartographic materials. The system also provides access to approximately 900,000 electronic resources in various forms including e-books, e-journals, and online indices and increasingly supports access via personal handheld devices.<sup>2</sup> There are numerous collection strengths in a wide range of disciplines reflecting the breadth of research and instructional programs at the University. The strong collections, facilities and staff expertise attract unique donations of books and manuscripts from around the world, which in turn draw scholars for research and graduate work.

Major North American Research Libraries <sup>3</sup>					
	1998-1999	2006-07	2007-08	2008-09	2009-10
ARL RANK	UNIVERSITY	UNIVERSITY	UNIVERSITY	UNIVERSITY	UNIVERSITY
1	Harvard	Harvard	Harvard	Harvard	Harvard
2	Yale	Yale	Yale	Yale	Yale
3	Stanford	Columbia	Toronto (3rd)	Columbia	Toronto (3rd)
4	Toronto (4th)	Toronto (4th)	Columbia	Toronto (4th)	Columbia
5	California, Berkeley	California, Berkeley	California, Berkeley	Michigan	Michigan

Top 5 Canadian Universities in the ARL Ranking of Major North American Research Libraries					
	1998-1999	2006-07	2007-08	2008-09	2009-10
RANK/ UNIVERSITY	RANK/ UNIVERSITY	RANK/ UNIVERSITY	RANK/ UNIVERSITY	RANK/ UNIVERSITY	RANK/ UNIVERSITY
4/ Toronto	4/ Toronto	3/ Toronto	4/ Toronto	3/ Toronto	
30/ Alberta	19/ Alberta	12/ Alberta	16/ Alberta	11/ Alberta	
31/ British Columbia	25/ British Columbia	25/ British Columbia	26/ British Columbia	24/ British Columbia	
57/ McGill	33/ Montreal	26/ McGill	34/ Montreal	31/ Montreal	
76/ York	36/ McGill	33/ Montreal	40/ McGill	37/ McGill	

**Space and Access Services:** The Library system provides a variety of individual and group study spaces for both undergraduates and graduates in the 10 central and 23 divisional libraries on the St. George, Mississauga, Scarborough and Downsview campuses. Study space and computer facilities are available twenty four hours, five days per week at one location, Robarts Library. Web-based services and electronic materials are accessible at all times from campus or remote locations, through the U of T based Scholars Portal and other leading edge digital services.

<sup>1</sup> Chronicle of Higher Education, "Library Investment Index at University Research Libraries, 2009 – 2010." In the Almanac of Higher Education, 2012.

<sup>2</sup> Figures as of 2010 taken from UTL's "What's new in E-Resources" page <http://main.library.utoronto.ca/eir/EIRwhatsnew.cfm> and UTL's annual statistics <http://discover.library.utoronto.ca/general-information/about-the-library/annual-statistics>

<sup>3</sup> Association of Research Libraries Statistics.



**Instruction & Research Support:** The Library plays an important role in the linking of teaching and research in the University. To this end, information literacy instruction is offered to assist in meeting Laboratory Medicine and Pathobiology degree level expectations in the ability to gather, evaluate and interpret information. These services are aligned with the Association of College and Research Libraries (ACRL) Information Literacy Competency Standards for Higher Education.<sup>4</sup>

**Program Specific Instruction:** Instruction occurs at a variety of levels for Laboratory Medicine and Pathobiology students and is provided by the faculty liaison librarian for Laboratory Medicine and Pathobiology. The Gerstein Science Information Centre facilitates formal instruction integrated into the class schedule and hands-on tutorials related to course assignments when requested. Librarians at the Gerstein Science Information Centre provided one-to-one consultations with graduate students who are conducting literature, scoping and systematic reviews for their theses. The Library, through its liaison librarians, customizes feeds of library resources. These appear prominently in Portal/Blackboard course pages. Examples of research guides in Biochemistry Molecular Biology are available at: <http://resource.library.utoronto.ca/a-z/subject.cfm?subject=14> and <http://link.library.utoronto.ca/MyUTL/guides/Index.cfm?guide=envhealth>.

**Collections:** All college and campus libraries collect materials in support of Laboratory Medicine and Pathobiology; the largest collection of materials is centrally located in the Gerstein Science Information Centre. Collections are purchased in all formats to meet the variety of preferences and styles of our current students and faculty. The University of Toronto Library is committed to collecting both print and electronic materials in support of Laboratory Medicine and Pathobiology at the University of Toronto.

**Journals:** The Library subscribes to 23 of the top 25 journals listed in Journal Citation Reports (JCR)<sup>5</sup> in subject area Pathology. Of these titles, all are available electronically to staff and students of the University. We have access to Expert Review of Molecular Diagnostics with a one-year embargo and the Library is investigating the possibility of a subscription to current content. The Library does not currently have access to the *International Journal of Immunopathology and Pharmacology* and will also pursue an online subscription to this journal. In addition, the Library subscribes to all 25 of the top 25 journals (by total cites) listed in Journal Citation Reports (JCR)<sup>6</sup> in the subject area of Microbiology for 2011 and 25 of the top 25 journals listed in the subject area Biochemistry and Molecular Biology. Of these titles, all 25 are available electronically to staff and students of the University.

**Monographs:** The University of Toronto Library maintains comprehensive book approval plans with 53 book dealers and vendors worldwide. These plans ensure that the Library receives academic monographs from publishers all over the world in an efficient manner. For Laboratory Medicine and Pathobiology, monographs are purchased in electronic form where possible. The Library currently receives all current e-books directly from the following publishers: Springer, Elsevier, Wiley, Informa and Books@Ovid.

**Preservation, Digitization, and Open Access:** The University of Toronto Library supports open access to scholarly communication through its institutional research repository (known as T-Space), its open journal and open conference services, and subscriptions to open access publications. In addition to acquiring materials, the Library is also, in cooperation with the Internet Archive, digitizing its monograph holdings published before 1923. These books are available without charge to anyone with access to the Internet through the Scholar's Portal e-Book platform.

<sup>4</sup> Association of College & Research Libraries. *Information Literacy Standards*. ACRL, 2006.

<sup>5</sup> 2008 Journal Citation Reports® (Thomson Reuters, 2009)

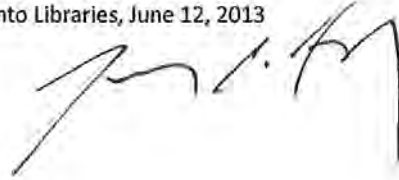
<sup>6</sup> 2011 Journal Citation Reports® (Thomson Reuters, 2012)

**Key Databases:** Medline/Ovid, OMIM, PubMed, SciFinder Scholar, Scopus, Web of Science

**Special Collection Highlight:** To support program commitments in Laboratory Medicine and Pathobiology, the Library purchases and subscribes to a variety of protocols and methods resources. (e.g. <http://guides.library.utoronto.ca/protocols?hs=a>)

Prepared by: Gail Nichol, Selector for Life and Health Sciences, January 28, 2013

Submitted by: Larry Alford, Chief Librarian, University of Toronto Libraries, June 12, 2013



## Student/Learner Support Services



### FACULTY OF MEDICINE | Student/Learner Support Services

<http://www.facmed.utoronto.ca/programs/studentsupport.htm>

*A range of support services delivered through various offices are available to learners at the Faculty of Medicine. They include the following:*

#### UNDERGRADUATE MEDICAL PROGRAMS

**(OHPSA) Office of Health Professions Student Affairs (<http://www.ohpsa.utoronto.ca/>)**

The University of Toronto Office of Health Professions Student Affairs (OHPSA) supports students enrolled in the Faculty of Medicine, from the Doctor of Medicine, MD/PhD, Medical Radiation Sciences, Physician Assistant and Occupational Therapy programs. The OHPSA has a multi-faceted range of programs that improve the quality of educational experience provided to students beyond the classroom. The major staff positions within the OHPSA and their roles include an Associate Dean Health Professions Student Affairs, Personal Counselor/Psychotherapist, Personal Counselor/Psychotherapist, Career Counselor, Learning Skills Counselor, and Senior Officer, Service Learning. The OHPSA offers counseling and student advising in Career Counseling, Personal and Wellness Counseling, and Learning Skills Counseling.

**Financial Assistance (<http://www.md.utoronto.ca/financialaid.htm>)**

The Student Financial Services Office administers non-repayable grant funding through the Faculty of Medicine Grant Program, the Faculty of Medicine MD Admission Bursaries, and the Enhanced Bursary Program. More than seventy percent of the students currently enrolled in the MD program receive some type of non-repayable assistance.

Other services provided by this office include personal meetings with every incoming year-1 student to discuss the costs of medical education, budgeting and funding strategies, and any questions or concerns the student might have. Support is provided to run workshops for preclerkship students on the topic of How Money Works. The workshops proved very successful, and led to the creation of an online series available to all medical students across Canada.

#### LIFE SCIENCES AND GRADUATE EDUCATION

**Graduate Student Funding (<http://www.facmed.utoronto.ca/programs/GLSE/awards.htm>)**

In the Faculty of Medicine graduate programs offer doctoral-stream students support packages at or above the University of Toronto minimum. Graduate student support packages are derived from multiple sources including University of Toronto Fellowships, departmental and affiliated hospital/research institute internal awards (i.e., OSOTF awards) and student stipends from supervisor's operating grant. In addition, students apply for major external competitive studentship awards including, but not limited to, CIHR, NSERC, OGS, and independent foundations.

