FOR RECOMMENDATION **PUBLIC** **OPEN SESSION**

TO:	Academic Board
SPONSOR: **CONTACT INFO:**	Sioban Nelson, Vice-Provost, Academic Programs (416) 978-2122, vp.academicprograms@utoronto.ca
PRESENTER: **CONTACT INFO:**	As above
DATE:	April 23, 2014 for June 2, 2014
AGENDA ITEM:	4

ITEM IDENTIFICATION:

Proposal for a new Master's of Health Science degree program in Translational Research in the Health Sciences, Faculty of Medicine

JURISDICTIONAL INFORMATION:

The Committee on Academic Policy and Programs has the authority to recommend to the Academic Board for approval new graduate programs and degrees. *(AP&P Terms of Reference, Section 4.4.a.ii)*

GOVERNANCE PATH:

1. Committee on Academic Policy and Programs [for recommendation] (May 13, 2014)
2. **Academic Board [for approval](June 2, 2014)**
3. Executive Committee [for confirmation](June 16, 2014)

PREVIOUS ACTION TAKEN:

The proposal for the Master of Health Science in Translational Research received approval from the Faculty of Medicine Faculty Council on May 5, 2014.

HIGHLIGHTS:

This is a proposal for a new graduate degree program in Translational Research in the Health Sciences from the Institute of Medical Sciences in the Faculty of Medicine. The proposed MHSc is a full-time 20 month professional master's degree program intended for highly trained students with a background in the health sciences such as clinical researchers, medical professionals, basic or social scientists who want to learn how to mobilize research discoveries, and medical knowledge into medical, social or policy innovation. Translational Research in the health Sciences "involves moving knowledge and discovery gained from the basic sciences to its

application in clinical and community settings"—from laboratory bench to patient bedside. Translational Research requires professionals who have a breadth of knowledge; are able to communicate using a variety of media channels and methodologies; and can apply iterative, repetitious refining processes, through design thinking in multidisciplinary teams across multiple knowledge silos. The two-year, 8-fcemaster's degree program is the first of its kind in Canada and is intended to educate professionals who can make connections between research and care; work in interdisciplinary, collaborative teams; and design techniques that move research towards application.

The proposed curriculum will be delivered in individually-customized, flexible modules with customizable paths to accommodate student interests and creativity. The program culminates in a group capstone project, which ensures rigor, consistency and meaningful standards across potentially diverse program outcomes.

The proposed program is the result of an extensive consultative process involving the Faculty of Medicine, Faculty of Information, Institute of Medical Science, Knowledge Media Design Institute and the Institute for Communication, Culture and Information Technology at UTM and the Master of Management Innovation program at UTM.

The program was subject to external appraisal in July 2013. The final external Appraisal Report provided by Dr. Michael Schlossmacher, (U of Ottawa) and Dr. David Hafler (Yale University) forms part of the proposal. The external reviewers made a number of helpful suggestions which resulted in small changes to the program as originally conceived as is reflected in the Dean's response to the review report dated January 2014.

FINANCIAL IMPLICATIONS:

Any new/additional financial obligations resulting from this program will be met at the Faculty/Divisional level.

RECOMMENDATION:

Be it Resolved

> THAT the proposed Master of Health Science degree program in Translational Research in the Health Sciences, as described in the proposal from the Faculty of Medicine dated February 18, 2014, be approved effective for the academic year September 2015.

DOCUMENTATION PROVIDED:

- *Proposal for a new Master's of Health Science degree program in Translational Research, Faculty of Medicine*

University of Toronto
New Graduate Program Proposal

Name of Proposed Program:	Translational Research in the Health Sciences (TR)
Degree Name and Short Form:	Master of Health Science (M.H.Sc.)
Professional Program (yes/no)	Yes
Graduate Unit (if applicable) where the program will reside:	Institute of Medical Science (IMS)
Faculty / Academic Division:	Faculty of Medicine
Faculty / Academic Division Contact:	Avrum Gotlieb, Interim Vice Dean, Graduate and Life Sciences Education
Graduate Unit Contact:	Allan S Kaplan MD FRCP(C), Director, IMS
Anticipated start date of new program:	September 2016
Version Date:	February 27, 2014

New Graduate Program Proposal

Professional Master's Program in Translational Research in the Health Sciences
Institute of Medical Sciences
Faculty of Medicine

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Section 2

Executive Summary

Today the dominance of the metaphor of the lone researcher translating knowledge in isolation has been eclipsed by models of interdisciplinary networks and collaborative teams as drivers of sustained innovation. Today's research in the medical sciences is increasingly driven by labs and networks of interdisciplinary researchers who collaborate, exchange information, and disseminate research. However, this clustering of research and the sheer volume of information being produced in the medical sciences, has created knowledge silos even within specializations that present new and significant obstacles to the flow of knowledge across boundaries—limiting the potential for research exchange, innovation, dissemination and translation.

A new kind of professional is required to meet the challenges in the volume of research and the long road to its successful implementation. Not a lone researcher who works in isolation, but a new kind of health care professional whose breadth of knowledge bridges specialized areas and who has the skills to abstract and translate research and knowledge from one context to another. This type of professional is increasingly a vital component for expediting innovation in the health sciences. This area of practice, called translational research, "involves moving knowledge and discovery gained from the basic sciences to its application in clinical and community settings"--from laboratory bench to patient bedside. Individuals who are able to make connections across disciplinary silos and mobilize research across varied intellectual and practical topographies are vital components of an infrastructure necessary to stay at the forefront of health research, innovation and commercialization.

Translational Research fosters an environment of innovation and interdisciplinary collaboration that encourages the 'translation' of basic scientific findings into patient benefits aimed at reducing the burden of human disease. The mobilization of medical knowledge, from the bench to the bedside, is a process that involves the abstraction and translation of the research, its communication and dissemination, and its application and evaluation at the new context. This mobilization of knowledge explores needs and develops potential solutions to test in clinical settings based on laboratory research and discovery. Mobilization involves not only the movement of research to be tested and applied to routine practice, but also involves how these findings may be deployed effectively, efficiently and in an acceptable form to promote update and optimal use of new insights. This concept is often summarized by the phrases "bench-to-bedside" and "bedside-to-community" (Westfall et al. JAMA, vol 297, no 4, pp 403-406, 2007) research. The work of understanding and translating laboratory research into clinical settings requires individuals who: have existing research or practitioner medical backgrounds and are able to collaborate with others, move contexts and communicate – individuals who are "bilingual" in the language of research and the design of its translation.

The new program is designed to bring together the strengths and resources across the University of Toronto and the Faculty of Medicine to facilitate translational research and medical innovation.The program centers on the themes of **breadth**, **deployment** and **integration** in Translational Research. The new program is a two year masters comprised of 8 FCEs with a focus on foundations in Translational Research (MSC1000H), modular topics in Translational Research (MSC4010Y), exposure to communication skills (MSC1003H), foundations in design

thinking (KMD1001H,1002H), project management and development skills (MSC2001Y) and a major capstone project (MSC4000Y). The program components are designed to augment the student's scientific training with practical and conceptual *breadth* in biomedical and translational practices ranging from wet lab research, clinical and population-based research to knowledge translation, development and commercialization. The program also provides students with the skills for designing an effective TR project *deployment* by stressing collaboration, communication, and iterative (repeated and process driven) interdisciplinary problem solving. Finally, students are challenged to *integrate* their knowledge and skills, to propose, refine, and execute an original project in Translational Research as part of the program's capstone project. By design, this new proposed program will provide students with a broad understanding of specific topics in medical sciences; foundational tools for design, information media communication and criticism; and opportunities to apply the learned knowledge through practical research driven projects. These projects, supervised by Institute of Medical Science (IMS) faculty will help students gain practical experience while contributing to the department and university's translation and innovation of ongoing cutting edge medical research.

With a strong background in broad, often interdisciplinary biomedical research, the University of Toronto's Faculty of Medicine's Institute of Medical Science is the ideal graduate unit to offer such a program. The program will provide the opportunity to fill Canada's need for highly qualified professionals with varied backgrounds and experience in the medical sciences who can make connections between research and care, are able to work with professionals from other backgrounds in interdisciplinary collaborative teams, and are able to design techniques that move research towards application.

The Translational Research in the Health Sciences program is a professional master's degree intended for highly trained personnel who have backgrounds relevant to the health sciences, such as clinical researchers, medical professionals, basic or social scientists; and who want to help mobilize research discoveries, and medical knowledge into medical, social or policy innovation. The program is ideal for: students with existing research agendas who wish to broaden or translate their activities to other domains; or students who wish to apply or translate existing or ongoing pure research or discoveries into clinical settings, social change or policy action. The program allows these students to expand the range of their knowledge, shift career trajectories, or learn to apply research and discoveries across domains.

By working on iterative ideation—the process of defining and refining ideas, design thinking, prototyping and evaluation, students in the program will gain experience to help abstract and communicate knowledge and develop and plan Translational Research projects to help move discoveries out of the lab towards experimentation and implementation at the bed-side. The program will focus on providing students with an introduction to a breadth of topics, depth in student-chosen areas, and the skills to integrate, communicate and iteratively design Translational Research projects in collaborative interdisciplinary teams. These skills will help graduates throughout the various phases of Translational Research from implementation, to rigorous assessment and continuous iterative improvement of the design. Students will be advised and formally mentored by IMS faculty throughout the program. Students will also have the opportunity to work with IMS faculty during their capstone projects, and in doing so, will also be contributing to the mobilization of discoveries at the university.

Training professionals who are able to 'translate' medical knowledge is instrumental to the future development, quality and sustainability of health care and its delivery. While there are a

few such programs in the USA, at Harvard, Yale and Duke University in a growing field in Translational Medicine, there is currently no professional master's program in Translational Research offered in Canada.

Program Rationale

The growth of biomedical research institutions in Toronto has helped position IMS to serve a larger role in promoting both basic and clinical research and the translation of this work between research disciplines and into changes in practice and better care of patients. IMS offers a range of opportunities to do multidisciplinary research in basic and clinical medical science. Our graduate supervisors are world-calibre researchers doing original work in research centres, teaching hospitals and basic science departments throughout Toronto. IMS has a long history of innovative training and research that has placed it at the forefront of clinical training in Canada. IMS has a large pool of expertise, access to hundreds of labs and researchers, and experience delivering modular courses. Through this diverse campus- and hospital-based faculty, IMS can provide access to infrastructure and the capacity to lead globally in the training of professionals in the Translational Research in the Health Sciences program.

Translational Research requires professionals who have a breadth of knowledge; are able to communicate using a variety of media channels and methodologies; and can apply iterative—repetitious refining processes, through design thinking in multidisciplinary teams across multiple knowledge silos. The training program of professionals focused on Translational Research will require researchers with a capacity to observe, and reflect while implementing change--individuals who are able recognize how the needs and autonomy of groups and individuals in all of their diversity are served by health care innovation. In Canada there is currently no professional master's program in Translational Research.

Integration of Degree Program with the University, Divisional and Unit Strategic Plans

As a unique program that will address a need in medical research to train professionals who can help deploy and integrate interdisciplinary projects is clearly aligned with the "University of Toronto Strategic Research Plan, 2012-2017: Excellence, Innovation, Leadership". Specifically, the University's priority to Promote: Healthy People, Healthy Communities, Healthy World. The Translational Research in the Health Sciences program will also contribute to Human Development and Health Through the Lifespan and Global Health, and to Public Health, which are sub-themes of the University's Strategic plan.

At the divisional level, the U of T Medicine Strategic Academic Plan, 2011-16 is embodied by core concepts of Integration, Innovation and Impact. A key overarching goal of the plan is to translate discoveries to improve health, equity and prosperity in our community and around the world, which fits well with this program's goal of training students to better understand and manage the interplay between innovation and implementation. In fact, integration is a key pedagogical pillar of curriculum design. This program will contribute to the Faculty's and University's international reputation for helping the 'translation' of clinical discoveries into tested innovations, by educating health researchers who bridge the gap between discovery and application.

Finally, the Translational Research in the Health Sciences program also plays a central role in the

IMS strategic plan (2012-2017) to advance Translational research and teaching. This program will train students to be more interdisciplinary and generate new project ideas and research that will ultimately strengthen Translational Research at the University of Toronto, Canada and the world.

Academic rationale

Translational Research has been identified as a key element of the medical innovation ecosystem. The Translational Research in the Health Sciences program will train professionals who help bridge the gap between basic discoveries and their integration into existing and related clinical and bedside practices, technologies and policies. The new program will take students with academic and professional backgrounds in the health sciences, health science research, and related scientific fields and provide them with the skills and experiential learning opportunities to move and translate research and scientific knowledge from 'benches' in labs, to clinical domains and or positive policy outcomes that improve the patient experience.

In essence the program provides the infrastructure to help students who understand health science research, or who are already involved in health science research to develop idea, projects or new research based on existing work and discoveries and expertise at IMS and the Faculty of Medicine. The program is intended for: those students who want to enter Translational Research and students engaged in Translational Research. For students who have an established trajectory, the program provides unique opportunities to extend or pivot research. The program allows students to supplement their lab skills with communication and design thinking; and provides the infrastructure to support new project ideas that extend or mobilize existing research. For those students who are new to Translational Research, the program is designed to provide both the practical and theoretical perspectives.

The proposed curriculum is based on a foundation of research excellence at IMS that will inform students on advances in clinical research and allow them to contribute to leading innovations by helping to translate the research in the labs into care at the bedside. To develop necessary theoretical frameworks and experiential skills the program will offer students:

1. an introduction to a range of health science areas (**breadth**);
2. skills to design and communicate translational projects (**deployment**); and
3. practical opportunity to learn by doing (**integration**).

These primary elements form the basis for the pedagogic pillars that establish the program and are discussed below.

Nomenclature

Since Translational Research spans a range of disciplines across the health sciences, the new program should be part of the existing graduate degree, Master of Health Science (MHSc). As a 'bridging' program it makes academic and pedagogical sense for the Translational Research in the Health Sciences program to be a path towards a Master of Health Science rather than being designated its own degree. We propose the new program in Translational Research in the Health Sciences offer a Master of Health Science degree.

Mode of delivery

The Translational Research in the Health Sciences program is a mentored cohort-based program. The courses are a blended delivery model including a range of delivery modes including: face-to-face seminars and lectures, mediated collaborative work, one-on-one discussions and online seminars. The program is predicated on a curriculum founded on three main themes:

1. **Breadth** of knowledge;
2. **Deployment** of knowledge; and
3. **Integration** of knowledge through Experiential Learning

The themes will be explored through a series of modules and seminar courses that culminate in a major capstone project. Each theme extends to the mode of delivery. Breadth of knowledge addressed by seminars, flexible modules and elective courses; deployment of knowledge is stressed through communication and design thinking; and integration is developed through group work, projects and the execution of a final capstone project.

Breadth

Translational Research in Medicine requires a background or understanding of a range of scientific and clinical practices, techniques and technologies. The program incorporates avenues for students to expand their training online, in the class-room as well as laboratory and clinical settings. Students coming into the program will bring with them a core skill-set in health science research—scientific or professional experiences that will enable them to function and participate in graduate curriculum that includes technical and disciplinary knowledge in the health sciences. Students will be expected to demonstrate laboratory skills and an educational background in the health sciences or equivalent professional experience. The program allows these students to apply their knowledge to other related Heath Science domains through Translational Research and design. Students will do this by taking required modules and elective courses which supplemented their abilities to move outside of their primary discipline or research concentration.

The students will first be challenged by a range of issues and flavours of Translational Research in MSC1000H: Foundations in Translational Research (.5 FCE), a case-based seminar on the translational topography. The students in the Translational Research in the Health Sciences program will also be challenged to push outside their established academic or professional backgrounds to engage with a wide range of material from a variety of modular content already established at IMS. The modular structure of the second foundation course, MSC 4010Y (2.0 FCE) will be required students to select 8 modules from a list to complete course credit. The modular approach allows students to select their own paths through the program that best help add to their individual learning outcomes. These pathways include online and face-to-face delivery models and are flexible enough to accommodate student needs (see Appendix E for a sample student initiated module outline).