For additional information see the division of Student Life Programs and Services on the St. George Campus <http://www.studentlife.utoronto.ca> and the Office of Student Services, School of Graduate Studies <http://www.sgs.utoronto.ca/informationfor/students.htm>.



For Life Sciences Undergraduate Students, see Services and Programs for Students, Faculty of Arts & Science <http://www.artsci.utoronto.ca/current/advising/services>.

## POSTGRADUATE MEDICAL EDUCATION

### Resident Wellness (<http://www.pgme.utoronto.ca/content/resident-wellness>)

The Office of Resident Wellness was established to help support the well-being of the University of Toronto's Postgraduate Medical Education trainees and to offer assistance to those encountering difficulties during training. One of the roles of the Office of Resident Wellness is to help residents develop the skills needed to maintain their own wellness as a resident and as a practicing physician. The Office includes a Director of Resident Wellness, Wellness Advisor/Counselor, and an administrative assistant.

### DISCOVERY COMMONS (<http://dc.med.utoronto.ca/content/services-students>)

The Discovery Commons is the Faculty of Medicine's information technology support unit, providing services to students, faculty, and staff. The following are services geared towards the specific needs of MD, PA program, doctoral-stream graduate and professional master's students.

- Audio Visual including lecture capture, videoconferencing, audience response system support (iClickers and Turning Point)
- Application Support including Learning Portal (Bb), Portal Information & Help, UTORid, UTORid information for students, T-Res, MedSIS, GradSIS, EEE, UGME Electives
- Facilities such as drop-in student computer labs, bookable computer labs/electronic classrooms
- On-demand computing support

## ST. GEORGE CAMPUS | Student Life Programs and Services

<http://www.studentlife.utoronto.ca/>

All students at the University of Toronto have access to a range of services and co-curricular educational opportunities that complement the formal curriculum. Delivered centrally through Student Life and other offices, these services and programs support, engage and challenge students to reach their full potential as learners, leaders, and citizens.

Students have access to comprehensive physical and mental health care on campus including a medical clinic, travel medicine services, immunization, contraception, and sexual health education. Counselling and treatment options for psychological and emotional concerns include psychotherapy, group therapy and pharmacotherapy, as well as specialized assault counseling services.

Housing needs, including off-campus housing listings and resources for students living independently, are met through the Student Housing Service.

Coaching and education in the development of key learning skills – from time management to overcoming exam anxiety

– is provided through the Academic Success Centre. The ASC also partners with faculty to integrate success strategies and support into the curriculum.

Students' career exploration and employment services are provided through a Career Centre offering resume and interview coaching, workshops, career resources, on and off-campus employment and volunteer listings, job shadowing, and career counseling.

Specialized services are provided for international students (orientation, advising, cross-cultural counselling),

students with disabilities (academic accommodations, advising), students with children or other family responsibilities (advising, resources, subsidized child care), aboriginal students (academic support, financial counselling) and lesbian, gay, bisexual, and transgender students (counselling, referrals).

Participation in campus life and experiential learning are facilitated through Hart House (clubs, committees, events), the Centre for Community Partnerships (service learning), the Multifaith Centre (interfaith dialogue, events), and the Office of Student Life (leadership development, orientation, recognition and support for student groups, activities.) Sport and recreational facilities and programs are provided to all students through both Hart House and the Faculty of Physical Education and Health.

## **SCHOOL OF GRADUATE STUDIES | Student Services**

<http://www.sgs.utoronto.ca/informationfor/students.htm>

All graduate students at the University of Toronto have access to registrarial services and co-curricular programs at the School of Graduate Studies that assist students in meeting their academic goals.

Administrative staff at the School of Graduate Studies (SGS) provides registrarial services to graduate students including, but not limited, to recruitment, admission, orientation, registration, fees, program progress, awards/financial assistance, and graduation.

The Grad Room is an accessible space on the St. George campus which provides University of Toronto graduate students with a lounge area and a multi-purpose space for academic, social and professional graduate student programming.

Grad Room is home to the Graduate Professional Skills Program (GPS). GPS is a non-academic program presented by SGS consisting of a variety of offerings that provide doctoral stream students a range of opportunities for professional skills development. The program focuses on skills beyond those conventionally learned within a disciplinary program, skills that may be critical to success in the wide range of careers that graduates enter, both within and outside academe. GPS aims to help students communicate effectively, plan and manage their time, be entrepreneurial, understand and apply ethical practices, and work effectively in teams and as leaders.

The Office of English Language and Writing Support (ELWS) provides graduate students with advanced training in academic writing and speaking. By emphasizing professional development rather than remediation, ELWS helps students cultivate the ability to diagnose and address the weaknesses in their oral and written work. ELWS offers four types of instruction designed to target the needs of both native and non-native speakers of English: non-credit courses, single-session workshops, individual writing consultations, and website resources.

## 10. INTERNAL AND EXTERNAL RELATIONSHIPS

LMP places considerable emphasis in establishing and nurturing relationships and partnerships in support of advancing our academic mission. LMP utilizes a pragmatic approach, consisting of both strategic (i.e., planned and targeted) and opportunistic (i.e., availability of personnel/ resources) mechanisms as circumstances dictate. Whether done from a strategic or an opportunistic perspective, the overarching goal is for desired outcomes to be achieved by robust processes.

LMP enjoys strong and vibrant relationships with U of T-affiliated hospitals and research institutes, and bodies such as the Ontario Forensic Pathology Service and Public Health Ontario. With faculty who are well placed in these settings (along with a strong contingent of campus-based faculty), LMP presence supports delivery of high quality education in all domains of laboratory medicine and pathology, and conducting research into the causes and mechanisms of disease. One major advance is that a diverse spectrum of learners (e.g., residents, fellows, graduate students, summer students) now have education and/ or research opportunities at the Ontario Public Health Labs, which until recently were considered “service only” and of limited access for students and trainees. With the expansion of the Faculty of Medicine to the Mississauga campus, LMP has developed new relationships with community-affiliated sites (Trillium-Credit Valley; Lakeridge) and strengthened existing relationships (St. Joseph’s; North York General Hospital; Toronto East General Hospital) and recruitment of part-time clinical faculty engaged in undergraduate and postgraduate medical education.

The hospital Chiefs, Vice Presidents and CEOs clearly recognize and support the importance of the academic mandate to their institutional priorities and thereby are key advocates to LMP. This support is considered tantamount to ensuring that limited resources are used wisely. As a recent example of hospital-LMP partnership, the creation of a new Area of Focused Competence (AFC) in Cytopathology involves the cooperation of hospitals vis-a-vis remuneration, space, etc. for trainees, while LMP contributes administrative support and interacting with the Royal College of Physicians and Surgeons of Canada. In addition, the creation of a template for Material Transfer Agreements (MTAs) between the hospitals and the University for the LMP Digital Laboratory Medicine Library initiative is a new direction for increasing both the level of engagement and level of commitment of institutions to work together for laudable goals. As indicated in the Research Report, LMP has partnered with hospital-based research centres and institutes for faculty recruitment and start-up, and recently has shown tangible success in a new Canada Research Chair Tier 2 award for an Assistant Professor in the Heart and Stroke Richard Lewar Centre at UHN – Toronto General Hospital.

Within the Faculty of Medicine, a number of LMP faculty have cross-appointments in other units, and vice versa. Chairs work together in support of enhancing the student experience, and through such mechanisms as the harmonized student stipend, the focus has shifted from inter-departmental competition to one of addressing needs aimed at enhancing overall quality and performance. In addition, LMP participates in several graduate studies collaborative programs and offerings hosted by extra-departmental units (“EDUs”), which provide students with thematic, inter-disciplinary education that leverages individual department strengths. Moreover, several LMP faculty have appointments and/or collaborations with other faculties (e.g., Faculty of Applied Science & Engineering) and schools (e.g., Dalla Lana School of Public Health). Relations between LMP and the Decanal Team are strong and are characterized by a solutions oriented approach. Recent examples include: navigating details of faculty appointments related to international recruitment; having post-PhD trainees in Clinical Chemistry and Clinical Microbiology register with the Office of Postgraduate Medical Education (PGME) to be eligible to access hospital information systems, health care records, etc.; working with the Vice Dean, CEPD to champion MTAs between hospitals and the university related to the LMP Digital Laboratory Medicine Library initiative. New interactions have been occurring with the Advancement Office of the Faculty of Medicine, and identification of promising fundraising initiatives is underway.

In addition to a multitude of research collaborations between LMP faculty and investigators located at other institutions (see Research Report), LMP has various relationships with other universities, including an agreement with McMaster University by which Toronto hospitals host electives for postgraduate trainees in McMaster’s residency training program in Medical Biochemistry. This arrangement was brokered by PGME and was deemed a

practical, effective way to enhance the training experience of residents in a very small specialty and, importantly, avoid duplication of administrative effort and allocation of resources for two universities (McMaster, Toronto) located ~70 km apart.

LMP Faculty are also involved in forging effective relationships with foreign governments and international agencies. Dr. Allison McGeer recently travelled to Saudi Arabia to provide expert consultation and advice to the government on the new coronavirus that is affecting their population. Dr. Michael Pollanen frequently travels to disaster-affected areas to provide Forensic Pathology consultation and assessment for, or on behalf of, such agencies as the International Committee for the Red Cross, INTERPOL, UNDP, CIDA and the Canadian Department of Foreign Affairs and International Trade.

LMP provides financial and/ or in-kind support of numerous lectures, symposia and other educational activities at the hospitals and the University that are relevant to the department's mandate. Examples include: named lectureships and symposia at hospital sites; symposia organized by the Centre for Forensic Science and the Toronto Centre for Phenogenomics that are offered on campus; residents' review course of the Canadian Association of Pathologists.

Importantly, LMP Student unions (CLAMPS and LMPSU) make key contributions to the success of departmental programs and student experience and the LMP leadership values having robust relationships with these groups. In addition to supporting social and academic activities outlined elsewhere in this self-study, LMP values the feedback and suggestions from students and trainees to continuously improve the quality of student life in the department.

In summary, whether done from a strategic or opportunistic perspective, LMP looks both internally and externally for relationships that promote continuous improvement and enrichment.

## 11. FUTURE DIRECTIONS

LMP is in a mature phase of its existence, having long completed the merger process and having built a common identity that is articulated by the simple yet compelling tagline: “Investigating Disease. Impacting Health.” The last five years have been devoted to strengthening our activities for operational excellence and program excellence, aiming to become an increasingly anticipatory unit. Numerous actions have increased operational and program excellence, for example: moving administrative support to the Medical Sciences Building from the Banting Institute; recruitment of exceptionally talented faculty and staff who are well placed to succeed in our large and complex system; revising curricula in our educational offerings to remain contemporary and relevant for attracting outstanding students and trainees; building our collegium through the introduction of cross-cutting research themes that span the continuum from discovery through to translation and clinical implementation. The major updating of the LMP website and enhancing mechanisms of communication have resulted in increasing the extent of engagement throughout the department. As recommended by the previous review, we have made choices designed to capitalize on our strengths and aim to add value through actions that can simultaneously benefit multiple constituencies. In addition to traditional outcomes such as career paths of graduates of our programs, or publications and citations, LMP faculty, students and trainees have had impact and been recognized in citizenship activities as manifested by achievements in social responsibility and professionalism. Overall, the reward and recognition achieved by LMP (with one index being success in obtaining competitive awards) is impressive and in a number of instances indicates that LMP “punches above its weight.”

One area of future emphasis for LMP is ensuring our graduates are well positioned to pursue a variety of career options. This can be achieved by ensuring students and trainees acquire solid fundamentals, master critical thinking and communication skills, and complete degree/program requirements within reasonable time. Coupled with solid fundamentals is the necessity for sufficient flexibility in curricula and training programs to have customized experiences suitable for particular career possibilities. Having a high level of engagement from students and trainees can help to shape the ongoing evolution of our departmental programmatic offerings, and promote a virtuous cycle of continuing to attract the best and brightest to LMP.

In contrast to the stringent accreditation standards and resources that are involved in undergraduate or postgraduate medical education, the structure for CEPD is comparatively less well defined, yet CEPD is the area which in actuality spans the vast majority of one’s professional career (i.e., on the order of decades, as compared to a few years for either undergraduate or postgraduate education). Recent announcements by the College of Physicians and Surgeons of Ontario to implement a system by which physician competence is investigated on a periodic basis (“every physician assessed every 10 years”) provide an important impetus for LMP to strengthen both the activity and the rigor of CEPD. In the previous cyclical review, it was noted that the continuing education offerings of LMP were modest and in a traditional format. Having committed to developing a cadre of faculty educators whose career trajectories for promotion are education-intensive, LMP is poised to enter a new phase of enhanced CEPD that is characterized by greater interactive learning, greater use of digital and electronic media, and collaborating with other units that innovate in this domain. LMP has a critical mass of creative and technically savvy faculty who have the potential to make major contributions to CEPD. Building the infrastructure needed to support innovation in education (e.g., LMP Digital Laboratory Medicine Library) is time-consuming and with increased clarity of the relationship of hospitals and the university in educational support, the goal is to achieve robust structures and relationships to enable accelerated future growth and development.

Concerning the research agenda, the goal is for LMP to be well prepared to successfully compete for new types of funding initiatives and support. This is an area in which strong collaborations and connectivity can help to position the department for success. The 2012 Annual Report of the Office of the Vice-President, Research & Innovation of the University of Toronto alludes to various strategies for “Leveraging Our Unique Strengths and Charting New Territory”, ranging from improved mechanisms of communicating research opportunities (e.g., searchable funding opportunity databases) to global research partnerships, where numerous memorandums of understanding are in place or in development. Importantly, the training of highly qualified personnel is considered mission-critical, and LMP must strive to continue to attract and develop exceptional individuals for a variety of career options. Given

the incredible creativity that exists within LMP, innovative approaches will need to be developed and implemented such that progress is enabled, not hindered.

Similar to other departments within the Faculty of Medicine, LMP has experienced considerable growing pains with the implementation of WebCV. Issues related to functionality, data quality, ability to transfer information to other CV formats (e.g., Common CV used by CIHR), formatting of reports, etc. have arisen during implementation. LMP will support faculty and administrative personnel to optimize the current situation, for example, in the context of use of WebCV for academic promotion. An overarching departmental goal is to have a robust CV-based system for a database of reliable information for use in analytics and reporting. As improvements and enhancements become available, LMP will act to operationalize them in a timely and effective manner.

LMP has engaged with the Advancement Office of the Faculty of Medicine, and several fundraising initiatives are underway. Given the reality of external revenues becoming increasingly important to departmental operations, advancement will assume a more prominent role as LMP moves forward. Enhanced alumni engagement will be a priority as LMP continues on its journey to, as expressed in the 2007 cyclical review, "...build financial resources to the 'top tier level'..." and a key enabling mechanism will be to offer superior, continuously improving programs of recognized excellence and impact.

There are a number of challenges, either current or on the horizon, facing LMP. Concerning faculty, there are challenges to replacing tenured faculty who retire, owing to continuous pressures on base departmental funding. To date, LMP has been fortunate to have talented faculty who are able to successfully compete for external awards (e.g., Canada Research Chairs; Investigator Awards) that contribute salary/ operating support and overall allow greater flexibility for the department to undertake projects and strategic initiatives such as the LMP Digital Laboratory Medicine Library. Within research institutes, there is the scenario in which well-funded and productive scientists are "at risk" for not being retained, owing to profound strategic decisions that are made at the institute level. (Of note, in the Canadian system, in contrast to the NIH, faculty salaries cannot be included within budgets for operating grants.) Within hospitals, there are recruitment challenges in niche areas that reflect overall tendencies to increasing sub-specialization. Moreover, alignment of hospital goals with those of the university (e.g., protected time for teaching, research and academic service such as committee membership, all of which can affect academic promotion) face increasing pressures in the climate of budgetary constraints, particularly as related to addressing government deficits. Faculty located at community affiliated sites will assume an increasingly key role in undergraduate and postgraduate medical education. Tools like the Clinical Faculty Job Activity Profiles provide clarification of performance expectations and a mechanism for accountability and justification of institutional support. Research space in the Medical Sciences Building is close to reaching the end of its serviceable life, and a plan for basic science renewal in the Faculty of Medicine is a key priority of the Vice Dean, Research and International Relations. LMP will continue to be highly engaged and aligned with the Faculty of Medicine and the University of Toronto, and we will work with our partners to achieve outcomes for which all can be proud.

## 12. REPORT OF FACULTY MEMBERS

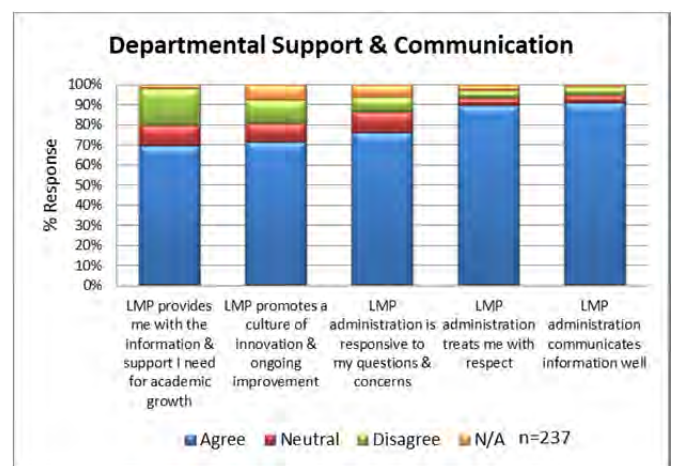
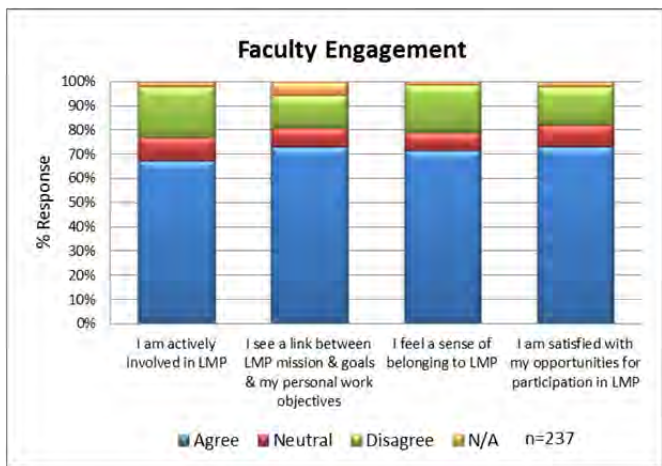
### Introduction

As part of the departmental review of the first term (2009-2013) of the Chair, Dr Richard Hegele, a faculty survey was sent to all faculty of the Department of Laboratory Medicine and Pathobiology (LMP) in order to gain an understanding of their perspectives on aspects of departmental engagement, communication, support for research, graduate and undergraduate education, and creative professional activities, as well as the effectiveness of the Chair. The survey was created by a committee of faculty members representative of all areas of the department. The responses were anonymous but linked to individual’s university affiliation, e.g. scientist on campus.