This introduction to a range of researchers, research and sub-disciplines is pivotal to providing the breadth of knowledge necessary to create professionals who are able to move across and beyond established disciplinary boundaries. Students are also required to extend the breadth of their knowledge base further with 1.0 FCEs–of electives to be taken in research stream graduate programs in the Faculty of Medicine. See Appendix D for a list of electives.

Deployment

Students who are able to make connections between research and practice also require the tools to be able to communicate and interactively rethink the knowledge gained to translate it into other contexts and domains. Today, communication means more than penmanship and written skills. Effective deployment of innovation increasingly is mediated by the internet and other forms of media, but deployment is more than just communicating basic science. It is also about envisioning applied clinical research and design of improved systems, policies and even community engagement based on laboratory research. Professionals who are involved in helping to mobilize basic discoveries increasingly require the familiarity with multiple channels of communication and novel deployment or design strategies of how to translate research into new contexts, applications and ways of doing things. The program will provide students with 0.5 FCEs of media and communication in the Health Sciences; and 1.0 FCEs in Knowledge Media Design for iterative design thinking for applied projects.

Integration

Advancing knowledge and ideas across research silos into applied projects requires integration of knowledge. Professionals that can translate and test research and help (re)integrate the outcomes back into research design, are the goal of Translational Research in the Health Sciences program. It is a bidirectional process, whereby, insights from the application of ideas are iteratively fed back across disciplines to inform fundamental research design. Moving ideas forward requires this integration of knowledge. In MSC2001Y (1.0 FCE) students will be provided with the tools and skills to manage a TR project and students will have opportunity to integrate knowledge through a collaborative capstone project (2.0 FCE). Guided by IMS Graduate Faculty mentors, students work directly in ongoing biomedical research, to develop group projects that explore application in other contexts and attempt to reintegrate back into research design. The integration of knowledge from the first year into Translational Research projects in the second provides students the chance to integrate theoretical frameworks with applied experiential learning.

Content

The content of the program has been structured around breadth, deployment and integration. The first year will be seminar and module based courses, selected with input from IMS faculty advisors, to provide students with breadth of scientific knowledge along with in-depth communication and design thinking skills. Students will grapple with the definitions and case-studies of Translational Research in MSC 1000H: Foundations in Translational Research, which provides students with the intellectual framework and context to move through the program. The course helps distinguish between predominant areas of basic and Translational Research and articulate the knowledge skills necessary to conduct TR research. Students will be introduced to the key issues facing Translational Research and will be provided with an overview of the tools and strategies involved in moving discoveries from “bench to bedside” and the community. The program builds on this foundation in MSC 4010Y, where students will customize their experience, by assembling a selection of 8 modular short courses from 3 core domains. The program then builds on this foundation and students are then provided with opportunities for

collaboration, iterative design and problem solving to integrate seminars and lectures with experiential learning by doing.

Students will also receive foundational introductions to communication and knowledge media design through seminars in KMD1001H, KMD1002H, and MSC1003H. These compulsory courses will provide students with breadth of domain specific knowledge alongside communication and design strategy skills that will supplement their scientific training and stress 'translating' basic research into applied innovation.

In MSC2001Y, students will be involved in a series of small project oriented workshops on topics, like ideation and ethics protocols. These workshops will provide students with the tools to approach TR projects and provide the scaffolding on which the subsequent capstone course is based. The workshop format allows students to work through problems through a project design cycle and be designed to help with cohort building and professional development. In the second year, students will be immersed in a major capstone project (2.0 FCE) that will allow them to apply the theoretical frameworks and skills established in the first year towards a project in Translational Research. Students will also have the opportunity to increase the breadth and depth of their knowledge while working on their projects through 1.0 FCE of approved electives.

Program Requirements:
Year 1 (4.0 FCEs)

MSC1000H: Foundations in Translational Research (0.5 FCE): This case based course looks at the different 'flavours' of Translational Research across the health sciences. Students will be introduced to the key issues facing Translational Research and be provided with an over view of the tools and strategies involved in moving discoveries from "bench to bedside". (**new course**)

MSC 1003H: Technology-mediated Scientific Communication (0.5FCE): Technology, both traditional and digital, mediates the communication between communicants. This course will be developed in consultation with the Institute for Communication, Culture and Information Technologies, a University of Toronto institute, and examines existing research about the use of both traditional and digital technologies in uni-directional and interactive communication. Students will also actively develop text-based communications content for traditional and digital media. The course will also investigate the necessity to be aware of the context of communication and its importance in developing communication in rich interactive environments.**(new course)**

MSC 2001Y: Projects in Translational Research(1.0 FCE):
This course is designed as a series of workshops that help the students plan and execute the capstone project. To complete the course students will have to complete 6 IMS and KMDI developed workshops (4-6 contact hours each) and participate in skill building seminars. The themes of these workshops will include: ideation, problem design, ethics, prototyping, evaluation and redesign, and integration through commercialization or innovation; and will be designed to help students advance their TR projects. For credit, each project team must submit a capstone project proposal, prototypes, a project poster and any presentation slides for evaluation. IMS will provide the direction and support for the student projects, but we envision sharing some of the supporting workshops that are planned as part of the Master of Information Knowledge Media

Design concentration in the Faculty of Information starting in Sept 2014.

MSC4010Y: Core Modules in Translational Research (2.0 FCE): Students will be able to customize their experience, by assembling a selection of 8 modular short courses from 3 core domains: A) Wet lab Research B) Clinical and Population-based Research and C) Knowledge Translation, Development and Commercialization, including ethical issues in translational research. Students will be required to pick course modules from all 3 research domains. Each course module involves ~12-20 h contact time. Completion of 8 modules will qualify for 2 FCE. For a sample of a module description see Appendix E: Sample MSC4010Y Module Description. (new course)

KMD1001H Core Seminar in Knowledge Media Design I – Fundamental Concepts/KMD1002H Core Seminar in Knowledge Media Design II – Contexts and Practices (1.0 FCE): These introductory knowledge media design courses (worth 0.5 FCE each) allow student teams from different program backgrounds (e.g. Engineering, Sociology, Education, Medicine, and Computer Science) to explore a problem from a variety of perspectives, and develop prototype approaches to the selected design issue. Mentors and advisers will be drawn from a pool of IMS affiliated instructors. Students will be provided resources to represent and model their ideas, so that the implications of their designs can be critically examined.

Year 2 (4 FCEs)

MSC4000Y: Capstone Project in Translational Research (2.0 FCE): All students will be required to complete a capstone project in translational research. Students will be assigned to a group of 3 – 5 students. Groups will have to work through a process of ideation to generate a project idea in Translational Research either based on IMS faculty research, or any other medical research context where there is appropriate mentorship or supervision, as determined by the Program Committee or designate. Groups will be required to establish clear individual and shared responsibilities and must submit self / peer evaluations as part of the final project deliverables.

Electives (1.0 FCE): For further breadth, students will select 1.0 FCE of courses in subjects of their own choosing. Typically this would be done in parallel with the Capstone Project to support synergies. Students will also be allowed to take electives outside the approved list with a pre-approval from the Translational Research in Health Scieincesprogram Director or designate.

Distinctiveness

The proposed program will provide students with a unique combination of Breadth, Deployment and Integration to help students acquire skills to translate clinical research and develop projects around research that can then be integrated into medical practices. Currently no other similar program in Translational Research exists in Canada. The proposed program is unique in the sense that the concentration is new to Canada, but it is also unique in its flexibility and curricular content. The delivery is designed to be flexible and customizable while contributing to core skills necessary to move research between benches and bedsides. The individually customized module requirements contribute to the programs breadth and will allow students to develop understanding of key principles in research areas outside, but complementary to, their personal

domains of research or professional practice. Core modules can evolve with research interests of faculty and student selection.

The critical feature of this program is its focus on interdisciplinary thinking and working in collaborative teams for the communication or deployment of translational research. Diverse disciplinary perspectives in the program can be seen in the varied body of students we anticipate the program will attract. Since Translational Research spans many modalities in medicine and the health sciences, and is being extended to other areas including social sciences, the type of student this program will attract may range across the health sciences and related disciplines. Clinicians, graduate researchers, medical health professionals and students from basic sciences may all potentially be attracted to the Translational Research in the Health Sciences program. They will benefit from the program's distinctive elements like iterative problem solving and experiential learning.

We feel strongly that students from social sciences in fields like Psychology, Communication, Education, or Sociology, with appropriate experience and health science interests, may also be attracted to medical focus of the Translational Research in the Health Sciences program. The flexibility and range of the Translational Research in the Health Sciences program has also been designed to accommodate and ensure their success. Suitable students will benefit from the programs flexibility and may, for example, wish to take their electives at other graduate units on campus—which has been built into the program design with the permission of the Director. Also, the modular structure of the core course allows students to get overviews of a range of medical disciplines, practices and skills. These students will be attracted by the access to a diverse range of ongoing research and diverse participating units, students and professors.

All students in this program will engage with a range of potential collaborators. The program will draw upon faculty from IMS, Joint Center for Bioethics, the Department of Pharmacology and Toxicology, the Department of Laboratory Medicine and Pathobiology, the Institute of Health Policy Management and Evaluation, the Dalla Lana School of Public Health, MaRS, Knowledge Media and Design Institute, the Institute of Biomaterial and Biomedical Engineering, the Faculty of Information, and the Institute for Communication, Culture and Information Technology.

A distinct feature of the program is the communication piece. To innovate it is not enough to make discoveries, researchers need to communicate their discoveries to multiple audiences across multiple domains to advance the health sciences. Communication skills and media literacy are increasingly necessary skills for the dissemination of knowledge, research and ideas in general. Students in the program will take part in a communication class that both discusses the larger questions of how media is changing, but also provides practical written and oral communication skills. MSC1003 will mentor students in the clear and effective exposition of ideas to diverse interdisciplinary audiences.

Another distinct element is the integration of design thinking as a way of collaborative problem solving. The Knowledge Media Design Institute at the University of Toronto advocates human-centred participatory design of media. KMDI has agreed to a memorandum of understanding to collaborate with IMS to develop workshops on key aspects of the design process. These

workshops and KMDI classes in general, are designed to address multidisciplinary audiences interested and involved in the design of knowledge media. During the courses and workshops offered by the Knowledge Media Design Institute, students will get opportunities to work in interdisciplinary teams from across University of Toronto disciplines, faculties and departments. Students will have the opportunity to discuss and reflect on human-centred design and iterative design thinking to 'translate' knowledge.

Finally, core to the experience, is the capstone project. Students will be guided through a process of planning and executing a project in TR. Students will work in collaborative teams to define, and propose a Translational Research project that the group can execute in one year that meets the rigorous guidelines of the Translational Research Program Committee. The committee, chaired by the Director of the TR Program, will report to the IMS Curriculum Committee and will be responsible for reviewing content, evaluation, mentorship, project proposals and project deliverables. The Program Committee will include IMS Faculty and domain experts as needed. Though the nature of each specific project may vary based on the team skill sets and backgrounds, each team will be encouraged to work with one (or more) of over 500 IMS associated faculty. The goal of the final project is not only to provide the mechanisms and didactic opportunities that allow students to collaboratively learn the skill-sets required to undertake Translational Research, but also provide students with access to working with labs and hospitals to help deploy their knowledge. The group capstone projects will require that students direct and contribute to the process of flexibly accommodating the insights of peers, as they envision, plan and model their own translational project ideas across disciplinary boundaries.

IMS will work with KMDI to develop a series of workshops designed to support students through the capstone project. These workshops will include set topics and themes like: Ideation, Prototyping, and Writing an Ethics Proposal. For example, during the Ideation workshop, each student group will have an opportunity to present their problem and associated ideas, and have the workshop group as a whole contribute to the brainstorming process to refine and redesign the ideas to improve the quality of the projects moving forward. These workshops will also be flexible enough to respond to the needs of the students as they progress with their capstone projects and the needs of the program as it develops. More broadly, the KMDI-led inter-divisional courses and workshops will introduce students to iterative design thinking skills and then help students implement those skills during their final projects. In KMD1001 and KMD1002 students are introduced to the fundamentals of media design as well as the contexts and methodological frameworks. Students are encouraged to go outside of their disciplinary comfort zones and will be introduced to a range of design thinking concepts with students from across campus. Students will also be able to brainstorm and design prototypes in collaborative times.

Need and Demand

In Canada, a number of institutes clearly identify Academic Faculty and Research Support Staff employment opportunities in Translational Research. Examples include: the Child & Family Research Institute in B.C; the Rick Hansen Institute—whose mandate includes translating

science into solutions for Canadians; and the Alliance of Translational Research Centres established to accelerate global drug development. All support projects in or employ research or clinical staff in Translational Research. Since the Obama administration prioritized Translational Research in 2010 the National Institute of Health in the United States has committed billions of dollars to Translational Research in Medicine. Growing numbers of TR programs across North America and the EU and the increased funding for Translational Medicine suggests a strong growth area in research centres, on interdisciplinary clinical teams, in teaching hospitals and the biotech and pharmaceutical industries for students in TR. The increasing number of Translational Research programs, institutes and funded projects in Canada, suggests a growing demand for professionals in this area.

The Translational Research in the Health Sciences program arises in part from the acknowledgement that the current pathways from research to application are fraught with inefficiencies. Bridging the divide between discoveries in laboratories and their implementation as clinical, policy or social innovation maximizes their social benefit. This bridging requires a new type of flexible and creative thinking professional whose expertise in the health sciences is leveraged to move knowledge between the "bench" and the "bedside". The program essentially tries to teach students how to apply medical research towards projects that will innovate or advance health science research, practices or policy. To ensure that the students receive support and direct supervision from IMS faculty and to ensure high-quality supervision for the capstone projects, the program will initially accept 20 students per year at steady state.

Currently, there is no program in Canada in Translational Research. In the USA, there are very few such programs and they are all at elite universities. Examples include the Mayo Clinic's Center for Translational Science Activities, the Brown University Master's Degree in Clinical and Translational Research, the Master of Science in Medicine Degree Program at Stanford University, and the University Of Pennsylvania School Of Medicine Howard Hughes Medical Institute Graduate Scholars Program. In addition, a number of training programs exist in TR, but they are not part of graduate training programs. Examples include the Harvard Catalyst- Harvard Clinical and Translational Scientific Center (offers a two week "Introduction to Translational Medicine" course) and the Duke University Translational Medicine Institute. An example in Europe is the Master of Science in Translational Medical Research Program at Heidelberg University. In summary such programs are nonexistent in Canada and only a few exist in the USA, though many are planned. There is certainly a need in Canada for such a new training program.

Graduates of the program will be able to demonstrate a depth of knowledge around Translational Research and its core contributory practices; the ability to understand and engage with ongoing laboratory or clinical research; the ability to communicate complex research to different audiences; and the ability to contribute to the design of novel research projects. Graduates will be able to demonstrate breadth across sub-disciplines, as well as the ability to communicate, design and research across a range of health care related fields. These Translational Research professionals can work with labs to 'translate' discoveries into applied research. These professionals will also be suited for teaching approaches to Translational Research in departments, hospitals, and research centres. Individuals with health science backgrounds who are able to communicate and translate basic research are also in demand by organizations such

Sickkids and MaRS to help facilitate innovation, evaluate new projects and work. Graduates may also find employment working in clinical settings to implement new projects, in institutions to set and communicate policy, with government or in the private sector as Chief Scientific Officers and policy advisors.

Table 1: Graduate Enrolment Projections

Year in program	*Academic year*	*Academic year*	*Academic year*	*Academic year*	*Academic year*
	2015/16	*2016/17*	*2017/18**	*2018/19*	*2019/20*
1	*10*	*20*	*20*	*20*	*20*
2	*0*	*10*	*20*	*20*	*20*
Total	*10*	*30*	*40*	*40*	*40*

**Steady state*

Admission Requirements

The Translational Research in the Health Sciences program is designed to accommodate advanced students in the health sciences with scientific training. This may include clinical researchers and medical practitioners, but will represent a rhizomic-heterogeneous effort from a diverse group working collaboratively. The ideal student for this program will already have relevant training in the health sciences and related fields; will be interested in a master's to augment their education or advance their research or career; be open and eager to collaborate to implement discoveries into research projects; and aspire to supplement or redirect their existing skills through a mentor driven modular (and customizable) program that leads to a Master of Health Science.