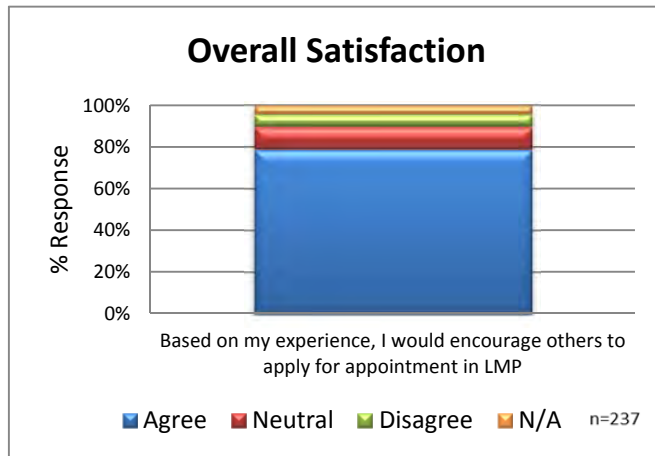
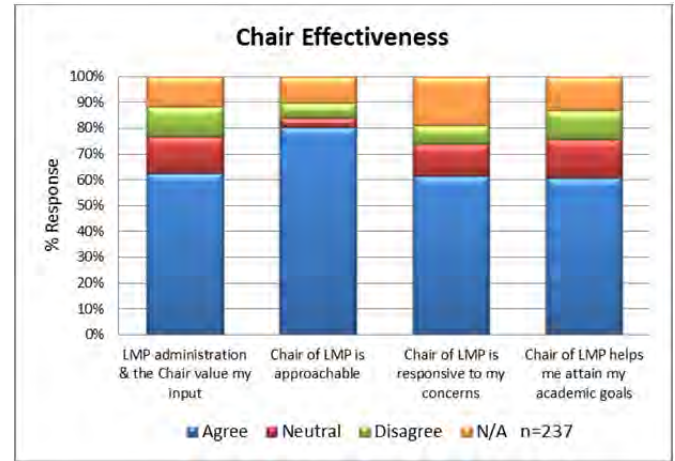
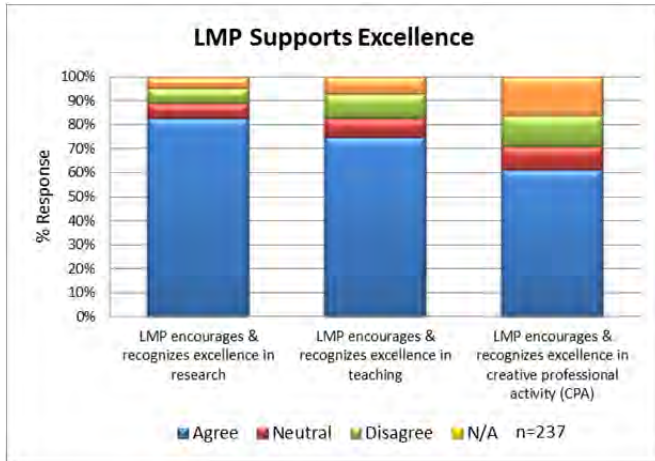
### The Survey

The survey consisted of 17 statements which required the faculty to select a position ranging from “Agree Strongly” to “Disagree Strongly”. Also included were the categories of “Not applicable” and “Don’t know” responses. In addition there were three statements for staff to provide short answers and a final “Comments” section to allow staff to make any statements they wished. The results were collated and reviewed by the committee and forms the basis of this report.

The LMP faculty consists of 16 scientists on campus, 46 scientists off campus, 21 clinical laboratory scientists which are hospital based, and 202 clinicians which are either full time or part time at the hospitals or have an adjunct appointment. There are 8 adjunct appointments. Staff are located at the campus, hospitals, and research institutes affiliated with the associated teaching hospitals. Of 293 faculty polled, 237 responses (81%) were received. The participation from the different groups varied from 62 to 98%. 147 of these completed surveys also contained personal comments in the final section. The responses to the 17 statements are shown below. To display the data in an informative manner, we have grouped the statements into 5 broad categories: 1) faculty engagement; 2) departmental support and communication; 3) LMP supports excellence (support for research, education and creative professional activity); 4) Chair effectiveness; and 5) Overall satisfaction as indicated by the statement “Based on my experience, I would encourage others to apply for appointment in LMP”.







There was an 81% response to the survey which is remarkable and indicates a faculty that is engaged and reads department communication. Overall the responses were very positive as the majority of respondents (median 73%; range from 61 to 91%) replied in the affirmative to the statements. Of note the percent responses were similar between clinicians and researchers and there did not seem to be one group that was particularly discontent. This is a remarkable accomplishment given the diversity of the department.

The survey clearly demonstrated that the faculty are engaged in the department activities, that they receive appropriate communication and support

from the administration, and that there is support for excellence in research, education and creative professional activities. They also indicated that the Chair is an effective and supportive leader. A number of the comments provided to the statement “Please list the strengths of the department” mention Dr. Hegele as one of them. Comments such as “good leadership”, “very appreciative of Dr. Hegele for his leadership in steering LMP in the right direction” or “excellent leadership provided by the Chair- highly responsive to staff and students and exceptional service by the administration” were not uncommon (>10% of comments). Of note more than 25% of the respondents commented on the diversity of our department and the potential for interdisciplinary collaboration as a major strength of LMP.

In regards to the request to list the areas where LMP could improve several common themes in the responses were noted. One was the need for funds for a) start-up for new recruits and b) seed money for small projects. At present, this is beyond the control of the Chair and actually is a University wide issue, which may be something that LMP leadership could champion. Another theme was the request for mandatory involvement of the Chair on search committees for new staff to ensure that academics will be maintained at the hospital level. Another comment was the need for better branding and marketing of LMP accomplishments. Some faculty actually listed this as a future direction e.g. “to market the achievements of the faculty through popular media”. Several individuals commented on the fact that they felt disconnected from the University and of note these were from clinicians. Integration of clinicians into a research intensive department is a challenge faced by many clinical departments.

The faculty were asked to list the top priorities for the next 5 years. These can be summarized as: 1) LMP should encourage and support research; 2) LMP should develop a plan that will focus on maintaining academics in the



hospitals in face of the increasing clinical demands and fiscal constraints, and 3) preparation of faculty and trainees for the future technological advances in lab medicine.

## Summary

1. While there is no ideal method to assess the collective outlook of a departmental faculty in a comprehensive manner, the committee thought that a survey had the greatest potential to be most reflective. The ability for faculty to add in comments also allowed for issues not included in the survey to be mentioned. The survey statements covered a variety of important areas relevant to LMP.
2. There was an 81% response rate to the survey from the faculty. This is a remarkable result in this era of survey burn-out, and supported the sense obtained from reviewing the comments of the respondents, of an engaged faculty.
3. The majority of the faculty were satisfied with the activities of the Chair and the Department and felt part of LMP. The faculty are very diverse in expertise, activities and location and yet there was no group that identified itself as more disadvantaged or unhappy supporting the cohesiveness of the staff. In fact many respondents took the opportunity to mention that they saw this diversity as one of the strengths of the department.
4. The faculty seems well aware of the department's strengths and accomplishments and wants LMP leadership to publicize these more broadly.

Clearly this is an engaged department with a desire to celebrate our strengths and to continue to strive for improvements as 79% of the respondents would encourage others to apply for an appointment in LMP.

## 13. REPORT OF STUDENTS

### Undergraduate Student Pathobiology Specialist Program Report

#### Methodology

All data collection was performed by executives of the Laboratory Medicine and Pathobiology Student Union (“LMPSU”) as per the request of the department, and information was collected in two ways: first, students were given links to an online Google form containing questions pertinent to the department of Laboratory Medicine and Pathobiology (referred to as “Pathobiology” henceforth), with all responses graded on a five-point scale – five being “strongly agree”, and one being “strongly disagree”; data collection was concluded on February 14th, 2013. Second, two evening sessions were held on February 12th and February 13th, 2013, where students were invited to come and participate in two-hour discussions regarding their general opinion of the department and to provide their input about areas for improvement.