Applicants will be admitted on the basis of academic preparation, references, and motivation. All applicants must demonstrate in a statement of interest and through their CVs exceptional scholarly achievement and significant research experience and provide at least three letters of reference. During the admissions process weight will be assigned to the applicants statement of interest in addition to the minimal requirements that will include a 4-year Honours BSc or MD from a recognized university program and a minimum A- (3.7/4, 80% or First Class Distinction) average in three of the four years (including final year) of the undergraduate degree. Applicants with significant research experience and/or academic research master's or PhD in related areas of study will be considered. Applicants with related research experience in professional health science or related social science may also be considered and are encouraged to apply.

Our goal is to attract a large, high-caliber, and diverse pool of students so that the effective requirements for acceptance are higher than admission requirements. This will allow the Program Committee to select from the pool of candidates who have a wealth of experience, creative interests and an enthusiasm for non-traditional collaborative work that produces translational outcomes. We expect this to be a key challenge for the selection process: the selection, from a large pool of qualified candidates, the individuals who will be judged the best fit to facilitate activities related to Translational Research in Health Sciences.

Students who have received their previous degree from a university where English is NOT the language of instruction must complete one of the following tests within the last year. Students, who took one of these tests more than one year prior to application, must take the test again.

Test of English as a Foreign Language (TOEFL) and the Test of Written English (TWE)

These two tests are taken together. Minimum scores are as follows:

	Internet Based Exam	Paper Based Exam
TOEFL	Overall - 93 Writing Score - 22 Speaking Score – 22	600
TWE	Not applicable	5

See the TOEFL website for more information.

Program Requirements

All students would be required to complete a total of 8.0 full-course equivalents (FCEs) as follows:

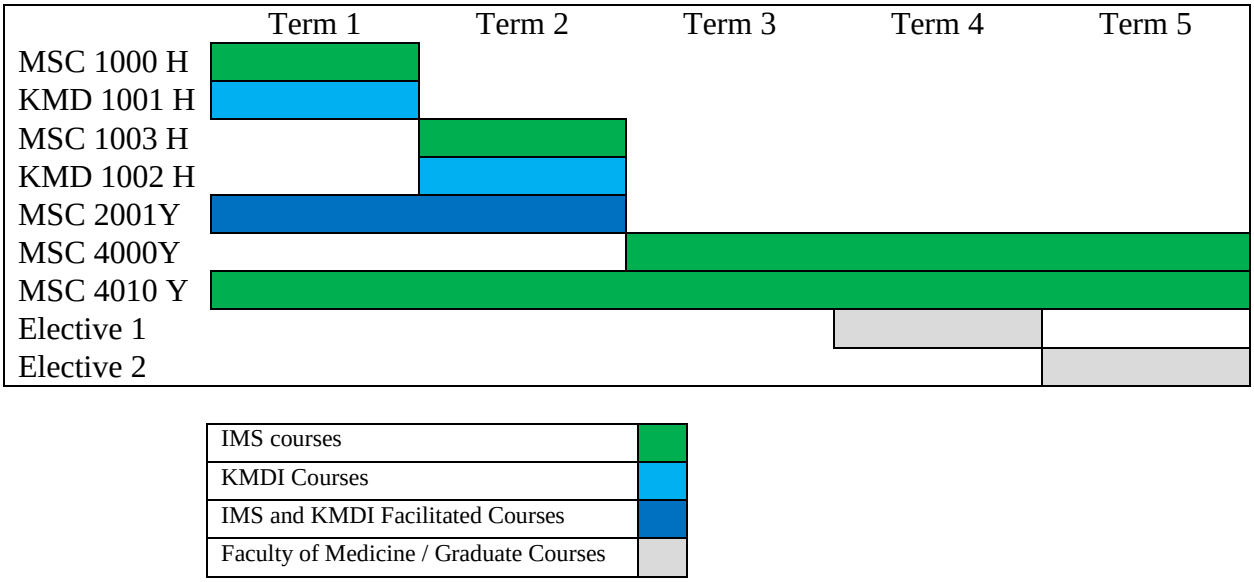
1) a course on the foundations in Translational Research (MSC1000H; 0.5 FCE);
2) a continuous modular "core" course in translational research (MSC4010Y; 2.0 FCE);
2) a course in advanced written and oral communication skills (MSC1003H; 0.5FCE);
3) two half-courses in interdisciplinary design (KMD1001H,1002H; 1.0 FCE);
4) a planning TR projects workshop course (MSC2001Y; 1.0 FCE);
5) capstone project course (MSC4000Y; 2.0 FCE); and
6) two half-courses of qualifying electives(1.0 FCE).

Table 1: Translational Research Program Curriculum

Term	**Course**	**Title:**
Term 1: Fall Term	MSC 1000 H	Foundations in Translational Research
	KMD 1001 H	KMD Fundamental Concepts
	MSC 2001Y	Projects in Translational Research
	MSC 4010 Y	Modules in Translational Research (2.0 FCE)
Term 2: Winter Term	MSC 1003 H	Information, Media and Communication Literacy for the Sciences
	KMD 1002 H	KMD: Contexts and Practice
	MSC 2001Y	Projects in Translational Research
	MSC 4010 Y	Modules in Translational Research cont'd

Term 3: Summer Term	MSC 4000Y	Capstone Project in Translational Research (2.0 FCE)	
	MSC 4010 Y	Modules in Translational Research cont'd	Projects in Tra
Term 4: Fall Term	MSC 4000Y	Capstone Project in Translational Research (2.0 FCE)	
	MSC 4010 Y	Modules in Translational Research cont'd	
	Elective 1	From List or With Approval (.5 FCE)	
Term 5: Winter Term	MSC 4000Y	Capstone Project in Translational Research cont'd	
	MSC 4010 Y	Modules in Translational Research cont'd	
	Elective 2	From List or With Approval(.5 FCE)	

Table 2: Typical Program Path by Term



See Appendix A for a full list of courses and descriptions.

Program Length:5 sessions full-time (Fall,Winter,Summer/Fall,Winter),
Time Limit: 3years

Program Description

Distinctive elements of the Program
To fulfil the depth, deployment and integration themes, the curriculum will be developed and

delivered in modular seminars and workshops with small group learning and discussion, problem-based learning, individual and team project assignments. Elements of the design have been woven throughout the program curriculum. The program has been distinctively designed to incorporate modular, collaborative, and mentorship-based experiential-learning.

Modular Structure
The modular structure of the curricular components of this program will provide for student selection, individual flexibility and interest driven learning opportunities. Modular structure allows for flexible and responsive content. The course Modules in Translational Research (MSC4010Y) allows students to select 8 modules throughout their tenure in the program to customize their learning. The modules will be student and faculty initiated, and approved and reviewed by the IMS Curriculum Committee to ensure thematic consistency and rigor. The narrow themed modules and course electives provide both breadth and depth in a student-driven learning model.

Collaborative
The program has been designed with collaboration in mind so MSC2001Y and MSC 4000Y allow students learning opportunity to develop a novel TR project guided by IMS faculty. Although each project and course will incorporate elements of individual assessment, they will also involve group presentations and deliverables. Each group assignment will incorporate peer and self-review mechanisms to provide for appropriate assessment of learning.

Mentored
The program incorporates mentored experiential-learning specifically through the main Translational projects students work on. Students are provided guidance and mentorship while shaping their project as they engage with IMS faculty in the planning stages, and work with a specific member or group to execute and evaluate project outcomes. The capstone project marks a unique opportunity for student to work with ground-breaking researchers to execute real-world "translational research" projects.

Flexible
In addition to the program core elements and experience, students have the opportunity to choose individuated paths through the program. Students can choose individual modules during MSC 4010Y and are provided with two half-courses of electives that can help either supplement their TR project or expand their individual interests.

These elements make a distinct program that has individual paths, but involves group work; has mentorship, but allows for original proposals and projects; and incorporates breadth, development and integration.

This program will initially be offered on a full-time basis, but may evolve to allow other program lengths. The initial recommended full-time program length is 20months (or five sessions) and a total of 8.0 FCEs at the graduate level.

Whereas the Province's Quality Assurance Framework requires that students complete a minimum of 2/3 their courses at the graduate level, the University of Toronto requires graduate

students to complete all of their course requirements from amongst graduate level courses. This proposed program complies with this requirement.

The Master of Management of Innovation (MMI, an existing program offered by the Institute of Health Policy Management and Evaluation (IHPME), in the Faculty of Medicine and the Dept. Management, UTM) shares some similarities with the proposed program insofar as both target the scientifically trained applicant and both focus on developing skill sets that are required to translate and develop innovation. However, whereas the MMI program is designed for individuals who are pursuing management careers in technology-focused organizations, the TR program is research and clinically oriented for individuals focussed not on the management of research, but on its mobilization and movement from laboratories into different contexts to directly benefit and improve patient care. Whereas the MMI is concerned chiefly with the mechanics of managing, the proposed program will focus on envisioning new solutions to health problems through interdisciplinary engagement in the acts of mobilizing knowledge to improve medical care, delivery and policy. The Translational Research in the Health Sciences program includes scientifically oriented courses like MSC1000H and MSC4010Y, in combination with communication and design skills which are entirely distinct from the MMI programs management focus. There is significant pedagogical and disciplinary differentiation.

Tuition will be consistent with all other professional MHSc programs in the Faculty of Medicine and we anticipate being eligible for government grant funding in order to help support the program.

For a more detailed description of core courses see Appendix A.
For a detailed description of elective courses see Appendix B.

Fields

There are no fields in the program.

Degree Level Expectations, Program Learning Outcomes and Program Structure

Master's DLE

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLE'S]	MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES	HOW THE PROGRAM DESIGN AND REQUIREMENT ELEMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES
EXPECTATIONS: *This MHSc in Translational Research is awarded to students who have demonstrated:*		
1. Depth and Breadth of Knowledge A systematic understanding of	Depth and breadth of knowledge is defined in Translational Research as knowledge of a broad range of scientific and medical disciplines coupled with	The program design and requirement elements that ensure these student outcomes for depth and breadth of knowledge are:

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLE'S]	MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES	HOW THE PROGRAM DESIGN AND REQUIREMENT ELEMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES
knowledge, and a critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of the academic discipline, field of study, or area of professional practice.	individual domain expertise and skills necessary to help mobilize knowledge and discoveries to other domains. This is reflected in students who are able to: **Breadth** 1. Identify a range of issues, methods and case-studies in Translational Research that distinguish between predominant areas of basic and Translational Research. Evaluate information across domains to appreciate broader implications and limitation of Translational Research. **2.** Describe, appraise and integrate range of scientific and clinical practices and research. **Deployment** **3.** Illustrate and identify Translational Research question, problem or strategies in a specific context. **4.** Demonstrate design thinking and communication skills specific to translating and articulating research between contexts (e.g. Design projects, trials, communicate key understandings to stakeholders). **Integration** 5. Demonstrate the ability to assess and synthesize knowledge using data and literature to inform new applications and strategies for care delivery. **6.** Formulate the hypothetical setting up of appropriate experiments, trials or design probes to test a hypothesis in the translation of research in the health sciences.	**Breadth** 1. MSC1000 is designed to allow students to examine a range of understandings of Translational Research across disciplines. The course introduces students to key issues and encourages a meta-analysis of the field through case-studies and analysis. 2. MSC4010 is designed as a series of modules that allow students to sample a range of topics from 3 core domains: A) Wet lab Research B) Clinical and Population-based Research and C) Knowledge Translation, Development and Commercialization, including ethical issues in translational research. The program also incorporates two course equivalents for breadth and depth in a range of approved 'electives' that allow students to focus on individual areas of interest in several areas across the faculty. **Deployment** 3. MSC1000 uses case-studies to model to study the deployment of Translational Research. 4. KMD1001/1002 and MSC1003 provide the foundations for design thinking and communication in the health sciences, and form core skill sets that help students manage and articulate Translational Research activities. **Integration** 5. MSC2001 is designed to allow students to demonstrate the ability to assess and synthesize knowledge in order to apply it towards a Translational Research project. 6. MSC4000 appraises the ability of students to formulate real and conceptual approaches to setting up of appropriate experiments, trials or design probes to test a hypothesis in the translation of research in the health sciences.
2. Research and Scholarship	For this **professional master's program**, research and scholarship is defined in	The program design and requirement elements that ensure these student

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLE'S]	MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES	HOW THE PROGRAM DESIGN AND REQUIREMENT ELEMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES
A conceptual understanding and methodological competence that i) Enables a working comprehension of how established techniques of research and inquiry are used to create and interpret knowledge in the discipline; ii) Enables a critical evaluation of current research and advanced research and scholarship in the discipline or area of professional competence; and iii) Enables a treatment of complex issues and judgments based on established principles and techniques; **and,** on the basis of that competence, has shown at least one of the following: i) The development and support of a sustained argument in written form; or ii) Originality in the application of knowledge.	Translational Research as experiential and applied mixed method oriented problem solving. This is reflected in students who are able to: **Breadth** 1. Define and describe a variety of translational research practices and cases-studies. 2. Associate the analysis of results with their broader significance. **Deployment** 3. Develop a research question or problem, help develop a protocol, assist in carrying out Translational Research, and disseminate the results. 4. Apply iterative design thinking to Translational Research. 5. Demonstrate the ability to effectively interact and collaborate with others across interdisciplinary research contexts. **Integration** 6. Formulate actual or conceptual research, policy, clinical or community initiatives that demonstrate Translational Research thinking. 7. Explain research contributions to a range of community through written form.	outcomes for research and scholarship are: **Breadth** 1. MSC1000 and MSC4010 are both designed to provide students with a variety of perspectives on Translational Research practices. MSC 1000 is a lecture style course while MSC 4010 allows students to take a range of individually selected modules. 2. In MSC1000 students are required to review and critically evaluate recent research and scholarship both in the sciences and in all the disciplines related to strategies and methodologies for Translational Research, specifically intended to provide students with real-world case studies to demonstrate the broader significance of TR. **Deployment** 3. In MSC2001 students are required to design and present their own research project in TR. 4. Students are required to demonstrate iterative design thinking in KMD 1001/KMD1002 to solve complex problems. 5. In KMD1001 & KMD1002 students are required to effectively interact and collaborate. In MSC2001 students will have to collaborate across contexts to assess potential projects in TR. **Integration** 6. MSC4000 requires students to propose their own TR projects intended to mobilize research. The capstone projects mentored and evaluated require students to demonstrate translational thinking.
3. Level of Application of Knowledge Competence in the research process by applying an existing body of knowledge in the critical analysis of a new question or of a specific problem or issue in a new setting.	Application of Knowledge is defined in the professional master's program of Translational Research as the ability to understand research and be able to work with others to help communicate it and facilitate its translation into a clinical context. This is reflected in students who are able to: 1. Demonstrate the roles and expertise as members of an interdisciplinary	The program design and requirement elements that ensure these student outcomes for level and application of knowledge are: 1. KMD1001and KMD1002 require students to engage with interdisciplinary teams to achieve goals. Students are required to demonstrate these skills during MSC2001 and MSC4000 as they plan and work on their capstone project. 2. MSC1000 requires students to analyse