Second-year participants were eliminated from consideration, as there are currently no second-year Pathobiology courses available. Results were averaged across all students after codifying survey responses, then subjected to pairwise-t-test comparisons between third-and-fourth year students to evaluate differences between groups. A Chi-square test was used to determine if whether students would recommend the Pathobiology specialist program independent of their year of study. All tests were run at a significance level of 0.05. Statistical analyses were internally performed in the statistical programming language, R, version 2.15.

Comments from the two evening sessions were unavailable as no students arrived for either session; this is likely due to the period in which sessions were arranged, as a variety of mid-term and assignment due-dates were concurrent with the meeting organized dates and times.

#### Results

From the online survey, students were asked to consider the following aspects of the department: interest in Pathobiology courses, quality of instruction in Pathobiology courses, communication by instructors in Pathobiology courses (with respect to answering student questions), program difficulty, program capability in preparing students for post-graduate careers, notifications for potential scholarships, international/out-of-province opportunities or extracurricular activities, and departmental attention to personal needs. Students were also asked if they would recommend the program to other undergraduate students at the University of Toronto and to make any comments they felt were not addressed in the previous questions. In total, 25 respondents completed the survey.

Averaged across all subjects, Pathobiology students generally reported that they had higher interest in courses offered by the department compared to others available on campus; similarly, students reported that they believed the department had suitably prepared them to enter their post-graduate career of choice, although fourth-year students were more likely to say there was better support than third-year students (Student’s t-test, p-value = 0.037). This correlates with subject responses of receiving above-average notifications about scholarship and research opportunities, although many felt that information regarding international experiences or extracurricular events was on par with other departments and that the department’s attention to their personal needs was average.

When asked to compare the quality of instruction between lecturers in the Pathobiology department against other courses, subjects reported that instructors from the department were generally of the same quality as other lecturers in different courses. However, fourth-year and third-year students responded in a significantly different manner: fourth-year students generally felt that Pathobiology instructors were of better quality and attended to student questions well, while third-year students felt the opposite, claiming that Pathobiology lecturers were worse and did not particularly stand out with respect to answering student questions (Student’s t-test, p-value = 0.0011 for instruction quality; p-value = 0.018 for answering student questions). Despite this difference, all Pathobiology students reported that they felt the program was of greater difficulty compared to other programs of study at the University of Toronto.

In general, 71% of our sample stated they would recommend the Pathobiology specialist program to other students at the University of Toronto. Whether or not a subject recommended the program was found to be independent of their year of study.

## Discussion

Although most of the data show that a majority of Pathobiology specialist students have a largely positive view of the program, we would like to address the categories in which third- and fourth-year students were found to differ in their opinion of particular categories.

Of interest is the significant difference between third- and fourth-year Pathobiology students with respect to instructor quality and communication. Some third-years who responded to the survey provided final comments that suggested they were unhappy with the fact that many of the third year Pathobiology courses were taught by multiple guest lecturers, and that it resulted in disjunctive themes to the course; no fourth years made a similar comment. There is the possibility that fourth year students, having accommodated to courses with multiple guest lecturers, were less adverse to their implementation and thus more likely to respond positively. However, as our survey did not ask students whether or not they preferred multiple guest lecturers, we are unable to make any recommendations or assertions based on this data alone.

In addition, we acknowledge that there is an element of bias among the third-year responses, as it was later discovered that a recent Pathobiology third-year course (LMP365) midterm had occurred. We believe that the difficulty of that midterm, which was quoted multiple times in comments made by third-year students, confounded our findings and resulted in bias in their responses.

## Conclusion

Students of the Pathobiology specialist program largely feel that the department is of better quality when compared to others at the University of Toronto, and that the design of the program gives them the exposure they require in order to pursue their post-graduate careers. Undergraduates about to graduate have positive reflections of the course, and are suitably impressed by the level of teaching given by the department; however, third-year students, who are undergoing their first exposure to this system, feel otherwise, although there may be a confounding element in the form of a recent examination.

Report of Students in the Pathobiology Specialist program, conducted by LMPSU and prepared by LMPSU President Desmond She.

## Graduate Student Report

On behalf of the graduate student body in LMP, we are delighted to share our perspective of the graduate student experience in the Department of Laboratory Medicine and Pathobiology. This report was prepared by nine students from representative groups within the program. To collect students' opinions, we consulted the entire student body through an online survey (36 responses from 154 students) and a Town Hall meeting (attended by ~20 students).

Graduate students at LMP are very happy with their overall experience. We believe the Department offers great diversity of research opportunities and coursework that creates an exceptional learning experience.

Most students agreed that their research experience in LMP created opportunities for future training, such as post-doctoral fellowships, and business or research related employment. Some students felt they would benefit from more exposure to industry-related job opportunities (e.g. seminars, panel presentations).

Overall, students are extremely pleased with the administrative support and guidance they receive from the LMP Department. The Graduate Coordinator (Dr. Harry Elsholtz) is very helpful, approachable, fair, knowledgeable and professional. He mentors students and provides valuable insight on many issues important to graduate students (supervisor and advisory committee rapport, scientific research and future career directions). He also makes significant efforts to resolve issues on behalf of students. The Graduate Administrators are friendly, readily available and prompt in their response to student inquires. As well, the addition of a Web and Communications Coordinator has resulted in a rejuvenated website, and the introduction of a tagline which has helped to unify the Department.

The department of LMP does an excellent job of offering students internal scholarships, travel awards and reminders to apply for Faculty and University-wide funding opportunities. Students are content with their guaranteed stipend that is harmonized with other departments within the Faculty of Medicine, and the top-up bonus stipend offered when meriting a prestigious scholarship. We appreciate the guaranteed research stipends because they provide the financial security necessary for us to focus primarily on research.

Overall students find their PI's approachable, knowledgeable, and professional. Most students believe their PI provides appropriate feedback and support when writing papers or manuscripts. With regard to Advisory Committees, students would like to have written feedback from committee members, including ideas that may not have been discussed during the meeting.

Courses in LMP span a wide variety of research areas to accommodate for the breadth of research that takes place in this department. Most agreed that the amount of coursework in the program is appropriate to enable us to focus on our thesis research. Students agreed that some of the courses offered in LMP were very helpful for their current and future research, and that LMP had some excellent course instructors. Some felt that because cancer and neoplasia are such major themes in LMP, courses in these areas could be offered every year (not alternate years).

The weekly student seminars, LMP 1001Y: Graduate Seminars in Laboratory Medicine and Pathobiology, are mandatory for all LMP graduate students. The seminar course has been changing over the last two years, and these changes have been well-received. The course syllabus has been updated, presentation guidelines were made clearer, and we have included the addition of student moderators in the class, which has been an excellent opportunity for students to practice introducing a seminar speaker. Some students would prefer to have 2-hour sessions and meet on alternating weeks, rather than 1-hour every week, in order to allow more opportunity for lengthy experimental work during the week. Students would also like to see a gradient for the attendance requirements: 100% for first-year students, with a decline to 70% for the senior students (e.g. PhD year 4+). The inclusion of student moderators is a great addition to the seminar series, but students would also like to see the course coordinators more actively engage the student members of the audience. As part of the course structure, five student reviewers are nominated each week; however, we feel that all students could submit a review (e.g. electronically/online) of each presenter each week, in order to improve student engagement. Lastly, we feel that

allowing second year PhD students a choice between presenting an “Introduction to their field” or “Lab meeting style” talks will add variety and improve the learning experience in this course for graduate students at every year of their program.

The Departmental Seminar Series: LMP hosts national and international researchers to discuss their exciting research programs with LMP faculty and graduate students once a week (held after the student seminar, LMP1001Y). Graduate students generally find these seminars insightful, as they highlight world class research both within and outside their immediate field of study, particularly when the diversity of research within the Department is represented.

The core course, LMP 1404H: Molecular & Cellular Mechanisms of Disease, is designed to expose students to a wide variety of research topics and to demonstrate the diversity of LMP research. While students believe that exposure to other fields of research helps them to appreciate and understand research as a whole much better, the majority of students believe that assignments and papers are far too detailed/dense for individuals at such an early stage in their academic career. Shorter papers aimed at a broad audience (i.e. Nature publications) are more appropriate. Evaluation is based on an oral presentation and several written assignments including a mock grant proposal. While students feel that the grant proposal itself is a useful exercise, they feel it would be more beneficial to write on a topic relevant to their own research field.

The department is at the fore-front of biomedical research, and makes considerable effort to prepare, train and mentor its students to ensure their future success. The Department recognizes that some students wish to explore careers outside of academia, and has brought in invited speakers to discuss their transition to jobs outside academia. However, students would like to see more of this career-oriented mentality throughout the graduate student experience.

The **Confederation of Laboratory Medicine and Pathobiology Students (CLAMPS)** is a democratically elected body of LMP students who volunteer to create an environment that cultivates student participation and interest in classes and activities within the department. The Department has done a wonderful job supporting and guiding CLAMPS initiatives, particularly the Graduate Coordinator and Graduate Administrators.