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLE'S]	MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES	HOW THE PROGRAM DESIGN AND REQUIREMENT ELEMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES
	team, required to optimally achieve a goal related to an appropriate translational research problem. 2. Propose and evaluate a project plan for investigation that critically, translates a discovery or body of knowledge into a new question in a new setting.	case-studies in Translational Research, critically approach best practices and test ideas for new questions and projects.
4. Professional Capacity/Autonomy a. The qualities and transferable skills necessary for employment requiring i) The exercise of initiative and of personal responsibility and accountability; and ii) Decision-making in complex situations; b. The intellectual independence required for continuing professional development; c. The ethical behaviour consistent with academic integrity and the use of appropriate guidelines and procedures for responsible conduct of research; and d. The ability to appreciate the broader implications of applying knowledge to particular contexts.	Professional Capacity/Autonomy is defined in Translational Research as the ability to understand the processes that help develop ideas and strategies that bridge research and clinical trials. This is reflected in students who are able to: 1. Work collaboratively to communicate complex ideas using varied communication and design strategies; 2. Demonstrate initiative, responsibility and team accountability in executing design projects; 3. Demonstrate appropriate project management and lab management skills. 4. Ability to synthesize and abstract information across domains to appreciate broader implications and limitation of Translational Research.	The program design and requirement elements that ensure these student outcomes for professional capacity/autonomy are: 1. KMD 1001/1002 allow students the opportunity to discuss interdisciplinary collaboration, iterative design thinking and varied strategies to communication. MSC1003 looks at scientific communication beginning with grants and moving to communication of research results using new media. MSC 4000 allows students the opportunities to apply skills towards a large collaborative project; 2. Demonstrate initiative, responsibility and accountability (group work throughout but especially during MSC2001 and MSC4000). 3. Planning and evaluating projects particularly in KMD1002 and MSC 2001 allow students to learn about the implementation of research projects, develop intellectual independence and use of appropriate infrastructures to research and implement projects such as ethics review boards, etc. 4. KMD1001 and MSC1003courses are generally structured around the synthesis and abstraction of information for appropriate audiences as primers for students. The MSC 4000 Capstone Project course is the opportunity for students to apply knowledge, analyse a specific problem domain and demonstrate an understanding of the broader goals and implications of Translational Research.
5. Level of Communications Skills The ability to communicate ideas, issues and conclusions clearly.	Communications Skills is defined in Translational Research as the ability to discuss and provide feedback to people beyond ones discipline; and the ability to effectively target specific audiences using appropriate media strategies.	The program design and requirement elements that ensure these student outcomes for level of communication skills are: 1. MSC1003 is specifically designed

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLE'S]	MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES	HOW THE PROGRAM DESIGN AND REQUIREMENT ELEMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES
	This is reflected in students who are able to: The graduate will be able to: 1. Present effectively research in such a way that it is easily understood, encourages discussion and promotes participation and collaboration in research and decision-making, through verbal, written and other non-verbal means/of communication, respecting the differences in beliefs and backgrounds. 2. Demonstrate the importance of cooperation and communication among health professionals so as to maximize the benefits to patient care and outcomes, and minimize the risk of errors. 3. Organize relationships with appropriate communities that are characterized by understanding, trust, respect, empathy and confidentiality.	around strategies of communication of scientific and biological knowledge. The MSC1003 and KMD 1001/1002 courses are the specific mechanisms designed to promote effective verbal and non-verbal communication and design practices. 2. Cooperation and collaboration is built into the program design, but is particularly evident during group workshops and seminars, the KMD courses and as an integral aspect of the MSC4000 Capstone project. 3. The advisory committee for each student is the specific mechanism by which students will be able to establish professional relationships and communities, but the program also gives students opportunities for interdisciplinary collaboration through interactions with KMD students, a range of mixed student groupings in MSC4010, and the relationships between labs and clinics established by the Capstone projects.

Assessment of Learning

The evaluation of students will be based on traditional assignments, participation in workshops and modules, and presentations of research through papers and presentations. The ability to integrate knowledge will be assessed through the requirement to develop comprehensive projects.

Assessment of Learning

Student performance in the program will be assessed through a variety of methods including: reports, presentations, assignments and project portfolios.

Students will receive grades for their performance in each course.

Table 3: Correlating program learning outcomes and assessed skills and competencies

Learning Outcomes	Assignments	Projects	Capstone Portfolio	Presentations
1.Depth and Breadth of Knowledge				
☐Display expertise in at least one area related to health sciences	✓	✓		
☐Critically assess a problem that is complex and has alternative design approaches.	✓	✓	✓	
☐Adjust communications to address different audiences	✓	✓	✓	✓
☐Identify key debates that result from conflicting stakeholder views	✓	✓	✓	
2. Scholarship				
☐Conceptualize, design, implement a Translational Research project	✓	✓	✓	
☐Make informed judgments on complex issues in the context of TR	✓	✓		
☐Articulate those strategies and judgments		✓	✓	✓
3.Application of Knowledge				
☐Assess a complex Translational Problem	✓	✓	✓	
4.Professional Capacity				
☐Complete the degree requirements in a timely manner	✓	✓	✓	
☐Demonstrate project management skills		✓	✓	
5.Communication Skills				
☐Communicate Complex ideas effectively	✓	✓	✓	✓
☐Communicate with interdisciplinary groups	✓	✓	✓	
☐Establish professional networks and communities		✓	✓	

Assessing Experiential Learning

Through its modular and flexible structure, the program has been designed to be responsive and accommodating to student interests and creativity. This responsive nature of the program necessitates an infrastructure for assessing learning that ensures rigor, consistency and meaningful standards across the potentially diverse outcomes anticipated. Central to this tension between flexibility and consistency is the capstone project. Evaluating student performance as part of the capstone project is a key feature of this program. This will be done on several levels to assure the quality of the student experience and the rigor of the projects and their outcomes. The Translational Research Program Committee (TRPC) will leverage existing departmental standard operating procedures (where applicable) and institute project specific measures for quality assurance and assessment.

As part of MSC2001 students will be required to draft a project proposal and select a Project Advisory Committee (PAC) for approval by the Translational Research Program Committee (TRPC). The project proposal will be required to include a rubric and metric for individual and group evaluation that will be negotiated between students and their PAC, and will be approved by the Program Committee to ensure rigor across projects and the means for final capstone assessment and evaluation. This apparatus will provide project specific flexibility to define deliverables and outcomes, and a program wide system for assessing quality and student achievement, and it will be the responsibility of the program Director and departmental Graduate

Coordinators to help students navigate the program and address any flagged issues.

During the Capstone project itself students will be required to provide their PACs project updates every three months to ensure ongoing feedback and review before final deliverable(s) are evaluated. Finally, the PAC will be required to submit a grade and an assessment of the project with clear demarcations of individual student contributions (in the case of group projects) to the TRPC for review.

On a departmental level, the TRPC will report to the established IMS Curriculum Committee and will forward any student issues or appeals that cannot be resolved at the program level to the department committees on standing. At the program level, the Director, IMS Graduate Coordinators, and the TRPC will be responsible for approving the student admissions, capstone proposals, PAC composition and final project evaluations. Students and student progress through the program as a whole will be closely monitor by program administrators to ensure appropriate progress and that all programmatic requirements are met.

Consultation

This program has been developed in consultation with the Faculty of Medicine, Faculty of Information, Institute of Medical Science, Knowledge Media Design Institute and the Institute for Communication, Culture and Information Technology.

Preliminary meetings between the group began in early 2011. At the Faculty of Medicine, discussions included:
Avrum Gotlieb, Vice Dean Graduate Affairs
Harry Elsholtz, Graduate Coordinator, LMP
Denis Grant, Chair, Dept. Pharmacology & Toxicology
Norman Rosenblum, Associate Dean, Physician Scientist Training
J. Paul Santerre, Director, IBBME
Barbara Secker, Director, Education & Practice, Joint Centre for Bioethics

Throughout 2011-2012 IMS engaged in discussions with potential program collaborators including ICCIT, KMD and the Faculty of Information. These preliminary discussions included:

Faculty of Information:
Seamus Ross, Dean, Faculty of Information
Andrew Clement, Interim Director, Knowledge Media Design Institute, Faculty of Information
Joseph Ferenbok, Assistant Director, KMDI, Faculty of Information

UTM:
Anthony Wensley, Director, ICCIT, UTM, Dept. Management, UTM and Rotman

Faculty of Dentistry:
Peter Pennefather, Leslie Dan Faculty of Pharmacy

In line with the University of Toronto Quality Assurance Process, this proposal has been developed in close consultation with the Office of the Vice-Provost Academic Programs and the SGS. In October, 2012, IMS had consultations with Avrum Gotlieb, Interim Vice Dean Graduate and Life Science Education and were given feedback on the initial ideas and provided guidance for moving forward. A sub-committee of the IMS Curriculum committee was established to help provide guidance for the development of the program moving forward and held its inaugural meeting January, 2013.

IMS has contacted Prof. Alberto Galasso, the Director of the MMI at the University of Toronto Mississauga. The MMI program does not incorporate a science research focus during the program, but may have synergies both for the students and the TR projects they execute. IMS will work with the MMI program to work on these and other future possible synergies. Of particular interest is to see whether MMI and TR program students can work together on aspects of the capstone projects.

Prof. Nick Woolridge, Director of the IMS professional masters in Biomedical Communication (BMC) is based at UTM and has served as a liaison between the IMS and the ICCIT. IMS and the ICCIT envisage a close working relationship between the proposed master's program in Translational Research and plans for future offerings at ICCIT involving medical and scientific communications. Dr. Joseph Ferenbok, who is the Assistant Director of KMDI, has helped developed this collaborative model for the two programs. Dr. Ferenbok is currently a lecturer in the IMS core seminar series in Translational Research.

The developers have also consulted with Allyson Hewitt, Advisor, Social Innovation and Director, Social Entrepreneurship, MaRS for a sense of Employment opportunities and collaboration with policy and industry partners in Translational Research. MaRS and other institutes whose mission is governed by social innovation and policy change will likely also be a significant area of potential employment for students with translational skills in medical research.

Resources:

Faculty Complement

The professors and clinical experts who will be core participants in this program are highlighted in Appendix B demonstrating the depth and breadth of research conducted at the Knowledge Media Design Institute, the Institute for Communication, Culture and Information Technology and Institute of Medical Science at the University of Toronto. The corresponding curricula vitae demonstrate their tremendous and collective expertise. It is significant to stress that the IMS graduate faculty will provide advisory expertise for students both individually and in the context of advisory panels on Capstone projects. IMS will be required to develop the 0.5 FCE foundations course, MSC1000, and fine tune expand the current MSC1010Y modular offerings to accommodate more modules for the MSC4010Y TR students. KMDI will provide access to KMD1001/1002 as part of an institutionally established MOU and ICCIT will co-develop the Communication In Health Sciences course, to be offered at the St. George Campus—effectively

coordinating interdepartmental synergies to leverage existing resources and expertise.

Administration
At full capacity the program will require a 0.6 FTE academic course director and 1 FTE administrative support to look after admissions, finances, graduation reviews, industry liaison, marketing and program coordination. The administrative support will also be key to supporting student access to modules and providing administrative support to capstone project groups.

Financial Support for Graduate Students
Financial support is not anticipated other than scholarships typically available to professional master's graduate students.

Space/Infrastructure
In steady state, it is expected that there will be up to 40 students (full-time) enrolled in any one term. Currently, IMS has teaching facilities include access to rooms that are appropriately configured for medium sized groups with large tables and chairs that can be rearranged for lectures, group discussions and small team projects. Most rooms have built-in projection system, speakers, blackboards and plenty of natural light. Wireless internet access is available for students as needed. These will generally suffice for most lecture-based courses such as MSC1000 and MSC1003.

Since no laboratory space is needed for the core courses in this program, and The TR students will not be affiliated with specific labs, the program will require a multipurpose specialized teaching space which will play a central role in helping to establish a sense of cohesion and execute their applied research projects. The hybrid classroom and ideation lab will provide students with the tools necessary to imagine, brainstorm and move forward their translational projects. The multipurpose space will allow the program to run its specialized workshops and seminars, and will become central to idea exchange and interaction to stimulate momentum and exchange for TR innovation.

Additional office space will house the two new staff for this program (Director and Administrative Assistant).

Quality and other indicators

Key aspect of the strength of the proposed program is the blending of expertise from across the University of Toronto. The Faculty of Information and the Knowledge Media Design Institute contribute expertise in information management and media design. Their interdisciplinary faculty provides a range of scholars concerned with knowledge curation and representation. ICCIT and Biomedical Communications contribute another range of collective faculty expertise that range from pervasive mobile computing to 3D animation rendering. The Institute of Medical Science brings a network of hundreds of laboratories and faculty whose collective expertise range across three key domains: A)Wet lab Research B) Clinical and Population-

based Research and C) Knowledge Translation, Development and Commercialization, including ethical issues in translational research.

Through the combined research and teaching assembled above from across the university students will have the opportunity to learn from these world-class researchers and bring that knowledge to bear when bridging the gap between the bench and the bedside.

Governance Process:

	Levels of Approval Required
Consultation with Provost	*June and September 2012*
Decanal and Provostial Sign Off	April, 2013
	Graduate unit approval
	Faculty/Divisional Governance
Submission to Provost's Office	
	AP&P
	Academic Board
	Executive Committee of Governing Council
Program may begin advertising as long as any material includes the clear statement that "No offer of admissions will be made to the program pending final approval by the Quality Council and the Ministry of Colleges Training and University (where the latter is required).""	
	Ontario Quality Council
	Submitted to MTCU (in case of new graduate degrees and programs, new diplomas)

Developed by the Office of the Vice-Provost, Academic Programs
June 26, 2012

Appendix A: List and description of courses

FCEs	**Title**	Description
0.5	**MSC1000H: Foundations in Translational Research**	This case based survey course looks at the different 'flavours' of Translational Research across the health sciences. The course helps distinguish between predominant areas of basic and Translational Research and articulate the knowledge skills necessary to conduct TR research. Students are introduced to the key issues facing Translational research and be provided with an over view of the tools and strategies involved in moving discoveries from "bench to bedside" and the community.
0.5	**MSC 1003H: Technology-mediated Scientific Communication**	Technology, both traditional and digital, mediates the communication between communicants. This course examines existing research about the use of both traditional and digital technologies in uni-directional and interactive communication. Students will also actively develop text-based communications content for traditional and digital media. The course will also investigate the necessity to be aware of the context of communication and its importance in developing communication in rich interactive environments.
1.0	**MSC 2001Y: *Projects in Translational Research***	This course is designed as a series of workshops that help the students plan and execute the capstone project. To complete the course students will have to complete 6 TR project workshops (4 - 6 contact hours each). The themes of these workshops will include: ideation, problem design, ethics, prototyping, evaluation and redesign, and integration through commercialization or innovation; and will be designed to help students advance their TR project proposals. For credit, each project team must establish an advisory committee and submit a capstone project proposal, prototypes, a project poster and any presentation slides for evaluation.
2.0	**MSC4000Y: Capstone Project in Translational Research**	All students will be required to complete a capstone project in translational research. Students will be assign groups of 3 – 5 students. Groups will have to work through a process of ideation to generate a project ideas in Translational Research either based on IMS faculty research, or any other medical or scientific research context where there is appropriate mentorship or supervision. To complete the project course students will have to complete 6 KMD workshops (4 contact hours each). Each project team must submit a proposal, prototypes, project poster and presentation slides for evaluation.

2.0	**MSC4010Y: Core Modules in Translational Research**	Students will be able to customize their experience, by assembling a selection of 8 modular short courses from 3 core domains: A) Wet lab Research B) Clinical and Population-based Research and C) Knowledge Translation, Development and Commercialization, including ethical issues in translational research. Students will be required to pick course modules from all 3 research domains. Each course module involves ~12-20 h contact time. Completion of 8 modules will qualify for 2 FCE.
0.5	**KMD1001H: Fundamental Concepts**	Knowledge media are systems incorporating computer and communications technology that enhance human thinking, creativity, communication, collaboration, and learning. Examples include the Web, email, instant messaging, blogging systems, knowledge management systems, digital libraries, collaborative virtual environments, video conferencing environments, and webcasting systems. This course reviews the emerging field of knowledge media design, and the use of digital media for communication, collaboration, and learning. The course includes topics in human-centred design; knowledge media technologies; social implications of knowledge media; examples and applications of knowledge media; and the future of knowledge media, and is organized via themes of design, media, and knowledge.
0.5	**KMD1002H Knowledge Media Design: Contexts and Practice**	This course is a theme-based Pro-seminar course for KMD Collaborative Program students combining lectures, public seminars, and participation in online discussions. Students who successfully complete the course will receive a Credit on their transcript rather than a specific grade. If students outside of the KMD Collaborative Program would like to take the course, they require special permission from the course Instructor. What are knowledge communities and how are their practices shifting in response to new media practices? This course addresses the past and current understanding of "persistent knowledge" that is defined by formal communities like school boards or graduate seminar courses, to less informal communities like fantasy sports or local folk music societies. We will consider the representations of such knowledge, its role within communities, and how it may be translated into new knowledge within and across community boundaries.

		These introductory KMD Collaborative Program core courses allows student teams from different program backgrounds (e.g. Engineering, Sociology, Education, Medicine, Computer Science,) explore a problem from a variety of perspectives, and develop prototype approaches to the selected design issue. Mentors and advisers will be drawn from instructors affiliated with the program through IMS. Students will be provided resources to represent and model their ideas, so that the implications of their designs can be critically examined.
1.0	**Electives**	For further breadth, students will select 1.0 FCE of courses in subjects of their own choosing from an approved list of courses. Typically this would be done in parallel with the Capstone Project to support synergies. Students will also be allowed to take electives outside the approved list with a pre-approval from the graduate coordinator.

Appendix B: Faculty Complement

Name	***Home Department / Unit***	***Rank***	***Graduate Faculty Membership Status (eg. Associate/ Full privileges)***	***Commitment to other programs***	***Hospital***	***Nature of contribution to this program (CI, TS, C/PS)****
Tenured						
Dr. Dina Brooks	*Physical Therapy*	*Professor*	*Full*	*Cardiovascular Science Collaborative Programs*	*Physiotherapist, West Park Hospital*	*C/PS*
Dr. Mark Chignell	*Mechanical Industrial Engineering*	*Professor*	*Full*	*Knowledge Media Design Institute*		*C/PS*
Dr. Peter Pennefather	*Pharmacy*	*Professor*	*Full*	*Knowledge Media Design Institute*		*C/PS*
Dr. Anthony Wensley	*Institute of Communication, Culture, and Information Technology*	*Associate Professor*	*Full*	*Knowledge Media Design Institute*		*C/PS*
Non-Tenure Stream (ie. CLTA)& Others (ie. Adjunct, status only, clinical faculty, visiting or other)						
Dr. Howard Mount	*Medicine*	*Assistant Professor*	*Full*	*Director of Education, IMS*		*CI, C/PS*
Dr. Joseph Ferenbok	*Knowledge Media Design Institute*	*Assistant Professor*	*None*	*Assistant Director, Knowledge Media Design Institute*		*CI*
Dr. Alan Bocking	*Department of Obstetrics and Gynaecology*	*Professor; Department Chair*	*Full*	*IMS,MSc, PhD Physiology,*	*Director, AMPATH (Academic Model Providing Access to Healthcare), Reproductive Health*	*C/PS*
Dr. Albert Wong	*Psychiatry*	*Associate Professor*	*Full*	*Full Member IMS; Pharmacology*	*Research Scientist, Centre for Addiction and Mental Health*	*C/PS*
Dr. Allan Kaplan	*Psychiatry*	*Professor*	*Full*	*Director, Institute of Medical Science; Chief of Clinical Research,*	*CAMH*	*C/PS*

				Center for Addiction and Mental Health; Vice Chair Research, Department of Psychiatry		
Dr. Andrea Furlan	*Medicine*	*Assistant Professor*	*NA*	*IMS; Clinical Fellow, Dep. of Medicine, Division of Psychiatry*	*Scientist, University Health Network*	*C/PS*
Dr. Anthony Joshua	*Medicine, Faculty of*	*Assistant Professor; Clinician Scientists*	*Associate Member*	*IMS*		*C/PS*
Dr. Berge A. Minassian	*Paediatrics and Neurology*	*Associate Professor*	*Full*	*Full Member IMS; Staff Paediatric Neurologist*	*Senior Scientist, Research Institute, The Hospital for Sick Children*	
Dr. Bernard Le Foll	*Family and Community Medicine*	*Associate Professor*	*Full*	*MSc, PhD IMS; Pharmacology; Psychiatry*	*Head, Translational Addiction Research Laboratory, CAMH; Independent Research Scientist, Centre for Addiction and Mental Health*	*C/PS*
Dr. Claudia dos Santos	*Medicine*	*Assistant Professor*	*Associate Member*	*IMS; The Collaborative Graduate Program in Genome Biology and Bioinformatics*	*Staff Intensivist, St. Michael's Hospital*	*C/PS*
Dr. Daniel Cattran	*Department of Medicine*	*Professor*	*Full*	*IMS;*	*Staff Nephrologist, UHN, Toronto General Hospital*	*C/PS*
Dr. Daniel Mueller	*Psychiatry*	*Associate Professor*	*Associate Member*	*IMS*	*Clinician Scientist, CAMH*	*C/PS*
Dr. David Kaplan	*Department of Medical Genetics and*	*Professor*	*Full*	*IMS; Neurosciences, Program in*	*Senior Scientist, The*	*C/PS*

	Microbiology				*Hospital for Sick Children*	
Dr. Donald Branch	*Laboratory Medicine and Pathobiology,*	*Associate Professor*	*Full*	*IMS*	*Director, Comprehensive Research Experience for Medical Students (CREMS) Program*	
Dr. Gideon Koren	*Paediatrics, Pharmacology, Pharmacy & Medicine.*	*Professor*	*Full*	*IMS*	*Director, Motherrisk Program, Division of Clinical Pharmacology and Toxicology*	*C/PS*
Dr. Jaques Belik	*Paediatrics*	*Professor*	*Full*	*IMS*	*Hospital for Sick Children*	*C/PS*
Dr. Jeffrey Medin	*Medical Biophysics*	*Professor*	*Full*	*IMS*	*Senior Scientist, UHN*	*C/PS*
Dr. Joseph Beitchman	*Public Health Sciences*	*Professor*	*Full*	*IMS; Child Psychiatry;*	*Head, Adolescent Service, CAMH*	*C/PS*
Dr. Karen Davis	*Surgery*	*Professor*	*Full*	*IMS*	*Associate Scientific Staff, Mount Sinai Hospital*	*C/PS*
Dr. Karen Gordon	*Department of Otolarynology*	*Associate Professor*	*Full*	*IMS*	*Scientist, The Hospital for Sick Children*	
Dr. Kirk Cheng Lun Lo	*Surgery*	*Associate Professor*	*Full*	*IMS, Associate Member*	*Consulting Urologist, UHN*	*C/PS*
Dr. Maria Carmela Tartaglia	*Medicine*	*Assistant Professor*	*None*		*Fellow, Affiliation universitaire ou postsecondaire hors Québec*	*C/PS*
Dr. Michael Fehlings	*Surgery*	*Associate Professor*	*Full*		*Medical Director, UHN*	*C/PS*

Dr. Michelle Adrienne Hladunewich	*Nephrology*	*Assistant Professor*	*None*		*Director, Division of Obstetrical Medicine, Sunnybrook Health Sciences Centre*	*C/PS*
Dr. NigilHaroon	*Medicine, Faculty of*	*Clinician Scientist, UHN*	*NA*		*Clinical Research Fellow, UHN*	
Dr. Norman Rosenblum	*Paediatrics, Physiology, Laboratory Medicine and Pathobiology*	*Professor*	*Full*	*Associate Dean, Physician Scientist Training, Medicine*	*Senior Scientist, Hospital for Sick Children*	*C/PS*
Dr. Paul Andrew Lam Sum Hwang	*Neurology; Paediatrics & Medicine*	*Associate Professor*	*Full*	*IMS;Co-Director University of Toronto Epilepsy Research Program; Head, Division of Neurology*	*Co-Director University of Toronto Epilepsy Research Program; Head, Division of Neurology*	*TS, C/PS*
Dr. Paul Arnold	*Psychiatry*	*Associate Professor*	*Full*	*IMS*	*Head, Anxiety Disorders Program; Staff Psychiatrist, Hospital for Sick Children*	*C/PS*
Dr. Richard Aviv	*Medical Imaging*	*Associate Professor*	*Associate Member*	*IMS; Biomedical Physics, Adjunct Professor, Ryerson University*	*Neuroradiology Divisional Head of Research, Sunnybrook Health Sciences Centre*	*C/PS*
Dr. Robert Inman	*Immunology,*	*Professor*	*Full*	*IMS*	*Visiting Professor in Medical Research, Royal College Physicians and Surgeons of*	*C/PS*

					Canada	
Dr. Robert Macdonald	*Surgery*	*Professor*	*Full*	*IMS*	*Head, Division of Neurosurgery, St. Michael's Hospital, Department of Surgery*	*C/PS*
Dr. Rupert Kaul	*Immunology*	*Associate Professor*	*Full*	*Visiting Lecturer, Department of Medical Microbiology, University of Nairobi*	*Medical Staff, Mount Sinai Hospital, UHN*	*C/PS*
Dr. Sophie Grigoriadis	*Psychiatry, Medicine*	*Associate Professor*	*Full*	*Associate Member, IMS*	*Adjunct Research Scientist, Women's College Research Institute*	*C/PS*
Dr. Steven Gallinger	*Surgery*	*Professor*	*Full*	*IMS*	*Head, HPB Surgical Oncology Community of Practice, Cancer Care Ontario*	*C/PS*
Dr. Tomas Paus	*Psychology and Psychiatry*	*Professor*	*Full*	*IMS; Adjunct Professor, Department of Neurology and Neurosurgery, McGill University*	*Tanenbaum Chair in Population Neuroscience, Senior Scientist, Rotman Research Institute*	*C/PS*
Dr. Tony George	*Endowed Chair and Head in Addiction Psychiatry;*	*Professor*	*Full*	*IMS*	*Clinical Director, Schizophrenia Program, CAMH*	*C/PS*
Professor Alan Moody	*Medical Imaging*	*Professor*	*Full*	IMS; Medical Biophysics	*Department of Medical Imaging, Sunnybrook Health Sciences Centre*	*C/PS*
Professor Arun	*Psychiatry*	*Professor*	*Full*	IMS; Psychology	*Clinical*	*C/PS*

Ravindran					*Director, Centre for Addiction and Mental Health*	
Dr. Sandra Black	*Department of Medicine (Neurology)*	*Professor*	*Full*	IMS; Institute of Biomaterials & Biomedical Engineering; Graduate Department of Rehabilitation Sciences	*Executive Director, Toronto Dementia Research Alliance*	*C/PS*
Dr. Ming F Agnes Wong	*Department of Ophthalmology*	*Professor*	*Full*	IMS, Department of Otolaryngology, Head & Neck Surgery Adjunct Professor Biology, York University; Adjunct Associate Professor, Washington University in St. Louis	*Staff Physician and Senior Scientist, Hospital for Sick Children*	*C/PS*
Dr. Sean Rourke	*Psychiatry*	*Professor*	*Full*	IMS, Psychology, Adjunct Professor, University of Windsor	*Scientific and Executive Director, Ontario HIV Treatment Network (Ministry of Health and Long-Term Care)*	*C/PS*
Professor Mingyao Liu	*Surgery/Medicine/Physiology*	*Professor*	*Full*	*IMS; Department of Physiology*	*Senior Scientist, Latner Thoracic Surgery Research Laboratories, UHN*	*C/PS*

Appendix C: Library Statement

University of Toronto Libraries Report for
Proposed Master of Health Science in Translational Research

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.[1] 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.[2] 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[3]					
	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**
	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

[1] Chronicle of Higher Education, "Library Investment Index at University Research Libraries, 2009 – 2010." In the Almanac of Higher Education, 2012.
[2] 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
[3] Association of Research Libraries Statistics.

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.

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 medical research 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.[4]

Program Specific Instruction: Instruction occurs at a variety of levels for graduate students and is provided by librarians at the Gerstein Science Information Centre and local hospitals. The Library facilitates formal instruction integrated into the class schedule and hands-on tutorials related to course assignments. Librarians at the Gerstein Science Information Centre provide one-to-one consultations with graduate students who are conducting literature, scoping or systematic reviews for their theses. The Library, through its liaison librarians, customizes feeds of library resources. These appear prominently in Portal/Blackboard course pages. Example: Bioinformatics: http://guides.library.utoronto.ca/content.php?pid=363517&sid=2975086 and Systematic Reviews in the Sciences and Health Sciences: http://guides.library.utoronto.ca/systematicreviews
Also, the liaison librarian for the Institute of Medical Science presents a seminar for graduate students called Tools in Informatics: advanced Information Searching.

Collections: All college and campus libraries collect materials in support of medical research; 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 medical research at the University of Toronto.

Journals: The Library subscribes to 22 of the top 25 journals listed in Journal Citation Reports (JCR)[5] in subject area Medicine, Research and Experimental. Of these titles, all are available electronically to staff and students of the University. The three journals that we don't have current access to are: Journal of Biological Regulators and Homeostatic Agents; Current Molecular Medicine; and Journal of Biomedical Nanotechnology. The Library is investigating a subscription to these journals.

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 medical research, monographs are purchased in electronic form where possible. The Library currently receives all current e-books directly from the following publishers: Springer, Elsevier, Informa Healthcare, Wiley, and Oxford University Press.

[4] Association of College & Research Libraries.*Information Literacy Standards*.ACRL, 2006.
[5] 2008 Journal Citation Reports® (Thomson Reuters, 2009)

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 in support of medical research, 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.

Key Databases: Medicine: Embase, Medline
Multi-disciplinary: Web of Science, Scopus

Special Collection Highlight: To support program commitments in medical research, 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, March 5, 2013

Submitted by: Larry Alford, Chief Librarian, University of Toronto Libraries, Date

Appendix D: List of Elective Courses

FCEs	Course	Description
0.5	**MSC1040H - Physiologic Basis of Disease**	This is a half-year lecture course designed for M.Sc. and Ph.D. students in the IMS who wish to gain an in-depth understanding of the basic mechanisms of disease, how these processes lead to the clinical syndromes and how medical research in these areas leads to effective therapy. The course will consist of twelve 2-hour lectures by faculty members of the University of Toronto who are authorities in the areas under discussion. The course's aim is to integrate fundamental knowledge at a basic molecular and cellular level with whole organ physiology in animals and humans to elucidate the processes by which derangements of physiology lead to the manifestations of disease. Finally, the processes by which this fundamental knowledge is used to advance the treatment of disease will be discussed. Where appropriate, epidemiologic studies and clinical trials related to a particular disease will be discussed as well. Topics that could be covered in this course include diabetes, atherosclerosis, coronary artery disease, congestive heart failure, asthma, acute lung injury, cystic fibrosis, Alzheimer's disease, inflammatory bowel disease, peptic ulcer disease, rheumatoid arthritis, organ transplantation, critical care-from bench to bedside, etc.
0.5	**MSC1051H - Research Bioethics**	The objective of this course is to familiarize students with ethical, regulatory and practical concerns that they will face as investigators, members of Research Ethics Boards, and in any other capacity that involves research and research review. The course offers a theoretical and practical introduction to the field of research ethics and the review of research protocols. The course materials that deal with the history of research ethics and with some of the theoretical concepts will be addressed in direct connection with some of the major themes in the ethics and regulation of medical research. Topics may include, but are not limited to: different approaches towards the protection of research subjects and the review and regulation of medical research; value and validity of research and the role of REBs; demarcating research from therapy; clinical equipoise and placebo controls; proportionate review and risk/benefit analysis; challenges to informed consent; vulnerability; inclusion of women and members of minority groups; research in developing countries; monitoring; integrity in research and conflict of interest. In addition, the course may address specific topical controversies
0.5	**MSC1085H - Molecular Approaches to Mental Health and Addictions**	This course investigates the neuroscience knowledge and research strategies underlying major psychiatric disorders. There will be an emphasis on human molecular genetic and genomic studies. Lectures will also discuss insights gained from other areas of research such as neuroimaging, pharmacology and animal models. Particular attention will be paid to how these studies have refined our understanding of clinical phenomena. Each faculty member will deliver a lecture for approximately 90 minutes describing their research work, including an introduction to their field, major methodological issues and key discoveries. Then, 30