CLAMPS organizes and executes the annual LMP Graduate Student Research Day (GSRD). On March 12, 2013 we held the 16<sup>th</sup> annual GSRD. Overall, students enjoy the event, and we have received positive feedback on changes made over the past few years, namely: the inclusion of upper year PhD students and post-doctoral fellows as poster judges, and the re-introduction of a plenary speaker. Students would like more feedback from the judges about their poster/presentation. In addition, students would like to see more poster prizes, either monetary or honorary.

CLAMPS also organizes academic seminars and invited speakers for students, social events for faculty and students, and has setup a peer mentorship program. Overall, LMP students enjoy CLAMPS events; however some students feel that a lack of cohesiveness of various labs/hospitals affiliated with our department is the cause of lower than expected levels of attendance of various events. We are aware that our Department’s diversity is both a strength and potential challenge with regard to Departmental cohesion. One possible approach is to host a coffee and cookies event every two weeks at a different research location to help students and faculty become familiar with various labs and strengthen department unity, as has been seen in some other departments.

Prepared by:

PhD students: Evgenia Bloch, Alex Falkenhagen, Sarah Higgins, Casandra Mangroo & Stephen McCarthy.

MSc students: Mena Abdel-Nour, Carlyn Figueiredo & Danielle Weber-Adrian.

## Postgraduate Trainee Report

The laboratory medicine program at the University of Toronto, Department of Laboratory Medicine and Pathobiology (LMP) is one of the largest and most versatile residency programs in North America, with more than forty residents currently enrolled only in the Anatomical Pathology stream. The program encompasses several training sites within Toronto including the University Health Network, Mount Sinai Hospital, St. Michael's Hospital, Sunnybrook Hospital, the Hospital for Sick Children, the Forensic Pathology Unit at the Office of the Chief Coroner, and several university-affiliated community hospitals in the greater Toronto area. At the end of the residency program, residents generally feel well prepared to enter into fellowships or jobs. Below are specific strengths and weakness for various aspects of the program. These were collected through contacting all trainees in anatomical pathology, general pathology, microbiology, and transfusion medicine programs via email and several in person.

### Training Sites

#### Strengths:

- A relatively high number of training sites, each with unique areas of expertise
- Various practice styles preparing residents for both general practice and sub-specialized mode of practice
- Many staff pathologists are world-known in their field
- The adequate support provided by the pathologist assistants and the admin staff maximizes the learning experience

#### Areas of Concern:

- As the anatomical pathology residency training program has been expanding the last several years, a number of concerns have started to rise:
  - Residents are concerned that the training may be compromised because the number of residents per rotation may increase. This is especially in rotations with inherently low volume of cases such as autopsy. This was more of an issue at the early stages of program expansion. As the residency training committee became more aware of the situation, a few changes have been made including confining the number of matched residents to a manageable number, limiting the number of residents per rotation (e.g. up to 2 for autopsy rotation), and opening opportunities at other sites (e.g. residents spend part of their autopsy rotation at the Forensic Unit beside the hospital, PGY3 going to community sites).
  - The number of off-service residents required to do pathology has been increasing contributing to the lower availability of seating
  - Because of program expansion and seating limitations, and as interest in pathology is increasing among medical students, the number of seating available for elective medical students is limited

### Quality of Material

#### Strengths:

- The program offers excellent and diverse variety of material that covers various aspects of pathology from the common to the extremely rare entities in appropriate volume
- None identified

### Teaching

#### Strengths:

- Excellent formal and non-formal teaching
- Formal teaching
  - Weekly program-wide academic half-days with a series of 3-hour didactic lectures, designed to cover the majority of fields of pathology
  - PGY2 school to introduce new residents to the principles of pathology
- Informal teaching
  - Continuous daily teaching with high resident to pathologist ratio (range 1:1 to 2:1)

- Continuous feedback including formal verbal and online evaluation in a timely and thorough fashion
- A variety of specialty and non-specialty rounds, different at different sites
- Continuous Evaluation and feedback:
  - All residents have to take a semi-annual in-house practice examination to monitor their progress through residency, and to evaluate their level among their peers
  - The program provided support for senior residents to evaluate their level in an international examination (Resident In-Service Examination - RISE). This exam is taken by all residents in the United States, in some Canadian universities and in other international institutions
- The program provides an extraordinary support for residents to attend lectures, seminars, and workshops

**Areas of Concern:**

- The half-day lectures frequently lack the interactive component. It is suggested that there would be more interaction between the presenter and the residents
- The level of the in-house exam may sometimes be beyond the level of the royal college exam, depending on the site running it. It is suggested that the general guidelines for this exam be unified across different sites.

## CanMEDS rules

**Strengths:**

- The program emphasizes the importance of CanMEDS rules through structured and non-structured manner:
  - Structured:
    - Providing pre-recorded CanMEDS Enrichment Lectures. These lectures are specific to laboratory medicine, and cover a variety of important real life situations
    - Introduction of CanMEDS journaling for residents to regularly reflect on various rules on their daily practice, and ways to enhance them
  - Non-structured:
    - Emphasis by pathologists on a daily basis
    - As the program director meets with each resident annually, he reviews the application of CanMEDS rules on the residents' daily practice, giving that aspect a significance equivalent to that of the clinical and academic performance of residents

## Research

**Strengths:**

- Highly encouraged throughout the program
- Abundant opportunities for clinical, translational and basic science research in various sites
- Support and encouragement for residents pursuing the clinician-investigator stream at various levels including the program director and the department chair
- Introduction of a research elective (as a half-day per week) for residents to run a research project
- Support to attend national and international conferences
- The LMP Residents and Fellows Research Day: continues to be an annual event that trainees look forward to present their research. The number of presentations and awards has expanded. The quality of the keynote speeches has been chosen to reflect important and timely topics.

## Program structure

**Strengths:**

- The program is well-structured to adapt residents of various interests while ensuring competency in all aspects
- Ample elective time

- Innovation and adaptability: The field of pathology is evolving, and the program has been evolving in a parallel fashion to adapt to these changes. Here are specific examples:
  - As molecular pathology becomes an important aspect of daily pathology practice, the rotation has been expanded from one month to three months, and including three different training sites)
  - Introduction of PGY2 school (see above)
  - Introduction of CanMEDS enrichment courses and journaling (see above)
  - Development of a longitudinal microbiology seminar (one hour per week, primarily resident led)
- Interpersonal Relations
  - Program Director: very approachable, understanding and supportive
  - Department Chair: very approachable and supportive, looks into innovation in the program and curriculum
  - Residency Training Committee: includes chief residents and a junior member, with a representative from all training sites, including community hospitals; respond promptly to the residents' suggestions and concerns
  - Shared half-days (medical microbiology program and infectious diseases program) helps maintain acumen and develop working relationships with our ID colleagues
  - Pathologist assistants and support staff: friendly, approachable, helps relieve stress
  - Relationship among residents: exemplarily collegial and professional

**Areas of Concern:**

- As the anatomical pathology residency program has been expanding, in addition to the expansion of fellowship programs and off-service residents, scheduling rotations has become difficult, and switching rotations has become more strict

We hope this review of the residents' point of view on the program covers all aspects you are interested in.

Sincerely,

The University of Toronto Laboratory Medicine Residents

(Compiled by Ghassan Allo, PGY4 and Chief Resident - Anatomical Pathology)



## 14. OTHER REPORTS

### Response to Recommendations Made in the 2006/07 External Review

- a. Leadership.** The reviewers recommended that Dr. Gotlieb be considered for re-appointment for a third term, and the Dean indicated that circumstances were appropriate for appointment of a new Chair. Concerning the “Chair-Chief” model, this was considered by the reviewers to be challenging given the “...balkanization inherent in the current federated...structure.” When Professor Hegele was recruited, he began as Chair and only after being in this role for over 2 years was it considered suitable for him to move into a “Chair-Chief” role, with operational oversight at the Hospital for Sick Children.
- b. Governance.** The reviewers suggested that Hospital Chiefs be considered for a “Vice Chair” or “Associate Chair” as a means to reinforce “...their sense of authority and responsibility for the academic mandates of the Department.” Based on subsequent conversations between the new Chair and Hospital CEOs, it was clear that the major Toronto hospitals consider their academic mandate to be prime importance, and the Chiefs were already highly engaged in this area.
- c. Finances.** It was noted that “[t]he Department has a number of small endowments.” and that “...the Department itself covers only 2.8% of the salaries of its hospital-based faculty” such that “...maintaining and enhancing relationships with the hospitals is essential to optimize faculty recruitment, retention, and career advancement.” LMP has established a relationship with the Advancement Office of the Faculty of Medicine to work on fund-raising initiatives. At the University of Toronto, the Clinical Faculty Policy has been in place for approximately 8 years, and this has resulted in understanding of the roles of responsibilities of hospital-based faculty to the academic mission through academic job descriptions signed off between the faculty member, hospital Chief and LMP Chair.
- d. Research Directions.** LMP was challenged to define a research agenda in translational research. As a result of the strategic planning exercise conducted in 2009-10, four areas were identified as relevant areas of emphasis for LMP: biomarkers, biobanking, quality and informatics.
- e. Educational Activities.** The reviewers were in general pleased with this aspect of departmental performance. We continue to innovate and revise offerings in each of our programs to sustain excellence. Going forward, CEPD will be an area of increased emphasis.
- f. Clinical Service.** The reviewers correctly identified trends in community laboratory outreach and potential impact on the academic mission. We have experienced exceptional outcomes in new faculty recruitment and clarification of roles through academic job descriptions as they relate to the Clinical Faculty Policy.
- g. Vision.** The days of merger, and associated concerns about “not losing ground” and “circling the wagons” are over. An updated LMP Strategic Plan will be a priority coming out of the current external review.
- h. Administration.** Operational excellence was identified as one of five key strategic priorities in the LMP Strategic Plan 2010-2015.