		minutes will be dedicated to discussion. The oral presentations will be attended by two faculty members who will generate a consensus grade for the presentation. Similarly, each written assignment will be evaluated by two faculty members and consensus grades will be assigned.
0.5	**MSC1089H - The Biopsychosocial Basis of Mental Health Addictive Disorders**	We will review the biopsychosocial basis of mental health and addictive disorders from the perspectives of etiology, pathophysiology, clinical phenomenology and diagnostics, genetics, neuroimaging, and treatment which have all contributed to our increasing understanding of psychiatric and substance use disorders from a biomedical ("disease") concept. The role of stigma and recovery would also be discussed from a biobehavioural and social determinants of health perspective, to produce an integrated perspective on mental health and addictive disorders. The contemporary approach to treatment of these disorders would also be discussed which emphasizes biological, psychological and social policy and prevention perspectives.
0.5	**MSC1090H - Introduction to Clinical Biostatistics**	The course emphasizes issues related to the comparison of two samples using tests of significance and confidence intervals and also covers linear regression and analysis of variance. Multiple regression models: linear, logistic, Poisson and Survival, are covered in my winter term graduate course MSC1060H.The course is designed for students in nutrition, pharmacy, nursing, dentistry, health economics and other clinical sciences. Weekly computer labs train students in the use of the statistical package SAS for data management and statistical analysis. During interactive Web based sessions students are able to access randomly generated datasets to practice and be examined on their ability to perform statistical analyses The heavy emphasis on the use of SAS for data management and analysis and the use of the Web to support intensive practice in the analysis of simple datasets is perhaps unique on this campus. This course is the first of a two-course sequence that introduces important concepts of statistical design and analysis along with an introduction to a very popular and powerful statistical package. The course is important for students who need to carry out their own data analyses.
1.0	**MSC2010Y - Advanced Concepts in Human Genetic Disease**	This course should encourage students to develop an approach to the genetic analysis, investigation and treatment of human disease. *Introduction to molecular approaches*: Students will be introduced to useful tools and concepts that enable the study of a wide spectrum of human diseases. These include such topics as: population identification and sample collection; genome scanning with subsequent linkage analysis; mutation detection methods; copy number variation analysis and the use of animal models. *Specific examples of the genetics of human disease:* In the body of the course, a series of 16 lectures will cover the genetic analysis of specific diseases. Lecturers will be encouraged to discuss: a brief description of

		the disease they intend to cover (eg: the basic clinical presentation and pathophysiology); the approach to the study of this disease; and the molecular changes that occur. Integration with animal models and the potential for human gene therapy will be encouraged. *Each lecture will provide an example of the application of molecular tools to the investigation of a specific human disease.* Lecturers will be encouraged to provide weekly reading assignments. The student will be required to prepare a Letter of Intent for a proposal that discusses the genetic analysis of a specific human disease (due February). Students are advised to identify a preceptor to help with their proposal idea. Preceptors are often chosen from the course lecturers, but students are not restricted to these individuals. While the preceptor will act in an advisory capacity, the student must carry out the initial problem identification and the preparation of the proposal. Considerable latitude will be allowed in the choice of project, preceptor and approach to the disease. The student will also present a final 10 minute, in-class slide presentation of this proposal (in March). As a final assignment, the student will write a short News & Views type article about a paper or papers in the filed of molecular medicine that have been published during the past calendar year. The topic must be unrelated to their thesis.
0.5	**MSC4001H: Foundations in Resuscitation Science Research**	This 0.5 credit course is aimed at enhanced understanding of the breadth of research in resuscitation science. It will provide students within disparate fields of research enquiry with the fundamentals of the discipline and provide a forum to discuss common areas of research interest, thereby further reinforcing a spirit of interdisciplinary research. Topics include bioethical issues particular to resuscitation research; health services research with high risk groups; outcomes research in critical illness; translational research in resuscitation and knowledge translation. From bench to bedside to curbside, students will gain a thorough understanding of the issues and concerns unique to the field of resuscitation sciences.
1.0	**MSC7000Y - Regenerative Medicine (Webcast)**	MSC7000Y is a unique flagship course of wide interest to students with a health professional background (i.e. MDs, RNs, clinicians and scientists) across Canada. This course will provide trainees with an understanding of the science behind the field, the bio-processes, new and emerging technologies, the ethical and regulatory aspects of implementation and the academic/industry partnerships on which clinical success is likely to be based. Content is as follows: **Background: Organ Failure** • Heart, Lung, Liver, Kidney, Pancreas Failure including physiology, human impact, and cost and the implications for regenerative medicine • Current Approaches to Management of Organ Failure including transplant and non-transplant approaches **Regenerative Medicine and Innovative Technologies (main focus)** • Stem Cells • Gene Therapy

		• Tolerance • Biomarkers & Assays • Regenerative Neuroscience • Tissue Manufacturing **Clinical Applications of Regenerative Medicine** • Translation of New Therapies from Bench to Bedside • Fundamentals of Clinical Trials Design • Evaluation of Health-Related Quality of Life • Patient Issues and Concerns • Cost-Effectiveness & Global Health Economics • Adoption of New Therapies **Ethics and Society** • Research Ethics • Transplant Ethics • Regenerative Medicine Ethics • Public Opinion and the Media • Biomedical Research Commercialization • Financing and the Role of the Biotechnology Industry • The Business of Regenerative Medicine • Visiting Speaker RM Series • Four lectures from visiting notable speakers within the field of Regenerative Medicine, taking place on Wednesday mornings (see course schedule).
	MSC8000Y - Transdisciplinary Studies in Infectious Disease (using Hepatitis C as a model)	This graduate full-course is a transdisciplinary exploration of hepatitis C, extending the students' understanding of the hepatitis C virus beyond a single discipline in order to enhance pursuits in hepatitis C research or management and prepare the student for a career in hepatitis C research. Beginning with an introduction to hepatitis C, students will soon find themselves immersed in all aspects of this infectious disease, covering scientific, medical, and social issues. Lectures include topics such as immune response to the infection, addiction behaviour of infected individuals, new drug and vaccine development, HIV/HCV co-infection, etc. This course is targeted towards students with a health professional background (i.e. MDs, RNs, social and basic scientists) and an active interest in infectious disease-related research. MSC8000Y is comprised of weekly web-conferenced lectures and discussions, running from September to April every other year. The presentation of the course can be divided into five different stages: orientation, pre-lecture, in-lecture, post-lecture, and conclusion.
0.5	**JCV 3060H Advanced Topics in Cardiovascular Sciences: Molecular Biology & Heart Signal**	This course is one of a set of four advanced seminar half-credit courses dealing with current areas in the cardiovascular system. Specifically, JCV3060H focuses on various aspects of the genetic, molecular and cellular properties of the heart and its' development and new techniques used to investigate these areas.

	Transduction	Areas that may be covered include: • Genetic regulation of heart development and function • Cell signalling • Molecular properties of cardiac ion channels, G-protein coupled receptors, sarcoplasmic reticular proteins • Circadian rhythms of gene expression • Molecular and cellular mechanisms of heart disease • Cell transplantation • Animal models to study heart disease
0.5	**JFK 1120H Selected Topics in Drug Development I**	This course is designed to introduce graduate students to general research and drug development in the pharmaceutical industry. Lectures will focus on government regulations, phase I through phase IV studies, marketing and quality control requirements in new drug approval. The course format is a combination of lectures given by faculty, specialist in the pharmaceutical industry and workshops.
0.5	**JFK 1121H Selected Topics in Drug Development II**	This course provides an in-depth examination of several issues facing the pharmaceutical scientists. Students will be required to apply fundamental principles of pharmaceutics and pharmacokinetics to current problems that are being faced in the pharmaceutical industry. Contemporary issues in pharmaceutics and pharmacokinetics will be covered. The course format is a combination of lectures given by faculty, specialist in the pharmaceutical industry and workshops.
0.5	**PSL1022H Reproductive and Developmental Medicine**	This is a seminar-based half course but extended over the entire year. This graduate course is directed at providing a greater understanding of the physiology and molecular mechanisms underlying common clinical reproductive disorders. The course is open to **8** graduate students working on research related to reproduction. Eight OB/GYN residents will also participate. The course will meet (not every week) for 2-hour sessions and two faculty members will be assigned to each session, which will consist the following: 1. A 20-30 minute overview of the topic by the faculty mentors 2. A 30 min clinical paper (presented by a graduate student)* + 15 min discussion 3. A 30 min basic paper (presented by a clinical trainee)* + 15 min discussion The goal is to have the clinical trainee and basic science trainee work as a team on related papers and then each present the paper that is not in their field of expertise.
0.5	**PSL1048H - Translational Physiology: From Molecules to Model Systems to the Clinic**	Through published examples, students will be exposed to: • identifying molecules (e.g., genome-wide human screens, discovering mutated genes) • designing/applying cell-based studies (e.g., selecting/creating appropriate cell-based assays, high-throughput screening) • selecting/creating appropriate models at the organ or animal level • obtaining 'proof-in-principle' data • proceeding to clinical trials Additional aims of the course are to augment:

		• oral and visual presentation skills • skills in both leading and participating in group discussions • critical and analytical thinking • awareness of translational medicine resources, including journals, local seminars, centres and consortia Each session will strive to include some controversy. For example, the presented papers might reflect differing views on: the molecule underlying a disorder, the cellular or animal models used, or the interpretation of genomic studies. Examples of possible topics and fields represented: • Neurophysiology: Assessing the potential for targeting inflammatory molecules to treat stroke. • Epithelial physiology: Identifying molecular targets for Cystic Fibrosis therapy. • Gastrointestinal physiology: Identifying dysregulated membrane fusion/exocytosis as an underlying mechanism of pancreatitis. • Integrative physiology: Discovery and structure-function analysis of inhibitors of receptor tyrosine kinases as potential cancer treatments.
0.5	**PSL1068H - Advanced Topics: Molecular Basis of Behaviour**	The goal of the course is for students to gain a broad perspective on the molecular basis of behavior. Students will discuss and evaluate advanced topics in the molecular determinants of behavior; from physiological to pathological mechanisms of plasticity. More specifically, we will explore learning and memory, pain and drug abuse.
0.5	**PSL1071H - Advanced Topics: Computational Neuroscience**	Computational neuroscience seeks to understand how the brain and nervous system compute. This highly interdisciplinary field requires both experiment and theory and encompasses several disciplines including physiology and mathematics. This course will focus on selected computational neuroscience aspects including: types of neuron and network models (detailed and simple representations, phase models), and techniques from dynamical systems theory that are used to analyze different models. The emphasis in this course will be on understanding the neurophysiological basis and assumptions in models and possible insights and understanding that can be achieved from the models and analyses.
1.0	**PCL 1004Y Graduate Course in Clinical Pharmacology**	This course aims at familiarizing the student with the rapidly growing field of clinical pharmacology. Graduates may pursue a career in this field in a hospital setting or in the pharmaceutical industry. The first part of the course (until Christmas) focuses on clinical pharmacokinetics. The second part is devoted to selected topics in clinical pharmacology with special focus on how to design and interpret drug studies. The final mark is based on a take-home exam (Christmas), and student's presentation (once per year). The course is limited to 15 graduate students.
1.0	**JNP1014Y**	A survey course examining several contemporary topics in toxicology

	Interdisciplinary Pharmacology	with emphasis on human/mammalian toxicology. Topics in the course may include: adverse drug reactions, acute poisonings, natural toxins, maternal-fetal toxicology, forensic toxicology, environmental chemistry, pesticides, dioxins, endocrine disruptors, regulatory toxicology, occupational toxicology, food toxicology, herbal products, alcohol, smoking, and drugs of abuse. Students are evaluated by their performance on written tests and assignments. Recommended Preparation: BCH210H, PCL201H, PCL302H, PCL362H, or their equivalents.
0.5	**JNP1017H Current Topics in Molecular and Biochemical Toxicology**	This course will emphasize the biochemical principles and mechanisms underlying the toxicity of drugs and foreign agents. In particular the current hypotheses that explain the events at the molecular level which determine and affect toxicity are examined and critically evaluated. This course is suitable for graduate students of pharmacy, toxicology, pharmacology, biochemistry, environmental science, pathology, neuroscience and medical biophysics. A weekly journal club will also be held after the lectures. Permission of the Pharmaceutical Sciences Department is required.
0.5	**JNP1018H Molecular and Biochemical basis of Toxicology I**	This course will emphasize the molecular biology principles and mechanisms underlying the toxicity of drugs and foreign agents. A journal club format is used to examine and critically evaluate the current hypotheses that explain the events at the molecular level which determine and affect toxicity. This course is suitable for graduate students of pharmacy, toxicology, pharmacology, biochemistry, environmental science, pathology, neuroscience and medical biophysics. A weekly journal club will also be held after the lectures. JNP1017H is not a prerequisite for this course.
0.5	**LMP1013H - Neoplasia**	This advanced course is designed to provide an in-depth examination of the molecular and cellular mechanisms giving rise to malignant transformation. The mechanisms of transformation by retroviruses and the DNA tumour viruses will be discussed. Then, specific non-viral molecular mechanisms involving signal transduction, cell growth, death and differentiation, the latter particularly in the context of embryonic development, will be analyzed. The involvement of genetic instability and epigenetic mechanisms during malignant transformation will also be discussed. Finally, these mechanisms will be used as the basis to discuss neoplasia in specific model tissues, specifically mammary, colon, CNS and lymphoid/myeloid tissues.
0.5	**LMP1407H 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.
0.5	**LMP1525H The Role of Genomics in the Era of Personalized Medicine**	The idea of this course stems from the necessity for our graduate students to get a grasp of the new advances in technology, especially those related to the concept of informatics and the role of molecular profiling and high throughput data generation and analysis. A unique role of the Department of Laboratory Medicine and Pathobiology is to bridge the gap between basic and translational sciences. An important objective of this course is to explore how understanding the pathobiology of disease can be translated to answer clinically

		meaningful questions. This course will also highlight the important role of biobanking in biomarker discovery, which are of core importance to our department.
	LMP1530H Next Generation Genomics in Clinical Medicine	Next generation genomics, especially whole genome sequencing, will facilitate the application of genomics in clinical practice at a grand scale. Despite the fact that there are already many individual molecular tests which are currently looking at genomic alterations in individual, or a few genes (known as molecular diagnostics), there is still no widespread clinical applicability of next generation genomics, such as whole genome sequencing.
	LMP2120H Molecular Clinical Microbiology & Infectious Diseases	Molecular Clinical Microbiology & Infectious Diseases is a course that provides an introduction to medical bacteriology, virology, mycology and parasitology. The course consists of lectures from specialists in each topic, and discussions on selected papers. Students should be familiarized with concepts pertaining to basic molecular biology principles and techniques for understanding various contemporary areas of research in clinical microbiology and their applications. This programme covers these areas, together with training in research skills.
0.5	**HAD 5735H "Commercialization of Health Research"**	This is an elective course for students in graduate research programs who wish to gain a better understanding of the commercialization of health research specifically and the knowledge-based economy in general. The course provides an overview of different aspects to research commercialization, including basic and applied research, technology transfer, venture capital, clusters, national innovation systems, and what Canada and other countries are doing to move their economies in this direction. This course will also be available for all students, in particular, business students and science students interested in learning about the business side of their research activities. Students working in public sectors such as research, science, or innovation policy; health policy and management; and education (including universities) may also find the course useful.
0.5	**HAD 5765H "Case Studies in Health Policy"**	This course analyzes the formation and implementation of public policy through the use of case studies, focused about important theoretical concepts. Students will develop the ability to understand and analyze the processes by which public policies are formed, and the ability to perform comparisons of policy alternatives. Guest lecturers may be used where appropriate to expand upon the process of policy implementation in an informal format. Cases to be analyzed will be selected from the attached list by the class. With the permission of the instructor, new cases may be added.

Appendix E: Sample MSC 4010Y Module Description

IMS Graduate Course Module -Ophthalmology & Vision Science

Objectives

Disorders of the eye and the visual system are important causes of morbidity in Canada and worldwide. This module would give the graduate student an overview of the numerous clinical and basic science researches taking place at the University of Toronto and its affiliate institutions; to find methods of early detection, prevention, and better treatments for most common vision related disorders.

Students doing vision science research can use this module to expand their overall understanding and perhaps see how their findings could be applied in other areas. Students without a background in vision science can also benefit from this module. They may find ways of applying their knowledge and skills to address challenges in vision research and explore opportunities for inter-disciplinary research.