## Specific Commentary Regarding LMP

### 1. Size, scope, quality, priority and appropriateness of undergraduate arts and science education.

The Specialist Program continues to attract high quality applicants and produce impressive outcomes. Broader faculty involvement has been achieved.

### 2. Size, scope, quality, priority and appropriateness of undergraduate medical education.

Appointment of a new LMP Director of Undergraduate Medical Education, Dr. Eleanor Latta, has resulted in the creation of a new second year integrated course, “Mechanisms, Manifestations, and Management of Disease”, which has culminated in Dr. Latta receiving a 2013 WT Aikins Prize for curriculum innovation. Efforts in the later years, e.g., involvement in the Transition to Residency program, are increasing the LMP presence throughout the undergraduate medical curriculum.

### 3. Size, scope, quality, priority and appropriateness of graduate, post-graduate and continuing education.

Graduate. Conflict resolution mechanisms are clearer and more robust than was the case in 2007; new funding opportunities for foreign students are available (e.g., Trillium Awards); tracking of alumni is increasing with new departmental administrative personnel. LMP has attracted MD-PhD students. The student union, CLAMPS, is highly engaged and effective.

Post-graduate. The Molecular Pathology rotation has been increased to 3 months in length, and includes emerging areas such as informatics. Funding of fellowship positions continues to be a challenge: one anticipated outcome of Toronto Central LHIN Laboratory Collaborative discussions was to redirect some cost savings into stable fellowship funding. This was not achieved. The Department is now working with the Advancement Office of the Faculty of Medicine to enhance fellowship support through fundraising.

Continuing Education. The major investment has been to align LMP with revamped CEPD in the Faculty of Medicine. This has been accomplished and LMP is poised to make new strides and achieve greater impact in continuing education, enabled by new mechanisms such as the LMP Digital Laboratory Medicine Library.

### 4. Size, scope, quality, priority and appropriateness of research activities.

Graduate studies. The LMP graduate studies program continues to attract high quality students and “punches above its weight” in terms of frequency of success in competitive awards, etc.

Opportunities for recruitment of young investigators. Over the last 5 years, LMP has recruited talented young faculty, three of whom are new Canada Research Chair recipients. High profile biobank recruit, Professor Michael Roehrl, has increased impact in this important aspect of the LMP translational research emphasis. The recruitment of Professor John Bartlett as Director of Transformational Pathology at the Ontario Institute for Cancer Research brings added internationally renowned expertise to LMP.

Collaborative research endeavours. Interaction between campus-based and hospital-based faculty have led to highly successful outcomes. For example, Professors Girardin and Streutker collaborated on an animal study that was published in Nature Medicine in 2011.

Funding. As evidenced elsewhere in this self-study report, LMP continues to do well in a highly competitive, chronically difficult federal funding climate and has shown resilience and adaptability in seeking “non-traditional” sources of operating funds.

**5. Scope and nature of the Department's relationship with cognate departments in the Faculty of Medicine.**

Cognate chairs encouraged LMP to “grab the reins” with respect to translational research. This has been approached by defining four areas of emphasis in the LMP Strategic Plan: biomarkers, biobanking, quality and informatics. There was concern by cognate chairs that expansion of outreach (e.g., molecular diagnostics) into the community might draw some pathologists away from their academic mission. Dr. Andrew Evans and his work in telepathology is an example of faculty outreach activities that have resulted in academic output and creative professional activity of considerable impact.

**6. Appropriateness and effectiveness of the departmental structure.**

The overall departmental structure in 2007 was deemed by the external reviewers as “workable.” Since then, some of the activities of the Director of Education have been decanted into the creation of new leadership roles in the Department, i.e., Directors of Undergraduate Medical Education, Postgraduate Education, and CEPD. Regarding management of departmental resource allocation, the new budget model that has since been implemented at the University of Toronto has had impact on the appropriateness of allocation.

**7. Departmental vision and long-range plan.**

The LMP Strategic Plan 2010-2015 was a direct result of this recommendation from the external review of 2007. Progress on implementation of the strategic plan is provided below.

**8. Morale of faculty and students.**

As judged by the faculty survey and student reports included in this self-study, morale is considered to be overall very good

**9. Management, vision and leadership challenges in the next five years.**

LMP has undertaken planning exercises as recommended by the reviewers. The Executive Committee (“CCEC”) is a key component to ongoing monitoring and evaluation of departmental activities and priorities. Enhanced communications efforts, e.g., the launching of a revamped website, are made with the intent to increase departmental visibility.

**10. Stature of the department, compared nationally and internationally.**

The external reviewers commented that the department is “comparable to the upper-tier” despite modest fiscal resources under the control of the Chair. The collective resources available in the Toronto system enable the department to achieve high levels of performance. As shown elsewhere in this self-study, individuals in LMP have assumed, and continue to assume, prominent leadership positions and are frequently recognized through notable awards and prizes.

**11. Perspectives on Academic Pathology.**

The reviewers reflected on emerging trends in academic pathology, including: patient-specific therapies; precision diagnostics and interventional therapeutics; telepathology; large data sets; next-generation diagnostics; therapeutics and clinical trials; advances in medical imaging; and a “growing armamentarium” of biologics. Through outstanding recruitment and access to superior infrastructure and resources, LMP is well positioned to excel in many of these areas: at the end of the day, it is the ability for talented, hardworking and deeply engaged people to be able to thrive in an enriched intellectual environment, and ensure there are robust mechanisms for growth, development and adaptation, that will ensure a bright future.

## Update on the Progress of the LMP Strategic Plan 2010-2015

Please find below an update on progress of the LMP Strategic Plan 2010-2015, as of May 31, 2013:

### Strategic Priority 1: Education

Goals	Implementation Strategies	Progress
<b>LMP Undergraduate Education (Pathobiology Specialist Program, Faculty of Arts and Science)</b>		
Continue to attract bright, motivated students	Promote the program via diverse modes of communication, including robust engagement with LMPSU	Ongoing involvement and leadership with LMPSU; revamped LMP website.
	Leverage enrollment opportunities while maintaining standard of quality and excellence	More aggressive efforts in student recruitment, using current students and alumni as “ambassadors.”
<b>LMP Undergraduate Medical Education</b>		
Develop and updated plan for education in pathology and laboratory medicine	In coordination with the Office of the Vice –Dean, Undergraduate Medical Education, develop LMP approach to “longitudinal learning” over the 4-year curriculum	Implementation of integrated “Mechanisms, Manifestations and Management of Disease” course in the second year: WT Aikins Prize winner. Working with clerkship leadership to incorporate practice lab medicine/pathology longitudinal learning opportunities in upper years (e.g., Transition to Residency).
<b>LMP Graduate Education: MSc/PhD</b>		
Introduce a “Foundations of Research” Curriculum	Develop description and outline, developed in conjunction with available opportunities at FOM and UofT; format can be adjusted to meet desired needs and outcomes, and working with CLAMPS	Revamped LMP1404 curriculum to include topics on scientific presentation skills, literature and grant review, etc.
Promote recruitment of graduate students into LMP	Adjust enrollment to reflect faculty recruitment and faculty development	Student success stories to promote recruitment. Aggressive efforts to nominate students for competitive awards (e.g., Vanier, Trillium).
<b>LMP Postgraduate Education: Residents</b>		
Introduce a “Foundations of LMP” Curriculum	Establish a working group to identify best practices; define themes and areas to be covered, faculty and metrics to evaluate	Progress made with Royal College to support this concept. Development in LMP to accelerate with a postgraduate retreat for 2013.
Enhance training in CanMEDS roles	Create a CanMEDS domains working group to identify areas to be addressed and coordinate activities ensuring comprehensive residents training	Implementation of an online CanMEDS enhancement course in LMP. Establishment of a new resident award (Dr. Stanley Raphael Award for Professionalism).