The module consists of a series of 12 lectures by faculty members of the University of Toronto who are leaders in their area of research. There will be two, one-hour, lectures per session/day. In each lecture, approximately 10 minutes of time would be allocated for questions/discussion. Topics that would be covered in this module include: molecular basis of ocular pathophysiology, visual electrophysiology, binocular single vision, strabismus, cataract & refractive surgery, glaucoma, diabetic retinopathy, macular degeneration, retinal stem cells, retinoblastoma, uveal melanoma, and migraine.

Prerequisites

No prerequisites. A background in biology, physiology, or medical science would be helpful.

Assessment

The week before each lecture, students will receive reading material and five questions to prepare brief written answers. At the beginning of each lecture, students will be given 5 multiple choice questions - related to the topic of the lecture - to be answered during the class.

Lecture Topics

1. Introduction to Anatomy and Physiology of the Visual System
2. Introduction to Molecular Basis of Ocular Pathophysiology
3. Visual Electrophysiology: Current Research and Future Directions
4. Refractive Surgery - Current Research and Future Directions
5. Glaucoma: Current Research
6. Diabetic Retinopathy: Clinical and Retinal Vascular Function Changes
7. Macular Degeneration (AMD): Current Research and Future Directions
8. Retinal Stem Cells: Current Research and Future Directions
9. Retinoblastoma: Current Research and Future Directions
10. Uveal Melanoma: Current Research and Future Directions

11. Binocular Single Vision, Stereopsis, Amblyopia and an Overview of Eye Movement
12. Disorders
13. Migraine and the Visual System - Current Research and Future Directions

UNIVERSITY OF TORONTO
FACULTY OF MEDICINE

EXTERNAL APPRAISAL REPORT

NEW PROGRAM PROPOSAL

The External Review Committee is asked to evaluate the standards and quality of the proposed program undergoing external review, commenting on the points below. The following template is based on the terms of reference and highlights the critical elements that must be considered. You are welcome to use this template if it is helpful in organizing your response. Please make note of any recommendations on any essential and/or desirable modifications.

PROPOSED PROGRAM FOR APPRAISAL	MHSc – Translational Research in the Health Sciences
COMMISSIONING OFFICER	Catharine Whiteside, Dean
DATE OF SCHEDULED REVIEW	2013-07-03

EXTERNAL APPRAISAL SUMMARY *(Please provide a summary of your findings.)*

Draft: October 20th, 2013; updated November 11th and November 14th, 2013; finalized November 15th, 2013

External Appraisal Summary:
Report by Dr. Michael G. Schlossmacher (University of Ottawa) and Dr. David Hafler (Yale University) as external advisors to the University of Toronto regarding a newly planned MHSc Program for Translational Research in the Health Sciences:

Summary:
The appraisers welcomed the opportunity to learn about the University of Toronto's newly proposed graduate program to obtain a Master's degree (MHSc) in Translational Research in the Health Sciences. We consider it a very innovative and promising project that is of high relevance to the needs of health sciences-oriented communities in Toronto, in Ontario and throughout Canada. We agree with the assessment of the Program Committee that future graduates with a MHSc in Translational Research in the Health Sciences (obtained from the University of Toronto) will likely provide critical leadership in key positions of academia, pharmaceutical enterprises, biotechnology firms, government agencies, private foundations as well as philanthropic organizations Thus, once approved and in operation the program has great potential to further expand the leading role of the University of Toronto in bringing new health care solutions to communities locally, nationally and globally.

Source of information:
This report is based on the digestion of material provided by the University of Toronto to the appraisers ahead of the one-day visit and based on meetings and discussions that took place during a site visit on July 3, 2013.

The following materials were provided to the appraisers and reviewed:

- New Program Appraisal / Terms of Reference for Master's degree (i.e., MHSc) – Translational Research in the Health Sciences (TRiHSc); 2 pages
- From Cell to Society: A Vision and Strategy for the Institute of Medicine. 2012-2017; 11 pages
- Institute of Medical Science TRiHSc – Master of Health Science (M.H.Sc.); 22 slides printed
- Institute of Medical Science at the University of Toronto – Executive Summary; 4 pages
- University of Toronto New Graduate Program Proposal; 49 pages.

Meetings by the appraisers with the following members of the University of Toronto faculty, administration and student body took place on July 3, 2013:

- Introductory briefings by Dr. Catharine Whiteside; Dr. Avrum Gottlieb
- Dr. Brian Corman; Dr. Allan Kaplan
- Members of the Program Committee: Drs. A. Kaplan, Howard Mount and Joseph Ferenbok
- Members of the IMS Leadership Team: Drs. A. Kaplan, Mingyao Liu, H. Mount, and Ms. Vasundara Venkateswaran, Brenda Toner, Cindi Morshead, Dr. J. Ferenbok
- Students and alumni: Greg Costain, Richard Foty, Brett Jones, Chloe McDonald, Brittany Rosenbloom, Ryan Rumantir, Isuri Weerakkody, Weining Yang
- The Vice-Provost of Academic Programs: Dr. Cheryl Regehr
- Leaders of the Cognate Programs and Units: Drs. Anthony Wensley, Tony Redpath, Rick Hegele, Fei-Fei Liu, Alan Moody, Steffen-Sebastian Bolz, Beverly Orser, Ruth Ross, Jim Rutka, David Jaffray, Christopher Yip, Daniel Roth
- Members of the Program Committee: Drs. A. Kaplan, Howard Mount and Joseph Ferenbok
- Exit meeting with Dr. Catharine Whiteside; Dr. Avrum Gottlieb

EXTERNAL APPRAISAL REPORT
NEW PROGRAM PROPOSAL

1. OBJECTIVES

- **consistency of the program with the University's mission, and Faculty's and Unit's academic plan**
- **clarity and appropriateness of the program's requirements and associated learning outcomes in addressing the academic division's graduate Degree Level Expectations**
- **appropriateness of the degree or diploma nomenclature**

The external appraisers felt that the proposed program, i.e., a Master's degree (MHSc) in Translational Research in the Health Sciences, clearly meets the University of Toronto's overall mission and the academic plan of the Faculty of Medicine, as communicated to us; this first-in-kind degree option in Canada promises to increase the pool of graduates (in Ontario and beyond) that have a background in the health sciences and -through the completion of the MHSc study program- will have broadened their expertise and acquired new skills that will allow them to bridge important divides in the translational gap. The University of Toronto seeks to educate professionals who link exciting new research results with their applications for the improved health of local, national and global communities. Future graduates are envisioned that will help transfer recently created knowledge to developers of new solutions (where it is indicated, as in care strategies, innovations, and drug development), to clinical practitioners (where it is already feasible based on recently developed evidence) and to policy makers in the community (where further research support is necessary to address unmet health needs in our societies).

The University of Toronto seeks to educate such professionals by making them 'bilingual'; individuals that will graduate with a Master's degree (MHSc) in Translational Research in the Health Sciences will already be proficient in their first language of basic research or the practice of medicine. As a result of the completion of the new study program they will then have acquired the additional skill to competently communicate in a second language, i.e., in their chosen domain of research application. In doing so it is envisioned that graduates with a MHSc will have in-depth insight into multiple disciplines of the health sciences, be able to help with the design of new projects, assist in the transformation of basic science concepts into applied research, and importantly, disseminate their knowledge through their own research, teaching and writings. As communicated by the Program Committee members, the University of Toronto sees a significant demand in Canada for professionals with a Master's degree (MHSc) in Translational Research in the Health Sciences, with which we agree. This new program will complement existing graduate programs at the IMS. Graduates will likely land jobs within government agencies, private foundations that fund research, for-profit biotech and pharmaceutical companies, not-for-profit research enterprises, and institutions of higher learning, to name the most important ones. In Toronto, the proposed graduate program also seeks to fill a niche between already existing -as well as newly created- institutes at and enterprises near the University of Toronto, such as those dedicated to innovation, commercialization and drug discovery (e.g., MaRS, MaRS Innovation, and Techna); it could also provide a strong link between the Faculty of Medicine, the Dalla Lana School of Public Health, and School of Pharmacy.

Regarding the clarity and appropriateness of the Master's degree (MHSc) in Translational Research in the Health Sciences the appraisers felt that the focus on "breadth", "deployment" and "integration" as pillars of the rationale underlying the proposed study plan (and as outlined in the "New Graduate Program Proposal" and as communicated during our site visit) was well chosen and logical. This tripartite structure is also well fitting with the established strengths of the University of Toronto, its well-known and successfully operating Institute of Medical Science (IMS), and with the mission of 9 fully affiliated hospitals and 18 partially affiliated hospitals at the Faculty of Medicine.

The external appraisers felt that the proposed name of the degree, i.e., Master's in Translational Research in the Health Sciences (MHSc), was fitting for the new program.

2. ADMISSION REQUIREMENTS

- **appropriateness of the program's admission requirements to the learning outcomes of the program**
- **appropriateness of any alternative requirements for admission into the program such as minimum grade point average or additional languages or portfolios, along with how the program recognizes prior work or learning experience**

Appropriateness of the program's admission requirements: This topic occupied a critical portion of our discussion with many members of the Faculty of Medicine that we met with. A key question revisited several times was: "How will you ensure that you recruit students not just based on their GPAs but rather based on the ability to think outside the box, their desire to challenge dogmas, and their commitment to bring about change?" We were informed of / reoriented to the fact that the "Master's in Translational Research in the Health Sciences (MHSc) is principally designed as a professional master's degree

intended for highly trained individuals who already have relevant backgrounds in the health sciences, such as clinical researchers, medical practitioners, basic scientists (or social scientists), and who now want to move discoveries from where they were made to where they can be used". It was communicated to the appraisers that the initial enrollment cap for the 2-year program will be at 20 students per year for the foreseeable future.

We understand that the minimum requirement is a Honors associated, 4-year BSc degree or MD degree. Applicants with a MSc or PhD degree in related areas of study (such as life and social sciences) will be considered, too. Will applicants with an engineering degree or an advanced nursing degree also be considered? An emphasis on marks, academic preparedness, the impact of 3 letters of reference, and the perceived level of motivation by each applicant will be given, as stated in the "Admission Requirements of the New Graduate Program Proposal". A strong commitment by the Program Committee is communicated to us "to set the bar very high regarding previous accomplishments of our applicants". The Program Committee is understandably building on the extensive experience by administrators at the University of Toronto with the running of its MD/PhD Program and IMS-based programs.

Suggestions by the appraisers regarding the admission process: The admission committee clearly wants to ensure the selection of the most qualified people for successful translation research into the program, i.e., of those who have demonstrated exceptional skills and a record of accomplishments in the past. What metrics could be employed rather than a system that is largely based on GPA? The most desirable individuals will have consistently shown a high level of self-motivation, emotional maturity, energy and commitment to 'bring about change' in the health sciences. How will the admission committee be assembled? How will it successfully identify those candidates that are able to "spark the critical new idea that connects all the known (and unknown) pieces?"

A well-communicated career goal would be essential; the recruitment of students who bring with them a well-defined, concrete project appears attractive to us, as is the selection of those who have overcome significant challenges in the past.

One recommendation is the use of a point system by which applicants are ranked via computed aggregate score compiling multiple parameters using a scale that ranges from 1-4 (or 1-5). These parameters may include (but are not limited to) domains gleaned from the letters of reference (e.g., creativity, communication skill, success in completing assignments, innovative behavior), from the letter of intent by the applicant (e.g., motivation, career goal, communication skill, past accomplishments), CV (e.g., a specific expertise, publication record, awards and prizes, patents applied for, patents awarded, past commercialization and licensing success), highest academic degree awarded, work experience (in years), the personal conduct during interview (e.g., emotional intelligence, ability to identify strengths and weaknesses in self) and language proficiency.

Finally, integrating a class composed of both MDs or PhDs at their level of maturity with a four year BSc degree will be challenging and needs careful reflection. While the doctoral degree prepared students will have acquired a skill set related to medical or scientific skills with the desire to apply these skills to translational projects, the students with just the BSc will not yet have that skill set and thus have more difficulty with integration of their knowledge base to translational science.

3. STRUCTURE

- **appropriateness of the program's structure and regulations to meet specified program learning outcomes and Degree Level Expectations**
- **program length in order to ensure that the program requirements can be reasonably completed**

Program structure and regulations to meet specified learning outcomes and degree level expectation: The external appraisers felt that the structure, regulations and outcomes, as provided in the New Graduate Program Proposal for the Master's in Translational Research in the Health Sciences (MHSc), were well developed. Members of the Program Committee stressed the overall importance of "the mix of seminars; courses, lectures; modules; workshops; and independent work by each student built into the system". We are in support of this approach to structure.

Program length: The external appraisers felt that the information provided on the length of the New Graduate Program Proposal for the Master's in Translational Research in the Health Sciences (MHSc) was appropriate for goals and content, and thus justified. What was only briefly touched on was whether residents in training or postdoctoral fellows in training would be able to participate in the new program on a part-time basis to complement their clinical and scientific education, respectively. The idea to accommodate part-time students in the future appeared attractive to the appraisers.

4. PROGRAM CONTENT

- **ways in which the curriculum address the current state of the discipline or area of study**
- **identified unique curriculum or program innovations or creative components and their appropriateness**
- **clarity of the nature and suitability of the major research requirements for degree completion**
- **evidence that each graduate student in the program is required to take all of the course requirements from among graduate level courses**

Members of the Program Committee reviewed the current outline of the curriculum during 5 terms for the appraisers in broad terms. The curriculum appears to adequately reflect the current state of the discipline (based on the list of required and elective courses listed in the Appendices). The very innovative use of "smaller modules to fill in the gaps in the background knowledge of which students have to take a minimum of 8 (out of >20 to choose from)" was reviewed, which we support. The overall focus is on the tripartite concept of breadth, deployment and integration within the 5 rubrics of: 1) depth and breadth of knowledge; 2) research and scholarship; 3) level of application of knowledge; 4) professional capacity and autonomy; and 5) level of the student's communication skill. The objective and outcomes are well matched by the number, content and goals of each course listed (as currently designed) in the "New Graduate Program Proposal for the Master's in Translational Research in the Health Sciences". There, the degree expectations will include the demonstrated ability to carry out work based on collaborations, design thinking, and effective communication, which we strongly support. The curriculum proposal is comprehensive and compelling. However, does the Program Committee also intend to offer any business-oriented modules (e.g., on the topic of writing a business proposal etc.) given the overall importance of improving the rate of commercialization in Canada's health care sector where it falls behind not in innovation but in related business development rates when compared to countries such as the US? Also, should students start preparing for the "capstone project" earlier in the program? Rather than a third term summer start for MSC 2001, could this course not be moved to the first term of the program?

Overall, we recommend striving for a healthy balance between a typical, professional degree-based structured program and students' individual freedoms, such as when pursuing a specific project ("capstone"). We state that the feasibility of pursuing individualized capstone projects -likely informed by the student's background experience prior to entering the MHSc Program- appears key. There, the following questions arise: Who is going to ensure the matching of the right PI / mentor with a student and his / her project? Given the diversity of the program's to-be-enrolled students (as well as the wide range of participating faculty), how will the Program Committee ensure that all students are held to the same degree of rigor when it comes to assessing their performances (see scoring below)? How will capstones be marked when completed – in the form of a published paper / mini-thesis / non-defendable report?

A graphic display of a typical graduate student's journey through the curriculum and his / her requirements to complete the 2-year program may be of help during the remaining review process of the program.

5. MODE OF DELIVERY

- **appropriateness of the proposed mode(s) of delivery (distance learning, compressed part-time, online, mixed-mode or non-standard forms of delivery, flex-time options) to meet the intended program learning outcomes and Degree Level Expectations**

During the site visit, the appraisers and members of the Program Committee did not review details of non-standard forms of delivery, of flex-time options or of distance learning. No specific reference re: the mode of delivery was identified by the appraisers in the "New Graduate Program Proposal for the Master's in Translational Research in the Health Sciences (MHSc)".