Goals	Implementation Strategies	Progress
<b>LMP Postgraduate Education: Fellows</b>		
Enhance structure and accountability in Clinical Fellowships	Establish LMP Clinical Fellowships Committee with appointment of a Director and representation from Academic Health Science Centres	Clinical Fellowship Director appointed (Dr. Golnar Rasty). LMP Fellowship Committee functioning within Faculty of Medicine; written standards established for granting U of T certificate to LMP clinical fellows.; evolution of Committee activity to AFCs.
	Operationalize the Post-Graduate Medical Education Task Force's Report ("Raising the Bar")	Completed
Enhance experience of PDFs	Clarify goals, objectives and expectations of PDFs as part of initial appointment	Offer letters now include more detailed expectations.
	Provide linkages and opportunities to relevant offerings available for career development, in conjunction with website re-design	Improved communications of events related to career development.
Continue LMP being recognized as a leader in Post-PhD training in Clinical Chemistry and Clinical Microbiology	Advocate for increased funding for trainees through MOHLTC	Discussions with MOHLTC have not been successful. Working with Advancement Office, LMP is now undertaking a fundraising effort in support of Clinical Chemistry trainees.
<b>LMP CEPD</b>		
Enhance LMP offerings in CE	Establish an LMP CEPD Committee, led by a Director and mandated to develop forward-looking, innovative CE activities and products	Director of CEPD appointed (Dr. N. Ismiil), who has invested considerable effort in participating at the Faculty of Medicine level to gain requisite knowledge. Faculty members have made proposals that would involve the LMP Digital Laboratory Medicine Library, once operational.

## Strategic Priority 2: Faculty Development

Goals	Implementation Strategies	Progress
Refine standards and completion of academic job descriptions	Begin with all new appointments and simultaneously extend across the department	Implemented for new appointments. Extension to existing faculty is a work in progress.
	Align reviews and goals set for faculty: coordinate Site Chief/Institute Director and LMP Chair reviews to ensure alignment and coherence of development and expectations	LMP Chair delegates academic performance reviews to Site Chiefs, with review of annual activity report submissions to ensure alignment. Alignment with Research Institute Directors is less developed.
	Work with partner institutions to advocate for appropriate staffing levels to fulfill the academic mission	LMP Chair works with Site Chiefs and Research Institute Directors in matters related to recruitment and staffing. Still some instances of “after the fact” notification of LMP.
Establish coaching and mentorship opportunities to nurture and develop talent across LMP	Establish mentorship working group to develop meaningful and effective mentorship opportunities across LMP: research, education, management and service/administration	LMP Chair participated in Faculty of Medicine Task Force on Mentoring. Current initiative is having faculty who have been successfully promoted share dossiers and experience for those contemplating academic promotion.
Facilitate ongoing faculty development	Working with Centre for Faculty Development (CFD), conduct a needs assessment of LMP faculty and identify the most pressing areas of need for action as the base for a longer term comprehensive LMP faculty development plan	Meeting with CFP leadership resulted in needing to define LMP approach to Creative Professional Activity (CPA) as a high priority. LMP Task Force on CPA provided clarification. In 2012-13 cycle, 7/9 successful LMP promotions had major CPA emphasis.
	Promote CFD-themed workshops on topics including career planning, effective mentoring, small group teaching, evaluation strategies, etc.	Initial focus on academic promotion; newly recruited, part-time clinical faculty in Mississauga have had faculty development sessions for leading Problem-based learning in undergraduate medical curriculum; evaluation of CanMEDS roles in postgraduate medical education.
	Explore and promote other sources of support, such as School of Graduate Studies; Provost’s Office; Centre for Teaching Support and Innovation	Tenure-stream faculty recruits attend orientation sessions provided by U of T. Senior faculty member tasked with understanding U of T resources for online learning.
	Leverage 2012 MOHLTC/OMA/LMFFA negotiations regarding clarity around academic protected time and related considerations	Did not work: LMFFA was buried into the most recent OMA Physicians Services Agreement that took effect on January 1, 2013 with the MOHLTC and still unclear as to how implementation will occur for 2013-14.

### Strategic Priority 3: Research Leadership

Goals	Implementation Strategies	Progress
Provide research leadership to LMP and working groups	Appoint a Director of Research for LMP	Completed. Dr. Michelle Bendeck appointed.
Enhance ability to compete for grants with a structured, internal peer review process (simple, supported and not redundant)	Establish an internal peer review process to be rolled out in LMP, offering the opportunity to participate either as grant applicant or peer reviewer	Implemented. This is a volunteer activity and has had uptake in several grant funding cycles.
Establish Thematic Interest Groups	Form Thematic Interest Groups to facilitate interaction and collaboration among LMP researchers round two major concepts: 1) Biological Thematic Interest Groups; and, 2) Technical Thematic Interest Groups. Establish a working group and target support online through the departmental website	Biological thematic areas established in alignment with those of the Faculty of Medicine and posted on revamped LMP website. First cardiovascular themed half-day held in 2013. Technical thematic interest groups not as high a priority, as individuals can participate in other units' offerings (e.g., Advanced Optical Microscopy Facility; Toronto Centre for Phenogenomics) and avoid duplication in LMP.
Facilitate mentorship that nurtures and develops talent	Create a working group on mentorship in LMP with the goal to provide an opportunity for newly recruited faculty members to secure support in building a strong and productive research program, in conjunction with Faculty Development	See above. Initial LMP faculty development efforts have focused preparing for academic promotion at U of T.
Develop and articulate LMP approach to translational research	Through Thematic Interest Groups, further articulate the education and research role of LMP in: biomarkers, biobanking, quality, and informatics	Thematic Research Half-days being established. Include translational research topics for deliberation.
	Increase involvement of clinical faculty members of graduate student thesis advisory committees, to bring an added dimension of clinical expertise that supports advancing the LMP translational research agenda	Completed. Now monitoring impact of clinical faculty members serving on thesis advisory committees.
Partner with affiliated hospitals, research institutes and agencies using a central LMP database as a resource	Establish LMP database to provide a "one stop" electronic reference hub/portal, with links to best practices and innovations enabling improved standards and performance, done in conjunction with website development and digital laboratory medicine initiatives	There is considerable information available within the system on standard operating procedures, best practices, etc. LMP does not wish to duplicate efforts of others. Some useful web-links provided on LMP website.

### Strategic Priority 4: Digital Laboratory Medicine (DLM)

Goals	Implementation Strategies	Progress
Establish LMP as a leader in DLM	<p>Create a DLM working group with a mandate to:</p> <ul style="list-style-type: none"> <li>- Develop the overall agenda for DLM</li> <li>- Create an inventory of digital material currently available in the department</li> <li>- Verify existing and potential DLM related activities and potential collaborative linkages across U of T</li> </ul>	The initial approach is to use the LMP Digital Laboratory Medicine Library to gain experience and lessons for more extensive future activities in DLM.
Develop a digital educational library for a diversity of users	As a first step, determine the potential to introduce digital images and online materials for undergraduate teaching	Done. Worked with Discovery Commons on technical aspects; administrative and oversight aspects done with lengthy process with Hospital for Sick Children and Faculty of Medicine Vice-Dean, CEPD culminating in signed MTA. Use of SickKids-U of T MTA as a template to roll-out to other sites.
	Develop a laboratory informatics curriculum outline ultimately for a diversity of users	Developed by Dr. G. Yousef for postgraduate education. Gaining experience to inform more extensive roll-out throughout LMP.
Produce a central portal/hub to support research and interdisciplinary collaboration	Determine the required structure and suggested content for a website dedicated to DLM – as a resource centre and base to link activities	Website being piloted.
Support E-Learning for continuing education and LMP programs	Identify the support required for online hosting of educational materials identifying select projects for the creation of a targeted online lecture series with whole slide imaging support and incorporation of other laboratory medicine disciplines	In progress. Faculty have approached LMP Chair with ideas for projects; will get rigorous evaluation upon the establishment of a Governance Oversight Committee for the LMP Digital Laboratory Medicine Library.



## Strategic Priority 5: Operational Excellence

Goals	Implementation Strategies	Progress
Overhaul LMP website and electronic communications	Establish a website working group, charged with informing the design of a revamped LMP website	Done. Working group's efforts showed outstanding level of engagement, useful input and feedback, and collegiality.
	Develop electronic communications strategy including initiating implementation	Major hire of website and communications administrative lead for LMP (Ms. Katie Babcock).
	Establish a database group, charged with aligning goals and objectives of education, faculty development, research leadership and digital laboratory medicine with enhanced electronic functionality of data and information management in LMP	Not yet done. Currently focusing on LMP Digital Laboratory Medicine Library.
Implement WebCV throughout LMP	Implement WebCV in cooperation with the Faculty of Medicine, through piloting on selected volunteer sites, and scaling up	>90% of LMP faculty now on WebCV. Numerous issues identified that limit full potential of WebCV at this time. LMP working with Faculty of Medicine to identify areas that need improvement to enhance utility and functionality of WebCV.
	Applicants for academic promotion will have WebCV in place for 2011-12 promotions cycle	Completed. All files for academic promotion in LMP must be done using WebCV format.
Foster LHIN and community engagement	Build and document LMP outreach efforts in Toronto Central LHIN, professional organizations, educational institutions, and others	LMP support of lectures, symposia, courses put on by others and relevant to department's academic mandate.
Build financial resources to the 'top tier level'	Build and alumni database, with alumni engagement efforts coordinated in conjunction with Faculty of Medicine Advancement Office	LMP engaged with Advancement Office of Faculty of Medicine. Two novel fundraising projects underway involving alumni engagement (support for Clinical Chemistry fellows; Forensic Pathology).