6. ASSESSMENT OF TEACHING AND LEARNING

- **appropriateness of the proposed methods for the assessment of student achievement of the intended program learning outcomes and Degree Level Expectations**
- **completeness of plans for documenting and demonstrating the level of performance of students, consistent with the academic division's statement of its Degree Level Expectations**

Little time was spent on that topic during the appraisers' visit. The score card shown on page 22 in the "New Graduate Program Proposal for the Master's in Translational Research in the Health Sciences (MHSc)" was reviewed; it appears to be based on a pass / fail system (checkmarks). Will it allow for personal comments drawing attention to strengths and weaknesses

that may help in the monitoring of a student's progress? Will the learning outcomes be reviewed at predetermined intervals? Does each student have an advisory committee that helps monitor successful progress through the program's milestones? Who will help advise the initial selection and then monitor the successful completion of individual learning units? Will there be a specific panel in place to discern the consequences when a student fails to make the expected progress? Will there be an appeal's process in place that is shared with an already existing graduate program, or will a separate process be in place given the distinct nature of the New Graduate Program Proposal for the Master's in Translational Research in the Health Sciences (MHSc)?

7. RESOURCES

- **adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, and any institutional commitment to supplement those resources to support the program**
- **participation of a sufficient number and quality of faculty who are competent to teach and/or supervise in the program**
- **adequacy of resources to sustain the quality of scholarship and research activities of graduate students, including library support, information technology support, and laboratory access**
- **faculty have recent research or professional/clinical expertise to sustain the program, promote innovation and foster an appropriate intellectual climate**
- **sufficiency of financial assistance for students to ensure adequate quality and numbers of students**
- **supervisory load distribution and the qualifications and appointment status of supervisors**

On the topic of adequacy of the administrative unit, utilization of existing human resources, and degree of institutional support to ensure success of the program, the appraisers met with the IMS Leadership Team, the Program Committee, and importantly, with several graduate coordinators currently working at IMS. With an expected enrolment of 20 students in the initial phase, which will rise to a total of 40 students in Year 3, the following requirements come to mind: 1) office space to house the director, 1 FTE administrative assistant for 20 students (and in the future, 2 FTE administrative assistants for 40 students in the program), as well as lockers and a gathering area for the program's students; 2) financial support for the director, who will likely spend ≥60% of his / her time on this responsibility, and his administrative assistant(s); 3) related non-personnel-based operating costs for this additional graduate office at IMS dedicated to the operation of the MHSc Program; 4) classroom space / meeting room for teaching of 20-40 students, if not available; and importantly, 5) the commitment by the University of Toronto to sustain the new program's financial viability for the foreseeable future.; 6) one additional infrastructure requirement should be the provision of a specifically designated area that could act as a hybrid space serving both as a multi-functional classroom and a launchpad (such as an "ideation laboratory") for new translational research ideas in the health sciences. We envision that this launchpad / hub of the program would foster the exchange of ideas, facilitate the establishment of a strong and cohesive cohort with its own identity within the landscape of the University, and provide students with the tools and support they need to execute their capstone projects. We posit that the new program and its success - and by implication - the University of Toronto's return on its investment will not be measurable for at least until the first three classes have graduated in 2019.

8. QUALITY AND OTHER INDICATORS

- **quality of the faculty (e.g., qualifications, research, innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the proposed program)**
- **program structure and faculty research that will ensure the intellectual quality of the student experience**

Due to the large number of available faculty members appointed through the Institutes of Medical Science (IMS) at the University of Toronto, many of whom are dedicated to the career as a physician-scientist, the appraisers predict that future students in the new graduate program for a Master's in Translational Research in the Health Sciences (MHSc) will be expertly guided by the number and quality of mentors, teachers and supervisors. It should be stressed that the IMS and University of Toronto represent Canada's #1 training ground with respect to the education of physician-scientists (from its MD/PhD Program, to the CIP track etc.). A list of participating faculty members was provided in Appendix B of the Program Proposal. The currently available infrastructure at the IMS, where the new graduate program will be based, as well as ongoing investments made by the University of Toronto in expanding its campus bode well for a successful launch and rapid integration.

However, the supervisory load distribution among participating faculty members, their related remuneration for their teaching of course elements, and the investigators' financial support for taking on students during their "capstone projects" need to be clarified. As the appraisers learned during their visit, this topic is currently under discussion. We can envision multiple sources and solutions for support, such as from external sources, e.g., Ontario Research Fund-type grants from the

Province (that partner academia with for-profit activities); industry-sponsored grants; contractual agreements; foundation-supported grants; and philanthropy that likely will be attracted by this first-in-kind project in Canada.

Likewise, for admitted students the ability to apply for merit-based bursaries, needs-based tuition support (i.e., waivers) and access to endowed fellowships for a highly innovative program at the University of Toronto deserve consideration. The appraisers point to competitive and prestigious funding vehicles in the US at Harvard and MIT in the form of Catalyst grants and Kauffman fellowship awards, respectively, that promote structured course work as well as individualized learning possibilities in the education of translational research-oriented students with a previously obtained degree in the medical sciences and engineering.

ANY ADDITIONAL COMMENTS

A final question is whether the University is considering to also accommodate applicants with a strong background in health sciences-oriented disciplines from engineering?

Date: November 15th, 2013

Signatures:

Mgs

Michael G. Schlossmacher, MD, FRCPC

David Hafler, MD, MSc

UNIVERSITY OF TORONTO
FACULTY OF MEDICINE

Catharine Whiteside, MD PhD
Dean
Vice Provost, Relations with Health Care Institutions

EXTERNAL APPRAISAL REPORT /NEW PROGRAM PROPOSAL
MHSc Program for Translational Research in the Health Sciences
Dean's Response

On behalf of the Faculty of Medicine, University of Toronto, I thank Dr. Michael G. Schlossmacher (University of Ottawa) and Dr. David Hafler (Yale University) for their thorough and expert in depth analysis of the proposal and their excellent report. I thank the administrative staff of the Institute of Medical Sciences (IMS) and all those who contributed to the preparation of the comprehensive new program proposal. Many thanks to all the faculty members and students who met with the external reviewers – your input was most helpful and the Faculty of Medicine is grateful for your engagement in the review process.

The Faculty of Medicine and the Vice Dean, Graduate and Life Sciences Education fully support the plans of the Institute of Medical Sciences for developing a new Professional Masters Graduate Program in the Institute which will provide our graduate students with a new innovative educational pathway to launch careers in the emerging area of translational research in the Health Sciences. We were pleased to see that the two appraisers consider the MHSc-Translational Research in Health Sciences program to be "a very innovative and promising project that is of high relevance to the needs of health sciences-oriented communities in Toronto, in Ontario and throughout Canada."
The following highlight the key findings of our two appraisers that represent challenges and opportunities for the highly successful Institute of Medical Sciences as it establishes this new innovative graduate program in Health Sciences.

Graduate Student Recruitment

The reviewers stressed the importance of attracting and selecting exceptional students to establish a strong foundation and trajectory for the new program. We agree with the reviewers that it is essential that we ensure that a large pool of high quality students apply to our program from a wide range of disciplines and educational backgrounds. To promote the interdisciplinary nature of this professional program we recognize the recruitment challenges as noted by the reviewers. To cast a wide net of the potential applicant pool we will promote widely across a range of scientific, social and clinical disciplines. Students are likely to come from life science related disciplines, but also from engineering, social science, health policy, education and other disciplines. There are excellent students in these sectors who would benefit from our educational program in translational research in the health sciences. We expect that there will be a considerable amount of cross-fertilization among the students as part of their educational experience, with interdisciplinary and interprofessional learning occurring among all the students. We see this as an important strength of the program.

We agree with the appraisers that the four year BSc students will have to be carefully selected in order to integrate well with PhD and MD graduates. The BSc students will have completed a specialist program (Honors program) which provides in-depth knowledge as well as rich hands-on mentored research experiences.

In response to reviewers' comments on recruitment, in the search process the four IMS graduate coordinators and the program director will identify students with ideas for change who are poised to drive innovation. Potential students will be assessed using a range of tools to rank the quality of their ideas and the 'fit' of their research interests in the program. With these goals in mind the reviewers' suggestion of a multifaceted evaluation rubric is now adopted by the program. In addition to the standard program requirements, each student will receive a personal interview and be scored on a range of criteria beyond their GPA. Weight will also be assigned to the applicant's Statement of Interest. The graduate coordinators and director will provide these evaluations to the

Translational Research Program Committee (TRPC) which will select an appropriate cohort of students based on the multifaceted evaluation rubric.

Program Structure

The external appraisers have presented several ideas for future development and offerings. The appraisers inquired about providing flexible streams, distance learning and part-time study. The current strategy however is to first put in place a comprehensive core program with a defined structure and then, once working, develop plans to present to our Faculty graduate curriculum committee to expand options to accommodate alternative learning models as required.

The recommended increases in personnel by the reviewers go beyond the standards generally used in the graduate programs in the Faculty of Medicine that are necessary to manage a well-organized graduate program.

Program content

The external reviewers identified the challenge of teaching and integrating students with a range of backgrounds and experience. The program focus on interdisciplinary collaboration and communication necessitates an *a priori* requirement that the students themselves are able and willing to interact and engage among themselves. They will learn from peers trained in disciplines other than their own and be willing to impart their own disciplinary knowledge as well. Strategies will be implemented by the program committee to ensure these learning outcomes occur. These strategies will include cohort building and opportunities for informal interactions between students and faculty.

The reviewers understood the innovative nature and goals of the program and offered suggestions about the program content. In particular, the reviewers asked whether the program "intend[s] to offer any business-oriented modules (e.g., on the topic of writing a business proposal etc.) given the overall importance of improving the rate of commercialization in Canada's health care sector…?" Our response is that it is important to keep the core focus of our program on how to translate and apply health sciences

knowledge into domains that benefit individual and population health care outcomes. Commercialization is seen as only one potential outcome of the Translational Research Program. Effective communication, business proposal and grant writing to targeted audiences is a core competency of our translational research program. Business-oriented entrepreneurial skills are already a part of current IMS MSC1010 modules and there is planned expansion to accommodate MSC4010. It is our intention to also teach related skills for targeted audience communication in MSC1003 and to ensure that there are workshops and seminars as part of MSC2001 and MSC4000 that address skills and strategies for commercialization, business networking and entrepreneurship. In addition, we will partner with those in the private sector and within the academic world to offer opportunities for collaboration for our students as part of their Capstone projects.

At the suggestion of the appraisers MSC2001, the preparatory course for the Capstone project, will be moved to the first term of the program. This program change has been made without any dramatic changes to the overall proposal. This suggestion is an excellent one. It will provide more time for students to think about their projects and put in place the necessary infrastructure for execution, including supervisory and collaborative issues. This change is done in combination with an additional reviewer recommendation to include in the proposal an info-graphic of a typical student's journey through the program.

The appraisers raised a number of significant questions about the execution of the Capstone project. They were very supportive of this programmatic element; however, they felt that work remains to be done for quality execution. In particular they had questions around administration, evaluation and quality assurances. These issues are under development and we will address them briefly below.

The appraisers asked about a process that ensures appropriate matching between students, project ideas and faculty supervisors. We are currently revising our website to include not only spotlights for faculty research but also the inclusion of forums, blogs and platforms that will help to categorize and make more visible the variety of research and

researchers at IMS. This will provide the Translational Research students with more information about potential project areas and potential Faculty for their Project Advisory Committees. We agree with the appraisers' suggestion to start MSC2001 in the first term of the program. As part of MSC2001 students will be required not only to draft a project proposal but will also have to select a Project Advisory Committee (PAC) for approval by the Translational Research Program Committee (TRPC). In response to the appraisers, the project proposal will also include a rubric and metric for both individual and group evaluation that will be negotiated between students and their PAC. The proposals will be approved by the Program Committee to ensure rigor across projects and the means for final capstone assessment and evaluation. The PAC will provide project specific flexibility to define deliverables and outcomes, and a program wide system for assessing quality and student achievement.

In appraisal of assessment of teaching and learning, the appraisers commented that the proposal suggests a pass/fail system of assessment for the program. This is incorrect. The chart (Table 3 of the proposal) represents the types of skills assessed and is not the means of assessment. It is meant to correlate between the program learning outcomes and skills and competencies assessed by the program. This has now been clarified in the proposal.

Quality Indicators

Quality indicators were also addressed by the appraisers. Our plan is to have several levels of quality assurance by implementing program and project specific measures as well as utilizing existing departmental processes. On a departmental level, the Translational Research Program Committee reports to the established IMS Curriculum Committee. Any student issues or appeals that cannot be resolved at the program level are forwarded to the Institute's committees on standing. At the program level, the Director and the Translational Research Program Committee will be responsible for approving the student admissions, capstone proposals, PAC composition and final project evaluations. As discussed above, there will also be a system of ensuring student success by the Project Advisory Committee whose mandate will be to support the student project

through mentorship and guidance. PACs will review Capstone project updates every three months to ensure ongoing feedback and review before final deliverable(s) are evaluated.

Student-Faculty Ideation Space

We agree that a dedicated student space or hybrid "ideation" space will help establish a sense of cohesion and a hybrid classroom / ideation lab would go a long way to provide students with the tools necessary to imagine, brainstorm and move their translational ideas forward. Space for renovation has been identified in the Medical Sciences Building (MSB) where IMS is located. A program-specific launchpad for translational research devoted to the exchange, germination and development of Translational Research ideas is clearly differentiated from other existing incubators / accelerators on campus. This translational research hub will form the center of new forms of idea exchange and interaction to allow students and faculty the tools, synergies and mechanisms to stimulate momentum and exchange for innovation.

Enhanced Financial Support

As suggested by the reviewers, IMS will seek out additional funding from philanthropic foundations, government granting agencies, industry and donors. The nature of the program will make it attractive to attract funds being dedicated to the Research and Innovation agenda that is embracing many Ontario and Canadian agencies, industries and philanthropies. These funds will provide additional student and faculty resources to enhance proposed translational projects and to finance project consumables and development costs as applicable. The Faculty of Medicine is prepared to provide IMS and the program Director guidance in these matters and to help the new program increase its revenues to continue to enhance its educational offerings. The students will be able to apply for those scholarships and bursaries available to MHSc students in the faculty and the university.

Summary

This external review was highly favourable. It has been extraordinarily helpful in identifying and discussing the strengths and challenges of this new program proposal. Several suggestions have now been incorporated into the proposal. The Faculty of Medicine will continue to work with IMS to establish this innovative graduate program.

Catharine Whiteside
Dean, Faculty of Medicine
Vice-Provost, Relations with Health Care Institutions, University of Toronto

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UNIVERSITY OF TORONTO

OFFICE OF THE VICE-PROVOST
ACADEMIC PROGRAMS

February 5, 2014

Professor Catharine Whiteside
Dean & Vice-Provost, Relations with Health Care Institutions
Faculty of Medicine
University of Toronto

Dear Cathy,

Re: Appraisal Report, Proposed new Master of Health Science in Translational Research

I am very pleased by the extremely positive appraisal of the proposed new Master of Health Science in Translational Research. Your administrative response to the appraisal nicely summarizes the report and highlights the specific suggestions made by the reviewers for consideration. I note that in response to the recommendations of the two reviewers the Institute of Medical Sciences has made a number of changes to the proposed program. These include the adoption of a proposed evaluation rubric to support the assessment of the capacity and fit of applicants to the program; web site changes and the introduction of other tools to provide prospective students with more information about faculty research strengths; starting the Capstone project earlier in the program; and developing rubrics to support consistency in expectations and assessment of learning outcomes. In your response, you have also addressed how the proposed curriculum will support the development of entrepreneurial, grant writing, business communications, and networking skills and will encourage students to learn from one another. Finally, in your letter you note that the proponents have also adopted the proposal that they create an "ideation" space.

The reviewers described the program as very innovative and comment that it should provide critical leadership in key positions in academia, pharmaceutical enterprises, biotechnology firms, government agencies, private foundations and philanthropic organizations. I will be very pleased to recommend this new professional Master's program to governance for approval, following approval at the Divisional level.

Sincerely,

Sioban Nelson
Vice-Provost, Academic Programs

cc.
Amy Lee, Executive Assistant to the Dean & Vice-Provost

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